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GLOBAL CLIMATE CHALLENGES, INNOVATIVE FINANCE, AND GREEN CENTRAL BANKING

Sayuri Shirai

ASIAN DEVELOPMENT BANK INSTITUTE

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Abbreviations

ADB	Asian Development Bank
AfDB	African Development Bank
AI	artificial intelligence
ASEAN	Association of Southeast Asian Nations
BCBS	Basel Committee on Banking Supervision
BOE	Bank of England
BOJ	Bank of Japan
CBD	Convention on Biological Diversity
CEO	chief executive officer
CIV	collective investment vehicle
COP	Conference of the Parties
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CSLN	Climate Safe Lending Network
CSRD	Corporate Sustainability Reporting Directive
DAC	Development Assistance Committee
DFC	United States International Development Finance Corporation
DFI	development finance institution
DSSI	Debt Service Suspension Initiative
ECB	European Central Bank
EMDEs	emerging and developing economies
EIB	European Investment Bank
EIF	European Investment Fund
ESCB	European System of Central Banks
ESG	environmental, social, and governance
ESMA	European Securities and Markets Authority
ESRB	European Systemic Risk Board
EU	European Union
FDI	foreign direct investment
FSA	Financial Services Agency
FSB	Financial Stability Board
G7	Group of Seven
GCF	Green Climate Fund
GFANZ	Glasgow Financial Alliance for Net Zero
GHG	greenhouse gas
GSIA	Global Sustainable Investment Alliance
IBRD	International Bank for Reconstruction and Development
ICAAP	internal capital adequacy assessment process

IDBG	Inter-American Development Bank Group
IFC	International Finance Corporation
IMF	International Monetary Fund
IOSCO	International Organization of Securities Commissions
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
IPSF	International Platform on Sustainable Finance
IRMF	Integrated Results Management Framework
ISSB	International Sustainability Standards Board
MAS	Monetary Authority of Singapore
MDB	multilateral development bank
MPC	Monetary Policy Committee
NDC	Nationally Determined Contributions
NGFS	Network of Central Banks and Supervisors for Greening the Financial System
NGO	nongovernment organization
NZAOA	Net-Zero Asset Owner Alliance
NZBA	Net-Zero Banking Alliance
ODA	official development assistance
OECD	Organisation for Economic Co-operation and Development
PBOC	People's Bank of China
PRB	Principles for Responsible Banking
PRC	People's Republic of China
PRI	Principles for Responsible Investment
R&D	research and development
ROK	Republic of Korea
RST	Resilience and Sustainability Trust
SBTi	Science-Based Target Initiative
SDG	Sustainable Development Goal
SDR	special drawing right
SEC	social, environmental, and climate
SGX	Singapore Exchange
SMEs	small and medium-sized enterprises
SyRB	systemic risk buffer
TCFD	Task Force on Climate-Related Financial Disclosures
UK	United Kingdom
UNEP FI	United Nations Environment Programme Finance Initiative
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
WACI	weighted average carbon intensity
WWF	World Wide Fund for Nature

About the Author

Sayuri Shirai is a visiting fellow and advisor for sustainable policies at the Asian Development Bank Institute. She is also a professor at the Faculty of Policy Management at Keio University and an advisor to the Nomura Research Center for Sustainability and the Nissin Oillio Group. During 2020–2021, she was a senior advisor to EOS at Federated Hermes, a provider of environmental, social, and governance (ESG) stewardship services, in London. This book benefited significantly from various presentations and associated intensive discussions at seminars organized by (i) the Policy Research Institute of the Ministry of Finance, Japan, in January 2023; (ii) Mizuho Securities Co., Ltd. in January 2023; (iii) the Research Institute for Environmental Finance, Japan, in October 2022; (iv) the Climate Change Centre of the European Central Bank in September 2022; (v) the Asian Development Bank Institute–Asian Development Bank Joint Conference on Development and Innovative Finance held in September 2022; (vi) the Bank Indonesia Institute in July 2022; and (vii) the Asian Development Bank Financial Sector Group Webinar in May 2022. The book also benefited from insightful comments provided by anonymous reviewers.

Foreword

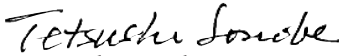
Environmental, social, and governance (ESG) investment is rapidly developing and expanding from developed to developing countries. Large companies and financial institutions are increasingly embracing ESG investment to reduce greenhouse gas (GHG) emissions, facilitated by advancements in digital technology. The Sustainable Development Goals (SDGs) and carbon neutrality are becoming increasingly challenging objectives, particularly in terms of financing and constrained fiscal capacities. This is true, especially among developing economies where public resources are insufficient to meet the physical, economic, and social investment gaps required to achieve the SDGs and carbon neutrality due to the size of public debt and fragile economic and social conditions since the coronavirus disease (COVID-19) pandemic and the subsequent energy and food crises. The amount of official development aid and development finance remains insufficient to support these countries. Greater international support is needed for developing economies to implement their climate mitigation and adaptation strategies. According to the 26th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP26) and the Glasgow Financial Alliance for Net Zero, to reach net-zero carbon emissions by 2050, $125 trillion of investment is required globally for the transition to mitigate the physical impacts of climate change.

To tap the financing opportunities in Asia and elsewhere, domestic and global financial institutions need a better understanding of risk-adjusted returns, risk mitigation measures, and transition-related criteria for shifting their portfolios to net zero. Key components in making decisions for private capital providers include credible climate-related disclosures and data, innovative financing schemes to mitigate transition finance–related risks and effective transition finance–related criteria. Public policy will be key in facilitating the required mobilization of private capital at scale. While various innovative finance schemes have been developed over many years, the momentum has gained traction in recent years for several reasons. One is that ESG investment, driven by global institutional investors and asset management companies, has been developing rapidly, and the focus is expanding beyond listed companies in developed countries. For example, impact investment is expanding globally because common global goals cannot be achieved without active participation by developing countries. The second factor is that many large companies and financial institutions wish to reduce

their GHG emissions to meet their carbon neutrality targets, so they are more eager to use sustainable materials and products. The third factor relates to the fact that digital and satellite image technology has helped monitor some environment-related projects and enable the traceability of sustainable products and services. At the same time, mechanisms for promoting debt-for-climate swaps or debt-for-nature-preservation swaps are becoming important since developing countries have accumulated public debt, particularly since the pandemic and limited budgetary resources.

Governments are primarily responsible for addressing climate change issues and implementing necessary climate policies to achieve carbon neutrality worldwide. Under such initiatives, financial supervisors are beginning to promote climate-related financial risk awareness among financial institutions and their risk management and consider climate-related financial supervision and regulation. Within their mandates, moreover, a growing number of central banks are also coping with climate issues to enhance the resilience of financial institutions under their supervision as well as that of their balance sheets and central banking operations against various climate risks. Some of them have also integrated climate factors into part of the conduct of monetary policy.

This book provides a comprehensive overview of global trends related to ESG investment and corporate management, innovative finance and debt-climate (or debt–nature preservation) swaps, as well as green monetary policy and financial regulations to cope with climate risks. The author highlights recent trends, actual practices, and areas of challenges. No other books appear to cover these topics extensively and comprehensively. I sincerely believe this book can be useful for many readers, including policy makers, financial institutions and investors, other stakeholders, and academics.



Tetsushi Sonobe
Dean
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Introduction

The world has committed greater efforts to achieve two major common international goals pledged in 2015. One is the achievement of 17 the Sustainable Development Goals (SDGs) by 2030, adopted at the United Nations (UN) Sustainable Development Summit. Those goals included sustainable economic growth, climate change, conservation of the environment and natural resources, poverty reduction and social development, and gender and human rights. The other is the Paris Agreement agreed upon at the 21st Conference of the Parties (COP21) to the UN Framework Convention on Climate Change (UNFCCC). It set a long-term goal of reducing greenhouse gas (GHG) emissions to well below 2°C (compared to pre-industrial times) by the end of this century and striving to approach 1.5°C. Subsequently, in 2018, the Intergovernmental Panel on Climate Change (IPCC), consisting of scientists worldwide, released a special report on global warming of 1.5°C, indicating the importance of achieving net-zero GHG emissions by 2050. Reflecting this view, many countries have committed to net zero or carbon neutrality around 2050 or a little after.

Global Challenges to Achieve the SDGs and Carbon Neutrality

It is increasingly clear that the two important international common goals pledged by the world in 2015 are becoming difficult to achieve without implementing additional global policy actions. The global economy has faced a series of adverse shocks in recent years, including the COVID-19 pandemic, cross-border supply chain disruptions, rising climate physical risks and disasters triggered by natural hazard, the Russian invasion of Ukraine, and energy and food shortages. The interest rate shocks driven by inflation, monetary policy normalization, and recent banking sector concerns in the United States (US) and Europe also added to economic difficulties across the globe.

Meanwhile, the high cost of fossil fuels since 2021 has reminded the world that more investment in clean or low-emission energy projects will be necessary to achieve net-zero GHG emissions if the world makes efforts to achieve a maximum temperature rise of well below 2°C or 1.5°C by the end of this century (relative to pre-industrial levels). The amount of investment has been inadequate for many years because of the limited scale of climate and energy policies adopted by the world. The Synthesis

Report of the Sixth Assessment Report (AR6) published in March 2023 by the IPCC warned that a continued increase in GHG emissions would lead to global warming of 1.5°C in the near term in considered scenarios. It stressed that three to six times greater climate investment would be needed relative to the current level (IPCC 2023).

The COVID-19 pandemic and the Russian invasion of Ukraine have exacerbated extreme poverty, inequality, and social and physical infrastructure shortages in low-income countries. One in five developing economies is projected to remain below its pre-crisis 2019 level in per capita income by the end of 2023 (UNESCAP 2022). If the current situation continues and no additional actions are adopted, globally achieving the SDGs will likely fall significantly behind, and refugees and conflicts will likely occur frequently in many parts of the world.

Climate-Related Physical and Transition Risks

Climate risks are generally decomposed into physical and transition risks. Physical risks are becoming increasingly materialized in recent years, with major disasters such as hurricanes, typhoons, torrential rains, and floods occurring more frequently and on a larger scale than in the past, as well as global warming and rising sea levels. These acute and chronic physical risks often adversely affect infrastructure, corporate production facilities, commercial and residential properties, and people's lives, thereby hindering economic activities, reducing food production, soaring commodity prices, generating health hazards, and reducing labor productivity. The global average temperature has already risen by about 1.1°C to 1.2°C from pre-industrial times, and damage from extreme climate events frequently occurs worldwide. To cope with increasing physical risks, "climate adaptation" policies and measures are becoming essential. To make the economy and firms more resilient to the increasing number of disasters triggered by natural hazard, governments may need to consider shifting production, housing, or factory locations to safer, inland places, building embankments and making infrastructure more resilient to disasters, adopting monitoring and warning systems of disasters. Companies and individuals must also consider actions to cope with rising physical risks.

On the other hand, climate-related transition risks are related to the risk stemming from transitioning toward a low-carbon economy through "climate mitigation" policies. Climate policies include carbon pricing (carbon tax and/or emission trading system); tighter environmental regulations to reduce GHG emissions and promote fuel consumption efficiency; removal of fossil fuel subsidies and increase in subsidies for greener projects and low-carbon technology development; and an

expansion of public investment necessary for achieving decarbonization. Public investment could be increased toward installing charging stations for electric vehicles (EVs), low-emission public transportation, greener public buildings, renewable energy electricity generation facilities in public areas, as well as accelerating forest management and restoration. When governments speed up implementing these climate mitigation policies, companies will be more encouraged to expand research and development (R&D) spending and capital investment in renewable energy, smart grids, EVs, storage batteries, hydrogen fuel and technology, carbon capture storage, and carbon capture utilization storage, etc. Such spending and investment can be expensive for companies, and there is a risk that such innovative activities will not bear fruit. Nevertheless, such risk and cost should be carefully balanced against new business opportunities that emerge in the transition process of the economy toward carbon neutrality. Low-carbon or decarbonization actions will help transform business models into more environmentally and economically sustainable ones from a long-term perspective.

Climate-related transition risks involve the restructuring of carbon-intensive industries and companies. Assets that intensively utilize fossil fuels will likely become stranded assets because their investment costs cannot be fully recovered under tighter environmental regulations and climate policies. If many financial institutions continue to invest heavily in such industries and companies, the financial system's stability might also be threatened. In addition, the number of lawsuits against companies conducting greenwashing practices, misleading consumers, and violating environmental rules and regulations will increase. Lawsuits related to physical risks are also possible if the causality from climate change to economic and social losses can be scientifically established. Such companies may face punishments and fines and lose clients and consumers due to their deteriorated reputation. Transition risks also include the disproportionately large adverse impact on low-income earners and small and medium-sized enterprises (SMEs) due to rising prices caused by carbon pricing for a certain period—the so-called "green inflation." Thus, it is essential for governments to perform a "just transition" policy to mitigate such adverse impacts on vulnerable people and companies to smoothen the transition process.

Climate-related physical and transition risks are inversely related. If governments delay the implementation of climate mitigation policies, transition risks will remain relatively low, but physical risks will increase significantly over time and nonlinearly. As a result, the global average temperature could rise to more than 3°C from the current level by the end of this century or even much sooner. Collective efforts must be made to limit the increase in global average temperature to 1.5°C or at

least well below 2°C by the end of this century to avoid this excessive global warming situation. While it is not easy for governments to implement climate transition policies in fear of facing transition risks, it is desirable to start implementing necessary policy actions to reduce GHG emissions as soon as possible to achieve a smoother transition. While climate mitigation policies are needed, the world must also implement climate adaptation policies. This book generally refers to physical and transition risks when referring to climate risks unless specified.

Growing Presence of ESG Investment and the Role of the Banking Sector

While the global average temperature has reached 1.1°C to 1.2°C, much-needed climate policies and actions have lagged. In 2020, GHG emissions decreased temporarily due to the impact of the COVID-19 pandemic and the resultant recession. Since then, GHG emissions have started to increase again. Amid energy shortages since 2021 and further deteriorated by the Russian invasion of Ukraine, fossil fuel production is increasing beyond expectations, and global warming continues progressing. A growing number of large listed companies worldwide are declaring carbon neutrality targets. This reflects not only their concerns about global warming but also pressures from climate-conscious investors to transform their businesses to be more environmentally sustainable. There is a rapid increase in investment that emphasizes the environment (E), society (S), and governance (G)—the so-called ESG investment. ESG investors are composed mainly of pension funds, insurance companies, and asset management companies entrusted with their management.

In April 2021, environmentally conscious industry groups aiming for net-zero GHG emissions from investments, loans, and financial services by 2050 came together to form the Glasgow Financial Alliance for Net Zero (GFANZ). This has generated the momentum for ESG investment to encourage more sustainable behavior in companies. More than 550 financial groups and institutions in about 50 countries have become GFANZ members, and the total assets under management have reached more than $130 trillion. In June 2022, GFANZ established a GFANZ Asia-Pacific Network and chose Singapore as the location of its secretariat to promote the decarbonization of emissions arising from investments and loans in the Asian region. The GFANZ Africa Network, headquartered in Nairobi, Kenya, was also established in September 2022. The world's major financial institutions are increasingly aware of the risk of losing prestige and business activities if these global trends leave them behind.

They might face the risk of being forced to implement specific climate-related strategies and responses without being well prepared and thus bear financial losses.

To respond to the SDGs and environmental issues, the most important priority is to set and implement detailed climate mitigation policies by governments to meet carbon-neutral targets. On top of that, a large amount of private capital and funds are needed to support corporate efforts that respond to such policies and promote transition. ESG investment generally focuses on large listed companies where disclosure of climate-related corporate information is progressing. ESG investment in SMEs and unlisted companies is also increasing but only slowly. Since their information disclosure is limited compared to listed companies, investors may need to invest more resources and take more risks. Thus, ESG investors are encouraging banks with diverse clients—from large corporations to SMEs—to help support those companies' climate transition efforts. In recent years, large companies have been required to disclose GHG emission data and set reduction targets with regard to their direct activities (Scope 1) and indirect activities, including electricity purchases (Scope 2), as well as emissions from their suppliers and users (Scope 3). Many large companies' suppliers are SMEs, while banks' clients include SMEs. Thus, large companies and banks could work together to support SMEs in reducing their emissions and improving disclosure of such information. Since small companies tend to hold relatively limited knowledge and skills needed to cope with climate transition risks, they are at increased risk of being left behind by global trends. Under such circumstances, for banks to promote the reduction of GHG emissions from investments and loans, a growing number of banks have increased consulting services and finance to support SMEs in setting emission reduction targets, disclosing related information, and formulating transition strategies. The role of regional banks, which have many SMEs as customers, in supporting activities that lead to low carbonization is becoming increasingly important.

Growing Investors' Focus on Nature Stock and Biodiversity Loss

Around the world, including at the Group of Seven (G7) summit, focus is gradually extended to natural capital stock and biodiversity loss beyond climate change. Natural capital stock refers to the ecosystem, including plants, animals, air, water, soil, minerals, biodiversity, etc. The services natural capital stock provides to human beings are largely unpaid and taken for granted by companies and individuals. As human demand

for natural capital stock continues to grow and outstrip its supply, the stock of natural capital has been declining at an unsustainable pace. In 2010, the UN Conference of the Parties to the Convention on Biological Diversity (CBD) held in Aichi, Japan, set 20 biodiversity targets for 2020 (so-called Aichi biodiversity targets) based on five strategic goals. These are (i) addressing the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society; (ii) reducing the direct pressures on biodiversity and promoting sustainable use; (iii) improving the status of biodiversity by safeguarding ecosystems, species, and genetic diversity; (iv) enhancing the benefits to all from biodiversity and ecosystem services; and (v) enhancing implementation through participatory planning, knowledge management, and capacity building. For example, Strategy (iii) included Target 11, which states that nations should conserve at least 17% of terrestrial and inland water and 10% of coastal and marine areas by 2020.

However, the results were disappointing. The Global Biodiversity Outlook 5, compiled by the CBD secretariat, found that none of the 20 targets were fully achieved globally by 2020 (Secretariat of the CBD 2020). The latest CBD was held in December 2022 in Montreal, Canada, where the world agreed on a new set of goals that must be achieved through 2030 and 2050 to improve biodiversity loss issues—the so-called Kunming-Montreal Global Diversity Framework. In particular, 23 targets were agreed on the 2030 goals. The targets included the effective restoration of 30% of degraded ecosystems by 2030 and the effective conservation and management of 30% of land and 30% of oceans by 2030.

On related issues, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), comprising a group of scientists, released a key report in 2019 (IPBES 2019). The report warned that biodiversity is declining at an unprecedented rate in human history due to human activities. Nearly 1 million species are threatened with extinction, many of which will likely become extinct within the next few decades. An average of around 20% of species in assessed animal and plant groups are threatened unless drastic action is taken to reduce the intensity of drivers of biodiversity loss. Without such action, there will be a further acceleration in the global rate of species extinction, which is already at least tens to hundreds of times higher than it has averaged over the past 10 million years. Globally, local varieties and breeds of domesticated plants and animals are disappearing. This loss of diversity, including genetic diversity, poses a serious risk to global food security by undermining the resilience of many agricultural systems to threats such as pests, pathogens, and climate change.

Climate change and natural capital are interrelated. For example, promoting afforestation and reforestation can lead to reduced GHG emissions. At the same time, it has a synergistic effect of increasing biodiversity. On the other hand, climate change and natural capital may face a trade-off relationship. For example, biomass power generation may reduce GHG emissions but accelerate biodiversity loss if biomass power generation leads to deforestation. Therefore, focusing solely on climate change risks may give rise to the risk of overestimating the environmental impact. Various initiatives have been launched to encourage major companies worldwide to disclose information on biodiversity and change their behavior. ESG investors and civil society are also extending their focus on a wide range of environmental issues, from climate change to biodiversity. At the government level worldwide, including the G7 summit, there is a rapid increase in the movement to focus on natural capital, including biodiversity, beyond climate change. The world now needs to work collectively to tackle the intertwined crisis of pollution, nature loss, and climate change, given that both biodiversity loss and GHG emissions continue to rise at an alarming rate.

Consideration for Debt-for-Climate or Nature Preservation Swap

Some developing economies currently face sizable external debt and climate and environmental crises. Therefore, it may be essential to consider debt-for-climate or debt-for-nature preservation swaps. In general, however, it may be difficult to work on a debt swap conditional on a commitment to taking climate actions or nature preservation for a long time with budgetary allocations. At the same time, some small, highly indebted economies might face climate change–driven catastrophes and disasters every year. While these economies may apply for support from international organizations and multilateral development banks (MDBs) or bilateral or multilateral climate or environmental funds, they may need greater action. Providing debt relief to developing economies will likely help developing economies. But there may be some concerns that providing grants without mandating climate actions could give rise to a moral hazard problem. This may be because debtors and creditors share the costs of debt distress, while only the debtor decides how to use the fiscal space gained through debt relief.

For this reason, debt-climate or debt-nature preservation swaps could be a more desirable form of fiscal support or grant if the expenditure commitment could become senior to debt service and the swap can

support a given climate or environmental expenditure at a lower cost to the creditors. The International Monetary Fund (IMF) has shown renewed interest in debt swaps. It stresses that there is an economic case for the climate or environmental conditional debt restructuring over general unconditional debt restructuring or debt treatments when climate actions materially lower sovereign risk. In such a case, new debt swaps involving green or blue bonds could mobilize more private capital from institutional investors. While this book mainly focuses on climate change issues, nature stock issues are touched upon concerning debt-for-climate and nature-preservation.

Green Financial Regulation and Central Banking

As it is becoming clear that climate risks will profoundly impact inflation, economic growth, and financial system stability, central banks and financial regulators have increasingly recognized that they can no longer ignore climate change and other environmental issues. Central banks are generally responsible for achieving price stability under the monetary policy mandate and financial stability under the macroprudential policy mandate. Therefore, central banks can consider climate risks within their existing mandates. Moreover, the global financial markets have been facing the problems of mispricing due to low-carbon prices. If these issues are left unaddressed, the transition toward a low-carbon economy will remain too slow to achieve carbon neutrality. While governments play the most crucial role in pursuing climate policy, central banks could contribute to governments' efforts within their existing mandates. Central banks and financial regulators have begun to discuss prudential policy and take measures to cope with climate-related financial risks by asking financial institutions to participate in the climate scenario analysis and/or climate stress test (which consider the impact on capital adequacy) exercises prepared by them—the so-called "top–down approach." Moreover, there are growing discussions on how to include climate risks with respect to the capital adequacy requirements regulation for banks in the Basel Framework. Central banks are also encouraged to lead by example by disclosing the impact of climate risks on their balance sheets, setting a GHG emission reduction target on their operations, and adjusting the composition of various domestic and foreign assets held by central banks for nonmonetary and monetary policy objectives.

Structure of the Book

Throughout this book, "carbon neutrality" and "net-zero emissions"

are treated synonymously to make it easier for readers, although there are differences in the exact definitions. The book was written for a wide range of readers, including governments, central banks, financial supervisors, international organizations, investors and financial institutions, nongovernment organizations, and academics. This book comprises six chapters. Chapters 1 and 2 provide basic background information, helpful for promoting understanding of the remaining Chapters 3–6.

Chapter 1 looks at corporate management from the perspective of ESG—issues increasingly focused on by ESG investors. Achieving the SDGs and net-zero GHG emissions will require a massive global increase in private sector finance. In recent years, expectations of sustainable investment, such as ESG investment to promote these goals, have increased, although clear government policies and long-term strategies at the national and local levels remain the most important element. One of the keys to realizing goals for a better future is to review and reform corporate behavior in light of helping solve environmental and social issues. The movement to call for conducting management reforms to promote more sustainable business models from companies will likely grow stronger through collaborative efforts from government policies, ESG investors, and civil society. These collaborative movements are prevalent in Europe and are gradually emerging, and are likely to strengthen in Asia and other regions in the near future.

Given that the accelerating transition of an economy toward carbon neutrality is a common global agenda, companies should understand the global trends and make efforts to increase R&D and capital investment to develop sustainable products and services. Chapter 1 will closely examine ESG-related business practices that ESG investors increasingly expect. Government measures to promote corporate disclosure on those practices and data are essential to encourage ESG investors' engagement with companies and thus accelerate a transition toward carbon neutrality.

Chapter 2 focuses on the banking sector. ESG investment is developing mainly among asset owners, such as insurance companies, pension funds, and asset management companies that manage those assets. Besides such ESG investors, banks are expected to play an important role in promoting corporate ESG management. In addition, global central banks and financial authorities are stepping up efforts to encourage banks and other financial institutions to understand climate-related financial risks and improve risk management, as explained in Chapter 6. Banks need to prepare for climate risks as climate change is likely to turn bank assets and other financial assets into nonperforming loans and reduce the value of the collateral. As banks improve their climate change risk management, there may be a growing movement

worldwide to differentiate lending rates and investment conditions according to companies' environmental responses. Chapter 2 also looks at recent banks' climate change initiatives, the issues of calculating GHG emissions from financed portfolios, as well as sustainable supply chain finance.

Chapter 3 focuses on climate-related innovative finance to support emerging and developing economies (EMDEs). The global economy has been facing a series of adverse shocks to EMDEs in recent years, including the COVID-19 pandemic, climate crisis, food and energy crises, capital outflows, and interest rate shocks driven by global monetary policy normalization. While investment in clean energy projects has been severely inadequate due to limited implementation of climate mitigation policies and limited finance to support decarbonization efforts, more financial support should be provided to EMDEs to help achieve climate and environmental goals and other SDGs. Chapter 3 overviews some innovative finance schemes applicable to EMDEs, called blended finance, to mobilize more private capital for climate and environmental projects. The rationales for promoting blended finance and various types of blended finance schemes are examined. Moreover, the chapter points out several examples of actual implementation led by the European Union (EU), some developed economies and their development financial institutions, the UNFCCC-convened Green Climate Fund (GCF), and private funds provided by ESG investors, banks, and charitable foundations. This chapter will shed light on blended finance schemes applicable to EMDEs.

Chapter 4 focuses on low-income developing economies with high debt and debt for the climate or nature conservation swaps. Promoting projects and activities to cope with climate change and the loss of nature stock is very challenging. Climate vulnerabilities and fiscal debt problems appear to be closely associated since economies that are more vulnerable to climate change tend to face higher public debt. Many developing economies with climate risks also tend to face a high risk of a fiscal crisis. On the one hand, climate change may exacerbate debt vulnerability by damaging infrastructure, productive capacity, and the tax base while raising borrowing costs. On the other hand, serious debt problems may reduce fiscal space for climate mitigation and adaptation investments, thus amplifying vulnerability to the physical and transition risks of climate change. Since the COVID-19 pandemic, the debt of many developing economies has been accumulating. Chapter 4 focuses on debt-for-nature or debt-for-climate swaps as an alternative to more conventional debt rescheduling and de facto grants to debt-distressed economies in exchange for climate projects and nature preservation. The chapter also points out suggestions for further actions through

better coordination among donor and recipient nations led by G7 and G20 nations for developing economies. It also provides policy-related recommendations regarding climate, environment, and innovative finance schemes, particularly for low-income developing economies, based on the analysis and associated discussions explored in Chapters 3 and 4.

Chapter 5 focuses on climate-related approaches and actions undertaken by central banks. Until recently, many central banks worldwide emphasized that they should be as neutral as possible to the market to spread the effects of monetary policies evenly throughout the economy. However, from a climate risk perspective, it is known that the current financial market faces the problems of mispricing or market failure and thus has been unable to allocate sufficient funds toward projects and activities leading to carbon neutrality. In recent years, central banks have begun to share a sense of crisis that climate change has a major implication on the economy, prices, and financial system. Thus, some actions must be undertaken to deepen understanding of how climate risks affect macroeconomic performance and financial markets, as well as to promote climate-related financial stability. The Network of Central Banks and Supervisors for Greening the Financial System (NGFS) has developed various suggestions on central banks' possible positions and responses to climate risks. Central banks are also encouraged to lead by example by disclosing the impact of climate risks on their balance sheets and operations and performing climate actions, including monetary policy. Chapter 5 focuses on the relationship between climate risks and central banks' mandates and several actions possibly taken by central banks. Several actual practices adopted by central banks in Japan, the People's Republic of China (PRC), Singapore, the euro area, and the United Kingdom (UK) are touched upon. The European Central Bank (ECB) is a leading central bank globally promoting comprehensive climate-related actions with road maps and timelines.

Chapter 6 sheds light on the climate-related prudential policy adopted by central banks and financial supervisors, including financial supervision and monitoring of financial institutions and financial systems. Financial regulators tend to focus on micro-prudential policy while central banks tend to pay attention to macroprudential policy—although some central banks are also responsible for micro- and macroprudential policies. A growing number of central banks and financial supervisors have already begun considering climate-related financial risks as part of prudential policy, including climate scenario analysis and/or climate stress test. In recent years, there have been growing discussions on how to include climate-related financial risks for the capital adequacy requirements regulation applied to banks in the Basel Framework—

particularly, the standard Pillar 1 capital requirement and/or Pillar 2 capital requirement. Active arguments have been conducted especially by central banks and financial regulators in Europe. This chapter also looks at detailed climate scenario analysis and/or climate stress tests as well as actual practices undertaken by central banks in Brazil, Japan, the PRC, Singapore, the euro area, and the UK. Central banks and financial supervisors in Europe take the lead in actively promoting climate-related financial regulations and surveillance.

1

Climate, Environment, and Corporate Management

Achieving the United Nations (UN) Sustainable Development Goals (SDGs) and net-zero greenhouse gas (GHG) emissions will require a massive increase in private sector activities and investment globally. In recent years, the presence of sustainable investment, such as environmental, social, and governance (ESG) investment, to promote these goals has been increasing. However, government policies and long-term strategies at the national level have been the most important priority. One key to realizing goals for a better future is to review and reform corporate behavior in light of helping solve environmental and social issues. The movement to demand corporate management reforms and transform business models will likely grow stronger through government policies, ESG investors, and civil society. This movement will gradually strengthen as climate-related physical risks materialize more frequently and on a larger scale over time. As the acceleration of climate mitigation policies is inevitable in the future, companies should deepen their understanding of global trends from now on and make efforts in capital investment and research and development (R&D) to develop sustainable products and services without delay. This chapter will look closer at ESG corporate management that investors and governments increasingly expect.

1.1 Growing ESG Investment and Its Features

The concept of ESG investment became known around 2006 when the UN Environment Programme Finance Initiative (UNEP FI) and the UN Global Compact launched an investor initiative. It presented six Principles for Responsible Investment (PRI) to call on institutional investors to consider ESG perspectives. The six principles mainly target asset owners, such as insurance companies, pension funds, and asset management companies. The principles included incorporating ESG elements, requesting asset management companies to disclose investee companies' information on ESG matters, making collaborative efforts to increase the momentum of ESG investment, and reporting the practice

and progress of ESG investment in the PRI format. As a result, ESG investors are increasingly making investment decisions based not only on traditional financial variables, such as short-term capital cost and financial returns, but also on nonfinancial information, such as ESG factors. As of September 2022, the number of PRI signatories reached 5,179 (of which 711 asset owners), with assets under management reaching $121 trillion.

Institutional investors are the main financiers in ESG investment and conduct investment in pursuit of environmental and social objectives with stronger governance within the scope of their fiduciary responsibilities. The Global Sustainable Investment Alliance (GSIA) classifies seven types of sustainable investment: (i) ESG integration, (ii) negative screening, (iii) engagement and voting, (iv) norms-based screening, (v) sustainability theme investing, (vi) positive screening, and (vii) impact investing (GSIA 2021). Of the seven categories, the most commonly used is **ESG integration**. This investment method incorporates ESG factors and conventional investment decisions based on company financial information (e.g., sales, recurring expenses, profits, asset value, price-earnings ratio) and macroeconomic information. The **negative screening** method excludes companies active in fields that do not meet predetermined investment criteria and mainly engage in activities incompatible with religious ethics, such as weapon manufacturing, gambling, tobacco, and alcohol. **Norms-based screening** excludes investment targets by comparing them with various international standards and principles set forth by international organizations. The **positive screening** method evaluates and invests in companies that perform relatively well from an ESG perspective in the same industry. Investment methods related to specific themes include sustainability-themed investment and impact investment. **Sustainability-themed investment** refers to activities, funds, green bonds, and social funds that sustainably contribute to individual themes related to the environment and society (e.g., women's empowerment, sustainable agriculture, renewable energy, green buildings).

On the other hand, **impact investment** tends to be more micro-project-based than thematic investment. It involves smaller investment scales aiming for both returns and additionality in light of achieving environmental and social goals that would not have been possible without the project. Blended finance, which will be explained in Chapter 3, is often characterized by impact investment. These classifications are not necessarily standardized around the world. In many cases, sustainability and ESG investments are often used interchangeably.

In particular, **engagement and voting** are powerful tools for influencing corporate behavior. Engagement is a method in which asset management companies conduct constructive dialogue on specific

ESG-related issues with companies to encourage corporate actions on behalf of asset owners. Voting rights are exercised through proxy voting rights of asset owners at general meetings of shareholders to vote against a company's board management team that is judged unsatisfactory in light of actively promoting ESG issues. These asset managers can also decide whether to support shareholders' proposals against the board or submit their own shareholders' proposals. This method puts pressure on companies to encourage them to take more action. Asset managers start by engaging with companies regularly. Then they move to the **escalation** stage when they judge companies have made no substantial progress. Escalation involves asking the chief executive officer (CEO) and other management team members questions at shareholder meetings, suggesting recommendations to the CEO through letters and requesting responses to them, posting such letters on asset managers' websites, exercising voting rights at shareholder meetings, and continuing to engage in such activities. Once specific targets and strategies for improvement through engagement are formulated, asset managers encourage target companies to understand the issues and suggest possible actions. Once corporate implementation is confirmed and viewed as achieving satisfactory outcomes, asset managers move on to the next stage by setting new specific topics and launching further engagement with the same or other targeted companies.

1.2 Long-Term-Oriented ESG Investment

In the stock markets, many traditional shareholders would like to see listed companies improve profits, increase dividends, and increase share prices through share buybacks in a relatively short period. Meanwhile, the number of ESG investments, which tend to consider environmental and social contributions and thus generate long-term corporate value, is increasing. Such ESG investors are less likely to change their investment decisions quickly, even when corporate profits deteriorate in the short term. Therefore, if a company can improve its ESG performance and maintain medium- to long-term returns, it is highly likely that ESG investors will become relatively stable investors for companies. In recent years, there has been a tendency for such investors to make shareholder proposals, especially on environmental issues such as climate change, and to gain support from other shareholders who agree with such proposals. Shareholder proposals on the social front have also been steadily increasing over the past few years, and their influence on issues such as diversity (gender, race, religion, etc.), equal pay, good working conditions, and human rights is growing. Some investors tend to oppose the company managers' proposals to appoint a CEO and some executive directors responsible for specific issues at the shareholders'

general meeting if the company's actions are considered unsatisfactory. To avoid ESG-related shareholder proposals presented at shareholder meetings, an increasing number of companies are trying to understand and respond to investor demands through engagement, especially before shareholders' meetings.

1.3 Corporate Governance Issues Emphasized by ESG Investors

ESG investors recognize that encouraging companies to improve their behavior from ESG perspectives will increase their medium- to long-term corporate value. Among the ESG issues, strengthening governance (G) is viewed as the foundation for promoting environment (E) and social (S) issues. Regarding governance, ESG investors emphasize the formulation of clear objectives and strategies for increasing the medium- to the long-term value of listed companies. To that end, companies are expected to improve the governance system of the board of directors.

1. Improving Corporate Governance

The board of directors, composed of the CEO, executive officers, and non-executive directors, is expected to increase diversity in terms of gender, minorities, races, nationalities, etc. Non-executive directors are also expected to be more independent and not have business dealings with the company (including the companies to which those non-executive members currently belong or have previously belonged). It is considered important to increase the independence of the board of directors to reflect more objective and professional opinions in management decisions. It is desirable that more than half of the board be independent directors. Non-executive board members are also expected to be selected based on skill, expertise, and experience. As the board of directors appoints and monitors the executive management teams, the chair of the board should be selected from the pool of non-executive directors rather than choosing the CEO as a board chairperson. Accordingly, an increasing number of companies worldwide are separating the chair of the board and the CEO. The chair's role is to set the agenda for the board of directors, promote information sharing among all board members to ensure that board meetings are properly prepared and run, foster a culture of free and open discussion among directors, and enhance the leadership and functions of the board. Attendance of all directors in board meetings and important committees should be disclosed to ensure they fulfill their responsibilities.

Many listed companies also tend to have independent audit committees. In addition, establishing a compensation committee and a nominating committee is considered desirable. Members of these meetings should include non-executive directors—one expected to serve as a chairperson of the committees. A majority of these committees should comprise non-executive board directors. The compensation committee determines the compensation of executive directors, officers, and senior managers. Raising their incentives is considered essential to improve the company's long-term performance.

On the other hand, an important role of the nominating committee is to formulate succession plans for the CEO and executive and non-executive directors of the board. Based on the company's long-term strategy, it is desirable to consider the required future skills, experience, and characteristics and to conduct strategic human capital and resource development to develop multiple candidates for the CEO and executive directors from an early stage. Long-term board membership of executive and non-executive directors, including the CEO, is generally seen as undesirable, although the situation varies depending on the specific conditions of companies. Many listed companies worldwide regularly conduct self-assessments of their governance functions or request assessments from external institutions to confirm that their boards of directors are functioning properly.

The board of directors is increasingly expected to enhance the company's long-term sustainable value, prioritize climate and social challenges by setting specific quantitative targets relevant to companies, and integrate those targets into daily corporate operations. For example, in the case of climate change, the board should exert greater efforts to deepen understanding of the risks of climate change and be responsible for the decision to formulate and implement transition strategies for decarbonization or low carbonization of corporate operations. Many of the directors still do not have a sufficient understanding of these climate issues, and there is a need for education and training of directors, as well as efforts by directors themselves to compensate for their lack of knowledge and acquire new information.

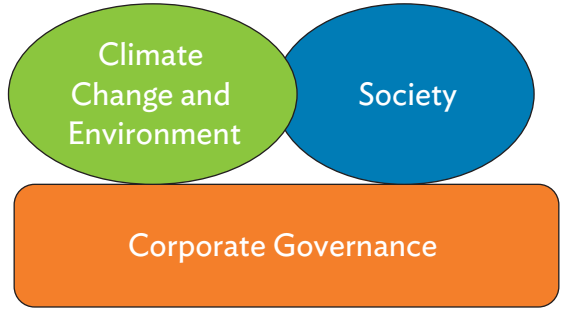
2. Strengthening Corporate Governance and Corporate Climate Actions

Among ESG, corporate governance is a foundation to promote corporate actions to make business models more environmentally and socially sustainable (Figure 1.1). Businesses must improve their governance to cope with climate risks and opportunities as well as disclose and monitor such information. The board of directors' leadership has become important, as the directors are responsible for regular oversight

and progress monitoring to put the company's transition strategy for carbon neutrality into action. Appointing an executive director with clear responsibility for climate change and establishing a sustainability committee under that director (or CEO as chair) are desirable. This director is assigned to incorporate climate issues into the entire company's operations and risk management. In addition to climate and other environmental issues, the board of directors is expected to promote diversity among executives and employees, decrease wage disparities, improve the working environment, and respect human rights. ESG investors increasingly demand that the board play a role in setting policies and confirming progress in these areas.

Regarding performance-linked remuneration for executive board members, including CEOs and executive officers, there is a growing view that linking corporate targets related to environmental and social issues to long-term oriented remuneration (such as stock compensation) is desirable. Numerical targets, including GHG emissions cut and the percentage of female managers, and linking compensation to the degree of progress relative to the targets should be set. However, in many cases, sufficient ESG-related data are unavailable, so data collection and target setting will likely improve over time. There is no common measurement standard on ESG data globally except that some improvement is taking place in the case of climate change. The world needs to accelerate collaboration in promoting standardization of taxonomy that classifies environmentally sustainable activities and other transitions and social activities as well as measurement approaches. Given that quantitative data are insufficient, there are issues in linking only indicators that can be quantified. A balance between quantitative and qualitative performance is necessary.

Figure 1.1: Positions Related to Environmental, Social, and Governance



Source: Prepared by the author.

1.4 Environment-Related Corporate Management Expected by ESG Investors

Large companies are increasingly expected to cope with climate change and other environmental issues, including reduction of plastic use, promotion of recycling and removal of waste, conservation of water and marine resources as well as natural resources and biodiversity, prevention of pollution, and the use of environmentally sustainable raw materials. Currently, ESG investors treat climate issues as urgent and pay greater attention to companies' GHG emission target setting and related detailed transition strategies toward decarbonization or low-carbonization. Therefore, disclosure of information on climate change is becoming a critical issue for ESG investors. Companies must disclose data, such as GHG emissions and reduction targets, in terms of absolute amounts and intensity units (emissions obtained by dividing emissions by sales, production volume, etc.). ESG investors focus on companies in high-emission industries (such as aluminum, concrete, chemicals, electricity, iron and steel, transportation). However, other large companies are also encouraged to disclose emission reduction targets and clear transition plans.

1. Task Force on Climate-Related Financial Disclosures Recommendations

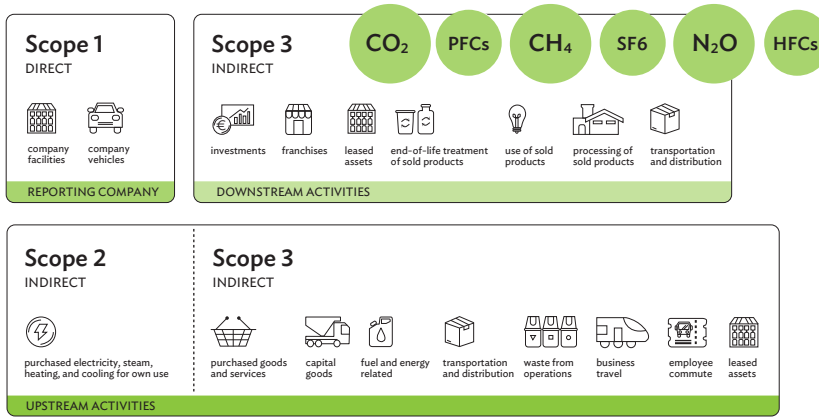
The Task Force on Climate-Related Financial Disclosures (TCFD) was created by the Financial Stability Board (FSB) in 2015 in response to the G20 decision that recommended organizations and companies disclose climate-related financial risks and opportunities for their clients, ESG investors, and stakeholders. The task force aimed to support and encourage ESG investors by providing useful information for their investment and financing decisions. The TCFD issued its initial recommendations in 2017 and updated them in 2021. Many countries have widely supported the TCFD's initiatives and guidelines as a basis for climate-related reporting by companies and financial institutions, However, few countries have disclosed in line with TCFD guidance and mandates.

The recommendations comprise four pillars: governance, strategy, risk management, and indicators and targets. The **Governance pillar** focuses on disclosing the organization's governance structure to cope with climate risks and opportunities, including board supervision and the role of management. The **Strategy pillar** describes the "material" climate risks and opportunities identified over the short, medium, and long term and their implications on the business models, strategies,

and financial planning. It also includes the climate scenario analysis, including a 2°C or lower scenario in line with the Paris Agreement, although ESG investors increasingly expect a 1.5°C scenario. (The case of climate scenario analysis conducted by banks, at the initiative of central banks and financial regulators, is reported in Chapter 6.) The **Risk Management pillar** describes identifying, assessing, managing, and integrating climate risks into overall risk management. Finally, the **Indicators and Targets pillar** aims to encourage ESG investors to deepen their understanding of the risks and opportunities of climate change of their invested companies and increase more sustainable assets in the investment and loan portfolios by making efforts to align with the Paris Agreement goals. Companies are expected to disclose information about Scope 1 (direct emissions from the company's operations) and Scope 2 (indirect emissions generated from purchased energy), and Scope 3 GHG emissions (such as those emitted by suppliers and users). Scope 3 emissions can be decomposed into 15 categories according to the GHG protocol (see Figure 1.2). It is vital for companies to disclose performance against the targets (especially GHG emission targets in the medium and long term), starting with Scopes 1 and 2. As it takes some time to collect comprehensive data on Scope 3, companies are expected to disclose Scope 3 data with some delay. But they should eventually incorporate these into the emission reduction targets if companies' emissions concentrate on Scope 3. Companies are also expected to explain how those targets will be met with detailed transition strategies, including allocating funds to investment and R&D activities.

Companies should set a net-zero target by 2050 at the latest for the total of Scopes 1 and 2 emissions and to indicate a 2030 target consistent with that. Setting Scope 3 emission reduction target with a timeline is also expected. According to the CDP, which promotes listed companies to disclose information on climate change and other issues (such as forests and water security), GHG emissions from supply chains are 5.5 times higher than from companies' direct economic activities (CDP 2019). According to the CDP, about 70% of the companies that responded to the company questionnaire disclosed information on their Scopes 1 and 2 emissions, but only 20% of them disclosed Scope 3 emissions. The CDP report stressed that companies should accelerate their efforts to reduce emissions through their supply chains. For example, emissions from combustion engine cars concentrate on Scope 3 (use of sold products), mostly from users when driving cars. Emissions from financial institutions concentrate on investment (i.e., financed emissions), namely, emissions arising from their counterparties through extending loans, investing in securities, etc. Collecting data on financed emissions will be a key to understanding climate-related

Figure 1.2: GHG Protocol Scopes and Emissions Across the Value Chains (Scopes 1, 2, and 3)



Source: Plan A (https://plana.earth/academy/what-are-scope-1-2-3-emissions).

financial risks for financial institutions, central banks, and financial supervisors (see Chapters 2, 5, and 6).

More recently, the global disclosure requirement has been in the process of standardization led by the International Sustainability Standards Board (ISSB). The ISSB was created by the International Financial Reporting Standards (IFRS) Foundation in 2021 with solid worldwide support from the FSB, various governments, and ESG investors. The ISSB published a draft for global climate-related and sustainability disclosure standards in March 2022 and is scheduled to finalize the draft by June 2023. Regarding setting corporate emission reduction targets, the ISSB plans to require disclosure of Scopes 1 and 2 emissions first and Scope 3 with a 1-year delay permitted. Once the reporting standards are finalized and endorsed by the International Organization of Securities Commissions (IOSCO), each country and region can use them by requiring domestic companies to disclose climate-related information accordingly from 2024.

2. Setting the Science-Based GHG Emission Target

Regarding GHG emission reduction targets, emphasis is placed globally on setting reliable targets based on scientific evidence. As a result, companies whose emission targets are certified by the Science-Based Targets Initiative (SBTi) are highly evaluated by ESG investors.

The SBTi is a science-based reduction target initiative run by four organizations: the UN Global Compact, CDP, World Resources Institute, and World Wide Fund for Nature (WWF). The SBTi certifies the 1.5°C target through scientific analysis based on IPCC scenarios. Companies' Scopes 1 and 2 emission reduction targets must be set with "near-term targets" for the next 5 to 15 years that are consistent with 1.5°C. If Scope 3 emissions account for more than 40% of the total GHG emissions, including Scopes 1 and 2 emissions, companies must set a short-term target covering 67% of Scope 3 emissions. The Scope 3 emission cut target should be consistent with the well-below 2°C target. Apart from this, setting emission cut "long-term targets"—which is up to 2050 in general and up to 2040 for the power sector—is also encouraged. Companies can set long-term targets provided they are committed to net zero under the SBTi standard. As of January 2023, 4,502 companies worldwide are participating in the SBTi, which must be certified within 2 years. Of these, 2,218 companies have already been certified, and 1,669 have committed to net-zero targets.

In recent years, some large companies increasingly utilize voluntary carbon credits purchased from third parties to reduce their emission volumes. According to the SBTi, however, companies cannot offset emissions by purchasing voluntary carbon credits to meet their emission reduction targets. Carbon credits can be counted only when they apply to the remaining unabated emissions at the time of achieving long-term SBT (such as the 2050 target). Those carbon credits must be generated from projects that remove carbon from the atmosphere, and the removed carbon must be stored permanently. This rule is set to promote companies to make greater efforts to reduce GHG emissions at their initiative without easily relying on carbon credits generated from third parties.

Furthermore, ESG investors have been paying attention to whether the strategies for responding to climate change advocated by companies are consistent with the lobbying activities carried out by industry groups to which those companies belong. If companies are developing and implementing transition strategies to meet net-zero goals, it might be reasonable to be involved in industry groups' activities that support government climate policy. However, investors are concerned that many companies continue to belong to industry groups that attempt to slow or block climate policy progress. For this reason, an increasing number of shareholders propose companies to disclose information about the industry groups to which the companies belong and the activities of the industry groups.

1.5 Social Issues Emphasized by ESG Investors

It is now widely viewed that companies might be able to increase their profitability and medium- to long-term corporate value by improving their business and management practices from the perspective of both environmental and social issues. Social issues cover a wide range, such as improving the diversity of the board of directors, managers, and employees; eliminating gender and racial disparities in wages and promotions; promoting work–life balance for employees; guaranteeing freedom of forming labor unions, respecting human rights, and preventing the use of child and forced labor; and promoting anticorruption practices and community development. In particular, major companies in advanced countries that import mineral resources and agricultural products from developing economies should focus on environmental sustainability related to procuring such resources and ensuring human rights and good working conditions in the supply chain networks. It is viewed as desirable for companies to set their policies on these issues and publicly announce them and monitor their direct and indirect activities through the supply chain networks. Companies are increasingly urged to set measurable goals for social issues that are relevant and considered the biggest challenges and to disclose strategies and progress toward achieving those goals. For technology companies and companies that handle customers' personal information, there is growing interest among investors in protecting data privacy or personal information, making companies more resilient to cyberattacks, and tackling hate speech and artificial intelligence (AI) bias.

1. Sustainable Resource Procurement and Economic Development in Developing Economies

As for EMDEs, an increasing number of ESG investors are emphasizing sustainable procurement to conserve natural resources on the planet and contribute to achieving the SDGs. As many of the raw materials are produced in EMDEs, investors encourage companies to conduct more responsible and sustainable production that considers the economic development of farmers and communities. It is recommended that companies responsibly procure agricultural products, foods, and beverages using sustainable raw materials. An increasing number of nonprofit organizations certify raw materials produced environmentally and sustainably to prevent deforestation. Blockchain can be used to establish traceability to reduce the risk of falsification of data on the production areas of mineral resources and agricultural products.

Electric vehicle and home appliance producers use many mineral resources, often produced in certain EMDEs where environmental and social issues are not well managed.

In the food industry, some companies have developed apps so consumers can read the QR code of the products they purchase, check farmers' information in real time, and directly support farmers. In addition, to promote sustainable agriculture by small-scale farmers in EMDEs, prevent deforestation, and increase their agricultural productivity, some large companies support small farmers in EMDEs with technologies, such as Internet of Things sensors, satellite images, and AI to predict agricultural yields based on weather data. Also, some large companies provide low-cost technical advice on how best to manage water and fertilizer use.

2. Focusing on Human Capital Gaining Momentum

To increase a company's medium- to long-term value, companies should treat their employees as a form of human capital who create and enhance corporate value rather than as a cost of production. Thus, companies are expected to invest more heavily in human capital by increasing training and upgrading skills for employees. As a result, there is a growing demand for companies to disclose information to enable ESG investors to judge the business conditions of companies from this perspective.

In the European Union (EU), under the Corporate Sustainability Reporting Directive (CSRD), detailed disclosure standards are presented for both large and small companies, including those related to the environment, and for human rights and labor standards. The content of disclosure required under the directive can be categorized into (i) promoting equal opportunities for all (gender equality, equal pay for equal work, vocational training and skill development for employees, inclusiveness focusing on minorities and persons with disabilities); (ii) improving the working environment (providing stable employment, creating a safe workplace and consideration for employees' health conditions, fairness in wages and promotions, dialogue between labor and management, wage negotiations by labor unions, work–life balance, etc.); and (iii) promoting disclosure on corporate activities regarding human rights, basic freedom, democracy, and anticorruption. Regarding (iii), disclosure is encouraged based on the UN Guiding Principles on Business and Human Rights, the Organisation for Economic Co-operation and Development (OECD) Guidelines for Multinational

Enterprises, the International Labour Organization Declaration on Fundamental Principles and Rights at Work, as well as the EU basic charter on citizens' political, social, and economic right. Companies must disclose activities for improvement, risk management, roles played by managers, lobbying activities, etc.

1.6 ESG Score Variations among ESG Rating Agencies

As the number of ESG investors and the amount of ESG investment grow worldwide, an increasing number of evaluation companies and data providers compile ESG scores on listed companies with ESG evaluation (score) services. Such information is useful for asset owners and their entrusted asset management companies when making investment decisions, engaging with companies, and exercising their voting rights. Well-known large data providers are Bloomberg, MSCI, Refinitiv, RobecoSAM, Sustainalytics, S&P Global, Bloomberg, FTSE Russell, and ISS Global.

1. Companies' Performance Based on ESG Scores

It is interesting to find out the ESG performance of companies prepared by the data provider. Below are the ESG scores compiled by the Bloomberg data set, whose ESG scores cover sustainability topics. Environmental topics (E) cover the following:

(1) carbon emissions—GHG Scopes 1, 2, 3 and emissions, carbon intensity, emission reduction initiatives, climate change policy, climate change opportunities and risks, and scope of disclosure;
(2) air quality—nitrogen oxide and other emissions;
(3) ecological and biodiversity impacts—biodiversity policy and environmental fines;
(4) energy—energy efficiency policy, energy consumption, renewable energy use, electricity use, and fossil fuel use;
(5) waste disposal—waste reduction policy, hazardous waste, waste recycled, raw materials used, and sustainable material sources;
(6) water—water policy, water discharged, and water consumption; and
(7) environmental supply change management.

Social issues (S) cover the following:

(1) the community and customers—human rights policy, child labor, quality assurance and recall policy, data protection, customer complaints, community spending, foundations, and giving;
(2) diversity—equal opportunity policy, gender pay gap, women and minorities in the management and workforce, and persons with disabilities in the workforce;
(3) ethics and compliance—business ethics policy, anti-bribery policy, and political duration
(4) health and safety—health and safety policy, fatalities, and incident rates;
(5) human capital—training policy, training cost, hours spent for training, fair remuneration policy, employment turnover, and labor union; and
(6) social supply chain management—supplies audited, and supplies in noncompliance.

Corporate governance issues (G) cover the following:

(1) audit risk and oversight—audit committee meetings, years auditor employed, size of the committee, independent directors and auditors, and attendance percentage;
(2) board composition—the company conducts board evaluation, size of the board, number of board meetings and attendance ratios, and number of executive and non-executive members;
(3) compensation—share ownership guideline, size of the compensation committee, number of independent members on the committee, and attendance ratios;
(4) diversity—board age limit, number of female executives, number of women on board, and ages of the youngest director and oldest director;
(5) nominations and governance oversight—the size of the nomination committee and attendance ratios, and number of independent members on the committee;
(6) sustainability governance—verification types, and employee training; and
(7) tenure—board duration.

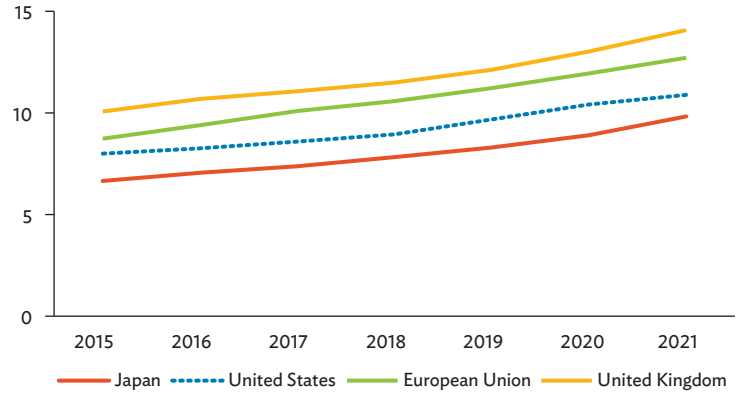
According to the Bloomberg ESG data, about an equal 33% weight is given to the E, S, and G scores, whereas around 4% weight is given to each of E, S, and G subtopic scores. Most of these ESG data are

obtained from companies' disclosed information (such as corporate social responsibility reports or sustainability reports, annual reports, and company websites), as well as a proprietary Bloomberg survey that requests companies to provide corporate data directly. Bloomberg provides scores on each company from 1 to 10 for E, S, and G separately. Thus. the ESG total score for a company varies from the lowest (0) to the highest (30).

Figure 1.3 shows ESG total scores from nonfinancial companies in the EU, Japan, the UK, and the United States (US) from 2015 to 2021. Japan covers 465 companies, the EU covers 659 companies, the UK covers 260 companies, and the US covers 1,866 companies. Figure 1.2 shows that, on average, companies in all the countries and regions improved their ESG scores over time. On average, the companies in the UK performed better than other countries, followed by the companies in the EU. Nevertheless, ESG scores are below 15 in 2021 for all countries and regions—well below the total scores of 30. This means that companies need to improve their ESG performance much more.

The ESG scores can be decomposed into E, S, and G scores separately, and each score varies from 0 to 10 (Figures 1.4, 1.5, and 1.6). Among the three types of scores, the G score has been evaluated higher than E

Figure 1.3: ESG Score of Nonfinancial Companies in Japan, the European Union, the United Kingdom, and the United States



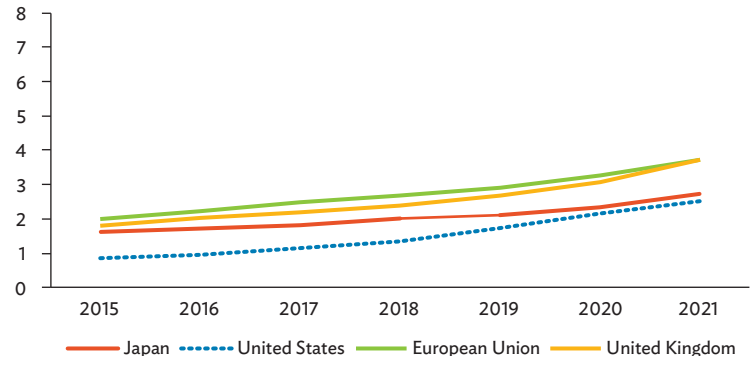
ESG = environmental, social, and (corporate) governance.

Source: Prepared by the author, based on Bloomberg's ESG data set.

and S scores, perhaps because the corporate governance concepts have been in place for some time in the world. In particular, the UK shows the highest G score. This fact is not surprising since the country led the adoption of the Corporate Governance Code for listed companies in 1992 after corporate scandals that set standards of good management practices about board composition, remuneration, successors' plans, shareholder relations, disclosure, risk management, etc. on a comply or explain basis. The code has been revised several times since then. The G score of the US is second to that of the UK, reflecting the issuance of a corporate governance code (the Sarbanes-Oxley Act of 2022) for listed companies in 2002 after the failures of Enron and WorldCom. The act's objective was to promote transparency and accountability in the management of listed companies. Since then, the code has been revised many times. It is mandatory for all listed companies, and companies may be subject to penalties or criminal prosecution in case of failure to comply.

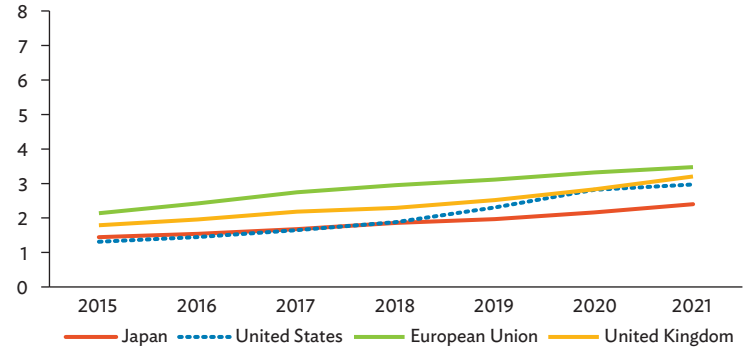
The E and S scores have been higher in the EU throughout 2015–2021 than in other economies. The UK improved its E score significantly to be comparable to the EU. These two economies have been more environmentally and socially conscious and have taken various policy measures, including disclosure and regulations, than others. Japan's S and G scores have been lower than the other three economies mainly because of the slowness in improving diversity at the board and employee levels.

Figure 1.4: Environmental (E) Score of Nonfinancial Companies in Japan, the European Union, the United Kingdom, and the United States



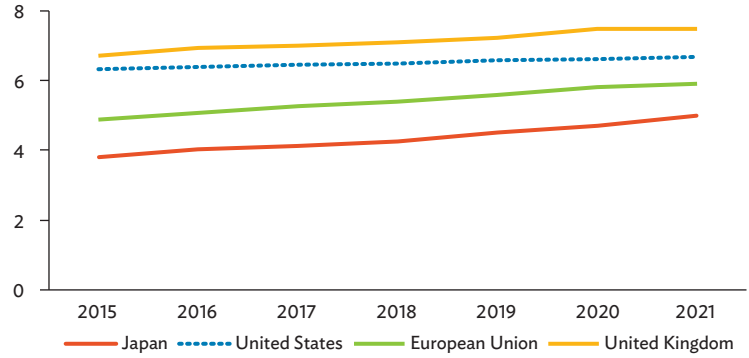
Source: Prepared by the author based on Bloomberg's ESG data set.

Figure 1.5: Social (S) Score of Nonfinancial Companies in Japan, the European Union, the United Kingdom, and the United States



Source: Prepared by the author based on Bloomberg's ESG data set.

Figure 1.6: Corporate Governance (G) Score of Nonfinancial Companies in Japan, the European Union, the United Kingdom, and the United States



Source: Prepared by the author based on Bloomberg's ESG data set.

2. ESG Score Variations and Challenges

ESG scores are often useful for investors wishing to contribute to achieving the SDGs and carbon neutrality through finance. The main sources of information used by ESG evaluation companies are public information disclosed by companies on company websites, including financial

statements, sustainability reports, and corporate governance reports; reports published by securities analysts and other experts; information provided from various news and media sources; litigation information; and reports published by nongovernment organizations (NGOs) and think tanks. Such evaluation agencies also contact companies directly for more detailed information and explanations. While some information can be clarified with detailed explanations through such communication, companies are unlikely to disclose confidential information.

Some evaluation companies, such as the CDP, send questionnaires in the same format to large listed companies and conduct evaluations (provide scores) based on the content of corporate responses to the questionnaires. In the case of climate change, a high evaluation is given to companies with a higher degree of detail and comprehensiveness in their responses. Also, companies are evaluated highly if their awareness of environmental issues and the environmental impacts, management methods, and GHG emission reduction actions align with the 1.5°C trajectory described in the Paris Agreement, and progress toward environmental stewardship is judged satisfactory. However, the CDP scores are based solely on the information provided in the responses provided by companies. High scores do not necessarily mean that such companies' climate actions are adequate. Indeed, the CDP admits that CDP scores are based on the level of activities reported in the responses and thus are not comprehensive metrics to measure the company's level of environmental sustainability.

The major ESG rating agencies in the world include the MSCI, Refinitiv, Sustainalytics, S&P Global, Bloomberg, FTSE Russell, and ISS Global. There are many other small rating agencies in the world. While such data are informative and help many investors, the ESG ratings of companies vary greatly among rating companies. This is true even though the information sources available to rating agencies do not differ much. The variation arises from the differences in the weight given to each piece of information and differences in calculation methods adopted by evaluation companies. Among ESG factors, the evaluation variability will likely be relatively low for the G (corporate governance) factor compared to E (environment) and S (social) factors because a certain degree of consensus has been formed on corporate governance issues and associated metrics and indicators. For example, companies are increasingly expected to promote diversity by raising the percentage of women, minorities, and foreigners on the board of directors and at managerial levels. G scores tend to be higher when companies have a higher percentage of independent, non-executive diverse board members. High G scores are also given when non-executive board directors chair the board and the compensation and nomination committees and when the majority of the board, compensation, and nomination committees

comprise non-executive board members. Furthermore, companies are evaluated highly when part of the remunerations of executive directors and officers are linked to sustainability-related medium-term targets (such as GHG emission cuts and diversity) and progress relative to the targets.

Regarding the E factor, there is consensus that setting GHG emission reduction targets in line with the Paris Agreement targets; disclosing GHG emissions data including Scopes 1 and 2 and, if available, Scope 3, and setting reduction targets based on scientific evidence such as SBTi are desirable. Meanwhile, there are significant differences in the evaluation methods on the E factor adopted by ESG rating agencies, mainly because of limited data available from companies concerning Scopes 1, 2, and 3, as well as GHG emission reduction short-, medium-, and long-term targets. In addition, rating agencies have different methodologies to evaluate companies' climate transition strategies. Different emphases, estimates, and weights lead to a completely different level of ESG single score among rating agencies.

Regarding the S (social) factor, gender diversity is commonly regarded as a priority item among ESG investors. However, many other items are covered in social issues, such as labor management, safe working environment, promotion, wage disparity, work–life balance, workers' retention measures, successor's plans, skill-up training, human rights, data privacy, AI bias, cybersecurity resilience, etc. One crucial challenge of E and S factors is that they include various issues with endless room for improvement. Just because a company has improved environmental and social practices and thus receives higher evaluation scores does not mean it has passed the test so that its actions and performance are perfect.

For example, suppose a company proactive in reducing GHG emissions and recycling activities has many women in its management team and is making excellent efforts to ensure its employees' work–life balance. Nevertheless, such a company could be slow in obtaining more environmentally and socially sustainable materials (such as agricultural materials, precious metals, and other industrial materials) and production inputs. As a result, the company may indirectly contribute to the destruction of forests and exploit local and child labor. It is difficult to evaluate such a company, and ESG scores can be easily divergent among data providers, depending on the issues prioritized. Another example is a technology-intensive company that handles personal data protection carefully, actively works on achieving carbon neutrality, and promotes diversity, but this company may be slow in addressing AI biases that lead to indirect racial or gender discrimination. This company may also exercise market power that deters competition, thus adversely affecting small and medium-sized enterprises (SMEs) and customers by charging

high fees. Companies with the highest ESG scores in evaluations tend to advertise those scores in their sustainability reports. While these companies can be congratulated on receiving high scores, high scores do not mean acquiring a "pass" mark from the environmental and social sustainability perspectives. The ESG scores are very different from credit ratings provided to bond issuers. Bond investors can have more confidence about the degree of creditworthiness when issuers obtain the highest credit ratings.

Wide variation of ESG scores is problematic for investors. Concerns are growing among investors and stakeholders since investment decisions may change depending on the rating agencies chosen. While large ESG investors can choose a few rating agencies, the high associated cost hampers them from using many rating agencies. Due to the cost factor, smaller investors find it even harder to choose multiple rating agencies. While credit ratings provided to bond issuers by various rating agencies tend to be closely associated with each other and thus rating variation is not a problem, it may take time for ESG scores to see more alignment. For this reason, each country should promote data collection and quality improvement and support standardization across the globe.

Billio et al. (2021) compared the ESG rating methodologies adopted by MSCI, Refinitiv, and Sustainalytics and found no common features with the definitions of ESG, including characteristics, attributes, and standards that define the E, S, and G factors. This analysis also found that differences in rating agencies' methodologies lead to opposite evaluations of the same company and affect sustainable investments, for example, by creating divergent benchmarks. Based on the literature review, it was also concluded that most ESG scores remain very different in terms of the definition of ESG materiality, information sources, and the weights applied to different criteria.

The SustainAbility Institute focused on 13 well-known ESG rating providers and conducted a questionnaire survey in 2022 among 33 investors and 104 companies about their evaluation of those rating providers concerning two criteria: quality and usefulness (Table 1.1). Some follow-up meetings were conducted with investors and companies (SustainAbility Institute 2023). The rating providers included the CDP, Refinitiv, Moody's ESG, Sustainable Fitch, FTSE4Good, RepRisk, EcoVadis, JUST Capital, S&P Global ESG, MSCI, Bloomberg, Sustainalytics, and ISS-ESG. These rating providers are headquartered in the US (six providers), the UK (three providers), the EU (two providers), and Switzerland (two providers). About 43% of investor respondents integrated ESG ratings and data into investment strategies. Almost all investor respondents use ESG rating products at least once a month. Despite heavy usage, about 52% of corporate respondents

Table 1.1: Survey Responses on ESG Rating Providers: by Investor and Company Respondents (%)

Investor Survey: Quality Rankings		
Rank	ESG Rating Provider	% Respondents Rating High Quality (4&5)
1	ISS-ESG	65
2	CDP	64
3	Sustainalytics	59
4	EcoVadis	50
5	S&P Global ESG	36
6	RepRisk	35
7	MSCI	35
8	Bloomberg	24
9	Moody's ESG	19
10	FTSE4Good	17
11	Refinitiv	14
12	Sustainable Fitch	11
13	JUST Capital	6

Investor Survey: Usefulness Rankings		
Rank	ESG Rating Provider	% Respondents Rating High Quality (4&5)
1	CDP	56
2	ISS-ESG	52
3	Sustainalytics	42
4	S&P Global ESG	30
5	Bloomberg	29
6	Moody's ESG	25
7	MSCI	23
8	RepRisk	23
9	Refinitiv	20
10	EcoVadis	16
11	FTSE4Good	12
12	JUST Capital	6
13	Sustainable Fitch	6

Corporate Survey: Quality Rankings		
Rank	ESG Rating Provider	% Respondents Rating High Quality (4&5)
1	CDP	80
2	S&P Global ESG	56
3	Sustainalytics	46
4	MSCI	43
5	ISS-ESG	34
6	EcoVadis	32
7	Bloomberg	19
8	RepRisk	19
9	Moody's ESG	18
10	JUST Capital	18
11	FTSE4Good	16
12	Refinitiv	9
13	Sustainable Fitch	5

Corporate Survey: Usefulness Rankings		
Rank	ESG Rating Provider	% Respondents Rating High Quality (4&5)
1	CDP	71
2	Sustainalytics	51
3	MSCI	49
4	S&P Global ESG	42
5	ISS-ESG	40
6	EcoVadis	34
7	RepRisk	24
8	Bloomberg	19
9	Moody's ESG	15
10	JUST Capital	14
11	FTSE4Good	10
12	Sustainable Fitch	7
13	Refinitiv	3

Source: SustainAbility Institute (2023).

and 49% of investor respondents have only moderate trust that ESG scores accurately reflect ESG performance. Overall, both investors and companies evaluated the CDP highly.

3. Growing Warnings from Regulators about ESG Scores

Information disclosure standards for companies are not yet standardized around the world. While standardization efforts are ongoing, companies have no guidelines to disclose indicators and targets. Thus, companies tend to arbitrarily use their preferred standards for disclosure, making it difficult to compare across companies by ESG investors. Some companies may be tempted to exaggerate the content of their disclosures or present information in ways that might easily lead to misunderstandings. In contrast, other companies remain reluctant to disclose ESG information. The underlying question is how credible information those rating agencies provide using the ESG scores, given that the information provided by companies is not standardized and, in many cases, not audited. In addition, since ESG rating agencies do not clearly explain their method of calculating the scores publicly, it is difficult to understand why such a judgment was made and the cause of the variation. Full public disclosure about their methodologies may be difficult because of the risk that other evaluation companies will imitate them; thus, the incumbents' scoring and data provision business will no longer viable.

The International Organization of Securities Commissions (IOSCO) warned in 2021 of unclear definitions of ESG scores and few explanations of what such ESG ratings or data products intend to measure (IOSCO 2021). IOSCO pointed out a wide variation of ESG ratings and data products, and some data and products have uneven coverage depending on industries or geographical areas. The resultant data gaps and uneven data treatments in turn may lead to inconsistencies in ESG investment strategies. In addition, IOSCO stressed that financial regulators in each country should strengthen regulations so that ESG rating companies are obliged to communicate with evaluated companies and confirm whether ESG scores and data are based on reliable and sound information. IOSCO's report also stressed that there might be some concerns about managing conflicts of interest, where the ESG ratings and data providers and consulting service providers for companies belong to the same organizations. There may be a case where a consultant service provider may guide companies to improve their ESG scores solely from the data computation perspectives without an accompanying improvement in actual practices. Thus, ensuring the ESG ratings or data products are based on sound information and treated fairly is important. Asset

managers wishing to promote the sustainability of invested companies using ESG score information purchased from ESG rating agencies can save their research costs and time. Nonetheless, it is impossible to confirm whether the investment policy based on such data can improve corporate ESG management. Therefore, an increasing number of major asset management companies are collecting information and researching on their own on major invested companies, producing ESG ratings for them internally, and using them in their investment policies and decisions.

Meanwhile, the European Securities and Markets Authority (ESMA), the EU's securities markets regulator, published survey results to obtain information about the market structure of ESG rating agencies within the EU (ESMA 2022). In its letter to the European Commission, ESMA pointed out that large non-EU data providers are few, while there are about 60 ESG rating data providers in the EU. Also, users of ESG scores tend to purchase such data from several data providers to increase coverage of companies in diverse regions and asset classes and obtain different types of information. Like IOSCO, ESMA found that the most common problems indicated by data users are a lack of coverage, insufficient details of data, and lack of clarity about rating methodologies. The letter also indicated that ESG ratings are provided to companies on an issuer pays basis (like regular credit ratings), and this practice has been more prevalent than anticipated. While companies rated by ESG rating agencies interact with the agencies, the survey results identified that uncertainty exists concerning the basis of the ESG ratings, including how information from interactions is reflected, when feedback from companies is conducted, and whether correction of errors about corporate information is made on time.

2

The Role of the Banking Sector in Promoting ESG-Oriented Corporate Management

ESG investment is growing among asset owners, such as insurance companies and pension funds, and asset management companies managing those assets. Besides, banks are expected to play an important role in promoting corporate ESG management. In addition, global central banks and financial authorities are increasing pressure on financial institutions, as highlighted in Chapter 6. There is the risk of destabilizing the financial system if the current financial system remains unchecked, as climate change will highly likely turn bank assets into nonperforming loans and reduce the value of the collateral. Based on this recognition, there is a rising global movement among central banks and financial regulators to encourage major banks to understand GHG emissions from their investment and loan portfolios, conduct climate scenario analysis, and improve climate-related financial risk management. An increasing number of ESG investors are also urging major banks to respond to climate change. As banks begin to transform their portfolios by improving climate risk management, it is expected that there will be a growing movement worldwide to differentiate lending rates and investment conditions for companies according to their environmental responses and strategies. The important role of banks is that, compared to ESG investors, who tend to reach out to relatively large companies with a significant asset management scale, banks have more opportunities to interact with SMEs. Thus, they play a central role in addressing climate change issues for SMEs. This chapter looks at recent banks' climate change initiatives, how to calculate GHG emissions from investment portfolios, address transition risks, and sustainable supply chain finance.

2.1 Expected Roles of Banks in Corporate Decarbonization and Low Carbonization

ESG investors worldwide are urging large listed financial companies. such as banks, not to mention large listed nonfinancial companies, to operate in an environmentally and socially responsible manner. Investors' engagement with banks on ESG issues is thus becoming active, and cases of exercising voting rights are growing in developed economies. Shareholder proposals are rising against banks that are judged to be too slow in responding to climate risks. ESG investors also increasingly work collectively with banks to encourage a reduction in their financed GHG emissions toward net zero by 2050 at the latest and to increase contact with their client companies to help reduce their emissions arising from business activities.

1. Participation in the Principles for Responsible Banking

In 2019, the United Nations Environment Programme Finance Initiative (UNEP FI) announced the Principles for Responsible Banking (PRB) to align banking operations with the international goals outlined in the SDGs and the Paris Agreement. The principles for institutional investors refer to the Principles for Responsible Investment (PRI) already announced in 2006. The PRB was subsequently introduced as the banking sector's version of the PRI. UNEP FI is an initiative established by UNEP in 1992 to promote the integration of ESG perspectives into the financial system. The PRB consists of six principles: (i) align banking business strategies with the SDGs and Paris Agreement goals; (ii) set goals and commit to reducing negative impacts and increasing positive impacts; (iii) behave responsibly toward customers; (iv) work closely with stakeholders to achieve society's goals; (v) implement commitment through effective governance and responsible banking; and (vi) be transparent and accountable for the impact on those goals.

Banks that have signed the PRB are required to take the following three steps. As a first step, banks are encouraged to conduct an impact analysis on the positive and negative impacts of investment and lending activities on society, the environment, and the economy by industry, technology, and region. After examining how to maximize the positive impact and minimize the negative impact, banks should start to consider how they can expand their business opportunities. As a second step, banks are suggested to set at least two targets concerning the areas generating the greatest impact (both positive and negative) from the perspectives of consistency with and contribution to the SDGs and

Paris Agreement goals. At least one of these goals should be related to the SDGs and the Paris Agreement. It is desirable to have measurable, quantitative, and qualitative goals, with timelines set and announced publicly. It is also good to identify any negative impacts that may arise in taking action toward those goals and consider countermeasures to mitigate them. While targets can be revised, setting more ambitious targets is expected. Banks should establish a governance structure at their banks' board level to monitor progress toward targets and the effectiveness of associated strategies.

As a third step, to fulfill accountability, banks should disclose in (existing) reports (such as sustainability and integration reports) data, targets, the degree of progress, impact, and contribution of their strategies to the goals. PRB signatory banks must publish their first report and self-assessment within 18 months and then annually after that. Banks are expected to implement all steps within 4 years after signing. The number of signatories has reached 316 worldwide, and the total assets are $89.5 trillion, accounting for around 49% of the world's bank assets. There are more than 300 signatory banks globally.

2. Banks Aiming for Net-Zero Emissions from Financed Portfolios

Many of the world's largest banks have pledged to achieve net-zero GHG emissions from their financed portfolios (recorded in Scope 3 investment as shown in Chapter 1) by 2050 at the latest. Against this backdrop, in 2021, the UN launched the Net-Zero Banking Alliance (NZBA), comprising banks that have committed to net-zero banking sector portfolios by 2050. The alliance is also a member of the Glasgow Financial Alliance for Net Zero (GFANZ). While the PRB aims to realize broader goals such as the SDGs, the Net Zero Banking Alliance is a climate-focused initiative. Thus, the UN-convened NZBA is the flagship climate initiative under the PRB, bringing together a global group of banks. These banks are committed to aligning their lending and investment portfolios with net-zero emissions by 2050. Currently, 129 are signatory banks whose total assets amount to $74 trillion and account for 41% of global banking assets.

Members of the NZBA must set net-zero targets by 2050, including GHG emissions from bank investment and lending activities. Consistent with this goal, banks must set targets for at least 2030 or earlier and shorter-term interim targets. By requiring shorter-term targets, GFANZ attempts to prevent short-term climate change responses from being put off by setting only longer-term goals. In addition, banks are expected to select one of the nine sectors with the highest GHG

emissions—agriculture, aluminum, cement, coal, commercial real estate and housing, steel, oil and gas, power generation, and transportation—within 18 months after signing. Banks are also expected to set reduction targets eventually for all nine sectors within 36 months. If some areas are excluded from targets, the explanations should be disclosed.

All of these targets are to be made public, and progress concerning the targets should be reported annually. Targets should be reviewed at least every 5 years in more ambitious directions (more emissions cut). Banks will likely adopt environmental policies that include measures leading to the achievement of the above goals and will begin to change the composition of their portfolios to achieve net-zero emissions. In particular, some ESG investors and NGOs focus on the financial activities of banks for coal mining and coal-fired power generation, which emit large amounts of GHGs, and the disclosure of specific reduction or phasing out targets related to such finance. There is increasing international pressure on banks to declare a moratorium on new investments as soon as possible.

Banks may find it difficult to achieve their net-zero targets unless their large client companies make significant progress in reducing GHG emissions. For this reason, to encourage companies to reduce their GHG emissions, banks must increase engagement with client companies and help them take new climate mitigation measures through consulting activities related to the formulation of transition strategies and information disclosure toward decarbonization and low carbon, as well as supporting those activities through investments and loans.

2.2 Measuring Emissions from Financed Portfolios

Like companies, banks are expected to disclose climate-related information in line with the TCFD guidelines and the disclosure standards prepared by the ISSB for banks. Banks' GHG emissions are overwhelmingly concentrated in Scope 3, which includes investments and loans rather than banks' financial activities, compared with direct emissions from own operations (Scope 1) and purchased electricity (Scope 2). Globally, investors increasingly believe that it is desirable for banks to set emission reduction targets arising from their portfolios and certify these targets based on scientific evidence. On this front, the Science-Based Target Initiative (SBTi) has issued guidance on SBT certification for the financial sector, which covers banks, insurance companies, and asset management companies (SBTi 2020). The approach for financial institutions is to reduce GHG emissions from various asset classes.

To obtain certification from the SBTi, a bank must set emission reduction targets for Scopes 1 and 2 and Category 15 (Investment) of Scope 3 and submit them to the SBTi for certification. In addition, companies are not expected to count carbon credits to meet their GHG reduction targets because carbon credits are not reductions arising from their business activities by taking concrete climate mitigation measures.

The SBTi's Three Approaches for Setting the Financed Emission Targets

The SBTi guidance focuses on corporate sector asset classes and links them to decarbonized and low-carbon pathways. Three approaches are available with regard to the reduction target-setting method under the SBTi. The first approach is the sectoral decarbonization approach, which uses "physical intensity" emission targets. Physical intensity emissions refer to emissions divided by volumes, not emissions divided by sales, etc. The approach applies to commercial real estate, mortgage loans, manufacturing (steel, cement, aluminum, and paper/pulp), as well as stocks, bonds, and loans with high GHG emissions. As physical intensity indicators, for example, emissions per square meter of floor space should be used for commercial real estate, while emissions per unit of electric power (megawatt-hour) should be used for power projects. Emissions per ton are calculated for the manufacturing industry, while emissions per revenue-passenger kilometer are calculated for transportation services such as airlines, passenger cars, buses, and railroads.

Regarding the period used for target setting, banks must set 5 years at a minimum and 15 years at a maximum from the time of the target submission to the SBTi. Also recommended is setting a longer-term goal for 2050. For example, Bank A, which invested in real estate, could use the following description for the target: "Bank A plans to reduce its GHG emissions from its real estate investment and loan portfolio by X% per square meter by 2030 compared to 2020." Furthermore, minimum conditions are set and defined as what proportion of the sector specified above must be covered by the target. For example, loans for commercial real estate operations must target at least 67% of the total square footage of commercial real estate in the base year through a sectoral decarbonization approach. In the case of project finance for power generation, there are specific rules.

For equities, fixed income, and loans, targets should be set for each asset class. If the sector to which the invested company belongs can apply a sectoral decarbonization approach, it must be adopted. In the case of financing for power generation projects, this approach should be used for all financing amounts. In addition to power generation, cement,

pulp and paper, transportation, steel, and buildings must have physical intensity emission reduction targets for banks' portfolios. For example, a target could be set using the following expression for Bank A's corporate loan for the steel sector: "For the steel sector, Bank A commits to reducing corporate lending by X% per ton of steel by 2030 compared to the 2018 reference year." The same is true for stocks and bonds. The portfolio reduction targets set in the sectoral decarbonization approach should be consistent with the emission reduction pathways of "well below 2°C (compared to pre-industrial levels) by the end of the century" presented for each sector, based on analyses such as the IPCC.

The second approach, the SBTi portfolio coverage approach, encourages companies to obtain SBTi-certified targets, aiming to achieve 100% coverage of such certified companies by 2040. Currently, the SBT requires companies to set targets consistent with the 1.5°C target. So, companies that commit to such strict reduction targets are subject to the second approach. Banks are expected to increase the number of such companies through engagement. The maximum coverage rate target period is 5 years, and the coverage rate target for each period (such as every 5 years) is expected to raise the rate target by drawing a linear path toward 100% by 2040. This approach is considered effective in reducing emissions related to stocks and loans. For example, suppose 10% of the companies that make up Bank A's corporate investment and loan portfolio as of 2020 have already been SBTi-certified. In that case, Bank A may attempt to increase the ratio by encouraging companies that constitute the remaining 90%. The ratio is suggested to be raised by 4.5% yearly (90/[2040–2020] = 4.5) to reach 100% by 2040. This bank also needs to provide a weighted average percentage of equities, bonds, and loans for reduction targets using this approach. A bank will encourage companies to set emission reduction targets based on Scopes 1 and 2. But for companies whose Scope 3 emissions exceed 40% of total emissions, Scope 3 emission reduction targets are suggested to be set.

The third approach is the SBTi temperature rating approach, which calculates a temperature score for a bank's current portfolio and encourages companies to set ambitious reduction targets to align the bank's temperature for the portfolio with long-term temperature targets. That is, a bank is expected to convert companies' published GHG emission reduction targets based on Scopes 1 and 2 into a temperature rise score and ensure that the temperature rise score for the entire portfolio will achieve at least a well-below 2°C scenario at the latest by 2040. In the case of the temperature rise score using Scopes 1, 2, and 3, a bank can set the target consistent with a more moderate minimum 2°C scenario. If companies' Scope 3 emission exceeds 40% of total emissions, Scope 3 must also be covered.

2.3 Sustainable Supply Chain Finance

In recent years, large companies have been working on reducing Scope 3 emissions in their supply chains. There is a movement by ESG investors to encourage an environmentally sustainable supply chain. Various companies are involved as suppliers, ranging from the upstream stage of obtaining inputs and materials to the downstream stage of selling products to users and consumers and disposing of the products. At each stage of the supply chain, companies are expected to increase sustainability to meet the demands of global consumers and investors, raising environmental and social awareness and ensuring sustainable corporate growth and corporate value. At the same time, many SMEs that have supply relationships with large companies often lack the knowledge and skills to improve their management systems and sales activities from an environmental and social perspective. There are concerns that such SMEs might be left out and excluded from corporate contracts and transactions in the future, while large listed companies are increasing climate mitigation actions and disclosure.

Meanwhile, banks promote decarbonization and low-carbonization of their investment and loan portfolios. To that end, they must consider new financial services schemes. Banks must be aware that investments and loans to SMEs that are slow to respond to climate risks will increase credit risk and possibly lead to nonperforming loans. Reflecting on these circumstances, a financial support mechanism called sustainability supply chain finance can be considered for SMEs as part of the support for forming sustainable supply chains by banks. To improve the environmental performance of SMEs while ensuring returns for banks that extend credit to them, the World Bank Group's International Finance Corporation (IFC) provides the Sustainable Supply Chains program by providing technical assistance to banks. This program is to strengthen credit risk assessment methods by banks from the perspective of environmental and social sustainability with technical support for practicing due diligence to monitor compliance with environmental and social standards.

Under the framework of sustainable supply chain finance, relationships between suppliers such as SMEs, large companies that purchase goods from SMEs, and banks will be important. In general, when SMEs sell goods to a large company as suppliers, an accounts receivable arises in which the large company defers the payment of the purchase price until a specific settlement date. While SMEs can hold accounts receivable and receive repayment on the settlement date, they may want to obtain working capital as soon as possible. Thus, they may choose to have the accounts receivable purchased by banks at a discount

before the settlement date. In this case, the banks will transfer the amount after deducting the discount fees to the account of the SMEs before the settlement date. These discount fees or rates are determined by the creditworthiness of the SMEs, which tend to be lower than large companies. Large companies tend to have a higher degree of creditworthiness, perhaps due to greater diversification.

Given this background, banks may consider providing lower discount rates related to those accounts receivable held by SMEs, reflecting the creditworthiness of large companies, which buy SMEs' products, if such SMEs obtain high evaluations from the perspectives of preset environmental criteria (such as GHG emission cut). Under the sustainable supply chain finance framework, SMEs could receive the same high creditworthiness and lower discount rates as large companies. Such SMEs continue to get working capital earlier than the settlement date but at a lower cost. In contrast, large companies continue to postpone the payment and thus save money until the settlement date. Banks also enjoy extending greener finance to SMEs—this scheme being similar to sustainability-linked loans. If SMEs cannot meet the preset environmental criteria, they are subject to the original discount rates reflecting their creditworthiness. This financing scheme can encourage SMEs to cut emissions while large companies can reduce Scope 3 emissions. Banks in Europe have developed this win-win scheme among three entities; it appears to be practiced by banks in other countries, including Japan.

3

Climate Change, Environment, and Blended Finance for Emerging and Developing Economies

This chapter focuses on climate-related innovative finance to support emerging and developing economies (EMDEs). The global economy has been facing a series of adverse shocks to EMDEs in recent years, including the COVID-19 pandemic and subsequent variant spread, climate crisis, food and energy shortages, volatile capital flows, higher public debt, and interest rate shocks driven by global monetary policy normalization. Investment in clean energy projects has been severely inadequate in EMDEs compared with developed economies due to the limited implementation of climate mitigation policies and limited finance to support decarbonization efforts. More financial support should be provided to EMDEs to help achieve climate and environmental goals and other SDGs. The chapter overviews recent developments and issues related to seeking finance that supports environmentally sustainable development in EMDEs. The ratios for promoting blended finance and various types of schemes are examined. Several examples of actual implementation of the schemes led by the EU, some developed economies, multilateral development institutions, the UNFCCC-convened Green Climate Fund (GCF), and the private sector initiatives are touched upon. The discussion in the chapter will shed light on some innovative finance schemes called "blended finance" that are applicable to EMDEs.

3.1 Financial and Official Development Assistance Flows to Emerging and Developing Economies

The world must work together to achieve the SDGs and cope with climate change and biodiversity loss and shift more focus on financing EMDEs to meet these goals. The International Debt Statistics 2022, compiled

by the World Bank Group, covers private and public stock and flow data for 123 economies (World Bank Group 2022). It shows that net debt and equity flow to EMDEs dropped in 2020 for 2 consecutive years (Table 3.1). In 2020, the sharp decline in net debt inflows by foreign private creditors (especially in the form of the withdrawal of banks and other flows) was more than offset by net debt inflows led by official creditors, including the World Bank Group—International Bank for Reconstruction and Development (IBRD) and International Development Association—and the International Monetary Fund (IMF). The total equity financial flows also dropped due to a sharp decline in net foreign direct investment (FDI) and, to a lesser extent, decreased portfolio equity inflows. Overall, bond and equity flows were relatively more stable than banks and FDI.

1. Growing Presence of the PRC Both as the Largest Recipient and Creditor of Finance

In addition, more than half of the net financial flows to EMDEs in 2020 concentrated on the People's Republic of China (PRC) as the largest recipient. Net financial flows to the PRC rose 33% in 2020 to $466 billion, of which net debt flows increased 62% to $233 billion and net equity inflows rose 12% to $233 billion. In sharp contrast, net financial inflows to EMDEs, excluding the PRC, fell 26% in 2020 to $443 billion, of which net debt inflows fell 21% to $202 billion and net equity inflows fell 31% to $240 billion. Within net equity flows, FDI fell 23% and portfolio equity flows turned negative, with an outflow of $24 billion compared to a small $3 billion inflow in 2019.

The World Bank report highlighted the PRC's unique position as the largest recipient and creditor (World Bank Group 2022). Over the past decade, almost 60% of net total financial flows to EMDEs from external creditors and investors—close to $4 trillion—went to the PRC. Of the nearly $4 trillion, about 40% was allocated to debt inflows, and 60% was allocated to FDI and portfolio equity flows. Consequently, the PRC's external debt stock rose 11% in 2020 to $2.3 trillion, including domestic and foreign currency–denominated external debt. But this debt size remained moderate in relation to the gross domestic product (GDP) at 16%. Short-term debt, of which about a third was trade-related, accounted for 53% of the external debt stock, but short-term debt declined from 57% in 2019 to 53% in 2020. Instead, long-term debt rose 22% in 2020 to $1.1 trillion due to a large increase in renminbi bond issuances by public and private entities in the China Interbank Bond Market (CIBM) purchased by nonresidents.

The sharp rise in nonresident investors' demand for renminbi-denominated bonds reflected the PRC's earlier economic recovery from the COVID-19 pandemic in 2020 (compared with other economies) and

Table 3.1: Aggregate Net Financial Flows to Emerging and Development Economies ($ billion)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Net financial flows, debt, and equity	1,324.9	1,223.8	1,457.7	1,136.3	207.6	721.0	1,289.9	1,108.2	953.8	908.6
Share of GNI (%)	5.7	5.0	5.6	4.2	0.8	2.8	4.5	3.7	3.1	3.0
Net debt inflows	717.2	587.7	814.8	539.8	–316.1	208.4	755.4	574.5	400.1	435.4
Long-term	405.0	468.5	447.6	394.7	171.6	243.3	433.4	352.4	372.3	419.4
Official creditors	39.1	34.3	30.7	47.8	49.2	62.3	56.2	81.3	64.0	128.6
World Bank (IBRD and IDA)	6.4	12.0	14.1	15.1	17.6	13.5	13.1	14.7	19.1	27.2
IMF	0.5	–8.4	–17.7	–7.2	4.8	5.0	3.6	30.9	21.6	46.5
Private creditors	365.9	434.2	416.8	346.9	122.4	181.0	377.2	271.1	308.3	290.8
Bonds	150.5	225.7	172.7	174.8	74.9	120.1	289.1	203.6	255.2	280.1
Banks and other private	215.4	208.6	244.2	172.1	47.5	60.9	88.1	67.5	53.1	10.7
Short-term	312.2	119.1	367.2	145.1	–487.7	–34.9	322.0	222.2	27.8	16.0
Net equity flows	607.6	636.1	642.9	596.5	523.6	512.6	534.5	533.6	553.7	473.2
Net foreign direct investment inflows	603.8	538.8	572.8	512.7	502.4	467.9	467.7	496.5	505.7	434.5
Net portfolio equity inflows	3.8	97.4	70.1	83.8	21.2	44.7	66.7	37.2	48.0	38.7
Change in reserves (– = increase)	–457.4	–284.1	–523.3	96.9	607.1	274.9	–313.5	84.1	–189.3	–330.4
Memorandum item										
Workers' remittances	337.2	362.8	384.0	414.8	416.9	408.0	444.2	481.9	501.7	499.5

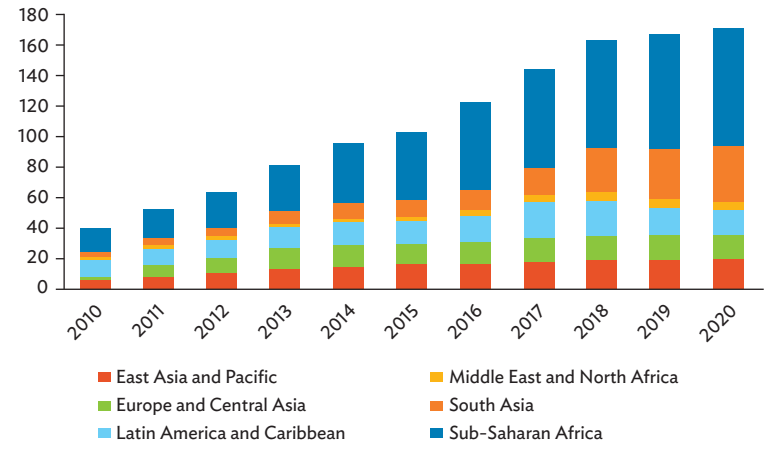
GNI = gross national income, IBRD = International Bank for Reconstruction and Development, IDA = International Development Association, IMF = International Monetary Fund.

Source: World Bank Group (2022).

the PRC government's concerted efforts to liberalize their cross-border financial accounts since 2016. Such efforts include (i) the removal of investment quotas or repatriation restrictions for foreign institutional investors under the CIBM Direct Access Program; (ii) the Bond Connect program in 2017, enabling investors to register and settle trades onshore in response to investors' concerns over repatriation and capital account risk as a result of holding assets and settling offshore; and (iii) the removal of repatriation, holding period, and quota restrictions in 2018–2020. As a result, nonresident participation in the onshore bond market has risen steadily. The PRC's bonds held by nonresidents totaled about $635 billion. They accounted for 58% of its long-term external debt in 2020. Including renminbi-denominated bonds in the Bloomberg Barclays Global Aggregate Index and China A-shares in the FTSE Russell emerging market index also contributed to the growing demand for renminbi-denominated bonds by foreign investors.

At the same time, the PRC became one of the largest bilateral creditors in the world, reflecting its high economic growth averaging over 9% over the past 2 decades. The combined debt from the PRC of low- and middle-income countries has risen sharply, reaching $170 billion in 2020 (Figure 3.1). This total size is rather large compared to EMDEs' combined debt owned by IBRD ($204 billion) and the International Development Association ($177 billion). Most debts owed to the PRC are related to large-scale infrastructure projects and operations in the extractive industries. This debt is defined as financing that the PRC has disbursed minus any principal payments made by the borrower. Thus, the debt data do not include loan commitments and undisbursed amounts and only cover public- and publicly guaranteed debt. The data also do not include debts owned by Chinese state-owned enterprises and the private sector not guaranteed by the government. The World Bank Group indicated that the data are reported in the aggregate; thus, creditors cannot be separately identified. The PRC's lending to EMDEs includes (i) concessional renminbi-denominated loans provided by the PRC government through the International Development Cooperation Agency; (ii) concessional (renminbi- and US dollar–denominated) loans from the Export–Import Bank of China managed by the Preferential Loans Department; (iii) nonconcessional US dollar–denominated loans extended by policy banks, including the Export–Import Bank of China,

Figure 3.1: Emerging and Developing Economies' Debt to the People's Republic of China ($ billion)



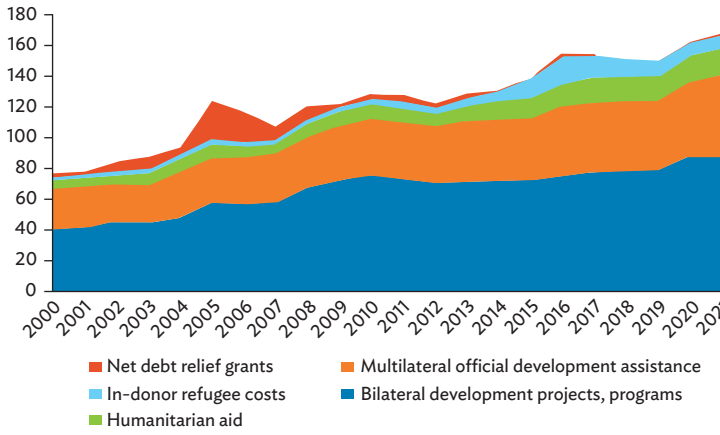
Source: World Bank Group (2022).

the China Development Bank, and the Agricultural Development Bank of China; and (iv) loans from commercial banks and suppliers insured by the PRC's official export credit agency, SINOSURE.

2. Growing ODA from Developed Economies but Failing to Meet the Gross National Income Target Ratios

The Development Assistance Committee (DAC) member economies have provided a significant net ODA to EMDEs over many years. The net ODA amount has provided a stable source of development financing and has cushioned the adverse impacts of past economic and financial crises faced by EMDEs. The net ODA steadily rose by 118% in real terms from 2000 to 2020 and increased from 2016 to 2020 by around 20% since the SDGs were adopted in 2015 (Figure 3.2). Although DAC member countries faced economic hardships in 2020, the net ODA rose further by 4% to $162 billion from the previous year, while all other major external resource flows, including the private sector, to EMDEs fell. Despite the COVID-19 pandemic in 2020, most donors had already approved their ODA budgets and thus maintained their commitments, with some members mobilizing additional funding to support severely distressed developing economies.

Figure 3.2: DAC Member Economies' Net Official Development Assistance in Real Terms ($ billion)



DAC = Development Assistance Committee.

Note: Data refer to the constant 2020 price.

Source: OECD (2022b).

The net total ODA rose in 2021 by 4.4% in real terms, the highest level ever recorded at $179 billion (OECD 2022b). The increase was mostly due to DAC member economies' support for the COVID-19 response, particularly donations to address global vaccine inequities. Excluding costs paid for vaccines, net ODA grew only by 0.6% in 2021, primarily arising from increases in multilateral funding. The amount of net ODA in real terms rose significantly in Italy (34.5%), the Republic of Korea (ROK) (21%), Slovenia (19%), Ireland (15%), the US (14%), New Zealand (14%), Spain (12.5%), Japan (12%), and Iceland (12%). In contrast, the amount dropped in the UK, Sweden, Norway, and the Netherlands. Although the absolute amount of net ODA rose in the aggregate, the ratio to combined gross national income was just 0.33%, failing to meet the UN's 0.7% target. Only five DAC members (Denmark, Germany, Luxembourg, Norway, and Sweden) met the 0.7% target. The 0.7% target was first agreed upon in 1970; since then, it has been repeatedly stressed at high-level international aid and development conferences. DAC member economies increased new and additional assistance for Ukraine and the Ukrainian refugee crisis and for mitigating the deepening food insecurity, hunger, and extreme poverty worldwide. However, they find it challenging to meet the 0.7% target.

While DAC member economies, including the EU, the US, the UK, and Japan, increased ODA in 2020, their other official development finance flows also increased significantly in 2020, particularly to Asia and Latin America, and especially through the World Bank, the IMF, regional development banks, EU institutions, the UN, etc. By contrast, non-DAC economies, including about 19 economies (excluding the PRC), reduced ODA in 2020 for 2 consecutive years. Other official development finance also dropped in 2020. Thus, development finance from non-DAC member economies and private finance should increase their contributions to meet the magnitude of financing needs in EMDEs.

3. G7 Initiatives to Promote Greater Collaboration with Other Donors and Recipient Economies

The G7 summit meeting in June 2022 agreed that the Partnership for Global Infrastructure Investment (PGII) would help counter the infrastructure gap in EMDEs. In the next few years, about $600 billion will be allocated to infrastructure development, including climate change in EMDEs, by mobilizing public and private sector money from the G7 economies. This amount includes multilateral finance. Based on the conversations between Chatham House researchers and members of the Biden administration, the Chatham House report explained that this initiative reflected the US government's intention to rebrand the

original Build Back Better World initiative as a PGII to promote greater collaboration with other G7 members and recipient economies with value-driven, high-standard, transparent, sustainable partnerships (Liao and Beal 2022). The pledged amount will likely be disbursed from the existing baseline budgets. Thus, additionality (i.e., new additional finance) obtained from additional sources of financing will unlikely happen for many economies.

This PGII framework appears to promote alignment with the proposal for a global certification framework for quality infrastructure investment, the so-called "Blue Dot Network," announced by the OECD in March 2022, to be financed jointly by the US and its Quad partners Japan and Australia. The OECD stressed that quality infrastructure projects should be developed in alignment with the G20 Principles for Quality Infrastructure Investment and other best-in-class frameworks (such as the SDGs, the Equator Principles, and the OECD Guidelines for Multinational Enterprises) through the establishment of a voluntary private sector–focused and government-supported certification scheme for attracting investment and ensuring their positive outcomes (OECD 2022a). The qualities under the certification framework focus on (i) infrastructure projects throughout the entire life cycle; (ii) openness and inclusiveness for all projects; (iii) implementation of widely accepted existing standards and instruments; (iv) credible and evidence-based assessment while minimizing cost and burden borne by participants; (v) support for mobilizing private sector investment; and (vi) recognition of varying levels of capacity of project developers and jurisdictions, thus encouraging the progressive realization of requirements for impactful infrastructure projects. Based on these qualities, a project to be certified must demonstrate alignment with a set of essential requirements derived from more than 70 international standards identified by the OECD. Then, a scoring system that translates compliance with individual requirements into an assessment of the entire project will be adopted. The point-based scoring system is expected to recognize levels of quality infrastructure; thus, a project that excels in specific areas will be granted additional points. Finally, an efficient and credible review process will take place, consisting of an initial self-assessment conducted by the applicant, followed by an independent verification by a third party. To generate efficiencies, existing due diligence procedures conducted by development finance institutions (DFIs) and other financing agencies, as well as existing certification schemes that share similar values and criteria, will be recognized and utilized flexibly.

Liao and Beal (2022) stress that whether these new forms of global partnership and collaboration initiatives will lead to mobilizing private sector finance remains unclear. While G7 nations have great aspirations to mobilize private capital, it is also important to recognize that the

role and leadership of donor economies are essential to materialize their aspirations. In addition, it is pointed out that funding pledges in development finance have been traditionally hard to fulfill, resulting in the disparity between commitments and actual disbursements. For example, G7 nations' bilateral ODA disbursements between 2002 and 2019 were 9% lower than the amount announced (Liao and Beal 2022). Over the same period, EU institutions disbursed 24% less development finance (a shortfall of more than $84 billion) than they had initially committed.

Meanwhile, the global climate or environmental finance landscape among donors and multilateral and regional institutions is well-known to be highly fragmented, leaving accountability for climate finance flows opaque and hard to measure objectively. So far, the climate finance landscape has mirrored the current political economy of the global development finance architecture and is largely donor-dominated (AfDB 2022). Weak coordination and lack of consensus on a methodology for measuring climate or environmental finance flows from different sources have led to a lack of transparency and accountability in tracking new and additional finance flows from various sources. This has led to increased trade-offs among climate finance and other development financing sources, including ODA and financing from multilateral development banks (MDBs).

It may be difficult for donor countries to increase the number of collaboration initiatives due to the need for a greater amount of time and people involved in negotiations. However, the Energy Transition Partnerships are a welcome step to increase donor coordination to mobilize more funds to concentrate on decarbonization for some economies. This was demonstrated by the Just Energy Transition Partnership for South Africa in November 2021 by the EU, France, Germany, the UK, and the US the 26th Conference of the Parties (COP26) to the UN Framework Convention on Climate Change (UNFCCC) . The partnerships were further promoted for Indonesia in November 2022 by Canada, the EU, France, Germany, Italy, Japan, Norway, the UK, and the US at COP27, as well as for Viet Nam in December 2022 by Canada Denmark, the EU, France, Germany, Japan, Norway, the UK, the US, and the private sector.

3.2 Developed Economies' Commitment to Climate Finance and Public–Private Partnership

EMDEs generally suffer from shortages of social and economic infrastructure, such as energy, transport, water supply and sanitation, water management (irrigation, flood control, safe water, etc.), schools,

and health care, constraining economic growth and hampering poverty reduction. Currently, energy consumption in EMDEs, excluding the PRC and India, is relatively low. However, energy demand is expected to increase in the future in the process of promoting industrialization and economic development. EMDEs are set to account for the bulk of GHG emissions growth in the coming decades unless much stronger action is taken to transform their energy systems. In a scenario reflecting today's announced and existing climate and energy policies, GHG emissions from EMDEs are projected to grow by 5 gigatons over the next 2 decades while falling by 2 gigatons in developed economies and plateauing in the PRC (IEA 2021). Therefore, an unprecedented increase in clean energy investment is required to put these countries on a pathway toward net-zero emissions in a cost-effective way. Clean energy investment in EMDEs declined by 8% to less than $150 billion in 2020, with only a slight rebound in 2021.

1. Developed Economies Failing to Meet Climate Finance

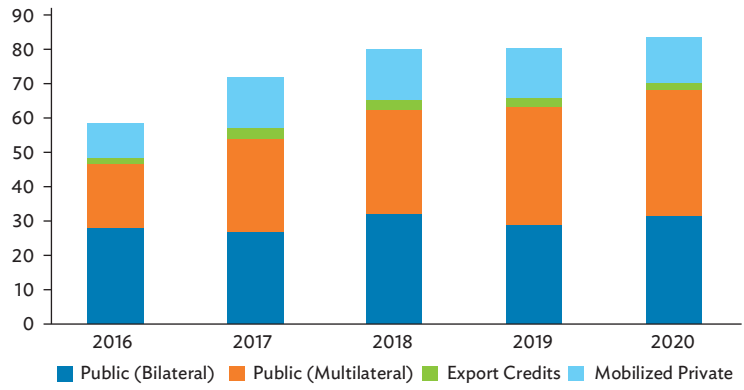
Energy investments in EMDEs currently depend heavily on public sources of finance. At COP15 of the UNFCCC in 2009 in Copenhagen, Denmark, developed economies committed to a collective goal of mobilizing $100 billion per year by 2020 for climate action in EMDEs, in the context of meaningful mitigation actions and transparency on implementation. This financial goal was formalized at the subsequent COP16 in 2010 in Cancún, Mexico. Subsequently, this goal was reiterated at COP21, in 2015 in Paris, France. It was agreed to continue with the same $100 billion annually until 2025. In addition to climate change mitigation, COP21 also agreed to balance support for adaptation to climate change as the frequency and loss of disasters triggered by natural hazard increased. At the request of donor economies, the OECD has been tracking progress on mobilizing $100 billion annually by combining public and private funds from developed economies and MDBs allocated to promote climate change mitigation measures in EMDEs.

In 2020, however, the total amount of climate finance for EMDEs rose by a mere 4% to $83 billion; thus, the promised financial support has not yet materialized (Figure 3.3). Of this $83 billion, public climate finance (bilateral and multilateral combined) continued to take a substantial share of the total and accounted for 82% (OECD 2022d). Private finance mobilized by public climate finance decreased slightly to $13 billion, while climate-related export credits remained small. Mitigation finance continued to represent the majority (58%) despite a decline in the amount by $2.8 billion. Adaptation finance grew by

$8.3 billion, accounting for 34% due to a few large infrastructure projects. Among the amount of public finance provided throughout 2016–2020, loans accounted for 72%, grants accounted for only 25%, and equity remained limited.

The share of loans was greater for multilateral public finance (84%) than bilateral public finance (59%). Within multilateral public finance, multilateral climate funds provided more grants (56%) than loans (39%) compared with MDBs, whose loans accounted for 91%. Despite the small amount, bilateral and multilateral climate funds provided more equity finance than MDBs. Multilateral climate funds include (i) the GCF, established in 2010 by the UNFCCC (also discussed in this chapter); (ii) the Adaptation Fund, established in 2001 under the Kyoto Protocol of the UNFCCC; (iii) the Climate Investment Fund, introduced in 2008 at the request of the G8 and G20; (iv) the Global Environment Facility Trust Funds, established in 1992 by IBRD; and (v) the Global Environmental Facility Least Developing Countries Fund, established in 2001 by the UNFCCC.

Figure 3.3: Total Climate Finance Provided and Mobilized ($ billion)



Source: OECD (2022d).

It should be noted that committing $100 billion a year is a relatively small amount for EMDEs. The BlackRock Investment Institute estimated that the investment required to achieve net zero in EMDEs is around $1 trillion annually (Bloomberg 2021). Among EMDEs, the PRC

has been actively investing in clean energy for many years. Excluding the PRC, the size of clean energy investments in EMDEs fell by 8% to below $150 billion in 2020 and increased only slightly in 2021. For the world to achieve net zero by around 2050, EMDEs, excluding the PRC, will need an additional annual investment of about $780 billion by 2025 (Climate Policy Initiative 2021). The IEA estimated that more than 70% of clean energy investments must be financed through private capital, especially in renewable power and efficiency (IEA 2021). Public sources of finance, including state-owned enterprises, will continue to play vital roles, especially in grid infrastructure and transitions for emission-intensive sectors. The provision of blended finance from DFIs is critical to attracting private capital to markets and sectors at early stages of readiness.

This chapter has pointed out that the ODA amounts provided by developed economies have been growing but remain insufficient to make progress on the SDGs and environmental agenda in EMDEs. According to the OECD, the shortage of funds (financing gap) for EMDEs to achieve the SDGs used to be estimated at $2.5 trillion annually until 2019. But the shortage had increased to $3.7 trillion annually by 2020 since the COVID-19 pandemic and associated economic contractions (OECD 2021). The funding gap has expanded further since 2020 because the COVID-19 pandemic, the global energy and food crises, and the Russian invasion of Ukraine required governments in EMDEs to make additional public spending while facing a decline in foreign capital inflows. Improving their financing situations requires expanding public funds from MDBs and developed economies as donors and long-term financial support from the private sector, including ESG investors. Therefore, it is important to explore innovative ways to attract more private capital or funding from institutional investors from developed economies.

2. Growing Focus on the Role of ESG Investors in Public–Private Partnerships

Various innovative finance schemes have been developed and practiced in the past. However, these schemes, mainly based on public funds, were unsuccessful in mobilizing large-scale mainstream funds toward EMDEs. In recent years, momentum has been gathered from private capital because investment focusing on ESG led by institutional investors has grown rapidly. Many large financial institutions are increasingly committed to cutting their financed GHG emissions by 2050. ESG investors mainly comprise long-term-oriented asset owners (such as pension funds and insurance companies) and their asset management companies. The amount of global sustainable finance—

the amount of assets under management—was estimated at $35 trillion in 2020 by the Global Sustainable Investment Alliance (GSIA), an international collaboration of membership-based sustainable investment organizations covering Australia, Canada, Europe, Japan, New Zealand, and the US (GSIA 2021). This amount grew by 15% in 2020 compared to the previous survey performed in 2018. The US and Europe remained dominant, accounting for 48% and 34%, respectively. It should be noted that the data did not cover emerging economies, including the PRC, whose green market size, including green bonds and green loans, has been expanding rapidly and is becoming comparable to the size of the US and Europe.

Moreover, at COP26 held in 2021 in Glasgow, UK, environmentally conscious global finance-sector-specific alliances—covering asset owners, asset managers, banks, insurers, financial service providers, and investment consultants—aiming for net-zero GHG emissions from their financed portfolio and activities by 2050, formed the GFANZ. Its formation has increased the momentum of ESG investments that seek to encourage corporate behavioral and business model changes through financing and investment activities. Their focus is gradually expanding beyond listed companies in developed economies, given that those mentioned common global goals cannot be achieved without successful performance in EMDEs. In line with the movement of ESG investment, large companies express intentions to reduce their GHG emissions and show more commitment, as demonstrated by participating in the RE100 initiative and setting GHG emission cut targets (and increasingly carbon neutrality targets). Companies are more eager to obtain sustainable materials and inputs from EMDEs to produce sustainable products and services. Digital technology, AI, and satellite imagery technology also improve the capacity to monitor some environment-related projects and their emission amounts more efficiently, enabling the traceability of sustainable products and services. Therefore, it may be time to examine how to mobilize ESG investment from new sources and expand existing finance from commercial banks or impact investors.

3.3 Blended Finance Schemes to Mobilize Climate and Environmental Projects

Expectations are rising worldwide that institutional investors will promote ESG investment in developed economies and contribute more funds to achieving the SDGs and net-zero GHG emissions in EMDEs. Since the global financial crisis in 2008, financial regulations have been tightened, making it difficult for investors to take risks, including investing

in EMDEs. If the current situation is left unaddressed, it will delay EMDEs' response to coping with climate change and other environmental problems and achieving SDGs. In recent years, blended finance has been under the spotlight because of the potential to effectively utilize public and private capital jointly and deepen investors' involvement in addressing global environmental and social issues. In light of this, the UN-convened Net-Zero Asset Owner Alliance (NZAOA) called asset managers to collaborate in increasing blended finance vehicles to EMDEs (UN-convened NZAOA 2021a, 2021b). The NZAOA is an initiative of institutional investors committed to transitioning their investment portfolios to net-zero GHG emissions by 2050. It is an important member of GFANZ with other sector-specific alliances, including the Net Zero Asset Managers Initiative. The following subsections will focus on the definitions, features, and structures of blended finance.

1. Blended Finance to Correct the Two Types of Market Failures

Blended finance is classified as part of impact investment. It is an approach that aims to positively impact (e.g., GHG emission reduction) and expand the supply of private capital. As the financial resources of EMDEs and the current public development funds are insufficient, it is becoming essential to examine innovative funding sources to mobilize more private capital. Blended finance is one form of public–private partnership financial arrangement.

Blended finance addresses two market failures that make it difficult for EMDEs to access financial markets. One is the externality related to projects. For example, some investments, such as renewable energy, may lead to decarbonization. Others may revitalize the economy for the community by constructing an environment-unfriendly factory complex that pollutes and harms the health of citizens. These positive or negative externalities are not reflected in project returns, thus failing to resolve market failures. Therefore, if blended finance can focus more on implementing projects with a positive environmental impact, enhancing the positive externality is possible. In this case, blended finance can realize "project additionality." To realize such a socially desirable project through a public–private partnership, it may be necessary to enable a continuation of the project by supplementing the low financial return with a grant or catalytic fund portion of public funds until the project gets on track and can operate sustainably and commercially. It is also possible to use part of the grants to pay for the cost of remediation of the negative externalities the project brings.

Another market failure is the problem arising from project information asymmetry. There is a high degree of uncertainty about the benefits of projects, and the lack of information has led to imperfect capital markets. As a result, private funders tend to view the project as a high-risk investment with a low probability of repayment in terms of income, resulting in an insufficient investment. In this circumstance, a blended finance mechanism might enable public funds to mainly invest in the initial phase and private investors to start financing the project with a small amount. Private investors may provide more funding after the project becomes more viable. Blended finance is important because blending the public fund portion with private funding can attract new private financing for projects that otherwise would not have been possible. In other words, blended finance can bring about "financing additionality."

2. Definition of Blended Finance and Eligible Projects

The concept of "blended finance" is used in various interpretations and does not have a single definition. The OECD defines it as "the strategic use of development finance to mobilize additional resources for sustainable development in EMDEs." Public funds here include both concessional and commercial market-rate funds. Under the OECD definition, "additional finance" refers primarily to commercial finance, and the focus lies on mobilizing commercial finance that is not currently directed toward development-related investments. All relevant, higher-level commitments made by the DAC member economies concerning development cooperation apply to blended finance in the same way as to other financing approaches. These include, among others, commitments to ODA financing targets, the commitment to leaving no one behind, commitments related to development effectiveness, and those related to untying aid. The Addis Ababa Action Agenda set out at the Third International Conference on Financing for Development in Addis Ababa, Ethiopia, in 2015 defined blended finance as the combination of concessional public finance with nonconcessional private finance and expertise from the public and private sectors, special-purpose vehicles, nonrecourse project financing, risk mitigation instruments, and pooled funding structures.

The World Bank Group's IFC, on the other hand, uses a narrower definition and defines blended finance as the use of relatively small amounts of concessional donor funds to mitigate specific investment risks and help rebalance risk and reward profiles of pioneering investments that cannot proceed on strictly commercial terms. In particular,

IFC focuses on promoting commercially sustainable project implementation and the standards for high-quality projects and expects to provide relatively short-term concessional financing.

Meanwhile, MDBs and bilateral development finance institutions (DFIs) have adopted the DFI definition of blended concessional finance and focus only on situations where contributions from donors or third parties are provided at concessional rates to be mixed with commercially based finance from DFIs and/or other investors. They use "blended concessional finance" instead of just "blended finance." Such reflects a need to particularly focus on using concessional finance in blending.

(1) Concessional funds are a particularly scarce resource, requiring grant-equivalent contributions from governments or other philanthropic institutions.
(2) The use of concessional resources in blending, therefore, requires a special rationale beyond other types of development finance.
(3) Blended concessional finance is particularly important in difficult markets and the most challenging and pioneering investments.
(4) The use of concessional resources presents special governance issues related to the potential for conflicts of interest between commercial and noncommercial financiers.

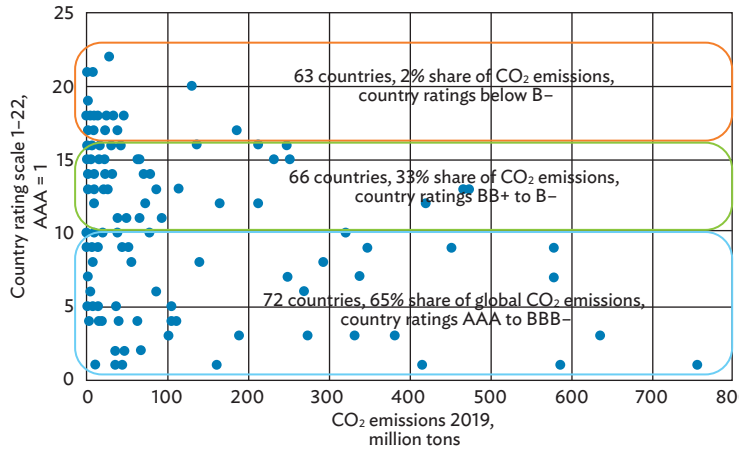
Although there is no uniform definition as described above, blended finance utilizes grants and low-interest concessional loans from international organizations, public funds from developed economies and DFIs, charity foundations, private capital and funds, etc. It is a mechanism that enables implementing projects in EMDEs that could not have been realized without the blend of public and private funds. Blended finance aims to achieve both a positive impact project and "funding additionality" referred to earlier. Once the project is on track, blended finance is expected to deliver appropriate risk-adjusted returns for private investors while realizing positive impacts (additionality), such as climate change, and co-benefits, such as community development. As far as possible, public funds should be viewed as temporary; thus, the public funds should be the minimum amount necessary. Ultimately, private investors' involvement should be increased over time by accumulating project achievements and experiences and increasing the confidence of private investors. The ultimate aim of blended finance is for projects to be implemented autonomously without public funds. Therefore, projects that permanently require public support or subsidies are not considered suitable for blended finance (Choi and Seige 2020; OECD 2021).

In other words, not all projects suit the blended finance mechanism. For example, projects such as sewerage and public roads, public education, national parks, or high-risk research projects in new technological areas are often better funded solely by public funds. Conversely, some projects can be implemented using only private investment with little use of public funds; in such a case, it is considered undesirable to use scarce public funds for such projects. In recent years, for example, solar power and wind power renewable energy can be commercial-oriented projects due to declining costs in many economies except for low-income economies. It is believed that when there are market failures, blended finance should be used to correct them and attract private funds. For this reason, many projects targeted for blended finance include renewable energy and energy efficiency improvements that can potentially provide commercially viable returns. In recent years, the blended finance mechanism has also emphasized the conservation of natural resources and the prevention of biodiversity loss.

3. Blended Finance, Credit Rating, and Quality

EMDEs, where blended finance is most likely to be effective, could be those with sovereign credit ratings of non-investment grade but not substantially below investment grade. The non-investment credit ratings make it difficult for them to procure funds substantially from the market independently, but the creditworthiness is slightly below investment grade. For these economies, debt problems are relatively less problematic, and their economic growth potential tends to be higher than highly indebted economies. Thus, the possibility of mobilizing private investors is relatively high. One Plant Lab (2021) indicates that about 72 economies whose CO_2 (carbon dioxide) emissions account for 65% of global emissions are subject to credit ratings of investment grade (from AAA to BBB–) on their sovereign bonds. These economies, including developed economies and some emerging economies such as the PRC, can finance their climate mitigation and adaptation projects and activities relatively more easily from domestic and international markets. Economies whose sovereign bonds are rated below investment grades can be classified into two groups. One is the group of about 66 economies whose CO_2 emissions account for 33% of global emissions and whose sovereign credit positions are rated below investment grades but equal to or above B– (from BB+ to B–). Another is the group of 63 economies whose CO_2 emissions account for only 2% and whose sovereign credit ratings are rated below investment grades and have a high-risk grade of below B– (Figure 3.4). Blended finance may be more suitable for the first group since these economies are more

Figure 3.4: Relationship between Credit Ratings and CO_2 Emissions



Source: One Planet Lab (2021).

likely to attract private investors if additional financial support from public funds is provided.

4. Principles and Quality of Blended Finance Schemes

The OECD sets five major principles for blended finance: (i) leveraging blended finance activities for socially, economically, and environmentally sustainable development objectives in EMDEs; (ii) expanding private sector finance; (iii) implementing projects tailored to local conditions in EMDEs; (iv) focusing on effective partnership; and (v) transparency and performance monitoring. In other words, it is essential to prioritize blended finance for projects that contribute to achieving the SDGs. The OECD emphasizes that it is desirable to commit to incorporating ESG perspectives when selecting projects for blended finance to ensure quality projects. It also states that it is desirable for MDBs and development finance institutions in developed economies to require responsible business conduct when selecting private investors and companies as project partners. For example, local project partners should be selected based on the OECD Guidelines for Multinational Enterprises and the UN Global Compact. In particular, the Guidelines for Multinational Enterprises include principles and standards on various

items, including information disclosure, human rights, employment, environment, corruption and bribery, consumer protection, science and technology, and the tax system.

Furthermore, MDBs approved the DFI Enhanced Principles in 2017, whose contents were strengthened compared with the 2013 DFI Guidance for Using Investment Concessional Finance in Private Sector Operations. Since then, the DFIs have focused on implementing enhanced principles in their operations and sharing best practices for their implementation. Thus, DFIs support the private sector only if they can make a financial contribution beyond what is available or that is otherwise absent from the market. DFI support should not crowd out the private sector (including new entrants) and should minimize the risk of disrupting or unduly distorting markets. Blended finance should address market failures effectively and efficiently so that DFI support for the private sector should contribute to catalyzing market development, mobilizing private sector resources, and minimizing the use of concessional resources to the greatest extent possible. DFI support for the private sector and the impact achieved by each operation should aim to be sustainable and contribute toward the commercial viability of project developers. The level of concessionality in the sector should be revisited over time. DFI private sector operations should promote adherence to high standards of conduct, including in corporate governance, environmental impact, social inclusion, transparency, integrity, and disclosure.

5. Major Participants in Blended Finance Schemes

Blended finance is not a new financing mechanism and has long been practiced for development projects in EMDEs. However, as mentioned above, developed economies have so far failed to provide ODA up to 0.7% of gross national income and $100 billion in climate finance to EMDEs. There is growing recognition that more financial support mechanisms, including blended finance, should be mobilized urgently for environmentally sustainable projects. As project developers, private companies in developed economies often participate in environment-related projects with local companies in host countries and contribute to EMDEs by utilizing their technologies, products, and services in practice. The main sources of funding for the projects, especially in the early stages, tend to be provided by the MDBs, including IFC, the World Bank, the Asian Development Bank (ADB), the African Development Bank (AfDB), the European Bank for Reconstruction and Development, European DFIs, the European Investment Bank (EIB), the Inter-American Development Bank Group, etc., as well as donor countries and their DFIs. In addition,

charitable foundations and civic organizations, including NGOs, are often active financial contributors despite their relatively small financial amounts. The governments of host countries play an important role in implementing projects, improving domestic financial regulations and tax systems to attract foreign public and private capital, and developing the capacity building of domestic operators of projects.

3.4 Mechanisms and Types of Blended Finance Schemes

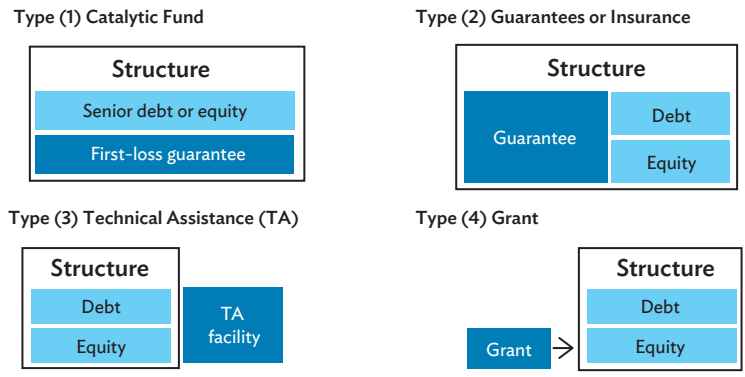
Blended finance often takes the form of fund-like collective investment vehicles (CIVs), which include bond funds, equity funds, and fund-of-funds. It can target a specific investment area (for example, climate change or small businesses) or cover broader areas. In practice, investments are made using equity, debt, technical assistance, guarantees, or insurance. CIVs can be decomposed into open- and closed-ended CIVs. Closed-ended CIVs have a limited period of fund-raising time during which new investments may be made. In contrast, open-ended CIVs can raise funds, make new investments, and redeem shares or funds anytime. In addition, a CIV may be structured such that all investors face the same risk and return profile. But it may be more important to have a more flexible structure that separates investors according to their risk-return appetite. For debt-based funds, the CIVs can be divided into senior and subordinated bonds, where repayment for senior bonds is prioritized over subordinated bonds. In addition to such funds, there are other forms of direct involvement in projects, such as investments in impact bonds, developers, and projects. Compared to such direct investment, funds account for less than 40% of the total number of transactions. As funds can mobilize more private capital, they account for more than 60% of the total amount raised (Convergence 2021).

1. Four Types of Blended Finance Schemes

Convergence, a nonprofit organization established by the Canadian government that collects and analyzes global blended finance information, publishes a report on trends to develop the global blended finance market. The members of Convergence comprise more than 200 institutions, including global charity foundations, the European Commission, financial institutions (such as the Dutch private bank Rabobank and the South African financial group Old Mutual), funds, and environmental NGOs (such as WWF).

Convergence classifies blended finance schemes into four types (Figure 3.5) (Convergence 2021). In the **Type 1 scheme (catalytic funds)**, public funds and foundations contribute the riskiest portion of equity capital to absorb first losses in the event of failure. By doing so, it is possible to reduce the investment risk of private investors. It is also a mechanism that aims to expand private funds by providing senior status that prioritizes returns. Public funds and charity foundations often provide grants and concessional loans and take the form of catalytic funds to attract private capital. Under the **Type 2 scheme (guarantees or insurance),** public funds or charity foundations provide partial or full guarantees or insurance at below-market terms, thereby reducing foreign exchange risks, political risks, etc. faced by private investors. It is a mechanism to give assurance and attract private funds. In the **Type 3 scheme (technical assistance),** MDBs and DFIs in developed economies generally provide technical assistance to support the formulation of project designs in the initial stage and to assist project and fund managers after investment. Legal advice is often offered to help project operators obtain loans from private banks smoothly. The **Type 4 scheme (grants)** is a method aimed at accelerating the initiation of a project by providing grants at the stage of project design, preparation, and the creation of a financing system.

Figure 3.5: Four Types of Blended Finance Schemes



Source: Convergence (2021).

2. Catalytic Funds as an Essential Element of Blended Finance

Among the four types described above, Type 1 (catalytic funds) is the most frequently utilized scheme, accounting for 85% of blended finance in 2020 (Convergence 2021). The ratio increased from 30% in 2018, reflecting that the risk of investment in EMDEs has increased since the COVID-19 pandemic. As a result, more financial support from public funds and charity foundations is needed to attract private investors. This indicates that mobilizing private capital is becoming increasingly difficult unless the catalytic effect of the funding is enhanced. Type 2 (guarantees or insurance) also reduces the risk for private investors but is not fully utilized. This is because only a few public finance institutions provide guarantees. Regular providers of guarantees are the US International Development Finance Corporation (DFC), the US Agency for International Development (USAID), and the Swedish development finance institution. Convergence has pointed out that the reasons DFIs in developed economies do not often use guarantees are (i) financial support to EMDEs through guarantees is not counted in the ODA accounting, (ii) the standardization of pricing for guarantees has not been progressed, and (iii) negotiations may become more complicated due to the involvement of third parties. Type 3 (technical assistance) accounted for nearly 30% in 2020, and this ratio has remained stable over time.

3.5 Actual Implementation of Blended Finance Schemes

ESG investment generally requires well-developed capital and financial markets where numerous large issuers and investors are present and audited disclosure of the financial statements has been regularly practiced. This situation does not necessarily apply to many EMDEs. While institutional capital can be utilized significantly to fill the financing gap for sustainable development in EMDEs, it is important to shed light on specific constraints EMDEs face, such as a lack of data disclosure and information systems and less developed capital markets in terms of size, depth, diversity, and liquidity. Global institutional investors generally allocate at least $150 million per debt investment and $50 million per equity investment. These thresholds on investment sizes are not easily achieved in capital markets of EMDEs (OECD 2022b, 2022c). Thus, sustainable finance policies and strategies applied in developed economies are not always relevant to EMDEs due to undeveloped or underdeveloped capital markets.

Meanwhile, such institutional investors can still invest in investment vehicles, including blended finance programs and projects and impact-centered private equity funds that invest directly in private companies. One drawback is that such investors cannot obtain liquidity that is usually provided in well-developed capital markets. The following paragraphs will shed light on the actual implementation of various blended finance schemes implemented by multilateral development institutions and specific funds as well as those led by the private sector.

1. Promoter of Blended Finance: The EU, MDBs, and Bilateral Development Institutions

The blended finance scheme, which utilizes public funds to crowd in private finance, can be essential in supporting national development priorities in areas that provide positive financial returns to repay the private partners with the provision of minimum levels of concessions or subsidies to the scheme. However, mobilizing private finance is becoming challenging recently amid the ongoing global uncertainties related to the Russian invasion of Ukraine, inflation, monetary policy normalization and tightening, and global economic performance.

Among developed economies, the EU has accumulated some experience with blended finance schemes. The EU provides a financial support scheme called the Blending Facility, which blends EU grants with other public and private funds (loans and equity) to expand additional funds and support projects in EMDEs with public and private partners. In 2017, the EU launched an initiative, the "External Investment Plan," which offers blended finance and guarantees to attract more funds from private investors and companies. The target areas are the EU's neighboring economies and Africa. The EU plans to set up a new European Fund for Sustainable Development and contribute €4.6 billion (about $5 billion) of public funds to de-risk private investors, thus mobilizing about €47 billion from them. These funds are allocated to projects such as small businesses, renewable energy, urban infrastructure, access to digital services, and agriculture to help create jobs in EMDEs, improve their living standards, contribute to achieving the SDGs, and support conflict areas and politically unstable economies. In addition, the EU is implementing new developments to attract potential private investors through technical assistance, business support for local companies, and support for the governments of EMDEs.

Meanwhile, the DFI Working Group chaired by IFC compiled a report on blended concessional finance for private sector projects performed by IFC and MDBs, including ADB, AfDB, EBRD, EDFI, EIB, the Inter-American Development Bank Group, the Asian Infrastructure Investment Bank, the Islamic Corporation for the Development of

the Private Sector, and bilateral development institutions. The report found that financed projects supported by blended concessional finance reached a total volume of more than $11.2 billion in 2020. Concessional funds committed to these projects via MDBs amounted to approximately $1.6 billion, while the total volume of private sector finance leveraged was roughly $3 billion. DFI's own-account investments in these projects were about $5.3 billion. The balance of funds came from other concessional contributions ($74 million) and contributions from other public sources at commercial rates ($1.2 billion). The most common concessional instrument committed by MDBs and bilateral DFIs in 2020 was senior debt, comprising 32% of the total committed concessional investment volume, followed by equity (19%), risk-sharing facilities and guarantees (19%), and subordinated debt (12%). The largest sector for offering concessional commitments was infrastructure (in many cases for climate change–related projects), which was prominent across all country income groups. The banking and finance sector (mostly in support of SMEs) was most prominent in upper- and lower-middle-income countries, while the other sectors, which include agribusiness, health, manufacturing, and services, were largely in low- and lower-middle-income countries. Concessional funds committed by the MDBs and bilateral DFIs were used the most in lower-middle-income countries and sub-Saharan Africa. Their concessional funds committed in 2020 increased by about 14% from 2019. The total volume of projects financed by blended concessional finance rose by 5%, with private mobilization totaling about $3 billion (a slight reduction from $3.2 billion in 2019) and public contributions totaling $1.2 billion (approximately doubled from $608 million in 2019; DFI Working Group 2021).

2. Green Climate Fund Established by the UNFCCC

The Green Climate Fund (GCF) is becoming an important UN-led player in blended finance schemes to focus on the impact of climate mitigation and adaptation measures and help achieve the Paris Agreement in EMDEs. The fund, established in 2010 and is based in Incheon, ROK, is a financial mechanism of the UNFCCC and the Paris Agreement to help EMDEs promote climate mitigation and adaptation practices. The GCF constitutes the largest climate fund in the world, promoting blended finance by employing some of its funds to help mobilize financial flows from the private sector into profitable climate-smart investment opportunities. Since the first project funding was approved in 2015, the GCF has built a portfolio of more than 100 projects. Its mandate is to support EMDEs to achieve their Nationally Determined Contributions (NDC) ambitions toward low-emissions and climate-resilient pathways

by investing across four transitions: built environment; energy and industry; human security, livelihoods, and well-being; and land use, forests, and ecosystems.

The GCF employs a four-pronged approach: (i) transformational planning and programming to maximize the co-benefits among climate mitigation, adaptation, and sustainable development; (ii) catalyzing climate innovation (investing in new technologies, business models, and practices to establish proof of concept); (iii) de-risking investment to mobilize finance at scale (using scarce public resources to improve the risk and reward profile and crowd in private finance); and (iv) mainstreaming climate risks and opportunities into investment decision-making to align finance with sustainable development (promoting methodologies, standards, and practices that foster new norms and values). The fund provides a diverse set of financing, including loans, grants, equity, insurance, and technical assistance, thereby enabling a reduction of the investment risk borne by the private sector.

GCF Activities and Types of Programs and Projects Targeted

The GCF aims to support climate mitigation and adaptation efforts by taking a 50:50 approach to these investments over time. However, the current allocation to climate mitigation programs has been greater than climate adaptation programs. The focus is on achieving an impact within eight mitigation and adaptation result areas. The mitigation result areas are (i) energy generation and access; (ii) low-emission transport; (iii) buildings, cities, and industries; and (iv) forestry and land use. The adaptation result areas cover (i) health, well-being, food, and water security; (ii) most vulnerable people and communities; (iii) infrastructure and built environment; and (iv) ecosystems and ecosystem services (GCF 2021). The total GCF portfolio commitment currently amounts to $10.8 billion, of which funding for the programs under implementation was $7.1 billion, and that already disbursed to the programs/projects was $2.7 billion. The total portfolio amount, including cofinancing, recorded $40.2 billion. The GCF is under the first replenishment period of 2020–2023, and contributions involving 34 economies pledged so far exceed $10 billion, almost all of which has been confirmed (GCF 2022). The main contributors are Germany and the UK ($1.8 billion each), France ($1.7 billion), and Japan ($1.5 billion).

The GCF sets the Integrated Results Management Framework (IRMF) to monitor, assess, and report how investments in programs and projects deliver climate results and how those results contribute to the overall objectives of the GCF to promote a paradigm shift toward low-emission and climate-resilient development pathways. The IRMF

is designed to be fully aligned with the two key ex ante investment criteria: "paradigm shift" and "impact potential" of the initial investment framework built on the objective expressed in the Updated Strategic Plan for the Green Climate Fund: 2020–2023, which defines the project and program eligibility and selection criteria, and assesses ex ante results of GCF investments. Programs and projects are submitted to the GCF board for approval using the initial investment framework template form. The IRMF also makes an ex post assessment, reporting, and analysis of the actual results of GCF investments.

The initial investment framework of the IRMF has three results measurement levels to track and monitor: (i) GCF impact level (paradigm shift potential); (ii) GCF outcome level and impact potential (reduced emissions in the case of climate mitigation or increased resilience in the case of climate adaptation); and (iii) GCF outcome level creating an enabling environment for the paradigm shift from activity-specific sub-criteria. Among these levels, the GCF impact level aims to assess how and to what extent the GCF has promoted a paradigm shift toward low-emission and climate-resilient development pathways by (a) supporting programs and projects in reporting how and to what extent the programs and projects have promoted a paradigm shift potential through interventions that reduce emissions and/or increase resilience (climate impacts); and (b) aggregating the information gathered via programs and projects at the impact results level of the IRMF architecture by considering the dimensions of scale, replicability, and sustainability. The results at this level are typically delivered beyond the lifetime of a program or project and may not be directly attributable to GCF interventions only. Meanwhile, the GCF outcome level and impact potential aim to measure observable results of GCF-funded programs and projects—namely, quantified reduced GHG emissions and increased resilience outcomes delivered via programs and/or projects. In addition, the GCF outcome level aims to inform how programs and projects have contributed to creating enabling conditions and environments for a paradigm shift in a country-driven manner and in line with the coverage area and activity-specific sub-criteria of a paradigm shift.

Below are a few examples of the programs and projects already approved and currently being implemented by the GCF. The fund is increasingly important in formulating diverse blended finance schemes, although the mobilization of private capital remains small.

FP156 ASEAN Catalytic Green Finance Facility (Green Recovery Program): The ASEAN Catalytic Green Finance Facility is Asia's first regional green recovery program aimed at promoting Southeast Asian economies' low-emission investments and supporting economic recovery from the COVID-19 pandemic. By catalyzing

increased climate finance from the private and public sectors, the program plans to support at least 20 high-impact, low-emission subprojects in the region, including energy generation and access; forest and land use; transport; and buildings, cities, and industries. The program was approved in 2021 and has been implemented since August 2022 in Cambodia, Indonesia, the Lao People's Democratic Republic, Malaysia, and the Philippines, although the least developed economies are prioritized. The total financing provided by the GCF reached $300 million (grants $20 million, loans $280 million). The facility's total financing amounted to $3.7 billion. Thus, the GCF funding covers 8% of the total financing. The remaining 92% is covered by cofinancing comprising loans of $3.4 billion, including contributions from ADB of about $3 billion as an accredited entity. The projects cover health, food, and water security; infrastructure and built environment; ecosystems and ecosystem services; energy generation; buildings, cities, and industries; and forests and land use.

FP190 Climate Investor Two: The GCF views the water cycle as a part of the global climate crisis because improperly untreated wastewater can be a source of carbon emissions. At the same time, coastal ecosystems can act as carbon sinks. The World Health Organization estimates that 750 million people lack access to clean water and 2.5 billion lack access to proper sanitation. Moreover, inadequate water and sanitation infrastructure is estimated to be related to 80% of all illnesses in the developing world. Given this background, the GCF created Climate Investor Two as its first at-scale fund to support the private sector in developing and constructing climate-resilient infrastructure projects in EMDEs in the water, sanitation, and ocean sectors. These areas usually do not attract much interest from the private sector. Climate Investor Two aims to unlock equity capital in the construction of water, sanitation, marine ocean, and related infrastructure project companies to enable projects to reach an operational stage to avoid, reduce, and sequester GHG emissions and help communities deal with the consequences of climate change. For instance, the fund will help countries undergoing, or expected to undergo, water stress in the water sector to adapt to climate change by building infrastructure that sources, transports, and treats the water necessary for both municipal and industrial users.

Climate Investor Two will deploy an innovative whole-of-life financing approach utilizing two independent but operationally interlinked funds: the Development Fund and the Construction Equity Fund. Least developed economies, small island EMDEs, and African economies are prioritized. Thus, the program covers 19 economies in the African region (Botswana, Côte d'Ivoire, Djibouti, Kenya, Namibia, Nigeria, South Africa, and Uganda); the Asia and Pacific region

(Bangladesh, India, Indonesia, Madagascar, Maldives, Morocco, Sierra Leone, and the Philippines), and the Latin America and the Caribbean region (Brazil, Colombia, and Ecuador). The total project funding amounted to $880 million. Of that amount, the GCF provides $145 million in grants, accounting for 16.5%. In contrast, the remaining $735 in the form of grants or equity was provided by cofinanciers, including the Dutch Entrepreneurial Development Bank as an accredited entity. The CI2 program was approved in July 2022.

FP180 Global Fund for Coral Reefs Investment Window: Coral reefs are among the world's ecosystems most threatened by climate change impacts. The main factors degrading the coral reefs are overfishing, agricultural runoff, sewage discharge, plastic disposals, and unsustainable tourism. Improving local management could alleviate the impacts of climate change on the coral reefs. Therefore, supporting and providing capital to local businesses for the sustainable use of ocean resources may considerably improve the resilience of reefs and the communities that depend on them. The GCF initiated the Global Fund for Coral Reefs Investment Window as its first global-scale program in the blue economy. The program supports 17 economies in EMDEs (Fuji, Indonesia, the Philippines, and Sri Lanka), the Latin America and Caribbean region (Bahamas, Belize, Brazil, Colombia, Ecuador, Guatemala, Jamaica, Mexico, and Panama), and the Africa and Middle East region (Comoros, Jordan, Mozambique, and Seychelles).

The program, which Pegasus Capital Advisors L.P. implemented as an accredited entity in the US, is expected to create a private equity fund to encourage investments in the blue economy and protect coral reefs. Targeting 17 countries in EMDEs, it aims to address critical financing and private investment barriers centered around the blue economy. The total program funding amounted to $500 million. The GCF provides $125 million, accounting for 25% of the total funding in the form of equity, and the remaining $375 million will be covered by cofinanciers, including Pegasus Capital Advisors L.P., in the form of equity investment. This equity investment is to encourage further public and private sector investment in the following areas—sustainable ocean production, ecotourism, sustainable infrastructure, and waste management. Additionally, the program will benefit from synergies with the investment window, which aims to mobilize $125 million of concessional capital from philanthropies and other agencies to foster an enabling environment for seeding a pipeline of investment-ready projects. The program was approved in 2021.

FP177 Cooling Facility: The rise in global temperatures has increased the demand for cooling, giving rise to GHG and fluorinated gas emissions, thus amplifying global warming. Therefore, the GCF

believes that low-carbon and sustainable cooling solutions are essential. The Cooling Facility will be one of the world's first cooling-focused facilities to provide cooling solutions in nine countries— in the African region (Kenya, Malawi, Príncipe, São Tomé, and Somalia), the Asia and Pacific region (Bangladesh and Sri Lanka), the Eastern European Region (North Macedonia), and the Latin America and the Caribbean region (El Salvador and Panama). It focuses on regulation and policy, technical assistance, and financing to address and help remove barriers to developing sustainable cooling investments. Planned measures include financing investments in innovative, climate-friendly cooling technologies and systems; creating an enabling environment by strengthening institutional, policy, and regulatory frameworks; and building the capacity of key stakeholders in technologies, business models, and cooling project appraisal and implementation. The total program funding amounted to $879.8 million. The GCF provides $147 million in grants and loans, accounting for 17.8%, while cofinanciers, including the World Bank as an accredited entity, support the remaining $723 million through loans, grants, and guarantees. The facility aims to mainstream and bring sustainable cooling solutions to scale across key sectors (agriculture, health, buildings) and the cooling value chain. In addition to climate mitigation and adaptation, the facility will lead to broader development impacts, such as helping lower pressures on already-strained energy systems, reducing local air pollution, and helping decrease losses of food and medicine. The program was approved in 2021.

3. Examples of Blended Finance Schemes Supported by Bilateral Development Finance Institutions and Private Capital

Four interesting cases of blended finance schemes are highlighted. These schemes are led by development financing companies, asset management companies, and/or charity foundations mainly established in developed economies.

African Local Currency Fund: The first example is the African Local Currency Bond Fund established in 2012 by KfW, Germany's state-owned financial institution, in line with the G20 Action Plan for developing a bond market denominated in the country's currency adopted in 2021 (OECD 2021). Developing the domestic capital market to raise financing for economic development is important. When local financial institutions and companies issue local currency–denominated bonds for the first time in the African region, they are generally unable to attract private investors. Thus, technical support on issuing conditions, pricing, and finance is provided. The African Local Currency Fund

comprises equity (paid-in capital) and senior debt. Equity constitutes the portion of the equity that absorbs the first losses. DFIs, impact investors, and institutional investors in developed economies invest in senior loans over 4- to 10-year terms. The involvement in the fund of well-known bilateral development institutions in developed economies, such as KfW, has the positive effect of giving local issuers and investors a sense of security, thus facilitating corporate finance and participation of investors. Private investors take the form of co-investments and are mostly made up of local institutional investors, such as domestic pension funds, insurance companies, and asset managers. As of the end of 2021, the fund had a $130 million portfolio and invested in local currency bonds in 19 countries, including South Africa. KfW and the British aid agency FSD Africa contribute the equity and subordinated debt portion. The senior debt portion is funded by IFC, FSD Africa, the AfDB, the Dutch Entrepreneurial Development Bank (a private development bank based in the Netherlands providing sustainable development assistance), and Calvert Impact Capital (a US-based nonprofit investment firm).

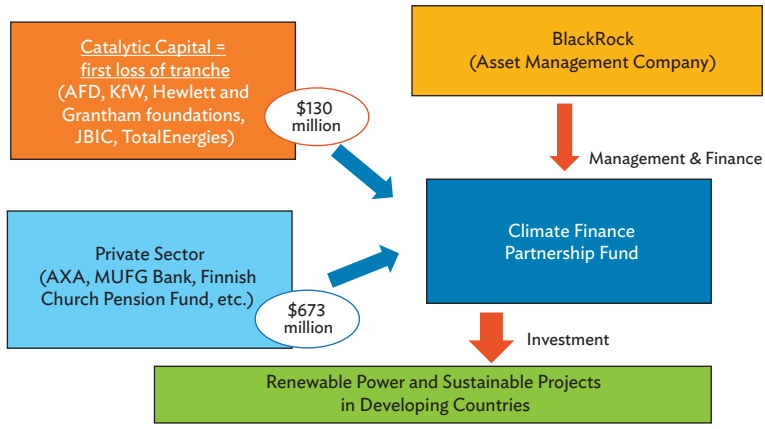
The Africa Agriculture and Trade Investment Fund: The Africa Agriculture and Trade Investment Fund, worth $170 million, targets sustainable agricultural investment in the African region. Deutsche Bank, a German private bank, manages the fund. The fund attracts public and private debt investors by classifying bond investors into A-shares, B-shares, and C-shares according to their repayment priority, with C-shares representing the riskiest junior tranches. The German Ministry for Economic Cooperation and Development has invested in C-shares with Germany's KfW, which constitutes the loss-absorbing portion in the event of losses on debt. By creating such a risk buffer, private investors are encouraged to invest in A-shares and B-shares, which are senior transaction shares with high priority for repayment, with the aim to expand the total investment amount. A-shares are the most senior shares, with maturities between 3 and 15 years. Depending on the fund's profitability, complementary dividends are possible. B-shares represent a mezzanine tranche with maturities between 5 and 15 years and rank junior to A-shares, providing a higher target dividend calculated on a 3-month Euribor + spread basis. The board also determines the spread in accordance with market conditions at the time of an investor's commitment. The Deutsche Bank and KfW fund B-shares. This structure potentially includes a D-share tranche consisting of capital gains from the fund's investments to absorb any losses before C-shares. Currently, the EU and the DSW Group, a German asset management firm, are also members of the fund. The United Nations Environment Programme (UNEP) and the International Labour Organization also participate in this scheme as advisors.

These funds, ranging from $250,000 to $30 million, have been invested in various projects in the agriculture sector. The maturities were initially concentrated on 3–5 years and extend up to a 10-year repayment term. While borrowers from the fund tend to be governments in developing economies and regional international organizations, these funds are provided ultimately to borrowers with diverse credit ratings, such as small farmers and local farming companies. Based on this experience, Deutsche Bank is launching a new blended financing scheme called the "Universal Green Energy Access Program" for clean energy projects in sub-Saharan Africa. The program, which includes the GCF referred to above as an investor, aims to raise $500 million.

Climate Finance Partnership Managed by BlackRock: The third example is the blended finance initiative called the Climate Finance Partnership, launched by BlackRock, the world's largest asset management company, in 2020. The French government's development finance institution (AFD), the German KfW, the Quadrivium Foundation, the Graham Foundation, and others have invested in catalytic funds of the Climate Finance Partnership. Catalytic funds are responsible for the equity tranches and junior equity portion aimed at reducing investment risks borne by private investors. The Japan Bank for International Cooperation and France's global oil major TotalEnergies later joined in investing in the catalytic fund. More than $670 million of funding has been realized by mobilizing nearly $540 million of private funding against a total of $130 million of catalytic funds. BlackRock's partnership was able to raise more than the target of $500 million from the private sector, reflecting the strong interest from private investors.

The fund aims to allocate capital to projects related to climate change mitigation to achieve net-zero emissions in EMDEs in the Asian, African, and Latin American regions—such as renewable energy; residential, commercial, and industrial energy efficiency; and low-carbon public transportation. The scheme stipulates that a quarter of the investment will be allocated to Africa. On its website, BlackRock acknowledges its long-term experience in renewable energy and sustainable investing, its commitment to incorporating climate and environmental risks in its assets under management, and its ongoing work to develop analytical approaches, such as measuring the physical risk of climate change and the impact on portfolios under various climate stress tests. Private investors participating in BlackRock's partnership include Axis Capital Holdings; AP2 Fund, which manages public pensions in Sweden; AXA Life Insurance in France; the Church Pension Fund in Finland; Standard Chartered Bank; Mitsubishi UFJ Morgan Stanley Securities; Dai-ichi Life Insurance; Sumitomo Life; Mizuho Bank; Sumitomo Mitsui Banking; and some family offices

Figure 3.6: Climate Finance Partnership Fund Managed by BlackRock



Source: Prepared by the author based on various information, including BlackRock and JBIC.

(Figure 3.6). Convergence was also involved in the design stage of this mechanism.

Catalytic Capital Consortium: The Catalytic Capital Consortium was established by the MacArthur Foundation based on a belief in supporting companies and funds that positively impact the development of the global community and economic growth by promoting projects that are difficult to raise funds for through the market but help EMDEs achieve the SDGs. The consortium plans to prepare $150 million as catalyst capital and to attract private funds, such as companies, asset management companies, and investors. The Rockefeller Foundation and Omidyar Network, eBay's philanthropic investment firm, also participate in the consortium. The MacArthur Foundation's catalyst fund plans to invest $30 million to attract at least $1 billion to the Zero Gap Initiative run by the Rockefeller Foundation. Similarly, the Rockefeller Foundation invests in the catalytic funds managed by the MacArthur Foundation to share knowledge and skills. According to the MacArthur Foundation, the global impact investment asset balance has reached more than $228 billion, and the market is expanding. But the supply of funds to companies with low credit ratings is small and accounts for only about 5% of the total impact investment assets. For this reason, catalytic capital and its expansion are essential to reduce

risks borne by private investors and thus increase funding for activities to achieve the SDGs, such as poverty reduction, education, housing, and climate change.

4. Examples of the Fund of Funds: Global Energy Efficiency and Renewable Fund

A well-known fund-of-funds example is the Global Energy Efficiency and Renewable Energy Fund, created by the EU in 2008 using funding from the EU, Germany, and the Netherlands to promote energy efficiency and renewable energy. The EU, Germany, and the Netherlands provided €110 million (about $120 million) in the catalytic funds, which private investors matched, thus resulting in a total of about €220 million. By 2015, the target amount of private funds had already been collected successfully. The fund has invested in multiple private equity funds that specialize in renewable energy and energy efficiency projects, and those private equity funds, in turn, invest in various projects. The focus is on funding infrastructure projects that generate clean electricity with low risk by using already-developed technologies. Equity financing for small-scale projects is almost nonexistent in these EMDEs, so the aim is to expand private equity funds and promote decarbonization and low carbonization at low risk.

The Global Energy Efficiency and Renewable Fund invests in 15 private equity funds in 144 countries across Asia, Africa, the Caribbean, and Latin America. It is operated by the board as an independent body from the EU and is advised by the EIB and the European Investment Fund (EIF). The EIB and the EIF are part of the European Investment Group. While the EIB is a policy-based financial institution, the EIF is a financial institution specializing in risk financing for SMEs. The EIF also provides guarantees to banks and guarantee funds that offer loans and guarantees to SMEs. Both EU organizations focus on providing support within the EU and to candidate countries for EU membership. They also conduct activities in other regions per the EU's diplomatic policy. These two EU public financial institutions play a role in discovering and proposing projects in EMDEs. To attract private investors, the Fund mitigates risks and considers regulatory constraints for private investors by offering preferential returns. At the initial stage, the fund devises ways to obtain relatively high returns for private investors. Private investors can now secure sufficient returns from engaging in positive environmental and development impact investments while fulfilling their fiduciary responsibilities. The Global Energy Efficiency and Renewable Fund also focuses on attracting fund managers to invest in such impact funds for the first time. At each transaction stage, detailed

explanations are provided to private investors to ensure they understand that the scheme follows environmental and social perspectives based on international best practices. The investment period by the fund ended in 2019, and all the funds have been invested. Under the $222 million operating fund, more than $10 billion can be raised by attracting many public and private funds both at the private equity fund and project stages.

4

Climate Change, Nature Stock, and Debt Swaps for Low-Income Developing Economies

For low-income developing economies with high debt, achieving the SDGs and promoting projects and activities to cope with climate change and loss of nature stock are challenging. Climate vulnerabilities and fiscal debt problems appear to be closely associated since economies that are more vulnerable to climate change tend to face higher public debt. Most low-income countries with climate risks tend to be also at high risk of a fiscal crisis. Causation may take place in both directions. On the one hand, climate change may exacerbate debt vulnerability by damaging infrastructure and productive capacity and the tax base, increasing fiscal costs for reconstruction after severe disasters triggered by natural hazard, and raising borrowing costs. On the other hand, serious debt problems may reduce fiscal space for climate mitigation and adaptation investments, thus amplifying vulnerability to the physical and transition risks of climate change. Since the COVID-19 pandemic, the debt of many developing economies has been accumulating. At the same time, global investors are becoming more interested in climate change and other environmental issues. Thus, there is a possibility that environmental swaps might be exercised more frequently than in the past. In addition, the development of AI and sensor technology has made it possible to monitor the ecology of wildlife and nature stocks (such as forests and maritime materials), and evaluate changes in the ecosystem, giving investors a sense of security and enabling more evidence-based financing approaches. This chapter focuses on debt-for-nature or debt-for-climate swaps as an alternative to more conventional debt rescheduling and de facto grants to debt-distressed economies in exchange for climate projects and nature preservation. The chapter also discusses performance-based grants as an alternative to these swap arrangements. It offers some suggestions for further actions for low-income developing economies through better coordination among donor and recipient nations led by G7 and G20 nations.

4.1 G20 Initiative to Cope with Growing Debt Problems in Low-Income Developing Economies

Since the COVID-19 pandemic, public debt in low-income developing economies has expanded significantly, and the G20 has demonstrated several supportive initiatives. First, the G20 adopted the Debt Service Suspension Initiative (DSSI) in April 2020 and established it the following month to provide a debt service suspension temporarily on official bilateral external debt provided by creditor economies for low-income economies facing high debt stress. The DSSI was agreed subsequently by the Paris Club members. As a non-Paris Club member and the largest bilateral creditor nation, the PRC also made a welcome move by participating in the DSSI. In practice, it turned out that about 48 out of 73 eligible economies participated in the initiative and suspended $12.9 billion in debt service payments owed to their creditors. The top low-income economies whose savings through the DSSI as a percentage of GDP were the largest include Maldives (4.9%, $272 million), Djibouti (4.3%, $143 million), and Mozambique (3.7%, $143 million).

However, the total amount of debt service payment subject to the DSSI accounted for only a quarter of the target set by the G20 member economies. Some eligible economies did not participate in the DSSI out of concerns about the potential heightened borrowing costs and possible credit rating downgrading since foreign investors might view the participation as a signal of weaker macroeconomic fundamentals and creditworthiness. Another challenge was that debt provided by the private sector, multilateral development banks (MDBs), and DFIs was not covered under the DSSI. The DSSI expired in December 2021, so many developing economies had to resume debt service payments amid global energy, food, and climate crises. Many of these economies had to prioritize allocating their funds to debt service payments over environmental, social, and infrastructure projects, further amplifying the risk of failing to achieve the SDGs and the Paris Agreement.

1. Participation in Debt Treatments by Non-Paris Club Members

Accordingly, the G20 introduced the Common Framework for Debt Treatments beyond the DSSI, which the Paris Club also agreed upon in November 2021. The Common Framework will be initiated at the request of a debtor country. The need for debt treatment and a

restructuring envelope will be assessed using an IMF–World Bank debt sustainability analysis. The participating official creditors' collective assessment will be consistent with the IMF-supported program and associated conditionality. This Common Framework considered the cutoff date in the 2020 DSSI term sheet that protects new financing provided after 24 March 2020. The key parameters include at least (i) the changes in nominal debt service over the IMF program period; (ii) the debt reduction in net present value terms, where applicable; and (iii) the extension of the duration of the treated claims. In principle, debt treatments in the form of debt write-offs or cancellations are not considered in the common framework. In the most difficult cases where debt write-off or cancellation is necessary upon the debt sustainability analysis and the participating official creditors' collective assessment, specific consideration might be possible, provided that each participating creditor shall fulfill its domestic approval procedures and keep other creditors informed of progress. The Common Framework attempts to ensure fair burden sharing among all official bilateral creditors and debt treatment by private creditors at least as favorable as that provided by official bilateral creditors.

The Government of Zambia formally requested debt treatment under the Common Framework in June 2022. Accordingly, the creditor committee, including 16 economies, was formed. The committee was co-chaired by the PRC and France and vice-chaired by South Africa. The IMF and World Bank Group, as observers, presented the latest macroeconomic developments regarding Zambia and the current status of their relationship with that country. Consistent with members' national laws and internal procedures, the creditor committee for Zambia is pursuing its work to find an appropriate solution to the country's external debt vulnerabilities in a coordinated manner. The committee stressed the importance for private creditors and other official bilateral creditors of Zambia to provide debt treatments under the Common Framework on terms at least as favorable, in line with the comparability of treatment principle. The negotiations involving major bilateral creditors are still ongoing.

At the request of the Government of Chad in applying the Common Framework, the creditor committee for Chad was also formed by France, India, the PRC, and Saudi Arabia, co-chaired by France and Saudi Arabia in May 2021. Chad was the first country to request a debt restructuring of external debt under the Common Framework in January 2021. The committee reached a deal in June 2021 but has since struggled to finalize negotiations with private creditors who hold a third of Chad's total external debt partly because of rising oil prices and possible revenue increase. Almost all the external debt owed to private creditors is

associated with debt owed to the Switzerland-based Glencore in the oil industry generated in 2013 and 2014. In November 2022, Chad became the first country to reach agreement between the government and external creditors.

Moreover, the Government of Ethiopia also applied to the Common Framework. Thus, a committee co-chaired by the PRC and France was also formed. The committee met in September 2021, but further negotiations were delayed due to the civil war. In November 2022, progress was made since Glencore, the PRC, and other creditors agreed to restructure the external debt of around $3 billion in November 2022. Following the agreement, Chad received approval from the IMF regarding the completion of the first and second reviews under the existing 3-year Extended Credit Facility adopted in December 2021. The approval enabled the country to obtain financial support of about $149 million (total disbursements amounted to $224 million). The IMF's approval and subsequent disbursement enabled Chad to become the first country to reach a debt treatment agreement with official and private creditors under the Common Framework.

While this donor coordination approach initiated by the G20 is welcome, one major constraint is that it applies only to highly indebted low-income economies and not to middle-income economies such as debt-distressed Sri Lanka, which defaulted for the first time in May 2022. After having continuous discussions, the IMF finally provided a 4-year financial support of $2.9 billion to Sri Lanka in March 2023. This became possible only after the IMF and the government obtained financing assurance from all major donors, including India, Japan, the PRC, etc. Initially, the Export-Import Bank of the PRC offered a 2-year moratorium in January 2023 but decided to support collective efforts to secure IMF loans to Sri Lanka.

2. Reallocating SDRs to Increase Sources of Financing to Developing Economies

The IMF significantly increased special drawing rights (SDRs) by about SDR456 billion ($650 billion) in August 2021. This is a welcome step since it helps increase its member economies' official reserves and enables greater access to borrowings from the IMF. Many developing economies have thus utilized their SDR allocations to support their economies and reduce poverty. Meanwhile, SDRs are distributed proportionately to member economies' IMF quota share. Thus, developed economies receive a larger portion of the SDRs allocated even though these economies can easily finance themselves from domestic

and international markets and, therefore, do not need to borrow from the IMF and use the SDRs. To cope with these issues and support developing economies, the G20 and G7 agreed on reallocating or lending $100 billion of their unused SDRs (about 25% of their allocated SDRs) to low-income economies, small island developing states, and climate-vulnerable middle-income economies in October 2021. Most of these reallocated SDRs are to be distributed through the IMF's traditional concessionary Poverty Reduction and Growth Trust targeting low-income economies, its newly created Resilience and Sustainability Trust (RST) providing loans up to 20 years (explained below), MDBs, and bilateral arrangements.

Thirteen countries have already pledged about $59 billion to the SDR reallocation, accounting for 24% of their total allocated SDRs of $250 billion. The economies that committed large, absolute pledged amounts included the PRC (about $13 billion, 34% of allocated SDRs); Germany (about $9.9 billion, 29%); Japan (about $7.8 billion, 20%); France (about $7.6 billion, 30%); and the UK ($5 billion, 20%). The G20 may take some time to reallocate $100 billion-equivalent SDRs since some large economies still need approval from their congress or parliament. Thus, the pledged amount of $59 billion does not include the amount from the US. In October 2022, the US government asked Congress to approve the proposal to lend $21 billion-equivalent SDRs to IMF trust funds.

Following the G20's decision, the IMF announced in April 2022 the introduction of the RST. The IMF's first affordable long-term financing was to help achieve sustainable economic growth in low-income, small island, and vulnerable middle-income economies. This facility, which came into effect in October 2022, is expected to support investments and projects that build resilience to structural challenges and maintain long-term economic and financial stability, including climate change. The trust will offer up to 20-year funding packages with a grace period of 10.5 years. This lending accompanies an IMF-monitored program comprising high-quality policy measures in line with the RST's objective. Since September 2021, Barbados and Rwanda have signed preliminary RST agreements with the IMF. Barbados requested a $183 million RST loan alongside a new traditional package of $110 million. Rwanda is seeking a 3-year, $310 million package. Costa Rica has requested $710 million in RST funding. Aside from the RST, the IMF lends money by financing from two main pools. The General Resources Account supports all member states, and the Poverty Reduction and Growth Trust offers loans to poorer countries at below-market rates. Traditionally, the IMF has focused on resolving

the balance of payments and currency and debt crises, where its funding is usually disbursed over much shorter periods—usually 2 or 3 years.

4.2 Nature Conservation and Debt Swap Since the 1980s

Since the COVID-19 pandemic, developing economies' debts have expanded significantly, and many are now facing debt distress. One way to help improve environmental sustainability in debt-stressed low-income countries is to promote nature conservation and debt swaps—debt-for-nature swaps and/or debt-for-climate swaps (hereafter "debt-for-nature swaps" for simplicity)—rather than pursuing the simpler debt forgiveness (haircut) or debt restructuring (reprofiling). Debt forgiveness or debt restructuring generally benefits only debtor economies by reducing their debt burden. In contrast, debt swaps can benefit both debtor and creditor economies by reducing the debt burden and allocating fiscal space by debtor economies for increased investment and actions in environmental and climate mitigation or adaptation projects.

The success of debt-for-nature swaps depends on the ability to develop a mechanism that would meet the diverse interests of participants—including creditors, debtors, nature conservation investors, environmental NGOs, and donors. Creditors, which often include commercial banks, commercial suppliers, export credit agencies, and official development aid agencies, must be willing to sell debt at discount prices, given that reducing debt through debt conversion is better than waiting for uncertain future repayment with the high risk of default. Creditors participate in the swaps mainly because recovering some portion of a debt is better than continuing to face the default risk until maturity arises and accumulates arrears. Debtors participating in the swaps can be the government or the private sector. Debtors should be able to allocate resources for environmental conservation in exchange for debt cancellation. Donors who provide funding for debt swaps will be interested in leveraging aid dollars for an identified conservation project while promoting economic growth through debt reduction. Normally, donors are involved in approving the financial terms of debt swaps and continue to monitor project performance as they would for any donor-funded project. Donors, often creditors, are frequently involved in debt swaps by approving the financial terms since the swaps might lead to environmental sustainability and promote economic growth through debt reduction. They also tend to continue monitoring conservation

project performance. Having a large difference between the original face value of the external debt and the redemption price is crucial to create fiscal space for nature conservation.

Debt relief linked to environmental goals or debt-for-nature swaps is not a new approach (Novikova et al. 2021). After World War II, the Paris Club, comprising major creditor economies, began to initiate large-scale debt relief programs in the form of "debt-for-equity swaps." Debt-for-equity swaps refer to the cancellation of external debt in exchange for local currency, at a discount, invested in shares in local companies or privatized local public enterprises. This scheme promotes debt, debt service reduction, and inward foreign investment. From the 1980s onward, the Paris Club creditors began to allow debtors to convert their public debt into local payments for social or environmental projects. Since then, debt-for-nature swaps have raised hundreds of millions of dollars for the environment. Most debt swaps have involved bilateral public external debt. Debt swaps have been conducted when donor economies hold external debt. However, dealing with external debt owned by commercial creditors is also possible. In the case of external debt issued to multilateral organizations, such as the World Bank, regional development organizations, and the IMF, these organizations cannot participate in debt swap arrangements due to their legal status.

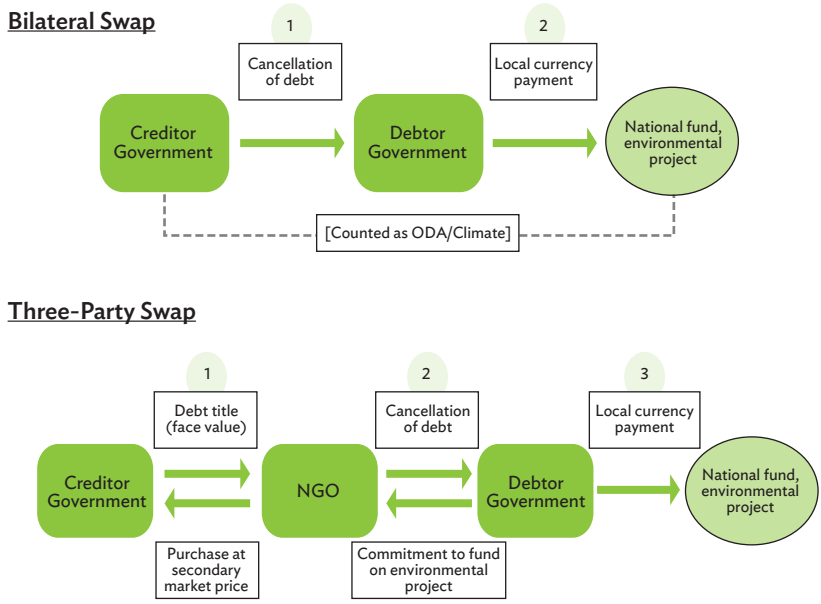
1. Bilateral and Three-Party Debt-for-Nature Swaps

The first debt-for-nature swap occurred in 1987 for the Bolivian government and was intermediated by Conservation International, a US NGO. It was conditional on the commitment that a portion of the government's external debt was canceled on the condition that 3.7 million hectares of land adjacent to the Amazon basin would be set aside for conservation purposes. The deal allowed the Bolivian government to reduce its external debt by $650,000. This was a three-party swap involving creditors, debtors, and environmental NGOs that worked as intermediaries.

Three-party debt swaps involve buybacks of privately held debt by the debtor government with finance provided by donors and/or new lenders. The swap can be intermediated by an international NGO, conditional on nature- or climate-related policy actions and/or investments (Figure 4.1). Three-party swaps often involve a process in which an NGO purchases external debt from creditors at a significant discount through the secondary market and then renegotiates the debt with the debtor developing economy. The NGO sells the purchased debt to the debtor government at a higher price than the debt purchased from the secondary market, but the debtor country still faces much less

external debt than it originally had. More specifically, the NGO passes the savings to the debtor government by refinancing the debt at a lower face value under the condition that the debtor allocates an agreed part of the savings in debt service payments in local currency to pre-agreed conservation investments. During refinancing debt transactions, the NGO can also lower the interest rate on the discounted debt, maturity, and currency denomination (often converting foreign currency into local currency).

Figure 4.1: Two Types of Debt-for-Nature Swaps



Source: Novikova et al. (2021).

Once the agreement is made, the debtor government usually spends money for nature conservation each year in line with the original debt repayment schedule of the initial external debt. The unused budgetary funds that would otherwise have been utilized to pay creditors must be used for pre-agreed investments in nature conservation and the implementation of environmental policies. In this way, the external debt of developing country governments will be reduced compared to the situation without debt swaps, and the free money can be used

for nature conservation. These expenditures can be allocated directly toward environmental projects or placed in a trust fund. In the latter case, the interest income earned on the managed funds can be used to finance environmental projects or provide grants to local NGOs. Such funds enable earmarking and increase accountability, as they are often managed by a committee comprising the debtor government, local agencies, and domestic and international NGOs. Thus, NGOs, especially international NGOs, play an important role as an intermediary and provide expertise and experience to facilitate investments by the developing economy toward conservation measures (UNESCAP 2022). Since the case of Bolivia, there have been several three-party debt swaps, mainly in Central and Latin America. Conservation International and other environmental NGOs, including the Nature Conservancy and WWF, have also played an essential role as an intermediary in various debt-for-nature swap schemes.

Compared to the three-party debt swaps, bilateral swaps are more commonly practiced. Bilateral debt swaps generally refer to swaps between bilateral creditor–debtor economies, in which a creditor cancels debt in exchange for a debtor government's commitment to setting aside local currency funding for agreed environmental purposes. The amount of local currency generated arises from a discount rate on the face value of the original debt. Bilateral debt swaps also require coordination among a debtor government, a creditor government, and local and international NGOs and agencies. Bilateral debt swaps took place mainly by involving bilateral creditors (donors) in the US, Canada, and several European economies, including Finland, Germany, Italy, the Netherlands, and Switzerland. One good example of a bilateral debt-for-nature swap is the one undertaken between Italy and the Philippines in 2012, involving the cancellation of €2.9 million (about $3 million) in public debt in exchange for environmental protection and poverty reduction investments. The projects in environmental conservation, reforestation, agriculture, and sustainable resource management emphasized the participation of local communities. By 2019, the program was estimated to have 17,000 beneficiaries, including local farmers and fishers from predominantly poor districts (Novikova et al. 2021).

2. Debt-for-Nature Swap Involving the Secondary Debt Market

In many cases, environmental debt swaps tend to be successful when low-income developing economies hold large outstanding external debts that are difficult to repay and have a high risk of default. Such a debt situation allows intermediaries, such as NGOs, to buy foreign debt

from the secondary debt market at a discounted price well below face value. The premise is that a secondary market exists where creditor governments and private financial institutions can buy and trade the distressed external debt of developing economies' governments at discount prices. A secondary debt market in Latin America was developed in the 1980s. It borrowed heavily from governments and commercial banks in developed economies out of concerns that these debtor economies would soon be unable to repay their external debts. By forming a secondary market, creditors could sell off their debt at prices well below face value. The secondary market price depends on the probability of default risk (sovereign credit rating), past debt write-off experiences, economic growth outlook, etc. The secondary market price is usually applied to third-party debt swaps. Regarding bilateral debt swaps, discount prices can be more flexibly decided through bilateral agreements.

Debt-for-nature swaps can occur even when no discounts are applied to debtor economies. In this case, no budgetary savings can be used for nature conservation. Since most of their debts are denominated in US dollars or other hard currencies, a debt conversion from hard currencies into local currencies still generates benefits to developing economies by changing the structure of debt portfolios and reducing foreign exchange risk. Because many environmental projects are paid for in the local currency, a debtor government can save hard currency and use it for other purposes, including accumulating foreign reserves or importing essential products.

Debt-for-nature swaps may help prevent the destruction of natural resources, such as tropical forests and mangroves and the associated tourism industry, to repay external debts. On the other hand, such swaps have often been criticized for negotiating developing economies' internal affairs and generating a limited positive impact on the environment since economic development is more highly prioritized. Low-income developing economies could face difficult trade-offs when the government has to secure land and areas to conserve ecosystem services and natural capital since those areas could have been used for economic development.

4.3 A New Era of Natural Capital and Debt Swaps

The COVID-19 pandemic that started in 2020 has increased debt in many developing economies. Meanwhile, the pace of biodiversity loss and global warming has been accelerating. Thus, these concerns have put debt-for-nature swaps under the spotlight again. The development of satellite imaging technology and digital technology supports this move

by making it easier to monitor forest conditions and conserve natural capital. Moreover, as ESG investment has been increasing globally, new financial instruments (e.g., green and blue bonds) can be associated with these swaps, creating opportunities for attracting more investment and financing from private investors.

A successful example of a bilateral debt-for-nature swap was implemented between the Republic of Seychelles and a club of public and private debtors in 2015 (Novikova et al. 2021). After defaulting on its external debt in 2008, the economy remained vulnerable to external debt problems while its environment and ecosystem continued to deteriorate. Seychelles in the Western Indian Ocean is an archipelago of 115 islands where coral reefs and endangered species live. The economy depends heavily on marine tourism and fishing. Debt-for-nature swaps were initiated by the Nature Conservancy in 2016. This scheme enabled Seychelles to cancel $21.6 million owned by Paris Club member economies, including Belgium, France, and the UK, in exchange for providing domestic investments in protecting its marine ecosystem. Thus, this is a debt-for-marine swap deal with Paris Club creditors in exchange for the government's commitment to allocating additional funds for marine conservation and climate adaptation efforts. The objective of the swap was to support Seychelles in increasing the marine protected area from 1% to 30% of its territorial waters by 2020.

Under the leadership of the Nature Conservancy, the Seychelles Conservation and Climate Adaptation Trust was established to purchase public debt from the European creditor economies at a discount price. Meanwhile, the Government of Seychelles committed to repaying loans to the trust at a lower interest rate, enabling the government to spend the resultant savings on ecosystem conservation projects and to protect 30% of its marine area from unregulated economic activities, such as fishing and drilling. By March 2020, Seychelles could make debt repayments on time and complete the protection of 32% of its marine area. Since this approach, debt-for-nature swaps have been viewed as a way to free up funds for the environment while reducing the debt burden of the borrowers (Yue and Wang 2021).

1. Belize's Three-Party Debt-for-Nature Swap Accompanying Blue Bonds

A recent successful example of a new type of swap is the natural capital and debt swap implemented in Belize in November 2021 (Owen 2022). Many of the examples of debt swaps that have been implemented so far are mainly concentrated in the Central and Latin American regions on the condition that the governments of developing economies will use

the repayment funds saved by reducing external debts due to swaps for nature conservation. In the case of Belize, by contrast, the uniqueness lies in the fact that the bonds issued in the past by the Government of Belize and held by private creditors are to be ultimately sold to other private investors in the form of environment-related blue bonds. In contrast, the bond market offers grants in the form of discounted prices. This is a mechanism to finance by investing.

The external debt reduced by this swap will be equivalent to 10% of Belize's GDP, while the prospect for progress in marine conservation, such as coral reefs, is promising due to the agreement between the Belize government and environmental protection groups. Belizean Prime Minister John Briceño emphasized that the Government of Belize will protect the country's marine areas and provide a foothold for long-lasting and robust economic growth (Owen 2022). With the support of the subsidiary of the Nature Conservancy, the government could buy back a $553 million "super bond" ($553 million of the entire Belize government's external debt being equivalent to 30% of GDP) at a discounted price of 55 cents to the US dollar. The subsidiary of the Nature Conservancy arranged a loan to the Belize government to finance a debt buyback practice. While about 85% of creditors (investors) of original bonds accepted the bond-for-cash exchange at 55 cents per US dollar of face value, the remaining investors were applied to the same terms, thanks to the collective action clause (Chamon et al. 2022).

Meanwhile, the Belizean government newly issued a $364 million equivalent blue bond in the market to fund this repurchase. Credit Suisse, a major Swiss financial institution, participated in coordinating and underwriting the issuance and sales of the blue bonds. Given that the IMF assessed that Belize's debt remained unsustainable in the absence of additional debt treatment measures, the DFC, the US government's development bank, decided to provide insurance to loans extended by the subsidiary of the Nature Conservancy and thus indirectly offered insurance for the blue bonds. This raised the credit rating from below investment grade to investment grade (Aa2, according to Moody's Corporation). As a result, it became possible to issue bonds at low-interest rates, with a grace period of 10 years and an extended redemption period of 19 years for global investors.

In exchange, the Belizean government agreed to use part of the debt relief to pre-fund a $23.4 million marine conservation endowment and commit to spending $4.2 million annually on marine conservation until 2041. It also agreed to double the size of the marine conservation parks from 16% to 30% of the country's seas by 2026. These parks grow coral reefs, mangroves, and seagrass on which fish lay their eggs. The government planned to fund conservation efforts beyond 2040

from a $23.4 million endowment. The mangroves and coral reefs are home to about 1,400 species, including endangered hawksbill turtles, manatees, and several endangered species of sharks. Global and ocean warming, overfishing, mangrove deforestation, and unplanned coastal development have all negatively impacted ecosystems, leading to biodiversity loss.

Initially, private investors were cautious about investing in Belizean blue bonds because the government had defaulted in the past. Nevertheless, the debt swaps worked well in Belize for several reasons (Owen 2022). First, signing agreements by the US DFC, Credit Suisse, and other large institutional investors has given impetus to the swaps. In particular, the involvement of the US development bank played an important role in increasing the credibility of the transaction. The provision of insurance by the US DFC enabled the blue bonds to obtain an investment-grade credit rating, stimulating demand from institutional investors, such as pension funds. Second, institutional investors increasingly incorporate ESG considerations into their investment decisions, leading to increased demand for these complex financial products. And third, with the Nature Conservancy continuing its 30-year conservation program experiences in Belize on a 274-kilometer coral reef reserve in the Caribbean Sea, the Belizean government was able to convince investors of its commitment to protecting marine resources. In other words, investors could judge that these blue bonds raise few concerns about "bluewashing" (exaggerating the prevention and conservation of marine resources, like greenwashing).

2. Application to Other Debt-Stressed Developing Economies

The realization of these new types of debt swaps suggests possible application for other economically distressed developing economies facing sizable external debt. The Nature Conservancy in Belize supported the rescheduling of debt held by Paris Club creditors. However, not all debt swaps could result in high-impact debt relief, like in the case of Belize. For a small Caribbean country like Belize, external debt is often large relative to GDP, so the impact of swap reductions could also be considerable. Moreover, the debt had been traded fairly cheaply in the secondary market. So, debt swaps could generate a significant impact. In any case, a debt swap is a financial transaction that secures the cash needed for environmental conservation and climate change projects. Since a large amount of external debt has accumulated in times of high-interest rates, there is room for the G7 and other developed economies to consider it actively as a financial mechanism for achieving development

and environmental improvement in developing economies. Since 2022, meanwhile, the normalization of monetary policy in the world and associated rising trends on long-term yields have reduced risk appetite among global investors, and several developing economies are facing debt problems. Thus, the debt market environment for performing debt-for-nature swaps is becoming unfavorable.

Meanwhile, in April 2022, the UN proposed to the Government of Sri Lanka, a middle-income country, that Sri Lanka, which defaulted on its loans in the same month due to a lack of foreign reserves, should negotiate debt-for-nature swaps to cope with debt and climate crises (*Financial Times* 2022). This proposal was not considered perhaps due to the political uncertainty, however. After the prolonged negotiations among major donor countries and the positive commitment from the PRC to help address Sri Lanka's debt problems, the IMF finally agreed to provide Sri Lanka with a 4-year financial assistance program totaling $2.9 billion, including grants, in March 2023. According to the data provided by the IMF, the country faces a total debt of $83.6 billion, of which $42.1 billion is domestic debt and $42.5 billion is external debt (IMF 2023). External debt consists of loans from the MDBs, official bilateral creditors, commercial creditors, bonds held by foreign investors, and loans through bilateral currency swap by the Central Bank of Sri Lanka from the People's Bank of China (PBOC). The amount of $11.5 billion is related to loans from the MDBs including the IMF, the World Bank, and ADB. These multilateral creditors enjoy preferred creditor status and these loans are not subject to debt restructuring. Loans from official bilateral creditors consist of those from Paris Club creditors ($4.8 billion, including $2.8 billion from Japan) and those from non-Paris Club creditors ($6.6 billion including $4.4 billion from the PRC and $1.8 billion from India). The Paris Club, which is a group of 22 countries in developed economies, conducts debt restructuring collectively by linking it to the IMF finance and economic programs. Eurobonds issued to foreign investors amount to $13.6 billion. Commercial loans of $3.2 billion include loans from China Development Bank (which is treated as a commercial bank). The central bank bilateral current swap loans recorded about $2 billion.

Debt negotiations are taking place among official bilateral and private sector creditors currently through multilateral negotiations. As the difficulties in reaching debt-restructuring agreements remain, France (chair of the Paris Club), India, and Japan agreed to form a joint multilateral platform in April 2023 to negotiate Sri Lanka's debt restructuring among creditors where the PRC participates as an observer. Reflecting the country's tough economic and debt conditions, the Central Bank of Sri Lanka expressed in May 2023 its willingness

to negotiate alternative financing schemes, including debt-for-nature swaps proposed by the United Nations Development Programme about a year ago. While applying debt-for-nature swaps involves many players and requires time-consuming negotiations, given the limited experiences accumulated in the country, growing attention is currently paid to the possibility of implementing an innovative financing scheme for the first time in the country.

4.3 Performance-Based Grants for Debt-Stressed Countries

One challenge of debt-for-nature swaps is the developing economies' need to allocate budgetary (or fiscal) resources to make a prepayment to the Nature Conservation Trust Fund. The lack of such budgetary resources may constrain the promotion of debt swap operations. Also, debt swap arrangements are often complicated and time-consuming since they involve many participants with diverse interests. Moreover, there is always a risk that the government will not fulfill the commitment set under the swap contracts to spend saved funds for nature conservation projects and activities.

Compared with debt-for-nature swaps, environmental or climate performance–based grants (or grant/loan combinations) could be an alternative to support environmental measures in a developing economy. Environmental performance–based grants can be formulated in a manner that would make it difficult for developing economies to allocate to other spending purposes. A debt-for-nature swap may cover various environmental projects and activities; thus, there is a risk of diverting some of the funds to activities not covered in the debt conversion contract by the debtor government. There are always incentives for highly indebted governments to divert some of the funds to make a debt service payment or for other community development and income support measures. In contrast, conditional grants can be more targeted to a specific purpose, such as climate mitigation or adaptation investment. Until the specified investment occurs, grants would not be disbursed to developing economies, thus eliminating incentives for these countries to divert funds for other purposes.

Comparing debt swaps and conditional grants, Chamon et al. (2022) concluded that debt swaps could be a more efficient form of fiscal support than conditional grants when the expenditure commitment is de facto senior to debt service payment. In addition, debtors may prefer debt-for-nature swaps over nature protection performance–based grants when the former offers debt relief more than what is needed to

finance the nature conservation investments. While grants typically cover, at most, the cost of an investment, debt-for-nature swaps could generally produce some net debt relief—namely, debt relief being set to exceed somewhat the cost of the nature conservation investment leading to a higher net fiscal transfer to developing economies. On the other hand, the same net fiscal transfer could be more cost-efficient from the perspective of a creditor or a donor funding the debt-for-nature swaps by combining a nature protection conditional grant, which pays for the conservation investment exactly, with some additional unconditional debt relief.

In general, highly indebted economies subject to debt rescheduling find it difficult to obtain new loans. In this case, developed economies tend to support these economies by providing grants and/or technical assistance. Performance-based grants are under the spotlight as one of the tools to reduce moral hazard and provide the right incentives to developing economies to invest in projects with climate and environmental objectives. The contract involves a financier that agrees to make payments to developing economies conditional on achieving pre-agreed, verifiable results. Such finance improves accountability by linking funding more directly to desired outcomes—such as a cut in GHG emissions or forest restoration—by providing flexibility on a set of measures to be undertaken rather than specifically targeted inputs (such as proceeds from finance designated to environmental projects), which might be ineffectual or ill-suited for local contexts. The performance-based grants might increase funding effectiveness and lower risks for financiers. Performance-based finance may foster autonomy in developing economies in terms of promoting innovative activities and initiatives by allowing them to choose the inputs and processes needed to achieve the desired results. Performance-based grants can be used to solve the principal-agent problem by aligning the objectives of donors or creditors with those of developing economies through a monetary incentive.

UN-Led Local Climate Adaptive Living Facility with Performance-Based Grants: Most local authorities in the least developed economies are unable to contribute effectively to climate change adaptation and resilience building because of a lack of awareness and incentives to focus on the issue of climate change adaptation, an inability to finance the incremental costs of climate change adaptation, and a lack of appropriate budgetary allocations at the national level. At the same time, local authorities are in an advantageous position to identify the climate change adaptation responses that best meet local needs and typically have the mandate to undertake the small to medium-sized adaptation investments required for building climate resilience. However, local authorities lack the financial resources to make investments and make

investments aligned with established decision-making processes and public planning and budgeting cycles.

Thus, the UN Capital Development Fund created the Local Climate Adaptive Living Facility to provide a mechanism to (i) integrate climate change adaptation into local government planning and budgeting systems, (ii) promote awareness and response to climate change at the local level, and (iii) increase the amount of finance available to local governments for climate change adaptation. The facility combines performance-based climate resilience grants, which ensure the programming and verification of climate change expenditures at the local level, with technical and capacity-building support. It uses the demonstration effect to trigger further flows for local adaptation, including national fiscal transfers and global climate finance for local authorities through their central government. In allocating grants, the facility ensures the programming and verification of climate change expenditures at the local level and offers strong incentives for general performance improvements, targeting areas of importance for enhanced resilience.

The facility's grants provide a financial top-up to cover the additional costs of making investments climate-resilient and are channeled through existing government fiscal transfer systems. To receive grants, climate information, and vulnerability and adaptation assessments must be reviewed or undertaken; needs and capacities must also be assessed. Local governments must develop local adaptation plans or programs in a participatory manner, integrate adaptation in their local development planning and budgeting processes, and cost and select adaptation measures to be financed through grants. Grants are then disbursed to support the implementation of the facility's investments in the context of local authorities' annual planning and budgeting cycles, and selected measures are implemented. Subsequently, performance is appraised in terms of the degree to which additional resources have been used to build resilience and promote adaptation to climate change. Audits are undertaken as part of the regular national process. Capacity-building activities are undertaken at various stages according to identified needs; they target the policy, institutional, and individual levels.

4.4 Suggested Actions to Promote Climate and Environmental Finance for Low-Income Developing Economies

Challenges remain in promoting innovative finance involving public–private partnerships, particularly from global institutional investors. Many financial institutions and institutional investors are subject to stringent financial regulations after the 2008 global financial crisis. Thus,

they tend to prioritize investment-grade bonds with a credit rating of BBB or higher and invest mainly in developed and some large emerging economies. However, because about 80% of EMDEs' government bonds have a speculative rating of BB or lower, with high political and exchange rate risks, private investors often hesitate to invest in these economies. Financial institutions that invest in speculative-grade securities require additional capital to build up a buffer, and these investments often do not provide enough returns to make up for the additional capital costs.

Since the COVID-19 pandemic, a few new but unfavorable macroeconomic and financial developments have taken place, which make it even more challenging for the world to achieve the SDGs by 2030 and carbon neutrality by around 2050. First, a rapid increase in inflation has accelerated the pace of normalizing and tightening policy rates by major central banks, including the US Federal Reserve. This has resulted in depreciation pressures on their exchange rates against the US dollar, amplifying inflation through higher imported inflation in developing economies. Many central banks in developing economies reacted to inflation and capital outflows by raising their policy rates. Second, public debt in developing economies has expanded to cope with the COVID-19 crisis, making it even more challenging to mobilize new funds from the private sector from developed economies under the worsening global macroeconomic environment and volatile financial markets.

Third, a climate crisis is frequently materializing in many places in the world, hurting low-income economies in particular. Fourth, the 2022 turbulence in the UK's gilt market, triggered by the announcement of the minibudget by the then newly formed government of Prime Minister Liz Truss, and the associated losses of pension funds arising from the sharp increase in gilt yields might have awakened many pension funds to increase cash and liquidity to prepare for stress periods. This might lead to lower demand for less liquid assets by institutional investors. Pension funds in the UK and other European economies have extensively used interest rate swaps and repo transactions to increase leverage and exposure to long-term gilts to improve asset–liability matching. When yields shoot up suddenly, these funds must sell assets to meet margin calls, resulting in higher yields. The regional banking failures in the US since March 2023 and the collapse of Credit Suisse in the same month also amplified tensions in the global financial markets. Given these various factors, low-income economies, including some middle-income economies, face unfavorable economic and financing situations. Thus, creditor nations must improve coordination in helping these economies and making their financial support more efficient and effective. Therefore, identifying factors that constrain the growth of capital

inflows into developing economies and considering countermeasures are essential.

Below are a few policy-related suggestions from this overview of recent climate, environment, and innovative finance schemes, particularly for low-income developing economies, based on the analysis and associated discussions explored in Chapters 3 and 4. This chapter also provides policy-related suggestions regarding climate, environment, and innovative finance schemes, particularly for low-income developing economies.

- Bilateral ODA and other development finance to developing economies could benefit from increasing greater coordination in some projects and sectors through sharing skills, knowledge, and funds, given that limited financial resources are available among donor economies in the face of difficult domestic economic conditions. Some European donors and their development finance institutions often collaborate on several projects. However, collaboration with other donors in different jurisdictions is rarely seen. Liao and Beal (2022) pointed out that the existence of parallel initiatives by G7 members in the same sectors heightens the risk of inefficient channeling of limited funds. In some cases, a clearer division of labor among the G7 nations, based on preferential geographies (for example, the EU with preferences on Africa, the US on Latin America, and Japan on Asia), might prove to be more efficient and impactful by possibly lowering fragmentation problems.
- On this front, developed economies' initiatives to promote the Energy Transition Partnerships are a welcome step to increase donor coordination to mobilize more funds to concentrate on decarbonization. This was demonstrated by the Just Energy Transition Partnership for South Africa in November 2021 by the EU, France, Germany, the UK, and the US at COP26 and for Indonesia in November 2022 by Canada, the EU, France, Germany, Italy, Japan, Norway, the UK, and the US, and for Viet Nam in December 2022 by Canada, Denmark, the EU, France, Germany, Japan, Norway, the UK, and the US. It is also important to have such partnerships, particularly for low-income developing economies, and to encourage other donors to participate in the initiatives.
- Among various groupings, the G20 is emerging as the most important group of economies discussing global issues. It successfully promoted some initiatives—such as the temporary debt suspension under the Debt Service Suspension Initiative (DSSI) in 2020–2021 and the multilateral debt restructuring

initiatives under the Common Framework for Debt Treatments beyond the DSSI to low-income developing economies. Moreover, the reallocation of some of the unused SDRs from developed economies and some G20 countries to low-income economies, small island developing states, and climate-vulnerable middle-income economies has been initiated since October 2021. The G20 needs to promote the Common Framework to more low-income countries and some middle-income high-debt economies. Greater coordination from non-Paris Club member countries is becoming important.

- All G20 economies have updated their NDCs with regard to their GHG emission cut targets set under the Paris Agreement. Since G20 economies account for about 80% of global GHG emissions, they should deepen collaboration on discussing detailed transition strategies and improving their monitoring schemes to track progress toward the NDCs. Issues should also be included in policy discussions, such as how to raise global carbon pricing from the current extremely low global emission price ($3). The IMF proposed in 2021 to introduce a three-tier price floor among major carbon-intensive economies, with prices of $75 for high-income economies, $50 for high-income developing economies, and $25 for low-income developing economies (Gasper and Parry 2021). This scheme could reduce global emissions by 23% in line with keeping global warming below 2°C. The G20 could explore discussions about the IMF proposal or similar differentiated carbon pricing proposals.
- More public funds that constitute catalytic funds are needed to promote blended finance schemes, particularly in low-income developing economies. Given limited budgetary resources, better coordination among donor economies and their development institutions could be useful. Blended finance has been utilized in some emerging economies to attract private financing of climate and environmental projects, but the size of the funding remains low. Donor economies could allocate more funds toward climate- or environmentally vulnerable economies than resilient countries, given that climate- or environmentally resilient, or less vulnerable countries tend to receive more climate or environmental finance than vulnerable ones. Traditional public funds tend to include grants, loans, technical assistance, and, to a lesser extent, equity investment. The important role of catalytic funds in blended finance should be discussed further by the G7

and G20 to increase collaboration among creditor nations from the perspective of mobilizing private capital.

- In addition, it may be worthwhile to prioritize increasing the contributions of public and private capital to the specialized multilateral climate or environmental funds that promote blended finance for low-income developing economies. The funds include the UN-led Green Climate Fund (GCF) described in Chapter 3. They are often intermediated through MDBs or bilateral development institutions, which can promote climate and environmental projects transparently and efficiently. Multilateral climate funds provide more grants than loans compared to MDBs, whose loans account for about 90%. Albeit by a small amount, such multilateral climate funds provide more equity finance than other MDBs.
- More global efforts could be pursued to deepen understanding of various global standards and indicators, including the Blue Dot Network being applied to infrastructure projects and making it more operational and more widely adopted at an international level at the G20. Many donor nations in developed economies have adopted their own environmental and social standards in conducting projects. Priority and preferences over various global standards vary depending on the specific circumstances of donor nations and recipient economies and national interests. While complete standardization may be difficult to pursue and is undesirable, some convergence concerning those environmental and social standards could help lower the burden of low-income developing economies. In the Asian region, many economies need more infrastructure investment, which the public sector has traditionally financed. Thus, they wish to promote private-sector funding to close the gap. To promote innovative and competitive financing solutions from the private sector, some common frameworks applicable to projects might help mobilize more funding into the region. As Liao and Beal (2022) suggested, more participation from all creditor economies and a deeper understanding from developing economies should be promoted to generate some alignment in development finance and possibly lead to greater positive outcomes.
- If possible, Paris Club and non-Paris Club member economies, including the PRC, could also pay more attention to the possibility of engaging in debt-for-nature swaps or debt-for-climate swaps for small, highly indebted economies when environmental and climate risk is expected to amplify the

sovereign credit risks while undermining their essential agriculture, fishery, and tourism industries. Paris Club member economies have already accumulated experience of debt-for-marine swaps or debt-for-climate swaps since the 1980s by working with various NGOs, so they can take the lead by involving non–Paris Club member economies. This might also apply to middle-income economies, such as Sri Lanka, with high debt. Moreover, donor economies might consider increasing the guarantees or insurance components of their development finance to promote innovative debt swaps accompanying green, blue, and sustainability-linked bonds, as demonstrated in the recent case of Belize's debt-for-nature protection swap and associated issuance of a blue bond backed indirectly by the US development finance institution.

- Donor nations tend to support debt-distressed economies with grants. Depending on economic conditions, donor nations might consider performance-based grants with clear preset performance targets (such as GHG emission cuts or carbon removal) in some projects instead of conventional unilateral grants. Under performance-based grants, the amount of disbursement of grants will depend on the assessment of whether the preset targets are on track. Some ODA nations have provided concessional loans for climate or environmental projects at even lower lending rates. However, performance-based finance could also be explored due to the possibility of ensuring more positive impacts. In doing so, donor nations may need to adjust their traditional development finance approaches to incorporate more flexibility into their financing operations.

5

Green Central Banking and Climate-Related Monetary Policy

This chapter focuses on climate-related measures initiated mainly by central banks to help foster a sustainable finance market, which is essential to achieve carbon neutrality worldwide. Realizing a carbon-neutral economy requires a large amount of investment and the mobilization of funds for that purpose. For this reason, central banks are increasingly expected to consider climate criteria regarding investments in their assets. While many central banks have already begun to encourage financial institutions to disclose climate-related information and improve risk management, as pointed out in Chapter 6, it is also important for them to set an example for financial institutions and investors by demonstrating their approach toward greener investment. Climate criteria could also be applied to the collateral framework by adjusting collateral eligibility and haircuts to collateralized assets. In particular, central banks are encouraged to disclose the impact of climate risks on their balance sheets and assets held to meet monetary and nonmonetary policy objectives. Setting a GHG emission reduction target on these financed assets and other operations is desirable. Several central banks in the euro area, the UK, and Singapore have already pursued this. Other operations cover printing and circulating central bank notes, operating payment and settlement systems, managing government deposits, etc. Disclosure of GHG emissions data and associated emission reduction targets is becoming essential. This chapter looks at possible climate-related central bank actions and highlights some actual practices and disclosure already implemented by some central banks worldwide.

5.1 Influential Role of the Network for Greening the Financial System (NGFS)

The Network of Central Banks and Supervisors for Greening the Financial System (NGFS) has suggested central banks' possible positions and responses to climate risks. The Network comprises more than 100 central banks and financial authorities globally. It is a network established at the end of 2017 and led by eight monetary and financial authorities in France, Germany, Mexico, the Netherlands, the PRC, Singapore, Sweden, and the UK. Other central banks and regulators joined as members later, including the Federal Reserve Board and the Office of the Comptroller of the Currency in the US. The secretariat operates at the central bank of France, and the current chair is Ravi Menon, the managing director of the Monetary Authority of Singapore (MAS) since 2022. MAS has been rapidly strengthening its presence in the world with regard to the development of ESG investment and sustainable finance strategies, as well as actively utilizing digitization to promote sustainable finance. Seventeen international organizations, including the IMF, the Financial Stability Board (FSB), BIS, and the Basel Committee on Banking Supervision (BCBS), participate in the NGFS as observers.

Rather than creating and enforcing common regulations, NGFS's objective is to encourage voluntary initiatives among members and encourage their supervised financial institutions to deepen their understanding of climate risks and improve risk management. The objective is to share the best practices some frontrunning members adopt and enable other members to refer to the financial regulatory and supervising practices in their jurisdictions. At the same time, the NGFS views that central banks should aim to develop a sustainable finance market to mobilize the funds necessary for achieving carbon neutrality worldwide, as realizing a carbon-neutral economy requires a large amount of research and development (R&D) and investment. The NGFS has been exploring various ways to incorporate climate risks into the supervision of financial institutions, make comprehensive assessments about the implications of climate change on the financial system, and develop financial markets that promote a low-carbon economy. It has been publishing a series of policy recommendations and guidelines, updating them, and extending the focus recently to other environmental issues such as biodiversity loss.

1. Possible Climate-Related Policy Actions for Central Banks

The NGFS emphasizes that the central bank should adopt its sustainable investment approach toward its balance sheets and demonstrate it to financial institutions and investors as a role model. Therefore, it calls for incorporating environmental criteria into various assets held by central banks and some monetary policy tools. "Green monetary policy" refers to policy incorporating climate change and other environmental criteria into the assets held by the central bank for monetary policy purposes as a result of open market operations, quantitative easing, long-term lending facilities provided to eligible financial institutions against collateral with some conditionality, and foreign exchange market interventions.

Table 5.1 presents possible climate change responses that central banks and financial regulators might consider. The responses include a macroprudential policy to promote financial stability, macroclimate modeling, asset purchases conducted for nonmonetary objectives, and asset purchase conducted for monetary policy objectives (NGFS 2021a). Many central banks and financial regulators have started considering climate-related financial risks as prudential policy, as explained in Chapter 6. This chapter focuses on macroclimate modeling and incorporating climate criteria in the assets held by central banks for monetary and nonmonetary purposes. In particular, the European Central Bank (ECB) has incorporated climate criteria in the corporate

Table 5.1: Possible Climate-Related Policy Options for Central Banks

Financial Stability	• Macroprudential policy • Climate scenario exercise and stress test
Macroclimate Modeling	• Integrating climate change risk to macroeconomic modeling
Nonmonetary Policy Asset Purchase	• Adopting the environmental criteria (e.g., pension funds and other assets)
Monetary Policy Asset Purchase	• Adopting the environmental criteria to asset purchases or foreign reserves
Credit Policy	• Adopting the environmental criteria to long-term lending, collateral, and volume

Source: Prepared by the author based on NGFS (2021a).

bond reinvestment program from October 2022. It also plans to introduce the climate criteria in the collateral framework in 2024. The PBOC has already taken a comprehensive climate-related approach toward banks' evaluation, collateral framework, and credit operations. The Bank of Japan (BOJ) and the central bank of Brazil also introduced climate criteria as part of their credit operations.

2. Developing Macroclimate Modeling

Many central banks are developing new models incorporating climate risks into their macroeconomic forecasting models. Central banks conduct monetary policy decisions based on various economic and financial data, economic and price forecasts based on macroeconomic models, and numerous statistical analyses. It is very challenging to integrate climate risks into macroeconomic models since climate change is expected to affect the economy over a fairly long period, and greater uncertainty exists concerning future climate physical risks and transition risks. Central banks regularly present forecasts for the GDP growth and inflation rates for the next 3 to 4 years. Given that climate risks will affect the financial system, GDP, prices, etc., central banks increasingly find it necessary to develop macroeconomic-climate modeling. In doing so, it is necessary to consider how climate risks are affecting and will affect key macroeconomic variables and thus the transmission channels of monetary policy. Complex questions must be addressed, such as how climate-related volatility of macroeconomic and financial variables can be priced and whether various monetary policy frameworks and measures affect climate change transmission channels differently. Therefore, it is important to deepen understanding and consider how to incorporate climate risks into monetary policy management (NGFS 2020d).

Understanding the transmission channels of monetary policy—such as analyzing how climate change affects companies and individuals and estimating the impact on the natural interest rate, output, and inflation—could become essential in making monetary policy decisions. It is necessary to understand that the time horizons of the impacts of climate risks on inflation and GDP depend on the type of climate risks. For example, transition risks might be roughly concentrated in the first decade or so, during which carbon pricing and associated price increase are implemented until carbon prices reach the appropriate level in line with carbon neutrality goals. Once carbon prices reach more or less socially desirable levels, any further increase will likely be terminated; thus, inflation will drop. In contrast, chronic physical risks may take much longer to materialize and influence the economy significantly

after 2050 or later. Acute physical risks are already generating losses and are expected to increase and generate more economic and social losses continuously. Thus, it is essential to distinguish these various climate impacts on the macroeconomy, prices, and financial variables and build them into modeling.

The concept of the natural interest rate is particularly important in making monetary policy decisions. The natural interest rate is a real short-term interest rate that equalizes the supply and demand for funds when the economy is at full employment, has high degrees of production capacity utilization, and has low and stable inflation. Central banks often judge whether the current monetary easing is sufficient by estimating the natural interest rate and comparing it with the actual real interest rate (roughly, it can be proxied by the short-term money market interest rate minus the inflation rate). For example, if the real interest rate is below (above) the natural interest rate, the monetary policy stance might be assessed as accommodative (tightening). In the downturn or recessionary phase of the business cycle, monetary policy decisions attempt to bring real interest rates below the natural interest rate. The opposite is true when the economy is booming or overheating. Therefore, the issue of how climate change affects the natural interest rate is important when considering monetary policy in the future.

As a purely conceptual consideration, the NGFS report discussed the potential impacts of economic variables that might affect the natural interest rate: namely, economic growth, technology, households' saving and consumption behavior, risk premiums, and fiscal policy. For example, the effect of economic growth on the natural interest rate can have both upward and downward effects. It is because the materialization of physical risks reduces the supply of labor and production, curbs economic growth, and lowers the natural interest rate. At the same time, countries receiving migrant inflows from countries prone to disasters will face an increase in labor supply and economic growth, leading to a rise in the natural interest rate. In addition, technology can also affect the natural interest rate in both upward and downward directions. This is because climate change might restrain innovation and push the natural interest rate down due to substantial economic and social losses. At the same time, however, it is also possible that climate policy will promote innovations such as renewable and clean energy and hydrogen fuel at the corporate level, thus raising the natural interest rate.

In contrast to economic growth and technology, the directions of the implications of climate change on the natural interest rate through saving behavior and risk premiums are clearer. The natural interest rate will likely be depressed in both cases. Precautionary savings, for example, will increase as economic uncertainty caused by climate

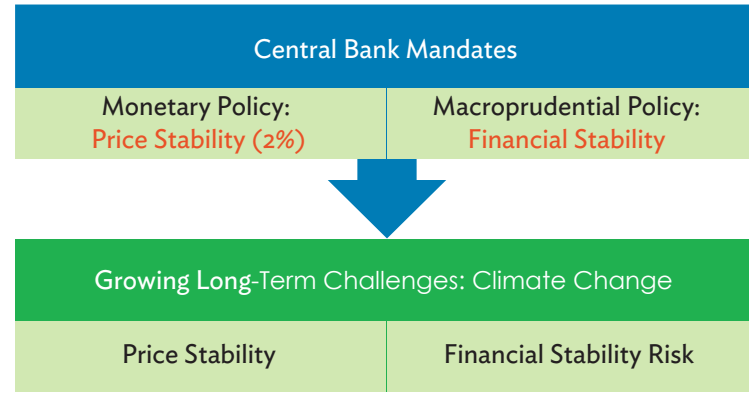
change increases. Low-income earners (who tend to have a higher propensity to consume) are less prepared for climate change and thus will likely be hit harder than high-income earners. This widens income and asset inequality, suppressing consumption across the economy and boosting the savings rate. The resultant higher savings rate might lower the natural interest rate. As for the risk premium, demand for safer and liquid assets such as government bonds might increase as companies, financial institutions, and individuals increasingly recognize climate-related uncertainty. Finally, the impact on the natural interest rate through the conduct of fiscal policy is expected to rise. This is because either a climate mitigation policy aiming at reducing GHG emissions or a climate adaptation policy (preventive measures) against disasters will increase fiscal spending and thus public debt. So, the natural interest rate is expected to rise.

As described above, the natural interest rate is affected by multiple factors, so it is not easy to reflect on them and estimate outcomes using an economic model. Nonetheless, the first step should be to understand and conceptualize the impacts of climate change individually. Through this process, central banks are expected to deepen their understanding of how climate change affects monetary policy transmission channels and monetary policy management and to develop analytical methods. As for the transmission channel of monetary policy, for example, climate change could reduce the value of financial assets held by banks and the value of collateral associated with bank loans, thereby reducing banks' willingness to lend to households and companies and lowering the effectiveness of the monetary policy. In that case, the effect of stimulating aggregate demand, such as consumption and capital investment, by lowering policy may weaken.

5.2 Central Banks' Mandates: Financial Stability and Price Stability

Central banks cope with financial stability mainly through macroprudential policy, including financial supervision and monitoring, while price stability is dealt with through monetary policy (Figure 5.1). There is a growing consensus worldwide that central banks and financial regulators should view climate risks as one of the major financial risks. Thus, many of them have begun to explore climate scenario analysis and/or climate stress tests regarding their supervised major financial institutions by incorporating longer-term frameworks and promoting financial institutions to understand climate-related risk factors. This development is strongly supported by the Basel Committee on Banking

Figure 5.1: Central Bank Mandates and Growing Long-Term Climate Risks



Source: Prepared by the author.

Supervision (BCBS), which concluded in 2021 that climate risks could be classified using the traditional financial risk categories. Thus, banks should incorporate climate-related financial risks, which include credit, market, and operational risks. Like transitional financial risk, banks need to develop their capacity and expertise to cope with newly emerging climate-related financial risks within the existing Basel Framework and stress test (Basel Committee 2022a).

Meanwhile, a consensus has not emerged on whether central banks should incorporate climate risks in their price stability mandate and monetary policy framework. Price stability is generally the most important element of central banks' mandate concerning monetary policy. Some central banks include additional mandates (such as the maximum employment objective set by the Federal Reserve and the maximum sustainable employment objective set by the Reserve Bank of New Zealand). However, such additions have not changed the monetary policy framework.

Dikau and Volz (2021) examined the mandates and objectives of 135 central banks and found that besides the price stability goal, only 15 central banks, or 12%, have explicit sustainability mandates. Meanwhile, 54 central banks, including the Bank of England (BOE) and the ECB, are mandated to support the government's policy priorities and price stability, accounting for 40% of the central banks examined.

The government policy priorities might include carbon neutrality goals and other sustainability goals committed by the government. The remaining 48% of the central banks do not have a direct or indirect mandate requiring them to deal with climate change–related goals. That said, from this group, 33 central banks have addressed climate risks and sustainability challenges. These include central banks in Australia; Hong Kong, China; India; Japan; Mexico; New Zealand; the PRC; and the ROK. These central banks' involvement in climate risks could be justified under the mandate of price stability or financial stability.

On the ECB, Article 127(1) of the Treaty of the EU sets price stability as the primary objective of the European System of Central Banks (ESCB; hereafter, this book uses the ECB interchangeably for simplicity). The same section additionally mentions that "[w]ithout prejudice to the objective of price stability, the ESCB shall support the general economic policies in the [European] Union with a view to contributing to the achievement of the objectives of the Union as laid down in Article 3 of the Treaty on European Union." Article 3 of the Treaty includes the objective of "sustainable development of Europe based on balanced economic growth and price stability, a highly competitive social market economy, aiming at full employment and social progress, and a high level of protection and improvement of the quality of the environment." This indicates that the ESCB's mandate reflects the EU's environmental objective. In addition, Article 127(1) also stated that "ESCB shall act in accordance with the principle of an open market economy with free competition, favoring an efficient allocation of resources." This provision could be interpreted as the secondary objective that includes avoiding reinforcing market imperfections, such as market failure of mispricing (Schnabel et al. 2022).

Price stability is the primary objective of monetary policy under the BOE Act. Supporting government economic policies, including growth and employment, is also required as the secondary objective under the Act. The HM Treasury annually sets out the remit and emphasizes "to achieve strong, sustainable and balanced growth" as the government's economic policy objective. In March 2021, the Chancellor updated the remit on this by redefining the policy "for achieving strong, sustainable and balanced growth that is also environmentally sustainable and consistent with the transition to a net zero economy." With this clearer mandate, the central bank's responsibility for climate risks and other environmental issues became more explicit.

Thus, the ECB and BOE view that green monetary policy can be pursued as long as consistency with the price stability mandate is maintained. The ECB has already begun incorporating climate criteria on a path aligned with the Paris Agreement goals through a **tilting**

approach based on issuer-specific climate scores in their corporate bond reinvestment strategies from October 2022, as explained below. The ECB is so far the world's most environmentally ambitious central bank as its comprehensive climate agenda announced in July 2021 covers macroeconomic modeling, detailed monetary policy instruments, financial risk assessment including stress tests, data collection, and disclosure. Meanwhile, BOE announced a similar tilting approach toward corporate bond purchases and reinvestment strategies in November 2021. In February 2022, however, BOE announced a plan to cease reinvestment and design corporate bond sales that would be completed no earlier than around the end of 2023 (revised to "by early 2024" in May 2022). The sales began in September 2022 and resumed the following month after a temporary halt caused by the massive sale-off of UK gilts following Prime Minister Liz Truss's announcement of a tax cut plan.

Some central banks appear to emphasize climate-related financial risks and prudential perspectives to cope with financial institutions rather than relating climate risks to price stability and monetary policy. For example, Federal Reserve Chair Jerome Powell stressed in his speech in January 2023 that the elected government could more properly undertake climate policy due to the possible impact of such policy on income disparity and a wide range of companies, industries, regions, and countries, and that monetary policy to promote a greener economy should not be undertaken without explicit congressional legislation (Powell 2023). Instead, he said the central bank would focus on climate-related financial risks because of the Federal Reserve's responsibility for banking supervision. His statement generated disappointed reactions from civil society. It may reflect the need for the central bank to be neutral about green monetary policy, given increasingly divergent views between different political parties at the US Congress regarding the role of the government and the Federal Reserve in promoting climate mitigation activities.

There is no question that governments should be primarily responsible for committing to achieve the Paris Agreement goals and implementing detailed climate policies and strategies. Meanwhile, there is a growing expectation that central banks could contribute to making the financial system and the economy more sustainable within the mandates, given that climate change is expected to increasingly influence macroeconomic variables and financial markets and systems, affecting the transition mechanism of monetary policy. Since consensus has not emerged yet on how climate factors could be integrated into the monetary policy framework, it may take time to see the spread of green monetary policy across the globe. Central banks' green policy actions

crucially depend on each country's government commitment to carbon neutrality and associated climate policy strategies, as well as support from the public.

5.3 Climate-Related Monetary and Nonmonetary Policies and Asset Management

This chapter focuses on climate-related measures that central banks have initiated to improve their risk management and help foster a sustainable finance market, which is essential to achieve carbon neutrality worldwide. Realizing a carbon-neutral economy requires a large amount of investment and the mobilization of funds for that purpose. For this reason, the NGFS is calling on central banks to consider climate criteria regarding investments in their assets. This also reflects a view that central banks need to set an example for financial institutions and investors and demonstrate their approaches to green investment. Central banks are encouraged to disclose the analysis of the impact of climate risks on their balance sheets and assets held to meet monetary and nonmonetary policy objectives following the TCFD guidelines prepared for companies and financial institutions (see Chapter 1). Setting a GHG emission reduction target on their operations, including printing central bank notes and other operations as well as financed emissions, is also possibly considered. Climate criteria could also be applied to the collateral framework by adjusting collateral eligibility and haircuts to collateralized assets.

1. Assets Held by Central Banks for Monetary Policy Objectives: Domestic Asset Purchases

The NGFS outlined its first practical approach toward integrating environmental perspectives into central bank asset management policies and provided recommendations with detailed practical examples (NGFS 2019b). Central banks tend to hold domestic and foreign assets for various objectives. Central banks' portfolios could be classified into four types of assets: (i) those held for monetary policy purposes, (ii) those held for nonmonetary policy purposes, (iii) those held for managing employees' pension assets, and (iv) those managed on behalf of third parties.

Central banks hold the first type of assets, for monetary policy purposes, as a result of conducting monetary policy following mandates set by the Central Bank Law and other related laws. Several central

banks hold assets due to implementing quantitative easing as part of unconventional monetary policies in the face of the effective lower bound on their short-term policy rates. Such central banks typically hold government bonds denominated in their domestic currencies. Besides government bonds, for example, the US Federal Reserve holds agency mortgage-backed securities and agency bonds. The ECB has covered bonds, corporate bonds, including green bonds, and other regional bonds. BOJ holds not only high-rated corporate bonds and commercial paper but also stock exchange-traded funds and real estate investment trusts. Moreover, some central long-term credit operations for eligible financial institutions. For example, the ECB implemented three rounds of long-term, low-cost lending to financial institutions under the Targeted Long-term Refinancing Operations. BOJ has also been implementing various long-term fund-supplying operations for some time.

The NGFS highlighted several monetary policy options for central banks to contribute to greening the financial market and helping the government's carbon neutrality goal (Table 5.2) (NFGS 2021a). The options included asset purchases, credit operations, and collateral (utilized in central banks' operations against financial institutions when central banks conduct credit operations). While many central banks conduct short-term credit operations for financial institutions, only several provide longer-term credit operations (such as those with a maturity of 1 year or longer). Asset purchases could take a **tilting approach** (i.e., increasing the weight of greener assets in the total asset purchased) and, in some cases, a **negative screening approach** (i.e., divesting assets in case bond issuers fail to meet climate criteria). A tilting approach is desirable if it is vital to promote carbon emission–intensive sectors and companies to make greater efforts to reduce emissions. A negative screening might be a last option for central banks and exercised in a limited manner since certain sectors or activities are excluded from the investable asset universe. It is possible to adopt the negative screening approach after observing corporate behavior for some time as an incentive mechanism. Such a policy may also depend on the government's climate policy and detailed strategies related to the specific sectors or activities that might be excluded.

In addition, credit operations listed in Table 5.2 could take the form of lowering interest rates if financial institutions have better climate-related lending performance, lowering interest rates when the composition of low-carbon assets accepted as collateral is greater, and providing access or greater access to central banks' lending facilities conditional on financial institutions' climate-related lending performance. Central banks could establish new long-term credit facilities by providing

Table 5.2: Selected Stylized Options for Adjusting Central Banks' Operational Frameworks to Climate Risks

Asset Purchases	
(1) Tilting purchases	Skew asset purchases according to climate-related risks and/or criteria applied at the issuer or asset level
(2) Negative screening	Exclude some assets or issuers from purchases if they fail to meet climate-related criteria
Credit Operations	
(3) Adjust pricing to reflect counterparties' climate-related lending	Make the interest rate for central bank lending facilities conditional at the extent to which a counterparty's lending (relative to a relevant benchmark) is contributing to climate change mitigation and/or the extent to which they are decarbonizing their business model
(4) Adjust pricing to reflect the composition of pledged collateral	Change a lower (or higher) interest rate to counterparties that pledge a higher proportion of low-carbon (or carbon-intensive) assets as collateral or set up a credit facility (potentially at concessional rates) accessible only against low-carbon assets
(5) Adjust counterparties' eligibility	Make access to (some) lending facilities conditional on a counterparty's disclosure of climate-related information or on its carbon-intensive/low-carbon/green investment
Collateral	
(6) Adjust haircuts	Adjust haircuts to better account for climate-related risks. Haircuts could also be calibrated such that they go beyond what might be required from a purely risk mitigation perspective to incentivize the market for sustainable assets.
(7) Negative screening	Exclude otherwise eligible collateral assets, based on their issuer-level climate-related risk profile for debt securities or on the analysis of the carbon performance of underlying assets for pledged pools of loans or securitized products. This could be done in different ways, including adjusting eligibility requirements, tightening risk tolerance, introducing tighter or specific mobilization rules, etc.
(8) Positive screening	Accept sustainable collateral to incentivize banks to lend or capital markets to fund projects and assets that support environment-friendly activities (e.g., green bonds or sustainability-linked assets). This could be done in different ways, including adjusting eligibility requirements, increasing risk tolerance on a limited scale, relaxing some mobilization rules, etc.
(9) Align collateral pools with a climate-related objective	Require counterparties to pledge collateral, such that it complies with a climate-related metric at an aggregate pool level.

Source: Prepared by the author based on NFGS (2021a).

long-term, low-interest finance based on the volume of extending green loans and/or investing in green bonds. The provision of new finance to such financial institutions has been practiced for the first time by the PBOC since November 2022 and then by BOJ since December 2022, as explained below.

2. Assets Held by Central Banks for Monetary Policy Objectives: Foreign Reserve Management

While domestic asset purchases are limitedly exercised by central banks worldwide, central banks in EMDEs often intervene in the foreign exchange market to mitigate fluctuations in their exchange rates. When their exchange rates appreciate sharply, foreign exchange intervention is usually carried out by purchasing foreign currency from the foreign exchange market and supplying the domestic currency to the market in exchange. As a result, many central banks maintain large amounts of foreign currency–denominated assets in the form of foreign reserves. Since these assets are held mainly for foreign exchange market intervention, the composition of foreign currency asset holdings is determined by several criteria (such as liquidity, creditworthiness, return, etc.). Central banks tend to hold foreign currencies in the form of deposits and government bonds issued mainly by major advanced countries, such as the US, due to the highly liquid and deep bond market in the world. The NGFS argues that changing the investment mix from the climate change risk perspective within the mandate is possible. However, one crucial difference between foreign reserve management and domestic asset management from the perspective of promoting a sustainable finance market is that the former supports a sustainable foreign market (including a green bond market), while the latter helps foster the domestic market. Singapore's MAS adopted emission targets on its investment portfolio primarily from foreign reserves based on the carbon intensity of its equities and corporate bonds portfolio (Scopes 1 and 2 emissions), as described below.

Denmark has been pegging the Danish krone to the euro as the primary objective of monetary policy, namely, maintaining low and stable inflation. The fixed exchange rate policy has been the main element of monetary policy in the past 4 decades. Denmark's central bank, Danmarks Nationalbank, has adopted responsible investment guidelines for financial assets, including foreign reserves accumulated under the fixed exchange rate regime and Danish mortgage bonds, based on the UN Global Compact for corporate social responsibility and violations of weapons conventions, as well as the Paris Agreement. Most of these assets are liquid, high-rated government bonds or short-term

money market products. Given that the secondary objective for foreign exchange reserve management is to achieve the highest possible return at moderate risk, foreign reserves are invested in equities and corporate bonds passively through exchange-traded funds. In 2022, the central bank of Denmark strengthened the responsible investment criteria further on foreign reserves with the decision to invest solely in exchange-traded funds consistent with the EU's minimum requirements for Paris-Aligned Benchmarks. The main minimum requirements comprise exclusion criteria and limitation of carbon dioxide equivalent (CO_2e) intensity. Under the exclusion criteria, companies are excluded from investment candidates if they are involved in controversial weapons, tobacco, or breaches of the UN Global Compact or OECD guidelines. Companies are also excluded if their maximum share of revenue exceeds 1% for lignite and anthracite, 10% for oil, 50% for gas, and 50% for power generation emitting more than 100 grams of CO_2e per kWh. As for the limitation of CO_2e intensity, the weighted average of companies' CO_2e intensity (GHG emission divided by the company's value) in the benchmark must be reduced by 50% relative to the general market and then by 7% annually. Emission data must cope with Scopes 1 and 2. Scope 3 must be included for all sectors by the end of 2024.

3. Assets Held by Central Banks for Nonmonetary Policy Objectives

Regarding assets held for objectives other than monetary policy, including the second and third types of assets mentioned earlier, some central banks maintain assets to fund their operational costs (personnel, computer system development, banknote issuance costs, etc.). Other central banks manage assets to earn some return while accepting a certain amount of risk. Moreover, some central banks manage various financial assets to deepen their understanding of market trends and conditions through actual investment. However, these nonmonetary policy operations must not affect the conduct of monetary policy. Central banks' asset management for nonmonetary policy purposes tends to cover a wider range of assets than the monetary policy objective because of greater considerations on returns.

As for the third type of assets, some central banks manage pension funds for central bank employees. The nature of pension liabilities and fiduciary duty determines the composition of these assets. Pension funds often manage a wider variety of domestic and foreign assets than the first and second types of assets. As long as fiduciary duties are met, there is room for integrating the environmental standard into asset management. Since this asset management is longer-term oriented

than the first and second types of assets, central banks need to pay less attention to short-term fluctuations in asset prices. Therefore, it is more suitable for environment-oriented investment. Regarding the fourth type of assets, those managed by some central banks on behalf of third parties, some central banks, for example, manage foreign reserves and sovereign wealth funds on behalf of local governments.

In recent years, an increasing number of central banks worldwide have been introducing climate criteria for managing these nonmonetary policy-related assets in Europe and other economies. Banque de France, for example, is a globally recognized environmentally conscious central bank, as evidenced by the fact that it serves as the secretariat to the NGFS. Banque de France was the first central bank to apply a responsible investment approach to its portfolio of funds and pension obligations in 2018. Under this policy, the central bank excluded investments in companies with high GHG emissions from the stocks invested by the fund and increased the weight of investment in companies with high ESG scores. A similar approach was applied to managing pension assets by the end of 2022. Banque de France also committed to divesting coal-related investments by 2024. As a founding member of the NGFS, De Nederlandsche Bank, the Dutch central bank, became the first central bank to sign the UN PRI in 2019. ESG perspectives are incorporated into nonmonetary policy related to foreign currency–denominated assets and domestic assets. Furthermore, companies producing cluster bombs; landmines; chemical, biological, and nuclear weapons; and others are excluded from investment targets. Based on the UN Global Compact Principles as the minimum ethical standards, the De Nederlandsche Bank practices negative screening to exclude problematic companies from investment targets.

4. Central Banks' Collateral and Reserve Requirements Frameworks

Central banks could consider applying green or environmental standards to monetary policy, particularly by adjusting the collateral framework and the reserve requirements. Regarding the collateral framework (Table 5-2), possible options could include (i) accepting green assets as the collaterals used for central banks' lending schemes, (ii) reducing the degree of haircuts (thus, accepting higher value) on those collaterals based on climate-related criteria, and (iii) adopting the negative or positive screening criteria to the eligibility of collaterals based on climate standards. The PBOC explicitly included green financial bonds in the eligibility criteria of the central bank's lending scheme in 2018. In 2021, the ECB announced that it is preparing to limit the share of assets

issued by entities with high carbon emissions that can be accepted as collateral from 2024.

In addition, reserve requirements, which obligate financial institutions to hold the minimum amount of reserve balances (liquid deposits) with their central bank, could be used to promote green monetary policy. For example, differential reserve requirements could be applied to the compositions of banks' portfolios. By allowing lower (higher) required reserve rates for financial institutions that hold greener, less carbon-intensive assets, central banks could promote financial institutions' green investments (Dikau and Volz 2018).

5.4 Central Banks' Climate-Related Financial Disclosure and Related Practices

An increasing number of countries and regions are urging companies and financial institutions to promote climate-related disclosure in accordance with the TCFD guidelines and the disclosure standards set by the ISSB, as pointed out in Chapter 1, and additional guidelines often set by governments reflecting their agenda (such as double materiality reflected in the EU's Corporate Sustainability Reporting Directive [CSRD] and Sustainable Finance Disclosure Regulation). On this front, the NGFS has expressed the view that central banks should also act as role models by actively disclosing the financial impact of climate change based on the TCFD guidelines to promote such information disclosure to financial institutions (NGFS 2021b).

The TCFD guidelines set out principles for disclosure based on four standard pillars (governance, strategy, risk management, and indicators and targets). Under the **Governance pillar**, the NGFS suggested that central banks could incorporate climate risks into all their operations, extending beyond the conduct of monetary policy. Central banks could describe how their board of directors understands and responds to climate risks with a clear organizational setting. The **Strategy pillar** could focus on making the financial system, the macroeconomy, and the central bank more resilient to climate risks by pursuing various central banking operations and conducting monetary policy. In the **Risk management pillar**, central banks should specify detailed risk management methods for specific operations, if possible. Furthermore, on the **Indicators and Targets pillar**, central banks could disclose GHG emissions from central bank operations, including printing central bank notes (could be classified as Scopes 1 and 2) and holdings of financial assets (Scope 3). At the same time, setting short- and medium-term emission targets and, if possible, a long-term carbon-neutral target for these emissions is considered desirable.

1. BOE as Front-Runner on Own Climate-Related Financial Disclosure

BOE led the central bank community in conducting its climate-related disclosures per the TCFD guidelines. In 2020, BOE became the first central bank in the world that disclosed detailed information in line with the TCFD guidelines. It also aimed at promoting the creation of norms for central banks and the finance sector around the world by practicing best practices themselves. The report is published and revised annually. The latest climate-related financial disclosure report was published in 2022 (BOE 2022b).

BOE's Climate-Related Governance Structure: According to the 2022 disclosure report, the section related to the Governance pillar explained that the central bank's management of climate risks is supervised by its Court of Directors. This court is a unitary board comprising five executive members (the governor and seven non-executive members). One of the non-executive members includes a chair chosen by the Chancellor of the Exchequer. The court sets the organization's strategy and budget and makes important decisions on resourcing and appointments. The Audit and Risk Committee is a sub-committee of the court to assist the court in maintaining effective risk management, internal controls, and financial reporting. In addition, the court reviews the central bank's progress against climate risk targets annually, with the results included in BOE's annual report.

BOE has three statutory policy committees: the Monetary Policy Committee (MPC), the Financial Policy Committee (FPC), and the Prudential Regulation Committee. The Chancellor of the Exchequer issues remits and recommendations to these policy committees. The BOE Act 1998 requires the Chancellor of the Exchequer to specify the definition of price stability and the government's economic policy objectives for the MPC at least once every 12 months. Price stability has been defined as 2% based on the 12-month increase in the consumer prices index. The government's economic policy objective had been defined as "achieving strong, sustainable and balanced growth." In March 2021, the Chancellor updated the MPC's remit to refine the government's economic strategy for "achieving strong, sustainable and balanced growth." As mentioned above, the expression was revised by adding "that is also environmentally sustainable and consistent with the transition to a net zero economy" after the expression above. This statement reflects the government's commitment to meet the net-zero GHG emissions target by 2050 by passing laws to end the country's contribution to global warming by 2050.

In 2022, BOE received two additional climate-related recommendations from the Chancellor toward BOE's FPC and the

Prudential Regulation Committee, reflecting global energy shortage issues. These committees were required to "have regard to the government's energy security strategy and the financial system's important role in supporting the UK's energy security—including through investment in transitional hydrocarbons like gas—as part of the UK's pathway to net zero." BOE's climate strategy is currently formulated based on these remit and recommendation letters. Governance of climate-related works at a management level is led by the two executive sponsors for climate change. One is the executive sponsor for the bank's policy functions, who is the executive director for financial stability strategy and risk; another is the executive sponsor for climate change across the internal operations, who is the chief operating officer.

BOE's Climate-Related Strategy: In the section related to the Strategy pillar, BOE clarified that one of the objectives of its work on climate change is to play a leading role in ensuring the financial system and the macroeconomy become more climate resilient. To do so, the central bank intends to enhance its resilience to climate risks and support the transition to a net-zero economy. The central bank put five key goals in place to achieve these climate objectives: (i) enhancing the financial system's resilience toward climate-related financial risks, (ii) supporting an orderly economy-wide transition toward net-zero emissions, (iii) promoting effective TCFD-aligned climate disclosure, (iv) contributing to a coordinated international approach toward climate change agenda, and (v) demonstrating best practices through acting on the central bank's operations. The 2022 disclosure report stressed that progress had been made with these five goals over the past year, including the publication of the central bank's Climate Biennial Exploratory Scenario exercise for major UK banks and insurers, as mentioned in Chapter 6. The central bank also actively communicates with the parliament, companies and business leaders, financial market participants, and civil societies on exploring climate issues and exchanging views. The Prudential Regulation Authority and the Financial Conduct Authority have also jointly organized the Climate Financial Risk Forum with a financial industry group to share best practices and accelerate financial institutions' capabilities to address climate change and risk management. The forum published a series of climate-related practical guides and tool kits in 2020 and 2021.

Regarding its micro- and macroprudential measures to enhance resilience to climate-related financial risks at both the individual financial institution and financial system-wide levels, BOE's Prudential Regulation Authority became the first prudential regulator in 2019 to publish a comprehensive set of supervisory expectations on how banks and insurance companies should enhance their approaches to

managing climate risks. This publication was followed by guidance reflecting feedback for financial institutions. The guidance included the supervisor's expectations that financial institutions maintain adequate capital to cope with climate-related financial risks, as pointed out in Chapter 6. The deadline for financial institutions to fulfill the supervisory expectations was by the end of 2021.

In late 2021, the PRA published a progress report and concluded that financial institutions made good progress in incorporating climate risks into governance frameworks. However, it acknowledged that common challenges remain in data gaps and modeling complexities. Alternative approaches (such as using proxy data, expert judgment, and assumptions) were suggested as interim tools to overcome some of the challenges. The regulator also emphasized that its supervisory approach would shift from assessing financial institutions' implementation in light of its supervisory expectations to actively supervising financial institutions from the end of 2021. This means that the regulator will examine whether financial institutions could demonstrate effective and active management of climate risks through regular supervisory engagements and reviews. Financial institutions are now requested to submit clear transition plans and take further assurance actions if progress is judged insufficient. BOE is also working with the government and other financial regulators to support the adoption of mandatory TCFD-aligned disclosure requirements across the economy by 2025. The UK government is also preparing a taxonomy to promote a sustainable financial market. The taxonomy classifies environmentally sustainable activities based on well-developed EU taxonomy by adding some UK-specific elements (see also Chapter 6).

BOE's Risk Management and Indicators and Targets: Regarding the section on the Risk Management and Indicators and targets pillars, BOE's 2022 disclosure report acknowledged that the central bank is exposed to climate risks across both its physical operations (e.g., emissions from its buildings and travel) and its financial operations (e.g., financial asset portfolios held for monetary policy purposes). BOE implemented several measures to enhance its management of climate risks. Since June 2021, for example, the central bank's important metrics related to climate risks have been reported regularly to its executive and non-executive risk committees and periodically to the Court of Directors. The central bank produced internal guidance to promote assessment and reporting on climate risks. This aim was to encourage more comprehensive thinking within BOE on the impact of climate risks and to increase internal consistency on reported risks.

One important contribution initiated by BOE has been its efforts to demonstrate best practices in climate risk reporting by disclosing

climate risk analysis on its asset holdings. In 2022, the central bank broadened its carbon emission metrics to include financed emissions in line with the TCFD guidelines (BOE 2022b). BOE also continues to strengthen its forward-looking risk measures by incorporating the latest climate scenarios presented by the NGFS. Regarding asset holdings, the 2020 disclosure report pointed out that climate performance related to its sovereign asset holdings across a range of indicators remained better than reference portfolios and in line with previous trends. The carbon emission related to its sovereign government bond holdings is measured by the **weighted average carbon intensity** (WACI), as recommended by the TCFD guidelines. This measure fell and remained lower than a G7 reference portfolio, thus indicating the lower carbon footprint in the UK relative to other advanced economies.

Regarding sterling nonfinancial (investment grade) corporate bond holdings, BOE announced its intention to align its Corporate Bond Purchase Scheme portfolio with the 2021 revision of its MPC's remit described above. The central bank published an associated comprehensive framework, including a tilting approach that incentivizes stronger climate-performing companies in accordance with a climate scorecard. An interim target on reducing WACI of the portfolio was set at 25% between 2020 and 2025. WACI of the corporate bond holdings as of February 2022 fell 8% on a year-on-year basis to 233 tons of CO_2 per million pounds sterling of revenue—18% below the level reported in the 2020 climate disclosure report. Subsequently, the central bank stopped purchasing new corporate bonds and shifted to the reinvestment strategy. Accordingly, the climate target was applied to the reinvestment framework of the Corporate Bond Purchase Scheme. An initial program of reinvestment operations was conducted from November 2021 to January 2022. In February 2022, the central bank made a monetary policy decision to reduce holdings of its entire portfolio, including government and corporate bonds, by ceasing reinvestment programs. Sales of corporate bonds began in September 2022 and resumed in the following month after a temporary pause.

Concerning emissions from operations, BOE is exploring its strategy to reduce emissions from its physical operations toward achieving net zero by 2050. It monitors its exposure to transition risks by tracking its carbon emissions from physical operations. In 2022, the central bank's carbon emission achieved its lowest since the emission target was set in 2015/2016. The amount of carbon emissions fell by 9% (1,027 tCO_2e) compared to 2020/2021 and by 51% (10,311 tCO_2e) compared to the baseline year of 2015/2016. The reduction in emissions since 2021 was mostly attributable to changes in banknote production, mainly due to a decline in demand for banknotes driven by the impact of the COVID-19 pandemic and a resulting decrease in the number of banknotes printed.

Notwithstanding that this recent decline could be temporary, BOE stressed that the decrease in carbon intensity is expected to generate a permanent change (BOE 2022b). The impact of the COVID-19 pandemic on emissions continued to be felt also because of the low levels of air travel by staff. While this impact will likely be temporary, new ways of working among BOE staff will unlikely revert to the 2019/2020 level. The central bank's efforts to shift to renewable electricity also contributed to declining emissions from operations.

2. ECB's Comprehensive Approach to Climate-Related Financial Risks and Green Policy Measures

The ECB has been attempting to integrate climate criteria in managing various assets it holds for monetary and nonmonetary purposes. In March 2023, the ECB published its first climate-related financial disclosures in line with the TCFD guidelines, which include information on its portfolios' carbon emissions and exposure to climate risks by publishing two reports (ECB 2023b, 2023c). The first report concerns the disclosures of ECB's euro-denominated assets held for nonmonetary policy objectives. The second report is about the disclosures related to ECB's holdings of corporate bonds purchased for the monetary policy objective—that is, corporate sector portfolios purchased under the corporate sector purchase program and the pandemic emergency purchase program. The disclosures and associated policies for nonmonetary and monetary policies are explained separately.

A. Disclosure of assets held for nonmonetary policy objectives

The Eurosystem members, comprising the ECB and all national central banks of the euro area economies, are solely responsible for their nonmonetary policy portfolios. Nonetheless, an agreement was made in 2021 to bring a common stance for climate-related sustainable and responsible investment principles concerning euro-denominated nonmonetary policy portfolios managed under their responsibility. This decision is consistent with the recommendations by the NGFS to improve climate risk management related to central banks' balance sheets mentioned above. The ECB also decided to start climate disclosures for these portfolios within 2 years, using the TCFD recommendations as the initial framework and reporting them in the Indicators and Targets pillar. The ECB and some national central banks (such as those in France and the Netherlands) have already been applying sustainable and responsible investment practices to manage their nonmonetary policy portfolios. Thus, the common stance is expected to promote disclosures and understanding of climate risks and help Eurosystem member central banks contribute to the transition to a low-carbon economy and

to EU's climate goals of achieving net-zero emissions by 2050 and 55% compared to the 1990 level by 2030 as an intermediate target.

ECB's Climate-Related Governance Pillar: The ECB holds its own funds' portfolios for nonmonetary policy objectives aimed at generating income to help finance the operating expenses of the ECB that are unrelated to the delivery of its supervisory tasks. These funds portfolio predominantly invests the ECB's financial resources, i.e., ECB's paid-up capital, the amounts set aside in general reserves, and the general provision for financial risks. The portfolio is invested in euro-denominated fixed-income assets of high credit quality. It is managed passively by the ECB's Directorate General Market Operations by closely tracking a benchmark maintained by the ECB's Directorate Risk Management in accordance with the risk control framework and strategic benchmark discussed by ECB's Internal Investment Committee and approved by the Executive Board. Moreover, the ECB staff pension fund aims to cover the current and future pension liabilities for ECB staff members and pensioners and is managed by external investment managers. ECB's Internal Investment Committee governs the policy, monitors external managers, and integrates climate factors into these investments. ECB staff–elected Pension Oversight Committee monitors the management of the pension funds from the perspectives of the beneficiaries' interests and in accordance with the rules. Their monitoring activities are reported to the Executive Board at least annually to enable monitoring of relevant risks and returns and climate factors. The Executive Board approves the investment strategies and interim and final sustainability targets for both own fund portfolios and pension fund annually.

ECB's Climate-Related Strategy Pillar: Regarding its own fund portfolio (mostly comprising sovereign bonds), the ECB pursues an impact investment strategy that targets a continuous increase in the share of green bonds by (i) directly purchasing green bonds in secondary markets during monthly rebalancing and (ii) investing in the euro-denominated green bond investment fund for central banks launched by the Bank for International Settlements in January 2021. As for the staff pension fund, the ECB has pursued a sustainability strategy since 2017 with the following four elements. First, investment managers must be signatories to the UN PRI and UN Global Compact. Second, investment managers are expected to vote and engage in line with their proxy voting and engagement guidelines, which incorporate ESG principles. They regularly report to the ECB on the impact of their voting and engagement activities. Third, the **negative screening approach** is exercised based on violations of the UN Global Compact principles, international treaties, and conventions related to controversial weapons. Finally, the staff

pension fund replaced all conventional equity benchmarks with their low-carbon equivalent in May 2020. This helped reduce the carbon footprint of the equity holdings by over 60%. In addition, the fund replaced the conventional corporate bond benchmarks with their Paris-aligned equivalent in February 2022. This helped reduce the holdings' carbon footprint by 50%, with subsequent annual reductions in carbon intensity of 7%.

ECB's Climate-Related Risk Management Pillar: Investment limits are monitored within the established risk management framework for nonmonetary policy portfolios. The staff pension fund ensures that the externally managed investment funds closely follow their respective low-carbon and Paris-Aligned Benchmarks. The Directorate Risk Management investigates detected breaches following a standardized procedure and appropriate resolutions are investigated and implemented. The own funds portfolio ensures that the thematic investment objectives are integrated in the ECB's strategic benchmark in accordance with pre-specified risk budgets.

ECB's Metrics and Targets Pillar: Four key metrics are used based on TCFD guidelines for ECB's staff pension fund and its own funds portfolio, most of which are composed of government bonds. These metrics are the (i) weighted average carbon intensity (WACI), (ii) carbon intensity, (iii) total carbon emissions, and (iv) carbon footprint. The WACI metric measures a portfolio's exposure to carbon-intensive issuers and serves as a proxy for a portfolio's exposure to climate transition risks. The carbon intensity metric measures the carbon efficiency of a portfolio in financing economic activity. The WACI and carbon intensity metrics are comparable across differently sized portfolios and over time, as they normalize issuers' emissions by measuring issuers' economic activity. By contrast, the total carbon emissions metric measures the absolute emissions associated with a portfolio and serves as a proxy for the contribution to global warming that a portfolio finances and thus its environmental impact. The total carbon emissions metric is non-normalized and is driven by fluctuations in portfolio values, limiting its informative value for comparison over time or across portfolios of different sizes. The carbon footprint metric normalizes the total carbon emissions metric by a portfolio's value, enabling comparability. As a principle, issuers' self-reported emissions data are preferred over emissions data modeled by the data providers, which are only used if self-reported data are unavailable. Metrics for sovereign issuers are based on production, consumption, and government emissions. The metrics are calculated using holdings, emissions, and financial data for the same reference year whenever possible. Metrics for corporate, supranational, and agency issuers are based on issuers' Scopes 1 and 2 emissions.

The availability of climate data for assets in the staff pension fund and the own funds portfolio have improved in recent years, reflecting improved climate-related reporting. The latest available Scopes 1 and 2 emissions data cover 99% of the corporate issuers held in the pension fund and 71% of the nonsovereign issuers held in their own funds' portfolio.

Per the disclosure report, the ECB has more than halved emissions from corporate and equity investments in its staff pension fund since 2019 (ECB 2023b). As a result, these assets are already aligned with the Paris Agreement and low-carbon benchmarks. As for its own funds portfolio, the ECB has gradually increased its share of green bonds from 1% in 2019 to 13% in 2022. As this portfolio consists mainly of euro area government bonds, its decarbonization depends to a large extent on countries' efforts to reduce their emissions and meet Paris Agreement goals.

With regard to the Targets pillar, the ECB aims to decarbonize its staff pension fund and its own funds portfolio in line with the goals of the Paris Agreement and EU climate neutrality objectives, as defined in the European Climate Law. In future disclosure reports, the ECB will work on portfolio-specific, quantitative interim decarbonization targets for the staff pension fund and the own funds portfolio. Meanwhile, the ECB will continue increasing the share of green bonds held in its own funds portfolio. By the end of 2023, the ECB aims for green bonds to comprise at least 15% of the nominal value of the portfolio.

B. Disclosure of corporate bonds held for monetary policy objective

In July 2022, the ECB announced climate strategies by including climate criteria in its corporate bond purchases, collateral framework, disclosure requirements, and risk management, in line with its climate action plan presented a year ago. All these measures are viewed in line with the ECB's primary objective of maintaining price stability and consistency with EU's climate neutrality objectives (i.e., supporting the green transition of the economy) mentioned above. As for corporate bond holdings, the ECB conducts only reinvestment purchases since net asset purchases, including other bonds, were terminated in April 2022 regarding the Pandemic Emergency Purchase Program and in July 2022 regarding the Asset Purchase Program. Under the reinvestment framework, the ECB decided to gradually decarbonize its corporate bond holdings from October 2022 by adopting a **tilting approach**, while the total volume of corporate bond purchases remains to be determined by monetary policy considerations in achieving the ECB's inflation target. This climate-related reinvestment strategy aims to mitigate climate-related financial risks on the Eurosystem balance sheet and incentivize

bond issuers to reduce emissions and improve disclosures. The July 2022 decision was followed up in September 2022 with more detailed information regarding the overall climate score used to tilt corporate bond holdings. The ECB started reducing the portion of assets held under the Asset Purchase Program in March 2023 by partially receiving cash redemption without reinvestment. The climate criteria remain applied to the reinvestment of other assets and assets held under the Pandemic Emergency Purchase Program.

ECB's Climate-Related Governance Pillar: ECB's second report published in March 2023 (ECB 2023c) describes the structure of the Governing Council that conducts the monetary policy (comprising the six members of the Executive Board and the governors of 20 national central banks or NCBs of the euro area). The Governing Council is supported by ECB's Executive Board, the Eurosystem's Market Operations Committee, and the Risk Management Committee regarding the oversight of climate-related risks and opportunities for monetary policy–related corporate sector holdings. In preparing climate-related policy proposals for the Governing Council, staff at the ECB and 20 NCBs responsible for portfolio and risk management work closely to integrate climate factors into the Eurosystem's asset purchases. Collaboration within the ECB at various levels contributes to the analyses used for policy recommendations put forward by the Eurosystem committees to the Executive Board. The reinvestment strategy is implemented by the portfolio management experts of the NCBs, which the ECB coordinates. The climate-related measures will be reviewed 1 year from their implementation at the latest and regularly after that.

ECB's Climate-Related Strategy Pillar: The ECB assesses the likely impact of climate risks on the financial risk profile of its corporate sector holdings. For this purpose, it uses (i) a climate scoring tool to assess corporate issuers' performance across multiple climate-related metrics that focus on transition risks (as described below in the Metrics and Target pillar); and (ii) climate stress testing (described in Chapter 6). It was decided to gradually reduce the carbon emissions related to its corporate sector holdings through the tilting approach to mitigate climate-related risks on its holdings of corporate bonds.

ECB's Climate-Related Risk Management Pillar: The ECB integrates climate-related risks across the entire risk management cycle. In identifying and assessing risks, the ECB expands risk drivers and sensitivities to include physical and transition risks, ensuring prudent, forward-looking, and data-driven risk measurement. The tilting approach for corporate bond purchases relies on the climate scoring tool to assess eligible corporate sector issuers' climate performance. The overall climate scores comprise the following three sub-scores:

(a) the backward-looking carbon emission intensity sub-score, (b) the climate disclosure sub-score, and (c) the forward-looking target sub-score. Of these, (a) is assessed based on bond issuers' past GHG emission performance relative to their peers within specific industry sectors and compared with all eligible bond issuers. The data cover Scopes 1 and 2 for the issuer concerned and Scope 3 at the sector level. Companies that reduce higher amounts of GHG emissions receive a higher score.

Regarding (b), an assessment is made on the quality of issuers' disclosure of GHG emission data. A higher score is given to the companies when a third party verifies their climate-related financial disclosures. A lower score is given to issuers that do not disclose emissions data. Thus, only estimates by third-party data providers are available. On (c), the sub-score is evaluated based on the GHG emission targets set by issuers. Companies on an ambitious decarbonization path toward the Paris Agreement targets are given a higher score. These three sub-scores intend to incentivize issuers to cut their emissions. The scoring and methodologies will be reviewed regularly and adjusted if favorable developments emerge in data collection, modeling, tighter regulation, and risk assessment capabilities. The three sub-scores are aggregated into an issuer-specific climate score with predefined weights. This Risk Management pillar also describes climate scenario analysis, as explained in Chapter 6.

ECB's Metrics and Target Pillar: Four key metrics are used with regard to the exposure of the ECB's corporate sector portfolios to climate risks. Those are (i) WACI, (ii) carbon intensity, (iii) total carbon emissions, and (iv) the carbon footprint—a similar approach already explained above for the nonmonetary policy portfolios. Among them, WACI measures a portfolio's exposure to issuers' carbon intensity and is a proxy for a portfolio's exposure to climate transition risks. WACI for the portfolio is calculated by weighing the carbon intensity score for each issuer by their respective share of holdings in the portfolio. On the carbon intensity metric, the carbon efficiency of a portfolio in financing economic activity is measured. Both WACI and carbon intensity metrics are comparable across time and different-sized portfolios since they normalize a portfolio's emissions by size. By contrast, the total carbon emissions metric measures the absolute emissions associated with a portfolio and is a proxy for a portfolio's financed contribution to global warming. This metric is the only non-normalized metric driven by fluctuations in portfolio size, limiting its informative value for comparison over time or across portfolios of different sizes. Finally, the carbon footprint metric normalizes the total carbon emissions metric by portfolio value, enabling comparison between portfolios of various sizes. All the above data cover Scopes 1 and 2 emissions of the ECB's

counterparties, based on information provided by issuers. Scope 3 data are not used due to limited availability. As data collection improves, Scope 3 data could be included in the future.

As for the Targets pillar, the ECB is targeting a decarbonization trajectory in line with limiting global warming to well below 2°C while pursuing efforts to limit it to 1.5°C. On its path toward climate neutrality, the ECB plans first to gain more experience with its selected data sources, methodologies, and tilting approach. Subsequently, the ECB will also consider setting intermediate targets. The Governing Council is committed to regularly reviewing the relevant measures to ensure that they continue to support the decarbonization path to reach climate neutrality objectives within the mandate.

ECB's disclosure report found that the corporate bonds held under the two corporate bond purchase programs—the corporate sector purchase program and the pandemic emergency purchase program—are on a decarbonization path. However, since the ECB has purchased more securities for monetary policy purposes, the portfolios' absolute GHG emissions have increased in recent years. Meanwhile, issuers' carbon intensity has gradually declined partly because the companies in the portfolio have lowered their emissions for every million euro of revenue they earn by significantly reducing their emissions and improving carbon efficiency. Another factor reducing the carbon intensity since October 2022 reflects the ECB's decision to adopt a tilting approach.

C. Introducing the climate criteria in the collateral framework by the end of 2024

Separately from the above disclosure on bond purchases, the ECB decided to work on its collateral framework in July 2022. The decision is to limit the share of bonds issued by high carbon-emitting issuers that can be accepted as collateral used by individual financial institutions when wishing to borrow funds from the ECB. Imposing the new limits aims to reduce climate-related financial risks in the ECB's credit operations. To begin with, such limits will be applied only to marketable debt instruments issued by nonfinancial companies. Once data quality improves, the new limits might be extended to additional asset classes. This new collateral framework is expected to be launched before the end of 2024, provided the necessary technical preconditions are fulfilled. The ECB plans to conduct tests before its implementation date to encourage financial institutions to prepare for this in advance. In addition, the ECB will examine the possibility of incorporating climate risks into haircuts applied to corporate bonds used as collateral for the central bank's lending operations. Central banks use haircuts (i.e., reductions) to the value of collateral based on the degree of riskiness

associated with collateralized assets. In any case, all these measures will not lead to a shortage of collateralized assets. The ECB will ensure that ample collateral remains available and thus enable monetary policy to be implemented effectively.

Regarding climate-related disclosure requirements for collateral, the ECB will accept marketable assets and credit claims from issuing companies and debtors that comply with the EU's Corporate Sustainability Reporting Directive (CSRD) as collateral used in the ECB's credit operations. The CSRD is expected to be implemented in January 2024 for companies already subject to the previous Nonfinancial Reporting Directive, with the first report to be submitted in 2025. The implementation date for all other large companies is January 2025, with the first report to be submitted in 2026. The implementation date for listed SMEs is January 2026, with the first report to be submitted in 2027. To encourage stakeholders to align with the new rules earlier, the ECB will conduct test exercises a year before the implementation date. Some assets pledged as collateral within ECB credit operations (such as asset-backed securities and covered bonds) may not fit into the CSRD disclosure framework. For these assets, the ECB intends to support better and harmonized disclosures of climate-related data.

D. Introducing climate criteria in risk assessment and management by the end of 2024

The ECB decided in July 2022 to enhance its risk assessment approaches to reflect climate risks better. Based on the assessment that current disclosure standards used by credit rating agencies are not satisfactory, the ECB will urge rating agencies to become more transparent about their approaches to incorporating climate risks into their ratings. The ECB will also encourage credit rating agencies to increase their willingness to meet climate-related disclosure requirements through more active communication with the relevant authorities. On this front, the ECB agreed on formulating common minimum standards regarding how national central banks' in-house credit assessment systems should include climate-related risks in their ratings. These standards will enter into force by the end of 2024.

E. Developing statistical indicators used for monetary policy and prudential policy

In January 2023, ECB's Statistics Committee of the European System of Central Banks published an initial set of climate-related statistical indicators using harmonized methodologies in the euro area (ECB 2023a). Three types of indicators were developed: (i) sustainable finance indicators, (ii) the carbon emission indicators of financial institutions, and (iii) physical risk indicators for loan, bond, and equity portfolios.

Among them, **sustainable finance indicators** focus on loans and bonds that finance sustainable projects and transition to carbon neutrality and are issued by issuers and held by investors in the euro area. As for the **carbon emission indicators**, data on the carbon intensity of loan and security portfolios held by financial institutions are prepared to evaluate the finance sector's climate-related financial risks and the role of financing the transition to carbon neutrality. These data help understand financial institutions' exposure to carbon-intensive counterparties. Regarding **physical risk indicators**, indicators focus on the physical risks stemming from global warming–induced disasters, such as floods and wildfires, to evaluate the performance of loans and securities. The data can be ranked based on their relative magnitude and be compared across euro area member countries, sectors, and types of disasters.

The ECB views that these data could be useful when considering climate factors in the design and implementation of monetary policy, financial stability analysis, and bank supervision. At the same time, it admitted that these indicators have several problems and limitations. For example, the sustainable finance indicators remain problematic because there is no internationally accepted definition of "sustainable finance." Moreover, the carbon emission indicators face problems of limited data coverage and no data adjustment being taken to consider price and exchange rate effects. The physical risk indicators need to improve by identifying the location and the vulnerability of exposed activities of debtors, as well as obtaining information about climate adaptation measures, such as constructing flood defenses and using insurance.

Together with these climate-related statistical indicators, metrics, and targets applied to the ECB's corporate bond reinvestment as prepared by the ECB, the EU's comprehensive efforts—EU taxonomy, the Sustainable Finance Disclosures Regulation applicable to institutional investors and financial market participants, as well as the CSRD requirement for about 50,000 companies in the region—also help the ECB and financial supervisors within the EU to deepen understanding of climate-related financial risks, improve risk management, and conduct green monetary policy.

3. PBOC's Green Monetary Policy Measures and Climate-Related Financial Risk Management

The PBOC is one of the PRC's major authorities that takes the lead in promoting green finance using various monetary and nonmonetary policies and prudential measures. The PBOC is one of the first central banks to conduct the climate-stressing exercise that has implications for banks' capital adequacy ratios mentioned above. The government and

the central bank are trying to achieve the two emission reduction targets (achieving peak carbon by 2030 and carbon neutrality by 2060) set in 2020. In developing green finance, the PBOC aims to develop the so-called green financial standard system (the PRC's version of taxonomy), strengthen financial institutions' surveillance and information disclosure requirements, provide incentive mechanisms, and promote green financial products and markets.

PBOC's Green Taxonomy: Green Bond Endorsed Catalog: One of the most important measures the PBOC adopted was the PRC's version of green taxonomy. The PBOC, the National Development and Reform Commission, and the China Securities Regulatory Commission have been developing the Green Bond Endorsed Catalogue since 2015 by unifying existing domestic standards on green bonds and green projects. The taxonomy is on a whitelist basis and is mandatory for all green bond issuers covering companies, financial institutions, and regulatory agencies. The catalog aims to clarify projects eligible for green bonds to improve the credibility of the green bond market. To make the catalog more consistent with the EU taxonomy, it removed "clean use of coal and other fossil energy sources." It adopted the EU's "do not significantly harm" principle in the 2021 edition (PBOC 2021a).

The PBOC collaborates with other central banks and co-chairs with the EU taxonomy working group established by the International Platform on Sustainable Finance (IPSF) in 2020. The EU launched the IPSF Union in 2019 to deepen international cooperation and, where appropriate, coordination on approaches for the capital markets (such as taxonomies, disclosures, standards, and labels). The founding members were the governments of Argentina, Canada, Chile, India, Kenya, Morocco, and the PRC. Later, 11 other economies, including Indonesia, Japan, Malaysia, New Zealand, Norway, Singapore, and Switzerland, joined the IPSF. In 2021, the taxonomy working group published the report "Common Ground Taxonomy-Climate Change Mitigation." The report covered an in-depth comparison exercise, including investigating areas of commonality between the EU and PRC's taxonomies (IPSF 2021).

Promoting Environment-Related Disclosure for Financial Institutions and Green Finance Evaluation Program: To improve climate-related information disclosure, the PBOC released the first Guidelines on Environmental Information for Financial Institutions in July 2021 (PBOC 2021b). The financial institutions included commercial banks, asset management, trust, and insurance companies. Financial institutions must report on their environmental objectives, strategic plans, actions undertaken, and major outcomes during the year. While much of the required disclosure content is like the TCFD guidelines,

financial institutions must disclose more detailed information beyond these guidelines.

On the environment-related governance structures, financial institutions are expected to disclose information about green finance committees at the board and executive levels. Also, financial institutions need to describe their environment-related strategic goals, analysis, and judgment on environment-related risks and opportunities, as well as management and monitoring of environment-related issues. The management positions or internal organizations and their main responsibilities must also be explained. This section is similar to the **Governance pillar** of the TCFD guidelines. The section on environmental risks and opportunities, which appears to be similar to the **Strategy pillar** of the TCFD guidelines, should cover the actual and potential impact of risks and opportunities on business and strategies, including the short-, medium-, and long-term perspectives and measures undertaken to deal with environmental impacts and their effects. Quantitative climate scenario analysis and/or stress tests are expected to be performed. In a separate section on environment-related policies and systems, financial institutions are expected to disclose new measures implemented during the reporting year and the implementation of the government's environmental policies, regulations, and standards.

Regarding the environmental risk management process section, financial institutions are expected to disclose the processes of identifying and evaluating environment-related risks and managing and controlling environment-related risks. This section appears to be similar to the **Risk Management pillar** of the TCFD guidelines. Regarding data sorting and verification, the guideline expects financial institutions to improve the timeliness and accuracy of environment-related statistical data disclosure by establishing data quality management systems and emergency measures to cope with possible data security incidents or accidents. This section appears to be partially similar to the **Indicators and Targets pillar** of the TCFD guidelines.

In addition to the TCFD-like disclosure, the PBOC expects financial institutions to disclose detailed information about financial products and impacts. For example, the section on environment-related products and services innovation should cover a description related to innovative green finance products and services offered by the financial institution—including the product name, the scope of delivery, financing terms, and environmental and social benefits of the financial institution's green product innovation. In addition, the section on the environmental impacts of the investment and financing activities includes descriptions of the overall investment and financing situation and its impacts on the environment, the implementation effect of green investment and

financing policies, and the green supply chain and its impact on the environment. The PBOC plans to set a schedule for financial institutions to meet these disclosure requirements to improve the green financial standards system.

To enforce the information disclosure, the PBOC introduced the Green Finance Evaluation Program in July 2021 on banks' holdings of green bonds. The program was applied to more than 20 major Chinese banks, including state-owned and policy banks (such as China Development Bank, Agricultural Development Bank of China, and Export-Import Bank of China). The ratings of each bank are assessed based on the quantitative assessment (whose weight is given 80%) and qualitative assessment (20%). The quantitative measures comprise the share of green bond holdings in their total assets, the year-on-year change in the total amount of green bond holdings, and the share of green bond business risks. The qualitative assessment is judged based on the quality of daily management practices and risk control policies. The PBOC uses these ratings to determine incentives and disciplinary measures applied to each bank. This July 2021 decision was an addition of green bonds to the PBOC's existing evaluation program covering green loans initiated in 2018 for the major banks. In addition, given that the size of the green bond market is rapidly growing in the country, the central bank decided to include both green loans and green bonds in the quarterly assessment of banks' contributions to the national and local green financing policies.

Providing Incentives for Financial Institutions to Promote Green Finance: The PBOC offered several incentives for financial institutions to promote green finance. For example, it included green financial bonds in the pool of eligible collateral used for monetary policy credit operations; namely, these bonds were added to the eligible collateral list applicable to its Medium-Term Lending Facility (MLF) in 2018. The MLF was launched in 2014 with maturities of up to 1 year.

As a pioneer in central bank-sponsored green credit operations, the PBOC introduced the **Carbon Emission Reduction Facility** to promote financial institutions to increase finance to green and low-carbon projects and activities in November 2021. The facility focuses on supporting the development of three key areas for carbon emission reduction—clean energy, energy conservation, and environmental protection—and carbon emission reduction technologies in a steady, orderly, targeted, and direct manner. Another facility, the **Special Central Bank Lending to Support the Clear and Efficient Use of Coal**, was introduced simultaneously to ensure energy supply security and promote orderly carbon emission reduction. This facility is designed to support the large-scale clean production of coal, the application of clean

combustion technologies, and other five areas. These two facilities reflect the strategy of developing clean energy while continuously supporting the clean and efficient use of coal and coal-fired power. Under the two facilities, commercial banks can finance eligible projects and activities at the prime loan rate (currently, 3.65% for the 1-year rate and 4.3% for the 5-year rate) determined by the PBOC as policy rates. Conditional on qualified loans extended by commercial banks, the PBOC provides 60% of such loans with a 1-year lending rate of 1.75% to those commercial banks (which can be rolled over twice).

To be qualified for these central bank lending schemes, the PBOC required financial institutions to disclose information concerning these loans, including the amount of carbon emission reduction loans and the volume of carbon emission reduction arising from such loans. In addition, the data must be examined and verified by third-party professional institutions to avoid greenwashing. The measure is expected to enhance the efforts to improve the information disclosure mentioned above. Over 200 financial institutions in pilot zones have tentatively compiled reports based on such environmental information disclosure.

PBOC's Cooperation with Singapore to Promote Green Finance: The PBOC and the Monetary Authority of Singapore (MAS) announced the establishment of the Green Finance Task Force in November 2021 to strengthen bilateral cooperation in green finance and, at the same time, facilitate the mobilization of private capital for the region's sustainable development needs. The task force was established to collaborate on setting standards and standardizing definitions of green finance. The task force also plans to collaborate on providing green and transition financing solutions, promote data collection and technology needed for increasing green financing flows, and enhance green investment opportunities in their regions. This initiative is part of the broader cooperation in green finance and capital market linkages between the two economies—including the exchange-traded-funds product link through the Shenzhen Stock Exchange and the Singapore Exchange (SGX), as well as a launch of low carbon index family by the Shenzhen and Shanghai Stock Exchanges and the SGX (which intends to serve as a benchmark for green funds in the PRC, the Association of the Southeast Asian Nations or ASEAN, and other Asian economies managed by fund managers).

In April 2023, the PBOC and MAS established the Green Finance Task Force that will focus on three areas: (i) taxonomies and definitions, (ii) products and instruments, and (iii) technology. On taxonomies and definitions, the two central banks will work on improving interoperability between the taxonomies developed by the PRC and Singapore, respectively, under the IPSF. A deepening of understanding

about transition activities classified by each country will be also conducted. This is a welcome step to promote sustainable finance markets in Asia. With regard to products and instruments, the SGX and China International Capital Corporation will adopt a workstream to improve the connectivity of green and transition bond markets between the two countries by allowing the issuance of such bonds and allowing investors to have access to those bonds in both countries.

As for technology, the Green Finance Task Force will establish a workstream between Singapore's Metaverse Green Exchange and Beijing Green Exchange to promote technology-based sustainable finance markets, including digital green bonds with carbon credits. Metaverse Green Exchange is a digital green exchange that enables cross-border transactions of digital (or "tokenized") carbon credit using distributed ledger technology and a large volume of transactions based on the Nasdaq technical system. The start-up company was founded in 2018 and licensed and regulated by MAS. Carbon credits are required to be audited by an independent party. Metaverse Green Exchange signed a memorandum of understanding with the Indonesia Stock Exchange in November 2021 to provide a carbon credit trading platform for Indonesia wishing to reduce GHG emissions. Beijing Green Exchange was established in February 2022 to focus on carbon credit trading and carbon finance under the Beijing Environment Exchange, which was established in 2008 and licensed by the Beijing municipal government. Beijing Green Exchange aims to become a national green exchange and to promote the corporation of green industries and projects along the Belt and Road Initiative.

4. BOJ's Approach to Climate Change through a Lending Scheme

BOJ regards climate change as one of the main challenges in conducting business operations and organizational management. Since 2021, BOJ has been actively working on measures to help financial institutions cope with climate risks.

BOJ's Climate-Related Lending Scheme: In December 2021, BOJ adopted the 1-year low-cost financing program (0% interest rate) called the Funds Supplying Operations to Support Financing for Climate Change Responses. These operations are to provide funds for financial institutions within their outstanding amount of climate-related investments or loans. The maturity under BOJ's climate-related lending scheme is 1 year and can be rolled over unlimitedly until the end of March 2031. The 0% interest rate on reserve balances held by financial institutions is applied up to twice as much as the amount

outstanding of funds provided by BOJ to the financial institution (thus, the negative interest rate is exempted for this amount). This incentivizes financial institutions to borrow from BOJ since the application of a negative interest rate (–0.1%) applicable to part of excess reserves (current account balances with BOJ) can be exempted.

To be eligible for this facility, financial institutions must disclose information in line with the TCFD guidelines, as well as targets and actual results for their climate-related investments or loans. However, to make this disclosure requirement more effective, BOJ and the government could promote mandatory disclosure by requiring all listed companies and financial institutions to disclose GHG emission data and emission cut targets, starting with Scopes 1 and 2, and later Scope 3, with clear timelines in line with the ISSB climate-related disclosure approach (Shirai 2022). The Financial Services Agency (FSA) and the Tokyo Stock Exchange recommended companies listed on the prime market to disclose based on TCFD and/or other guidelines on a comply or explain basis without specifying detailed targets and data disclosure under the latest corporate governance code revised in 2021. From the accounting year 2023 (starting April 2023 for many companies), the FSA requires all companies publishing an annual securities report to create a new section about "Sustainability Policy and Initiatives." This is a welcome step since some unlisted companies are covered under this securities reporting requirement. However, disclosure was made compulsory only on the Governance and the Risk Management pillars. In contrast, disclosure on the Strategy and Indicators and Targets pillars was left to the companies' discretion, depending on the importance. The government could consider taking immediate action to encourage companies and financial institutions to disclose GHG emission data and emission reduction targets and detailed transition strategies by setting clear timelines and in a phased manner according to the size of the companies.

The above climate-related lending initiative is in line with BOJ's statement announced in July 2021 that climate change could have a huge impact on economic activities, prices, and financial conditions in the medium to long term. While supporting the private sector's efforts on climate change from a central bank perspective will contribute to stabilizing the macroeconomy in the long run, BOJ stressed the need to keep its market neutrality and avoid direct involvement in micro-level resource allocation (BOJ 2021). It is unclear what "avoiding direct involvement in micro-level resource allocation" means. So far, BOJ has applied climate criteria only with regard to its lending schemes. The climate criteria are not applied to the purchases and reinvestment of corporate bonds and commercial papers, as well as purchases of

stock exchange–traded funds and real estate investment trusts. It may be desirable for BOJ to consider applying the climate criteria to these assets to make its climate policy more consistent.

BOJ's Disclosure in Line with the TCFD Guidelines: In 2022, BOJ disclosed information in line with the TCFD guidelines about its operations but without setting a reduction target (BOJ 2022). Regarding the Governance pillar, the Policy Board meeting approved the Strategy on Climate Change in 2021 and conducted an interim review of the Medium-Term Strategic Plan (Fiscal 2019–2023) to address climate change in conducting business operations and organizational management in line with the strategy comprising of five areas: monetary policy, financial system, research, international finance, and communication. BOJ also collaborates closely with all major international organizations, including the NGFS. Also, the central bank invests in the Asian Bond Fund launched by the Executives' Meeting of East Asia-Pacific Central Banks (EMEAP) to support emerging economies' bond market. In 2021, furthermore, BOJ decided to purchase foreign currency–denominated green bonds issued by EMEAP member governments and other foreign institutions to further deepen local currency–denominated green bond markets in the region.

It should be noted that BOJ's holding of foreign currency assets is limited and amounts to only about $66 billion. The Ministry of Finance makes a decision to intervene in the foreign exchange market by issuing short-term bills and manages Japan's foreign reserves of approximately $1.1 trillion, while BOJ intervenes in the market only as an agent of the government. BOJ set up the Climate Coordination Hub to promote information sharing and coordination internally between various departments on detailed measures and address issues related to climate change. Every fiscal year, the central bank conducts performance reviews of related initiatives taken by each department.

On the Risk Management pillar, BOJ pointed out that some progress has been made in the five areas set out in its Strategy on Climate Change. The monetary policy now uses the Funds Supplying Operations to Support Financing for Climate Change Responses mentioned above. On the financial system, the central bank has been engaging with financial institutions through its on-site examinations and off-site monitoring of climate-related financial risks and their engagement with corporate counterparties on decarbonization. The pilot climate scenario analysis was conducted with the FSA in 2022, as described in Chapter 6. BOJ has been trying to reduce GHG emissions and promote energy saving in its head office and branches. The central bank is also strengthening its business continuity plan to cope with the increasing flood risk. Regarding the Indicators and Targets pillar, BOJ has begun to disclose data on direct (Scope 1) and indirect

(Scope 2) carbon dioxide (CO_2) emissions stemming from its business operations every fiscal year. The efforts have resulted in a decrease in CO_2 emissions in recent years.

5. MAS's Climate-Related Risk Management and Green Monetary Policy

Singapore has the largest sustainable finance market in ASEAN. MAS also intends to contribute to developing a climate-resilient financial center in the country by actively conducting green monetary policy.

Developing the Traffic Light-Based Taxonomy: MAS developed the Singapore version of the taxonomy and fostered a sustainable financial market in Singapore. Singapore's taxonomy uses EU taxonomy as a reference. However, MAS has been developing a unique science-based traffic light classification system that classifies economic activities in accordance with an activity's contribution to climate change mitigation. The "green" classification refers to activities that contribute substantially to climate change mitigation in line with a pathway to net zero by 2050. The "amber" classification using the thresholds and criteria includes transition activities either toward the green within a specific time frame or enabling significant emission reductions in the short term. The "red" classification refers to harmful activities incompatible with a net-zero pathway.

MAS's Disclosure Based on TCFD Guidelines: MAS published its sustainability report in 2021. The latest 2022 report was released per TCFD guidelines (MAS 2022a). In the section related to the Governance pillar, MAS established the Green Finance Steering Committee (chaired by a managing director) to discuss strategies to develop a climate-resilient finance sector. Before tabling this committee, the relevant initiatives are made at the Management Financial Supervision Committee and Management Financial Stability Committee, both chaired by a deputy managing director. The former holds a weekly meeting to decide on policies related to the supervision and regulation of the finance sector. The latter holds a quarterly meeting to identify and assess risks to the financial system and discuss macroprudential policy. Since 2019, MAS has convened the Green Finance Industry Task Force, comprising representatives from financial institutions, companies, industry associations, etc. The task force aims to accelerate the sustainable finance market mainly through four major areas: (i) development of a taxonomy, (ii) improvement of disclosures, (iii) promotion of green finance solutions, and (iv) enhancement of environmental risk management practices by financial institutions.

Regarding the section related to the Strategy pillar, MAS has integrated environmental risks into its supervisory framework and

processes at the individual financial institution and system-wide levels. It also actively promotes international collaboration with various organizations to facilitate sharing best practices and promote globally compatible frameworks. MAS's managing director currently chairs the NGFS. MAS also collaborates with the BIS Innovation Hub Singapore Centre on Project Viridis to help financial sector supervisors to have a deeper understanding of banks' exposures to green and nongreen assets.

Regarding the Risk Management pillar, MAS issued the Guidelines on Environmental Risk Management to Financial Institutions in 2020 (which became effective in June 2022). Before implementing the Guidelines, MAS conducted thematic reviews of financial institutions' environmental risk management practices in 2021. The engagement was also conducted with selected banks, insurers, and asset managers through surveys and dialogue and published information papers on the environmental risk practices of banks, insurers, and asset managers. MAS collaborated with the Green Finance Industry Taskforce and the Association of Banks in Singapore to develop a standardized environmental risk questionnaire for financial institutions to obtain common major risk data from corporate client counterparties before making financing and investment decisions. It also worked closely with Singapore Exchange (SGX) to finalize a road map on mandatory climate-related financial disclosures in line with the TCFD guidelines. By 2025, mandatory climate reporting is expected to cover 60% of SGX-listed entities by number and 78% by total market capitalization.

The SGX requires all listed companies to provide climate reporting on compliance or explain the basis for financial years starting in January 2022. Companies belonging to the industries identified by the TCFD as most affected by climate change (i.e., financial industry; agriculture, food, and forest products industry; and energy industry) will be subject to mandatory reporting without a comply or explain basis from the financial year 2023. This tighter reporting requirement will also be applied to the materials, buildings, and transportation industries from the financial year 2024. Other listed companies will continue to be required to disclose climate reporting on the compliance or explain the basis. In addition, the SGX provides ESG metrics as guidance, which helps companies prepare for disclosing relevant data.

MAS's Climate Target on its Investment Portfolio: Regarding the Indicators and Targets pillar, MAS has launched a 2030 environmental sustainability road map. This includes emission reduction targets including Scopes 1, 2, and 3 (business air travel and outsourced currency operations) for fiscal year (FY) 2025 and FY2030. Regarding the investment portfolio mostly arising from foreign reserves (Scope 3), MAS measures the carbon intensity of its equities and corporate bonds portfolio based on Scopes 1 and 2 emissions. The carbon profile of the

equities and corporate bonds portfolios are reported using WACI. This measures carbon intensity (i.e., the CO_2 equivalent emissions per unit of revenues) for each corporate counterparty in the portfolio, weighted by the relative size of the investments in the respective portfolios. MAS aims to reduce WACI of the equity portfolio by up to 50% by FY2030 compared to the base year of FY2018. WACI for the corporate bond portfolio as of the end of March 2022 was 76% lower than the benchmark. These efforts have helped reduce portfolio exposure to securities issued by companies in carbon-intensive sectors.

5.5 Conclusions and Challenges Related to Green Monetary Policy

This chapter overviews several policy options that central banks might adopt to enhance the resilience of central banking operations against climate risks and to reduce exposure of their balance sheets to climate-related financial risks. Moreover, such central banks' actions will likely promote climate-related financial risk management of financial institutions (and indirectly improve risk management of their counterparties), thus greening the financial market and fostering a sustainable financial market.

In particular, monetary policy options are highlighted by the NGFS and increasingly by various stakeholders. The options include asset purchases, credit operations, and collateral used in central banks' operations against financial institutions when central banks conduct credit operations. Asset purchases could take a tilting approach by increasing the weight of greener assets in total assets purchased and/or negative screening in some cases. The tilting approach was adopted into the ongoing reinvestment strategy by the ECB in October 2022. A tilting approach is recommended if it is important to encourage emission-intensive sectors and companies to reduce GHG emissions.

Moreover, central banks may provide long-term climate-related loans to financial institutions. Such credit operations could take the form of lowering interest rates conditional upon the fact that such financial institutions have extended climate-related finance to the private sector. Central banks could also lower lending rates for financial institutions whose composition of low-carbon assets accepted as collateral is greater. The central bank of Brazil, BOJ, and the PBOC have adopted environmental criteria in their lending programs. Moreover, several central banks have already begun integrating climate and other sustainability criteria into their foreign asset management frameworks. MAS is the first central bank to adopt emission targets on its investment portfolio, mostly from foreign reserves based on the carbon intensity of

its equities and corporate bonds portfolio.

Central banks are responsible for achieving price stability under the monetary policy mandate as well as financial stability under the prudential policy mandate set under the central bank acts. While central banks can consider climate risks within their existing mandates, not all have acted in the same direction. A growing number of central banks focus on climate-related financial stability, as described in Chapter 6. Meanwhile, only a few central banks have adopted green monetary policy, mainly because consensus has not emerged yet on how to incorporate climate risks in their price stability mandate. The US Federal Reserve emphasizes the priority should be given to climate-related financial risks and prudential perspectives over price stability, while the ECB focuses on both mandates.

Moreover, the short-term interest rate (policy rates), central banks' main monetary policy tool in the world, is intended to influence all the segments of the domestic economy and sectors equally, including carbon-intensive activities. Thus, when the short-term interest rate is low, the monetary policy effect may offset some impacts of climate-related asset purchases and credit operations aiming at incentivizing financial institutions (and indirectly their counterparty companies) to take more low-emission or decarbonization activities. In contrast, the opposite happens when monetary policy tightens since tighter monetary conditions discourage both economic activities of emission-intensive companies and low-emission companies. This is happening in the euro area, the UK, and the US since the short-term interest rate is rising and quantitative tightening (defined as a reduction of the balance sheet size) is taking place. This means that the government's long-term financial support to promote low carbonization and decarbonization is more important and sustainable.

For these reasons, all central banks strongly emphasize that national (and local) governments and legislators are primarily obligated to formulate and implement climate mitigation and adaptation policies to cope with climate risks. If governments and legislators better understand climate risks and accelerate necessary climate policies in line with their carbon neutrality targets, central banks may be in a better place to take green monetary policy more actively (such as refining the collateral scheme). In any case, central banks can start by promoting more financial institutions to deepen their understanding of climate-related financial risks and improve their risk management strategies. These efforts will certainly help foster more effective, sustainable financial markets. The next chapter elaborates on associated recent developments.

6

Green Prudential Policy and Financial Regulation

In recent years, central banks and financial regulators have begun to share a sense of crisis that climate change has a major implication on the economy, prices, and financial system, so some actions must be undertaken. Also, from a climate risk perspective, it is known that the current financial market faces mispricing or market failure arising from low carbon prices that do not reflect social costs. If this issue is left unaddressed, it could delay the achievement of carbon neutrality in the world by keeping financial support to carbon-intensive activities. Central banks and financial supervisors have begun considering climate-related financial risks as part of the macro- and micro-prudential policy to achieve financial stability. In particular, they increasingly encourage major financial institutions under their supervision to undertake climate scenario analysis. More than 30 central banks and financial regulators conducted climate scenario analysis. Some central banks are preparing to conduct climate stress tests that may consider implications on capital adequacy. In addition, there have been growing discussions in recent years on how to include climate-related financial risks to the capital adequacy requirements regulation applied to banks in the Basel Framework—particularly the standard Pillar 1 and/or Pillar 2 capital requirement. This chapter overviews prudential policy and measures to cope with climate-related financial risks, including climate scenario analysis and/or climate stress test, as well as recent discussions on how to reflect climate-related financial risks in the existing Basel Framework.

6.1 Road Map for Addressing Climate-Related Financial Risks

Financial regulators are increasingly aware of climate-related financial risks and recognize the need for improving supervisory and regulatory approaches. Given this background, the FSB acknowledges that climate-related financial risks should be prioritized to maintain the stability of financial institutions and the financial system. The entity has

acknowledged that climate-related financial risks should be prioritized to maintain the stability of financial institutions and the financial system as a whole. It then published a road map in July 2021, in consultation with the Basel Committee on Financial Supervision (BCBS), the NGFS, the International Organization of Securities Commissions (IOCSO), and other global-standard setters and international organizations. The road map focused on four major areas with detailed steps that should be undertaken in a phased manner for each area. The four priority areas are (i) information disclosure by companies (including financial institutions); (ii) collection and creation of comparable, reliable data; (iii) vulnerability analysis that financial authorities can also use (such as climate scenario analysis); and (iv) climate supervision systems and measures, and detailed measures to be taken by each final stage (FSB 2021).

To ensure the financial system's stability as a whole, it is necessary to enhance the ability of each financial institution to respond to climate risks. Financial institutions' proper responses and better financial decision-making depend crucially on collecting reliable, comparable, standardized data of corporate counterparties. If more reliable information becomes available, financial institutions can allocate funds to companies more stably, and the financial system will become more resilient to climate change. Regarding this information disclosure, the road map showed that the International Sustainability Standards Board (ISSB) of the International Financial Reporting Standards (IFRS) Foundation is promoting the standardization of ESG information disclosure for companies and financial institutions. Once endorsed by IOSCO, the finalized documents will be used by financial regulators in each country and region. A road map progress report was published in July 2022 (FSB 2022a).

Regarding progress in disclosure, the report mentioned that the ISSB published two disclosure drafts in March 2022 ("sustainability-related financial disclosures" and "climate-related disclosures"). These drafts are being revised by following up on public comments and will be finalized in the first half of 2023. Other than pointing out that the number of countries and regions implementing climate scenario analysis and/or stress test is increasing as related to vulnerability analysis, the progress report concluded that the steps above are in the process of tackling issues for improvement.

The FSB issued the final report on the supervisory and regulatory approaches to climate-related financial risks in October 2022 (FSB 2022b). Recommendations for financial supervisors and regulators covered three key areas: (i) promoting supervisory and regulatory reporting and collection of climate-related data from financial

institutions; (ii) developing financial system-wide perspectives and possibly supervisory and regulatory tools and policies to address climate risks; and (iii) considering other potential macroprudential policies and tools at an early stage. Five recommendations related to area (i) and several recommendations related to area (ii) were proposed.

With regard to reporting and data collection related to area (i), the FSB report recommended that supervisory and regulatory authorities (a) accelerate the work toward collecting climate-related data and key measurements (including Scopes 1, 2, and 3 GHG emissions) to improve assessment and monitoring of climate risks for financial institutions; (b) improve data quality by reviewing financial institutions' internal audit and assessment functions and considering the need for third-party verification schemes; (c) develop standard definitions related to physical risks and transition risks (such as those proposed by the ISSB and other standard-setting international bodies); (d) standardize regulatory reporting requirements proportionately to the nature, size, and risk profiles of a financial institution's activities; and (e) promote global coordination. In particular, the authorities were encouraged to urge financial institutions to report climate-related qualitative information supplemented with available quantitative information to their supervisors.

On supervisory and regulatory tools related to area (ii), the FSB recommended, among others, that authorities (a) focus not only on micro-prudential measures targeting each financial institution but also on macroprudential measures to consider the implications of climate risks on the whole financial system; (b) utilize climate scenario analysis and/or stress test over a longer time horizon as a tool for macroprudential purposes against key finance sectors (i.e., banks and nonbank financial institutions); (c) use, for example, NGFS climate and other established scenarios as pointed out below; and (d) promote international discussions and coordination. Starting with credit risk, future climate scenario analysis and stress test could extend to market risk, followed by liquidity and insurance (underwriting) risks as long as they pose material risks and thus influence the financial system's resilience.

Regarding other potential macroprudential policies and instruments related to area (iii), the FSB stressed that micro-prudential instruments alone might not suffice to tackle the cross-sectoral, global, and systemic dimensions of climate risks. Hence, the need to examine macroprudential policies and instruments to complement micro-prudential measures was suggested. The macroprudential policies might include utilizing capital buffers to cope with unaddressed systemic climate risks. Possible adjustments to the existing capital adequacy requirements framework

can be pursued. As part of its road map to address climate-related financial risks, the FSB considers the conduct of peer review over its supervisory and regulatory practices and updates the recommendations in 2025.

6.2 Climate Prudential Policy and Climate Scenario Analysis

In April 2019, the NGFS released its first comprehensive report and emphasized that central banks and financial authorities have the power to ensure a more resilient financial system against climate risks by clarifying that climate risks contribute to financial risks (NFGS 2019a). Furthermore, the fact that climate-related financial risks are insufficiently incorporated into current asset valuations indicates a major risk in the current financial systems and markets. Therefore, the NGFS stresses that its members should cooperate to correct market mispricing. Support was also proposed for the formulation of taxonomies for classifying environmentally sustainable activities—those developed for some time by the EU and recently by other economies, including the PRC, Singapore, and ASEAN. Furthermore, the NGFS encouraged listed financial institutions (and companies) to disclose information to investors following TCFD recommendations.

1. Climate Scenario Analysis

Generally, many central banks and financial authorities, such as those in Europe and the US, regularly ask financial institutions to assume several extreme scenarios for a relatively short period, up to 2 to 3 years ahead, and check the adequacy of the institution's capital. This is called a **stress test**. For example, the most recent 2022 scenario test by the Federal Reserve and the US Office of the Comptroller of the Currency, which were applied mainly to large banks in the US, conducted a stress test for a period of 3 years from the first quarter of 2022 to the first quarter of 2025. They use the estimates on real GDP, prices, households' disposable income, the unemployment rate, residential and commercial real estate prices, stock prices and their volatility, yields on government and corporate bonds, and economic performance of major foreign economies. The US regulators prepared the baseline scenario and then compared it with a few extremely adverse economic scenarios to determine the degree of soundness of financial institutions—that is, capital adequacy. The adverse scenarios, for example, assume that a global recession would put a heavy strain on the domestic residential,

commercial real estate, and corporate bond markets, and lead to a sharp rise in the unemployment rate, a fall in real GDP, and a fall in inflation.

Many economic models used for such conventional stress tests are based on short-term economic deviations for several years from long-term economic equilibrium. In other words, the stress tests are based on business cycle–based approaches. For this reason, the NGFS views that such conventional stress test approaches are unsuitable for analyzing climate risks that cause structural changes in the economy and thus affect the long-term equilibrium. Moreover, existing stress tests have a short observation period of just several years ahead, which is also not desirable for analyzing climate change that requires a longer observation period, such as at least up to 2050 or longer. In addition, conventional analytical models hardly reflect trends in energy and agricultural supply systems. Thus, modeling climate risks requires new analytical models focusing on the interrelationships between physical, transition, and economic risks.

A conventional simple economic growth model cannot reflect climate policies for mitigating climate risks and the associated costs, as well as complex transition paths such as the impact of climate policies on climate change. Developing models that incorporate climate change requires a different mindset and analytical approach. Awareness of these issues has prompted the NGFS to examine and formulate climate scenarios. Although great uncertainty exists regarding future projections of the relationship between climate change and the economy and finance, a mechanism that allows monetary and financial authorities to promote an understanding of the implications of climate change on the financial market and the economy is still necessary and useful. In addition, once the NGFS can prepare basic climate scenarios to be commonly applied to each jurisdiction as a basis, central banks and financial supervisors in each jurisdiction can refine their sophisticated analytical methods reflecting country- and region-specific features and agenda.

2. Top-Down and Bottom-Up Climate Scenario Approaches

The NGFS's climate scenario analysis does not aim to predict future outcomes and estimate the impact of climate risks on financial institutions' capital adequacy. Rather, several climate scenarios are prepared based on assumptions: "What if situation A or situation B happens in the future?" Through scenario analysis, central banks and financial regulators can give practical advice to supervised financial institutions, influencing their corporate client behavior. Such scenarios are useful not only for central banks and financial authorities but also for financial

institutions and companies when conducting their climate scenario analysis in line with TCFD guidelines.

The climate scenario test aims to have each financial institution adequately understand climate risks and encourage decarbonization or low carbonization of their financial service activities to improve risk management. The NGFS calls it a "climate scenario analysis" and does not use the word "climate stress test." This is probably because stress test is normally related to the calculation of the capital adequacy of financial institutions against adverse scenarios and are thus closely related to financial regulations. It will likely take some time to increase the understanding of financial regulators and financial institutions about climate risks. Once understanding climate risks is deepened among financial institutions, regulators can require financial institutions to collect data and information, thus leading to improved monitoring approaches. Hence, the NGFS probably thought that the first step should be limited to climate scenario analysis to promote the understanding of climate risks among financial regulators and financial institutions supervised by the regulators.

Climate risk scenarios can be analyzed using a top-down or a bottom-up approach. In the top-down approach, central banks and financial regulators estimate the financial impact of climate change on financial institutions based on these institutions' reported data and other macroeconomic and financial data. Since it is implemented under a unified framework, the advantages are that the calculation method can be more consistent; it is also easy to compare financial institutions. However, additional qualitative information is often required to make more meaningful risk management assessments for climate risks. In the bottom-up approach, by contrast, regulators select multiple climate scenarios, major economic variables, and other factors to be used in the scenarios. But the main exercises are conducted by major financial institutions by requesting them to do their calculations. The advantage of this approach is that it encourages financial institutions to develop their own internal quantitative and qualitative analytical capabilities and promotes their deeper understanding of how climate change will affect their balance sheet under each scenario. Facilitating institutions' understanding and encouraging voluntary climate change responses are expected. It is also hoped that financial institutions will take further initiatives by using this work as an opportunity to select more scenarios voluntarily and independently and further deepen their analysis within their capabilities.

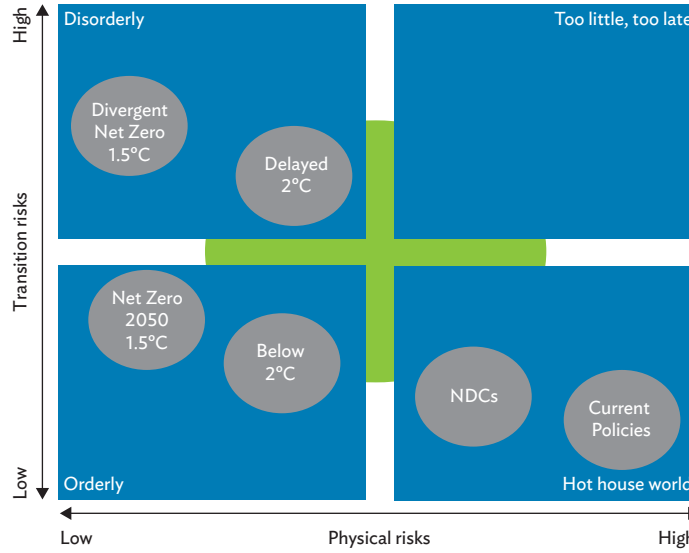
3. Promoting Climate Scenario Analysis by the NGFS

In June 2020, the NGFS (2020c) published the first guide to enable central banks and financial supervisors to organize climate scenarios affecting the financial system and encourage them to utilize the prepared climate scenarios in the central bank's monetary policy and financial institution supervision. The guide offers four steps to do so. As a first step, central banks and financial supervisors prepare climate scenarios for financial institutions. Based on these scenarios, financial institutions and systems in their jurisdictions can fully withstand stress under their respective climate scenarios. It also pointed out that the same approach could be applied to the evaluation of structural changes in the economy and the investment portfolio of central banks.

As a second step, apart from the climate scenario analysis used by central banks and financial regulators in each country or region, the NGFS intends to jointly develop other reference scenarios with academic experts and institutions and plan to make climate scenario analysis available to members. As a third step, the NGFS indicated its intention to assess the impact of climate risks on various economic and financial variables, such as GDP, commodity prices, stock prices, bond yields, and bank loan valuations. Finally, as a fourth step, the NGFS will encourage central banks and financial regulators to disclose the results of their climate scenario analysis publicly. Disclosing information about the results (usually aggregate results rather than individual institutions' results) will lead to increased awareness of climate risks among financial institutions, which can motivate financial institutions to improve their climate risk management systems voluntarily.

Six Types of Climate Scenarios Presented by the NGFS: The NGFS published for the first time the "Climate Scenario Analysis Guidelines for Financial Institutions" in 2020, which central banks and financial supervisors could utilize (NGFS 2020b). Since its first release in 2020, the NGFS scenarios have been refined yearly, and the latest report explored six scenarios in line with the first report (NGFS 2022a). The six scenarios are decomposed into (1) Orderly scenarios (Net-Zero [1.5°C] scenario and Below 2°C scenario), (2) Disorderly scenarios (Delayed 2°C scenario and Divergent Net Zero scenario), and (3) Hot House World scenarios (Nationally Determined Contributions or NDCs scenario and Current Policies scenario). Transition risks are higher, but physical risks are lower under Orderly scenarios. Transition risks are limited but physical risks are much higher under the Hot House World scenario (Figure 6.1).

Figure 6.1: NGFS Six Types of Climate Scenarios



Source: NGFS (2022a).

Orderly scenarios assume the introduction of moderate climate policies sooner than other scenarios, which becomes more stringent over time. As a result, both physical and transition risks can be relatively contained. The Net-Zero 2050 scenario envisages that limiting global warming to 1.5°C is feasible as major advanced economies, including Australia, Canada, the EU, Japan, the UK, and the US, promote ambitious climate policies and accelerate innovations to achieve net-zero GHG emissions by 2050. The Below 2°C scenario is less favorable than the Net-Zero 2050 scenario since climate policies are expected to become gradually stringent. In the case of **Disorderly scenarios**, transition risks are higher than in Orderly scenarios because climate policies are delayed until around 2030. Thus, later, more stringent climate policies are necessary to limit global warming below 2°C under the Delayed 2°C scenario. Alternatively, divergent climate policies reaching net zero around 2050 are adopted across economies and sectors, so the cost borne by the world is higher under the Divergent Net Zero scenario. Finally, **Hot House World scenarios** assume that global efforts are insufficient to halt significant global warming even though some climate policies are implemented in some environmentally conscious jurisdictions. Thus, these scenarios show severe physical risks, e.g., global warming and

rising sea-level. The NDCs scenario assumes that all pledged emission reduction targets will be achieved, even if most of the economies and regions have not yet begun to implement credible, effective climate policies. The Current Policies scenario will likely generate higher physical risks than the NDCs scenario because of the assumption that only currently implemented climate policies are expected to be maintained in the future.

6.3 Climate Scenario Analysis for Six Central Banks

1. BOE's Climate Biennial Exploratory Scenario Analysis

BOE made a first move than other central banks and financial regulators in the world with regard to climate scenario analysis called Climate Biennial Explanatory Scenario Analysis. The then-Governor Mark Carney issued a warning regarding the risks associated with climate change, including physical, transition, and liability risks, and urged the financial sector to prepare for the threats to financial resilience and longer-term prosperity (Carney 2015). Under his leadership, the central bank began to work on climate risks from an early stage through its Prudential Regulatory Authority. In 2015, the central bank analyzed the impact of physical and transition risks on balance sheets for major insurance companies and, in 2018, for major banks. Based on these pilot experiences, BOE became the world's first central bank that issued a supervisory statement in 2019 to major banks and insurance companies to encourage them to take a more strategic approach toward climate-related financial risks. In 2020, it published an open letter to chief executive officers (CEOs) of financial institutions, providing more detailed guidance on how to have an approach to manage climate-related financial risks by the end of 2021. In October 2021, the central bank released the Climate Adaptation Report, highlighting the progress in financial institutions' climate change risk management (BOE 2021).

BOE prepared the comprehensive climate scenario analysis in 2019, announced the detailed approach in 2020, released a data template in 2021, and conducted its first detailed bottom-up scenario exercise on climate risks—the so-called climate biennial explanatory scenario analysis—involving 7 large banks and 12 (large or large general) insurance companies in the UK in June 2021. These banks covered about 70% of bank lending to companies and households in the UK. Large insurance companies covered about 60% of the UK's life insurance market by asset size. General insurance companies also accounted for

60% of the market by gross written premium. Sectors included those ranging from agriculture (particularly crop and animal production); mining (extraction); manufacturing (automobile, coke and petrol, food, chemical); electricity; construction; wholesale and/or retail trade; and (land and air) transport. The exercise targeting banks focused on credit risk, emphasizing risks related to large corporate counterparties. Banks' assets in the exercise included domestic and international (residential and commercial) mortgages, corporate loans, car finance, and other consumer credit. The exercise targeting insurers focused on changes in invested assets, reinsurance recoverable, and insurance liabilities. Insurers' assets included government bonds, other bonds, equities, derivatives, property, and reinsurance assets.

The exercise aimed to investigate the financial system's resilience against physical and transition risks under three NGFS scenarios: Net Zero, Delayed, and Current Policies. The aggregate results of the bottom-up method of climate scenario analysis were published in 2022 (BOE 2022a). Loss projections for banks focused on credit risk associated with their lending activities. The focus of insurers was on changes in the value of invested assets and insurance claims. The analysis did not seek to assess the full impact on financial institutions' income and capital positions. The analysis found that climate risks could exert downward pressure on the profitability of banks and insurance companies in the UK. However, the overall costs could be lower through early and well-managed actions to curb GHG emissions. Some initial costs borne by banks and insurance companies may be ultimately passed on to their customers, such as companies and households. Such adverse impacts would be large in the Current Policies scenario, where physical risks will be substantially high. BOE acknowledged that banks and insurance companies in the UK had made good progress in some aspects of their climate risk management, although further improvements should be made.

2. ECB's Climate Prudential Approaches and Stress Test

The ECB has also made substantial efforts to develop comprehensive approaches to managing climate change for financial institutions. In September 2020, the ECB consulted with major banks about its supervisory approach related to climate change. Based on the feedback, in October 2020, a risk-based supervisory approach (focusing on areas perceived as high risk) was adopted to implement oversight to ensure the safety and soundness of supervised banks against climate change (ECB 2020). Emphasizing that climate change mitigation policies should be the responsibility of elected governments of member countries,

financial institutions should reflect climate and environmental risks in their investment and loan balance sheets. The central bank stressed the importance of ensuring financial system resilience, which should be confirmed through the supervisory process. Such a prudential policy could also help correct the mispricing of climate risks, which can support the efficient and smooth transition of the economy toward a carbon-neutral economy. In addition, the central bank acknowledged that banks' information disclosure and available data are currently scarce and need further improvement. The ECB plans to assess whether financial institutions' business activities are sustainable and sufficiently resilient by conducting self-evaluation according to the supervisory guideline. As a first step, a plan was announced to conduct supervisory evaluations of banks' business activities from 2022 and to cooperate with relevant EU authorities.

In 2022, the ECB conducted its first bottom-up climate stress test for 41 large financial institutions (ECB calls it a stress test). It was undertaken to assess supervised institutions' degree of preparation for managing climate risks. The results will supplement the ongoing supervisory review of banks' climate and environmental risk management practices. The 2022 climate risk stress test results found that banks have made considerable progress concerning their climate stress-testing capabilities. As the exercise revealed many deficiencies, data inadequacy, and inconsistencies across banks, it was stressed that banks should make substantial further progress in their approaches in the near future (ECB 2022a). The test found that those large banks generated non-negligible income from activities related to the 22 most GHG-emitting industries, with the share of interest income related to these industries amounting to more than 60% of total nonfinancial corporate interest income on average. Given that the possible losses arising from the exposure crucially depend on their client companies' transition plans, banks should increase and emphasize their customer engagement as a priority to gain further insights into those plans. The results also highlighted that those large banks would likely face acute physical risks in Europe (i.e., drought and heat events, and flood risk), and such risks depend significantly on the geographical location of their lending activities, leading to non-negligible losses in some cases.

The ECB conducted (1) a short-term, 3-year Disorderly Transition Risk scenario and the two Physical Risk scenarios (flood risk and drought, and heat risk); and (2) the 30-year Transition scenarios in line with the NGFS scenarios. Regarding the short-term scenarios, the combined credit risk and market risk losses for the 41 banks would amount to around €70 billion (about $76 billion). However, the central bank stressed that this estimate would likely understate the actual

risk for several reasons. First, the scenarios were not adverse relative to other regular stress test scenarios since no economic downturn accompanying the negative climate effects was envisaged. In addition, the data and modeling approaches underlying the banks' projections are still preliminary, with climate factors only captured to a limited degree. In addition, the exposures covered in the scope of this exercise only accounted for around one-third of the total exposures of the 41 banks.

Under the 30-year Transition scenarios, losses that may occur in the context of the transition to a more sustainable environment are projected to be notably lower under the Orderly scenario (phasing in of sustainable climate policies) than in the case of Delayed and Disorderly transition paths. The exercises revealed that many banks lacked clearly defined long-term strategies for credit allocation policies that reflect the various transition paths, suggesting that large banks must formulate their long-term strategic planning (e.g., green transition plans and targets) soon. The exercise also revealed that many banks are still at an early stage in factoring climate risks into their credit risk models. In many cases, credit risk parameters projected by banks were found to be insensitive to the climate risk shocks captured in the scena.

3. PBOC's Climate Stress Test and Implication on Banks' Capital Adequacy

The PBOC conducted in 2021 the first climate stress test against 23 major banks, including policy banks and major commercial banks in the PRC. The results were published in February 2022. The exercises focused on the impact of an increase in GHG emission costs on the repayment capability of companies in carbon-intensive industries, including thermal power, steel, and cement, and the subsequent impact on banks' asset quality and capital adequacy levels. The capital adequacy ratio for these banks was 14.89% at the end of 2020. The exercise found that this capital adequacy ratio could fall to 14.57% under the lightly adverse climate scenario, but the ratio could fall to 14.27% under the more severe climate scenario (China Banking News 2022).

The PBOC stated that all the banks in the exercises satisfied the capital adequacy ratios because lending to the carbon-intensive industries constituted a small percentage of their total loans. Nonetheless, the deputy governor published a note stressing that the companies in the carbon-intensive sectors should promote emission cuts to prevent a decline in repayment capacity envisaged under various climate stress scenarios. Anticipated rising emission costs and strengthening of climate policies would promote industrial restructuring and likely generate stranded assets and other transition risks (Reuters 2022). The

PBOC plans to cover other emission-intensive industries in future stress test exercise.

4. BOJ's Climate Scenario Analysis

In August 2022, the FSA and BOJ jointly released the results of a bottom-up pilot scenario analysis on three major banks and three major insurance companies using the three main climate scenarios—Net Zero 2050, Delayed Transition, and Current Policies—the NGFS developed (FSA and BOJ 2022). For banks, the analysis covered credit risk. Banks chose materially important emission-intensive sectors by themselves. They used their analytical framework and modeling developed to capture sector-specific risk factors. They estimated additional credit costs for the entire sector examined based on a group of sampled companies. As for other sectors, including households, banks were allowed to use macroeconomic indicators (such as customizing their stress test models). This exercise was not intended to assess the quantitative impacts of climate change on financial institutions due to data availability and methodology constraints. Based on banks' credit exposures as of the end ofMarch 2021, the results indicated that the banks' estimated increase in annual credit costs due to transition and physical risks was considerably lower than their average yearly net income. These results were similar to those published by financial institutions in their sustainability reports. The FSA and BOJ, however, cautioned about these exercise results because of significant differences in models, sectors, variables, and assumptions adopted by the banks, even though the results demonstrated each bank's capacity to conduct a risk analysis. The exercise also revealed that it is essential to improve comparability across banks by encouraging the use of common assumptions, which will be necessary to deepen understanding of the issues in climate risk estimation and enhance risk management at individual banks.

Regarding insurance companies, the exercise focused solely on physical risks (particularly acute risks caused by typhoons and floods) related to their underwriting business. These companies assessed the magnitude of climate-driven physical dangers in light of changes in insurance claim payments by using the climate scenarios built on an intensified magnitude of specific disasters. The results showed that claim payments increase as temperatures rise. At the same time, analyzing only specific scenarios (such as disasters triggered by natural hazard) is insufficient to assess changes in the probability and frequency of climate-driven disasters in the future. The results also varied among insurance companies due to a lack of uniform assumptions and risk

models adopted by each nonlife insurance group. The report also acknowledged the need to consider conducting a stochastic analysis as a future analysis by considering the probability of occurrence of various climate scenarios incorporating the impact of future climate change and using the same risk model across the nonlife insurance companies.

5. MAS's Industry-Wide Stress Test Incorporating Macroeconomic and Financial Implications

MAS has been working on a financial industry-wide stress test (so-called Industry-Wide Stress Test) and adopted the first test in 2018 for insurance companies on a scenario featuring extreme flooding. These participating insurance companies needed to consider the impact of higher claims on their balance sheets from damage incurred to insured properties. Subsequently, more work was conducted to deepen the understanding of climate risks by MAS for financial institutions. The exercise was conducted for banks and insurance companies in 2020 and 2021. The financial stability review's special features on climate change reported the preliminary results, including a description of MAS's multiyear iterative approaches for a climate stress test and climate-related modeling. Also, climate risk transmission channels to financial stability and potential second-order effects were described.

Building on these earlier experiences, MAS adopted a more comprehensive bottom-up climate scenario exercise in 2022 for selected major banks and insurers in Singapore to raise their awareness of climate risks' potential economic and financial implications. It aimed at deepening understanding for both MAS and financial institutions to improve the capability to cope with climate risks. Participating banks accounted for more than 70% of total domestic nonbank lending in Singapore. Participating insurance companies covered more than 90% of total assets for direct life and composite insurance companies and more than 70% of gross weighted premiums for direct general insurance and reinsurance companies. The exercises incorporated long-term climate scenarios using three climate scenarios developed by the NGFS (Orderly Transition Net Zero 2050 scenario, Disorderly Transition scenario, and No Additional Policies scenario) as part of the broader 2022 Industry-Wide Stress Test exercise. The Disorderly Transition scenario used the Delayed Transition scenario. The No Additional Policies scenario examined the potential implications of heightened physical risks over the short and long term.

Moreover, the NGFS's Current Policies scenario was also performed to reflect an acute physical risk shock over the short term focusing on 1-in-200-year flooding event within ASEAN-5 economies. The results

of the exercises were published in MAS's Financial Stability Review 2022 (MAS 2022b). The report stressed that the 2022 climate scenario analysis allowed participating banks and insurers to incorporate climate risks into their risk assessment frameworks. This could help develop internal capabilities and utilize third-party expertise. Like other central banks and regulators, the analysis found large data and methodological gaps. This suggested the urgent need to improve data collection and model development works.

As for the short-term impacts, the exercises showed that a 1-in-200-year flooding event in the ASEAN-5 economies under the No Additional Policies scenario significantly disturbed their economic activities. This led to a decline of ASEAN-5 GDP by 5.1% in level terms by the end of 2022 compared with the No Flood scenario. The shock disproportionately impacted sectors relying heavily on physical capital stock (such as manufacturing and construction). These companies might end up ceasing operations temporarily due to a lack of access to the physical capital stock, power failures, and damaged equipment. In addition, flood-related damages and the disruption to supply chain networks contributed to inflationary pressures across the ASEAN-5 economies and their major trading partner economies. Based on these results, participating banks projected that they would need to prepare additional provisions to account for flood-driven credit losses. This could lead to higher credit costs. The magnitude of the rise in credit costs was diverse among participating banks mainly because of different business models adopted and divergent lending activities extending across the ASEAN-5 economies.

Moreover, locational differences resulted in divergent severity from the flood event. Flood mitigation and adaptation policies and measures adopted by the governments in the region also influenced credit losses. On aggregate, participating banks projected that their flood-driven credit losses in 2022 would amount to about 15% of their net profits. Participating general insurance and reinsurance companies projected a significant increase in gross incurred claims in 2022. This was primarily because the impact was severe on their property business services related to flood-driven damages on residential and commercial properties. While these projected gross incurred claims will subsequently fall in 2023 and 2024, they will remain slightly higher than by the end of 2021.

As for the longer-term exercises, it was found that both physical and transition risks could potentially exert a significantly large impact on banks' and insurance companies' balance sheets. For participating banks, the probability of defaults related to their climate-relevant sector credit exposures was projected to rise over time under all three climate scenarios. These results reflected heightened credit stresses driven

by both transition and physical risks. On transition risks, most banks projected a sharp increase in the probability of defaults by 2040 under the Disorderly Transition scenario compared to the Orderly Transition scenario. This credit deterioration was most pronounced in relatively emissions-intensive sectors (i.e., fossil fuels and energy-intensive manufacturing sectors). As for physical risks, several banks projected that their probability of defaults would rise significantly under the No Additional Policies scenario. This is because high temperatures lead to chronic changes in living conditions, including deterioration of people's health, lower labor productivity, reduced agricultural production, and higher sea levels. On an annualized basis, the associated credit losses could amount to 8% or 9% of banks' net profits each year. This could cause downward pressure persistently on banks' profitability.

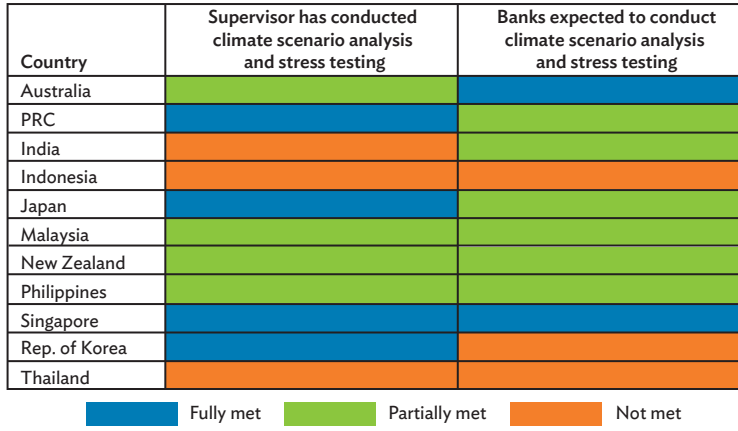
As for insurance companies, physical and transition risks were projected to adversely affect assets and liabilities under the static balance sheet assumption. Insurance companies projected a decline in the market value of their emission-intensive sector credit exposures and sovereign debt holdings under the three climate scenarios because of a persistent rise in interest rates across the horizon covered. The gradual increase in interest rates over the long term will likely be related to policy responses to inflationary pressures driven by higher carbon prices and supply-side disruptions caused by materializing physical risk events. General insurance companies would experience a smaller decrease in the market value of their debt holdings due to the shorter maturities of their asset holdings. For life insurance companies, a rise in interest rates would also lead to a decline in their policy liabilities, thus partially mitigating the adverse impact on their overall balance sheet positions.

Insurance companies projected that the market value of emission-intensive sector equities holdings would increase over the scenario observation period because of continued economic growth. However, this increase in the market value varied depending on climate scenarios. By 2050, the market value of those equities holdings was projected to be highest under the Orderly Transition scenario, followed by the Disorderly Transition scenario, and then the No Additional Policies scenario. The difference in the results arose from the adverse impact of heightened transition and physical risks on equity valuations. Such shocks on those equity holdings emerged especially throughout 2030–2035 under the Disorderly Transition scenario. This is because the abrupt and sharp rise in carbon prices made some carbon-intensive assets stranded in emission-intensive sectors. Regarding liabilities, general insurance and reinsurance companies projected the largest increase in unexpired risk reserves under the No Additional Policies scenario. This was because of the severe stresses arising from physical

risks (such as rising temperatures and sea levels) and the frequency and severity of disasters. Nonetheless, the projected increase will unlikely be large since insurance companies tend to have short contracts and could thus adjust premiums to offset the impact of changes in claims. Meanwhile, increases in projected unexpired risk reserves under the Orderly Transition and Disorderly Transition scenarios were milder due to the relatively limited physical risks.

The World Wide Fund for Nature (WWF) reported that Singapore has performed best among the 11 countries in Asia, including Japan and the PRC, in terms of climate scenario and stress test analysis (Saphira et al. 2023a). WWF evaluated Singapore as the highest in having conducted a comprehensive climate scenario exercise fully led by the central bank and expecting banks to conduct their climate scenario analysis fully (Figure 6.2). This is probably due to the wider coverage of financial institutions requested to participate in the climate scenario analysis. Also, MAS is working closely with the banking association to promote a standardized approach for financial institutions to grasp climate risk divers related to their clients. Most importantly, Singapore's decision to encourage listed companies and financial institutions to disclose information in line with TCFD guidelines on a mandatory basis, as reported in Chapter 5, is highly appreciated.

Figure 6.2: Supervisory Actions and Expectations on Stress-Testing and Scenario Analysis in the Asia and Pacific Region



Source: Saphira et al. (2023a).

6. Federal Reserve's Plan to Conduct Climate Scenario Analysis

The US Federal Reserve announced in September 2022 that six of the nation's largest banks whose consolidated assets exceed $100 billion would participate in a bottom-up pilot climate scenario analysis. The exercise aims to enhance the capabilities of financial supervisors and financial institutions to quantify and manage climate-related financial risks. Related details of climate, economic, and financial variables used for the exercise will be published soon. Based on the analysis of the impact of the climate scenarios on specific portfolios and business strategies of participating financial institutions, the central bank will review the analysis and begin engaging with them to build their capacity to manage climate-related financial risks. The exercise will be launched in early 2023 and is expected to conclude toward the end of 2023. Insights gained from the exercise will be published at an aggregate level, including lessons learned about identifying potential risks and risk management practices. The central bank stressed that this climate scenario analysis is separated from the bank stress test regularly conducted to examine whether large banks have enough capital to continue lending to households and businesses during a severe recession. The central bank emphasized that climate scenario analysis is exploratory and does not have capital consequences. By considering a range of possible future climate scenarios, the exercise could help the participating large financial institutions and financial supervisors deepen their understanding of how climate-related financial risks may materialize and could differ from historical experience.

According to the Pilot Climate Scenario Analysis Exercise Participants Instructions published in January 2023, the climate scenario analysis will comprise two modules separately prepared for physical and transition risks based on the existing works by the IPCC and the NGFS (Federal Reserve 2023). As for the physical risk module, the focus will be on loan portfolios related to residential and commercial real estate for 1 year in 2023 by considering a severe hurricane event causing storm surges and precipitation-driven floods in the northeast region as a common shock. Moreover, the idiosyncratic shock component will also be considered by allowing participants to select a hazard event and one of the 10 geographic regions based on the degree of importance to their business models and exposures. Meanwhile, the transition risk module will ask the six financial institutions to shed light on corporate and commercial real estate loan portfolios for 10 years, from 2023 to 2032, under the Current Policies scenario and the Net Zero 2050 scenario compiled by the NGFS. The trading book will be excluded from the climate scenario analysis.

7. Review of Climate Scenario Analysis Exercises by the NFGS and FSB

In November 2022, the NGFS and the FSB jointly published a report on initial findings from climate scenario analyses conducted by various central banks and financial regulators (NGFS 2022b). The report was also sent to G20 leaders before that year's Bali Summit. Although the climate scenarios prepared by the NGFS helped provide a reference, these scenarios were insufficient to enable a good comparison across financial institutions and economies due to the significant variations in the scope and objectives among central banks and financial authorities.

According to the report, the overall impacts of climate risks were not small. But they were contained from the perspective of the domestic financial system because most of those climate risks were likely to concentrate in some sectors and regions. The report admitted that these findings could be too optimistic given that many companies have not yet disclosed Scope 3 GHG emission data. As Scope 3 emissions could account for about 70% of total emissions in most sectors, corporate GHG emissions based on Scopes 1 and 2 are clearly insufficient to promote carbon neutrality. The report emphasized that tails risks and spillovers associated with climate change developments may be large and unmanageable. The measures of exposure and vulnerability are likely understated because many climate exercises have not captured second-round effects, potential nonlinearity features of climate risks, and other potentially large risks (such as abrupt fire sales of assets in emission-intensive sectors). These exercises are still exploratory, so the results do not yet translate into micro- or macroprudential policy actions and assessments. Further efforts among central banks and financial regulators are needed to improve data availability and consistency, and comparability at the global level through deeper cross-border cooperation.

6.4 Green Capital Requirements Regulation and Associated Discussions

With a growing understanding that climate risks will significantly impact the financial system's stability, some central banks and financial regulators have begun to review prudential regulations beyond promoting data collection and improving monitoring and supervisory capacities. It may take some time to implement standardized regulatory approaches globally, given that climate scenario analysis in many jurisdictions has revealed that financial institutions have not yet deepened their understanding of climate risks and risk management

approaches. Financial institutions adopting divergent approaches regarding risk assessment and strategies also require time to form a consensus about common approaches. The data, including Scope 3 of corporate counterparties, must also be collected with more uniform methodologies. Nonetheless, it is still worthwhile to consider the possible implications of climate risks on existing financial regulations.

1. BCBS Capital Regulatory Requirement Framework

Financial regulations that are important for prudential perspectives refer generally to the Basel capital adequacy and liquidity regulations (liquidity coverage ratio and stable funding ratio). The BCBS established these regulators to ensure the soundness of financial institutions, given that disruptions to the financial system could adversely impact the whole economy. These financial regulations have been adjusted and updated to reflect the emergence of new types of risks often revealed during various financial and economic crises. Regarding capital requirements, financial institutions can take flexible approaches, such as the internal ratings-based approach for credit risk. Thus, individual financial institutions within the approach can deal with new emerging risks flexibly.

The Basel III Framework, aiming to have a safe and sound financial system, comprises three pillars concerning capital requirements: Pillar 1 (minimum regulatory requirements), Pillar 2 (supervisory review process), and Pillar 3 (disclosure requirement). Pillar 1 (minimum capital requirements) covers regulatory rules on minimum loss-absorbing capital requirements based on the ratio of a bank's capital to its risk-weighted assets. The risk-weighted assets are calculated by assigning different risk weights to a bank's assets, reflecting that some assets are riskier than others. Risks generally cover credit risk, market risk, and operational risk here. Credit risk typically necessitates larger capital requirements than other risks and is calculated to reflect unexpected losses for a particular stress level calibrated over 1 year. Two approaches are permitted: (i) the standardized approach with fixed risk weights applied or (ii) the internal ratings-based approach whose parameters are estimated by a bank's internal models. Market risk capital requirement focuses on the risk of losses resulting from changes in market prices (e.g., equity prices), while operational risk copes with the risk of losses driven by inadequate or failed internal processes.

In addition to the 8% minimum capital requirements, capital buffers must be added to the minimum requirements. Those capital buffers include capital conservation buffer, countercyclical capital buffer, and global systemically important bank (G-SIB) buffer. A capital conservation buffer is designed to ensure banks hold additional

usable capital that can be utilized when losses arising from a significant sector-wide downturn occur. Countercyclical capital buffer deals with counter procyclicality in credit cycles to strengthen the banking sector's resilience, and financial regulators increase the buffer when a cyclical systemic risk (such as excessive lending leading to a deterioration of loan quality and, hence, potential losses) appears to be rising. G-SIB buffer is designed to increase the resilience of global systemically important banks as a going concern to offset the potentially greater impact that the distress or failure of such banks would exert.

Meanwhile, Pillar 2 complements Pillar 1 and refers to capital buffers to ensure banks place sound internal processes and use proper risk management techniques to support their business activities. It is based on a sound supervisory judgment about corporate governance related to risk management and misconduct risk. Also, risks covered but not fully captured under Pillar 1 should be included here. Banks must maintain their capital structure above the minimum level set by Pillar 1. Banks must also assess the internal capital adequacy for covering all potential risks related to their operations—including interest rate risks in the banking book, nonfinancial risks (such as strategic, business model, and reputation risks), and credit concentration risks. There are four principles: one principle related to banks and three principles related to financial regulators. The first principle requires banks to perform a regular internal capital adequacy assessment process (ICAAP) as an integrated approach to risk management and capital management to determine a strategy for maintaining the necessary capital level. Meanwhile, the three other principles require supervisors to review and evaluate banks' ICAAP and strategies, require banks to conduct businesses above minimum capital requirements, and urge supervisors to take early actions using various supervisory tools and activities. Thus, ICAAP is an important part of Pillar 2, and financial supervisors generally allow banks to report standardized but somewhat flexible risk assessments. Furthermore, Pillar 3 focuses on supervision through enhanced market transparency and market discipline to strengthen financial system stability.

2. Discussions about Pillar 1 versus Pillar 2 Framework to Cope with Climate Risks

There is a growing debate on how to incorporate climate-related financial risks into the Basel Framework, particularly concerning the standard Pillar 1 capital requirement or Pillar 2 framework. The BCBS examined this issue in 2021 and concluded that climate risk drivers, including physical and transition risks, can be translated into traditional

financial risk categories rather than representing a new type of risk. Traditional risk categories include credit, market, operational, liquidity, and reputational risks (BCBS 2021b, 2021c). This suggests that climate-related credit, market, and operational risks could be covered under the existing Basel Framework.

The Financial Stability Institute published a report in February 2022. It stressed that Pillar 2 could be the candidate for incorporating climate risks and maintaining sufficient capital to cope with them, given the longer time horizons and the higher degree of uncertainty associated with the materialization of such risks (Coelho and Restoy 2022). The report also pointed out that adjusting the standard Pillar 1 instruments to incorporate climate risks could be challenging at this stage since Pillar 1 capital requirements are calibrated for a 1-year time horizon based on historical loss experience, given that such historical loss data are unavailable for climate risks. More forward-looking approaches are necessary when calibrating capital requirements related to climate risks. By contrast, the Pillar 2 approach could conduct a capital assessment using climate scenario analysis and stress tests. Climate stress tests might enable financial regulators to consider the potential impact on financial institutions under various climate scenarios. Financial regulators could use these exercises to promote financial institutions' awareness of potential deficiencies in their climate risk management framework, thus requiring financial institutions to improve their risk management practices and enhance their loss-absorption capacity. The Financial Stability Institute stressed that more flexible approaches are possible using Pillar 2 rather than the Pillar 1 framework. This view is consistent with a conventional view that Pillar 1 requirements should be calibrated based on each bank's actual risk of incurring losses over a 1-year time horizon and based on historical loss experiences rather than forecasts. Thus, it was stressed that these approaches are unsuitable for coping with climate risks.

Meanwhile, Manifest Climate (2022) pointed out some rationales for adjusting the Pillar 1 capital requirement concerning climate risks. First, there are differences between the objective of Pillar 1 (capital requirements based on risk assessments) framework and the current actual practice of Pillar 1 (setting capital requirements based on a 1-year time horizons and historical loss experience) framework. Regarding climate risks, these impacts are unlikely to be extrapolated properly using historical loss experiences anyway because most of the financial effects have not yet materialized and cannot be modeled precisely. Therefore, setting capital requirements should evolve to incorporate climate risks. Second, the historical experiences related to the implementation of the Pillar 1 framework suggest that the "risk-based" approach is not

based on some objective formula but on the subjective interpretations of financial regulators and financial institutions. For example, the Basel Framework allows banks to calculate the Pillar 1 requirements for their credit portfolios using a standardized or an internal ratings-based approach. While the former standardized approach appears to be based on an objective formula, the risk weights reflect information from external credit rating agencies, whose approaches could also be subjective and not entirely science-based. The 2008 Lehman shock was also attributable to the improper credit risk ratings associated with complex financial assets.

Moreover, some financial regulators intentionally apply lower risk weights for bank exposures to small and medium-sized enterprises to promote credit extension. Meanwhile, the latter internal ratings-based approach enables banks to adopt their credit rating models to determine appropriate risk weights reflecting a borrower's actual probability of default and a bank's loss given default. However, there is room for discretion since these values are determined using banks' data and models. For these reasons, Manifest Climate stressed that that is still worthwhile to consider incorporating climate risks under the Pillar 1 framework.

In responding to the public consultation on the BCBS document related to the 18 principles pointed out below, the Climate Safe Lending Network (CSLN) also stressed the importance of the Pillar 1 framework. It criticized the BCBS for failing to consider the most effective, feasible approach using Pillar 1 capital measures to improve banks' capital adequacy against climate-related losses (Climate Safe Lending Network 2022). The CSLN is made up of financial institutions, NGOs, and policy experts and stressed that Pillar 1 measures would correct the underpricing of both micro- and macro-prudential climate-related risks and prevent the buildup of assets, which would either be stranded (causing financial stress in the economy) or cause losses and damage through more severe climate impact (also causing financial stress in the economy, potentially irreparably). Adjusting the Pillar 2 framework proposed by the Financial Stability Institute is not favored by the CSLN. Even though the Pillar 2 requirement provides financial regulators an array of tools, such as capital add-ons, to address risks not fully captured or covered under the Pillar 1 framework, the CSLN stated those measures are not being used in practice. This may be because financial regulators lack the confidence or competence to utilize them in response to climate risks (Manifest Climate 2022). In practice, financial regulators use Pillar 2 only to remedy bank-specific issues to manage risks identified under the Pillar 1 framework. Thus, Pillar 2 capital add-ons are unlikely to be applied at the size and scale needed

to capture climate risks. Regarding the Pillar 3 requirement, the CSLN also proposed that the BCBS consider mandatory disclosure of all GHG accounting per asset and asset category, including both on-balance and off-balance sheet elements. The data should include the corporate client Scope 3 GHG emissions for the most emission-intensive sectors.

3. BCBS Guidance Related Climate-Related Financial Risks

In November 2021, the BCBS published a public consultation document on 18 principles for effectively managing and supervising climate-related financial risks (BCBS 2021a). This publication aims to promote a principles-based approach to improve both banks' risk management and supervisors' practices related to climate-related financial risks. Following the consultation and various responses, the BCBS published a finalized guideline in June 2022 (BCBS 2022a). Principles 1 through 12 guide banks on effectively managing climate-related financial risks, while principles 13 through 18 guide prudential supervisors. The proposed principles attempted to achieve a balance in improving practices related to managing climate-related financial risks and providing a common baseline for internationally active banks and supervisors while maintaining sufficient flexibility given the high degree of heterogeneity and the nature of evolving practices in this area.

In particular, principle 5 is related to capital and liquidity adequacy. It states that banks should identify and quantify climate-related financial risks and incorporate those risks (assessed as material) over relevant time horizons into their internal capital and liquidity adequacy assessment processes, including their stress testing programs where appropriate. Banks should include climate-related financial risks assessed as material over relevant time horizons that may negatively affect their capital position (i.e., through their impact on traditional risk categories) in their ICAAP. Banks should also look at the impact of those risks on their liquidity position in their internal liquidity adequacy process. Principle 10 indicates that banks should understand the impact of climate-related risk drivers on their liquidity risk profiles.

The BCBS has been investigating the extent to which climate-related financial risks can be adequately incorporated into the existing Basel Framework by identifying potential gaps and considering possible enhancements to the framework. This assessment is being conducted across the regulatory, supervisory, and disclosure dimensions. For further information related to the June 2022 guideline, the BCBS developed responses in the form of frequently asked questions in December 2022 to clarify how climate-related financial risks might

be captured under the existing Pillar 1 standards without making any changes to the standards themselves (BCBS 2022b). This is consistent with the BCBS conclusion made in 2021 (mentioned above) that climate risks can be captured in the traditional financial risk categories, including credit, market, operational, and liquidity risks (BCBS 2021b, 2021c). The BCBS stressed that there is no need to change the existing Basel Framework since climate-related financial risks can be treated just like traditional financial risks. Due to data limitations and the need for developing capabilities and expertise, the BCBS encouraged flexible treatments within the existing framework.

4. Using Pillar 1 Capital Requirement to "Prevent" Climate Risks

In 2021, Finance Watch proposed adjusting the Pillar 1 capital requirement to prevent banks from increasing fossil fuel investment. This appears to be an approach to "prevent" climate risks through prudential supervision rather than coping with climate risks. Finance Watch is a European NGO located in Brussels, Belgium, aiming to solve environmental and disparities issues by actively using the power of finance. It urged the EU to aggressively adjust the Pillar 1 capital requirement (Finance Watch 2021). Under the current EU regulatory framework, the capital adequacy ratio (ratio of capital to risk-weighted assets) sets a risk weighting of 20%–150% for investments and loans to companies. On such practices, Finance Watch criticized that the risk weight is very low and instead proposed increasing the risk weights on fossil fuel–related investments to 125% and on new fossil fuel extraction and production to 1250%. Finance Watch views that Pillar 1 could be an appropriate place for considering asset-specific prudential capital for banks' fossil fuel assets. This proposal intends to require more capital to conduct fossil fuel extraction and thus reduce profitability in their business. It also advocated that insurance companies raise minimum capital requirements for equity investments in fossil fuel assets with regard to their solvency margin ratios used to measure their soundness.

This "one-for-one" approach is supported by the CSLN, which favored implementing capital charges on fossil fuel assets under the Pillar 1 requirement. To do so, defining climate-harmful activities using taxonomies for bank prudential purposes is necessary. Such an approach could largely impact banks' capabilities to mitigate credit risks, contributing to containing global climate risks for bank prudential purposes. For example, capital requirements that apply to financing a gas field operation would help protect banks against asset-level stranding risks.

One challenge with regard to this standardized approach is that the higher risk weights are applied only directly to fossil fuel-related investment so that other GHG emission-intensive manufacturing, services, and agricultural activities are not covered. Ideally, the risk weights under the Pillar 1 framework should be applied to all exposures across banks' portfolios based on the degree to which business activities contribute to climate change (could be estimated using a bank's client companies' carbon footprint). The higher the borrower's emissions, the higher the multiplication factor applied to their baseline risk-weighting (Manifest Climate 2022). However, it may take time to adopt this approach because of lack of data, insufficient disclosure, lack of standardized disclosure and calculating approaches, etc. On this front, the standardization efforts led by the ISSB are a welcome step, but it will likely take time to collect reliable corporate counterparties' Scopes 1, 2, and 3 data.

The NGFS pointed out challenges related to the one-for-one approach using Pillar 1 capital requirements. This is due to a lack of reliable data and methodologies for quantifying climate risks and calibrating prudential requirements. Moreover, the lack of a risk-oriented taxonomy that promotes a common definition of "green" and "brown" assets makes it difficult to apply risk differentials between "green," "nongreen," and "brown" assets (NGFS 2020a). The taxonomy was developed by the EU. It is a classification system over a list of environmentally sustainable economic activities with clear definitions and science-based technical screening criteria to promote sustainable finance and avoid "greenwashing" under the EU green deal. The UK Green Technical Advisory Group, established by the UK government as an independent expert group, reported that about two-thirds of more than 30 taxonomies or principles worldwide are either already in place or under development. They use the EU taxonomy as a framework or view it as a benchmark. Those two-thirds include Australia; Bangladesh; Canada; Chile; Colombia; the EU; Georgia; Hong Kong, China; India; Indonesia; Israel; Kazakhstan; Mexico; New Zealand; the ROK; the Russian Federation; Singapore; South Africa; Sri Lanka; Thailand; Türkiye; and Viet Nam. Thus, the GTAG recommended that the UK government follow the EU taxonomy with some UK-specific elements to promote interoperability and help reduce the burden on companies (GTAG 2023).

Another challenge pointed out by the NGFS is that the available historical data indicate the insignificance of risks stemming from climate change and the energy transition. The reliance on backward-looking models also poses substantial analytical challenges. Furthermore, the divergence between the timing to see a materialization of climate risks and the 1-year time horizon used by financial institutions' risk

management or financial regulators for a prudential framework is problematic. Compared to banks, most nonlife insurance undertakings can reprice their contracts yearly. This helps mitigate the loss potential of future climate risks since higher insurance payouts to pay for property damage, for example, can be balanced out by charging higher premiums.

6.5 BOE's View: Using Capital Requirements for Improving Soundness, Not for Preventing Climate Risks

BOE's Prudential Regulation Authority released its Climate Adaptation Report in 2021, the first report of its kind issued by a global financial regulator. The report indicated BOE's intention to consider capital requirements under the existing Basel Framework as part of its climate prudential policy. It also reflected its expectation that banks would incorporate judgments of their exposure to climate-related financial risks in the manner they have already been assessing their capital requirements for other financial risks (BOE 2021). Capital adequacy requirements could be used to improve the resilience and soundness of financial institutions against potential climate-related losses. Thus, it may be feasible to require banks with large GHG emission-intensive assets to secure a larger capital.

At the same time, however, the Climate Adaptation Report stressed that careful considerations would be necessary for the following reasons. On the other hand, using a capital requirements framework to address the "causes" of climate change and thus encourage GHG reductions to mitigate climate change would not be desirable. Given that financial institutions make business decisions about where to invest and finance from the perspective of various opportunities and costs, addressing the "causes" of climate change could be more effectively addressed by government-led climate policy. Climate policy, through active use of emission regulations and carbon pricing, can more effectively promote behavioral changes in companies, financial institutions, and individuals. On the other hand, responding to the "consequences" of climate change means "adapting" actions toward climate change, whereas responding to "causes" corresponds to "mitigation" actions such as reducing GHG emissions. The soundness of banks can be improved by raising the credit risk weights to cope with the risk of incurring losses from investment and loan portfolios due to climate change. This is a tool to promote banks' "adapting" actions.

The above views reflect BOE's concerns that using historical data for climate-related financial risks will be less useful in calibrating future

risks since such risks are likely to materialize over short-, medium-, and long-term horizons and grow over time. Historical data could be altered by tipping points and climate policy interventions. This means that the issue of quantifying climate risks for capital requirement purposes is still nascent and inconclusive, requiring further research. According to BOE, banks can cope with climate risks using Pillar 1 and 2 capital requirements under the existing Basel Framework. Financial institutions are expected to capture and examine capital needs related to climate-related financial risks. For example, banks can adjust credit risk assumptions on banks' probability of default and loss given default in an internal ratings-based approach under Pillar 1. Banks can also consider add-ons under the Pillar 2 framework if their material risks are not captured well by the Pillar 1 framework. BOE suggested that capital add-ons can be used in response to significant weaknesses in firms' risk management and governance. Meanwhile, insurance companies can be required to assess their capital adequacy through their own risk and solvency assessment practices. However, unlike banks, the insurance regulatory regime does not have a Pillar 2 add-on framework.

While these existing regulatory capital measures could capture the consequences of climate change to some extent through reference to credit ratings and the accounting regime, BOE warned that this practice is imperfect due to capability gaps and regime gaps. Capability gaps refer to the difficulties inherent in estimating climate-related financial risks due to a lack of relevant granular data or modeling techniques that can fully incorporate climate factors. The climate scenario analysis might help reduce capability gaps. On the other hand, regime gaps refer to possible challenges in capturing climate-related financial risks due to the design or use of methodologies in capital regimes. In the micro-prudential regulatory regime, methodologies are mostly calibrated using past data to capture risks evolving over a relatively short time horizon. While this helps ensure capital is set more objectively and quantifiably, there is a risk of underestimating future climate-related financial risks. The macroprudential regime for banks can take a more flexible approach to time horizons. But its current application might be less suitable for noncyclical risks like climate risks that increase gradually over an extended period. In insurance, the capital regime does not contain an analogous capital buffer aimed at macroprudential risk (BOE 2021). BOE said it might consider strengthening the capital adequacy framework from 2022 onward if necessary.

BOE's Prudential Regulation Authority published guidance for financial institutions and indicated the supervisor's expectations that financial institutions maintain adequate capital to cope with climate-related financial risks.

6.6 ECB's Approach toward Active Use of Capital Requirements

The ECB is taking the lead worldwide in clarifying the steps toward implementing capital requirements to cope with climate-rated financial risks. Essentially, three steps are being taken to encourage banks to meet all supervisory expectations by the end of 2024 in accordance with its Guide on Climate-Related and Environmental Risks published in 2020. As a first step, the ECB announced its expectation that large banks adequately categorize climate and environmental risks and fully assess their impact on the banks' activities by March 2023. As for the second step, banks are expected to include climate and environmental risks in their governance and risk management strategies by the end of 2023. Third, banks should prepare plans to transition toward a low-carbon economy and actively engage with corporate clients. They should set interim targets and limit their risk-taking to meet long-term climate commitments. As a final step, banks are expected to meet all remaining supervisory expectations on climate and environmental risks by the end of 2024.

1. ECB's View on Using Pillar 1 Capital Requirement

The EU's Capital Requirements Directive requires financial institutions to maintain sound, effective, and comprehensive strategies. The directive also requires banks to assess and maintain on an ongoing basis the amounts, types, and distribution of internal capital that they consider adequate to cover the nature and level of the risks to which they are or might be exposed. In addition to any material risks, banks are expected to consider any risks that may arise from pursuing their strategies or relevant changes in their operating environment. To meet this, banks' assessment of materiality plays an essential role in their ICAAP and risk management. Many banks are already assessing capital adequacy in the context of climate and environmental risks as part of their ICAAP under the Pillar 2 framework. Generally, such assessments are conducted using climate scenario analyses to consider forward-looking factors over a longer time horizon. The ICAAP includes a description of the transition and physical risk scenarios and a calculation of the scenario's impact on quantitative metrics (such as provisions, capital, and profitability).

The ECB, in principle, supports the view of utilizing the Pillar 1 requirement to cope with climate risks. At the same time, however, the ECB admitted that many challenges exist in capturing climate-related financial risks. Thus, some of the principles and methodologies

used under the Pillar 1 framework might not be applicable, especially considering the forward-looking nature of climate risks. This is because some parts of the Pillar 1 Basel Framework are backward-looking and depend on consistent, historical data. By contrast, climate risks require new types of granular data and more innovative models to quantify the key drivers of physical and transition risks. The lack of reliable data on climate-related financial risks represents a major challenge to applying the Pillar 1 framework (ECB 2021). Thus, a fundamental review of the Pillar 1 framework might be necessary before application. The ECB concluded that supervisory measures, including Pillar 2 requirements, may be desirable to address the climate risk exposure of individual banks.

Meanwhile, the European Banking Authority (EBA) published a discussion paper in May 2022 to explore the role of climate and environmental risks in the prudential frameworks for credit institutions and investment firms (EBA 2022). The authority requested feedback from stakeholders, particularly on whether and how climate and environmental risks can be incorporated into the Pillar 1 prudential framework. EBA also launched discussions on the potential incorporation of a forward-looking perspective in the prudential framework. It stressed the importance of collecting relevant and reliable information on climate and environmental risks and their impact on financial institutions' financial losses. The consultation was held until August 2022, and a final report is scheduled to be released in 2023.

2. Consideration of Climate Risk Buffers as a Macroprudential Measure

The ECB stressed that the macroprudential approach may be necessary to address the climate-related challenges and risks for the banking sector. One way to do so is to use existing macroprudential tools, particularly existing capital-based macroprudential tools. This could help limit the accumulation of climate risks and increase banks' resilience if these risks materialize. Such tools might also influence the allocation of new funds toward investments less exposed to climate risks. Also, by helping reduce banks' climate risk contributions, such macroprudential tools could exert additional mitigating effects on the economy-wide accumulation of climate risks. Moreover, the ECB also expressed views that it may be worthwhile to consider quantitative and qualitative restrictions on banks' portfolios to contribute to limiting the accumulation of climate risks, notwithstanding operational and legal hurdles (ECB 2021).

As a related issue, the ECB and the European Systemic Risk Board (ESRB) published a joint report in 2022 on how climate shocks can influence the financial system in Europe. They proposed using macroprudential capital buffers (ECB and ESRB 2022). In addition, they identified several amplifiers of climate risks across the financial system. For example, transition risks might be magnified because of economic and financial linkages between banks and between banks and their corporate counterparties. In contrast, physical risks might be amplified through the interdependent occurrence of large disasters triggered by natural hazard (i.e., water stress, heat stress, and wildfires), which might happen in clusters and exacerbate each other and, in turn, transmit through market dynamics.

The ECB and the ESRB also jointly performed climate scenario analysis and suggested that climate risks might evolve within the financial system in a specific order. First, unforeseen climate shocks could have an abrupt impact on market prices. Initially, such shocks may adversely affect the portfolios of investment funds, pension funds, and insurance companies. Second, this sudden market repricing could drive companies into default, thus giving rise to losses for exposed banks. Under the Disorderly Transition scenario (assuming an immediate and substantial increase in carbon prices in later periods), the market losses of insurance companies and investment funds could amount to 3% and 25% on stress-tested assets in the near term. The Orderly Transition (Net Zero by 2050) scenario could mitigate such repricing shocks and thus the fallout of companies and banks, reducing the probability of corporate defaults by around 13% to 20% by 2050 compared to the Current Policies scenario. This lower repricing shock could also reduce credit losses for banks. The report demonstrated that climate risks could quickly spread throughout the entire financial system under the Disorderly Transition scenario, where financial market losses from abruptly repricing climate risks could affect investment funds and insurance companies and trigger corporate defaults and credit losses for banks.

By demonstrating the systemic nature of climate risks, the report indicated that micro- and macroprudential policies should be adopted together to mitigate the systemic nature of climate risks. The ECB and the ESRB viewed that a comprehensive approach, including the commonly applied Pillar 1 framework, would ensure a certain degree of consistency in coping with climate risks. However, insufficient data and methodological difficulties suggest that more work is needed to consider the effective utilization or revision of the current Basel capital requirement that fully captures the unique features of climate risks. Based on this recognition, the ECB and the ESRB suggested that a

macroprudential tool might be able to address the systemic features of climate risks, and this tool should complement the Pillar 2 framework. The macroprudential approach should be sufficiently flexible for climate risks since the impact of climate risks is highly uncertain.

As a suggested tool, the ECB and the ESRB pointed out that the systemic risk buffer (sectoral SyRB) in its sectoral application could be used to limit the accumulation of climate risk concentration and enhance the resilience of banks against the materialization of climate risks. The European Commission already indicated the sectoral use of the SyRB to cope with certain sets or subsets of exposures to climate-related physical and transition risks in the past. The sectoral use of the SyRB may be adequate to discourage concentrated exposures to climate risks. The use of a sectoral SyRB would imply higher capital requirements, thus increasing banks' resilience against the materialization of climate risks.

Compared to the sectoral SyRB, the SyRB does not differentiate sectors. The SyRB already constitutes part of the existing macroprudential tools. Thus, this could be used as a general tool to guard against systemic aspects of climate risks that are not necessarily linked to the concentration risk of individual financial institutions. The SyRB aims to address systemic risks that are not covered by (i) the capital requirements regulation mentioned above, (ii) the countercyclical capital buffer, and (iii) global systemically important banks and other systemically important institutional buffers. By avoiding a distinction between sectors, the SyRB could be viewed as a less challenging tool than a sectoral SyRB. In using SyRB, a flat SyRB could be envisaged to address unexpected climate-related exogenous shocks. If desirable, this climate-related SyRB could potentially be released as a new separate climate risk buffer.

3. ECB's Analysis of Good Practices Developed by Banks

Over the past periods, several European financial institutions have introduced advanced ways to integrate climate and environmental risks into capital adequacy assessment. While climate scenarios developed by the NGFS and the IPCC are often utilized, banks also implement different internal approaches for credit, market, and operational risks. In many cases, the capital adequacy assessment is made by banks when the decision is made to allocate additional economic capital specifically for climate and environmental risks.

Regarding good practices performed by banks concerning capital adequacy assessment for credit risk, the ECB picked one bank that used climate scenarios developed by the NGFS and the IPCC for physical and

transition risk assessments and for performing stress test simulations on the bank's portfolios (ECB 2022b). Using externally available data (such as asset-level and price data) and corporate client data, the simulations estimated the impact of the climate scenarios on the bank's earnings before interest, taxes, depreciation, and amortization. The results help the bank estimate corporate client–level default probabilities under different climate scenarios until 2030. These stressed client-level default probabilities were subsequently aggregated to the sector level to develop sectoral heatmaps. The heatmaps could be used to identify sectors most significantly impacted by climate and environmental risks. The bank then calculated the difference between the stressed portfolio probabilities of default and the baseline portfolio probabilities of default. When the calculated difference exceeded the materiality threshold, the bank allocated an economic capital buffer for the appropriate amount of exposure at risk under the Pillar 2 framework.

Concerning good practices performed by banks related to capital adequacy assessment for operational risk in ICAAP, the ECB chose one bank that identified four plausible climate scenarios where climate risks could trigger material operational risks in the next 12 months. The four climate scenarios included (i) damage to physical assets; (ii) business disruption and system failures; (iii) noncompliance with climate-related laws, rules, and regulations; and (iv) reliance on outsourcing. In each climate scenario, the loss estimates were calculated by considering various hypothetical impacts, including potential remediation costs, legal costs, and forgone revenue. Historical loss events or entity-specific data supplemented these estimates. Based on the outcomes of the climate scenarios, the bank decided to allocate an economic capital buffer to cover the risks as regulated in the Pillar 2 framework.

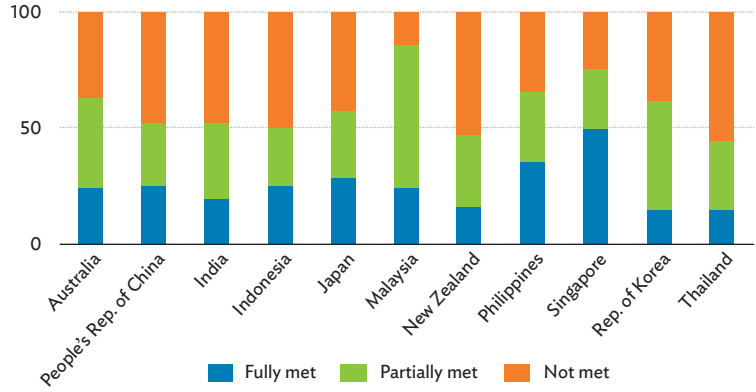
Regarding good practices conducted by banks related to capital adequacy assessment for market risk, the ECB highlighted one bank that assessed the effects of climate risks on market risks for its trading book. This bank used climate scenario analyses for physical and transition risks. As for transition risks, the bank used climate scenarios developed by the NGFS and the IPCC as input to create a more granular internal scenario as an extension. All relevant market risk exposures on bonds, equities, and derivatives were used for the Base Line and Disorderly Transition scenarios with different severity levels. On the sensitivity analysis, profit and loss simulations were conducted to examine the impact of selected variables (for example, carbon prices or credit spreads) of affected sectors. As for physical risks, several stress testing scenarios were used to assess and quantify the impact on profit and loss of extreme weather events for its trading book. The positions examined included equities, securitized products, commodities, and foreign exchange rates.

The stress impact was modeled with the assumption of the sell-off of those assets in the case of reduced prices. Based on the stress test results, the bank prepared a regulatory buffer for climate and environmental risks related to market risk as regulated in the Pillar 1 framework.

6.7 Singapore as Active Climate-Related Financial Regulator in the Asia and Pacific Region

The WWF Sustainable Financial Regulations and Central Bank Activities (SUSREG) have been assessing the degree of progress on sustainable financial regulations and central bank activities (WWF 2022). Regarding climate-related financial regulatory performance, 87 indicators were used, ranging from supervisory expectations on climate to enabling an environment that supports regulatory progress. Like the climate scenario analysis, it concluded that Singapore again performed best in Asia and the Pacific by fully satisfying half of SUSREG's climate-related indicators, the largest numbers. Singapore was followed by Malaysia and the Philippines. Figure 6.3 shows climate-related regulations. All the countries have met only around 50% of these indicators fully or partially. Thus, all 11 countries need to improve their climate-related financial regulations.

Figure 6.3: SUSREG Climate-Related Indicators in the Asia and Pacific Region
(%)

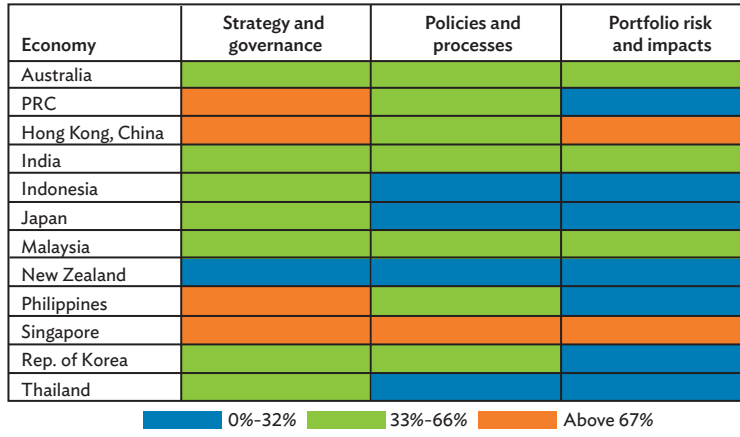


Source: Saphira et al. (2023a).

In addition, the WWF SUSREG framework focuses on the level of a country's climate-related micro-prudential framework that focuses on banks' practices to enhance safety and soundness against climate-related financial risks. The assessment was made for banks in each country by taking into account three aspects: (i) strategy and governance (effective corporate governance, long-term horizon, and climate-related risk management) as suggested by the BCBS guidelines released in June 2022; (ii) policies and processes (ability to understand climate-related financial risks and their drivers and integration of such risks into risk management processes); and (iii) portfolio risks and impacts (comprehension of exposure to climate risks and the extent of negative impacts of those risks, adoption of science-based targets in line with the Paris Agreement). The WWF SUSREG framework then evaluated how well banks in each economy performed with regard to these three aspects (Saphira et al. 2023b).

WWF warned that the region had paid little attention to the capital and liquidity requirements of the Basel Framework. However, Singapore is evaluated relatively highly in terms of sustainable finance regulation and central bank activities (see Chapter 5 with regard to MAS's comprehensive climate-related actions). Figure 6.4, for example, shows that Singapore performed best as it received a high evaluation in the three aspects among the 12 Asian economies. WWF reported

Figure 6.4: Fulfillment of Climate-Related Indicators on Supervisory Expectations on Banks



Source: Saphira et al. (2023b).

Singapore's superior performance was due to the issuance of guidelines covering a comprehensive, detailed set of supervisory expectations for banks on environmental risk management by MAS. The related action by Singapore's Association of Banks, which prepared a list of questionnaires that banks can use vis-à-vis their clients to assess climate risks and mitigate such risks, was also helpful in improving banks' climate-related prudential actions. Singapore was followed by Hong Kong, China; the Philippines; and the PRC.

6.8 Brazil's Adoption of Environmental Criteria to the Capital Requirements

The central bank of Brazil (Banco Central do Brasil) appears to be one of the first central banks in the world that have already integrated social and environmental criteria into prudential regulations. In 2014, the National Monetary Council, the government authority responsible for monetary and credit policy, announced a guidance directive for financial institutions to promote social and environmental responsibility policies. In response to the directive, the Brazilian Federation of Banks developed a taxonomy identifying economic activities that potentially exert large environmental impacts. Subsequently, banks began to report the credit allocation to these sectors voluntarily.

In 2017, the central bank of Brazil (Banco Central do Brasil), the financial regulator responsible for supervising financial institutions and issuing currency, reflected social and environment–related financial risks in the ICAAP of the Basel capital requirements framework. This means that the financial supervisor asked banks to cover social and environmental risks that banks are likely to be exposed to over the next 3 to 5 years within the Pillar 2 framework by conducting their assessment of additional capital above the minimum capital requirement set under the Pillar 1 framework. Miguel, Pedraza, and Ruiz-Ortega (2022) pointed out that only the largest banks were required to conduct the ICAAP practice to assess their additional capital needs, even though all banks in the country were expected to do so based on the risks they incurred. These large banks' size accounted for more than 10% of Brazil's GDP. Indeed, about 10 banks had a good level of understanding about the high-risk corporate counterparties and sectors and thus identified the effects. Although the 2017 regulation did not specify climate-related physical and transition risks, economic activities with substantial GHG emissions were identified as environmentally high-risk activities and sectors in the 2014 taxonomy. This taxonomy was updated in 2020 to reflect climate risks more explicitly.

Miguel, Pedraza, and Ruiz-Ortega (2022) analyzed Brazil's bank lending data and taxonomy of environmentally high-risk sectors to examine the incidence of the 2017 capital requirement regulation on bank credit, companies' economic activities, and GHG emissions. The results found that the new capital requirement contributed to reducing large banks' lending toward environmentally high-risk sectors and shortened the maturity of such loans. However, smaller banks that were not required from the capital requirement regulation and exempt from the ICAAP exercise expanded their lending to high-risk sectors and lengthened the maturity of such loans, resulting in higher credit exposure to climate risks. Overall, a substantial reduction in large banks' lending activities to environmentally high-risk sectors was partially offset by an increase in lending activities by smaller banks to the same sector. The paper warned that financial regulators need to consider the whole financial system to make climate-related prudential regulators more effective. It was also found that the impact of financial regulation in the high-risk sector was more substantial for SMEs with limited access to credit than for large companies, suggesting the adverse impact of prudential regulation on financial inclusion.

In 2020, furthermore, the central bank of Brazil explicitly reflected sustainability in its strategic agenda over five issues—regulation, supervision, policy and instruments, partnerships, and internal actions—with detailed measures (WWF 2022). The central bank also joined the NGFS in 2020. New regulations were published in 2021 on managing social, environmental, and climate (SEC) risks for financial institutions, and a sustainability criterion was included in rural credit by prohibiting lending to companies and agents engaging in illegal SEC practices. Providing rural credit to activities and projects in preservation areas and properties in environmentally embargoed areas and indigenous lands is also prohibited. The Green Bureau for Rural Credit was also established to promote and expand the verification of SEC criteria in financial institutions' financing activities toward rural producers to complement SEC regulations.

The central bank also asked financial institutions to disclose information in line with the TCFD guidelines by first focusing on the Governance, Strategy, and Risk Management pillars in 2021 and, subsequently, the Indicators and Targets pillar by the end of 2023. Within this framework, financial institutions must formulate their SEC responsibility policy concerning their business activities and relationship with stakeholders and disclose related information. The central bank also released the first climate scenario analysis results in 2022 by focusing on borrowers' credit exposure to transition risks and is also working on estimating the impacts of social and environmental

risks in Brazil's economy and financial system. SEC risks and opportunities are also integrated into the central banks' decision-making processes, sustainability actions, and risk management.

6.9 Conclusions and the Way Forward

In recent years, central banks and financial regulators have begun to deepen the understanding that climate change has a major implication on the economy, prices, and financial system, so some actions must be undertaken. The Financial Stability Board (FSB) stressed the need to improve companies' and financial institutions' disclosure with data collection, promote financial institutions to perform climate scenario analysis, and financial authorities to improve their surveillance, as specified in a road map developed in 2021. A consensus is gradually emerging worldwide that central banks and financial regulators should view climate risks as a major financial risk. Central banks generally cope with financial stability through macroprudential policy, while financial regulators focus on micro-prudential policy. More than 30 central banks and financial regulators have started incorporating climate risks into financial stability frameworks by requiring major financial institutions to conduct climate scenario analysis. The analysis is becoming central to helping deepen financial institutions' understanding of climate risks and improving their risk management. This chapter overviewed prudential policy and measures to cope with climate-related financial risks, including climate scenario analysis and/or stress test.

Climate scenarios are provided, for example, by the NGFS. Financial authorities can use them as a reference and adjust to some country- or regional-specific factors. The climate scenarios can be decomposed into (i) Orderly scenarios (Net-Zero scenario and Below 2°C scenario), (ii) Disorderly scenarios (Delayed 2°C scenario and Divergent Net-Zero scenario), and (iii) Hot House World scenarios (Nationally Determined Contributions scenario and Current Policies scenario). Transition risks are higher under the Orderly scenarios, while physical risks are much higher under the Hot House World scenario. The main scenarios are Net-Zero, Delayed 2°C, and Current Policies.

Beyond such analysis, growing discussions have taken place in recent years on how to include climate-related financial risks in the Basel Framework among BOE, the ECB, various EU financial regulators, the BCBS, and BIS. As collecting consistent data from financial institutions (and their corporate counterparties) and refining methodological approaches take time, adopting the Pillar 1 framework (minimum capital requirement) may not become feasible soon. This is because under the Pillar 1 framework, credit risks, for example, are calculated

for a 1-year time horizon based on historical loss experience, and such historical loss data are not available for climate risks. In addition, more forward-looking approaches are necessary when considering climate risks that tend to be amplified over time and are nonlinear. Thus, the Pillar 2 approach is more feasible as capital assessment can be made flexibly using climate scenario analysis and stress tests. Some European banks have begun to examine capital adequacy and place some capital buffers to the Pillar 2 framework in many cases and, to a lesser extent, to the Pillar 1 framework. Moreover, various macroprudential policy tools, including the systemic risk buffer (SyRB) that could cope with climate-related systemic risks as a complement to Pillar 2 framework, could be a potential tool.

The first step to installing more effective climate-related prudential measures for central banks and financial supervisors is to focus more intensively on promoting disclosure of financed GHG emissions (i.e., Scope 3 emission for financial institutions). Doing so requires disclosing GHG data of nonfinancial companies—which are financial institutions' major clients—including Scopes 1, 2, and 3 for nonfinancial companies. While companies need time to collect reliable data, governments and financial regulators should set a clear deadline and make disclosure mandatory in a phased manner according to the company's size. Moreover, requiring companies to set short-, medium-, and long-term emission cut targets as well as transition strategies, together with GHG emission data, is essential to promote a transition of the economy toward carbon neutrality and have effective climate-related risk management both on the nonfinancial and financial sectors. While governments and financial authorities should push for more climate policies and climate-related financial risk management, some progress has been made gradually. These positive trends are unlikely to be reversed, given that global warming is happening much faster than expected. Instead, more countries and financial authorities will take more decisive action toward realizing carbon neutrality in the near future.

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Global Climate Challenges, Innovative Finance, and Green Central Banking

Global Climate Challenges, Innovative Finance, and Green Central Banking provides a comprehensive and timely analysis of key trends in climate finance, blended finance, debt-for-climate swaps, and green monetary policies and financial supervision.

The book first explores corporate management reforms for promoting sustainable business models that address global environmental, social, and governance imperatives, as well as the banking sector's critical role in encouraging these practices among small and medium-sized enterprises.

It then discusses climate finance in developing countries, including blended finance schemes to attract private capital for climate and environmental projects. It also examines debt-for-nature conservation swaps for addressing debt challenges faced by low-income countries, which are often intertwined with climate vulnerabilities.

The book concludes by spotlighting central banks and financial regulators' climate-related practices. It examines the mandates and potential actions of central banks, such as disclosure of climate risks on banks' balance sheets and operations and climate-focused monetary policy. It further notes financial authorities' increasing integration of climate risks into their prudential policies and ongoing discussions on incorporating these risks into the regulation of capital adequacy requirements.

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The Asian Development Bank Institute (ADBI) is the Tokyo-based think tank of the Asian Development Bank. ADBI provides demand-driven policy research, capacity building and training, and outreach to help developing countries in Asia and the Pacific practically address sustainability challenges, accelerate socioeconomic change, and realize more robust, inclusive, and sustainable growth.

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