

INTERNATIONAL FINANCE FORUM (IFF)

GLOBAL FINANCE AND DEVELOPMENT REPORT 2021

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Global economic outlook, risks and policy priorities
Global green finance development index and country rankings
Roadmap to global carbon neutrality and China's actions

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Room 1101, No. 35 Jinshifang Street, Xicheng District, Beijing 100033, China
Contact number: +86 10 5087 3634
Web address: www.iff.org.cn

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Foreword

In 2021, the global economy has pulled off a strong recovery from last year's deep recession caused by the COVID-19 pandemic. The rebound has been supported by the successful development of the vaccines and their roll-out across the world, more effective measures to contain outbreaks, and continued fiscal stimulus and monetary accommodation. Despite the encouraging progress, however, the pace of recovery remains highly uneven across countries. Global vaccination roll-out faces many hurdles, and the pandemic continues to pose risks to people's health and livelihood, and to the economy. Inflation is looming in many parts of the world. Trade tensions between major economies have continued to cloud the global outlook. And the pandemic will leave scars on social and human development worldwide for many years to come. Addressing all these challenges requires continued and closer international cooperation.

In addition to strong global recovery, the world has also made encouraging progress in forming policy actions against climate change. On 14 November in Glasgow, United Kingdom, leaders from nearly 200 nations reaffirmed their commitment to the Paris Agreement on Climate Change and agreed on several key implementation issues including carbon market mechanisms, reducing fossil fuel subsidies, phasing down coal, and ending deforestation. As emission reduction commitments under nationally-determined contributions are way below the levels need to achieve the global climate goal set by the Paris Agreement, the leaders called for more drastic actions.

To strengthen continuous tracking and research on major global issues, with a view to promoting economic recovery and sustainable development and enhancing the role of financial services, starting from this year, the International Finance Forum (IFF) is to produce the Global Finance and Development Report (GFDR). The IFF GFDR aims to provide an annual assessment of global economic trends and prospects, financial development and innovation, and long-term challenges and policy issues based on cross-country data. It will be launched at the IFF Global Annual Meeting.

The inaugural issue of IFF GFDR contains three chapters. Chapter 1, Global Economic Outlook, provides the latest updates on the COVID-19 pandemic and recent global economic development, and assesses the economic outlook, risks, and policy priorities. The report calls for the global community to work together to speed up the vaccination rollout and eliminate vaccine divide, ensure a smooth monetary policy transition, end trade tensions, promote green recovery, and support low-income countries.

Chapter 2 focuses on recent global developments of green finance, a key part of policy actions to address climate change. In this chapter, the IFF launches the Global Green Finance Development Index (GGFDI) along with country rankings. The GGFDI is jointly developed by the IFF and the Central University

of Finance and Economics in China. It is a quantitative measure of progress in developing green finance at the country level and focuses on three areas, policy and strategy, product and market, and international cooperation. The GGFDI provides rankings in green finance development of the world's 55 largest economies as of the end of 2020.

Chapter 3 provides an overview of the latest understanding on the actions needed to meet the Paris Agreement climate goal, and of selected studies on how China can contribute to the global actions and peak carbon emissions before 2030 and achieve carbon neutrality before 2060. It reviews the latest assessments on the required energy and industrial transformations, investments, and policy measures to achieve the 2°C and 1.5°C targets, based on various reports of the Inter-governmental Panel on Climate Change (IPCC) and International Energy Agency (IEA). The chapter also surveys selected studies on the technical options available and discusses policy actions needed for China to achieve its dual carbon goals.

The IFF is an independent, non-profit, non-governmental international organization founded in Beijing in October 2003, established by financial leaders from more than 20 countries, regions and international organizations including China, the United States, the European Union, and the United Nations. IFF is a long-standing, high-level platform for dialogue and communication, as well as a research network in the financial realm, and has been upgraded to F20 (Finance 20) status. It strives to build the Finance 20 forums through joint efforts. IFF has continuously demonstrated its commitment to be a driving force in economic recovery and prosperity. It will continue to serve as a platform for exchanges among financial and economic leaders and play the role of a strategic think tank for financial diplomacy.

It is hoped that the data and analysis in this report will contribute to global discussions on policies needed to end the pandemic, reduce risks to the global economic recovery, promote green investment and fight against climate change, and make development more inclusive and sustainable.

ZHANG Jizhong
Founding Secretary-General and CEO
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WANG Yi
IFF Academic Committee Member
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ZHANG Jizhong
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ZHOU Yanli
Member of the CPPCC National Committee
Former Vice Chairman of the China Banking and Insurance Regulatory Commission

ZHU Xian
Vice President and Secretary General of IFF
Former Vice President, World Bank
Former Vice President & Chief Operations Officer, New Development Bank

ZHUANG Juzhong
IFF Chief Economist, Former Deputy Chief Economist of Asian Development Bank

Production team

Leader

ZHUANG Juzhong

IFF Chief Economist, Former Deputy Chief Economist of Asian Development Bank

Advisors

TANG Dingding

IFF Academic Committee Member
Former Chairman of Compliance Review Panel at Asian Development Bank

ZHU Xian

Vice President and Secretary-General of IFF
Former Vice President, World Bank
Former Vice President, New Development Bank

LIN Jianhai

IFF Vice President and Director of IFF Global Center
Former Secretary General of the International Monetary Fund

ZHANG Jizhong

Founding Secretary-General of IFF
CEO, Director of the Executive Committee of IFF

Core members

WANG Yao

Professor and Director-General of International Institute of Green Finance (IIGF), Central University of Finance and Economics, China

CHAI Qimin

Director of Strategic Planning and Research Department, National Center for Climate Change Strategy and International Cooperation, China

MAO Qian

Director of International Cooperation Department, IIGF, Central University of Finance and Economics, China

TOLENTINO Jade

Consultant of IFF

Other members

Joanna ZHUANG

Deputy Secretary-General of IFF

SHEN Gang

Media Center Director of IFF

NIE Yanpeng

Green Finance Expert of IFF

LI Zhen

Deputy Director of Green Finance Research Center, IIGF, Central University of Finance and Economics, China

GONG Gang

Professor and Dean of Institute of Financial Research (IFR), Yunnan University of Finance and Economics, China

LIN Han

Research Assistant, IIGF, Central University of Finance and Economics, China

WANG Xuesong

PhD student, IFR, Yunnan University of Finance and Economics, China

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ZHUANG Juzhong
Leader of the production team
Chief Economist
International Finance Forum (IFF)

Definitions and assumptions

The use of country groupings in this report is based on geographical regions, income, membership in international forums or economic unions, or other international conventions, following the classifications of the World Bank, the International Monetary Fund (IMF), the Asian Development Bank (ADB), or other international organizations.

European Union (EU) includes Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, and Sweden.

Euro area includes Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Portugal, Slovak Republic, Slovenia, and Spain.

Group of 20 (G20) economies are composed of Argentina, Australia, Brazil, Canada, China, the EU, France, Germany, India, Indonesia, Italy, Japan, Mexico, Russia, Saudi Arabia, South Africa, South Korea, Turkey, the United Kingdom, and the United States.

BRICS refers to Brazil, China, India, Russia, and South Africa.

Belt and Road Initiative (BRI) economies include the 139 members of the Belt and Road Initiative.

Developing Asia comprises the 46 developing member economies of ADB, which are further grouped into Central Asia (Armenia, Azerbaijan, Georgia, Kazakhstan, the Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan), East Asia (Hong Kong Special Administrative Region (SAR)) ; Mongolia; China; South Korea; and Taiwan, China), South Asia (Afghanistan, Bangladesh, Bhutan, India,

Maldives, Nepal, Pakistan, and Sri Lanka), Southeast Asia (Brunei, Cambodia, Indonesia, the Lao People's Democratic Republic, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam), and the Pacific (Cook Islands, the Federated States of Micronesia, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Timor-Leste, Tonga, Tuvalu, and Vanuatu).

Asia and the Pacific is Developing Asia plus Japan, Australia, and New Zealand.

ASEAN-5 is composed of selected five countries of the Association of Southeast Asian Nations (ASEAN), including Indonesia, Malaysia, Philippines, Thailand, and Vietnam.

High-income Asian economies includes Australia; Hong Kong SAR; Japan; South Korea; Macao SAR; New Zealand; Singapore; and Taiwan, China.

Latin America and the Caribbean, Middle East and North Africa, Sub-Saharan Africa, and the Organization for Economic Co-operation and Development follow the World Bank country groupings.

The symbol "\$" and the word "dollar" refer to United States dollars.

For ease of statistical reporting, the economies are divided between advanced economies and developing economies, following the IMF groupings. Developing economies include both emerging markets and developing economies.

Country coverage of regional groupings in figures, tables, and boxes may vary according to data availability. Data are as of early November 2021.

Abbreviations and acronyms

ACGF	ASEAN Catalytic Green Finance Facility
ADB	Asian Development Bank
AE	advanced economies
AfDB	African Development Bank
AfDF	African Development Fund
AIIB	Asian Infrastructure Investment Bank
aop	average of period
AP	Asia and the Pacific
ASEAN	Association of Southeast Asian Nations
AUM	assets under management
BECCS	Bioenergy with Carbon Capture and Storage
BOK	Bank of Korea
BRICS	Brazil, China, India, Russia, and South Africa
CAF	Development Bank of Latin America
CBI	Climate Bonds Initiative
CCF	China Carbon Forum
CCUS	Carbon Capture, Use, and Storage
CDC	Centers for Disease Control and Prevention
CEB	Council of Europe Development Bank
CIF	Climate Investment Funds
CO ₂	carbon dioxide
COP	Conference of the Parties
COVID-19	coronavirus disease
CPI	consumer price index
CUFE	Central University of Finance and Economics
D&T	development and transfer
EBRD	European Bank for Reconstruction and Development
ECB	European Central Bank
EFC	Energy Foundation China
EIB	European Investment Bank
EM	emerging market
eop	end of period
EPs	Equator Principles
ERICSG	Energy Research Institute of China State Grid
ESG	environmental, social, and governance
ETS	emissions trading system
EU	European Union
FDI	foreign direct investment
FED	Federal Reserve
FSB	Financial Stability Board
G20	Group of 20 economies
GABV	Global Alliance for Banking on Values
GACC	General Administration of Customs of People's Republic of China
GCF	Green Climate Fund
GDP	gross domestic product
GEF	Global Environment Facility
GFSG	Green Finance Study Group
GGFDI	Global Green Finance Development Index
GHG	greenhouse gas
GIP	Green Investment Principles
GSIA	Global Sustainable Investment Alliance
GW	gigawatt
H1	the first half of the year
IBRD	International Bank for Reconstruction and Development
ICCSA	Institute of Climate Change and Sustainable Development
IDB	Inter-American Development Bank
IDFC	International Development Finance Club
IEA	International Energy Agency
IFC	International Finance Corporation
IFF	International Finance Forum

IIF	Institute of International Finance
IIGF	International Institute of the Green Finance
ILO	International Labour Organization
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
IPSF	International Platform on Sustainable Finance
JBIC	Japan Bank for International Cooperation
L&D	loss and damage
LA	Latin America and Caribbean
LDC	least developed countries
LDCF	Least Developed Country Fund
MDBs	multilateral development banks
METI	Ministry of Economic, Trade, and Industry
MIGA	Multilateral Investment Guarantee Agency
MN	Middle East and North Africa
MOE	Ministry of Environment
MOFA	Ministry of Foreign Affairs
MRV	monitoring, reporting, and verification
MSME	micro-, small-, and medium-sized enterprises
NA	North America
NDCs	Nationally Determined Contributions
NDF	Nordic Development Fund
NDRC	National Development and Reform Commission
NGFS	Central Banks and Supervisors Network for Greening the Financial System
OBPS	Output-Based Pricing System
OECD	Organization for Economic Co-operation and Development
PEPP	pandemic emergency purchase program
PIDG	Private Infrastructure Development Group
PPP	Purchasing Power Parity
PRA	Prudential Regulation Authority
PRI	Principles for Responsible Investment
PV	photovoltaic
QE	quantitative easing
s.a.	seasonally adjusted
SA	Sub-Saharan Africa
SBN	Sustainable Banking Network
SCCF	Special Climate Change Fund
SCMP	South China Morning Post
SDG	Sustainable Development Goal
SFSG	Sustainable Finance Study Group
SIDS	Small Island Developing States
SIF	Sustainable Insurance Forum
SRI	Socially Responsible Investing
SSE Initiative	Sustainable Stock Exchanges Initiative
SSP	Shared Socioeconomic Pathways
TCE	tons of coal equivalents
TCFD	Task Force for Climate-Related Financial Disclosures
UK	United Kingdom
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNEP	United Nations Environment Programme
UNEP FI	UNEP Finance Initiative
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
WEO	World Economic Outlook
WHO	World Health Organization
WRI	World Resources Institute
WTO	World Tourism Organization
y-o-y	year-on-year

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Highlights

While the world continues to grapple with the COVID-19 pandemic, the global economy staged a strong rebound in the first half of 2021. The rebound has been supported by expanding coverage of vaccination, more effective measures to contain the outbreaks, and continued fiscal stimulus and monetary accommodation. Despite outbreaks of the more contagious Delta variant of the virus in many parts of the world, the global recovery remains on track—even as the growth momentum has softened in the second half of this year and the pace of recovery has continued to vary across countries. Chapter 1 of this report looks at the global economic outlook. The global economy is forecast to grow 5.9% in 2021 and 4.7% in 2022. The strong recovery has caused prices to rise in many countries. The global consumer price inflation is projected to reach 4.5% this year, and to moderate to 3.8% in 2022, as demand-supply gaps narrow.

There are several downside risks to this outlook. Slower-than-expected vaccine rollout, especially in the developing world, and more virus mutations could lead to resurgences of outbreaks worldwide, causing governments to reimpose strict containment measures and slowing down growth. Higher and more persistent inflation could prompt abrupt adjustments in the direction of monetary policy in advanced countries, leading to large asset price corrections and macroeconomic instability and, in many developing countries, capital outflows and currency market volatility, disrupting the recovery process. Last but not the least, geopolitical tensions, including frictions between the United States (US) and China over trade, technology and other fronts, continue to be a concern with negative implications for global recovery.

The pandemic will leave lasting scars in social and human development worldwide. It has disrupted the global fight against extreme poverty and increased income inequality, as poor and low-income households are more vulnerable to health shocks. The pandemic has also led to reduced spending on education and delayed investment in greening the economy in many countries, as resources were diverted to responding to the pandemic. Rising unemployment has caused erosion of the human capital of the unemployed.

All these can significantly slow down the global progress towards meeting the Sustainable Development Goals (SDGs) and make the implementation of the Paris Agreement on Climate Change more challenging. This report features two special studies examining these longer-term development issues.

Achieving the Paris Agreement climate target and SDGs requires substantial investment in green infrastructure and technologies. Green finance, which mobilizes private and public resources for green investment, has grown rapidly in recent years. Chapter 2 of this report reviews recent development of green finance and develops a global green finance development index (GGFDI) to measure country performance. The GGFDI focuses on three areas: policy and strategy, product and market, and international cooperation. It ranks France the first among the 55 world's largest economies. The other economies in the top 10 list include, in the order of ranking, the United Kingdom (UK), Germany, China, Netherlands, Japan, Sweden, Denmark, Spain and the US.

Despite the encouraging progress, green finance development faces many challenges. These include uneven development across countries, limited diversity in products and services, lack of consistency in green finance definitions and disclosure standards, and the negative impact of the COVID-19 pandemic. To address these challenges, the report calls for continued policy support, more financial innovations to develop diversified green finance products and services, and greater harmonization of green finance definitions and disclosure standards within and across countries. It also calls for closer international cooperation, especially in harmonizing definitions and standards, promoting sound investment principles and practices, developing human capital and building capacity, facilitating climate-related financial flows to low-income and vulnerable countries, and improving green finance statistics and data collection.

The recent 26th Conference of Parties (COP26) of the United Nations Framework of Climate Change Convention (UNFCCC) in Glasgow, UK calls for more ambitious and urgent actions to limit the global temperature rise below 1.5°C above pre-industrial levels and to achieve carbon neutrality by the mid-century. China has recently announced that it will strive to peak CO₂ emissions before

2030 and achieve carbon neutrality before 2060 (the dual carbon goals). Chapter 3 of this report provides an overview of the latest understanding on the global actions needed to meet the Paris Agreement climate target and how China can contribute to the global actions and achieve its dual carbon goals.

Global economic outlook

Update on the COVID-19 pandemic

- The COVID-19 pandemic, so far having caused more than 250 million infections and over 5 million deaths globally, has continued to pose a significant risk to the world. The emergence of the more contagious Delta variant of the virus led to another wave of infections in recent months. There are, however, large variations in how the pandemic has evolved over time across countries. As of early November 2021, the number of daily new infections per million population was the highest in Europe at 312, followed by North America at 188, Middle East and North Africa at 87, Latin America and Caribbean at 37, Asia and the Pacific at 12, and Sub-Saharan Africa at 3.
- The successful development of COVID-19 vaccines had earlier raised the hope that the pandemic will soon come to an end. But the emergence of the Delta variant has caused concerns over their efficacy. However, emerging evidence suggests that the vaccines remain highly effective in protecting against severe infections, hospitalization, and deaths even in cases of the Delta variant. They are also effective in preventing infections. There has also been positive news on the development of the medicine to treat COVID-19 infections lately.
- While vaccination remains the most effective way to live through the pandemic, the global vaccine roll-out has faced many hurdles. By early November 2021, only 40% of the global population had been fully vaccinated. While the figure was 60% in North America and 56% in Europe, it was only 50% in Latin America and Caribbean, 45% in Asia and the Pacific, 30% in Middle East and North Africa, and less than 4% in Sub-Saharan Africa. The unequal access to the vaccines between developed and developing world, or the so-called vaccine divide, has raised concerns that it is leading to a multi-speed economic recovery.

Recent economic developments

- Global economy staged a strong rebound in the first half of 2021, with the combined gross domestic product (GDP) of the Group of 20 (G20) countries, representing 80% of the world economy, growing 7.7% compared with the same period last year. However, growth is highly uneven across countries, reflecting a combination of factors, including the extent of GDP contraction in 2020 (the base effect), the evolving situation of the pandemic and stringency of containment measures, the speed of rolling-out of vaccination programs, and the rigor of fiscal and monetary stimulus.
- While global recovery is on track, growth momentum has softened somewhat in the second half of this year. The resurgence of the new infections related to the Delta variant has had marked impacts on consumer sentiment and business confidence. At the same time, the supply chain disruptions worldwide due to bottlenecks in the production system caused by the pandemic, ranging from labor shortages, port congestions, and backlogs in the supply of parts and components, have started to constrain growth.
- As the economy rebounds, inflation is on the rise in a large part of the world. Global headline consumer price inflation rate rose from 2.2% in January 2021 to 4.6% in September. Rising inflation has been driven by a number of factors, including surging commodity prices, supply chains bottlenecks, large fiscal stimuli and monetary accommodation, especially in the advanced countries, and currency depreciations in some developing economies.
- Recovery of GDP growth has led to recovery of trade, which in turn supported GDP growth. The value of global merchandise exports grew 30.1% in the first 8 months of 2021—38.3% for developing economies and 26.1% for advanced countries. China continued to be the world's largest trading nation accounting for 18.1% of the global merchandise trade value in the first 8 months, followed by the US accounting for 13.4%, Germany 9%, Japan 4.5%, and France 3.8%.
- Economic recovery and stimulus measures have helped keep global financial markets broadly stable. Stock markets have been buoyant in many countries. Capital flows to

emerging markets have been strong, with net portfolio flows reaching \$224 billion in the first 9 months of 2021, 9 times higher compared with the same period last year, and net foreign direct investment flows amounting to \$230 billion in the first 6 months, growing 22%. But several emerging market currencies, especially Argentina, Turkey, and Brazil, depreciated against the US dollar.

Update on fiscal and monetary policies

- In 2020, governments around the world introduced massive fiscal and monetary policy measures to support the health sector and protect businesses, jobs, and low-income households. At the same time, historically low interest rates were combined with massive quantitative easing programs. In 2021, countries around the world have continued to provide fiscal stimuli and monetary accommodation, although with a less extent. For the G20 countries, the cumulative contribution to GDP of the key fiscal measures—additional spending and tax cuts—over two years is estimated to be 14% of their combined 2020 GDP.
- Multilateral financial institutions have played an important role in forming global responses to COVID-19. By August 2021, the IMF and eight multilateral development banks (the African Development Bank, the Asian Development Bank, the Asian Infrastructure Investment Bank, the European Bank for Reconstruction and Development, the Inter-American Development Bank, the Islamic Development Bank, the New Development Bank, and the World Bank) have committed close to \$500 billion in total for pandemic-related assistance to developing countries, with more than \$330 billion having been disbursed.
- While the stimulus measures have prevented the economy from deeper recessions, they have also raised concerns over increased financial vulnerability. Fiscal support has led to record fiscal deficits and public sector debt in many countries. Quantitative easing has ballooned central bank assets in major advanced economies, injected massive liquidity into markets, and inflated asset prices. These measures have also contributed to rising consumer price inflation in many countries.

Outlook, risks, and policy priorities

- Despite moderation in momentum, global recovery is on track. The consensus view is that the global economy will grow about 5.9% this year. Advanced economies will grow 5.2%, contributing 37% of global growth, and developing economies will expand 6.4%, contributing 63%. Across regions, developing Asia will contribute 42.5%, North America 17.8%, the EU 12.7%, Latin America and Caribbean 7.5%, Middle East and North Africa 6.9%, high income Asia 5.5%, developing Europe 4.2%, and Sub-Saharan Africa 1.9%. Across countries, China will remain the largest contributor to global growth at 26.3%, followed by the US at 16.7%, and India at 11%.
- Global recovery is set to continue in 2022. Countries that are more advanced in vaccinating their population will be able to further relax social distancing measures as full or near-full vaccination is achieved. Fiscal and monetary policies will continue to support recovery—although the strength of support will be reduced due to the concerns over fiscal sustainability and inflationary pressures. With waning base effect, the global economy is seen to expand 4.7% in 2022, with the advanced economies combined expanding 4.2% and developing economies together growing 5%.
- The size of the global economy should return to its pre-pandemic level by 2021. While the global economy is expected to recover to its pre-pandemic *trend* level by 2025 and the advanced economies combined is expected to do so by 2023, the gaps will not be eliminated any time soon for developing economies as a group.
- Inflationary pressures are expected to remain elevated in a large part of the world, but ease somewhat in 2022. The consensus view is that global consumer price inflation is to rise from 3.5% in 2020 to 4.5% this year—from 0.7% to 2.7% for the advanced economies and from 5.1% to 5.5% for developing economies. In 2022, with easing supply bottlenecks, more stable commodity prices, and reduced fiscal and monetary stimuli, global inflation is projected to taper off to 3.8%—from 2.7% to 2.2% for the advanced economies and from 5.5% to 4.9% for developing economies.
- There are, however, several downside risks to this outlook. The biggest risk is resurgences

of the COVID-19 outbreaks in a large scale, due to slow progress in vaccination rolling out or emergence of new variants of the virus. Another risk is macroeconomic and financial instability. Higher and more persistent inflation could trigger abrupt adjustments to monetary policy in advanced economies, causing large corrections in asset prices, capital outflows from emerging markets, and exchange rate volatility. A further risk is an escalation in geopolitical tensions. All these could disrupt the recovery.

- The pandemic will leave lasting scars in social and human development worldwide. The pandemic has stalled progress in poverty reduction and increased income inequality as low-income households are more vulnerable to health shocks. It has also led to reduced spending on education, erosion of the human capital of the unemployed, and delayed investment in greening the economy in many countries. All these will significantly slow down the global progress towards achieving the SDGs, and make the implementation of the Paris Agreement more challenging.
- Going forward, policy priorities will depend on country circumstance. But at the global level, the following priorities, which require multilateral efforts, will go a long way towards ending the pandemic, reducing risks to the global recovery, and sustaining inclusive and sustainable growth: (i) speeding up the vaccination rollout and eliminating vaccine divide; (ii) ensuring smooth monetary policy transition; (iii) ending trade tensions; (iv) promoting green recovery; and (v) supporting low-income and lower-middle-income countries.

Global green finance development index and country rankings

Recent global development of green finance

- *Financing needs of green growth.* The adoption of the SDGs and the Paris Agreement on Climate Change in 2015 represent two major milestones for global action towards sustainable development. The SDGs aim to improve people's lives, eradicate poverty, protect the environment, and fight against climate change. The Paris Agreement sets a concrete climate goal for the world — limiting the global

temperature rise well below 2°C above the pre-industrial levels and pursuing efforts to limit it to 1.5°C.

- Implementing the SDGs and the Paris Agreement requires a rapid transition to a green growth path and substantial investment in green and low-carbon infrastructure and technologies. The funding requirement for achieving the SDGs is estimated at \$3.9 trillion annually from 2015 to 2030 or 11% of the projected developing countries' combined GDP. Global energy investment needs, consistent with the 1.5°C pathway, are estimated at \$3.26 trillion per annum or 2.4% of the projected global GDP during 2016-2050. Such large-scale investments require both public resources and private capital.
- *What is green finance and why it is important.* Green finance refers to financial services that support private and public financial flows toward activities that mitigate and adapt to climate change, protect the environment, ecosystem and biodiversity, and improve the efficiency of resources utilization. Green finance products range from green bonds, loans, equities, investment funds, guarantees, and carbon credits to green insurance, leasing, and financial derivatives. It also covers bilateral and multilateral climate-related financial flows to developing countries.
- Investments in green infrastructure and technologies require long-term finance, are subject to significant risks, and have high social benefits but low financial returns. Short-term profit-focused traditional finance often leads to underinvestment in green projects. Through policy interventions, developing green finance helps to channel private capital to green investment. Green finance instruments also provide new asset classes to cater to the needs of different investor groups, whether looking for long-term, socially responsible or new investment opportunities, or for diversifying risks. Furthermore, green finance helps reduce climate-related systemic risks pertaining to the financial sector.
- Before the 1990s, green finance was largely driven by socially responsible investing (SRI). From the 1990s, climate change became a critical global issue and climate finance entered into international policy discussions, leading to several multilateral climate funding mechanisms

being set up to support climate actions in developing countries, while SRI was broadened to cover environmental, social, and governance concerns as a wealth management approach. Since 2015, the adoption of the SDGs and the Paris Agreement led to the proliferation of green finance worldwide.

- *Recent data on green finance.* Comprehensive data on green finance in its entirety are not yet available and hence it is difficult to estimate its overall size globally. However, a number of studies and sources have collected data on several key components of green finance, providing insights into their magnitude and growth dynamics.
 - o According to the Climate Bond Initiative (CBI), global green bond issuances grew 46% annually since 2014 and reached \$1.047 trillion cumulatively as of 2020, with the private sector accounting for 56%, public sector 30% and development banks (mostly MDBs) 14%. In 2021, the issuance of global green bonds has continued to grow strongly, reaching a total of \$350 billion in the first nine months.
 - o According to the OECD data, bilateral and multilateral climate-related financial flows to developing countries attributed to developed countries, including private finance mobilized by these flows, increased from \$58.5 billion in 2016 to \$79 billion in 2018, but are still short of the \$100 billion per annum committed by the developed nations. South-South climate financial flows have also grown strongly in recent years.
 - o According to the World Bank data, the total revenue generated from emission permit auctions worldwide, covering 29 regional, national and sub-national emission trading systems that have been implemented, increased from \$0.23 billion in 2008 to \$25.5 billion in 2020, reaching a cumulative \$103 billion by the end of 2020. Most of these revenues have been used for investment in climate mitigation projects.
 - o Environment, social, and governance (ESG) investing provides a major source of green finance too. According to the Global Sustainable Alliance data, at the start of 2020, total global sustainable investment was estimated at \$35.3 trillion in five major markets (the US, Canada, Europe, Japan,

and Australia and New Zealand), accounting for 35.9% of total assets under management by asset managers and institutional investors in the five markets.

- o Publicly available cross-country data on green loans are not available. However, the People's Bank of China has been collecting and publishing data on green loans extended by financial institutions in China since 2013. According to this data, China's outstanding green loans reached about \$2 trillion in the first quarter of 2021.
- *Policy support for green finance.* In many countries where green finance has grown strongly, governments have made strong efforts to put in place a comprehensive green finance policy framework, with key elements including national policies and strategies for green growth and sustainable development; green finance strategies, green taxonomy and project catalogs; green finance support programs; development of market infrastructure and services; and international cooperation.
- *International cooperation in green finance.* International cooperation has played a critical role in developing green finance. It has taken different forms, including financial transfers, knowledge sharing, multilateral policy and regulatory cooperation, and cooperation among market participants promoting sound investment principles and peer-to-peer learning.

Global green finance development index and country rankings

- The global green finance development index (GGFDI), jointly developed by the International Finance Forum (IFF) and the International Institute of Green Finance (IIGF) of Central University of Finance and Economics (CUFE) in China and presented in this report, is a quantitative measure of progress in developing green finance at the country level. Focusing on three areas—policy and strategy, product and market, and international cooperation, it aims to provide consistent information on the global development of green finance. The key results of GGFDI 2021, covering the world's 55 largest economies, are summarized below.
 - o France is ranked the first among the 55 countries by the GGFDI score. The other

countries in the top 10 list include, in the order of ranking, the UK, Germany, China, Netherlands, Japan, Sweden, Denmark, Spain and the US. With the exception of the US, these countries have high ranks in all the three focal areas: policy and strategy, product and market, and international cooperation.

- o Those ranked above the median are mostly advanced countries with a relatively mature financial system. But several emerging markets also score high. Apart from China which is ranked 4th in GGFDI score, Mexico is ranked 15th, Chile 17th, and Brazil 21st. Several developed countries are ranked below the median, including Canada, New Zealand, Greece and Australia.
- o There are notable differences between rankings in GGFDI and its three components. In policy and strategy, the top 10 list includes, in the order of ranking, the UK, France, China, Hungary, Japan, Portugal, Brazil, South Korea, Netherlands, and Denmark. In product and market, the top 10 list includes France, Germany, Netherlands, the US, Denmark, the UK, Sweden, China, Austria, and Spain. In international cooperation, the top 10 list includes Japan, France, Germany, the UK, China, Spain, Brazil, Mexico, Norway and Canada.
- o Among the G20 countries, the top performers in GGFDI include France, the UK, Germany, China and Japan with more or less equally high ranks in the three focal areas. The middle group includes the US, Italy, Mexico, South Korea, Brazil, Canada, and South Africa, with notable differences in the approach to green finance among them. The third group with low scores among G20 countries includes India, Indonesia, Russia, Argentina, Australia, Turkey, and Saudi Arabia. But some countries in this group are ranked higher in policy and strategy, such as Russia, Argentina, and Indonesia.
- o Overall, GGFDI results show that the development of green finance is very uneven across countries. The average score of GGFDI is 50 for the 55 countries. It is 62.1 for the developed countries and 39.2 for developing economies. Across the region, the average score is the highest for Europe at 63.6, followed by North America at 61.7,

Latin America at 53.8, Asia and the Pacific at 47.1, Africa at 41.4, and the Middle East at 20.6.

- o Cross-country differences are the smallest in the scores for policy and strategy and the largest for product and market. These suggest that even in countries that are ranked low in GGFDI, governments are making policy efforts, and in these countries, the development of green finance is partly constrained by their less developed financial sector and capital markets. Thus, developing green finance requires not only strong policy support, but also financial and capital market reforms.

Fostering green finance for sustainable development

- Despite the encouraging progress, the review and results of GGFDI point to a number of issues and challenges in global green finance development. These include (i) uneven development across countries; (ii) limited diversity in products and services; (iii) lack of consistency in green finance definitions and disclosure standards; and (iv) the negative impact of the COVID-19 pandemic.
- Addressing these issues and challenges requires continued policy efforts to incentivize more actions. Policy priorities are many and likely depend on country circumstances. This report highlights the following:
 - o *Putting in place an effective policy framework for supporting green finance.* Countries where green finance is better developed mostly have a relatively comprehensive green finance policy framework. Such a policy framework often has two elements: (i) a long-term national strategy for sustainable development to lay the foundation for green finance and its sustained growth; and (ii) a green finance strategy and action plans.
 - o *Promoting financial innovation to develop more diversified green finance products and services.* Diversified products and services can cater to varying needs of large and small firms, different investor groups, and households. This study finds that a country's green finance development is often related

to the maturity of its financial system. Thus, developing green finance also requires continued reforms to make the financial system more open, liquid and efficient.

- o *Promoting harmonization in green finance definitions and disclosure standards.* Given the differences in the level of development and financial systems across countries, globally uniform green finance definitions and disclosure standards may not be practical. A gradual and more feasible approach is to focus on harmonization at a regional level or among countries with similar circumstances initially, while encouraging countries to move towards adopting global definitions and standards.
- o *Strengthening international cooperation in developing green finance.* International cooperation can play an important role in (i) harmonization of green finance definitions and disclosure standards; (ii) promotion of sound investment principles and practices; (iii) developing human capital and building capacity; (iv) facilitating climate-related financial flows to low income and vulnerable countries; and (v) improving green finance statistics and data collection.

Roadmap to global carbon neutrality and China's climate actions

Achieving global carbon neutrality

- The latest Intergovernmental Panel on Climate Change (IPCC) report provides unequivocal evidence that the widespread use of fossil fuels, large scale changes in land-use, and deforestation have led to a rapid increase of greenhouse gases (GHG) in the atmosphere and global warming of about 1.1°C from pre-industrial levels. COP26 in Glasgow renewed the call for more ambitious and urgent global climate actions.
- The adoption of the Paris Agreement on climate change in 2015 is a major milestone in global climate actions. It set a global climate goal to avoid the catastrophic impacts of climate change. It also put in place a “bottom-up” implementation mechanism based on “Nationally Determined Contributions (NDCs).”
- Keeping global warming below 2°C requires global anthropogenic carbon dioxide emissions to reach net-zero around 2070, and limiting it to 1.5°C implies targeting net-zero emissions by 2050. By September 2021, 136 countries covering 75% of the global GHG emissions have formally adopted, announced, or are considering a concrete target date to achieve carbon neutrality—despite the emission reduction commitments made so far under the NDCs globally are way below the levels consistent with the Paris Agreement climate goal.
- Achieving the Paris Agreement climate goal requires rapid, far-reaching, and unprecedented transformations in energy and industrial systems, infrastructure, and land use globally, supported by carbon capture, use, and storage (CCUS) technologies. For the energy sector, the required transformations involve significantly increasing the share of low-carbon energy, decarbonizing the power sector, and demand side management.
- Implementing these transformations requires large investments in low-carbon energy systems and technologies. Equally important is strong policy support. Countries around the world have used a variety of policies to support climate mitigation, including regulatory measures, carbon pricing and trading, measures that encourage climate action by the entire society, and international cooperation.

China's climate actions

- China has recently announced that it will strive to peak CO₂ emissions before 2030 and achieve carbon neutrality before 2060 (the dual carbon goals). China has implemented a variety of climate actions in recent decades, including conserving energy, improving energy efficiency, investing in renewables, and piloting emissions trading, and it has recently launched a national emission trading system.
- China's CO₂ emissions per unit of GDP fell by 48.4% during 2005-2020, more than its international commitment of 40-45% reduction. In 2020, non-fossil fuels accounted for 15.9% of the primary energy consumption, while renewables and nuclear energy together accounted for more than 32% of the power generation. China is now a world leader in

installed solar and wind power capacities and in growing forests.

- Independent studies have shown that, to meet the dual carbon goals, China will need to significantly transform its energy system, including energy conservation and efficiency improvement, decarbonization of the power sector, electrification of end-use sectors, and carbon sequestration, such that:
 - By 2030, in primary energy consumption, coal is reduced to 2.3-2.9 billion ton of coal equivalent (TCE) or 41-50% and non-fossil energy is increased to 26-31%. In power generation, non-fossil energy is increased to 49-56% and renewables to 40-45%, while coal is reduced to 40-50%.
 - By 2050, in primary energy consumption, coal is reduced to 0.3-1.0 billion TCE or 5-18% and non-fossil energy is increased to 59-85%. In power generation, non-fossil energy is increased to 81-90% and renewables to 70-81%, and coal is reduced to 8-12%, with residual fossil energy mostly combined with CCUS. Meanwhile, the electrification rate in end-use sectors reaches 50-65%.
- These technical solutions will have to be supported by strong policy actions. At a broad level, continued structural transformation—by shifting resources from labor-intensive production to technology- and knowledge-intensive production and developing new and high-tech industries and modern services—will go a long way towards controlling energy demand, reducing carbon emissions and achieving the dual carbon goals.
- This development strategy needs to be implemented in tandem with policy actions that directly support the dual carbon goals, including regulation, carbon pricing and emission trading, investing in renewables and low carbon energy, developing green finance, public awareness campaigns, and international cooperation. For the energy sector alone, investments required to meet the dual carbon goals will range from \$510 billion to \$710 billion (or 1.7-2.4% of GDP) annually on average between 2020-2050, according to the estimation by Tsinghua University in China.
- China's national emissions trading system launched in July 2021 will play an important role in achieving the dual carbon goals. To reap

its full potential, further steps needed include expanding its coverage from the power sector to emission-intensive industries; tightening emission caps in line with the dual carbon goals; introducing auctions in emission permit allocation; putting in place mechanisms for risk management and price stability; and strengthening the monitoring, reporting and verification system.

- While China's dual carbon goals are critical to the global fight against climate change, the country faces tremendous challenges. However, achieving the two goals will bring significant benefits that far exceed costs. It will reduce pollution, foster a green environment, improve the quality and sustainability of growth, and raise the quality of life for Chinese people. It is an inevitable step towards realizing the vision of "Beautiful China". It also presents an opportunity for China to lead the global green development.

Chapter 1: Global economic outlook

1.1. Introduction

The global economy staged a strong rebound in the first half of 2021, after experiencing a sharp contraction in 2020 due to the COVID-19 pandemic. The combined gross domestic product (GDP) of the Group of 20 (G20) countries—representing 80% of the world economy—grew 7.7% compared with the same period last year. The expanding coverage of vaccination worldwide, more effective and smarter measures to contain the outbreaks, and continued fiscal support and monetary accommodation have all contributed to the V-shaped recovery. However, while almost all countries registered positive growth, the pace of recovery varied widely. In the second half, global growth momentum has softened somewhat, due to the outbreak of the Delta variant of the virus in many parts of the world and supply side bottlenecks. Strong recovery has also caused inflation to rise in many countries.

The global economy is now forecast to grow about 5.9% in 2021, with the advanced economies expanding 5.2% and emerging market and developing economies (hereafter referred to as developing economies) 6.4% (Figure 1.1). In 2022, global growth will taper down to 4.7%. Global inflation is expected to reach 4.5% this year and moderate to 3.8% next year. But there are significant downside risks to this outlook. The biggest risk is resurgences of the COVID-19 outbreaks in a large scale, due to slow progress in vaccination rolling out, especially in the developing world, or emergence of new variants of the virus. Another risk is macroeconomic and financial instability. Higher and more persistent inflation could

prompt abrupt adjustments to monetary policy in advanced economies, causing large corrections in asset markets, sudden capital outflows from developing countries, and exchange rate volatility. A further risk is an escalation in geo-political tensions. All these could disrupt the recovery.

Despite the V-shaped recovery, only half of the world's economies will return to their pre-pandemic level in 2021. Moreover, while the global economy is expected to return to its pre-pandemic *trend* level by 2025 and the advanced economies combined will do so by 2023, the gaps will not be eliminated any time soon for developing economies as a group, according to the International Monetary Fund (IMF)'s medium-term growth projections (IMF 2021a).

The pandemic will leave lasting scars in social and human development worldwide (Box 1.1). It has stalled progress in poverty reduction and increased income inequality as low-income households are more vulnerable to health shocks. It has also led to reduced spending on education, erosion of the human capital of the unemployed, and delayed investment in greening the economy in many countries. All these will significantly slow down the global progress towards meeting the Sustainable Development Goals (SDGs), and make the implementation of the Paris Agreement more challenging. Thus, international cooperation in ending the health crisis and supporting the recovery, while providing assistance to low-income countries, has become ever more important.

Box 1.1: Impact of the COVID-19 pandemic on the progress in achieving the Sustainable Development Goals

The COVID-19 pandemic will leave lasting scars in social and human development worldwide. According to a United Nations report (2021), the health crisis will significantly slow down the global progress towards achieving the Sustainable Development Goals. In 2020 alone, the pandemic led to

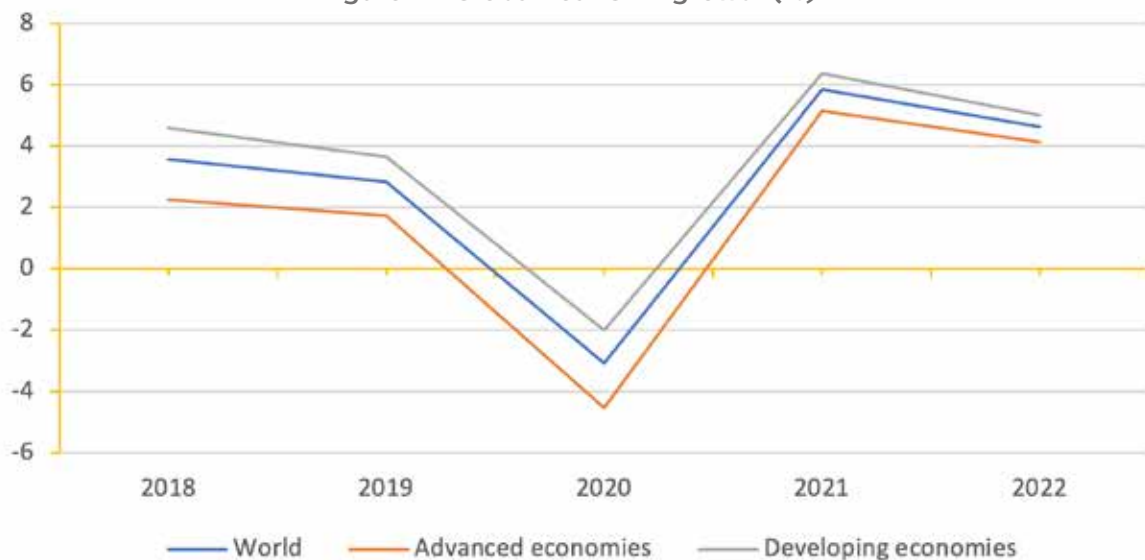
- An additional 119–124 million people being pushed back into extreme poverty worldwide;
- An additional 70–161 million people experiencing hunger;
- A halt or reversal of progress in health, reduction of life expectancy, and worsening of health inequality;
- An additional 101 million or 9% of children falling below minimum reading proficiency

levels, and an aggravation of education inequality, especially among poor or vulnerable groups;

- A loss of the equivalent of 255 million full-time jobs, especially among women and youth;
- A reversal of progress in reducing income inequality since the global financial crisis, with the average Gini coefficient for developing countries rising by an estimated 6%;
- An increase in gender disparity as working poverty disproportionately affects women;
- A stall or reversal in a decade of progress in reproductive, maternal and child health and an aggravation in the burden of non-communicable diseases;
- A worsening in water stress in regions with already high or critical levels.

Source: United Nations. 2021. The Sustainable Development Goals Report 2021. <https://unstats.un.org/sdgs/report/2021/The-Sustainable-Development-Goals-Report-2021.pdf>.

Figure 1.1: Global real GDP growth (%)

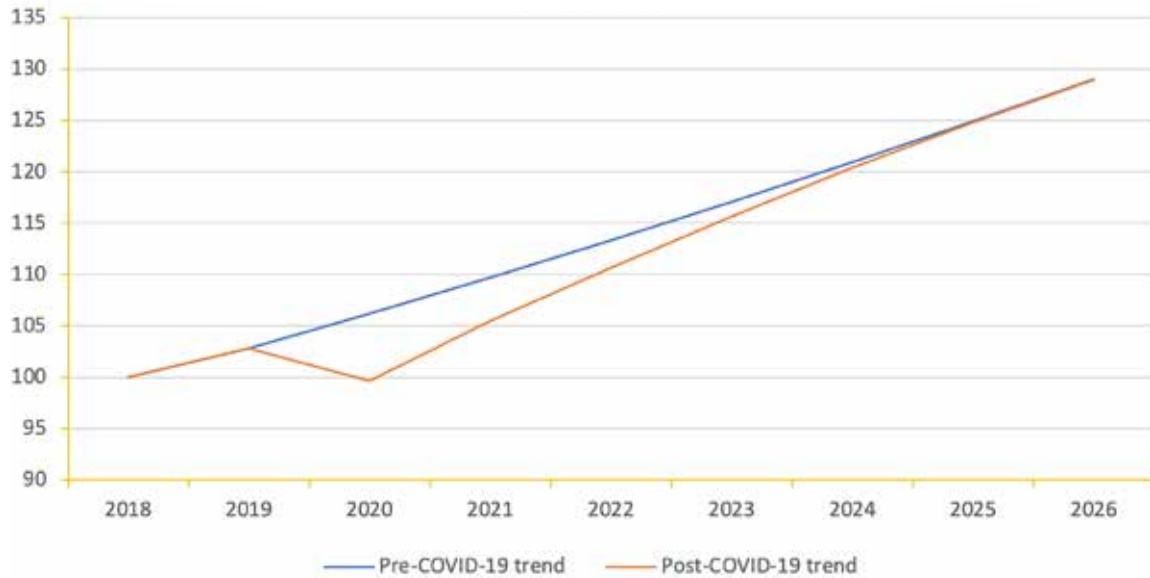


GDP = gross domestic product

Note: Growth rates are weighted at purchasing power parity.

Sources: International Monetary Fund, Focus Economics forecasts, and International Finance Forum staff estimates.

Figure 1.2: Recovery of global real GDP (2018=100)



COVID-19 = coronavirus disease, GDP = gross domestic product.

Note: Growth rates are weighted at purchasing power parity.

Sources: International Monetary Fund, Focus Economics forecasts, and International Finance Forum staff estimates.

1.2. Recent economic developments

Update on the COVID-19 pandemic

The COVID-19 pandemic has had multiple waves and is not over.

The world experienced multiple waves of the COVID-19 pandemic since it broke out in early 2020, causing more than 250 million infection cases (3.2% of the global population) and over 5 million deaths worldwide so far.¹ Due to the emergence of the more contagious Delta variant of the virus, the daily new infections climbed again from late June and early July in many regions following earlier declines (Figure 1.3). With about 400,000 people still getting infected and 5,000-6,000 dying from the infection everyday globally, the pandemic is not over. There are, however, large variations in how the pandemic has evolved over time across the world. In early November 2021, the number of daily new infections per million population was the highest at 312 in Europe, followed by North America at 188, Middle East and North Africa

at 87, Latin America and Caribbean at 37, Asia and the Pacific at 12, and Sub-Saharan Africa at 2.

The successful development of COVID-19 vaccines had earlier raised the hope that the pandemic will soon come to an end, but the emergence of the Delta variant has caused the concern over their efficacy. However, emerging evidence suggests that the vaccines remain highly effective in reducing the likelihood of getting infected and protecting against severe infections, hospitalization, and deaths even in cases of the Delta variant. For example, according to the data reported by the US Centers of Disease Control and Prevention (CDC) covering 16 US jurisdictions, in August 2021 when the Delta variant was the predominant variant of the virus in the country, unvaccinated persons were 6.1 times more likely to test positive for COVID-19 and 11.3 times more likely to die from COVID-19, compared to fully vaccinated persons. Data from 14 US states

¹ The cutoff date for data collection in this report is early November 2021.

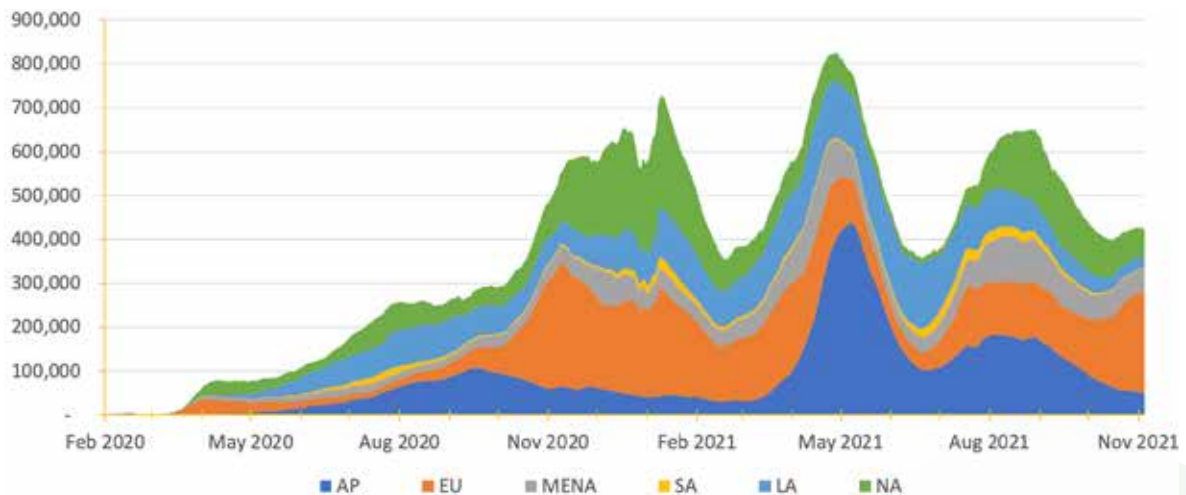


show that, for all adults aged 18 years and older, the cumulative COVID-19-associated hospitalization rate was about 12 times higher in unvaccinated persons than fully vaccinated persons as of 28 August 2021 (CDC n.d.). There has also been positive news on the development of drugs to treat the COVID-19 infections lately.

While vaccination remains the most effective way to live through the global pandemic, the global COVID-19 vaccine roll-out has faced many hurdles. By early November 2021, only about 51% of the global population had been inoculated with at least a single dose

of COVID-19 vaccines, and 40% fully vaccinated. While the fully vaccinated population reached 60% in North America and 56% in Europe, the figure was only 50% in Latin America and Caribbean, 45% in Asia and the Pacific, 30% in Middle East and North Africa, and less than 3% in Sub-Saharan Africa (Figure 1.4). Within each region, there are also large variations. The unequal access to COVID-19 vaccines, especially between advanced and developing countries, or the so-called vaccine divide, has raised concerns that it is leading to a multi-speed economic recovery, and has led to worldwide calls for rich nations to do more in sharing the vaccines with poorer countries to close this divide.

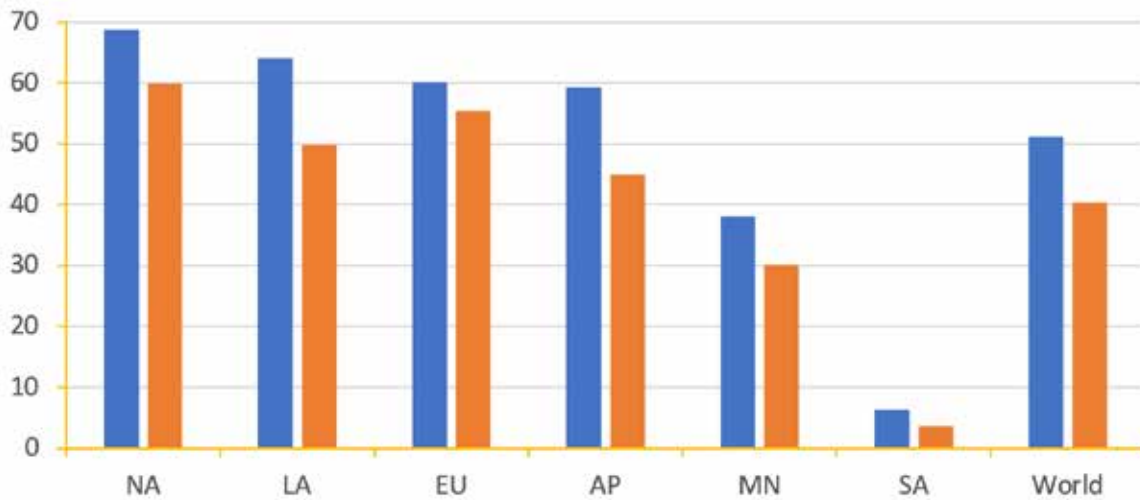
Figure 1.3: Daily new infections, major regions, as of 5 Nov. 2021
(7-day moving average)



Note: AP = Asia and the Pacific, EU = Europe, LA = Latin America and Caribbean, MENA = Middle East and North Africa, NA = North America, SA = Sub-Saharan Africa.

Source: ADB. COVID-19 Policy Database. <https://covid19policy.adb.org/>; World-meter. COVID-19 Coronavirus Pandemic <https://www.worldometers.info/coronavirus/>; and the World Health Organization.

Figure 1.4: Global progress in vaccination, as of early November 2021 (%)



AP = Asia and the Pacific, EU = Europe, LA = Latin America and Caribbean, MN = Middle East and North Africa, NA = North America, SA = Sub-Saharan Africa.

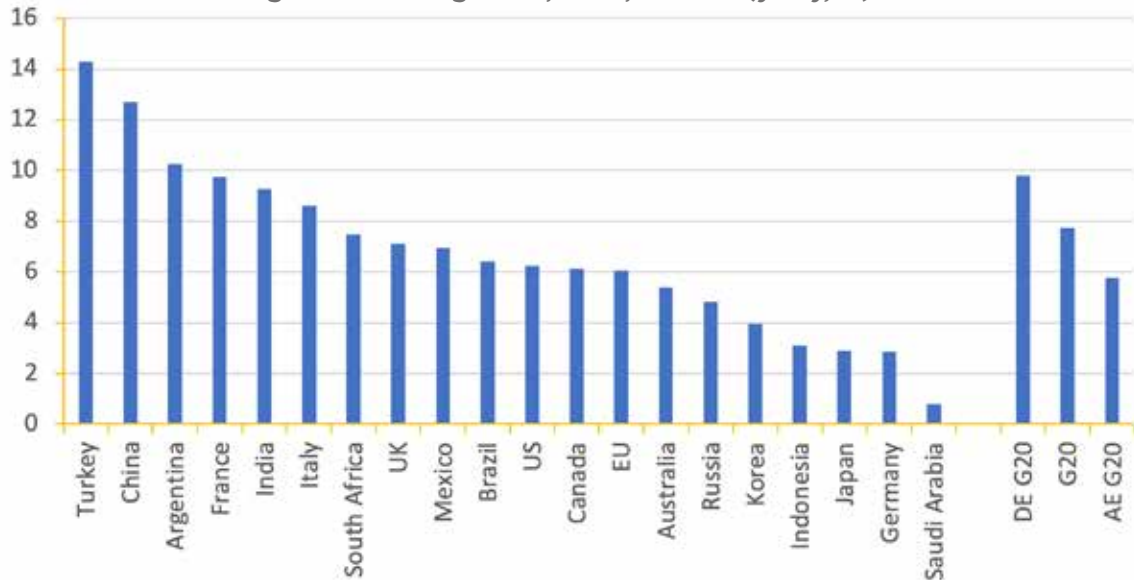
Source: Ritchie, Hannah. et. al. 2020. Coronavirus Pandemic (COVID-19). OurWorldInData.org; <https://ourworldindata.org/coronavirus>.

GDP growth

The global economic recovery has continued, but the pace is uneven across countries.

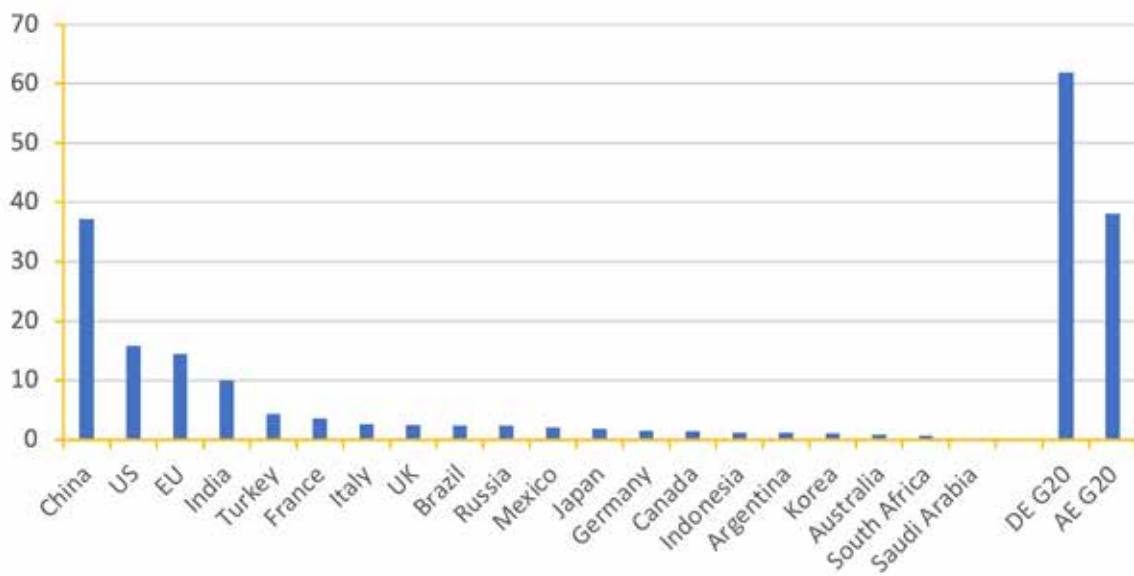
The global economy staged a strong rebound in the first half (H1) of 2021, with the combined GDP of the G20 countries, representing 80% of the world GDP (in purchasing power parity [PPP] terms), growing 7.7% compared with the same period last year (Figure 1.5). However, growth is highly uneven across countries, ranging from 14.3% in Turkey and 12.7% in China, to 6.2% in US and 6.0% in European Union (EU), to 3.1% in Indonesia and 2.9% in Japan, and to 0.8% in Saudi Arabia. China contributed 37.3% of the global growth, followed by US at 15.9%, the EU at 14.5%, India at 10%, and Turkey at 4.4% (Figure 1.6). Advanced G20 countries together grew 5.8%, accounting for 38% of the G20 growth, and developing G20 countries combined grew 9.8%, contributing 62%. The cross-country variations in the pace of recovery reflected a combination of factors, including the extent of GDP contraction in 2020 (the base effect), the evolving situation of the pandemic and stringency of containment measures, the speed of rolling-out of vaccination programs, the strength of fiscal and monetary stimuli, and the resiliency as well as potential growth of the economy.

Figure 1.5: GDP growth, G20 , H1 2021 (y-o-y, %)



H1 = the first half of the year, DE = developing economies, AE = advanced economies, G20 = Group of 20 economies, UK = United Kingdom, US = United States, EU = European Union.
Sources: OECD. OECD Statistics. <https://stats.oecd.org/>; Trading Economics; and China National Statistical Bureau.

Figure 1.6: Contribution to G20 GDP growth (%)



H1 = the first half of the year, DE = developing economies, AE = advanced economies; G20 = Group of 20 economies, UK = United Kingdom, US = United States, EU = European Union.
Sources: Authors' estimation on the basis of data from OECD. OECD Statistics; <https://stats.oecd.org/>; Trading Economics; and China National Statistical Bureau.

On the demand side, final domestic consumption is the dominant contributor to growth in Australia, Canada, China, Mexico, Russia, and Turkey, the UK, and the US, ranging from 4.6 to 8.9 percentage points (Figure 1.7). On the other hand, gross capital formation contributed more in Brazil and India. External balance is the largest contributor to growth in South Korea and its contribution is also sizable in China, the EU, Japan, and Turkey, but it reduced growth

in Australia, Canada, India, the UK, and the US. The strong rebound in final domestic consumption was reflected in the pick-ups in retail sales. The seasonally adjusted monthly retail sale volume has recovered to its pre-pandemic level in all the advanced economies and most developing economies in Figure 8, with the notable exception of Indonesia and South Africa where retail sales were affected by surges in COVID-19 infection cases due to the spread of the Delta variant.

Figure 1.7 (a): Demand-side decomposition of GDP growth, selected developing economies, H1 2021 (% point)

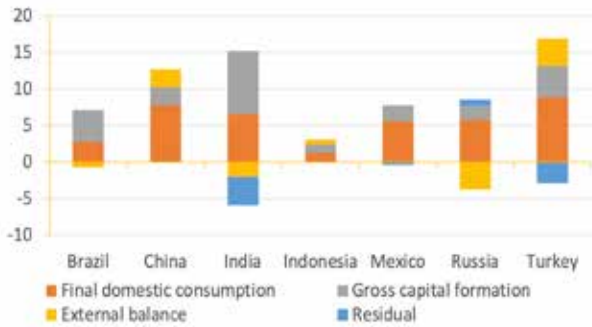
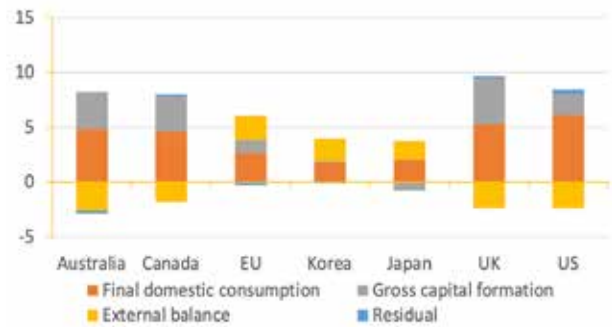


Figure 1.7 (b): Demand-side decomposition of GDP growth, selected advanced economies, H1 2021 (% point)



EU = European Union, UK = United Kingdom, US = United States. Source: OECD. OECD Statistics. <https://stats.oecd.org/>.

Figure 1.8 (a): Index of retail sales volume, selected developing economies (s.a., Dec. 2019=100)

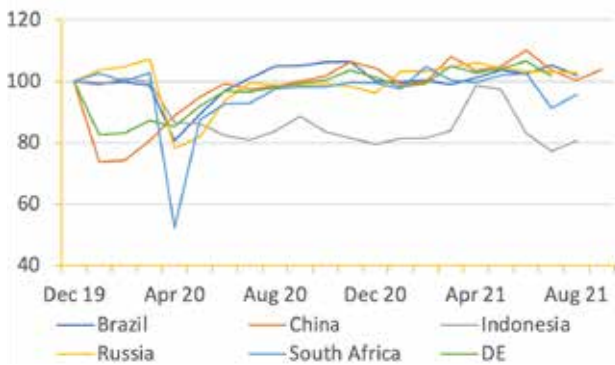


Figure 1.8 (b): Index of retail sales volume, selected advanced economies (s.a., Dec. 2019=100)



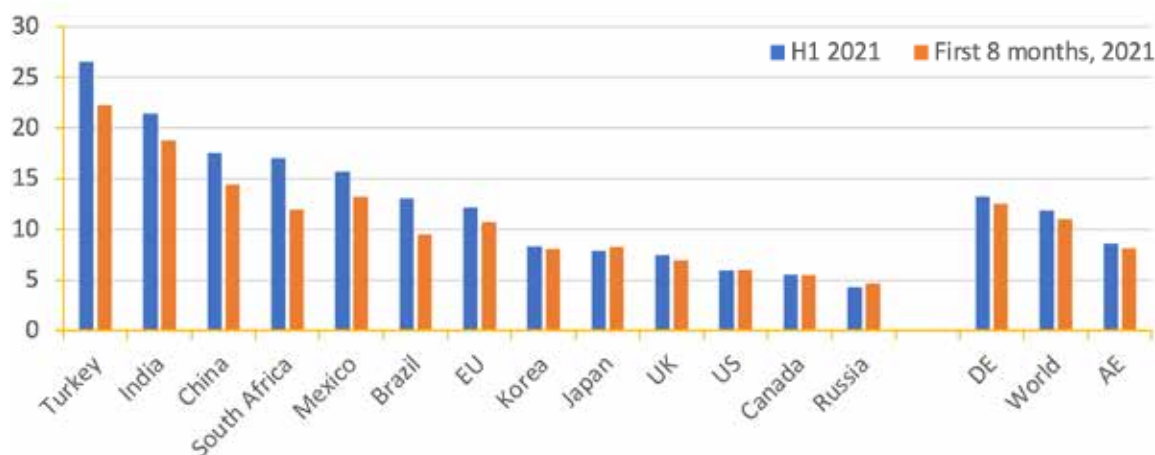
s.a. = seasonally adjusted, EU = European Union, US = United States, UK = United Kingdom, AE = advanced economies, DE = developing economies. Sources: OECD. OECD Statistics; <https://stats.oecd.org/>; national statistical agencies for China and Russia; Trading Economics for other developing countries.



On the supply side, global growth has been driven by recovery in both industry and services sectors. Global industrial production grew 11.8% year-on-year in the first half of 2021 (Figure 1.9). It grew 13.2% for developing economies and 8.6% for the advanced countries. Industrial production growth was particularly strong for Turkey, India, China, Mexico, and South Africa, at 17-26.5%, partly reflecting the low base last year. Among the advanced countries, the expansion was led by the EU at 12.2%, followed by South Korea at 8.3%, Japan at 7.8%, UK at 7.4%, and US at 5.9%. The first 8-month growth however suggests some moderation in industrial production growth in the third quarter. As

a result of strong but differential growth, the seasonally adjusted monthly industrial production volume has returned to its pre-pandemic level for both advanced countries and developing economies as a whole (Figure 1.10). The services sector also recovered across-the-board in H1 of 2021, after a sharp contraction last year. While the services' recovery was less strong than the industrial sector in many countries—as it is more susceptible to COVID-19 outbreaks and social distancing measures—it contributed more to growth in most economies due to its large share in GDP (Figure 1.11). The industry sector accounted for a larger share of growth only in India and South Korea.

Figure 1.9: Industrial production growth, H1 and first eight months, 2021 (y-o-y, %)

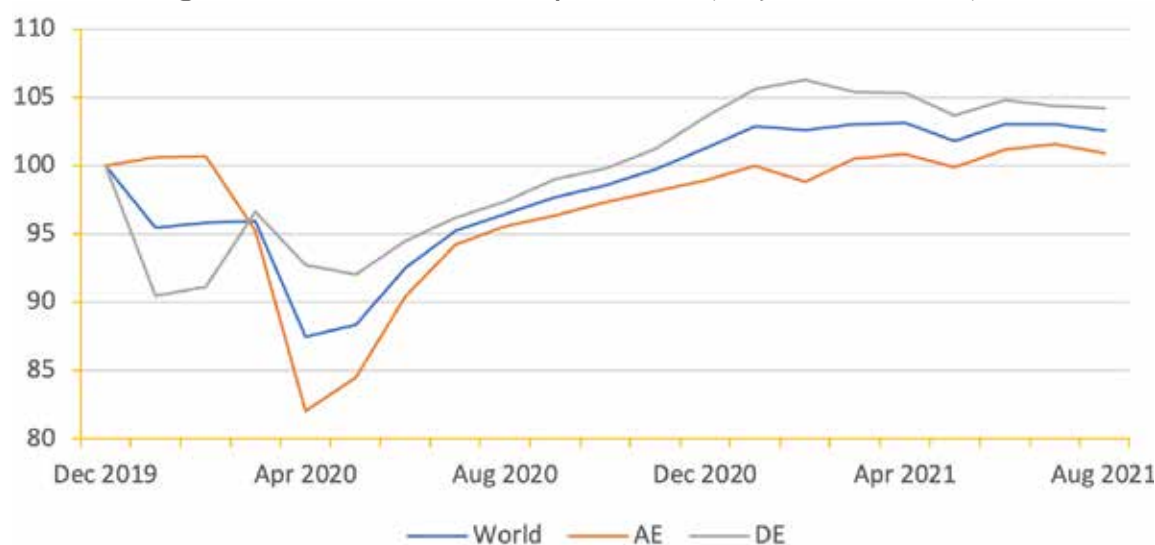


H1 = the first half of the year, s.a. = seasonally adjusted, EU = European Union, US = United States, UK = United Kingdom, AE = advanced economies, DE = developing economies.

Note: The first eight-month data for UK and Canada only cover the first seven months.

Sources: CPB World Trade Monitor for global data and China; <https://www.cpb.nl/en/worldtrademonitor>; Indian Ministry of Statistics & Programme Implementation for India; <http://mospi.nic.in/iip>; and OECD statistics web site for the rest of countries.

Figure 1.10: Index of industrial production (s.a., Dec. 2019=100)



s.a. = seasonally adjusted, AE = advanced economies, DE = developing economies.

Source: CPB Netherlands Bureau for Economic Policy Analysis (CPB). 2021. World Trade Monitor; <https://www.cpb.nl/en/worldtrademonitor>.

Figure 1.11 (a): Supply-side decomposition of GDP growth, selected advanced economies, H1 2021

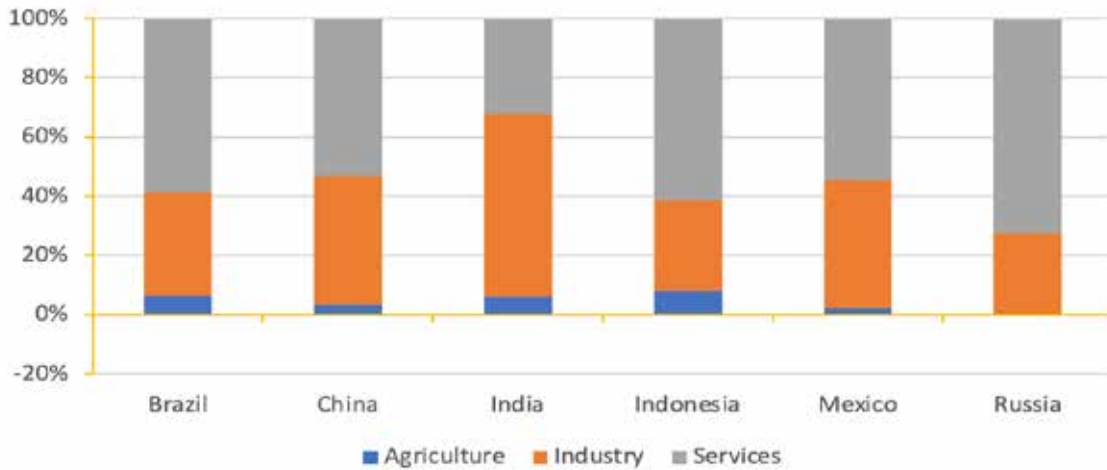
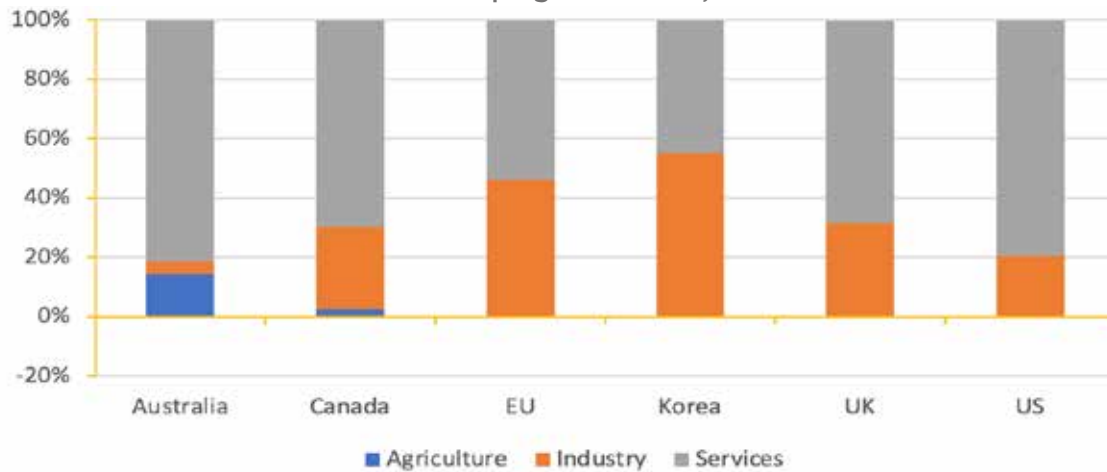


Figure 1.11 (b): Supply-side decomposition of GDP growth, selected developing economies, H1 2021



H1= the first half of the year.

Source: OECD. OECD Statistics. <https://stats.oecd.org/>; and Trading Economics (for US data).

The spread of the Delta variant and supply disruptions have caused growth momentum to soften in recent months.

The resurgence of the daily infections due to the spread of the Delta variant has had marked impacts on consumer confidence in a large part of the world. At the same time, the supply chain disruptions worldwide due to bottlenecks in the production system caused by the pandemic, ranging from labor shortages, port congestions, and backlogs in the supply of parts and components, have started to constrain growth. Purchasing managers’ indices show reduced business optimism for the months ahead in both the manufacturing and services sectors in

many countries (Figure 1.12). Recent retail sales and industrial production data also suggest softening growth momentum. As a result, many investment houses and international organizations reduced their 2021 growth projections for several major economies, including the US, China, Japan and Germany. The IMF in its October 2021 issue of World Economic Outlook (WEO) reduced global GDP growth projection for 2021 by 0.3 percentage point from its July 2021 Update, reflecting a downgrade for advanced economies—in part due to supply disruptions—and for low-income developing countries, largely due to worsening pandemic dynamics (IMF 2021a).

Figure 1.12 (a): Manufacturing purchasing managers' index (deviation from 50)

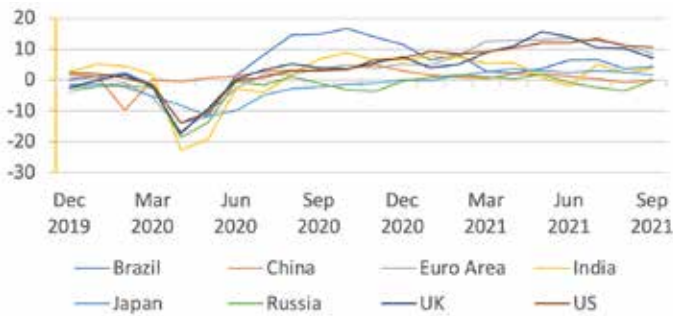
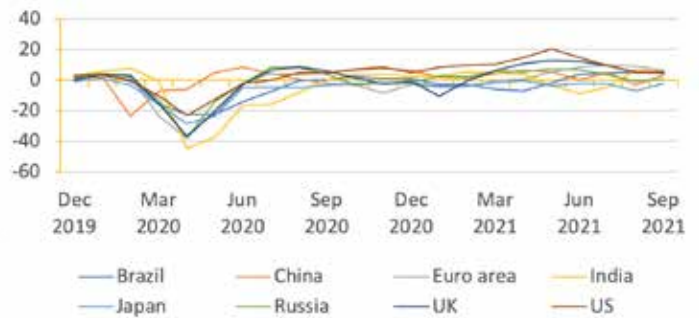


Figure 1.12 (b): Services purchasing managers' index (deviation from 50)

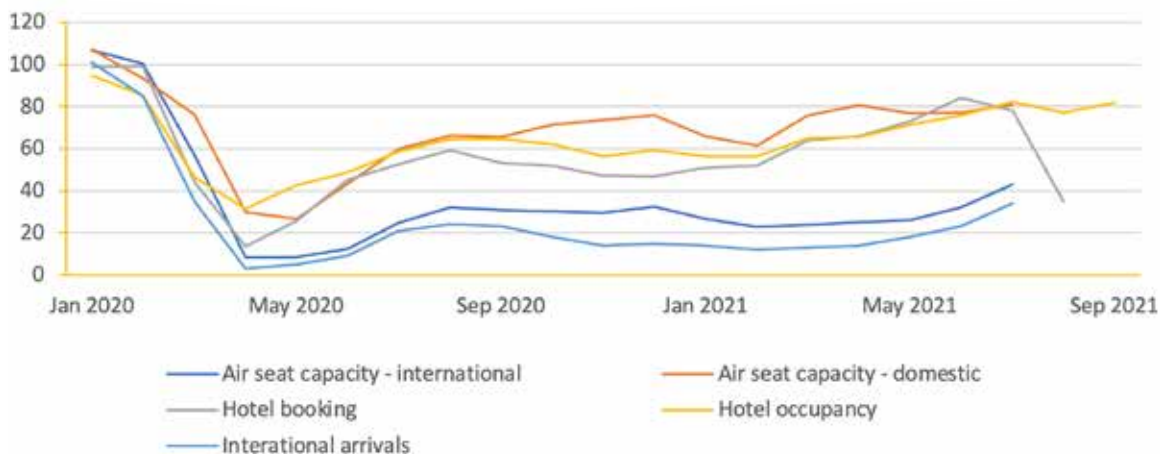


UK = United Kingdom, US = United States.
Source: Trading Economics.

The global tourism industry was one of the hardest-hit sectors by the COVID-19 pandemic. According to the World Tourism Organization (WTO), global tourism suffered its worst year on record in 2020 (Figure 1.13), with international arrivals dropping by 74% amounting to 1 billion compared with the previous year, due to an unprecedented fall in demand and widespread travel restrictions, devastating the hospitality and transport sectors (WTO n.d.). This compares with the 4% decline recorded during the 2009 global

economic crisis. Despite some recovery from the worst time in April 2020, the tourism sector remains in very bad shape. The number of international arrivals, international air seat capacity utilization, and domestic air seat capacity utilization in July 2021 was only 34%, 43%, and 81%, respectively, of the level in the same month in 2019. Hotel booking in August 2021 was only 35% and hotel occupancy in September 2021 was only 82% of the level in the same months in 2019.

Figure 1.13: Impact of COVID-19 on the world's tourist industry (the same month in 2019=100)



Source: World Tourism Organization. n.d. UN WTO Tourism Recovery Tracker; <https://www.unwto.org/unwto-tourism-recovery-tracker>.

Unemployment and Inflation

As the economy rebounds, unemployment has fallen.

Labor markets were hit hard by the pandemic in 2020 as governments around the world introduced travel restrictions, social distancing measures, and nationwide lockdowns to contain the spread of the virus. The monthly unemployment rate reached more than 13% in the US and 23% in India during the initial wave of the pandemic, and remained elevated in Europe and other parts of the world throughout the year (Figure 1.14). In response, many governments increased spending on social protection and came up with various job protection programs. Without these programs, job losses would have been even greater. Nevertheless, according to the International Labour Organization (ILO 2021), in 2020, the pandemic led to a decline in hours worked equivalent to 255 million full-time jobs lost.

As the economy started to rebound, the unemployment rate has also fallen. In the US, the seasonally-adjusted monthly employment rate declined steadily in 2021, from 6.3% in January to 4.6% in October. In South Korea, it dropped from 5.4% in January to 3% in September. In the EU, the unemployment rate stood at 6.7% in September, which is 0.7 percentage point lower than the year-start level. Among developing economies, it declined with varying degrees. However, in Brazil and Turkey, the unemployment rate remains at a 2-digit level.

Despite the positive developments in labor markets, IMF in its October 2021 WEO notes that employment and participation in labor markets are still below their pre-pandemic levels in a large part of the world, “reflecting a mix of negative output gaps, worker fears of on-the-job infection in contact-intensive occupations, childcare constraints, labor demand changes as automation picks up in some sectors, replacement income through furlough schemes or unemployment benefits helping to cushion income losses, and frictions in job searches and matching” (IMF 2021c:7). The employment gaps between current and pre-pandemic levels remain bigger in developing economies than in advanced economies on average, and within an economy, among youth, lower-skilled workers, and women. IMF notes that, if these gaps persist, they could worsen economic inequalities.

Figure 1.14 (a): Unemployment rate, selected advanced economies (%)

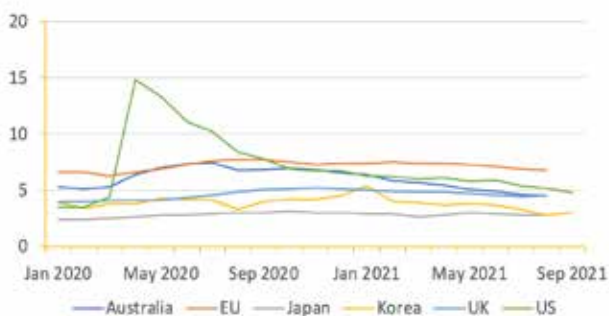
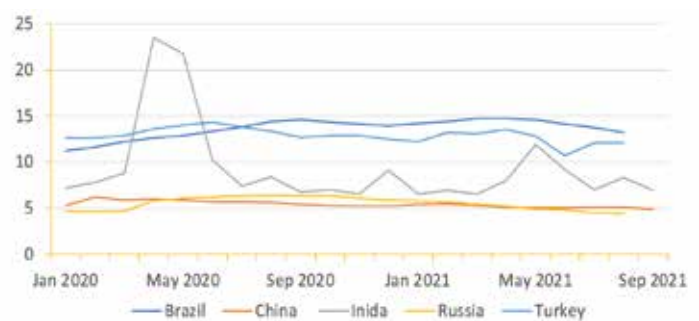


Figure 1.14 (b): Unemployment rate, selected developing economies (%)



EU = European Union, UK = United Kingdom, US = United States.
Sources: OECD. OECD Statistics. <https://stats.oecd.org/>; and Trading Economics.

Inflation is on the rise in many parts of the world.

Global economic rebound has been accompanied by rising inflation in many parts of the world. Global headline monthly consumer price inflation rate (y-o-y) rose from 2.2% in January 2021 to 4.6% in September (Figure 1.15 (a)). Among the advanced G20 countries, the rise in inflation was most pronounced in the US, from 1.4% to 5.5% during the same period, followed by the EU, from 1.7% to 3.6%, and UK, from 0.9% to 3.1%. South Korea's inflation rose from 0.6% in January to 2.5% in October. However, since October 2020, Japan continued to experience negative inflation until September 2020 when the y-o-y inflation turned to positive. Among

developing economies, Argentina and Turkey have had double-digit inflation for several years and inflation is again on the rising trend after dipping somewhat last year due to the COVID-19. During January-September 2021, inflation rose from 4.6% to 10.2% in Brazil, from 5.2% to 7.4% in Russia, from 3.2% to 4.9% in South Africa, and from 3.2% to 4.4% in India (Figure 1.15 (b)). Inflation dipped from close to 5.7% to 0.6% in Saudi Arabia, as the impact of value added taxes introduced last year faded, and it maintained at less than 2% in Indonesia. China experienced negative or close to zero inflation in late 2020 and early 2021, but saw inflation edging up to 1.3% in May. Since then, it softened again and stood at less than 1%.

Figure 1.15 (a): Monthly consumer price inflation, G20 and selected advanced economies (y-o-y, %)

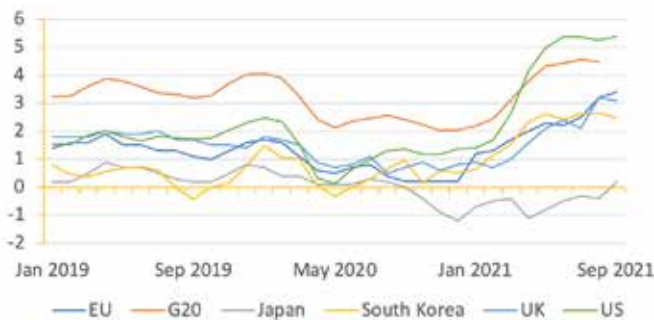
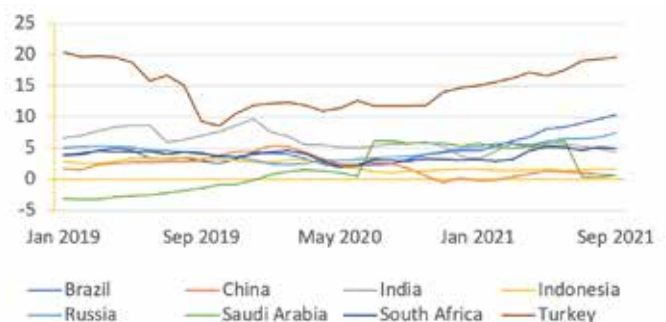
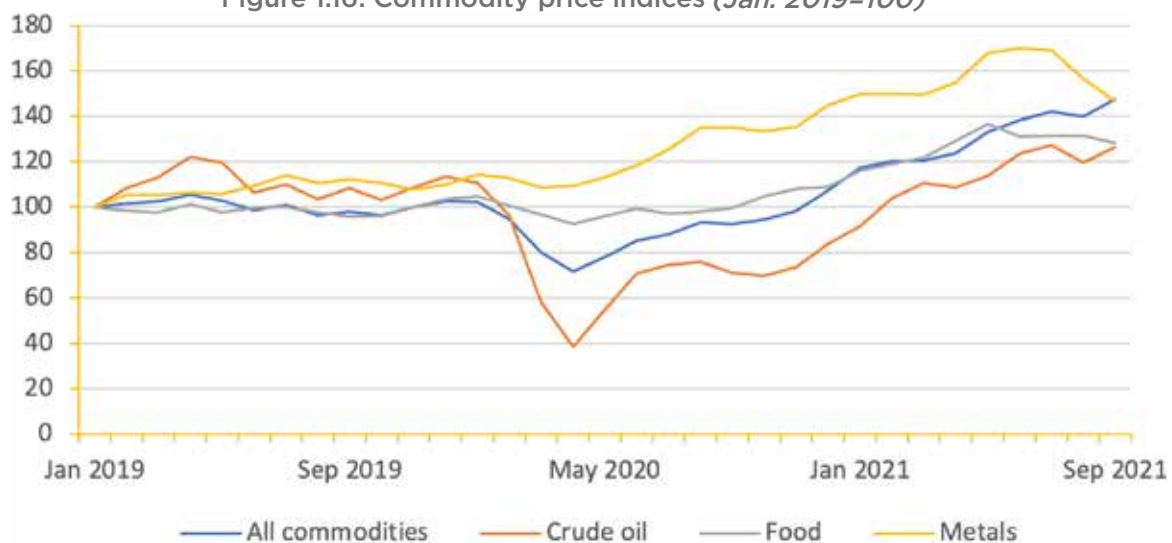


Figure 1.15 (b): Monthly consumer price inflation, selected developing economies (y o y, %)



EU=European Union, G20=Group of 20 economies, US=United States, UK=United Kingdom, y-o-y = year-on-year. Source: OECD. OECD Statistics. <https://stats.oecd.org/>.

Figure 1.16: Commodity price indices (Jan. 2019=100)



Source: International Monetary Fund (IMF). IMF Primary Commodity Prices; <https://www.imf.org/en/Research/commodity-prices>.

Rising commodity prices are a key driver of rising inflation globally. Commodity prices are being pushed up by growing demand due to the recovery in global economic activity, as well as some specific supply-side factors. Prices of major commodities have all accelerated from their dips in the second quarter of 2020. By September 2021, the global price index covering all commodities rose by close to 44% from its pre-pandemic, end-2019 level, with metal prices up by 33%, food prices 24%, and oil prices 11.4% (Figure 1.16). Alone with rising commodity prices, international shipping rates have also soared due to capacity constraints caused by pandemic-induced disruptions to port services and labor supply, with the Balti Exchange Dry Index (a benchmark for the price of moving the major raw materials by sea) surging by 270% between December 2019 and October 2021. All these are feeding into domestic prices. For instance, in Europe, the average monthly electricity wholesale price rose by more than 120% in France, 140% in Germany, and 160% in Italy between January-September 2021 (Statistica n.d.).

Global shortages of semi-conductors are also pushing up the prices of goods that use microchips. These range from computers, cars, and smartphones to household appliances such as television sets, washing machines, refrigerators, and video game consoles. The car industry has been worst affected by semi-conductor

shortages. The resulting factory closures, laying-off of workers, and cuts in vehicle production reduced new vehicle availability at a time when demand is already high. The shortages of semi-conductors started with the faster-than-expected-recovery of the car industry that generated excess demand for microchips.

A further factor that can explain the rise in inflation is the base effect. The y-o-y inflation rates are compared with the same months in 2020 when prices were depressed because of the COVID-19 outbreaks and the ensuing lockdowns. For instance, the annual inflation in September 2020 was only 0.2% in the EU and 1.4% in the US, while it was 1.1% and 1.7%, respectively, in the two economies in September 2019.

Apart from these common drivers, there are country-specific factors contributing to rising inflation. In the US, the ultraloose monetary policy characterized by the near-zero interest rates of the US Federal Reserve (the “Fed”) and the authorities’ massive asset purchases have led to floods of liquidity in the financial system generating high demand for goods and services. In the euro area, rising inflation partly reflects the impact of a new weighting scheme of the inflation basket. In Argentina and Turkey, during 1 July 2020–1 July 2021, the dollar value of national currencies depreciated by 26% and 22%, respectively, and these depreciations can explain a large part of high and rising inflation.



Trade

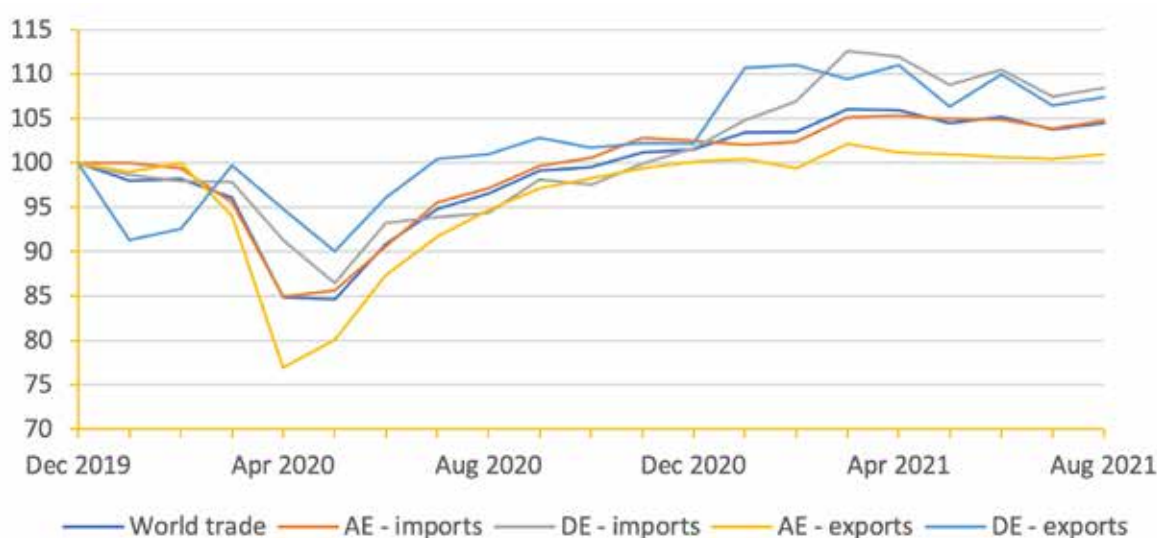
Recovery of GDP growth led to recovery of trade, which in turn supported GDP growth.

Global merchandise trade volume contracted by 5.3% in 2020. The decline was particularly significant for advanced economies. Trade contraction started to moderate from June 2020 as countries started to relax lockdown measures. The seasonally-adjusted monthly volume of global merchandise trade returned to its pre-pandemic level towards the end of 2020, and exceeded that level by 4.5% in August 2021 (Figure 1.17). The pace of recovery is faster for developing economies than for advanced countries, especially in exports: the volume of merchandise exports exceeded the pre-pandemic levels by 8.4% for the former in August 2021, while only 1.0% for the latter. However, the pace of trade recovery has weakened somewhat in developing economies in more recent months, reflecting softening global recovery momentum.

Year-on-year, the value of global merchandise exports (including both volume and price

effects) grew 30.1% in the first 8 months of 2021, and the growth was 38.3% for developing economies and 26.1% for advanced countries (Fig 1.18). Across countries, the growth ranged from 60% in South Africa to 17% in UK. Most countries with rapid export growth are resources-rich and have benefited from rising commodity prices. Some also had a low base due to large contractions in 2020. Global merchandise export value growth in the first 8 months was driven mainly by Asia, contributing 38.2% of the total, followed by the EU at 36.4%, and North America at 11.6%. Latin America and Caribbean, Middle East and North Africa, Sub-Saharan Africa, and Russia combined accounted for 13.8%. By country, China alone contributed 23.3% of global merchandise export value growth in the first 8 months of 2021, followed by the US at 8.5%, Germany at 8%, Italy at 4.2%, and Japan and Russia each at 3.9%. In the case of growth of merchandise imports, the largest contributor was Europe at 41.5%, followed by Asia at 33.8%, North America at 16.6%, and other three regions combined at 8%. Across countries, the largest contributor to global merchandise import growth was China at 19.2%, followed by the US at 14.2%, Germany at 7.2%, India at 5.1%, and France and Italy each at 3.7%.

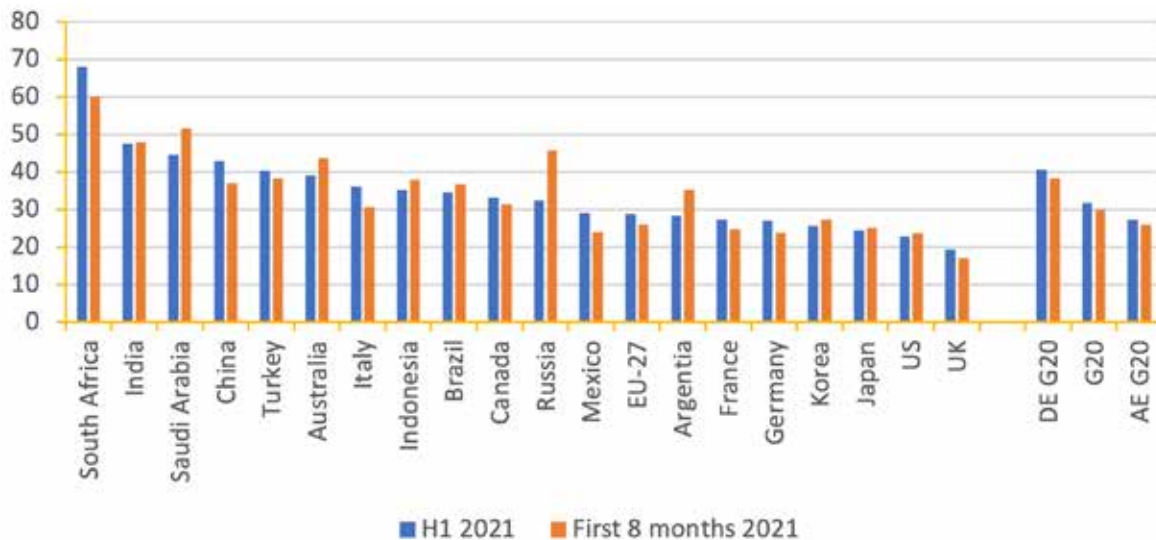
Figure 1.17: World merchandise trade volume (s.a., Dec. 2019=100)



s.a. = seasonally adjusted, AE = advanced economies, DE = developing economies.

Source: CPB Netherlands Bureau for Economic Policy Analysis (CPB). 2021. World Trade Monitor. <https://www.cpb.nl/en/worldtrademonitor>.

Figure 1.18: Growth of merchandise export value, 2021 (y-o-y, %)



AE = advanced economies, DE = emerging markets, G20 = Group of 20 economies, EU = European Union, UK = United Kingdom, US = United States, y-o-y = year-on-year.
 Source: OECD. OECD Statistics. <https://stats.oecd.org/>; and Trading Economics.

In the first 8 months of 2021, China continued to be the world’s largest trading nation accounting for 18.1% of the global merchandise trade value, with the US at the second spot accounting for 13.4% and Germany third at 9%. According to China Custom data (GACC n.d.), in the first three quarters of 2021, the Association of Southeast Asian Nations (ASEAN) continued to be China’s largest trading partner, accounting for 14.4% of its exports and imports, followed by the EU at 13.7%, US at 12.4%, Japan at 6.3%, and South Korea at 6%. China’s electrical machinery and equipment exports accounted for 58.8% of its total export value and grew 23% year-on-year, and its labor-intensive exports grew 9.5% and medical equipment and medicine grew 108%.

Financial markets and capital flows

Economic recovery and stimulus measures helped to make global financial markets broadly stable.

Stock markets were hit heavily in the initial months of the pandemic, with share prices falling sharply in March 2020 (Figure 1.19). Markets stabilized and started to recover as countries around the world announced large fiscal and monetary stimulus packages from April 2020 onwards. In 2021, global stock

markets have continued to recover, supported by fiscal stimuli and monetary accommodation, despite large volatility as market sentiments responded to news on the pandemic, vaccine development and economic recovery. By the mid-October 2021, the stock prices rose by 17.9% in the euro area, 16.5% in the US, 13% in Australia, 12.6% in Singapore, 11.5% in the UK, and 4.1% in Japan, from their year-start levels. Among emerging markets, the stock prices rose by 35.8% in Saudi Arabia, about 27% in India and Russia, 12.8% in South Africa, and 4% in China, but declined by 11% in Brazil during the same period.

The pandemic led to large capital outflows from emerging markets in initial months as rising global risks induced investors to seek safe heavens, with combined outflows of nonresident portfolio equity and debt reaching a total of more than \$80 billion in March 2020 for the 15 selected economies in Asia, Middle East, Eastern Europe, Latin America and Caribbean, and Africa (Figure 1.20 (a)). Since November 2020, however, nonresident portfolio capital flowed back to emerging markets, partly due to subsiding global risks associated with positive news on the development of COVID-19 vaccines and partly due to the ample liquidity and ultra-low interest rates in advanced countries that induced investors to see higher returns elsewhere.

Figure 1.19 (a): Daily stock price index, selected advanced economies (1 Jan. 2020=100)



Figure 1.19 (b): Daily stock price index, selected developing economies (1 Jan. 2020=100)



Source: Trading economics.

In 2021, portfolio capital to emerging markets continue to be volatile. The Institute of International Finance (IIF) reports that in the first 9 months, the total net portfolio capital flows to emerging markets reached \$224 billion, of which, debt flows accounted for 81% and equity 19% (Figure 1.20 (a)). Portfolio capital flows into emerging market are likely to continue to be volatile, affected by multiple factors including the evolution of the pandemic, speed of vaccination, inflation outlook and policy responses, and timing of the policy normalization in advanced countries, especially in the US.

The pandemic has also had some impacts on foreign direct investment (FDI) flows to emerging economies that usually tend to be more resilient. According to a United Nations Conference on Trade and Development report (UNCTAD 2020), net FDI flows declined by an estimated 42% in 2020 from previous year for the world as a whole. FDI flows into developing economies decreased by 12%, to an estimated \$616 billion. But the fall was highly uneven across developing regions, with developing Asia weathering the storm well as a group, attracting an estimated \$476 billion in FDI in 2020, and flows to China rising by 4% to \$163 billion, supported by a return to

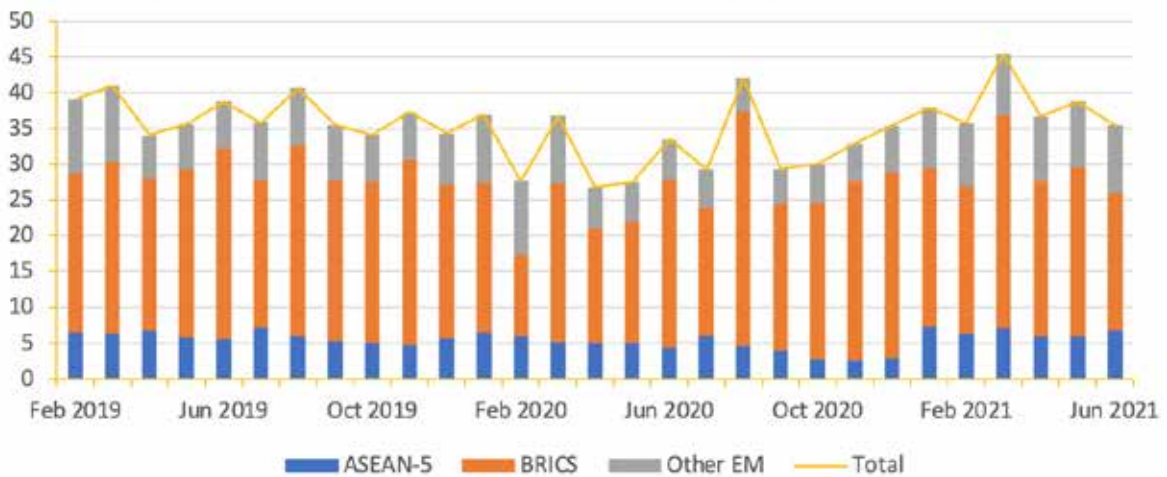
positive GDP growth and the government's targeted investment facilitation program that helped stabilize investment after the early lockdown. In the first half of 2021, based on data from Trading Economics, the total net FDI flows to emerging markets reached \$230 billion, compared with \$189 billion in the same period last year. Of this total amount, close to 40% or \$91 billion were destined to China, 17% or \$39 billion went to ASEAN-5 countries, and 43% or \$100 billion went to other emerging markets (Figure 1.20 (b)).

According to China's commerce ministry data, FDI flows into China jumped 19.6% year-on-year to CNY 859.51 billion (\$ 129.26 billion) in January-September 2021. Foreign investment in the service sector rose 22.5% from a year earlier to CNY 685.32 billion; and that in the high-tech sectors grew by 29.1%, of which high-tech services rose 33.4% and high-tech manufacturing went up 15.2%. Among the main sources of investment, FDI into China from the ASEAN countries rose 31.4%, while that from the countries along the Belt and Road surged by 31.9%. In 2020, China displaced the US to become the world's largest FDI recipient. In 2021, FDI to China has remained strong (Box 1.2).

Figure 1.20 (a): Net portfolio capital flows to emerging markets (\$ billion)



Figure 1.20 (b): Net inward FDI flows to emerging markets (\$ billion)



ASEAN-5 = Indonesia, Malaysia, Philippines, Thailand, and Vietnam; BRICS = Brazil, Russia, India, China, and South Africa; EM = emerging markets, FDI = foreign direct investment.
 Sources: Institute of International Finance. Capital Flow Tracker for portfolio flows; <https://www.iif.com/Research/Capital-Flows-and-Debt/Capital-Flows-Tracker>; Trading economics for FDI flows.

Box 1.2: Foreign Direct Investment to China

In 2020, China displaced the US to become the world’s largest Foreign Direct Investment (FDI) recipient, with net inflows amounting to \$163 billion. The country has remained the top preferred FDI destination of companies worldwide, according to a survey by the American Chamber of Commerce.

Several factors have been contributing to China’s appeal as an attractive destination for global FDI. One is its speedy and successful containment of the COVID-19 pandemic, making it the only major economy that posted positive economic growth in 2020. A second factor is its “trade agreement network”, which has, as of 2021, involved 100 double tax treaties, providing a degree of confidence to investors looking for more certainty on their potential tax liabilities.

The third factor is China's market reforms and policies that have continued to lessen market restrictions and improve the business and regulatory environment. Such measures include the reduction of negative lists by 2020, implementation of the foreign investment law, and establishment of more free trade zones.

In view of China's upbeat economic prospects, the quicker recovery of its service sector and the continued leveling up of its industrial structure, the country's outlook for FDI inflows continues to be positive, particularly in the financial, high-tech services, and high-end manufacturing sectors.

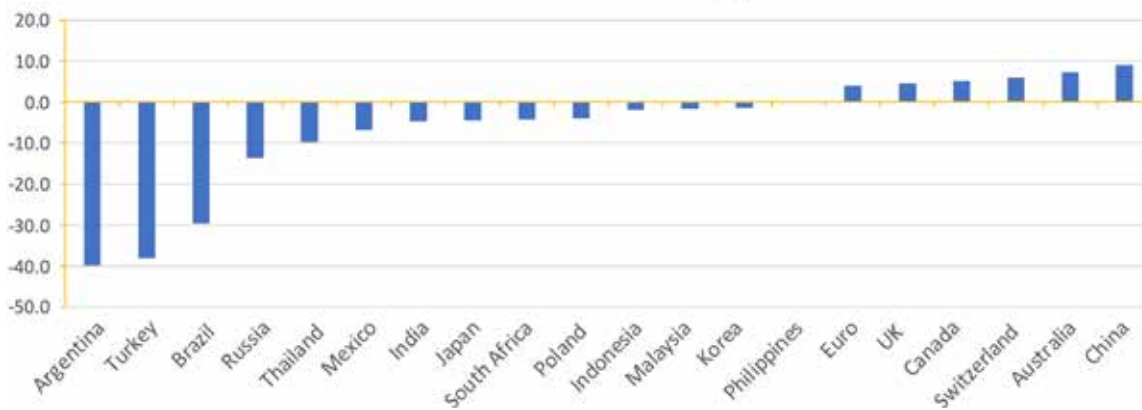
Source: Zhou, Qian. 2021. China's FDI Inflow Surge in Q1 2021: An Explainer. China Briefing; <https://www.china-briefing.com/news/chinas-fdi-inflow-surge-in-q1-2021-an-explainer/>

The changing directions of capital flows have also had significant impact on the movements of exchange rates of emerging markets. Several emerging markets' exchange rates depreciated significantly in the initial months of the pandemic as global economic risks heightened, foreign capital flowed out, and economies sunk. In 2021, many emerging market currencies continued to be volatile, moving with the changing situation on COVID-19 outbreaks and news related to the pace of economic recovery. Among emerging market currencies, compared with the pre-pandemic, the dollar value of the local currency declined by 40% for Argentina, 30% for Turkey and Brazil, 14% for Russia, 10% for Thailand, 7% for Mexico, about 4% for India, Poland, and South Africa, and 2% for Indonesia and Malaysia, as of late October 2021 (Figure 1.21). It remained more or less unchanged for the Philippines, and it rose by 9% for China. On average Asian currencies have been more stable than other

emerging market currencies, partly because the outbreaks have been more contained in the region, especially when looking at the number of infection cases or deaths per million population due to COVID-19. In Argentina, inflation remained at double-digits as the country tried to renegotiate with the IMF over the repayment of its mounting debt after defaulting to private foreign investors last year. In Turkey, the weakness of the currency this year has partly been caused by market concerns cover the direction of the country's monetary policy.

The advanced economy currencies generally gained against the greenback, with the exception of the Japanese yen, as the world's third largest economy has seen continued declines in domestic price levels in recent months leading to market expectation of prolonged implementation of the country's quantitative easing program.

Figure 1.21: Change in the dollar value of national currencies, 1 Jan. 2020 - 29 Oct. 2021 (%)



Source: International Monetary Fund (IMF). IMF Exchange Rates; <https://www.imf.org/external/np/fin/ert/GUI/Pages/CountryDataBase.aspx>.

As a barometer of sovereign risks and conditions of macroeconomic fundamentals, the yield spread of 10-year government bonds of emerging markets versus their US counterpart all jumped in early 2020 following the outbreak of the pandemic, although with varying degrees (Figure 1.22). But the spreads declined subsequently as large fiscal and monetary stimulus worldwide helped to

stabilize global financial markets and slow down and later stop capital outflows from emerging markets. In 2021, the yield spreads have remained largely stable in most emerging markets, with the exception of Brazil and Turkey due to investors' concern over macroeconomic conditions in the two countries, and Argentina, as the country continued to be mired in a multi-year debt crisis.

Figure 1.22 (a): 10-year government bond yield spread, BRICS (bp, vs US 10-year government bond)

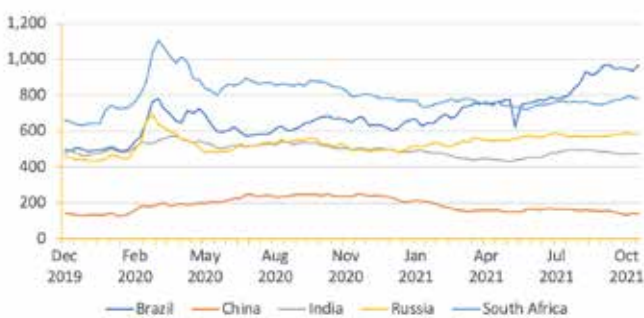


Figure 1.22 (b): 10-year government bond yield spread, ASEAN-5 (bp, vs US 10-year government bond)

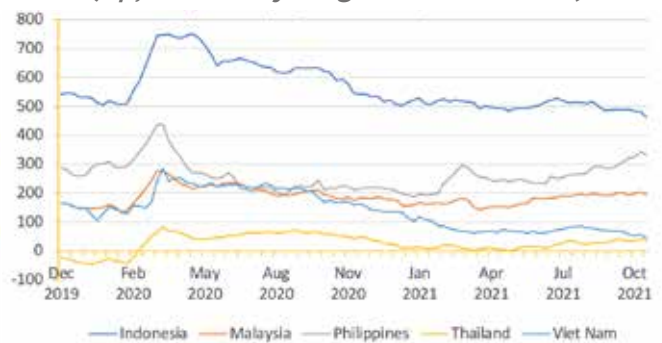
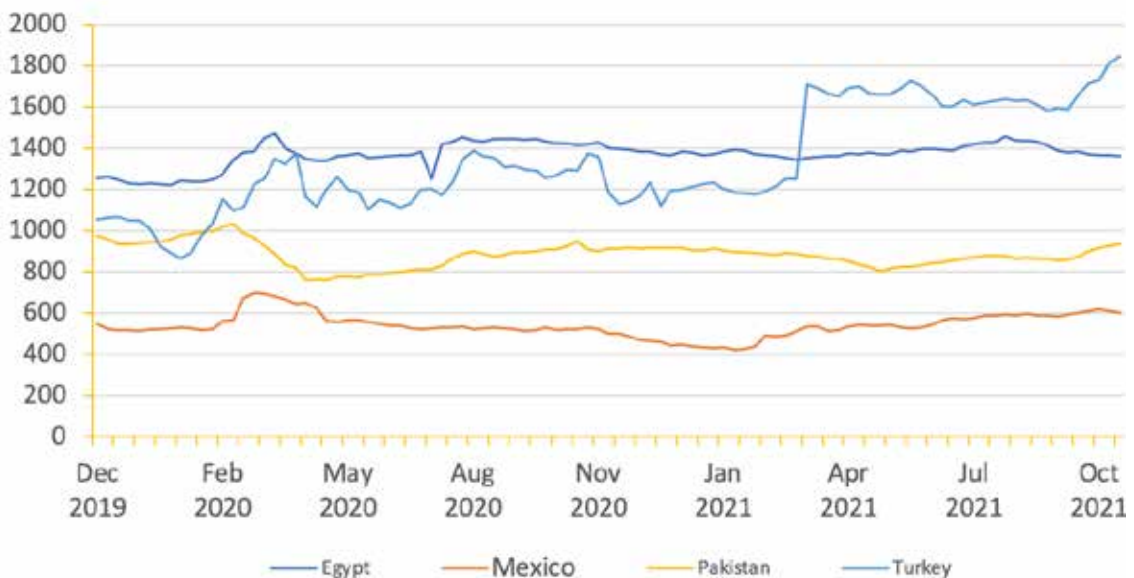


Figure 1.22 (c): 10-year government bond yield spread, other developing economies (bp, vs US 10-year government bond)



ASEAN-5 = Five countries of the Association of Southeast Nations, bp = basis point, BRICS = Brazil, China, India, Russia, South Africa, US = United States.

Source: World Government Bonds.

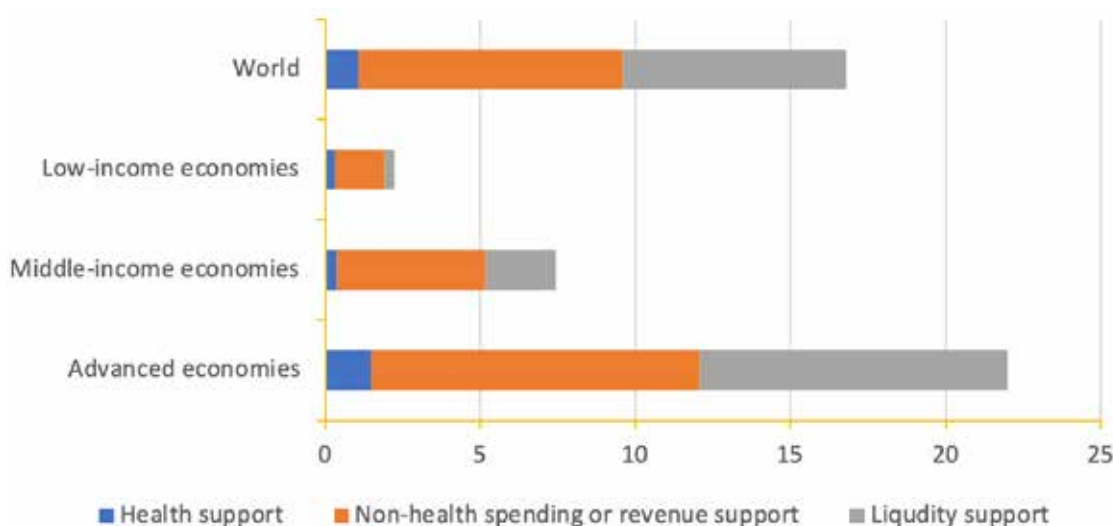
<http://www.worldgovernmentbonds.com/spread-historical-data/>.

1.3. Fiscal and monetary policies

Countries around the world have continued fiscal and monetary stimulus measures.

In 2020, governments around the world introduced massive fiscal and monetary policy measures to support the health sector; protect businesses, jobs, and poor and low-income households; and shore up the economy. The support for the health sector included additional government spending to boost testing and strengthen treatment capacities for COVID-19 infections, increase the suppliers of personal protective equipment and medical goods and services, and in several countries, support the development of vaccines. Fiscal support for affected firms and households included wage subsidies, extension of unemployment insurance covers, in-kind and cash transfers to low-income households, tax cuts and deferrals, reduction in utility fees, credit support and loan guarantees, and job creation (such as through infrastructure investment). Monetary policy measures included, among others, liquidity support through central banks purchasing government bonds and assets from the private sector, cuts in interest rates, and regulatory changes (such as reducing the required reserve ratios) to encourage loan creation, especially to support SMEs.

Figure 1.23: Global fiscal responses to COVID-19 (% of 2020 GDP)



COVID-19 = coronavirus disease, GDP = gross domestic product

Sources: Asian Development Bank. ADB COVID-19 Policy Database. <https://covid19policy.adb.org/>; International Monetary Fund; Database of Fiscal Responses to COVID-19. <https://www.imf.org/en/Topics/imf-and-covid19/Fiscal-Policies-Database-in-Response-to-COVID-19>; and various country sources.

According to the IMF, in 2020, the total global fiscal support committed to cope with the COVID-19 pandemic reached 16.8% of the world's combined GDP, with 1.1 percentage points allocated to the health sector, 8.5 percentage points flowing into spending or revenue support for businesses and households, and 7.2 percentage points channeled into liquidity support (Figure 1.23). The size of the fiscal package was the largest for the advanced economies, at 22% of GDP, with spending and revenue support more or less equal to liquidity support; followed by middle-income economies, at 7.4% of GDP, dominated by spending and revenue support; and low-income economies, only at 2.2% of GDP, spending and revenue support also accounting for the bulk of fiscal support. The difference in the size of fiscal

packages reflected, on one hand, the severity of the pandemic—the advanced economies such as the US, the UK and many members of the European Union were hit hardest by the virus in 2020. On the other hand, it also reflected the fact that the advanced economies have on average greater capacities in mobilizing fiscal resources. From March-April 2020, central banks around the world reduced policy interest rates to their historical lows (see Figure 1.24 below).

In 2021, countries around the world continued to deploy fiscal stimuli and monetary accommodation to support economic recovery. In the US, which introduced two large fiscal stimulus packages in 2020 amounting to \$4,013 billion or 19.1% of GDP, the federal government provided another round of coronavirus relief in March 2021 with an estimated cost of \$1,844 billion (about 8.8% of 2020 GDP), with measures including extending unemployment benefits programs, sending direct stimulus payments of \$1,400 to eligible individuals, providing direct aid to state and local governments, adding resources to vaccination programs, and increasing funding for school reopening. In early August, the Senate approved a \$1 trillion infrastructure bill to rebuild the nation’s deteriorating roads and bridges and fund new climate resilience and broadband initiatives, delivering a key component of President Biden’s agenda (Ngo 2021). The

bill was approved by the Congress in early November 2021.

Among other advanced economies:

- In France, with 2020 total fiscal support reaching \$603 billion or 23.5% of GDP, the 2021 budget included additional funding for emergency program amid ongoing containment measures of around 0.7% of GDP. The 2021 budget also incorporated key elements of the fiscal package (“Plan de Relance”) announced in September 2020 to support the recovery of the French economy amounting to about € 100 billion over two years.
- Germany’s fiscal stimulus in 2020 reached \$1,472 billion or 38.8% of GDP. In March 2021, the government adopted another fiscal stimulus package of € 60 billion (1.7% of GDP), to back measures adopted in earlier packages (including support for families, young workers and affected businesses) along with additional support for health spending.
- In Japan, with total fiscal support in 2020 amounting to \$2,210 billion or 44% of GDP, the government in December 2020 adopted another fiscal package (the Comprehensive Economic Measures to Secure People’s Lives and Livelihoods toward Relief and Hope) of around \$710 billion for implementation in 2021. In

Figure 1.24 (a): Central bank policy rate (%)

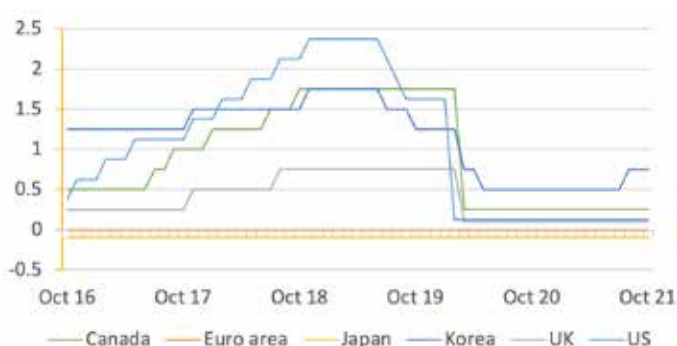
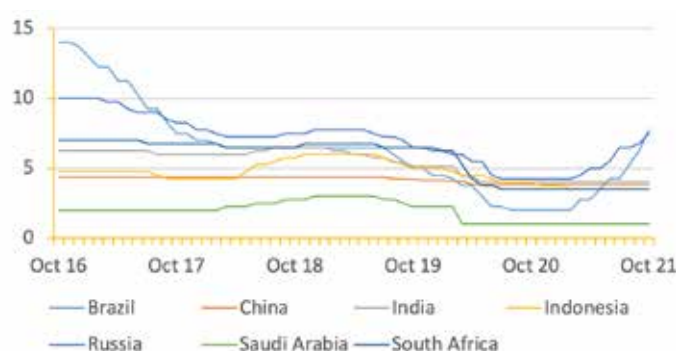


Figure 1.24 (b): Central bank policy rate (%)



UK = United Kingdom, US = United States.

Source: Bank for International Settlements. Central Bank Policy Rates; <https://www.bis.org/statistics/cbpol.htm> (accessed 21 Nov 2021).

March 2021, the government adopted a record budget worth \$1 trillion for FY2021 that includes 5 trillion yen in emergency spending related to the pandemic.

- South Korea's total fiscal package for 2020 amounted to \$222 billion or 13.6% of GDP). For 2021, the government budgeted a fiscal deficit of 75.4 trillion won. On 25 March 2021, the National Assembly approved a supplementary budget for 14.9 trillion won (0.8% of GDP). Measures would include relief for affected small business owners and workers, employment support, vaccine rollout, financial support for small businesses, and support to low-income households. On 1 July 2021, the government announced a proposed 2nd supplementary budget for 2021 amounting to 33.0 trillion won (1.6% of GDP).
- In the UK, following fiscal support amounting to \$878 billion or 32.4% of GDP in 2020, the government announced an additional fiscal stimulus of £59 billion (nearly 2.6 % of GDP) for the fiscal year of 2021-2022 in March 2021, consisting of COVID-related support measures at £43 billion and £15.7 billion to boost the recovery.

In China, which in 2020 provided fiscal support (additional spending and foregone revenues) totaling to more than \$710 billion (or 4.7% of GDP) and liquidity support of \$93 billion equivalent to 1.3% of GDP, the government has budgeted a fiscal deficit of 3.2% for 2021, lower than previous year's 3.6%, with the outbreak under control and economic recovery well under way. But the size of total fiscal spending will be larger. The government will increase general fiscal transfers to local governments to support job creation, businesses, and people's livelihoods. The government has also announced to extend the duration of value-added tax relief measures for small-scale taxpayers and increase their monthly sales tax threshold from CNY 100,000 to CNY150,000. In addition to the preferential policies already in force, the income tax will

be halved for micro and small enterprises and self-employed individuals with annual taxable income of below CNY 1 million.

Among other developing countries:

- Brazil's total fiscal package (including liquidity support) amounted to \$206 billion or 14.5% of GDP, with measures including the expansion of health spending, temporary income support to vulnerable households, employment support, lower taxes and import levies on essential medical supplies, and new transfers from the federal to state governments to support higher health spending and as cushion against the expected fall in revenues. Most of these measures have expired in end 2020, but the Emergency Aid program has been renewed for April-July 2021.
- India's total fiscal support in 2020 amounted to \$215 billion or 8.2% of GDP. For the FY 2021/22, the central government budget for FY2021/22 expanded spending on health and well-being, including a provision for the COVID-19 vaccination program (350 billion rupees). The fiscal deficit in FY2021-2022 is estimated to be 6.8% of GDP, compared with an estimated 9.5% of GDP in FY 2020-2021. The central government also extended a scheme for providing interest-free loans to states for capital expenditure to FY2021/22 (150 billion rupees) and expedited the release of Disaster Response Fund to state governments (from June to May).
- In Indonesia, total fiscal assistance from the government in 2020 amounted to \$38 billion or 3.6% of GDP, under a national economic recovery program (PEN). In 2021, the government has budgeted a total of IDR 699.4 trillion rupiah for the PEN.
- In Russia, the government announced a fiscal package estimated at \$64 billion, equivalent to 4.5% of GDP, over 18 months under the nationwide economic recovery plan in 2020. In 2021, the anti-crisis fiscal support is expected to be much less at

around 1.5% of GDP. The cost of social spending announced in the President State of the Nation Address in April 2021 is estimated at 0.3 % of GDP over two years.

- In Saudi Arabia, the government provided a total of \$21 billion of fiscal support, equivalent to 3% of GDP in 2020. In 2021, most of the fiscal support introduced in 2020 have been withdrawn. But the wage support program through the unemployment insurance fund SANED has been extended through July 2021 to the sectors that are still being affected by COVID-19.
- South Africa’s fiscal stimulus package in 2020 had been relatively large among emerging markets, at \$28 billion or 10% of GDP. Many of the measures introduced in 2020 were extended to 2021, including unemployment benefits or grants, food distribution programs, support for SMEs under stress, and loan guarantees for eligible businesses.

On the monetary front, most central banks around the world have maintained policy rates at historical low levels (Figure 1.24). In the US, the Federal Reserve (FED) continues to use forward guidance on the future of its key interest rate. In its November 2021 policy meeting, it left the target range for the rate unchanged at 0-0.25%, but decided to begin reducing the monthly pace of its net asset purchases by \$10 billion for Treasury securities and \$5 billion for agency mortgage-backed securities, citing the substantial further progress the economy has made towards the goals it set last December (FED 2021). It also indicates that the rate’s target range is expected to be maintained until “labor market conditions have reached levels consistent with the Committee’s assessments of maximum employment and inflation has risen to 2% and is on track to moderately exceed 2% for some time”. It notes that inflation is elevated, but “largely reflecting factors that are expected to be transitory”.

In the euro area, the European Central Bank

(ECB) in its October policy meeting left record-low interest rates unchanged and maintained net purchases under its Asset Purchase Program at a monthly pace of € 20 billion, but indicated it would start conducting a moderately lower pace of net asset purchases under the pandemic emergency purchase program (PEPP) for the rest of the year, due to improved economic and financial conditions (ECB 2021). It reiterated the PEPP envelope would be maintained at €1.85 trillion until at least the end of March 2022 and, in any case, until it judges that the coronavirus crisis phase is over. The central bank expects the key ECB interest rates to remain at their present or lower levels until it sees inflation reaching 2% well ahead of the end of its projection horizon and durably for the rest of the projection horizon.

In Japan, the central bank continues to implement quantitative and qualitative easing program. Faced with continued deflationary pressure, the Bank of Japan (BOJ) in its meeting on 18 June decided to extend the Special Program to Support Financing in Respond to the Novel Coronavirus by 6 months until March 2022. In its July meeting, it left the key short-term interest rate unchanged at -0.1% and kept the target for the 10-year Japanese government bond yield at around 0%. These were maintained in its October policy meeting.

In South Korea, the Bank of Korea (BOK) raised its base rate by 25 basis points to 0.75% in its August 2021 meeting, the first-rate hike in almost three years. In the October policy meeting, it left the rate unchanged at 0.75%. The policy statement indicates that BOK will continue to conduct monetary policy to sustain the recovery and stabilize inflation at the target level over a medium-term horizon, while paying attention to financial stability.

In the UK, the monetary policy committee of the Bank of England (BOE) in its November meeting decided to maintain the base rate at 0.1% and the total target stock of asset



purchases at £895 billion. It notes that CPI inflation is expected to rise further in the near term, but the “upward pressure is expected to dissipate over time, as supply disruption eases, global demand rebalances, and energy prices stop rising” (BOE 2021). As a result, it projects CPI inflation to fall back materially from the second half of next year.

Among emerging markets and developing economies, the People’s Bank of China (PBOC) has continued to maintain prudent monetary policy coupled with targeted support for micro-, small- and medium-sized enterprises (MSMEs). In July 2021, it reduced the required reserve rate by 50 basis points to 12% to support the real economy, releasing around 1 trillion yuan (or \$154 billion) in long-term liquidity into the economy. But the PBOC has left its benchmark one-year lending rate unchanged at 3.85% since April 2020. The statement of its Monetary Policy Committee meeting in the third quarter of 2021 indicates that the monetary policy will aim to maintain growth of money supply in line with growth of nominal GDP, give greater priority to serving the real economy, and maintain overall economic stability, while continuing to support MSMEs. The Reserve Bank of India kept its benchmark repo rate unchanged at 4% at its October policy meeting, pronouncing it was maintaining an accommodative monetary policy stance as long as necessary to support the economic recovery and to help mitigate the negative impact of COVID-19.

On the other hand, in response to rising inflation, the Central Bank of Russia in its October policy meeting decided to raise its benchmark policy rate by another 75 basis points to 7.5%, the sixth in a row since February 2021. The central bank expects inflation to reach 7.4-7.9% at the end of

2021 and its current monetary policy stance is aimed to return inflation to 4%. In the same month, Brazil’s central bank raised its benchmark interest rate by 150 basis points to 7.75%, its biggest hike since 2002, as it tries to tame surging inflation, which reached 10.25% in September—far above its target ceiling of 5.25%.

Multilateral financial institutions have played an important role in forming global responses to COVID-19

The scale of shocks of the COVID-19 pandemic has been unprecedented, and funding needs for countries to adequately support their recovery are enormous. Funding gaps are particularly large for developing countries. Since March 2020, multilateral financial institutions have played a critical role in expanding the fiscal space of developing countries to fight against the pandemic and mitigate its effects (Table 1.1).

By August 2021, the IMF and eight multilateral development banks (the African Development Bank, the Asian Development Bank, the Asian Infrastructure Investment Bank, the European Bank for Reconstruction and Development, the Inter-American Development Bank, the Islamic Development Bank, the New Development Bank, and the World Bank) have committed close to \$500 billion for the pandemic-related financial assistance to developing countries, with more than \$330 billion having been disbursed. These funding resources are supporting developing countries in their fight against the pandemic, including financing of emergency health responses and vaccination programs; improving and expanding social safety nets; support for SMEs to maintain and create jobs; spending on education; and investing in infrastructure to support economic recovery.

Table 1.1: Summary of COVID-19-related assistance from multilateral financial institutions

	Allocated Resources	Disbursements	Description of assistance
Africa Development Bank	\$10 billion	\$4.07 billion	<ul style="list-style-type: none"> COVID-19 Response Facility
Asian Development Bank	\$29 billion	\$22.5 billion	<ul style="list-style-type: none"> Initial COVID-19 response package to address the severe impacts of the pandemic Asia-Pacific Vaccine Facility
Asian Infrastructure Investment Bank	\$13 billion (from April 2020 to April 2022)	US\$8.1 billion	<ul style="list-style-type: none"> Crisis Recovery Facility to finance immediate health sector needs, support economic resilience, and to address liquidity constraints
European Bank for Reconstruction and Development	€21 billion	€8.3 billion	<ul style="list-style-type: none"> Resilience Framework for funding short-term liquidity and working capital needs Expansion of financing under its Trade Facilitation Program Fast-track debt restructuring Framework for supporting small and medium enterprises Vital Infrastructure Support Program
Inter-American Development Bank	\$12 billion	\$7.5 billion	<ul style="list-style-type: none"> Responses: Fiduciary response, corporate response, support to countries, support to the private sector, working with strategic partners, supporting entrepreneurs, open innovation and knowledge Priority areas: Strengthening public health preparation and response capacity, safety nets for vulnerable population, economic productivity and employment, fiscal policies to ameliorate economic impacts, other areas
International Monetary Fund	\$1 trillion in lending capacity, \$250 billion of which are to be made available (as of Aug 2021)	US\$ 115.9 billion (as of August 2021)	<ul style="list-style-type: none"> Emergency Assistance Catastrophe Containment and Relief Trust Augmentation under Existing Programs New Financing Arrangement Capacity Development
Islamic Development Bank	\$2.3 billion		<ul style="list-style-type: none"> A funding package consisting of a Respond, Restore and Restart (3R) program, which includes emergency support, acquisition and deployment of medical equipment, and economic support
New Development Bank	\$10 billion	RMB14 billion and \$7 billion	<ul style="list-style-type: none"> COVID-19 Emergency Response Loans and COVID-19 Economic Recovery Loans
World Bank	\$150 billion	\$160 billion	<ul style="list-style-type: none"> New projects, restructuring, and emergency component of new projects, and use of disaster financing instruments COVID-19 crisis response to save lives, protect the poor, ensure sustainable business growth, and rebuild better

Sources: International Monetary Fund. 2021. COVID-19 Financial Assistance and Debt Service Relief. <https://www.imf.org/en/Topics/imf-and-covid19/COVID-Lending-Tracker#ftn> (accessed 16 August 2021); Asian Infrastructure Investment Bank. 2021. COVID-19 Crisis Recovery Facility. <https://www.aiib.org/en/policies-strategies/COVID-19-Crisis-Recovery-Facility/index.html> (accessed 16 August 2021); Asian Development Bank. 2021. COVID-19 Coronavirus: ADB’s Response <https://www.adb.org/what-we-do/covid19-coronavirus>; IADB. 2021. The IDB Group in Response to COVID-19. <https://www.iadb.org/en/coronavirus>; World Bank 2021a.; COVID-19 COVID crisis response. Infographic. <https://www.worldbank.org/en/who-we-are/news/coronavirus-covid19>; EBRD. 2021. The EBRD Coronavirus’ Solidarity Package. <https://www.ebrd.com/what-we-do/coronavirus-solidarity>; Islamic Development Bank. https://www.isdb.org/sites/default/files/media/documents/2020-10/1.%20IsDB%20Group%20Report%20on%20Covid-19%20and%20Islamic%20Finance__FINAL.pdf.

The stimulus measures have supported recovery ...

The record levels of fiscal and monetary stimuli introduced around the world have helped to meet the emergency needs of the health sector, households and the corporate sector, and supported economic recovery. Figure 1.25 presents the estimated cumulative effects of key components of the fiscal stimulus measures—additional spending and tax cuts—on GDP of G20 countries individually and as a whole. Assuming a cumulative average fiscal multiplier of 1 for advanced economies and 0.8

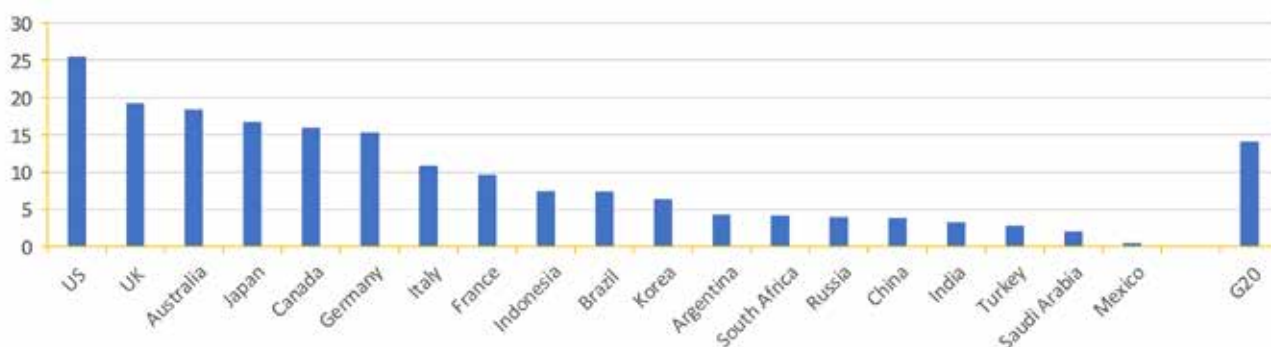
for developing economies, the cumulative contribution of these measures to GDP over two years, as a percentage of 2020 GDP, is estimated to range from 25.5% for the US and 15.3-19.3% for Australia, Canada, Germany, and Japan, to 6.4-10.9% for Brazil, Indonesia, France, Italy, and South Korea, and to less than 5% for Argentina, China, India, Mexico, Russia, Turkey, Saudi Arabia, and South Africa. For these countries as a whole (excluding the EU level fiscal support and packages of individual EU members other than France, Germany, and Italy), the cumulative contribution over two years is about 14% of their combined 2020 GDP. These figures suggest that, without the fiscal stimulus, declines in world output and GDP in individual countries would have been much greater.

... but also raised concerns over increased financial vulnerability

While fiscal stimuli played a critical role in preventing the economy from deeper recessions, these have also led to record

fiscal deficits and high public sector debt in many countries (Figure 1.26). In 2020, among the advanced economies, the fiscal deficit reached 15% of GDP in the US, close to 13% in UK, 11% in Canada, 10% in Japan, around 9% in Italy, France, and Australia, 7% for the EU as a whole, a little over 4% in Germany, 2% in South Korea, and 11% for the advanced economies as a whole. Among developing economies, the fiscal deficit was the highest in Brazil at 13% of GDP, followed by India at 13%, Saudi Arabia, China, and South Africa at around 11%, Indonesia 6%, Turkey and ASEAN-5 5%, Russia 4%, and slightly over 9% for developing economies as a whole. For 2021 and 2022, according to IMF projections, the fiscal deficits will be lower in most of these countries, but remain high. The large fiscal deficits have led to surges in gross government debt, from 104% of GDP in 2019 to 123% in 2020 and an estimated 122% in 2021 for advanced economies and from 54% in 2019 to an estimated 63% in 2020 and 2021 for developing economies, raising concerns over fiscal sustainability in some countries (Figure 1.27).

Figure 1.25: Estimated cumulative contributions of fiscal stimulus, G20 countries (% of 2020 GDP)



G20 = Group of 20 economies, US = United States, UK = United Kingdom. The estimate for G20 excludes the EU level fiscal support and packages of individual EU members other than France, Germany, and Italy. Source: Author's estimation.

② A fiscal multiplier measures the short-term impact of discretionary fiscal policy on GDP, usually defined as the ratio of a change in output to an exogenous change in government spending or tax with respect to their baselines. The size of fiscal multipliers varies across different fiscal instruments and depends on structural (such as trade openness, exchange rate regimes, labor market rigidity, and fiscal position) as well as transitory characteristics (such as the monetary policy stance and the stage of business cycles) of an economy. See a recent survey and empirical by Dime, Ginting, and Zhuang (2021). <https://www.adb.org/sites/default/files/publication/726471/ewp-638-fiscal-multipliers-asian-countries.pdf>.

Figure 1.26 (a): Fiscal balance, selected advanced countries (% of GDP)

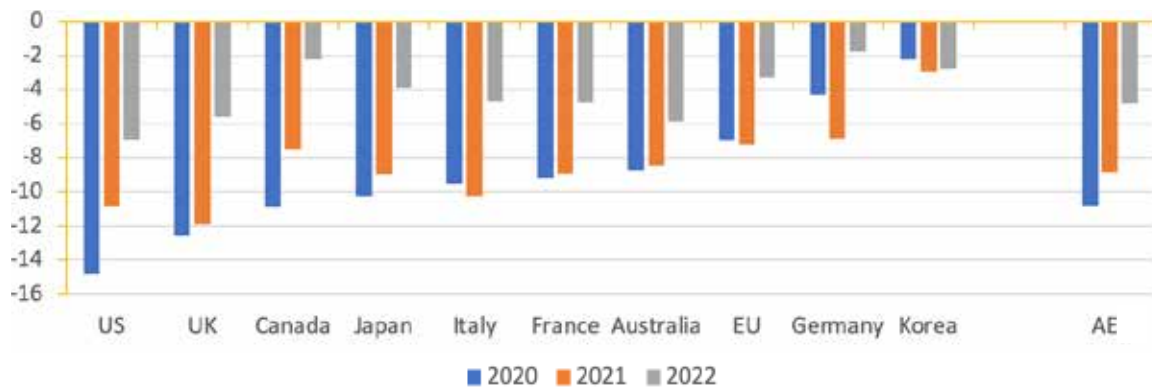
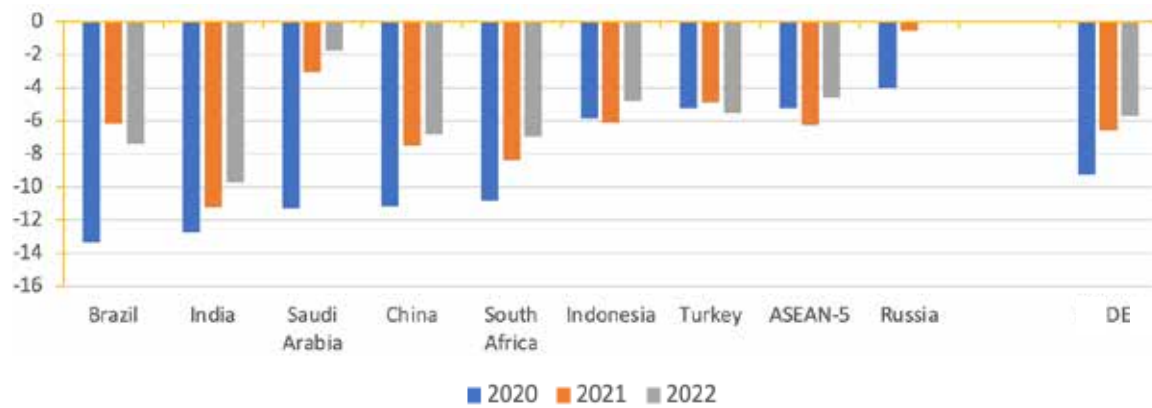


Figure 1.26 (b): Fiscal balance, selected developing countries (% of GDP)



ASEAN = Association of Southeast Asian Nations, UK = United Kingdom, US = United States, EU = European Union, AE = advanced economies, DE = developing economies.
 Source: International Monetary Fund (IMF). IMF Data; <https://www.imf.org/en/Data>.

Figure 1.27 (a): Gross government debt, advanced economies (% of GDP)

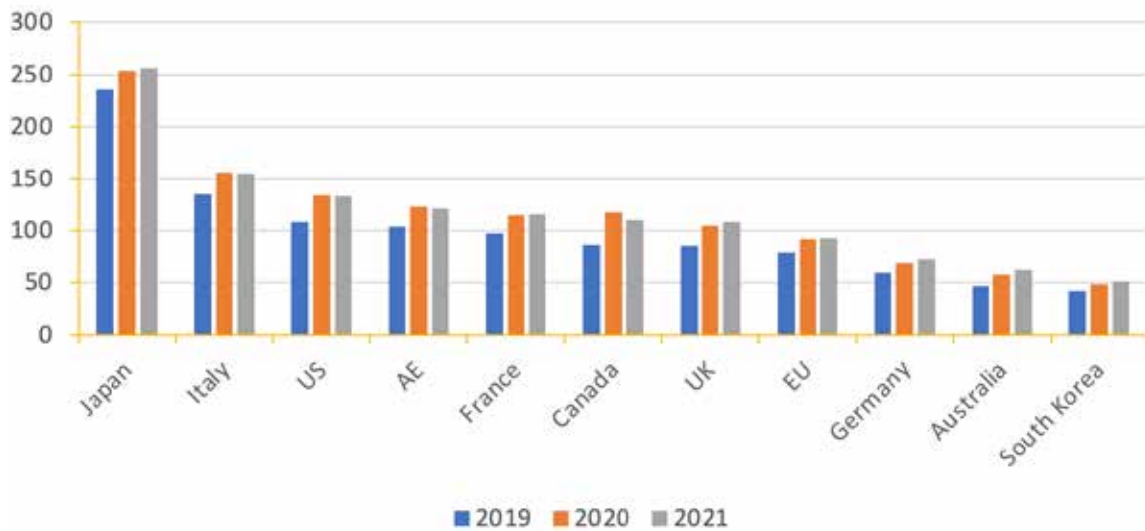
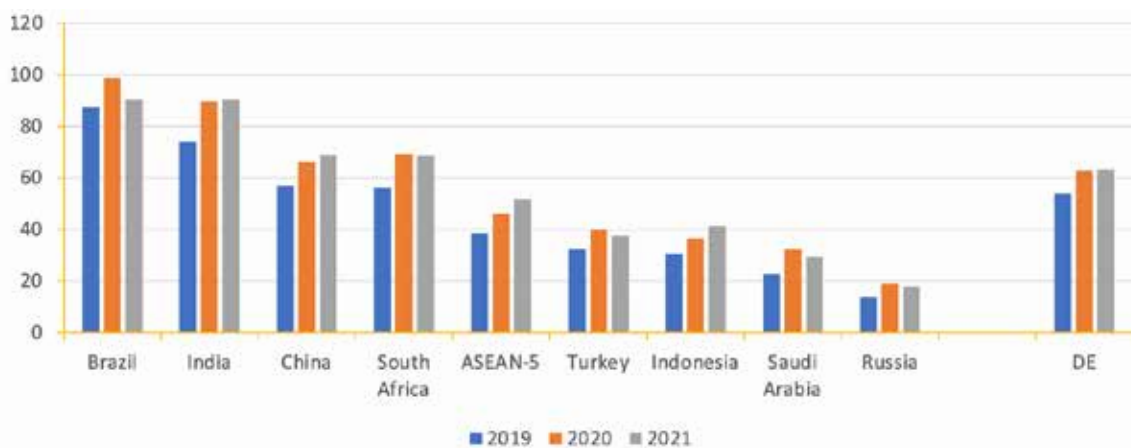


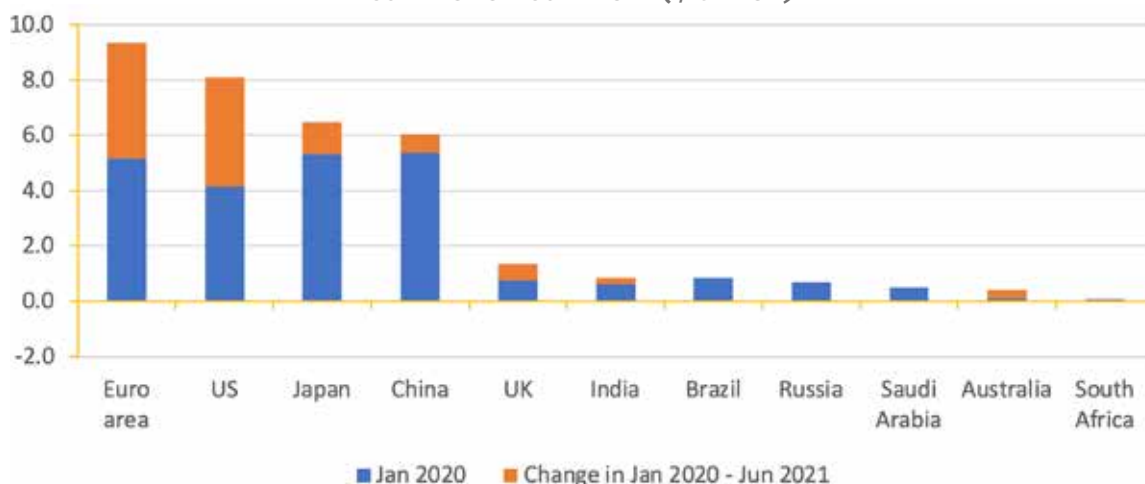
Figure 1.27 (b): Gross government debt, developing economies (% of GDP)



AE = advanced economies, DE = developing Economies, ASEAN = Association of Southeast Asian Nations, UK = United Kingdom, US = United States, EU = European Union.

Source: International Monetary Fund (IMF). IMF Data. <https://www.imf.org/en/Data>.

Figure 1.28: Change in the size of central bank assets, selected economies, Jan. 2020 - Jun. 2021 (\$ trillion)



US = United States, UK = United Kingdom.

Sources: Various central bank web sites.

Much of the additional government debt to finance fiscal deficits were financed by central banks purchasing government bonds under QE programs. This, plus the purchasing of the private sector bonds to support the businesses, has led to surges in central bank assets in their balance sheets. The US Federal Reserve's assets increased from \$4.15 trillion in January in 2020 to \$8.1 trillion in June 2021, growing by 95% (Figure 1.28). During the same period, assets of Reserve Bank of Australian jumped by 250%, those of the European Central Bank and Bank of England both surged by about 80%, and of the Bank of Japan grew by 22%. On the other hand, central banks in developing

countries have adopted QE measures to a much lesser degree. Among those in Figure 1.26, only Reserve Bank of India saw its assets increasing significantly, growing by 35% during this period. People's Bank of China saw its balance sheet expanding by 12%. Balance sheets of other central banks either contracted or stayed unchanged. The ballooning of central bank assets in advanced countries, while needed in responding to the catastrophic shocks to economies, have raised concerns over possible effects on global inflation expectations and also created the challenge of engineering a smooth exit from these measures without creating large volatility in the global financial markets.

1.4. Outlook, risks, and policy priorities

Outlook

Despite moderation in momentum, global recovery is on track with varying-speed across countries.

Following a strong rebound in the first half of this year, more recent data suggest some moderation in global growth momentum in the second half, as outbreaks of the Delta variant of the virus led to a tightening of containment measures in many countries and a weakening in consumer confidence, and as bottlenecks in global supply chains caused by the pandemic started to constrain growth. As a result, many investment houses and international organizations adjusted their growth projections for 2021 downward for some parts of the world. The consensus view now is that the global economy will grow about 5.9% this year (using country weights at the PPP exchange rates) (Table 1.2).⁹ The advanced economies combined will grow 5.2% and developing economies as a group will expand by 6.4%. But there are large variations in the pace of recovery across countries, reflecting a number of factors, including the progress in rolling out vaccination, the strength of fiscal and monetary support, extent of contraction in 2020, and some country-specific developments.

At these rates, the advanced economies will contribute 37% of the global growth in 2021, and developing economies will contribute 63%. Across regions, developing Asia will contribute 42.5%, North America 17.8%, the EU 12.7%, Latin America and Caribbean 7.5%, Middle East and North Africa 6.9%, high income Asia 5.5%, developing Europe 4.2%, and Sub-Saharan Africa 1.9%. Across countries, China will remain the largest

contributor to global growth at 26.3%, followed by the US at 16.7%, and India at 11%.

In 2022, global recovery is set to continue. With the vaccines remaining effective, there has been a growing expectation that countries that are more advanced in vaccinating their population will be able to further relax social distancing measures as full or near-full vaccination is achieved. Furthermore, countries across the world will continue to maintain expansionary fiscal and monetary policies—although the strength of the stimuli will be reduced due to the concerns over fiscal sustainability and inflationary pressures. Against this background, with the waning base effect, the global economy is seen to expand 4.7% in 2022, with the advanced economies combined expanding 4.2% and developing economies together growing 5%.

Among major groups of economies, in 2021 and 2022, developing Asia is to grow 7.2% and 5.9%; high income Asia 3.8% and 3.2%; developing Europe 4.4% and 3.6%; the EU 5.1% and 4.3%; Latin America and Caribbean 6.0% and 3.1%; Middle East and North Africa 5.3% and 4.0%; North America 6.0% and 4.5%; Sub-Saharan 3.7% and 3.9%; ASEAN 3.3% and 5.3%; BRICS countries 7.6% and 5.5%; G20 6.2% and 4.7%; and one-belt-one-road economies 5.9% and 4.8%, respectively.

Among major advanced economies, the US economy is projected to grow 6.1% in 2021 and 4.5% in 2022. After expanding 6.2% (y-o-y) during H1 2021, growth momentum has softened in the second half due to a number of factors. The spread of the Delta variant caused a resurgence of infection cases in recent months and led to a weakening in consumer confidence. Supply-chain disruptions and the reported shortage of workers in some sectors are expected to weigh on growth. However, part of these

⁹ In this report, growth and inflation projections are based on the latest forecasts by Focus-Economics and international organizations (such as the IMF, World Bank, and ADB), and analysis of International Finance Forum (IFF) staff.

impacts will be offset by the strong fiscal support and accommodative monetary stance. The recent job market data show the unemployment rate has continued to decline, standing at 4.6% in October. With about 58% of the population fully vaccinated as of early November, the US will be one of the earlier countries returning to normalcy. The Fed has started cutting asset purchases in response to rising inflation, but is expected not to raise the rate any time soon. The infrastructure bill will support recovery.

The EU is projected to grow 5.1% in 2021 and 4.3% in 2022. The bloc grew 6% (y-o-y) in H1 2021, supported by rebound in both industry and services sectors on the supply side and domestic consumption and exports on the demand side, as the vaccination rolling-out proceeded rapidly, the number of new COVID-19 cases declined and restrictions were relaxed. Among the bloc's larger economies, the rebound was particularly strong in France, Italy, and Spain. In July, economic sentiment reached an all-time high and the composite purchasing managers' index (PMI) posted the strongest reading in many years. Although the latter slipped in August and September, it still signaled strong expansions in both the manufacturing and services sectors. These led many investment houses and IMF to upgrade the EU's 2021 growth—although Germany's 2021 growth was downgraded owing to the supply chain disruptions. In 2022, the ECB will continue to maintain expansionary monetary policy and low interest rates. To support growth and recovery, the European Commission is expected to disburse more grants and loans to member economies under its 750 billion euro pandemic recovery package. A high vaccination rate, with close to 65% of the population fully vaccinated as of earlier November, will enable the bloc to further relax social distancing measures in 2022.

The Japanese economy is projected to grow 2.4% in 2021 and 2.6% in 2022. It grew 2.9% (y-o-y) in H1 2021, as the recurrence of COVID-19 outbreaks and increased restrictions

stifled economic activity. The fourth State of Emergency from July to September will weigh on growth in the second half. At the same time, the economy continues to be under deflationary pressure. But the rapid pick-up in vaccination rolling out—with fully vaccinated population reaching close to 74% in early November, continued expansionary fiscal and monetary policy, and improving external demand will support growth in 2022.

The South Korea economy is projected to grow 4% in 2021 and 3% in 2022. The economy grew 3.9% (y-o-y) in H1 2021, supported by strong export growth and rebound in industrial production. Fiscal stimulus including a supplementary budget in March supported both private and public spending. The economy in the second half will feel the effect of the new wave of cases and containment measures. On a positive note, labor market remains strong as indicated by a low unemployment rate, which will boost private spending in the coming months. In 2022, sustained fiscal spending—as indicated by the most recent supplementary budget, resuming private consumption, a buoyant external sector, and a rising vaccination rate will support growth.

The UK economy is projected to grow 6.3% in 2021 and 5.2% in 2022. The economy grew 6.5% (y-o-y) in H1 2021, benefiting from speedy vaccination rollout, which enabled the removal of restrictions, and supported by fiscal stimulus and monetary accommodation. However, a resurgence of infection cases, Brexit tensions, and global supply chain jitters are likely to have dampened growth momentum somewhat in the second half. On a positive note, a strong labor market, continued fiscal support and monetary accommodation, and a high vaccination rate, standing at 68% of early November 2021, will help keep the recovery on track.

Among major developing economies, China is projected to grow 8.2% in 2021 and 5.6% in 2022. After expanding 12.7% (y-o-y) in H1 2021, growth momentum has also softened in

the second half. Power shortages, measures to control pollutions and contain the financial risk in the real estate sector, and renewed mobility restrictions in areas with bump-ups in Covid-19 cases will all have some dampening effect on growth. The economy grew 4.9% in the third quarter, lower than the market expectation. On the other hand, exports surged in recent months amid solid global demand. In 2022, fiscal and monetary policies will remain accommodative. China is leading the vaccination drive in the developing world, with about 76% of its population being fully vaccinated as of early November 2021, creating the conditions for maintaining normalcy in the domestic economy. Growth will also be supported by strong external demand. The supply-side reforms and demand-side management will continue to help improve the quality of growth.

ASEAN is projected to grow 3.3% in 2021 and 5.5% in 2022. The region grew 4.2% (y-o-y) in H1 2021, supported by improving household spending and strong growth of merchandise exports. Since the second quarter, however, new waves of infection cases driven by the Delta variant led to reimposition of stringent containment measures in Indonesia, Malaysia, the Philippines, Thailand, and Viet Nam. Despite recent moderation in the number of new cases and relaxation of some measures across the region, they have slowed down growth momentum. Supply chain disruptions are also weighing on growth in countries that are parts of these chains such as Malaysia, Philippines, Thailand, and Vietnam. Furthermore, declines in remittances have constrained household spending in remittance-dependent countries such as Indonesia, the Philippines, Myanmar, and Cambodia. Part of the negative impacts of the pandemic has been offset by fiscal stimulus and monetary accommodation. In 2022, growth is seen to be driven by continued global recovery, fiscal and monetary support, and efforts of governments around the region to accelerate vaccination rollout, which remained very low

at 33% as of early November.

The Brazilian economy is projected to grow 5.0% in 2021 and 1.9% in 2022. The economy grew 6.7% (y-o-y) in H1 2021, driven by a strong pickup in fixed investment and surging exports that have been supported by rising commodity prices and strong external demand. On the other hand, household spending remained weak amid elevated daily new infection cases and strict social distancing measures until recently. Fiscal stimulus has continued to support growth, although the strength has been reduced with some support measures removed. The interest rate remains low compared with its historical levels although it has been hiked five times this year by the central bank to contain inflationary pressures. In 2022, growth will be supported by continued strong exports, but constrained by political tensions, weak fiscal positions, and uncertainties brought by the pandemic.

The Indian economy is projected to grow 9.0% in 2021 and 7.6% in 2022. The economy grew 9.3% (y-o-y) in H1 2021, driven by a low base effect and a strong rebound in industrial production, despite experiencing the worst hit by the pandemic. The growth momentum is likely to have softened somewhat in the second half as the base effect fades and uncertainties increased due to the resurgence of infection cases in a large part of the world. However, recent upticks in both manufacturing and services composite PMI signal that recovery is on track. In 2022, efforts to boost the vaccination rate, which remains low at 25% as of early November, continued fiscal stimulus and monetary accommodation, and improving external demand will help support private consumption and fixed investment.

The Russian economy is projected to grow 3.6% in 2021 and 2.7% in 2022. The economy grew 4.8% (y-o-y) in H1 2021, driven by strong recovery in private consumption. However, weaker data on retail sales and PMI in the third quarter suggest moderating growth

momentum, likely due to a resurgence of infection cases and reimposition of mobility restriction measures since June. On the other hand, export growth accelerated, benefiting from rising commodity prices. Fiscal stimulus continues to support growth, but much less than last year, and the central bank started to raise interest rate to prevent return of inflation. In 2022, Russia will continue to benefit from elevated commodity prices, but will be constrained by a low vaccination rate, which stood at 34% as of early November 2021.

The South African economy is projected to grow 4.3% in 2021 and 2.3% in 2022. The economy grew 7.2% (y-o-y) in H1 2021, rebounding from a deep recession last year, thanks to a recovery in industrial production, fixed investment and strong export growth. However, the resurgence of infection cases from June and subsequent reimposition of strict containment measures are likely to have weakened growth momentum in the second half—despite an improving sign in more recent months. In 2022, the country will continue to benefit from elevated commodity prices, but its growth will be constrained by high unemployment, weak public finance, power problems, and slow progress in vaccination rollout.

But the developing economies as a group will not return to its pre-pandemic trend level any time soon.

The global economy should return to its 2019, the pre-pandemic level by 2021. However, about half of the developing economies (including most countries in Latin America and Caribbean, half of developing Asian economies, one third of Sub-Saharan economies, two thirds of Middle East and North African economies, and one third of developing European economies) and half of the advanced economies (including most EU members and Japan) will not return to their pre-pandemic level in 2021—they will only return to their pre-pandemic level by 2022. Moreover, it will take much longer for many of these economies to return to their pre-pandemic *trend* levels (these are the levels that could have been achieved if the economy had continued to grow at the recent trend rate in the absence of the pandemic). According to the IMF's medium-term growth projections, the global economy is expected to recover to its pre-pandemic trend level by 2025 (see Figure 1.2), and the advanced economies combined is expected to do so by 2023, but the gaps will not be eliminated any time soon for developing economies as a group.



Table 1.2: GDP growth projections (%)

	2018	2019	2020	2021	2022
				Projection	
World (PPP)	3.6	2.8	-3.1	5.9	4.7
Major groups of economies					
Advanced economies	2.3	1.7	-4.5	5.2	4.2
Developing economies	4.6	3.7	-2.0	6.4	5.0
Developing Asia	6.4	5.2	-0.8	7.2	5.9
High income Asia	1.6	1.0	-2.9	3.8	3.2
Developing Europe	3.6	3.0	-3.2	4.4	3.6
European Union	2.3	1.9	-5.9	5.1	4.3
Latin America and Caribbean	1.1	0.2	-7.0	6.0	3.1
Middle East and North Africa	1.9	1.1	-2.0	5.3	4.0
North America	2.9	2.3	-3.6	6.0	4.5
Sub-Saharan Africa	3.3	3.2	-1.6	3.7	3.9
ASEAN	5.3	4.7	-3.3	3.3	5.3
BRICS	5.8	4.6	-0.9	7.6	5.5
G20	3.7	2.9	-3.1	6.2	4.7
One-belt-one-road economies	4.4	3.7	-1.2	5.9	4.8
Major economies					
Argentina	-2.6	-2.1	-9.9	7.3	2.5
Australia	2.8	1.9	-2.4	4.0	3.8
Brazil	1.8	1.4	-4.1	5.0	1.9
Canada	2.4	1.9	-5.3	5.0	4.5
China	6.8	6.0	2.3	8.2	5.6
France	1.8	1.8	-8.0	6.0	3.9
Germany	1.1	1.1	-4.6	3.2	4.4
India	6.5	4.0	-7.3	9.0	7.6
Indonesia	5.2	5.0	-2.1	3.5	5.2
Italy	0.9	0.3	-8.9	5.8	4.3
Japan	0.6	0.0	-4.6	2.4	2.6
Korea	2.9	2.2	-0.9	4.0	3.0
Mexico	2.2	-0.2	-8.3	6.1	3.5
Russia	2.8	2.0	-3.0	3.6	2.7
Saudi Arabia	2.4	0.3	-4.1	2.4	4.5
South Africa	1.5	0.1	-6.4	4.3	2.3
Turkey	3.0	0.9	1.8	8.1	3.7
United Kingdom	1.3	1.4	-9.8	6.3	5.2
United States	2.9	2.3	-3.4	6.1	4.5

Note: Definitions of major groups of economies are in the front pages.

Sources: Growth rates for 2018-2020 from IMF; growth projections are based on forecasts by FocusEconomics, international organizations (such as IMF, the World Bank and ADB), and IFF staff analysis.

Inflationary pressures will remain elevated in many parts of the world, but ease somewhat in 2022.

Rising inflation this year, especially in the advanced economies, reflects multiple factors, including recovery of economic activity (partly driven by large fiscal and monetary stimuli), supply bottlenecks caused by the pandemic, higher commodity prices, and the base effect. In some emerging markets, currency depreciations have caused import prices to rise. The consensus view is that global consumer price inflation rate is to rise from 3.5% in 2020 to 4.5% this year—from 0.7% to 2.7% for advanced economies and from 5.1% to 5.5% for developing economies (Table 1.3). Among the advanced economies, the rise in inflation will be most pronounced in the US—the country with the largest fiscal and monetary stimuli, from 1.2% to 4.3%, followed by Germany, from 0.4 to 2.7%, Canada from 0.7% to 2.5%, the EU from 0.7% to 2.2%, the UK from 0.9% to 2.1%, and Australia from 0.9% to 2.0%. For the other advanced economies in the G20 group, inflation in 2021 will stay below 2%, and Japan is expected to experience a zero-inflation.

Among developing economies, Argentina and Turkey will continue to experience a double-digit inflation in 2021, reaching about 47% and 17.2%, respectively, partly due to large currency depreciations. Annual consumer price inflation rate will double to 6.1% in Russia and 7.1% in Brazil, and reach 5.5% in Mexico and 4.3% for South Africa.

For the other developing economies in the G20 group, consumer price inflation rate is expected to fall in 2021 from the 2020 level, including China, India, Indonesia, and Saudi Arabia.

In 2022, inflation pressures are expected to remain elevated in parts of the world, but the consensus view is that the global inflation will moderate somewhat for a number of reasons. First, the expanding coverage of vaccination will lead to further recovery of global economic activity, reducing supply-side bottlenecks. Second, commodity prices are likely to be more stable next year than this year because of moderating demand growth and expanding supply (World Bank 2021b). Third, governments around the world are likely to trim the extent of fiscal and monetary stimuli or in some countries start to tighten monetary policy to control inflation.

IMF's baseline inflation projection in its October 2021 World Economic Outlook (IMF 2021a) is that across most economies, inflation is expected to come down to its pre-pandemic range in 2022 once supply-demand mismatches resolve. It listed a number of reasons for this projection, such as remaining slacks in labor markets and structural factors especially increasing automation that have reduced the sensitivity of prices to changes in labor market conditions. But it also noted the lagged pass-through to broader inflation from higher food and oil prices for importers—that means that price pressures could stay elevated into 2022 in some developing economies.



Table 1.3: Annual consumer price inflation projections (%)

	2018	2019	2020	2021	2022
				Projection	
World (PPP)	3.7	3.7	3.5	4.5	3.8
Major groups of economies					
Advanced economies	2.0	1.4	0.7	2.7	2.2
Emerging market and developing economies	4.9	5.1	5.1	5.5	4.9
Developing Asia	2.8	3.5	3.4	2.7	3.2
High income Asia	1.3	0.7	0.2	1.0	1.1
Developing Europe	3.4	4.1	3.1	5.6	4.3
European Union	1.8	1.4	0.7	2.2	1.8
Latin America and Caribbean	6.7	8.3	6.8	9.5	8.0
Middle East and North Africa	12.0	9.6	11.3	14.3	9.4
North America	2.4	1.8	1.2	4.2	3.2
Sub-Saharan Africa	8.6	9.9	14.3	11.0	8.7
ASEAN	2.8	2.2	1.5	2.3	2.6
BRICS	2.7	3.6	3.4	3.2	3.3
G20	3.0	3.1	2.6	3.3	3.0
One-belt-one-road economies	4.4	4.4	4.5	4.8	4.2
Major economies					
Argentina	34.3	53.5	42.0	47.0	45.0
Australia	1.9	1.6	0.9	2.0	1.7
Brazil	3.7	3.7	3.2	7.1	5.0
Canada	2.3	1.9	0.7	2.5	2.3
China	2.1	2.9	2.4	1.3	2.2
France	2.1	1.3	0.5	1.7	1.3
Germany	1.9	1.4	0.4	2.7	1.6
India	3.4	4.8	6.2	5.5	4.8
Indonesia	3.3	2.8	2.0	1.7	2.7
Italy	1.2	0.6	-0.1	1.4	1.6
Japan	1.0	0.5	0.0	0.0	0.5
Korea	1.5	0.4	0.5	2.0	1.6
Mexico	4.9	3.6	3.4	5.5	3.7
Russia	2.9	4.5	3.4	6.1	4.7
Saudi Arabia	2.5	-2.1	3.4	3.0	2.0
South Africa	4.6	4.1	3.3	4.3	4.4
Turkey	16.3	15.2	12.3	17.2	14.0
United Kingdom	2.5	1.8	0.9	2.1	2.6
United States	2.4	1.8	1.2	4.3	3.3

Note: Definitions of major groups of economies are in the front pages.

Sources: Inflation for 2018-2020 from IMF; Inflation projections are based on forecasts by FocusEconomics, international organizations (such as IMF, the World Bank and ADB), and IFF staff analysis.

Against these considerations, the global consumer price inflation is projected to taper off to 3.8% in 2022 (Table 1.3). Inflation will moderate from 2.7% to 2.2% for advanced economies and from 5.5% to 4.9% for developing economies. Among the advanced economies, the US inflation is projected to soften from 4.3% in 2021 to 3.3% in 2022 and the EU from 2.2% to 1.8%. Among developing economies, inflation is expected to remain at a two-digit level in Argentina and Turkey as the two countries continue to face macroeconomic challenges. It is expected to moderate to 5%, 4.8%, and 4.7% in Brazil, India, and Russia, respectively. China's inflation in 2022 is expected to edge up to 2.2%. Inflation in other major developing economies is expected to range from 2% to 3.3%.

Risks to the outlook

There are a number of downside risks to this outlook.

The resurgence of the COVID-19 outbreak remains the biggest risk.

The biggest risk to the global economic outlook is resurgences of the COVID-19 outbreaks in a large scale due to slow progress in vaccination rolling out in developing countries or virus mutations making the vaccines ineffective. While

vaccination remains the most effective way to live through the pandemic, there are significant variations in the speed of its rolling out across the world. The vaccination gaps or divide could result in the delayed normalization of economic activity, low consumption and weak investment, constraining growth of developing economies. It could also affect growth in countries with a high vaccination rate through international travel, trade and investment channels. According to an ADB study (2021), slow progress in vaccination rolling out could reduce its baseline 2021 GDP growth for developing Asia by about 1 percentage point.

Slow progress in vaccination rolling-out could also increase chances of virus mutations. When there are more infections in a population, virus mutating will be more likely to occur. Virus mutations could increase the transmissibility of the virus, make the disease more deadly, or reduce the efficacy of diagnostics, therapeutics, or vaccines (WHO 2021). The WHO has in its web page listed four “variants of concern” of the COVID-19 virus, including Alpha, Beta, Gamma, and Delta; one “variant of interest”; and many more “variants under monitoring” (WHO n.d.). The currently predominant Delta variant has been found to be much more contagious than previous variants and, as of July 2021, was reported in 96 countries, and has led to surges in new infections in a large part of the world in recent months.



Macroeconomic and financial instability could disrupt the recovery process.

Macroeconomic and financial instability presents another risk to the global outlook. One source of the instability could be the future trajectory of inflation in the advanced economies, especially in the US. While the monetary authorities in advanced economies still consider the recent pickups in inflation temporary, there are a number of reasons why inflationary pressures could become more entrenched. Firstly, demand-supply mismatches could persist, due to renewed outbreaks. Secondly, rises in world commodity prices may not moderate as expected next year. Thirdly, the massive monetary and fiscal stimuli, especially in the US, could de-anchor inflation expectations from central bank targets. Lastly, it has been suggested that deglobalization, which has been occurring since the 2008 global financial crisis and has been accelerated by the COVID-19 pandemic, could generate inflation pressures as well (Marin 2021).

Faster-rising and more persistent inflation may prompt abrupt adjustments in monetary policies in advanced countries. The ample liquidity created by expansionary monetary policy and QE programs since the pandemic started have ballooned asset prices and boosted portfolio capital flows to emerging markets as investors seek higher yields. Thus, for the advanced economies, abrupt changes in the direction of monetary policy could lead to large price corrections in asset markets and instability in broad macroeconomy. For emerging markets and developing economies, they face the added risk of sudden capital outflows and exchange rate volatility. All these could disrupt the global recovery process.

Geo-political tensions could undermine recovery.

There are still many spots of geo-political tensions in the world today that could undermine global recovery if escalating and

becoming out of control. One of these is the relations between the US and China in trade, technology and several other fronts. The trade war, started by the US under its previous administration, is not over. According to the estimates of Peterson Institute of International Economics (Bown 2021), a Washington-based think tank, by the early 2021, 66.4% of Chinese exports to US were subject to US tariffs of 19.3% on average (compared with 3% US tariffs on imports from the rest of the world), while 58.3% of US exports to China were subject to Chinese tariffs of 20.7% on average (compared with 6.1% Chinese tariffs on imports from the rest of the world). Despite recent talks between the two sides, there are no signs as yet for both to roll back their tariffs. Continued trade disputes between the world's two largest economies undermine investor confidence and are not conducive to global recovery.

Policy priorities

Looking ahead, policy priorities depend on country circumstances. At the global level, policy priorities to end the pandemic, reduce risks to the economic outlook, and sustain an inclusive and sustainable recovery include (i) speeding up the vaccination rollout and eliminating the vaccine divide; (ii) ensuring smooth monetary policy transition; (iii) ending trade tensions; (iv) promoting a green recovery; and (v) supporting low-income and lower-middle-income countries.

Speeding up vaccination roll-out and bridging the vaccine divide to end the global pandemic.

As the large vaccine divide presents a significant threat to the global recovery, urgent actions are needed to assist low- and lower-middle-income countries to ramp up their vaccination campaigns. According to IMF estimates, closing the vaccine divide would cost the world \$50 billion, but bring \$9 trillion cumulative gains in terms of avoided economic losses (IMF 2021c). The global community should firmly stand behind

the World Health Organization's call for vaccinating at least 40% of the population in every country by the end of 2021 and 70% by mid-2022. Rich nations should share their excess vaccine doses with poorer countries and provide necessary funding support. Low- and lower-middle-income countries should mobilize financial, institutional, and health sector resources to address demand-side constraints. Multilateral development banks should help their developing members to access external support needed to speed up vaccination. Closing the vaccine divide also requires building developing countries' capacity to manufacture safe, effective, and affordable COVID-19 vaccines.

Ensuring smooth monetary policy transition to maintain macroeconomic stability.

The historical levels of fiscal and monetary stimuli around the world have played a critical role in preventing the global economy from sinking into deeper recessions, stabilizing financial markets, and maintaining economic and social stability. As the economy rebounds and inflation is on the rise, monetary authorities face the challenge of deciding on an appropriate exit strategy for the stimuli and on timing of policy normalization. As past experiences have shown, both premature and delayed policy normalization can be detrimental to recovery and economic stability. Given the significant uncertainty over the inflation trajectory, central banks' ability to ensure smooth policy transition will be tested. To avoid large market reactions to policy changes, policy messages need to be carefully communicated. With highly integrated global financial markets, policy makers—especially in advanced economies—will have to consider not only impacts of policy changes on their domestic economies, but also spillovers to other markets—especially in developing countries. Developing economies, on the other hand, should continue to strengthen their macroeconomic fundamentals and reduce vulnerability to external shocks, and use macroprudential

policy tools in disposal to act when necessary. Advanced and developing economies should work together to prevent the repeat of the “taper tantrum” in 2013. Global processes such as G20 and regional processes such as ASEAN+3 provide appropriate venues for policy coordination.

Ending trade tensions to boost global recovery.

The trade war between the US and China has cost both sides as well as the global economy dearly. Economic toll of the trade war on the US has been estimated to range from 0.3% to 0.7% of GDP in 2019, while job losses have been estimated to amount to more than 300,000 (Zandi, et al. 2019; Hass and Demark 2020). China also felt economic pain as a result of the trade war. China's GDP growth dipped from 6.7% in 2018 to 6.1% in 2019, although not entirely due to the trade war. IMF reduced its 2019 growth projection for China twice after the trade war started, by a total of 0.3 percentage points. Global GDP growth fell from 3.6% in 2018 to 2.8% in 2019 partly due to the trade war. While the world is watching closely at how the US-China trade relations will evolve under the US new administration, an early ending of the trade war will provide a strong boost to the global recovery. Reduction in tariffs will also help to alleviate inflationary pressures. Countries should resolve trade disputes through rules-based multilateral trading system.

Promoting green recovery to address climate change.

The pandemic has delayed actions to address longer-term development issues in many countries as resources were diverted to respond to the health crisis. One of these issues is addressing climate change” to “promoting green and low-carbon transition”. The Paris Agreement in 2015 set the global climate goal—limiting the temperature rise below 2°C above pre-industrial levels and pursuing efforts to limit it even further to 1.5°C to avoid the catastrophic impacts of climate

change. Keeping global warming below 2°C requires global anthropogenic carbon dioxide emissions to reach net-zero around 2070, and limiting it to 1.5°C implies targeting net-zero emissions by 2050. Achieving carbon neutrality requires rapid, far-reaching, and unprecedented transformations in energy and industrial systems, infrastructure, and land use, and large investments in renewable and low-carbon energy sources and green technologies. Countries should accelerate green investments and promote green recovery. Part 2 of this report looks at financing of green investment and related policy issues. Part 3 provides detailed analysis of the roadmap to achieving global carbon neutrality and policy priorities.

Support for low-income and lower-middle-income countries.

The pandemic has led to significant increases in government debt burdens in many countries as the authorities around the world increased fiscal spending to support businesses and protect jobs, assist poor households and the unemployed to cope with the health crisis, and stabilize the economy. The high debt burdens have constrained governments, especially in low- and lower-middle-income countries, in boosting vaccination and addressing longer-term issues such as achieving SDGs and taking

climate mitigation and adaptation actions. High debt burdens have also increased these countries' vulnerability to external shocks. The global community has an obligation to assist low- and low-middle-income countries in going through this difficult and challenging time. In this regard, MDBs will have an important role to play, on top of what they have already done (see Table 1.1 in Section 1.3). However, multilateral funding support is not a substitute for bilateral sources, especially from rich nations. The global community should work together to ensure that low- and lower-middle-income countries have needed financial resources to vaccinate their entire populations, make significant progress in achieving SDGs, and take climate mitigation and adaptation actions.

IMF recently allocated Special Drawing Rights (SDRs) equivalent to \$650 billion to its 190 member countries (Box 1.3). 42.2% of this amounting to \$274 billion was allocated to emerging market and developing economies, of which, \$21 billion was allocated to low-income countries, while advanced economies have received \$376 billion (57.8%). As many advanced economies that have received SDR allocations may not have a pressing need to use them—especially when compared with resource-constrained low-income ones—they may consider lending or donating a share of their SDR allocations to help vulnerable countries and/or finance global initiatives.

Box 1.3: How can IMF's special drawing rights be used to support developing countries?

On August 23, 2021, the International Monetary Fund (IMF) allocated special drawing rights (SDRs) equivalent to \$650 billion to its 190 member countries. This is the largest SDR allocation ever made by the IMF in its history. Since then, there have been calls by developing countries, particularly those in Africa, and nongovernmental organizations for “recycling” the SDRs received by advanced economies to support poorer nations and finance global initiatives.

What is the SDR. The SDR is an international reserve asset created by the IMF in 1969 to

supplement other reserve assets of its member countries. The SDR is based on a basket of international currencies comprising the U.S. dollar, the euro, the Chinese renminbi, the Japanese yen, and the British pound sterling. The SDR is not a currency, but is part of countries' official reserves and can potentially be converted into freely usable currencies.

What is an SDR allocation. The IMF's Articles of Agreement allow for allocations of SDRs if there is a long-term international need, which is similar to the issuance of currency by a central bank. Since 1969, the IMF has issued

four rounds of general allocations and a one-time special allocation, in a total amount of about \$936 billion, including the allocation made this year. The last time the SDR general allocation took place was in August 2009 in the amount of \$250 billion to help member countries address the impact of the global financial crisis.

General allocations of SDRs are distributed to member countries in proportion to their quota (ownership) shares in the IMF. For this year's allocation, the share of emerging market and developing economies is about 42.2% (\$274 billion), of which 3.2% (\$21 billion) is for low-income countries, while advanced economies have received 57.8% (\$376 billion). The fact that advanced economies—many of which may not need the SDRs in the first place—have received the bulk of the allocation raises a question whether their SDRs can be recycled toward other purposes.

What can the SDR be used for. Once received, member countries can hold their SDRs as part of their official reserves or sell some or all of their SDR allocations. Countries can exchange SDRs for freely usable currencies, which may take place under a voluntary arrangement or under a mandatory designation plan by the IMF. Since 1987, the SDR market has functioned through voluntary arrangements. Countries can also use SDRs as the payment of interest on and repayment of loans from the IMF, or payment for quota increases in the IMF.

The use of SDRs involves a financial cost. This occurs when a country reduces its SDR reserves vis-à-vis its SDR allocations received from the IMF. Countries that sell their SDRs for freely usable currencies reduce their SDR reserves and thus need to pay an SDR interest rate on the difference between their SDR allocations and their SDR reserves. On the other hand, countries that buy SDRs with freely usable currencies increase their SDR reserves and thus receive an SDR interest rate on the amount over their allocated SDRs. The sale and purchase of SDRs effectively replace one reserve asset by another.

Can SDRs be “recycled” toward other purposes. As many advanced economies that have received SDR allocations may not need to use them, while poorer countries are badly in need of additional financing, questions are asked whether the former could voluntarily lend or donate a share of their SDR allocations to help vulnerable countries and/or finance global initiatives. Possible ways to do this include:

First, some of the countries have already used some of their SDR allocations to help others in need. For instance, during the current crisis, several countries have lent part of their SDR allocations to scale up loan resources of IMF's Poverty Reduction and Growth Trust (PRGT), which is a concessional lending facility for poor countries. Creditor countries are paid SDR interest rates on the SDRs provided, and could channel additional SDRs to boost PRGT lending.

Second, richer countries can donate a share of their allocated SDRs to support poorer countries and to help their recovery from the pandemic. However, for donor countries, doing so would incur a financial cost equivalent to the SDR interest rate. This is, therefore, less feasible than lending the SDRs to the PRGT.

Third, the IMF is currently considering establishing a new Resilience and Sustainability Trust to be financed by “recycled” SDRs—the proposal that is also endorsed by the recent G20 communiqué. The new Trust would facilitate structural transformations, including greener recoveries from the COVID-19 crisis and sustainable growth in the medium term. Possibility is also being explored to channel SDRs to support lending by multilateral development banks.

Finally, proposals are also being considered to establish “special purpose vehicles” to recycle SDRs for financing climate change, pandemic preparedness, and other global initiatives. Again, as SDRs are reserve assets and using them involves a financial cost, the extent to which these proposals can be put into use remains to be seen.

Source: “IMF Governors Approved a Historic US\$650 Billion Allocation of Special Drawing Rights,” IMF Press Release, No. 21/235, August 2, 2021; and various other IMF publications.

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Chapter 2

Global green finance development index and country rankings

2.1. Introduction

Climate change, environmental protection, and sustainable development have risen to the top of global policy agenda in recent years. Recognizing the importance and urgency of responding to these challenges, the global community has reached a consensus on the need for more mitigation and adaptation actions and for making growth and development green. The Paris Agreement on Climate Change sets the target of limiting the global temperature rise below 2°C above pre-industrial levels and pursuing efforts to limit it even further to 1.5°C. The Sustainable Development Goals (SDGs) contain many environment-related targets, including ensuring access to clean water, sanitation, and sustainable modern energy for all; controlling pollution and managing wastes; and taking urgent action to combat climate change and its impact, along with eradicating extreme poverty and reducing inequality. These objectives have provided broad directions towards green and low-carbon transformation for the world. Achieving the Paris Agreement climate target and SDGs require all countries to undertake urgent, far-reaching, and unprecedented measures. One of the challenges in pursuing these is to ensure adequate funding for investment needed to turn the goals into reality.

Against this background, green finance is increasingly attracting worldwide attention. Green finance mobilizes private capital and public resources to invest in sustainable development projects. Many countries

including the United Kingdom (UK), the European Union (EU) members, and China have already made significant headway in developing green finance. Over the past few years, there have been efforts to assess and evaluate progress and performance in green finance at the country and city levels, with a view to identifying bottlenecks and policy priorities. In 2016, the Group of 20 countries adopted the Green Finance Synthesis Report (G20 2016). The report assessed the development of green finance in G20 countries and international organizations, evaluated the scope for green finance-related international cooperation, and proposed several policy options. In 2017, the Green Finance Progress Report published by United Nations Environment Programme (UNEP) reviewed the progress in implementing the G20 policy options (UNEP 2017). In 2019, the UNEP released the *Sustainable Finance Progress Report*, which reviewed the progress in G20 countries as well as some non-G20 countries in the implementation of the G20 policy options (UNEP 2019). In 2018, Z/YEN, a London-based think tank, started publishing the *Global Green Finance Index* regularly, which evaluates the overall development of green finance in 66 major cities around the world (Z/YEN 2018).

The development of green finance is affected by multiple factors—micro, macro, policy, and institutional—and is often constrained by information and knowledge gaps, inadequate analytical capacity, and perceived policy and regulatory risks.

Providing continuous and comparable information on green finance is of vital importance and can help facilitate more actions at country and international levels. Existing research and information on green finance cover only a limited number of economies, and cannot provide a full picture of the progress globally. The purpose of this report is to bridge this knowledge gap by developing a *Global Green Finance Development Index* (GGFDI) that measures country progress and performance based on systematic studies and data collection.

This chapter is organized into three sections. Section 2.2 discusses and reviews the financing needs of green growth, the concept of “green finance” and reasons why it is important, recent development of green finance, policies in developing green finance in selected countries, and international cooperation in green finance. Section 2.3 presents GGFDI results and country rankings covering the 55 largest economies of the world. Section 2.4 discusses future challenges and policy priorities for fostering green finance development and innovation.

2.2. Recent global development of green finance

2.2.1. Financing needs of green growth

The world faces twin challenges (Organization of Economic Co-operation and Development [OECD] 2011). On the one hand, it needs continued strong growth to expand economic opportunities for a growing population, especially for 6.4 billion people or 84% of the world total in middle- and low-income countries where a large proportion still suffers from hunger and lives in poor conditions. On the other hand, it faces rapidly growing environmental pressure: air and water pollution, loss of biodiversity, depletion of natural resources, and climate change.

Scientists believe that carbon emissions released into the atmosphere from burning fossil fuels have caused the global surface temperature to rise by about 1.1°C from pre-industrial levels (Intergovernmental Panel on Climate Change [IPCC] 2021). This has led to more droughts, floods, extreme weather events, and rising sea levels, inflicting suffering to millions of people and causing hundreds of billions of dollars in economic losses every year worldwide. At the same time, at an international level, the annual cost associated with the health damage from ambient air pollution is estimated to be \$5.7 trillion in 2016, equivalent to 4.8% of global GDP (World Bank 2020). A report by Lancet Commission on Pollution and Health shows that in 2015 alone, diseases caused by air, water, and soil pollution had been responsible for 9 million premature deaths, or 16% of all global deaths that year (Landrigan, et.al. 2017). Furthermore, according to a 2019 report by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem (IPBES 2019), up to one million plant and animal species are facing extinction due to human activities.



Box 2.1: Global responses to growing environmental pressures since the 1970s

The 1972 United Nations (UN) Conference on the Environment in Stockholm was the first world conference to make environment protection a major issue (UN 1970). In 1987, sponsored by the UN, a World Commission on Environment and Development report (1987), *Our Common Future*, introduced for the first time the concept of sustainable development and described how it could be achieved. The UN Conference on Environment and Development in 1992 held in Rio, Brazil, also known as the “Rio Earth Summit,” aimed to produce a broad agenda and a new blueprint for international action on environmental and development issues that would help to guide international cooperation and development

policy in the 21st century (UN 1992). It adopted the Rio Declaration on Environment and Development, the UN Framework Convention on Climate Change (UNFCCC), the Convention on Biological Diversity, and the Declaration on the principle of forest management. Since then, countries around the world have intensified environmental protection efforts. In the meantime, successive UN conferences, including the Conferences of Parties since 1995, have continued to deliberate on concrete actions needed and roadmaps to make development sustainable, culminating in the adoption of the Sustainable Development Goals and Paris Agreement on Climate Change in 2015.

Sources: United Nations. Conferences: Environment and Sustainable Development; <https://www.un.org/en/conferences/environment/>; UN Conference on Environment and Development. 1992. Report of the UN Conference on Environment and Development. Rio de Janeiro. 3-14 June; [https://undocs.org/en/A/CONF.151/26/Rev.1\(vol.I\)](https://undocs.org/en/A/CONF.151/26/Rev.1(vol.I)); UN World Commission on Environment and Development (WCED). 1987. Report of the WCED: Our Common Future; <https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf>.

The global community has responded to growing environmental challenges from as early as the 1970s (Box 2.1). The adoption of the SDGs and the Paris Agreement in 2015 represents two major milestones for global actions to make development sustainable. The SDGs, contained in *Transforming Our World: the 2030 Agenda for Sustainable Development* (UN 2015a), were adopted by 150 world leaders at the United Nations (UN) Summit on Sustainable Development in September 2015 in New York. With 17 goals and 169 targets, the SDGs aim to improve the lives of the world’s people, eradicate poverty, promote prosperity and well-being for all, protect the environment, and fight against climate change. The Paris Agreement on Climate Change, adopted by 196 countries at the 21st UN Conference of the Parties (COP) in Paris in December 2015,

set a concrete climate goal for the world—limiting the global temperature rise below 2°C above pre-industrial levels and pursuing efforts to limit it further to 1.5°C, and put in place an implementation mechanism that has increasingly ambitious “Nationally Determined Contributions (NDCs)” insert space before at its core (UN 2015). The IPCC report (2018) on *Global Warming of 1.5°C* further shows that, in order to meet the 1.5°C climate target, the world would have to reduce carbon emissions by 45% from the 2010 levels by 2030 and achieve carbon neutrality by 2050.

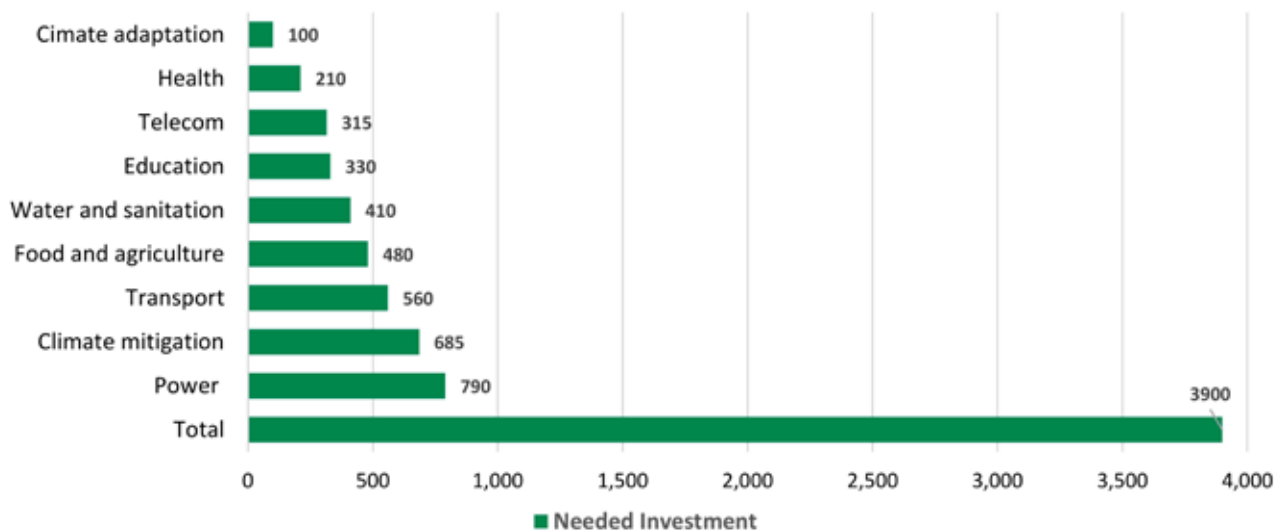
Implementing the SDGs and climate mitigation and adaptation actions under the Paris Agreement requires a rapid transition to a green growth path for countries around the world, and needs substantial investment

in green and low-carbon infrastructure and technologies. It has been estimated that the total investment needs for developing countries globally to achieve the SDGs would amount to \$3.9 trillion annually from 2015 to 2030, equivalent to 11% of the projected developing countries' combined GDP (Figure 2.1). A more recent estimate by OECD suggests that the annual funding gap for developing countries to keep them on track for the 2030 SDGs increased in 2020 by 70% to \$4.2 trillion as a result of the COVID-19 pandemic (OECD 2020a). Meanwhile, according to IPCC (2018), global annual average energy investments (renewable energy, energy efficiency improvement, electrification, and low-carbon technologies) consistent with the 1.5°C pathway are estimated to be about \$3.26 trillion, or 2.4% of the projected global GDP, for the period 2016-2050. A new study by UNEP, World Economic Forum, the Economics of Land Degradation Initiative and Vivid Economics (2021) shows that the world needs to invest

a cumulative amount of \$8.1 trillion in nature to meet the climate, biodiversity and land degradation targets.

Financing such large-scale investments requires both public sector resources and private capital. The UN Conference on Trade and Development (2014) estimated that to achieve the SDGs, the private sector will have to finance 40-50% of the needed investment in the power sector, 30-40% in the transport sector, 40-80% in telecommunications, up to 20% in water and sanitation, 75% in food and agriculture, 40% in climate mitigation, up to 20% in climate adaptation, and 15-20% in health and education. How to attract private investors to finance the SDGs and climate mitigation and adaptation has become a major development issue for many countries. Thus, green finance, which attempts to channel private capital and public resources to invest in green and low-carbon projects, has been receiving growing attention worldwide in recent years.

Figure 2.1: Annual investment needs to implement the SDGs for developing countries, \$ billion (in 2015 constant prices), 2015-2030



Source: United Nations Conference on Trade and Development. 2014. World Investment Report 2014. p.142. Table IV.2. https://unctad.org/system/files/official-document/wir2014_en.pdf.

① Assuming an annual average gross domestic product (GDP) growth rate for developing countries of 5% during 2016-2030 (this is the average growth rate during 2000-2020).
 ② Assuming a global annual average GDP growth rate of 3% during 2016-2050.



2.2.2. What is green finance and why is it important

What is green finance?

Green finance instruments have emerged as a major and popular asset class in global investment, and are attracting growing interest from governments, institutional investors, investment banks and asset management companies, multilateral development banks (MDBs), and the general public. According to data compiled by Climate Bonds Initiative (CBI n.d.a.), global green bond issuances increased from \$37 billion in 2014 to \$290 billion in 2020, growing at 41% annually.

Green finance origin can be traced to the concept of socially responsible investing (SRI) first associated with the anti-war movement in the West in the 1960s.⁹ SRI investment gained increasing popularity in the 1970s and 1980s, as it embraced other social concerns over time, including civil rights, gender equality, nuclear power, and environment. A soaring number of new funds were launched that combined social and environmental consciousness with financial objectives. Several catastrophic man-made disasters—such as the nuclear disaster in Chernobyl in 1986 and the oil spill in Alaska by the Exxon Valdez (an oil tanker) in 1989—became catalysts for individuals and institutions to invest in more socially- and environmentally-responsible firms. The standardized approach to SRI at that time involved building a portfolio that behaved like the traditional market while avoiding investments in alcohol, tobacco, weapons, gambling and environmental pollution.

Accompanying the proliferation of SRI was the rising popularity of a more broad-based approach to wealth management, known as ESG (Environmental, Social, and Governance) investing. ESG investing considers a broader set of due diligence questions on how environmental (such as pollutions), social (such as labor standards) and governance (such as transparency) factors impact performance, both positively and negatively. The term “ESG” first appeared in the UN Global Compact Report, *Who Cares Wins: Connecting Financial Markets to a Changing World* (2004). The report developed guidelines and recommendations on how to better integrate ESG issues in asset management, securities brokerage services, and associated research functions. This publication, together with the UNEP-commissioned *Freshfields Report* (2005), became the basis of the Principles of Responsible Investment (PRI) launched at the New York Stock

⁹ The origins of socially responsible investing in the United States began in the 18th century with Methodism, a denomination of Protestant Christianity that eschewed the slave trade, smuggling, and conspicuous consumption, and resisted investments in companies manufacturing liquor or tobacco products or promoting gambling.

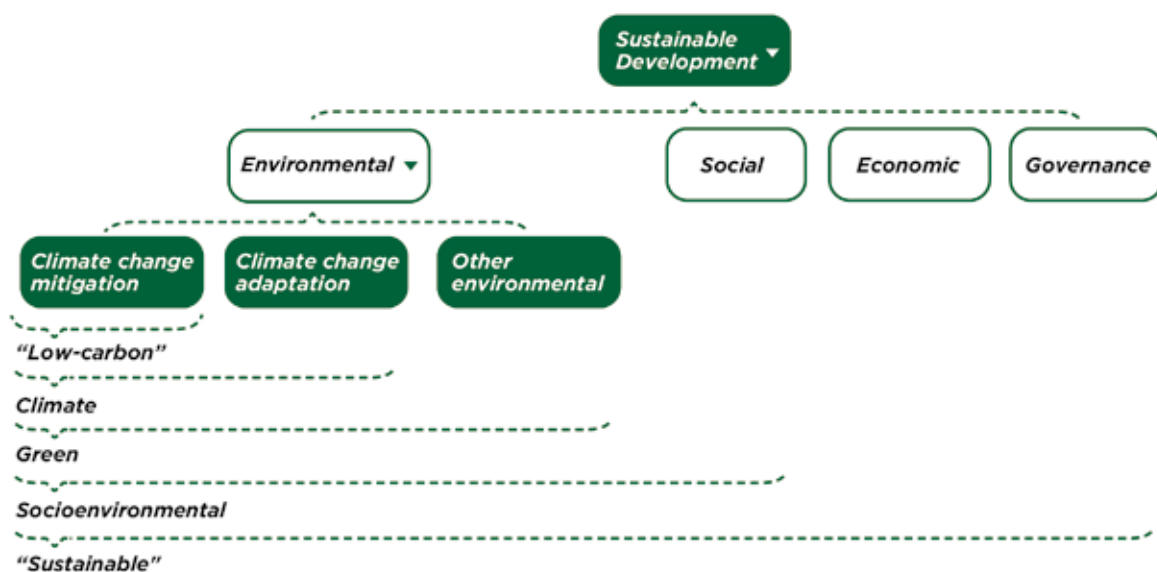
Exchange in 2006 and the UN Sustainable Stock Exchange Initiative (SSEI) launched in 2009.

From the 1990s, the term “climate finance” entered into international climate policy discussions and negotiations. The concept of climate finance can be traced to the 1992 Rio Earth Summit. Originally it referred to financial flows from developed to developing countries to assist in climate mitigation and adaptation actions under the principle of “common but differentiated responsibility,” as agreed when the UN Framework Convention on Climate Change (UNFCCC) was adopted. Over time, multilateral development banks (MDBs) established various climate funds, sourced from bilateral contributions as well as their own resources, to support mitigation and adaptation actions in developing countries. Developing countries also started to take climate actions using their own funds, and the private sector started to invest in low-carbon technologies such as renewable energy. The UNFCCC (n.d.a) now defines climate finance as “local, national or transnational financing—drawn from public, private, and alternative sources of financing—that seeks to

support mitigation and adaptation actions that will address climate change”.

While climate finance focuses on addressing climate change, green finance has a broader scope and covers financial flows to investments in other areas of environment protection. The term “green finance” was first used in an article published in the *European Energy and Environmental Law Review* in 1994 (Devas 1994) which described how to make finance work for environmental protection. At the turn of the 21st century, the term started to gain popularity. Initially green finance and climate finance were used as interchangeable terms. Over time, green finance has become an important policy focus on its own, partly because global policy discussions were broadened from low-carbon growth to green growth that includes objectives of controlling air and water pollution, conserving natural resources, and protecting ecosystem and biodiversity (OECD 2011). The popularity of green finance received a boost after the global community adopted the SDGs and Paris Agreement in 2015, as it raised the important issue of how to finance their implementation.

Figure 2.2: Alternative definitions of new finance



Source: United Nations Environment Programme. 2016. *Inquiry: Design of a Sustainable Financial System - Definitions and Concepts - Background Note*; https://wedocs.unep.org/bitstream/handle/20.500.11822/10603/definitions_concept.pdf?sequence=1&isAllowed=y.

In 2016, the G20 established the Green Finance Group under China’s G20 presidency. In the same year, it released the first *G20 Green Finance Synthesis Report (2016)* which defined “green finance” as the “financing of investments that provide environmental benefits in the broader context of environmentally sustainable development.” “Environmental benefits” cover reduction in pollution and in greenhouse gases (GHG) and carbon dioxide (CO2) emissions, and improvements in the efficiency of resources utilization. The report highlighted the critical importance of developing green finance, pointing to the problems of large investment and funding gaps, low share of “green” finance products, the difficulty of internalizing environmental externalities, maturity mismatch, and information asymmetry. It emphasized that the development of green finance touches on the need for effective environmental risk management in the entire

financial system, and that public and private financing are both critical components of green finance.

In 2016, a UNEP publication (2016) reviewed various definitions and concepts related to green finance provided by countries and organizations, and developed a framework in which one can see how some of the key concepts commonly brought up in recent policy discussions and dialogue, such as “sustainable,” “social environment,” “green,” “climate,” and “low carbon,” are related (Figure 2.2). It made a distinction between approaches to sustainable finance that take a broad environmental, social, economic, and governance perspective, and those that adopt a narrower definition, focusing only on environmental issues. Belonging to this latter category is an even more limited approach, one that only targets climate change mitigation and adaptation (Table 1.1).

Table 2.1: Differences among climate finance, green finance, and sustainable finance

Climate finance	<i>Particularly associated with the United Nations Framework Convention on Climate Change definition, which describes it as “local, national, or transnational financing, which may be drawn from public, private, and alternative sources of financing. Climate finance is critical to both the reduction of emissions and to the adaptation of countries to reverse the climate change impacts.”</i>
Green finance	<i>Generally used to convey something broader than climate finance, in that it addresses other environmental objectives and risks. It tends to be understood with a greater focus on greening broader flows of investment rather than mainly concerning public and public-leveraged financial flows.</i>
Sustainable finance	<i>Having the broadest coverage, including green finance and finance targeted at addressing other social and governance issues. It covers all financing targeted at achieving the Sustainable Development Goals.</i>

Source: United Nations Environment Programme. 2016. *Inquiry: Design of a Sustainable Financial System - Definitions and Concepts - Background Note*; https://wedocs.unep.org/bitstream/handle/20.500.11822/10603/definitions_concept.pdf?sequence=1&isAllowed=y.



Other international organizations and national authorities have also provided definitions of green finance:

- In 2016, the People's Bank of China (PBOC), Ministry of Finance (MOF) and five other government agencies in China jointly issued *Guides on Establishing A Green Financial System*. Green finance was defined as “financial services that support economic activities aiming to improve environment, respond to climate change, facilitate resource conservation and efficient utilization, including investment and financing, operations, and risk management of projects for environmental protection, energy conservation, clean energy, green transport, and green buildings.”
- In 2017, the European Commission (EC), in its report “*Defining ‘green’ in the context of green finance*,” defined a green project as “satisfying one of the six conditions: mitigating climate change; adaptation to climate change; support sustainable use and protection of water and ocean resources; transition to circular economy; addressing pollution; and protection and recovery of biodiversity and ecosystem” (EC 2017). The green projects definition excludes fossil fuel upgrading projects, as these are considered as leading to the locking-in of GHG emissions in the future.
- The International Capital Market Association (ICMA 2020) considers green finance broader than climate finance, as it also addresses other environmental objectives, such as natural resource conservation, biodiversity conservation, and pollution prevention and control.
- The International Finance Corporation (IFC), based on a survey of existing green finance definitions, concludes that there are significant commonalities among green finance definitions of different countries and organizations, such as industries of renewable energies and green buildings, but there are also differences in some specific areas—such as nuclear energy, reduction of noise pollution, and carbon

capture and storage—reflecting different positions on these issues among countries (IFC 2017).

It is worth noting that climate finance, green finance, and sustainable finance are driven largely by the need to address emerging global environmental and social challenges and require significant policy interventions. On the other hand, SRI, ESG investing, and, more recently, impact investing, are related to investment concepts of private sector wealth management. Impact investing is an investment strategy aiming to create positive social, environmental, or governance benefits apart from financial gains (ICMA 2020).

In this chapter, green finance is defined as

“the financial services that support financial flows toward activities that help to mitigate and adapt to climate change, protect environment, ecosystem and biodiversity, and improve the efficiency of resources utilization.”

Green finance includes climate or carbon finance. Its products can range from green bonds, loans, equities, investment funds, guarantees, and carbon credits to green insurance (such as climate or flood insurance), leasing, and financial derivatives. Green finance covers both private and public funding for green investment, and includes multilateral and bilateral financial assistance to developing countries for climate mitigation and adaptation and environment protection.

Why is green finance important?

The importance of green finance can be understood from perspectives of both funding demand and supply side.

On the funding demand side, green finance facilitates financial flows to investment in green projects and programs. As discussed earlier, the financing needs of investments in climate mitigation and adaptation (such as renewables, infrastructure proofing, and

flood control) and environment protection (such as controlling air and water pollution) are huge. These investments often require long-term finance, are subject to significant risks, and have low financial returns. At the same time, they have strong positive externalities and significant social benefits. As free market cannot price in these positive externalities and social benefits, short-term profits-focused traditional finance often leads to underinvestment in green projects and programs. Green finance corrects such market failure through policy interventions. The policy interventions may include (i) regulatory measures, such as setting mandatory lending quotas for green projects, green labelling of financial instruments, mandatory requirements for incorporating environmental risks in investment decisions by financial institutions, and introducing more stringent disclosure requirements for green finance products to reduce information asymmetry; (ii) financial incentives, such as interest rate subsidy, tax credit, and credit enhancement including government guarantee; and (iii) governments' direct involvement in green investment or private-public partnerships that help to catalyze private capital.

On the funding supply side (i.e., investors), green finance instruments provide new asset classes to cater to the needs of different investor groups. For example, green finance products can meet the need of pension funds and insurance companies looking for long-term investment and stable returns, and of the investor groups with strong social responsibility for the opportunities to invest in projects that generate significant social and environmental benefits. They also provide opportunities for investment in sectors with rapid technological progress such as renewables and new energy vehicles. Furthermore, green finance products allow financial institutions to diversify their financial portfolios to reduce overall risks, either as a result of regulatory requirements or the consideration to maximize risk-weighted long-term returns. The risks can come from climate change-related extreme events such

as floods, storms, forest fires, droughts, and rising sea-levels; or damage to ecosystems brought by pollution accidents, (e.g., oil spills and nuclear leakages); or damage to natural resources such as landslides, water shortages, and loss of biodiversity. They can also come from changes in climate policy, technology, and consumer and market sentiments during the transition to a lower-carbon economy. Not only green finance allows individual financial institutions to diversify risks, it also helps to reduce systemic risks to the financial sector from these two sources.

A recent survey by the Economist Intelligence Unit (EIU 2020) of 161 institutional investors in Australia, New Zealand, Japan, Hong Kong Special Administrative Region of China and Singapore found that 68% of the respondents intended to increase their allocations to sustainable finance, and that 27% expect to have 25% to 50% of their assets under management in sustainable investments in three years' time. It found that portfolio diversification is the main motivation for investors' allocations to sustainable finance, followed by investing for "sustainability or impact outcomes" and enhanced financial returns. About 68% of the respondents said that their sustainable investments performed better than their traditional equivalents. Furthermore, around 70% agreed that sustainable investments had a greater positive impact on their organization's reputation than traditional investments.

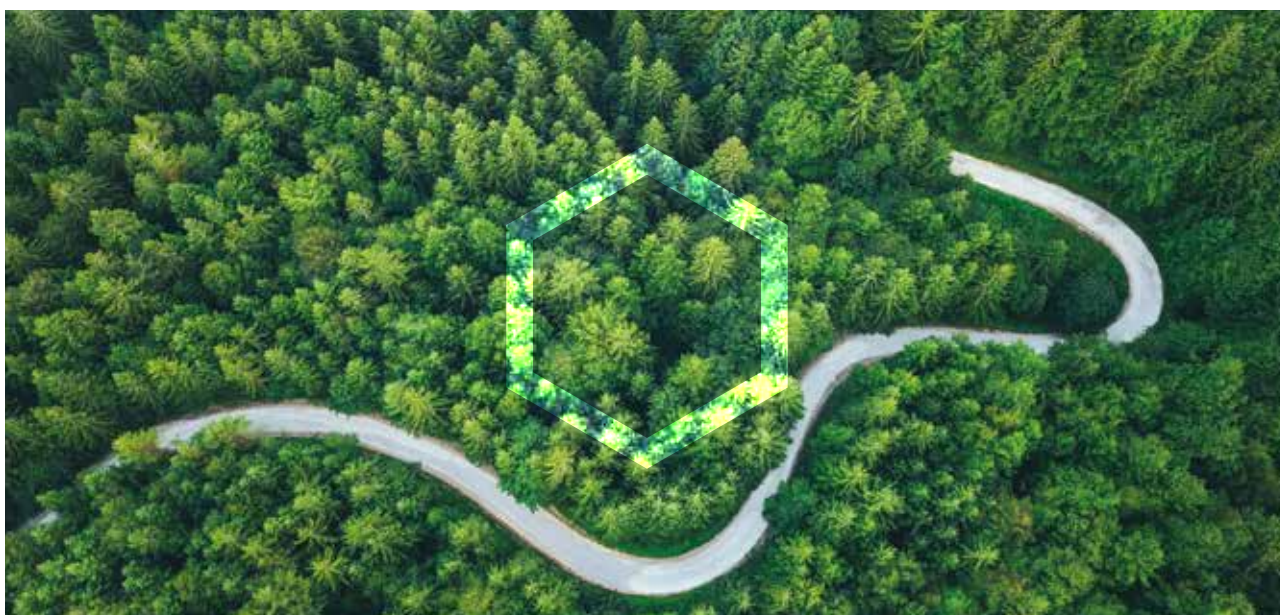
Similar surveys had been carried out in other countries and regions and showed similar results. In Europe, according to a series of consumer-focused surveys conducted by 2DII (2019), two-thirds of French and German retail investors said they would like to invest in an environmentally responsible manner. In the US, according to a Morgan Stanley study (2019), 85% of individual investors surveyed were interested in sustainable investment. The study observed that the respondents were most interested in the themes of plastic reduction (46%) and climate change (46%), community development (42%), circular

economy (39%) and the SDGs (36%). In China, results of the Survey of Public Attitudes towards Sustainable Investment conducted by China Social Investment Forum (SIF) and Sina Finance in 2021 showed that a majority of individual investors consider factors such as “environment”, “labor”, “health”, and “business ethics” in their investments, and 86% of the respondents indicated that they will consider sustainable investment factors (GSIA 2021).

Empirical studies find that green financing improves the environmental performance of a firm, city or an economy that issues green bonds. Based on a study of 225 public firms that issued corporate green bonds worldwide, Flammer (2021) discovered that stock market responds positively to the issuance of corporate green bonds, and the response is stronger for green bonds that are certified by independent third parties and first-time issuers. Further, the study found that, following the issuance of green bonds, firms improved their environmental performance (i.e., higher environmental ratings and lower CO2 emissions). An Asian Development Bank (ADB)-commissioned study (Luo, Tian, and Yang 2021), based on data from 265 Chinese cities from 2015 to 2018, reveals that a city with higher green bond financing in a

given month sees significantly lower AQI (air quality index) and PM2.5 concentration after 12 months. Another study, commissioned by ADB and based on country-level data from 54 major economies around the world from 2007 to 2019, concludes that CO2 emissions at the country level fell on average after the first green bond issuance in the market (ADB 2021a).

In sum, developing green finance helps the international community to respond to climate change and environmental challenges, correct market distortions, improve the sustainability of the financial sector, and promote green innovation. The financial sector plays the role of financial intermediation and risk management. Green finance can significantly promote the development of green industries and mitigation and adaptation of climate change. When market mechanisms and prices cannot reflect fully the positive externalities of green projects, green finance can lead to increased investment and R&D activities in green industries, and it represents important improvements and innovation of the traditional finance. Green finance will become more and more important in internalizing environmental externalities.



2.2.3. Three stages of global green finance development

The global development of green finance can be roughly divided into three stages.

The first stage, before the 1990s. In this stage, the world faced growing environmental pressures. Many European and US investors with socially responsible consciousness started to pay attention to environmental (and social) problems and incorporate these considerations into investment decisions. Many companies also came to realize that their long-term value was intertwined with the quality of environment and the health of the planet. During this period, a time when the development of green finance was largely market-driven, the world witnessed the soaring popularity of SRI.

The second stage, from the early 1990s to 2015. In this stage, climate change became a critical global issue, marked by the adoption of the UNFCCC in the Rio Earth Summit in 1992. During this period, governments became a key driver of green finance, with several multilateral funding mechanisms established. The Global Environment Facility (GEF), established in 1992 on the eve of the Rio Earth Summit, was the first major multilateral financing mechanism to support developing countries in meeting the objectives of international environment conventions and agreements including on biodiversity, climate change, chemicals, and desertification. In 1994, the UNFCCC came into effect, and it called on developed countries to provide financial resources to developing countries to implement climate mitigation and adaptation actions, in accordance with the principle of “common but differentiated responsibility”. GEF was entrusted with the operation of UNFCCC’s climate-related financial mechanism. In 2001, the COP7 of UNFCCC established the Least Developed Country Fund (LDCF) and the Special Climate Change Fund (SCCF), to be administered by GEF, and the Adaptation Fund, to be managed by the World Bank. These funds aim to provide financial support for climate change responses in developing countries, mostly adaptation projects and programs.

In 1997, the COP3 of UNFCCC adopted the Kyoto Protocol, mandating industrialized countries to reduce their GHG emissions by at least 5% below the 1990 levels over the commitment period of 2008-2012 (UNFCCC n.d.b). The Kyoto Protocol came into effect in 2005. Under the Clean Development Mechanism of the Kyoto Protocol, developed countries can invest in emission reduction projects in developing countries and earn carbon credits to meet their GHG reduction obligations, thus providing another source of financing for climate mitigation in developing countries. The Kyoto Protocol also allowed developed countries to manage their excess demand for or excess supply of carbon credits through carbon trading. In 2005, the EU launched emissions trading through a cap (on total emissions) and trade (of emitting rights) system. After the first stage of the experiment, the EU emissions trading system entered the second stage in 2008, to fulfill the pledge under the Kyoto Protocol (European





Commission (n.d.c). In 2010, the COP16 of UNFCCC established the Green Climate Fund (GCF) as another operating entity of its financial mechanism, with the mandate of supporting developing countries to limit or reduce their GHG emissions and to adapt to the impacts of climate change. The GCF became operational in 2015 and is now the world's largest climate fund.

During this stage, MDBs (the World Bank and regional development banks) also set up various climate adaptation and mitigation funds to support their developing member economies to take climate actions. Many bilateral donors increased their support for climate adaptation and mitigation projects and programs in developing countries. Apart from these official green finance initiatives, there were also market-driven voluntary green and sustainable finance initiatives, with the objectives of peer-to-peer learning and advocacy of sound investment principles. These included UNEP Finance Initiative (UNEP FI) launched in 1992; Equator Principles adopted in 2003; the Task Force on Climate-Related Financial Disclosures (TCFD) created in 2003; Principles of Responsible Investing (PRI) adopted in 2006; UN Sustainable Stock Exchange Initiative launched in 2009; Global Alliance for Banking for Values (GABV) created in 2009; the Sustainable Banking Network (SBN) launched in 2012; the UNEP Finance Initiative's Principles for Sustainable Insurance adopted in 2012; and the Green Investment Principles (GIP) for greening investment in the Belt and Road launched in 2018 (see more discussion in Section 2.2.5).

Market innovation in green finance is also an important feature of this stage. In 2007, the European Investment Bank issued the world's first 'climate-conscious' bond in Luxembourg Stock Exchange. In 2008, the World Bank issued the first batch of green bonds (World Bank 2019). Since then, the

issuance of green bonds has proliferated, with international standards becoming more and more established. The first corporate green bond was issued by Vasakronan, a Swedish property company in 2013, the same year when the first green municipal bond was issued by Massachusetts of the US (CBI n.d.b).

The third stage, from 2015 onwards. From 2015 onwards, the adoption of the SDGs and Paris Agreement provided a boost to the global development of green finance. The Paris Agreement reaffirmed that developed countries should take the lead in providing financial assistance to countries that are less endowed and more vulnerable. For the first time, it also encouraged voluntary contributions by other Parties. Climate finance is needed for mitigation, because large-scale investments are required to significantly reduce emissions. Climate finance is equally important for adaptation, as significant financial resources are crucial for countries to adapt to the adverse effects and reduce the impact of a changing climate. The Parties at the Paris Climate Change Conference in 2015 also agreed that the operating entities of the financial mechanism of UNFCCC—GCF and GEF—as well as the SCCF and the LDCF would serve the Paris Agreement (UN n.d.b).

Since 2016, the issuance of green bonds has grown rapidly, across multiple currencies and with wide regional coverage. Concentration of issuance has, however, mostly been in advanced and several emerging economies, with US, China, and France at the top in terms of the issuance amount in value. Poland issued the first sovereign green bond in 2016. There have also been significant developments in carbon markets and carbon finance. The EU emissions trading system increased the cap reduction factor and raised the share of emission allowances that were auctioned to 57% in 2020. In 2021, it

entered its fourth phase (2021-2030), with further revisions introduced including raising the pace of annual cap reduction to 2.2% as of 2021, to ensure emission reductions in support of the EU's 2030 emissions reduction target (European Commission n.d.b). In 2015, South Korea also launched its emission trading system, as the first nation-wide trading system in East Asia. In July 2021, China launched its national emissions trading system, after piloting it in 7 provinces. It covers 40% of China's carbon emissions in 2020 and is now the world's largest in terms of emission coverage. Today, more and more countries and regions in Europe, North America, the Asia and Pacific, Latin America and Caribbean are taking actions to develop carbon markets, while at a differing pace.

In recent years, topics such as carbon neutrality and energy transition have become buzz words. In order to achieve the emission reduction targets and SDGs, many countries have launched the Green New Deal or similar green development strategies. As of August 2021, 136 countries (including the EU) covering approximately 75% of the global carbon emissions have formally adopted or announced or are considering a concrete carbon neutrality target, with 124 targeting by 2050, 5 before 2050, 5 before or by 2060, and 2 having already achieved the target (see more discussions in Chapter Three of this report). All these have provided favorable policy conditions for the rapid development of green finance.

In sum, the rapid expansion in green finance globally in recent decades has been driven by multiple factors. The most important of these is the political consensus on the need

for transition to a green and low-carbon development path for every country in the world. This political consensus is built on increasing scientific knowledge on the linkages between human activities, climate change, and environmental sustainability; soaring human and economic costs of climate change and environmental degradation the world has witnessed; and rising public awareness of the significant environmental and climate risks to humanity of taking no action. The frameworks of international dialogue, negotiations, and cooperation under the UN System and other international processes such as the G20 have played a critical role in facilitating the building of this political consensus.

Beyond the political consensus, key drivers of green finance include (i) the huge financing requirements for transitioning to green and low-carbon growth; (ii) the inability of traditional finance to meet these funding needs because of the deviations between market and social benefits of investment in green projects, and policy interventions including regulatory measures and financial incentives used to correct these deviations; (iii) large funding gaps in developing countries to implement mitigation and adaptation projects and the commitments of developed countries to provide climate action assistance under the principle of common but differentiated responsibilities; and (iv) rising popularity of green projects (such as renewable energy) among investors with strong social responsibilities, or with the need to diversify their investment portfolios, or with strong appetite for investment return from rapid technological progress and falling costs (e.g., from wind and solar power).



2.2.4. Recent data on green finance

Despite its rapid development, comprehensive data on green finance covering all its products and instruments are not yet available and, therefore, it is difficult to estimate its overall size globally. However, a number of studies and sources have collected data on some key components of green finance, providing insights into their magnitude and growth dynamics. This section focuses on (i) green bonds; (ii) official climate-related financial flows; (iii) revenue flows from carbon pricing; and (iv) ESG investing. Finally, this section will also look at green loans in China where systematic data are available.

Global green bond issuances

According to data compiled by Climate Bonds Initiative (CBI n.d.a) using a set of uniform eligibility criteria, the total annual green bond issuance globally increased from \$37 billion in 2014 to \$297 billion in 2020 (Figure 2.3).⁶ In 2020, by market, developed countries accounted for 80.5% and emerging markets 16% of the global issuances (Figure 2.4); by region, Europe accounted for 53.8%; North America 21.1%, Asia-Pacific 18.3%; Latin America 2.7%; and supranational (mostly MDBs) 3.6%. The cumulative green bond issuances for the world as a whole reached \$1.047 trillion as of 2020, of which, 35.4% were allocated to the energy sector, 26.6% for buildings, 18.8% for transport, 9.8% for water, 3.8% for land use, and 3.6% for waste management (Figure 2.5). On a country basis, \$223.7 billion of the cumulative amount was issued by the US, followed by China at 129.7 billion, France at \$124.3 billion, Germany at \$93.3 billion, supranational at \$90.1 billion, and the Netherlands at \$54.4 billion (Figure 2.6). In 2021, the issuance of global green bonds has continued to grow strongly, reaching \$350 billion in the first nine months.

CBI data also show that, of the total cumulative green bonds issued during 2014-2020, 56.4% were issued by the private sector, including financial institutions, non-financial corporations, and asset-backed securities (ABS); 30% by the public sector, including sovereign issuers, local governments, and government-based entities; and 13.6% by development banks, largely MDBs. In 2020, because of the pandemic, green bonds issued by the public sector increased to 40.3% (from 27.1% in 2019) and that by the private sector declined to 51.9% (from 61.9% in 2019), as public sector issuers are generally less vulnerable to market dynamics than private sector issuers because they tend to have long-term investment plans in place.

⁶ Climate Bonds Initiative (CBI) uses a three-step screening process to classify a green bond as eligible: (i) identification of climate-themed, self-labelled debt; (ii) screening sectors and green credentials to determine if the proceeds will finance eligible expenses, assets, projects or activities that are in line with the Green Definitions (adapted from its Climate Bonds Taxonomy and Sector Criteria that are consistent with the 2 degree global warning target of the Paris Agreement); and (iii) evaluating the use of proceeds threshold. Only bonds which are expected to allocate all net proceeds to aligned green assets, projects or activities are included in the Climate Bonds Initiative Green Bond Database (CBI n.d.b).

Figure 2.3: Global green bonds issued by region, \$ billion

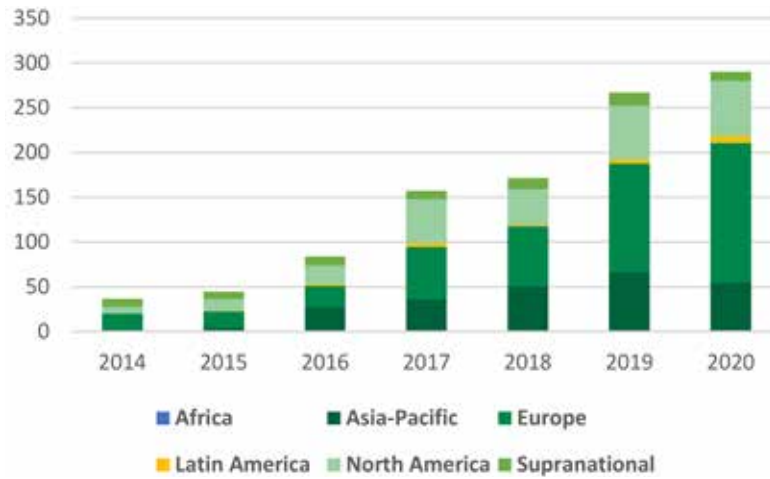
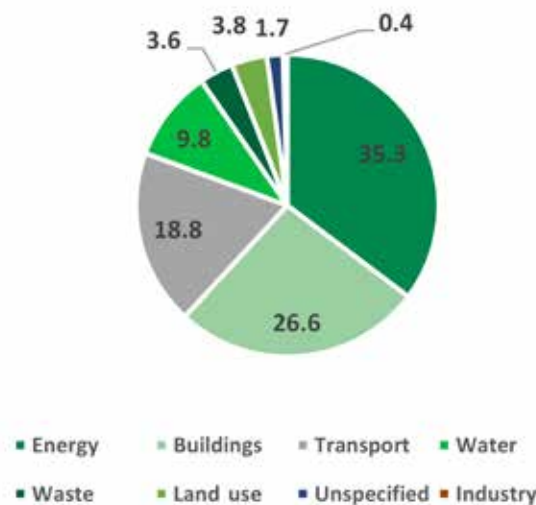


Figure 2.4: Global green bonds issued by market, \$ billion



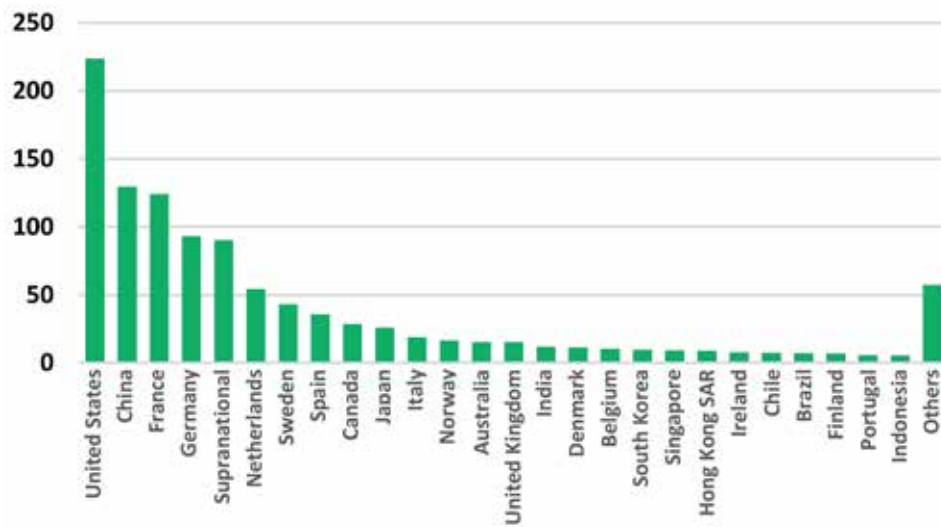
Source: Climate Bonds Initiative. Interactive Data Platform; <https://www.climatebonds.net/market/data> (accessed 27 July 2021).

Figure 2.5: Share of cumulative green bond insurance by sector (%), as of end-2020



Source: Climate Bonds Initiative. Interactive Data Platform. <https://www.climatebonds.net/market/data> (accessed 27 July 2021).

Figure 2.6: Cumulative green bonds issued by economy, \$ billion, as of end-2020



Source: Climate Bonds Initiative. Interactive Data Platform; <https://www.climatebonds.net/market/data> (accessed 27 July 2021).

While CBI uses a set of uniform criteria to determine whether a green-labeled bond is eligible for inclusion in its database, it needs to be noted that there are differences in the definition of green finance and criteria in assessing the greenness among countries and international organizations. For instance, until recently, China’s green bond criteria include clean coal and oil projects, given its current dominance of coal-fired power generation and the need to replace dirty coal with clean coal as an interim measure. Thus, according to China’s green bond definition, its cumulative green bond issuance by the end of 2020 was CNY1.4 trillion, or close to \$215 billion, much higher than the CBI number of \$129.7 billion (which excludes clean coal and oil projects).

There have been efforts to move towards a uniform definition and mutual recognition in green finance among countries in recent years, in order to facilitate cross-border capital flows. For instance, the PBOC has expressed the desire to speed up the development of China-Europe Common Green Finance Catalogue, while the EU has expressed the willingness to jointly develop with China common green finance classification standards. In 2021, the latest version of *China’s Green Bond Support Project Catalogue 2021* excludes clean coal and oil projects (Government of China 2021), resolving a key issue in green bond standards between China and other major countries and representing a major step towards harmonizing with the EU’s Sustainable Finance Clarification Plan.



Official climate financial flows

Official climate financial flows have grown in recent years, especially after the adoption of the Paris Agreement, with developed countries reaffirming their commitment (made in 2009 at the Copenhagen Climate Change Conference) to provide \$100 billion each year to support climate actions in developing countries. At the same time, climate finance support from developing countries to developing countries, a key part of the South-South Cooperation on climate action, is also growing.

Bilateral and multilateral climate financial flows from developed to developing countries. OECD and UNFCCC compile data on official climate financial flows from developed to developing countries in a systematic way. According to the data they compiled, bilateral and multilateral official climate financial flows (including export credits) to developing countries attributed to developed countries increased from \$39.6 billion in 2013 to \$64.4 billion in 2018, growing by 62.6% (OECD 2020) (Figure 2.7). Including private finance that was mobilized by these flows (where consistent data are available only from 2016), total official climate-related financial flows to developing countries attributed to developed economies increased from \$58.5 billion in 2016 to \$79 billion in 2018.

Bilateral flows have continued to rise except for a slight drop in 2017. In 2018, bilateral climate finance reached \$32.7 billion, accounting for two-fifths of the total climate-related financial flows representing a 45% expansion compared to the level in 2013 (\$22.5 billion). OECD data on bilateral climate-related finance flows cover 26 countries, mostly developed, plus the EU.⁹ Bilateral flows included grants, loans, equity investment, and developmental guarantees.

Multilateral climate-related finance flows to developing countries attributed to developed countries has been increasing too, despite a decline in 2015, with the 2018 figure (\$29.6 billion) almost doubling the 2013 value. It covers climate-related finance flows from MDBs (including the World Bank and regional development banks) and multilateral climate funds attributed to developed countries,¹⁰ and included grants, loans, and equity investments.

Official climate-related financial flows have also mobilized a large amount of private capital for climate investment in developing countries. The amount increased from \$10.1 billion in 2016 to \$14.6 billion in 2018 (OECD 2020b).

⁹ The data cover Australia, Austria, Belgium, Bulgaria, Canada, Cyprus, Czech Republic, Denmark, Estonia, European Union (European Commission and European Development Fund), Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Lithuania, Luxembourg, Malta, Monaco, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom and United States (OECD 2020b).

¹⁰ The multilateral development banks (or funding institutions) include: African Development Bank (AfDB), African Development Fund (AfDF), Asian Development Bank (ADB), Asian Infrastructure Investment Bank (AIIB), Council of Europe Development Bank (CEB), Development Bank of Latin America (CAF), European Bank for Reconstruction and Development (EBRD), European Investment Bank (EIB), IDB Invest, Inter-American Development Bank (IDB), International Bank for Reconstruction and Development (IBRD), International Development Association (IDA), the International Finance Corporation (IFC), Multilateral Investment Guarantee Agency (MIGA) and Private Infrastructure Development Group (PIDG). Meanwhile, the multilateral climate funds include: Adaptation Fund, Climate Investment Funds (CIFs), Green Climate Fund (GCF), Global Environment Facility (GEF) and Nordic Development Fund (NDF) (OECD 2020b).

Figure 2.7: Green financial flows to developing countries, provided and mobilized by developed countries, in \$ billion

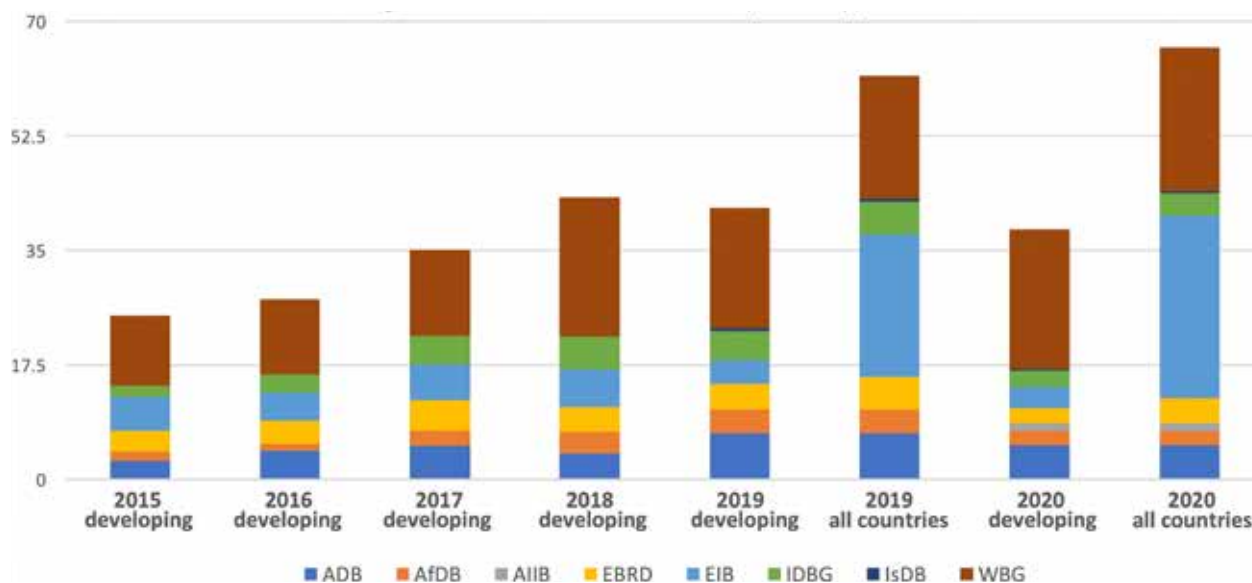


Note: The gap in time series in 2015 for mobilised private finance results from the implementation of enhanced measurement methods. Hence, the sum of green finance flows in 2016-18 and in 2013-14 are not directly comparable.
 Source: OECD. 2020b. *Climate Finance Provided and Mobilized by Developed Countries in 2013-18*. <https://doi.org/10.1787/f0773d55-en>.

On a sector basis, energy was the most targeted sector in the context of total climate-related finance provided and mobilized by developed countries in 2016-18, accounting for 34% of the three-year average, followed by transport and storage at 14%, water and sanitation at 7%, and banking and business services at 5%. By theme, over the period of 2016-18, for which the grand totals are comparable, climate finance targeting mitigation and adaptation was on the rise on a year-by-year basis. Adaptation finance

grew by an annual average of 29%, from \$10.1 billion in 2016 to \$16.8 billion in 2018. Mitigation finance increased mainly from 2016 to 2017 when it surged from \$42.2 billion to \$52.3 billion and reached \$55 billion in 2018. Finance for cross-cutting objectives reached \$7.1 billion in 2018. In relative terms, mitigation continues to represent over two-thirds of total climate-related finance provided and mobilized. Adaptation finance, however, inched up slightly in relative terms, from 17% in 2016 to 21% in 2018.

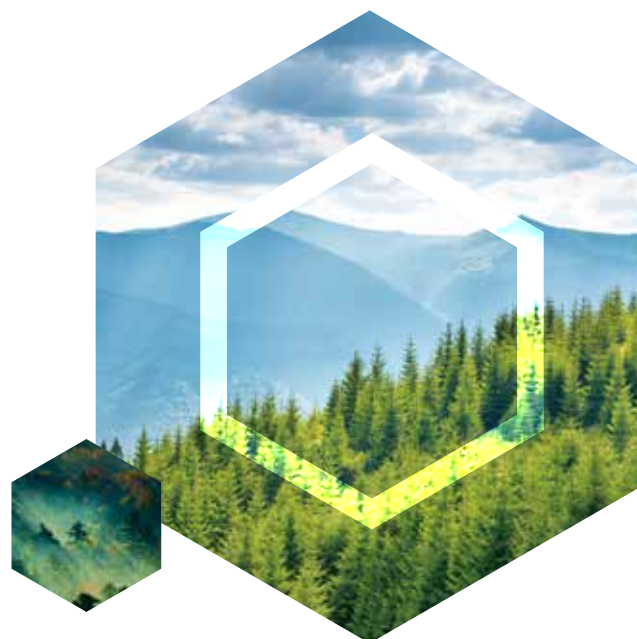
Figure 2.8: MDBs' climate finance commitments, 2015-2020, \$ billion



AfDB=African Development Bank, ADB=Asian Development Bank, AIIB=Asian Infrastructure Investment Bank, EBRD=European Bank for Reconstruction and Development, EIB=the European Investment Bank, IDBG=the Inter-American Development Bank Group (IDBG), IsDB=the Islamic Development Bank, WBG=World Bank Group.
 Source: AfDB, et. al. 2021. *Joint Report on Multilateral Development Banks' Climate Finance 2021*; https://www.isdb.org/sites/default/files/media/documents/2021-06/2020%20Joint%20MDB%20report%20on%20climate%20finance_Report_final%20web.pdf

Over the period of 2013-2018, the growth of public climate finance provided by developed countries (excluding export credits) was mainly driven by developmental loans, increasing from \$19.8 billion in 2013 to \$46.3 billion in 2018. Grant financing grew to \$12 billion in 2016 and retained similar values in the next two years. Equity appears as a marginal instrument during the six-year period. In relative terms, the share of loans in public climate finance rose from 52% in 2013 to 74% in 2018, while the share of grants decreased from 27% in 2013 to 20% in 2018.

According to OECD data, 72% of bilateral loans provided during 2016-18 were concessional according to OECD Development Assistance Committee (OECD/DAC) criteria. Multilateral providers do not extend concessional finance based on these criteria but rather on the income group status of recipient countries. On that basis, 54% of loans committed by multilateral climate funds were reported as concessional, while 76% of MDB loans were labelled as non-concessional since they are provided to developing countries outside the low-income group. But in practice, such non-concessional multilateral loans still present favorable terms and conditions compared to the capital market.



MDBs climate finance. In the past few years, MDBs have all scaled up their support for climate mitigation and adaptation in developing countries, and announced ambitious targets (AfDB, et. al. 2021):

- African Development Bank (AfDB) aims to double climate-related finance to US\$ 25 billion for the period 2020-25, giving priority to adaptation finance.
- For ADB, by 2030, at least 75 per cent of the number of its committed operations will be supporting climate change mitigation and adaptation. Climate-related finance from ADB's own resources is targeted to reach \$100 billion for the period 2019-30 (ADB 2021b).
- Asian Infrastructure Investment Bank (AIIB) aims to reach or surpass by 2025 a 50% share of climate-related finance in its actual financing approvals.
- European Bank for Reconstruction and Development (EBRD)'s green finance is to account for more than half of total annual EBRD investment by 2025.
- European Investment Bank (EIB) aims to gradually increase the share of its financing dedicated to climate action and

environmental sustainability to over 50% of its operations in 2025.

- Climate finance in Inter-American Development Bank Group (IDBG) operations for 2020-23 is targeted to reach 30% or more.
- Islamic Development Bank (IsDB) is committed to a climate finance target of 35% of total financial commitment by 2025.
- The World Bank announced its goal of allocating an average of 35% of its financing to climate finance over the period 2021-25.

As shown in Figure 2.8, in 2015, total climate-related finance flows to developing countries of the 8 MDBs listed amounted to \$25 billion.⁹ In 2019, this reached \$41.5 billion. It fell slightly in 2020 because of the pandemic, but remained a sizable amount at \$38 billion. Including the flows to developed countries, the total climate finance of these MDBs reached \$66 billion in 2020. These figures exclude climate finance provided by the New Development Bank (NDB). In 2020, NDB committed a total of US\$ 816 million for climate finance, accounting for approximately 19 percent of its total approved financing excluding its support in response to the Covid-19 pandemic. All of the committed climate finance was directed to middle-income economies and dedicated to climate mitigation activities.

South-South climate and green financial flows. South-South official climate and green finance also consists of multilateral and bilateral flows, but there are no systematic data available. Multilateral flows include

those of MDBs and multilateral climate funds attributed to developing countries. IsDB and the NDB are two typical examples of multilateral South-South finance cooperation as they are owned entirely by developing countries.

Bilateral South-South climate-related financial flows include those under various bilateral climate and green cooperation initiatives and financing vehicles among developing countries. For example, China established two funds in 2015 totaling \$5.1 billion, designed to help developing countries tackle climate change and development problems. The China South-South Climate Cooperation Fund is to provide CNY 20 billion (approximately \$3.1 billion) to assist developing countries in tackling climate change. The Fund for South-South Cooperation with initial funding of \$2 billion is to assist developing countries in implementing the post-2015 Development Agenda. Under the Belt and Road Initiative (BRI), China issued the Green Investment Principle (GIP) in 2018 to promote green investment (Green Belt and Road Initiative Center n.d.), and the proportion of its green investment has been increasing in recent years. For example, in the first half of 2020, China's investment in renewable energy in BRI related countries surpassed investment in fossil energy for the first time (CCICED 2021). With China recently announcing to discontinue investment in coal-fired power projects overseas, its green investment in the BRI countries will increase further. Brazil, India, Saudi Arabia, and the United Arab Emirates, among others, have also provided financial assistance to other developing countries for climate mitigation and adaptation in recent years (UN 2017).

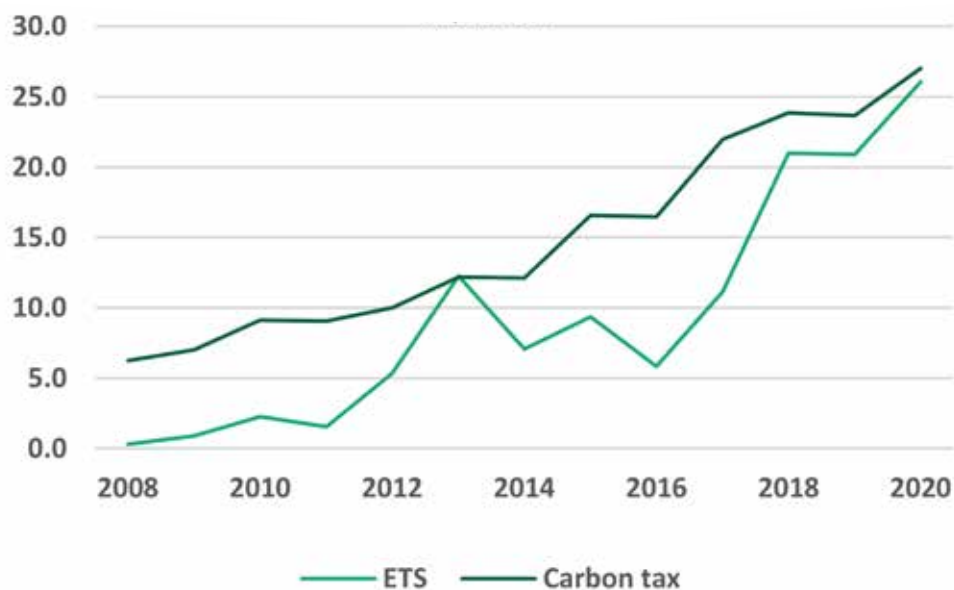
⁹ MDB flows in Figure 2.8 include all flows, while in OECD data in Figure 2.7, MDB flows only include those attributed to developed countries. (2000-2020).

Revenues from carbon pricing

Carbon pricing generates revenues for the government and firms and is also a source of green finance—when the revenues are used to fund green investment. Carbon pricing can take the form of a carbon tax or an emissions trading system (ETS). In 1990, Finland was the world’s first country to introduce a carbon tax. As of 2021, 27 national jurisdictions worldwide have introduced a carbon tax covering 5.4% of global GHG emissions (World Bank n.d.). These include 18 European countries where the tax rate ranges from less than € 1 per ton of carbon emissions in Poland and Ukraine to more than € 100 in Sweden (Green Fiscal Policy Network 2021).

In countries that have established an ETS, governments generate revenues from auctioning emission permits. The EU ETS was established in 2005 and has been the largest in the world in terms of emissions coverage, until recently when China launched its national ETS in July 2021. Other major ETSs include the California Carbon Market started in 2012; the Regional Greenhouse Gas Initiative covering 11 US states started in 2009; Quebec Carbon Market established in 2013; South Korea’s Emissions Trading System (ETS) launched in 2015; China’s 8 provincial pilot ETS started during 2013-2016; New Zealand ETS initiated in 2008; and Switzerland ETS started in 2008. Following the launch of China’s national ETS in 2021, the world carbon trading now covers 16% of the global GHG emissions.

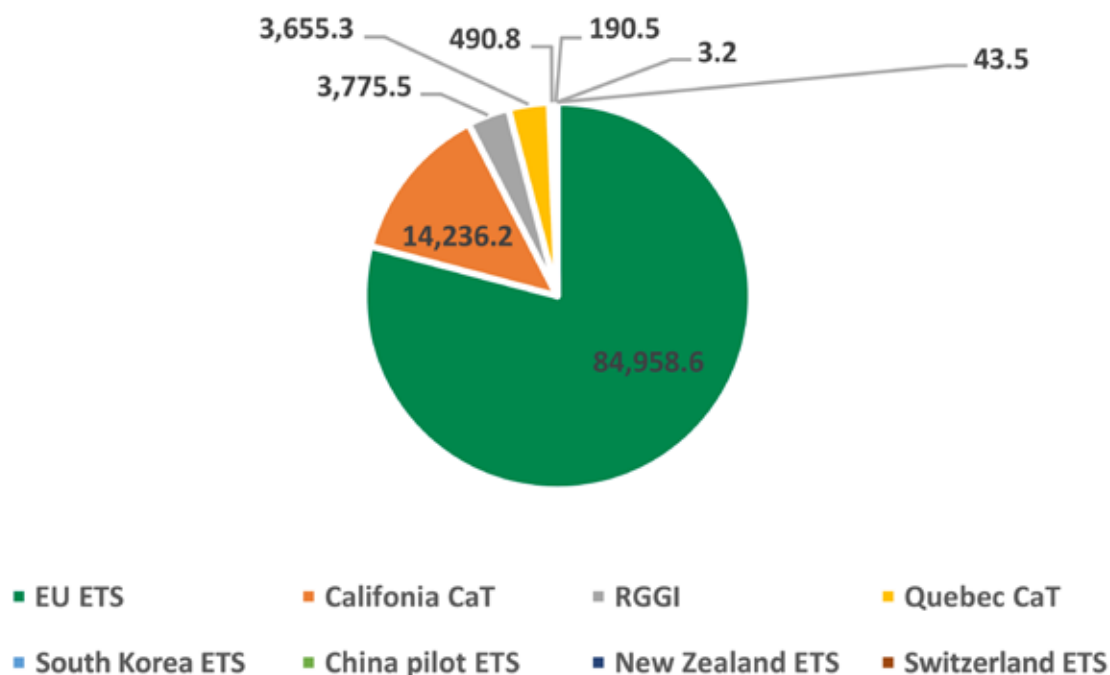
Figure 2.9: Global annual revenues from carbon pricing, 2008-2020, in \$ billion



ETS=Emissions Trading System

Source: World Bank. Carbon pricing dashboard; https://carbonpricingdashboard.worldbank.org/map_data. Accessed 3 August 2021.

Figure 2.10: Cumulative auction revenues of carbon emission permits by ETS, in \$ million, as of end-2020



CaT= Cap-and-trade, ETS=Emissions Trading System, RGGI=Regional Greenhouse Gas Initiative.
 Source: World Bank, Carbon pricing dashboard; https://carbonpricingdashboard.worldbank.org/map_data. Accessed 3 August 2021.

According to the data compiled by the World Bank, global annual revenues generated from carbon taxes increased from \$6.2 billion in 2008 to \$27 billion in 2020, and from auctioning emission permits surged from \$0.23 billion to \$25.5 billion during the same period (Figure 2.9). Global cumulative revenues from auctioning emission permits reached \$103 billion by the end of 2020, of which, the EU accounted for 82%, the US 17.5%, and South Korea ETS 4% (Figure 2.10). According to an International Carbon Action Partnership report (ICAP 2021a), most of the revenues from auctioning emission permits have been used for investment in mitigation projects, including energy efficiency, clean and renewable energy, low-carbon innovation, and industrial decarbonization.

ESG investment

ESG investment is a major source of green finance. Although data on the allocation

of total ESG investments among the three themes (environment, social and governance) are not available, looking at the total amount of ESG investment over time provides insights into its growth dynamics. However, caution is needed. First, the ESG investment data include investment focused on social and governance issues, not just environment-related. Second, the data may overlap, to some extent, with the data on green bonds discussed earlier.

According to Global Sustainable Investment Review 2020, at the start of 2020, total global sustainable investment reached \$35.3 trillion in five major markets (the US, Canada, Europe, Japan, and Australia and New Zealand), a 15% increase from 2018 (Figure 2.11). Sustainable investment assets made up 35.9% of total assets under management (AUM) by asset managers and institutional investors in the five markets, up from 33.4% in 2018. In 2020, of the total sustainable

investment assets, institutional investors accounted for 75% and retail investors accounted for 25%. Sustainable investment assets have continued to build up in most regions, with Canada experiencing the highest growth of 48% in absolute terms from 2018 to 2020, followed by the US at 42%, Japan at 34%, and Australia and New Zealand at 25%, while Europe reported a 13% decline due to a changed measurement methodology.

In the meantime, a report by Morningstar Manager Research (2021) reveals that the increase in the number of sustainable products across the globe, market appreciation, and positive inflows have continued to drive global sustainable fund assets—which are part of the sustainable investment assets in Figure 2.11—to \$2.25 trillion by the end of Q2 2021, up 12% from the end of the first quarter. Europe remains by far the most developed and diverse sustainable ESG fund market, accounting for 82% of global sustainable ESG fund assets, followed by the US at 14%. A report by IMF (2021) looked at a sample of more than 36,500 funds active as of the end of 2020, and found that about 4,000 had a sustainability label, of which nearly 1,000 had an environmental theme and a little more than 200 had a climate-specific theme. Sustainable funds, including those with a climate-specific label,

totalled about \$3.6 trillion, accounting for 7.3% of total AUM of the funds in the sample. Funds with a specific climate focus amounted to \$130 billion. The report also notes that sustainable investment funds (and climate funds in particular) have grown faster than their conventional peers in the recent past.

Green loans

Data on green loans are much patchier. Unlike green bonds, consistent and publicly accessible data covering the entire world are not yet available for green loans. However, China has been collecting and publishing data on green loans in a systematic way since 2013. According to the data released by the PBOC, China’s total green loan stock increased from CNY8.23 trillion (6% of the total loan stock) in 2018 to CNY13.03 trillion (7.2% of total loan stock) at the end of the first quarter of 2021, growing by 58% (Figure 2.12). Of the total green loan stock, 50% was for investment projects that directly reduce carbon emissions and 18% for projects that contribute to reducing carbon emissions indirectly. By usage, 48% of the total green loan stock was for greening infrastructure and 26% for developing clean energy. By sector, transport, logistics and postal services accounted for 30% and power, heating and gas and water supply accounted for 29%.

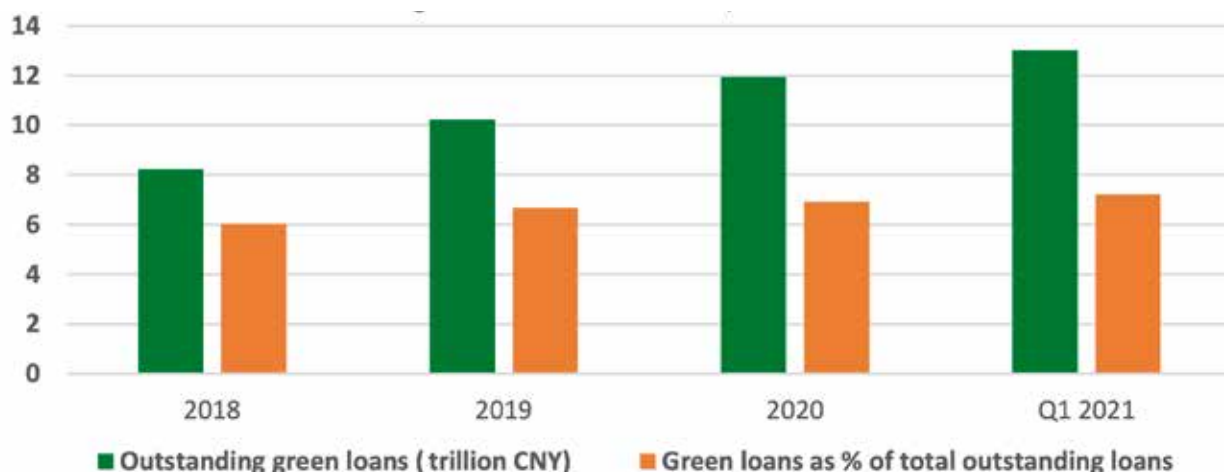
Figure 2.11: Outstanding global assets under management, 2016, 2018 and 2020, in \$ trillion



AUM=assets under management

Source: The Global Sustainable Investment Alliance. 2020. *Global Sustainable Investment Review 2020*; <http://www.gsi-alliance.org/wp-content/uploads/2021/08/GSIR-20201.pdf>.

Figure 2.12: Green loans in China, 2018-2021



CNY=Chinese yuan

Source: The People’s Bank of China, Statistical Report on Loan Allocations of Financial Institutions. Various years.

In sum, the past years have seen significant growth of green finance flows, whether looking at global green bond issuances, official climate finance flows, revenue from carbon pricing, volumes of ESG investing, or green loans. But this growth has largely been driven by developed countries, especially the US and EU, while the share

of developing countries as a whole remains low, except for green loans which have limited data. Thus, while more policy actions are needed to foster the development of green and sustainable finance to support the implementation of the SDG and climate mitigation and adaption actions, this is more so for developing countries.



2.2.5. Policies for developing green finance in selected countries

In countries where green finance has grown strongly, governments have put in place a comprehensive supportive policy framework. Key elements of the policy framework include: (i) national strategies and policies for green growth and sustainable development, national emission reduction targets and action plans, and green industry policies, all of these helping to lay a foundation for green finance development; (ii) green finance strategies, green taxonomy and project catalogue, guidelines related to green financial instruments such as green bonds, green loans, green insurance, and green funds, and regulation on climate-related information disclosure and climate risk management for financial institutions; (iii) green finance support programs, such as interest rate subsidy, tax credit, government guarantee, supportive regulatory procedures, and private-public partnership; (iv) development of market infrastructure and services, such as carbon trading, national green fund or credit facility, green accreditation and labelling, and green investment benchmarks; and (v) international cooperation for regulatory and policy coordination, peer-to-peer learning, and advocacy of sound investment principles.

The European Union and the United Kingdom

Both the EU and the UK have developed relatively comprehensive green finance policy frameworks.

The European Union (EU). The EU has established clear organizational structures for green finance through coherent strategies and policies. The adoption of the SDGs and the Paris Agreement laid the foundation for its commitment to align financial flows with a pathway towards low-carbon and climate-resilient development. In 2019, the European Commission proposed the European Green Deal, which aims to transform the EU into a modern, resource-efficient, inclusive and competitive economy, achieving net-zero GHG emissions by 2050 (European Commission n.d.a). Its European Green Deal Investment Plan, announced in January 2020, aims to mobilize at least € 1 trillion of sustainable investments over the next decade to support the green transition. As an essential part of the Green Deal, green and sustainable finance has become a major policy agenda. The agenda comprises the Action Plan on Financing Sustainable Growth (adopted in March 2018), the renewed Sustainable Finance Strategy (adopted in July 2021), and a new Strategy for Financing the Transition to a Sustainable Economy (adopted in July 2021) (European Commission n.d.b).

To implement these policies and strategies, the EU has introduced a series of regulations and guidelines. These relate to the EU taxonomy for sustainable activities, corporate disclosure of climate-related information, EU climate and ESG benchmarks, sustainability-related disclosure in the financial services sector, and the European green bond standard (European Commission n.d.b).

- The EU taxonomy provides criteria for defining whether or not economic activity is environment-friendly. It not only provides companies, investors, and policymakers with relevant standards to identify which economic activities are environmentally sustainable, but also protects private investors from greenwashing and help direct investments to where they are most needed. The Taxonomy Regulation was published in June 2020 and entered into force in July 2020.
- On corporate disclosure of climate-related information, the European Commission issued new climate reporting guidelines in January 2019 to supplement the 2017 non-binding guidelines on non-financial reporting. The guidelines adopted the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) of the Financial Stability Board to guide companies in reporting the impacts of their business on the climate and the impacts of climate change on their business.
- In April 2020, the EU's Regulation 2019/2089, known as Low Carbon Benchmark Regulation, entered into force. It lays down minimum requirements for EU Climate Transition Benchmarks and EU Paris-aligned Benchmarks at the EU level, as well as benchmarks' ESG disclosures. The benchmarks help investors to compare the carbon footprint of their investments.
- In March 2021, the EU's Sustainable Finance Disclosure Regulation (SFDR) came into application, laying down sustainability disclosure obligations for financial firms such as fund managers, insurers and banks that provide financial products and services within the region towards end-investors.
- In July 2021, as part of the European Green Deal Investment Plan, the EU Commission adopted the European Green Bond Standard—a voluntary standard to drive capital into projects that will help EU meet its net-zero carbon emission goals by 2050. The standard will use the detailed

definitions of green economic activities in the EU Taxonomy to define what is considered a green investment.

The EU's ETS is considered another key part of green finance. It is currently the world's largest carbon market measured by annual transactions—accounting for 30% of the global carbon trading volume in 2020. The EU ETS now covers 30 countries, including 27 EU member states, Norway, Iceland and Liechtenstein, with a link to the Swiss carbon market; and 40% of the EU's total GHG emissions (European Commission n.d.c). From 2021, it enters its fourth phase (European Commission 2015). The ETS is based on a cap-and-trade mechanism, which sets a cap on GHG emissions and distributes carbon allowances through auctions and free allocations (Qin 2021). It is an initiative of EU, not individual EU members and, therefore, policies and legislation at the EU level have become the major driving force of its development. Following the Brexit, the UK withdrew from the EU ETS in 2021 and started a separate carbon trading scheme.

The United Kingdom (UK). Like the EU, the UK has also developed a relatively comprehensive green finance policy framework. The Green Finance Strategy launched by the government in 2019 put forward two goals: to align private sector financial flows with clean, environmentally sustainable and resilient growth, and to strengthen the competitiveness of the UK financial services sector. Three strategic pillars were introduced to achieve these goals (UK government 2019).

The first pillar is Greening Finance, which aims to ensure that current and future financial risks and opportunities arising from climate and environmental factors are integrated into mainstream financial decision-making. The second pillar is Financing Green, which aims to accelerate finance to support the delivery of the UK's carbon targets and clean growth, resilience and environmental ambitions, as

well as international objectives. It identifies specific actions to mobilize private finance flows into the clean growth and environmental sectors. The third pillar is Capturing the Commercial Opportunity, which attempts to secure that the UK continues to capture the commercial opportunities arising from the “Greening of finance” and the “Financing of green.” It strives to consolidate the UK’s position as a global hub for green finance and position the UK at the forefront of green financial innovation and data analytics (UK government 2019).

In this process, the UK regulators have played a major role. These include the Prudential Regulation Authority (PRA) of the Bank of England, the Financial Conduct Authority, the Financial Reporting Council, and the Pensions Regulator. PRA’s role is to guide and regulate the insurance and banking sectors to incorporate the risks caused by climate change into the risk management system. The Bank of England is the first central bank to undertake climate disclosures in line with the TCFD of the Financial Stability Board. It has also implemented climate stress testing on the UK’s financial system. The Financial Conduct Authority put forward the UK Corporate Governance Code and Stewardship Code together with the Financial Reporting Council to explore how to effectively integrate climate change and other ESG factors into investment activities. The Pensions Regulator has contributed to the inclusion of ESG considerations in pension management through efforts like updating investment guidance, revising the Responsible Investment Code and setting up an industry working group on climate change (UK government 2019).

In the past 20 years, the UK has implemented a series of initiatives domestically and internationally with a goal to lead the development of global green finance. These include, among others:

- Listing the first green bond on the London Stock Exchange in 2009;
- Launching an International Climate Fund in 2011;
- Establishing a national-level Green Investment Bank in 2012;
- Co-chairing with China the first meeting of the G20 Green Finance Study Group in 2016;
- Establishing the UK Green Finance Taskforce, publishing the Clean Growth Strategy, and becoming one of the first countries to endorse the TCFD recommendations in 2017;
- Publishing the Green Finance Strategy in 2019;
- Establishing a Green Technical Advisory Group tasked with developing the UK’s green taxonomy to mirror the EU taxonomy in 2021.

The UK started to develop its carbon pricing scheme in 2002, which had been operational through the EU ETS since 2005. Brexit led to UK’s departure from the EU ETS and its establishment of an independent carbon emissions trading scheme (ECIU n.d.).

The United States

In the United States (US), environment- and climate-related policy is decentralized, and most decisions are made at the state-level, different from the situations in the EU, UK and China. There have been large swings in the climate policy in the US. During the Trump's presidency, the country backed away from most climate change-related commitments and withdrew from the Paris Agreement. The Biden administration rejoined the Paris Agreement and has made a commitment to the target of net-zero emission by 2050. The government has also pledged to fully decarbonize the power sector and reduce building stock's emissions by 50% by 2035 (Climate Action Tracker 2021), and re-establish the US as a climate leader in the world. At the UN General Assembly in September 2021, President Biden announced the commitment to double the US climate change aid by 2024 to USD 11.4 billion per year (Volcovici 2021). However, according to Climate Action Tracker (2021), while the Biden administration has set more ambitious targets and broad plans for climate action, the US Congress will need to pass new legislation to put the country on a path towards the pledged ambition levels and onto an emissions pathway to zero GHG emissions.

At the state-level, some states have made more progress than others in green transition. As there is no national emission trading system (ETS), states such as California and Massachusetts established their own ETSs, in 2012 and 2018, respectively. There is also a Regional Greenhouse Gas Initiative (RGGI) that covers power sector emissions trading among 11 US states (ICAP 2021a).

Due to the absence of a national green finance policy framework and relevant action plans, green finance development in the US is largely driven by market. US financial institutions were considered to be laggards on sustainability issues compared with their European counterparts (UNEP 2016). However, because its financial system is the largest and one of the most dynamic in the world, the US has easily

become the largest source of ESG investment and one of the largest green bond issuers in the world. As US financial institutions make up a large share of the global debt and equity markets, there are enormous opportunities and potential to scale up green finance in the country.

China, Japan and South Korea

East Asia is one of the vigorously engaged regions committed to developing green finance outside the EU and UK. China, Japan, and South Korea all have developed a relatively comprehensive green finance policy framework. However, there are variations in the development approach and priorities among the three countries.

China. China's green finance policy framework can be characterized as one with sound top-level policy design, a "top-down" implementation approach, and innovative local pilot projects. In September 2015, the State Council issued the *Integrated Reform Plan for Promoting Ecological Progress*, which called for accelerating the construction of ecological civilization and building a green financial system, marking the development of green finance a national strategy. In August 2016, seven ministries and commissions including the PBOC, the Ministry of Finance, and the National Development and Reform Commission (NDRC) jointly issued the *Guidelines for Establishing a Green Financial System*. It clarified the definition of green finance and provided a strategic framework for the development of green finance in China (Wang and Xu 2020).

To implement this strategy, the concerned ministries and commissions have issued various green finance policy guidelines covering green credit, green securities, green insurance, green funds, green public-private partnership (PPP), environmental rights trading, and local pilot projects. These include, among others, the *Green Loan Guidelines* (issued in 2012), the *Catalogue of Green Bond Support Projects* (first

introduced in 2015 and re-issued in 2019 and 2021), and the *Guidelines on Promoting the Investment and Financing in Response to Climate Change* (issued in 2020). Many other central ministries are also fully engaged in fostering the development of green finance in China.

At the local level, local governments have developed green finance systems that suit their local development needs. By June 2020, a total of 100 provincial-level green finance policy documents had been issued across 31 provinces, municipalities that are directly under the central government, and autonomous regions. These cover general directions of local green finance development and policies related to various green financial instruments.

Piloting financial reforms and innovations at the local level are an essential feature of China's green finance development approach that distinguishes it from the EU and other countries and regions. It allows each pilot region to explore green finance policies in consideration of local conditions. *Article 28 of the Guideline on Building a Green Financial System* proposes to support local development of green finance with the following suggestions:

“.....to explore ways to support local development of green finance through re-lending, prudential macroeconomic assessment and capital market financing tools.....to encourage local governments where conditions allow to mobilize more private capital to invest in green industries through specialized green guarantee mechanisms and the establishment of green development funds.....to support local governments in making use of the green bond market to provide financing for medium- and long-term green projects with stable cash flows.....to support local governments to include projects with significant environmental benefits in the green project database and list them in national asset trading centers, so as to support financing through multiple channels..... to encourage and support cooperation of

local governments with international financial institutions and other foreign entities in carrying out green investment.....”

(The State Council Information Office of the People's Republic of China 2016).

In line with this Guideline, since 2017, the executive meetings of the State Council have set up pilot zones for green finance reform and innovation in nine municipalities in six provinces, including Guangdong, Zhejiang, Jiangxi, Xinjiang, Guizhou and Gansu. Each pilot zone has introduced differentiated policies and standards to promote integration of green financial markets into local industrial development, and foster innovations in green finance products, services and development models (Wang and Xu 2020).

To support green growth and development in the Belt and Road countries, in 2018, the Green Finance Committee of China Society for Finance and Banking and the City of London Corporation's Green Finance Initiative jointly developed the Green Investment Principles (GIP), a set of principles for greening investment in the Belt and Road (Wang 2019). The development of the GIP was participated by Principles for Responsible Investment, Sustainable Banking and Finance Network, Belt & Road Bankers Roundtable, Green Belt and Road Investors Alliance, World Economic Forum, and the Paulson Institute. The principles include (i) embedding sustainability into corporate governance; (ii) understanding environmental, social, and governance risks; (iii) disclosing environmental information; (iv) enhancing communication with stakeholders; (v) utilizing green financial instruments; (vi) adopting green supply chain management; and (vii) building capacity through collective action. By June 2021, the GIP expanded its membership to 39 signatories and 11 supporters from 14 countries and regions around the world.

In September 2020, China announced to

the world that it will strive to peak carbon emissions before 2030 and achieve carbon neutrality before 2060, laying a firm foundation for the development of green finance.

Japan. In comparison, Japan has focused more on developing relevant policies targeting different sectors, instead of developing a top-level design for a green financial system. Government agencies that have worked on green finance include the Ministry of Environment (MOE), the Ministry of Economy, Trade, and Industry (METI), the Financial Service Agency, and the Cabinet Office. Among them, MOE and METI are considered the chief partakers responsible for energy and industrial policies, while others are in charge of climate change-related policies. In addition, the Ministry of Foreign Affairs (MOFA), the Japan International Cooperation Agency, and some other ministries have also engaged in the policymaking of climate investment and financing to a certain extent. Japan has also set up the Global Warming Prevention Headquarters to coordinate climate-related policies and actions among various agencies.

By August 2020, Japan had issued a total of 41 policy documents concerning sustainable finance (Institute for Global Environment Strategies 2020). Among the policy documents issued, five concern green bonds (including *Green Bond Guidelines 2017 and 2020* issued by MOE), one is related to green loans and sustainability bonds (*Green Loan and Sustainability Linked Loan Guidelines 2020* issued by MOE), 16 are for ESG and CSR, and two are on TCFD and ESG standards (including *Guidance for Climate-related Financial Disclosure* issued in 2018 by METI).

To support the development of the green bond market, the Ministry of Environment is implementing a Financial Support Programme for Green Bond Issuance. Under this programme, government subsidies are provided to cover additional expenses when issuing green bonds, such as on external

reviews before, during and after assurances; and consulting services in developing green bond frameworks. To be eligible for the subsidy, more than half of the proceeds of the green bonds must be used for domestic decarbonization projects, such as renewable energy and energy efficiency. The issuers can be companies based in Japan and municipalities. The bonds can be denominated in Yen or foreign currencies. They can be issued domestically or overseas, and through public offering or private placement.

Japan is a major donor in global green and climate financing. By March 2021, Japan's cumulative contribution to multilateral climate funds reached \$40.5 billion (Climate Funds Updates 2021). To encourage Japanese companies to export low-carbon technologies, Japan set up the Joint Crediting Mechanism in 2011. Under the scheme, Japanese companies could offer low carbon technologies to developing countries to help them reduce carbon emissions in exchange for carbon credits, which could be used to meet Japan's emission reduction target. As of June 2019, Japan had signed bilateral Joint Crediting Mechanism partnerships with 17 developing countries in Asia, Africa, Latin America, and Middle East (Ministry of Foreign Affairs of Japan 2020).

South Korea. The development of green finance in Korea has also followed a top-down approach. The green finance policy framework is based on its National Strategy of Green Growth launched in 2008 (OECD 2017). The Presidential Committee on Green Growth (PCGG) was established in 2009 to follow through on the national strategy. The year 2009 was regarded as the initial year for green finance development in South Korea when the Green Finance Scheme was officially released (Oh and Sang-hyup 2018). In 2010, the Framework Act on Low Carbon, Green Growth was enacted, which elevated the strategy of green growth to a legal level and clarified the definition and implementation methods of green growth. Following the first five-year plan for green growth in 2009, South

Korea introduced the second five-year plan for green growth in 2014 and the third in 2019, emphasizing the importance of building a green financial system and strengthening international cooperation on green finance and putting forward the vision of building an inclusive green country.

South Korea's Ministry of Strategy and Finance, Ministry of Foreign Affairs (MOFA) and PCGG have played an important role in facilitating the developing green finance. The Ministry of Strategy and Finance is in charge of the Green Climate Fund (GCF) as designated by the government, while the MOFA is responsible for climate negotiations. The PCGG leads the implementation of green growth strategies, including the Framework Act on Low Carbon, Green Growth mentioned above. According to Article 28 of this act, the government shall innovate financial instruments to support low-carbon and green growth. Based on this, state-owned financial institutions such as the Korea Finance Corporation and the Export-Import Bank of Korea have formulated measures to support green industries, including extending credit guarantees and waiving insurance premiums.

In 2020, South Korea launched "The Korean New Deal," planning to invest about \$142.62 billion in the next five years to promote economic and social development, transformation and upgrading. It consists of three parts—"Digital New Deal," "Green New Deal," and "Stronger Safety Net"—and aims to support the post-COVID recovery of South Korea's economy and lay the foundation for future economic growth (Shinmun 2020). The green new deal endeavours to attain carbon neutrality and expedite the low-carbon and green transition of the economy. In accordance with this plan, South Korea will prioritize three areas: the green transformation of infrastructure, low-carbon decentralized energy, and green industrial innovation. The National Green Growth Strategy and the Korea New Deal

have provided green finance with a solid foundation.

The Korean ETS (K-ETS) was established in 2015 as the first national ETS in East Asia and the second largest ETS after the EU ETS at that time (ICAP 2021b). At its inception, the K-ETS covered about 70% of its GHG emissions. At present, it includes six major sectors: industry, building, transport, heat and energy, waste treatment, and public utilities, involving a total of more than 600 market participants. In terms of mechanism design, at the launch, the K-ETS utilized the country's 2012 GHG emissions as the benchmark and set a goal of reducing the emissions by 22% by 2030. Its updated NDC targets a 24.4% reduction from 2017 emissions by 2030. The K-ETS has also been developed in phases. In the first phase (2015-2017), emission quotas were distributed free of charge. From the second phase (2018-2020), a small proportion of the quotas were allocated through auctions. The third phase will be for the period 2021-2025.

The Association of Southeast Asian Nations (ASEAN)

The Association of Southeast Asian Nations (ASEAN) consists of 10 Southeast Asian countries: Indonesia, Malaysia, the Philippines, Thailand, Singapore, Brunei, Cambodia, Laos, Myanmar and Vietnam. The ASEAN member states are among the most affected by climate change in the region due to their geographical locations, high dependence on natural resources, and overall, relatively low levels of incomes and adaptive capacity. ASEAN member states need large amounts of green investment to promote sustainable development and transformation. It is estimated that ASEAN's total green investment needs during 2016-2030 amount to US\$3 trillion, including \$1.8 trillion for infrastructure, \$0.4 trillion for new energy, \$0.4 trillion for energy efficiency improvement, and \$0.4 trillion for food, agriculture, and land use (UN Environment and DBS 2017).

MDBs have played an important role in the development of the ASEAN green financial market. They have worked with ASEAN countries to reduce investment risks and attract private capital through blended finance and credit enhancement mechanisms, in order to meet the region's huge funding needs for green investment, especially to scale up green infrastructure investment. Many MDBs, including IFC, ADB, AIIB, etc., are not only issuing green bonds in ASEAN, but are also major investors in many local green bonds. Through market participation, they actively promote the development of the ASEAN green financial market (CBI 2020).

In 2019, the ASEAN Infrastructure Fund and ASEAN member states initiated the ASEAN Catalytic Green Finance Facility (ACGF) (ADB n.d.). This regional green finance initiative aims to develop reliable projects through better use of public funds; mobilization of private sector capital, technology, and efficient management; and acceleration of green infrastructure investment in the ASEAN region. At the seventh meeting of ASEAN Finance Ministers and Central Bank Governors in March 2021, ASEAN endorsed the initiative to develop an ASEAN Taxonomy for Sustainable Finance (ASEAN 2021). The ASEAN Taxonomy will be the overarching guide for all ASEAN member states, complementing their respective national sustainability initiatives and serving as ASEAN's common language for sustainable finance. The meeting also endorsed the establishment of the ASEAN Taxonomy Board to develop, maintain and promote a multi-tiered taxonomy that will take into account ASEAN's needs, as well as international aspirations and goals. Further, the meeting endorsed the initiative on ASEAN Sustainable

Banking Principles, which will serve as guiding principles to help ASEAN central banks develop further sustainable banking guidelines and tools aligned with each respective country's context.

Currently, Singapore, Malaysia, and the Philippines have established working groups under the guidance of their regulatory authorities to establish the definition of sustainable finance in their countries. The sustainable finance standards at the ASEAN level will help coordinate country initiatives and create better conditions for improving transparency and promoting capital flows. The ten ASEAN countries vary significantly in economic and social development as well as in green finance development. Countries such as Singapore, Indonesia, Malaysia, and the Philippines are more developed than others in green finance.

Other countries and regions

Small Island Developing States (SIDS)⁹—located in the Caribbean Sea, Pacific Ocean, Atlantic Ocean, Indian Ocean and South China Sea—and Least Developed Countries (LDC)¹⁰ are most vulnerable to climate change and its impact, and require substantial investment in their capacity to manage environmental risks, especially in climate adaptation. Due to their less developed financial systems, they have to rely heavily on financial support from developed countries and multilateral climate investment and financing mechanisms. As discussed earlier, in the past two decades, several funds have been established to address global climate change challenges, including LDCF and SCCF that were specifically established to support LDCs and SIDS. MDBs have also paid a

⁹ Small Island Developing States (SIDS) were officially recognized as a group of special environment and development areas at the United Nations Conference on Environment and Development in 1992.

¹⁰ According to the definition of the UN Department of Economic and Social Affairs (UNDESA), refer to "low-income countries facing structural obstacles to sustainable development", including 35 African countries, 3 Pacific Island countries, and 8 Asian countries.

particular attention to supporting these most vulnerable countries.

Under the Paris Agreement, developed countries pledged to mobilize \$100 billion each year to support and help developing countries to cope with climate change by 2020, and increase it further after 2020. The implementation of this commitment is crucial to achieving the climate goal of the Paris Agreement. OECD analysis shows that in 2018 climate funding transferred from developed countries to developing countries (including private capital mobilized) was \$79 billion (see earlier discussions), below the \$100 billion goal. It is estimated that between 2017 and 2018, only about 20.5% of bilateral climate funds were invested in LDCs, and only 3% were invested in SIDS. Thus, although international assistance to SIDS and LDCs has been increasing, the amount is not sufficient to meet the needs of these countries in addressing climate change.

2.2.6. International cooperation on green finance

International cooperation has played a critical role in the development of green finance. International cooperation in green finance can take many forms, such as financial support (see Section 2.2.4), cooperation among policy-makers and regulators, and voluntary cooperation among market participants for peer-to-peer learning and advocating of good practices. This section focuses on the latter two.

Cooperation among policy-makers and regulators

Multilateral policy and regulatory cooperation on green finance has been vigorous in recent years, with various initiatives, frameworks, platforms, and mechanisms established to provide policy support. The major initiatives include: the G20 Sustainable Finance Study Group (SFSG), the Central Banks and Supervisors Network for Greening the Financial System (NGFS), the International Platform on Sustainable Finance (IPSF), the Coalition of Finance Ministers for Climate Action, the Sustainable Banking Network (SBN), the Sustainable Insurance Forum (SIF), and, at a regional level, the ASEAN Catalytic Green Finance Facility (ACGF).

The Sustainable Finance Study Group (SFSG) was formerly known as the G20 Green Finance Study Group (GFSG), which was established in 2016 with the objective of exploring and channeling private capital into green sectors. In 2018, SFSG replaced GFSG to continue its work but to further expand the scope of its responsibilities. SFSG aims to identify institutional and market barriers to green finance based on the country experiences and to develop opportunities to enhance the capacity of the financial system to mobilize private capital for sustainable investment. In 2021, the SFSG started a discussion on the development of a multi-year G20 Roadmap for Sustainable Finance. It is designed to be a multi-year action-oriented document that will inform the broader G20 agenda on climate and sustainability in the years to come. The roadmap was endorsed by G20 finance ministers and central bank governors at its 4th meeting in October 2021 (G20 2021).

The Central Banks and Supervisors Network for Greening the Financial System (NGFS n.d.) was launched in 2017 jointly by eight central banks and regulators.

As of April 2021, it has 89 members and 13 observers. The NGFS aims to support global efforts to strengthen the actions needed to achieve the objectives of the Paris Agreement and to enhance the role of the financial system in managing risk and mobilizing finance for green and low carbon projects. To this end, NGFS defines and promotes best practices within and beyond member countries, and carries out green finance analysis. According to the NGFS 2020 annual report, the NGFS covers 100% of global banks and two-thirds of global insurers, and its member countries account for 75% of global GHG emissions and 85% of global GDP.

The International Platform on Sustainable Finance (IPSF) was launched in October 2019 by the European Union, together with authorities from Argentina, Canada, Chile, China, India, Kenya, and Morocco (European Commission n.d.d). Since its launch, Indonesia, Japan, Norway, the UK, Switzerland, and other countries have also joined. The objective of IPSF is to scale up the mobilization of private capital towards environmentally sustainable investments. It has been engaged in strengthening dialogue among policymakers, promoting best practices, comparing differences between initiatives, and identifying barriers and opportunities of sustainable finance. IPSF also works to coordinate different practices in capital markets, such as sustainable or green taxonomy, disclosure standards, and green labeling, which are essential for promoting environmentally sustainable investments on a global scale.

The Coalition of Finance Ministers for Climate Action (CFMCA) brings together fiscal and economic policymakers from over 50 countries in leading the global climate response and in securing a just transition towards low-carbon resilient development (CFMCA n.d.). At the 2018 Annual Meetings of the World Bank Group and the International Monetary Fund in Bali, Indonesia, governments from 39 countries came together to boost their collective

engagement on climate action. The meeting highlighted the challenges posed by climate change, the unique role of the world's finance ministers to address them, and ways in which these efforts could be strengthened. Several governments expressed strong support for the development of a Coalition of Finance Ministers, which would promote cohesion between domestic and global actions on climate change, boost ambitions, reaffirm commitments, and accelerate actions to implement the Paris Agreement. Since its launch, finance ministers from 50 countries have signed on to the Helsinki Principles, a set of six principles that promote national climate action.

In addition, there are also sustainable financial platforms with national regulators as members, such as the Sustainable Banking and Finance Network (SBFN n.d.), formally the Sustainable Banking Network, and the Sustainable Insurance Forum (SIF n.d.). The SBFN arose during the International Green Credit Forum, hosted by IFC and the China Banking Regulatory Commission in 2012, with banking regulators and associations in emerging markets as the main entities. The SBFN is committed to advancing sustainable finance in line with international good practices. The network now has 43 member countries representing \$43 trillion or 86 percent of the banking assets in the emerging markets. Founded in 2017, the SIF is a platform for insurance supervisors and regulators with an aim to promote sustainable practices in the insurance industry in various countries through cooperation and information sharing.

The ASEAN Catalytic Green Finance Facility (ACGF) is a multilateral cooperation mechanism dedicated to accelerating green infrastructure investment in Southeast Asia, supporting ASEAN member governments in preparing and channeling public and private funding for infrastructure projects that promote environmental sustainability and contribute to climate change goals (ADB n.d.). The ACGF was set up by the ASEAN

Infrastructure Fund in 2018 to operate on a three-year pilot basis (2019-2021) and was officially launched in April 2019. ACFG is owned by ASEAN member countries and the ADB which also manages the facility. It is the first regional green finance initiative to focus on developing and scaling up green projects in ASEAN nations. The ACFG provides ASEAN member governments with technical assistance to identify and prepare commercially viable green infrastructure projects as well as loans to cover their capital investment costs. This two-pronged approach is conducive to reducing the investment cost of green infrastructure projects, making them more attractive to private capital investors.

Cooperation among market participants

In the past 20 years, cooperation among market participants in green and sustainable finance has proliferated aiming to facilitate peer-to-peer learning and advocating sound principles and practices. The major initiatives include the Equator Principles (EP), the Task Force on Climate-Related Financial Disclosures (TCFD), the United Nations Environment Programme Finance Initiative (UNEP FI), the Principles for Responsible Investment (PRI), the Sustainable Stock Exchange Initiative (SSE Initiative), the International Development Finance Club (IDFC), among others.

The EP was launched by some of the world's leading financial institutions in 2003. It is a risk management framework, adopted by financial institutions, for determining, assessing, and managing environmental and social risks in projects and is primarily intended to provide a minimum standard for due diligence and monitoring to support responsible investment decision-making. Designed according to IFC's environmental and social policies and guidelines, the EP applies globally, to all industry sectors and to five financial products: (i) project finance advisory services, (ii) project finance, (iii) project-related corporate loans, (iv) bridge

loans, and (v) project-related refinance and acquisition finance. The EP has now been adopted by 125 financial institutions in 37 countries producing annual EP reporting (EP n.d.).

The TCFD was established by the Financial Stability Board (FSB) to develop recommendations for more effective climate-related disclosure that could promote more informed investment, credit, and insurance underwriting decisions and, in turn, enable stakeholders to understand better the concentrations of carbon-related assets in the financial sector and the financial system's exposures to climate-related risks. In 2017, the TCFD released climate-related financial disclosure recommendations. According to the TDFC's 2020 Status Report, the number of organizations expressing support for the TCFD grew by more than 85% in the 15 months to October 2020, reaching over 1,500 globally, including over 1,340 companies with a market capitalization of \$12.6 trillion and financial institutions responsible for assets of \$150 trillion, and over 110 regulators and governmental entities from around the world (Financial Stability Board 2020). Many of these organizations have begun to implement the TCFD recommendations or continue to refine and improve their climate-related financial disclosures, with a growing number of regulators issuing new rules in line with TCFD recommendations.

Green finance-related initiatives launched or supported by UN organizations in collaboration with market participants are also an important part. Launched in 1992, UNEP FI is a partnership between UNEP and the global financial sector to mobilize private sector finance for sustainable development. UNEP FI works with more than 350 members—banks, insurers, and investors—and over 100 supporting institutions to help accelerate the development of sustainable finance and support the integration of sustainability into financial market practices. The frameworks UNEP FI has established or co-created include Principles for

Responsible Banking (PRB), Principles for Sustainable Insurance (PSI), and Principles for Responsible Investment (PRI). The PRI was adopted in 2006, calling investors to incorporate environmental, social, and governance (ESG) factors into investment decisions. The six principles of the PRI now have about 3,800 signatories from over 60 countries representing over US\$120 trillion of assets (UN PRI n.d.). The PSI was established in 2012, and has been adopted by 180 organizations worldwide, including insurers representing more than 25% of world premium volume and \$14 trillion in assets under management (UNEP Finance Initiative n.d.a). The PRB was launched in 2019 with more than 130 banks collectively holding \$47 trillion in assets, or one third of the global banking sector. It provides a unique framework for ensuring that signatory banks' strategies and practices align with SDGs and the Paris Climate Agreement (UNEP Finance Initiative n.d.b).

In addition, the Sustainable Stock Exchange Initiative (SSE Initiative n.d.) was established in 2009 with the support of the United Nations. It works to explore how exchanges, in collaboration with investors, regulators, and companies, can enhance corporate transparency—and ultimately performance—on ESG issues and encourage sustainable investment. At present, more than 100 exchanges worldwide have joined the initiative, covering more than 50,000 listed companies with a total market capitalization of more than \$88 trillion. Another global

multilateral platform supported by the United Nations is the Financial Centre for Sustainability (FC4S n.d.). The main objective of the platform is to accelerate the development of sustainable finance by facilitating the exchange of experience among financial centers, promoting consensus building, and achieving common goals. So far, 30 financial centers have joined the platform.

The other cooperation initiatives in green or sustainable finance among market participants include IDFC, GABV, and GIP for B&R. The International Development Finance Club (IDFC n.d.) was founded in 2011 and is composed of development financial institutions, working to implement the SDGs and the Paris Agreement agendas through joint forces of the global development financial institutions. The IDFC currently has 26 member institutions and publishes Green Finance Mapping Report every year. Global Alliance for Banking for Values (GABV n.d.), created in 2009, is a network of banking leaders from around the world, committed to advancing positive change in the banking sector to make it more transparent and support economic, social and environmental sustainability; and, as discussed earlier, the Green Investment Principles (GIP) is a set of principles for greening investment in the Belt and Road, designed to encourage sustainable and socially responsible investments by signatories in developing countries.



2.3. Global green finance development index

This section presents results of a *Global Green Finance Development Index* (GGFDI) developed jointly by International Finance Forum (IFF) and International Institute of Green Finance (IIGF) of Central University of Finance and Economics (CUFE) in China. The GGFDI is a quantitative measure of progress and performance in developing green finance at the country level, based on systematic studies and data collection. It aims to provide policymakers, financial practitioners, enterprises, scholars and other stakeholders with consistent information on the global development of green finance to aid policy and business decision-making. It draws on research work at IIGF.

2.3.1. Methodology

The GGFDI is constructed from 53 country-level indicators that are related to green finance development one way or another. Of these indicators, 14 are quantitative, 5 are semi-quantitative, and 34 qualitative. The 53 indicators (Level 4) are first aggregated into 25 indicators (Level 3), which are further aggregated into 6 (Level 2). The 6 Level 2 indicators are then aggregated into 3 indicators (Level 1): Policy and Strategy, Product and Market, and International Cooperation. Finally, the 3 Level 1 indicators are aggregated into the overall GGFDI. All 53 indicators (Level 4) are given an equal weight in constructing the GGFDI. Table 2.2 presents all these indicators.

Principles for constructing the GGFDI

The development of the GGFDI aims to ensure that the results are transparent, objective, comparable, and analytically rigorous. It considers data availability as well.

Transparency. The GGFDI is constructed using publicly available information, including government policy documents

and official data, databases of international organizations, research reports of think tanks, websites of global and regional green finance initiatives or platforms, and reports and websites of financial institutions.

Objectivity. The GGFDI is not based on expert perception surveys. Instead, all the indicators are evaluated objectively using data and information specifically collected.

Comparability. The GGFDI ensures cross-country comparability by (i) only including indicators that are available for most countries covered in the study and (ii) collecting data that follow uniform definitions of relevant concepts across countries (an example being green bonds).

Analytic rigor. Despite data limitations, the GGFDI captures key aspects of green finance development. Further, the indicators selected are carefully evaluated to ensure that they are closely related to and can capture green finance development, including policy efforts, market dynamics, and commitment to international cooperation.

Data availability. Since green finance is a relatively new field and the GGFDI covers a large number of countries with great diversity, data covering all major aspects of green finance are incomplete. Thus, the availability of data is also one of the key considerations in selecting indicators to be included. With the continuous development of global green finance and the improvement of information disclosure, it is hoped that the GGFDI can be further improved over time as more and better data become available.

Table 2.2: The indicator system of the GGFDI

Level 1	Level 2	Level 3	Level 4	Type of indicator	
Policy and Strategy	Green development policy and strategy	Green development strategy	• Availability of national green development strategy	Qualitative	
			• Availability of green development action plan	Qualitative	
			• Availability of green industry-related policy	Qualitative	
		Climate mitigation commitment	• Nationally determined contribution	Semi-quantitative	
	• Carbon pricing policy		Semi-quantitative		
	Green finance-related policy and strategy	Green finance general policy	• Availability of green finance strategy	Qualitative	
			• Availability of green bond related policy	Qualitative	
			• Availability of green loan related policy	Qualitative	
			• Availability of green insurance related policy	Qualitative	
		Green finance product related policy	• Availability of green fund related policy	Qualitative	
• Availability of climate-related information disclosure policy			Semi-quantitative		
Green finance risk management related policy	• Availability of financial institution environment stress test policy	Semi-quantitative			
Product and Market	Green finance products	Green bonds	• Cumulative value of green bonds issued/GDP	Quantitative	
			• Value of new green bonds issued/GDP in 2020	Quantitative	
			• Cumulative number of green bond issuances	Quantitative	
			• Number of new green bond issuances in 2020	Quantitative	
			• Cumulative number of green bond issuers	Quantitative	
		Green loans	• Availability of green loans	Qualitative	
			• Availability of new green loans in 2020	Qualitative	
		Green insurance	• Availability of environment insurance products	Qualitative	
			• Availability of other green insurance products	Qualitative	
		Green or ESG funds	• Availability of green or ESG funds	Qualitative	
			• Availability of new green or ESG funds in 2020	Qualitative	
		Carbon finance	• Availability of carbon trading	Qualitative	
			• Availability of spot carbon financial products	Qualitative	
			• Availability of carbon financial derivatives	Semi-quantitative	
	Institutional development of green finance market	National developmental financial institutions	• Green loan commitment	Qualitative	
			• Availability of environment and social safeguards	Qualitative	
			• Availability of green finance technical assistance	Qualitative	
		National green bank or fund	• Availability of national green bank or fund	Qualitative	
			• Green or sustainable investment commitment	Qualitative	
		Sovereign wealth fund	• Voluntary climate-related information disclosure requirement	Qualitative	
			• Climate risk stress testing requirement	Qualitative	
			• Environment and social safeguard compliance requirement	Qualitative	
		Commercial financial institutions	• ESG reporting requirements	Qualitative	
			• Availability of written guidance on ESG reporting	Qualitative	
			• Availability of ESG related training	Qualitative	
			• Availability of green finance- or sustainability-related index	Qualitative	
		Securities exchange	• ESG reporting requirements	Qualitative	
• Availability of written guidance on ESG reporting	Qualitative				
• Availability of ESG related training	Qualitative				
• Availability of green finance- or sustainability-related index	Qualitative				
International Cooperation	Participation in international sustainable finance platforms or networks by regulatory agencies		Network of Central Banks and Supervisors on Greening the Financial System (NGFS)	• Participation by central bank or regulatory agency	Qualitative
			International Platform for Sustainable Finance (IPSF)	• Participation by regulatory agency	Qualitative
			Sustainable Banking and Finance Network (SBFN)	• Participation by regulatory agency	Qualitative
			Coalition of Finance Ministers for Climate Action	• Participation by the ministry of finance	Qualitative
	Participation in international sustainable finance initiatives by market participants		Sustainable Stock Exchanges Initiative (SSE Initiative)	• Participation by stock exchanges	Qualitative
			International Development Finance Club (IDFC)	• Participation by development banks	Qualitative
			Equator Principles	• Total number of financial institutions signed up	Quantitative
				• Number of financial institutions signed up in 2020	Quantitative
				• Number of insurance companies signed up to Principles of Responsible Insurance (PRI)	Quantitative
		UNEP Finance Initiative (UNEP FI)	• Number of banks signed up to Principles of Responsible Banking (PRB)	Quantitative	
• Number of institutions signed up to UNEP FI in 2020			Quantitative		
Responsible Investing Principle (PRI)		• Total number of institutions signed up	Quantitative		
		• Number of institutions signed up in 2020	Quantitative		
Task Force on Climate Change Related Financial Disclosure (TCFD)	• Total number of institutions supporting TCFD	Quantitative			
• New number of institutions supporting TCFD in 2020	Quantitative				

ESG=environment, social, and governance.

PRI = Principles of Responsible Insurance, PRB = Principles of Responsible Banking.

GGFDI construction process

Indicator structure and selection. The GGFDI follows a 4-level structure. Level 1 indicators aim to measure three key aspects of green finance development: Policy and Strategy, Product and Market, and International Cooperation, focusing on policy efforts to promote green finance, green finance market dynamics and product innovation, and the commitment of regulatory agencies and market participants to international cooperation in developing green finance, respectively.

Each Level 1 indicator is broken down into two key aspects measured by Level 2 indicators. Policy and Strategy is divided into green development policy, which measures policy efforts to pursue green development (such as climate mitigation and adaptation and environment protection), and green finance-related policy, which tracks policy efforts to develop green finance. Product and Market is divided into green finance products, which assesses progress in green finance product innovation, and institutional development of green finance market, which assesses financial institutions' commitment to promoting green finance and environment-related information disclosure and risk management. International Cooperation is divided into participation in international sustainable finance platforms or networks by regulatory agencies, which captures government commitments to international cooperation for policy coordination, and participation in global sustainable finance initiatives by market participants, which measures market participants' commitment to adopting internationally accepted sound investment principles and practices and peer-to-peer learning.

Each Level 2 indicator is further broken down into several Level 3 indicators and each Level 3 indicator is divided into several Level 4 indicators, on the basis of their relevance, cross-country comparability, and data availability. All Level 4 indicators are

collected from publicly available information as described above.

Indicator scoring. The GGFDI uses three types of Level 4 indicators: quantitative, semi-quantitative, and qualitative. Each qualitative indicator is either graded as 100, if a country satisfies the condition (e.g., the government has issued a green finance policy or is a member of an international green finance initiative), or graded as 0, if a country does not satisfy the condition.

Scoring quantitative indicator follows a max-min standardization method. For each indicator, the maximum and minimum values are identified among the values of all countries covered by the GGFDI. The score of indicator Y for country X is given by

$$G_y = 100 \times (Y_x - Y_{min}) / (Y_{max} - Y_{min})$$

where Y_{min} is the minimum value of indicator Y among all the observations across the 55 countries covered by the GGFDI, and Y_{max} is the corresponding maximum value. This standardization method ensures that for each country, every quantitative indicator has a maximum possible score of 100 and a minimum possible score of 0. The higher the score, the better is a country's performance. For indicators with outlier values, log-transformation is applied before they are standardized.

Semi-quantitative indicators are scored either using a 0-50-100 or a 0-20-40-60-80-100 scoring system, both with a minimum score of zero and maximum score of 100.

Indicator aggregation. Each Level 4 indicator is multiplied by an equal weight of 0.018868 before it is aggregated into a Level 3 indicator. This weight is equal to 1/53, with 53 being the total number of Level 4 indicators of the GGFDI. Each Level 3 indicator is a simple sum of the weighted Level 4 indicators that belong to the Level 3 indicator. Each Level 2 indicator is a simple sum of the related Level 3 indicators. Each Level 1 indicator is a simple sum of the related Level

2 indicators. The GGFDI is a simple sum of the three Level 1 indicators, with a maximum possible value of 100 and minimum possible value of zero.

Country and period coverage. The GGFDI covers 50 largest economies in the world in terms of the size of GDP at 2019 Purchasing Parity Prices (PPP), sourced from the World Bank's World Development Indicators database, plus 5 economies that are considered important in green finance development. The study uses data up to 31 December 2020.

Limitations of the GGFDI

Green finance is a relatively new finance field, and the associated policy issues are also new for many governments. Cross-country data and information on green finance is very limited. There are also differences in definitions of green finance among different jurisdictions. These pose challenges for the construction of the GGFDI, and lead to some limitations.

First, the GGFDI is based on the Global Green Finance Database developed by IIGF of CUF. Data and information collected by this database are all from publicly available sources. This ensures the transparency of the GGFDI. On the other hand, confining to publicly available data limits its information coverage, and may lead to biases in results, as there could be cases where the low scores of green finance development for some countries are a result of insufficient data and information disclosure, rather than the lack of green finance development. In addition, language differences among countries also limit data collection, especially for those whose official languages are not widely used.

Second, most indicators used for measuring Policy and Strategy are qualitative. These indicators can measure whether or not a country has introduced a particular green development or green finance policies, but cannot measure how these policies have

been implemented and enforced in practice. In many cases, the indicators can show the differences between countries where the green finance policy framework has been well established and those where it has not, but they cannot zoom down to differences in policy strength among countries where the policy framework is largely in place.

Third, for indicators measuring Product and Market, there are differences in definitions of sustainable finance, green finance, climate finance, and ESG across jurisdictions, reflecting differences in governments' policy focuses and countries' stages of development. Inevitably, these differences affect the accuracy of the GGFDI. For example, some countries collect and publish data on green funds, while others only release data on sustainable investment funds. Another difficulty is the lack of quantitative data on most green finance products. Data on green bonds (with comparable definitions) are available for most countries, but data on green loans, green investment funds, and other green finance products are patchy, and can only be measured qualitatively.

Fourth, indicators for International Cooperation have largely focused on global green finance initiatives, but not regional and bilateral ones, and have not considered international cooperation in climate finance.

Lastly, the GGFDI system applies a uniform set of equally weighted indicators and criteria to all countries regardless of their stage of development and maturity of the financial system. In assessing green development policy, it has not considered differential responsibilities between developed and developing countries. In assessing green finance products and financial institutions' commitment to green finance and environment-related information disclosure and risk management, the GGFDI has not distinguished countries with a mature financial system and well-diversified financial products from those with a less developed financial system and undiversified financial

products. Therefore, the results of the GGFDI only provide objective assessments on the development of green finance in the countries covered, but do not necessarily recommend countries to work towards targets that are not compatible with their stage of economic and financial development.

All these limitations point to large scope to improve the GGFDI, to make its information coverage more comprehensive, weighting scheme more scientific, and results more accurate. This will be the priority for the future editions of the GGFDI. In the meantime, we welcome feedback from all those working to support the development of green finance, whether by providing comments, suggestions, and data sources, or pinpointing data errors.

2.3.2. The GGFDI and country rankings

All countries

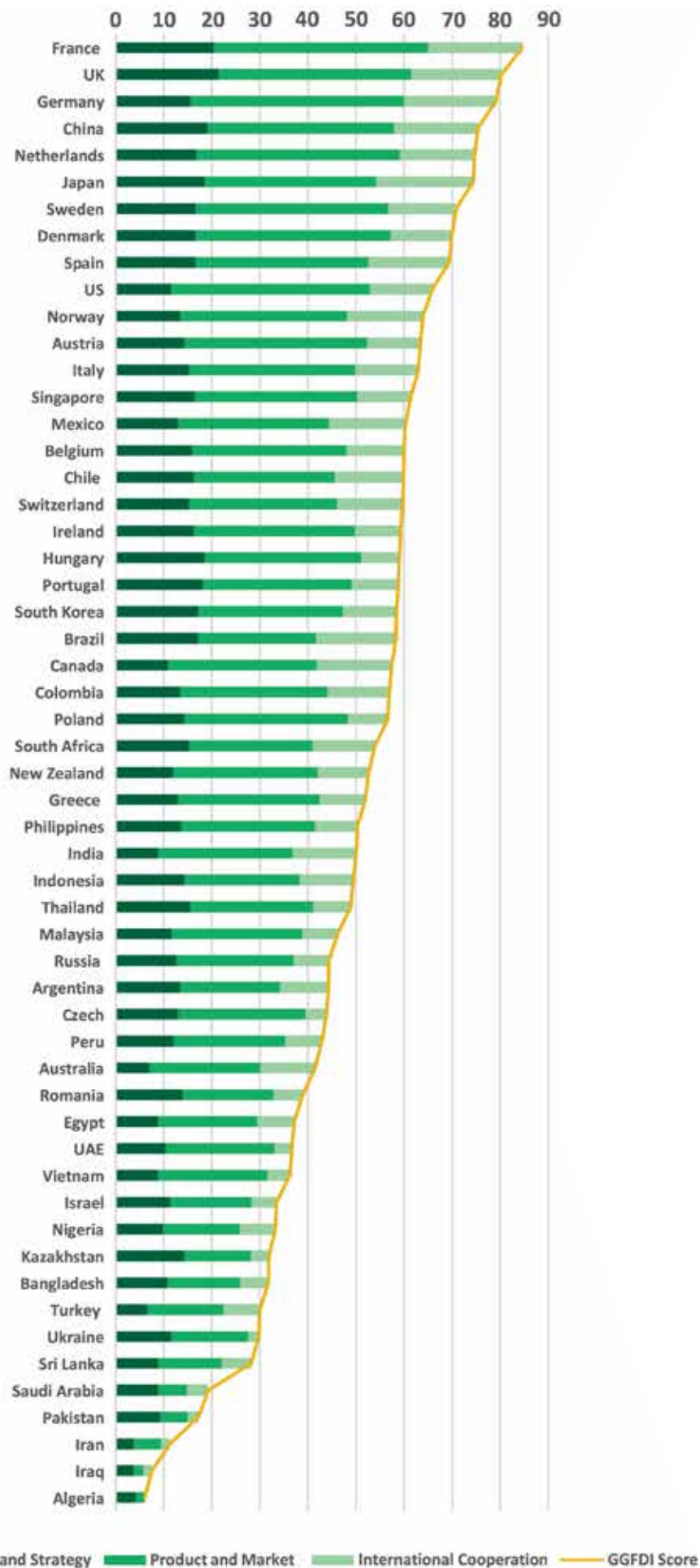
GGFDI scores and country rankings. Figure 2.13 presents results on GGFDI and its three components for the 55 countries covered, based on data up to 31 December 2020. France is ranked the first by the GGFDI score. The other countries in the top 10 list include, in the order of ranking, the UK, Germany, China, Netherlands, Japan, Sweden, Denmark, Spain and the US. The median country is South Africa. Those with a score above the median are mostly advanced countries with a relatively mature financial system. But several emerging markets also have high rankings, such as China which is ranked 4th, Mexico 15th, Chile 17th and Brazil 21st. Several developed countries are ranked below the median, including Canada, New Zealand, Greece and Australia. The average

score of GGFDI is 50 for the 55 countries. It is 62.1 for the developed countries and 39.2 for the developing countries. Across the region, the average score is the highest for Europe at 63.6, followed by North America at 61.7, Latin America at 53.8, Asia at 47.1, Africa at 41.4, and the Middle East at 20.6 (Figure 2.14 on P107).

Most of the top 10 countries ranked by GGFDI have high scores in all its three components (Table 2.3). Many of them have put in place a green finance strategy or similar policy framework, are active in green bond markets, have developed relatively diversified green finance products and needed market infrastructure, are strong supporters of global green finance initiatives, and have large number of financial institutions that have signed up to sustainable investment principles. For example, France is ranked the first in GGFDI, second in Policy and Strategy, first in Product and Market, and second in International Cooperation. The UK is ranked second in GGFDI, first in Policy and Strategy, sixth in Product and Market, and fourth in International Cooperation. China is ranked fourth in GGFDI, third in Policy and Strategy, eighth in Product and Market, and fifth in International Cooperation. Similarly, countries that are ranked low in GGFDI also tend to be ranked low in all the three components. But there are exceptions. For example, the US is ranked 10th in GGFDI, fourth in Product and Market and 17th in International Cooperation, but only 38th in Policy and Strategy. Hungary, Portugal and South Korea are ranked the 20th, 21st and 22nd in GGFDI, but 4th, 6th, and 7th in Policy and Strategy, respectively. Mexico is ranked 15th and Brazil 23rd in GGFDI, but 8th and 7th in International Cooperation. Romania and Kazakhstan are ranked low in GGFDI, but have a relatively high score in Policy and Strategy.



Figure 2.13: GGFDI scores and country rankings, 2020



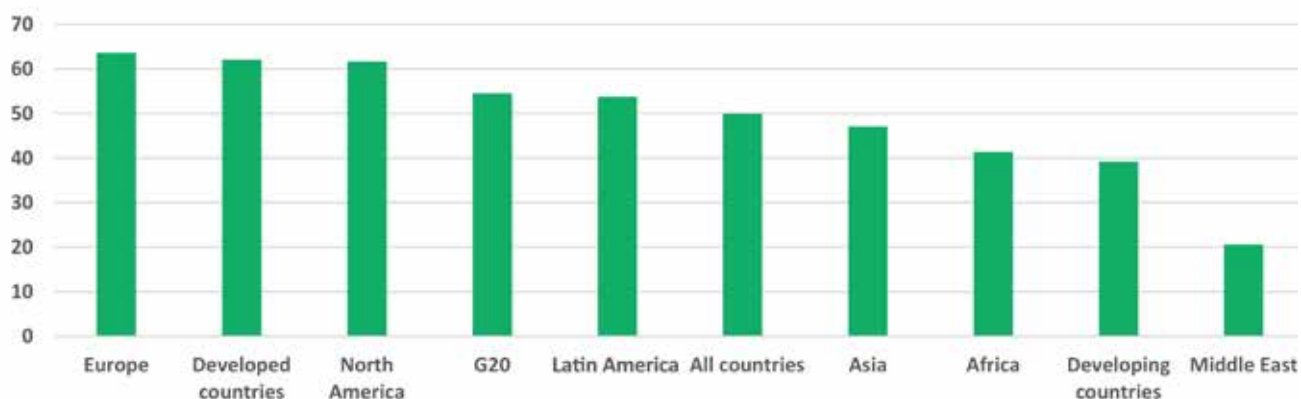
Source: Authors.

Table 2.3: GGFDI and its three components - all country rankings

	Overall	Policy and Strategy	Product and Market	International Cooperation
France	1	2	1	2
UK	2	1	6	4
Germany	3	17	2	3
China	4	3	8	5
Netherlands	5	9	3	11
Japan	6	5	11	1
Sweden	7	10	7	13
Denmark	8	11	5	20
Spain	9	12	10	6
US	10	38	4	17
Norway	11	28	12	9
Austria	12	22	9	26
Italy	13	19	13	16
Singapore	14	13	15	25
Mexico	15	31	19	8
Belgium	16	16	18	21
Chile	17	14	27	12
Switzerland	18	20	22	14
Ireland	19	15	16	31
Hungary	20	4	17	34
Portugal	21	6	20	29
South Korea	22	7	25	24
Brazil	23	8	34	7
Canada	24	41	21	10
Colombia	25	29	23	19
Poland	26	23	14	33
South Africa	27	21	32	18
New Zealand	28	36	24	27
Greece	29	32	26	30
Philippines	30	27	29	32
India	31	46	28	15
Indonesia	32	24	36	23
Thailand	33	18	33	35
Malaysia	34	37	30	40
Russia	35	34	35	41
Argentina	36	30	41	28
Czech	37	33	31	47
Peru	38	35	37	36
Australia	39	51	38	22
Romania	40	26	43	42
Egypt	41	47	42	38
UAE	42	43	40	50
Vietnam	43	48	39	46
Israel	44	40	44	45
Nigeria	45	44	46	39
Kazakhstan	46	25	49	49
Bangladesh	47	42	48	44
Turkey	48	52	47	37
Ukraine	49	39	45	52
Sri Lanka	50	49	50	43
Saudi Arabia	51	50	51	48
Pakistan	52	45	52	51
Iran	53	54	53	53
Iraq	54	55	54	54
Algeria	55	53	55	55

Source: Authors.

Figure 2.14: Average GGFDI scores by country group



Source: Authors.

Rankings in Policy and Strategy. Policy and Strategy has two Level 2 indicators: green development policy and strategy and green finance-related policy and strategy. The former focuses on whether a country has an overall green development strategy and action plan, nationally determined contribution (NDC) commitment, and carbon pricing. In the case of a NDC commitment, it differentiates whether there is a commitment, whether there is a carbon neutrality target, and whether the target has been made into the law. However, as indicated earlier, these indicators do not take into consideration a country's stage of development and differentiated responsibility in emission reduction. As a result, developed countries, especially European countries, tend to receive high scores. In the case of carbon pricing, it considers both carbon tax and carbon trading, and those countries with both such as France and Japan receive a higher score than countries with only one or none of them. Green finance-related policy and strategy looks at whether or not a country has a general policy, product specific policies, and policy related to climate-related information disclosure and risk management including stress testing. Countries with a relatively mature financial system, mostly developed countries, tend to receive a high score. In the case of information disclosure and stress-testing, countries where these are compulsory, mostly in Europe, get higher

scores than those where these are voluntary or non-existent.

The UK is ranked the first in Policy and Strategy, and the other countries in the top 10 list include, in the order of ranking, France, China, Hungary, Japan, Portugal, South Korea, Brazil, Netherlands, and Sweden. Some of these countries such as the UK, France, Japan and Portugal are scored equally high in both green development and green finance-related policies and strategies. The high rank of China, Hungary, Brazil, South Korea and Netherlands is driven more by a high score in green finance-related policy and strategy, and for Denmark is more driven by its high score in green development-related policy and strategy. Though the EU has put in place a comprehensive policy framework for green finance, some of the policy measures are not compulsory, and therefore, there are differences in policy strength among the EU members, leading to varying scores in Policy and Strategy. Among other countries, Colombia, Norway, Mexico, New Zealand and Canada have a relatively low rank (below the median country Philippines) in Policy and Strategy mainly because they have a low score in green finance related policy and strategy, while their green development policy and strategy area has a much higher rank.

Figure 2.13 also shows that cross-country

differences in scores of Policy and Strategy are the smallest among the three Level 1 indicators, with a coefficient of variation of 1.22, suggesting governments in all the countries, including those with low scores in GGFDI and the other two components, are taking steps to promote green development and green finance.

Rankings in Product and Market. Product and Market has two Level 2 indicators: green finance products and institutional development of green finance market. The former includes green bonds, loans, insurance, funds, and carbon finance. Among these, only green bonds are measured quantitatively. The other green finance products are all measured qualitatively due to the lack of consistent data across countries. The use of qualitative indicators for most green finance products limits the ability of GGFDI to differentiate countries with differing levels of the development of green finance products. Green bonds are measured by the ratio of the value of green bonds issued to GDP, and hence the effect of country size is eliminated in country scores, and countries with a relatively small economy but high issuance of green bonds are scored high such as Sweden. Institutional development of green finance market mainly measures the commitment of various types of financial institutions to green finance and whether there are systems in place for environment-related safeguards, information disclosure, and risk management such as stress testing.

France is ranked the first in Product and Market, and other countries in the top 10 list include, in the order of ranking, Germany, Netherlands, the US, Denmark, the UK, Sweden, China, Austria, and Spain. Most of these countries have equally high ranks in both green finance products and institutional development of green finance market. But Spain has benefited mainly from a high score in the former and Austria from the latter. Many countries outside the top 10 receive quite different scores in the two areas. For example, Norway is ranked the sixth and

Portugal 10th in green finance products, but their scores in the green finance market are much lower. On the other hand, Japan, Singapore, Colombia, Malaysia, and Vietnam are ranked the 9th, 10th, 11th, 12th and 13th, respectively, in the green finance market, but receive much lower score in green finance products. As indicated earlier, Product and Market measures the actual status of green finance development, rather than policy objectives or intentions that Policy and Strategy tries to measure. Countries such as the US and Germany are ranked high in Product and Market partly because of their well-developed financial system and capital market. On the other hand, countries such as Kazakhstan and Romania are ranked low (below the 40th) even though they are ranked above the median in Policy and Strategy. Figure 2.13 shows cross-country differences in scores of Product and Market are the largest among the three components of GGFDI, with a coefficient of variation at 4.34.

International Cooperation. International Cooperation also has two Level 2 indicators: participation in major global green finance platforms and networks by financial regulators and in major international green finance initiatives by market participants. Such participation facilitates green finance-related cross-country policy coordination, sharing of good practices, harmonization of standards, and peer-to-peer learning. Due to data constraints, International Cooperation considered only global initiatives. Thus, for countries that have been active in bilateral or regional cooperation in green finance, such as the UK and Germany, this aspect has not been captured. International green finance platforms and networks in which financial regulators are participants and covered by GGFDI include Network of Central Banks and Supervisors on Greening the Financial System (NGFS), International Platform for Sustainable Finance (IPSF), Sustainable Banking and Finance Network (SBFN), and Coalition of Finance Ministers Climate Action (CFMCA). These are all measured

with a qualitative indicator. The results show that most of the 55 countries' central banks or financial regulators are members of NGFS, the exceptions being the US, Czech, and several countries in Middle East, North Africa and South Asia. Members of SBFN are mostly developing and emerging economies. Members of the CFMCA mainly include developed countries and several emerging economies. IPSF was initiated by the EU jointly with Argentina, Canada, Chile and China, and it has quickly attracted new members.

Global initiatives participated by market participants covered by GGFDI include Sustainable Stock Exchanges Initiative (SSE Initiative), International Development Finance Club (IDFC), Equator Principles, UNEP Finance Initiative (UNEP FI), Responsible Investing Principle (PRI), and Task Force on Climate Change Related Financial Disclosure (TCFD). The first two are measured with a qualitative indicator and the rest are measured quantitatively by counting the number of participating financial institutions. The results show that most of the 55 countries have participated in SSE Initiative, but the participation in IDFC is more limited. There are large differences in the number of financial institutions that have signed up to or supported PRI and TCFD across countries. For instance, in France, the UK, Germany, Netherlands, and Australia, the number of financial institutions that have signed up to PRI have all reached more than 100, but the number is much lower in other countries. In the case of TCFD, in countries such as China, India, and Brazil, more and more financial institutions are signing up to it, but overall, developing countries are scored lower than developed countries such as the UK, Japan, the US and Australia.

Japan is ranked the first in International Cooperation, and the other countries in the top 10 list include, in order of ranking, France, Germany, the UK, China, Spain, Brazil, Mexico, Norway and Canada. Thus, not only developed countries, but many emerging economies are also actively pursuing international cooperation in green finance. Other emerging markets that are outside the top 10 but still ranked high include Chile, India and South Africa. Most of the top 10 countries have equally high ranks in official and market participation in international cooperation. But Brazil's high rank is driven mainly by a high score in market participation. Most countries with a low rank in International Cooperation tend to have equally low ranks in both official and market participation. Even though Romania and Czech are EU members, they are not ranked high in International Cooperation, possibly reflecting the fact that, while the EU policy has helped the two countries to receive a relatively high score in Policy and Strategy, domestic interests in green finance are not as high. In countries dominated by high-emission industries such as Russia, despite government support for green finance, responses from market participants have been weak, leading to low ranks in International Cooperation. Figure 2.13 also shows that cross-country differences in International Cooperation scores are in-between the other two Level 1 indicators, with a coefficient of variation at 2.53.



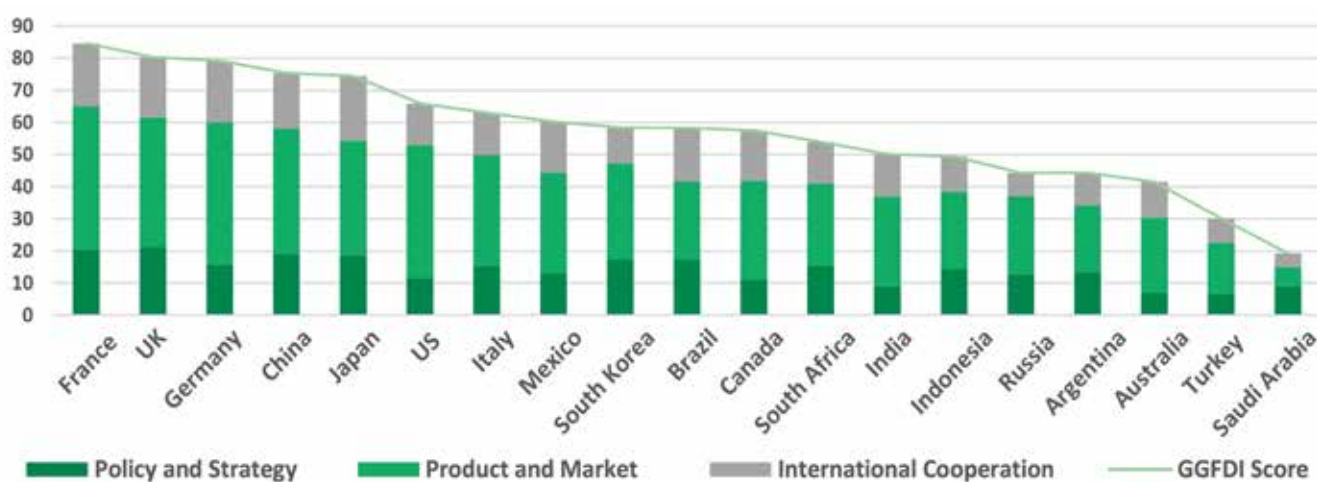
G20 countries

G20 countries have made significant efforts in promoting green finance. As discussed earlier, in 2016, G20 leaders adopted the *G20 Green Finance Synthesis Report* (G20 2016), which put forward seven broad financial sector options for voluntary implementation by countries to facilitate the mobilization of green finance. In 2017 and 2019, UNEP released *Green Finance Progress Report* (2017) and *Sustainable Finance Progress Report* (2019), respectively, assessing the progress in implementing the policy recommendations in G20’s 2016 synthesis report. Figure 2.15 presents scores of GGFDI and its three components for G20 countries, excluding the EU. G20 countries’ average score of GGFDI is 54.5, higher than the average score of the 55 countries, reflecting the active promotion of green finance within the G20 group. The median country is Brazil. G20 countries above the median are, in the order of ranking, France, the UK, Germany, China, Japan, the US, Italy, Mexico, and South Korea. G20 countries below the median include, in the order of ranking,

Canada, South Africa, India, Indonesia, Russia, Argentina, Australia, Turkey, and Saudi Arabia.

Based on GGFDI scores, G20 countries can be roughly divided into three groups. The first group includes France, the UK, Germany, China and Japan. These countries score equally high in the three components of GGFDI (within top 7, Table 2.4). The second group includes the US, Italy, Mexico, South Korea, Brazil, Canada, and South Africa. These countries show large differences in the development approach to green finance, with the US and Canada more oriented towards the market, South Korea, Brazil and South Africa have a high rank in Policy and Strategy, while Italy and Mexico receive more balanced rankings in all the three components. The third group with low scores includes India, Indonesia, Russia, Argentina, Australia, Turkey, and Saudi Arabia. Some of these countries also attain a high score in Policy and Strategy, such as Russia, Argentina, and Indonesia. But in Product and Market and International Cooperation, there are sizable differences between this group and the other two.

Figure 2.15: GGFDI scores and country rankings, 2020, G20 Countries



Source: Authors.

Table 2.4: GGFDI and its three components - G20 country rankings

Ranking	Overall	Policy and Strategy	Product and Market	International Cooperation
1	France	UK	France	Japan
2	UK	France	Germany	France
3	Germany	China	US	Germany
4	China	Japan	UK	UK
5	Japan	South Korea	China	China
6	US	Brazil	Japan	Brazil
7	Italy	Germany	Italy	Mexico
8	Mexico	Italy	Mexico	Canada
9	South Korea	South Africa	Canada	India
10	Brazil	Indonesia	South Korea	Italy
11	Canada	Argentina	India	US
12	South Africa	Mexico	South Africa	South Africa
13	India	Russia	Brazil	Australia
14	Indonesia	US	Russia	Indonesia
15	Russia	Canada	Indonesia	South Korea
16	Argentina	India	Australia	Argentina
17	Australia	Saudi Arabia	Argentina	Turkey
18	Turkey	Australia	Turkey	Russia
19	Saudi Arabia	Turkey	Saudi Arabia	Saudi Arabia

Source: Authors.

Emerging and developing countries

As mentioned earlier, the development of green finance is partly affected by a country's stage of economic development and the maturity of its financial system. In the case of the commitment to emission reductions, for example, developed countries have a greater responsibility than developing countries and hence they on average score higher in green development policy and strategy. Similarly, in many developing countries, the financial system is not yet well developed and financial market infrastructure is incomplete, affecting the development of green finance. These issues can be addressed by looking at developed and developing countries results separately. Figure 2.16 and Table 2.5 present scores of GGFDI and its three components for

emerging markets and developing economies only.¹⁰

The 31 emerging and developing economies can be divided into three groups on the basis of GGFDI scores. The first group, where green finance is relatively well developed among developing countries, includes, in the order of ranking, China, Mexico, Chile, Hungary, Brazil, Colombia, Poland, South Africa, Philippines, and India. Five of these countries are G20 members and two are EU members. Active promotion of green finance within the two regional clubs certainly has created positive impact on these countries, through peer-to-peer learning and policy coordination. Most of these countries have more or less equally high ranks in all the three components, the only exception is India, which is ranked

¹⁰ This report follows the IMF definition of emerging and developing economies.

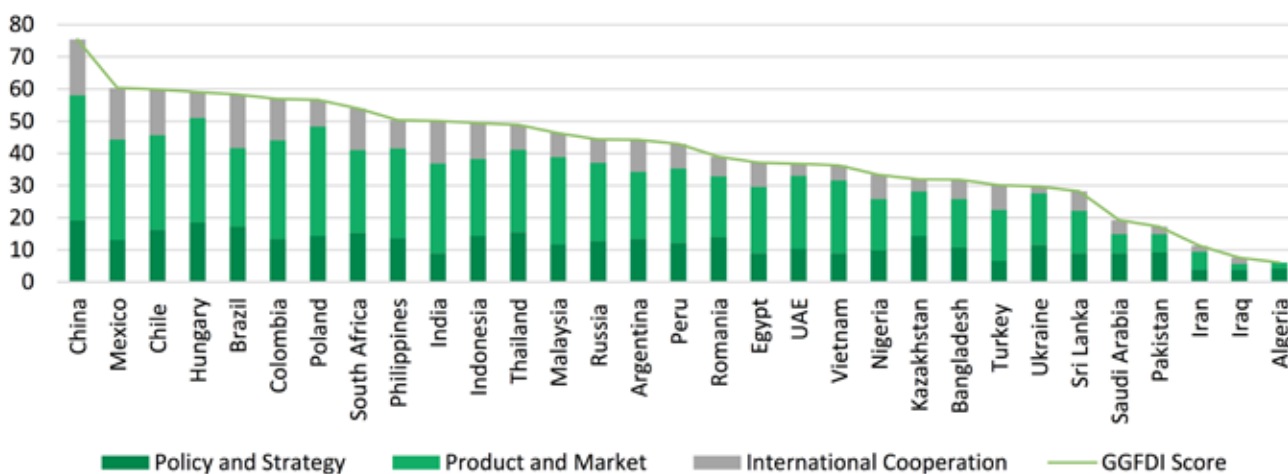
seventh in Product and Market and fifth in International Cooperation, but below the median country in Policy and Strategy.

The second group, where green finance is developing, includes Indonesia, Thailand, Malaysia, Russia, Argentina, Peru, Romania, Egypt, UAE, and Vietnam. Most of these countries are members of regional clubs which are actively promoting green finance: three are G20 members, one is an EU member, and four are ASEAN members. Many of these receive scores in the three components comparable to their scores in GGFDI. But there are exceptions. For example, Thailand is ranked 12th in GGFDI but fifth in Policy and Strategy; Indonesia is ranked 11th in GGFDI but eighth in Policy and Strategy and International Cooperation; Malaysia is ranked 13th in GGFDI but ninth in Product and Market; Argentina is ranked 15th in GGFDI but ninth in International Cooperation, and Romania is ranked 17th

in GGFDI but tenth in Policy and Strategy. Similarly, Egypt and Vietnam are ranked 18th and 20th in GGFDI but 24th and 25th in Policy and Strategy, respectively; The UAE is ranked 19th in GGFDI but 26th in International Cooperation.

The third group, where green finance is less developed, includes Nigeria, Kazakhstan, Bangladesh, Turkey, Ukraine, Saudi Arabia, Pakistan, Iran, Iraq, and Algeria. Many of these are oil-exporting countries, have a greater reliance on emission-intensive industries, and face greater challenges in green transition. Some have been affected by war until recently, which has certainly constrained the development of their economy, the financial sector, and hence green finance. These countries tend to have low scores in all three components of GGFDI. The exceptions are Kazakhstan, which is ranked ninth in Policy and Strategy, and Turkey, a G20 member, which is ranked 15th in International Cooperation.

Figure 2.16: GGFDI scores and country rankings, 2020, emerging and developing economies



Source: Authors.



Table 2.5: GGFDI and its three components - emerging and developing country rankings

Ranking	Overall	Policy and Strategy	Product and Market	International Cooperation
1	China	China	China	China
2	Mexico	Hungary	Poland	Brazil
3	Chile	Brazil	Hungary	Mexico
4	Hungary	Chile	Mexico	Chile
5	Brazil	Thailand	Colombia	India
6	Colombia	South Africa	Chile	South Africa
7	Poland	Poland	India	Colombia
8	South Africa	Indonesia	Philippines	Indonesia
9	Philippines	Kazakhstan	Malaysia	Argentina
10	India	Romania	South Africa	Philippines
11	Indonesia	Philippines	Thailand	Poland
12	Thailand	Colombia	Brazil	Hungary
13	Malaysia	Argentina	Russia	Thailand
14	Russia	Mexico	Indonesia	Peru
15	Argentina	Russia	Peru	Turkey
16	Peru	Peru	Vietnam	Egypt
17	Romania	Malaysia	UAE	Nigeria
18	Egypt	Ukraine	Argentina	Malaysia
19	UAE	Bangladesh	Egypt	Russia
20	Vietnam	UAE	Romania	Romania
21	Nigeria	Nigeria	Ukraine	Sri Lanka
22	Kazakhstan	Pakistan	Nigeria	Bangladesh
23	Bangladesh	India	Turkey	Vietnam
24	Turkey	Egypt	Bangladesh	Saudi Arabia
25	Ukraine	Vietnam	Kazakhstan	Kazakhstan
26	Sri Lanka	Sri Lanka	Sri Lanka	UAE
27	Saudi Arabia	Saudi Arabia	Saudi Arabia	Pakistan
28	Pakistan	Turkey	Pakistan	Ukraine
29	Iran	Algeria	Iran	Iran
30	Iraq	Iran	Algeria	Iraq
31	Algeria	Iraq	Iraq	Algeria

Source: Authors.

Developed countries

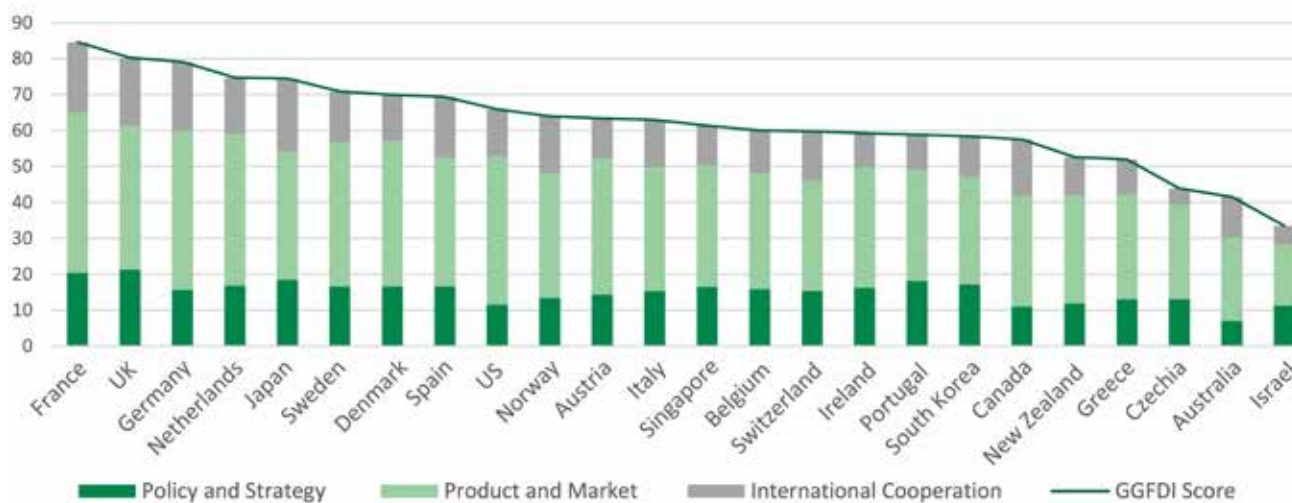
Figure 2.17 and Table 2.6 present scores and country rankings of GGFDI and its three components for developed countries. These countries can also be divided into three groups on the basis of the scores of GGFDI. The first group, where green finance is well developed, includes France, the UK, Germany, Netherlands, Japan, Sweden, Denmark, and Spain. These countries have equally high ranks in all the three components similar to those in GGFDI, with the exceptions of Germany, which is ranked 13th in Policy and Strategy, and Denmark, which is ranked 13th in International Cooperation.

The second group, where green finance is less developed than the first group, includes the US, Norway, Austria, Italy, Singapore, Belgium, Switzerland, and Ireland. These countries also have comparable scores in the

three components to those of GGFDI in most cases. The exceptions are the US, which is ranked fourth in Product and Market, but only 21st in Policy and Strategy; Norway, which is ranked sixth in International Cooperation; Austria, which is ranked eighth in Product and Market; and Ireland, which is ranked 22nd in International Cooperation.

The third group, where green finance is less developed than the rest of the developed countries, includes Portugal, South Korea, Canada, New Zealand, Greece, Czech, Australia, and Israel. Most of these countries have low scores in the three components comparable to those of GGFDI. The exceptions include Portugal and South Korea, which are ranked the 4th and 5th, respectively, in Policy and Strategy; Canada, which is ranked 7th in International Cooperation; and Australia, which is ranked 15th in International Cooperation.

Figure 2.17: GGFDI scores and country rankings, 2020, developed economies



Source: Authors.

Table 2.6: GGFDI and its three components - developed country rankings

Ranking	GGFDI	Policy and Strategy	Product and Market	International Cooperation
1	France	UK	France	Japan
2	UK	France	Germany	France
3	Germany	Japan	Netherlands	Germany
4	Netherlands	Portugal	US	UK
5	Japan	South Korea	Denmark	Spain
6	Sweden	Netherlands	UK	Norway
7	Denmark	Sweden	Sweden	Canada
8	Spain	Denmark	Austria	Netherlands
9	US	Spain	Spain	Sweden
10	Norway	Singapore	Japan	Switzerland
11	Austria	Ireland	Norway	Italy
12	Italy	Belgium	Italy	US
13	Singapore	Germany	Singapore	Denmark
14	Belgium	Italy	Ireland	Belgium
15	Switzerland	Switzerland	Belgium	Australia
16	Ireland	Austria	Portugal	South Korea
17	Portugal	Norway	Canada	Singapore
18	South Korea	Greece	Switzerland	Austria
19	Canada	Czech	New Zealand	New Zealand
20	New Zealand	New Zealand	South Korea	Portugal
21	Greece	US	Greece	Greece
22	Czech	Israel	Czech	Ireland
23	Australia	Canada	Australia	Israel
24	Israel	Australia	Israel	Czech

Source: Authors.

2.4. Fostering the global development of green finance: Challenges and policy priorities

Driven by global actions to fight climate change and accelerate transition to green growth and sustainable development and supported by various policy and market-driven initiatives, green finance has expanded rapidly in recent years as a key funding source of green investment. Green finance products and instruments have emerged as new and popular asset classes catering to needs of different investor groups. While these developments are encouraging, a lot more needs to be done in developing green finance in order to make financial flows consistent with pathways towards sustainable development. The review of global green finance development and quantitative assessments of the progress at the country level in this report point to a number of issues and challenges that need to be addressed through continued policy efforts to incentivize more actions by market participants and other stakeholders.

2.4.1. Issues and challenges

First, funding gaps for green investments remain large. As highlighted earlier, the financing needs for achieving the SDGs amount to \$3.9 trillion annually during 2015-2030 and for global energy investment consistent with the 1.5°C target amount to \$3.26 trillion annually during 2016-2050. These are far greater than the current size of global green finance.

Second, the development of green finance is very uneven across countries. The results of Section 2.3 show large variations in the status of green finance development among the world's 55 largest countries, whether looking at policy and strategy, product innovation and market development, or international cooperation. On average, developed countries scored much higher than developing countries, and most countries in the top 10 are from the developed world. However, several emerging markets are making significant headways, such as China, Mexico, Hungary, Chile, and Brazil, and they are ahead of some developed countries such as Canada, Greece, New Zealand, and Australia. On the other hand, in several countries in Africa, Middle East and South Asia, green finance is still at a nascent stage.

Third, green finance is not well diversified in financial instruments and services in many countries. Even in countries ranked high in this report, recent development has been mostly concentrated in areas of green bonds and green funds (ESG). Green loans, green securitization, green venture capital and private equity, and green financial services catering to households such as green mortgages, green home equity loans, green car credit, green credit cards, green and carbon insurance are much less developed. Green financial services catering to households promote green investment by households, green securitization allows small- and medium-sized enterprises to

undertake green investment, green venture capital supports green technological innovation, and all of these are important for the transition to green growth and sustainable development.

Fourth, there are large variations in definitions of green finance and standards of information disclosure across countries and institutions. Worldwide, a large number of stakeholders, including central banks and financial regulators, financial institutions, investors, financial services providers, academia and NGOs, and international organizations and MDBs have been involved in defining what is “green” in the context of green finance (EU 2017). These definitions are often developed individually and vary regarding scope and level of detail, reflecting country circumstances such as the level of economic development, existing industrial and energy structures, and resource endowments, as well as the purpose of defining “green”. While some definitions are used by multiple stakeholders (e.g., the list of eligible categories provided in the Green Bond Principles, methods underlying certain green indexes), many financial institutions and companies often define “green” in their own terms. The lack of consistent and globally accepted green taxonomy and project catalogue, as well as variations in transparency and disclosure standards, are not conducive to cross-border green financial flows and have often been considered by global investors and issuers as a critical constraint to cross-border green investment.

The last is the negative impact of the COVID-19 pandemic on green finance. The pandemic has brought large shocks to the economy, society, and human development globally, and required unprecedented government responses. Facing the pandemic, many developed countries put forward new green deals or green recovery plans, but

many developing countries, with limited resources, had to make a difficult choice between maintaining short-term economic and social stability and ensuring long-term environmental sustainability. Before 2020, many countries had already integrated green and sustainable growth into their long-term development strategies; but since the pandemic started, they found it challenging to implement their earlier commitments (Shipalana and Chigwenya 2021). Some of them, particularly in South America and Africa, had to switch policy priorities from addressing climate change to stabilizing the economy and employment, and hence to support fossil energy industries (Climate Action Tracker 2020). The negative impact of the COVID-19 pandemic could slow down the development of green finance in these countries.

2.4.2. Policy priorities

Addressing these issues and challenges requires continued policy efforts to incentivize more actions by market participants. Policy priorities for fostering global development of green finance are many and likely depend on country circumstances. This report would like to highlight the following.

The first is to put in place an effective policy framework for supporting green finance. Countries where green finance is better developed all have a relatively comprehensive green finance policy framework. Such policy frameworks often have the following elements: (i) a long-term national strategy for sustainable development to lay the foundation for green finance and its sustained growth; (ii) a green finance strategy and action plans. The latter may include a green taxonomy and green project catalogue, guidelines and policies related to green financial products and instruments,

and regulation on corporate and financial sector climate-related information disclosure and risk management; (iii) supporting programs for green finance (interest rate subsidies, tax credits, credit enhancement and guarantees, and public-private partnerships); and (iv) measures to develop green finance market infrastructure such as emissions trading systems, national green investment funds or credit facilities, and green accreditation, certification, and labelling services.

The second is to promote green financial innovation to develop more diversified green finance products and services. This applies to all the countries where green finance products are not well diversified. This study finds that a country's green finance development is often related to the country's maturity of the financial system. Thus, developing green finance also requires continued reforms to make the financial sector more open, liquid and efficient, including measures (i) to deepen capital markets, develop more diversified financial products and instruments, and support participation by institutional investors; (ii) promote competition; (iii) promote financial inclusion by improving access to underserved groups such as SMEs and low-income households; (iv) strengthen financial regulation to safeguard the financial system; and (v) promote financial innovation. For low-income and small island developing countries, it is critical for the international community to continue to provide financial support for climate adaptation and mitigation. They can also attract private green investment by improving the business environment.

The third is to promote harmonization in green finance definitions and environment-related information disclosure standards. Inconsistency in definitions of green finance and green projects across countries make investment decisions by global investors difficult and deter cross-border capital flows. On the other hand, because of cross-country differences in the level of economic and financial development, globally uniform definitions of green finance and green projects may not be practical. A gradual and more feasible approach is to focus on harmonization at a regional level or among countries with similar circumstances initially, while encouraging countries to move towards adopting global definitions. For example, China and the EU are working on adopting a common green taxonomy (Wang and Han 2021). Efforts are also needed to harmonize disclosure standards. In most countries outside the EU, environment-related information disclosures are still voluntary. There is a need to gradually move towards compulsory information disclosure. A regional approach and sector approach can also be adopted in harmonizing disclosure standards.

Within a country, there is no reason why different government agencies and financial institutions should adopt different definitions of green products and standards of disclosure. In China, for example, the People's Bank of China (PBOC) and the National Reform and Development Commission (NDRC) used separate green bond support product lists before 2021. In 2021, the list was harmonized after PBOC, NDRC and China Securities Regulatory Commission (CSRC) jointly issued the Catalog of Green Bond Support Projects. The new Catalog also

removes clean coal products from the support list, eliminating a major difference in green projects from the EU definition.

The fourth is to further strengthen international cooperation in developing green finance. International cooperation can play an important role in (i) harmonization of green definitions and information disclosure standards; (ii) promotion of sound investment principles and practices; (iii) human capital development and capacity building; (iv) facilitating financial support for low income and vulnerable countries; and (v) improvement of green finance statistics and data collection. A large number of global and regional green finance platforms, networks, and initiatives, participated by financial regulators and market participants worldwide, provide excellent venues to discuss harmonization of definitions and standards. They are also well positioned to provide green finance-related training and capacity building, supported by multilateral development banks. Governments should encourage more domestic financial institutions to sign up to global principles of responsible banking, insurance and investment. In green finance statistics and data collection, Climate Bond Initiative (CBI n.d.b) provides a very good example. Finally, developed countries should make every effort to fulfill their pledge on funding support for developing countries for climate mitigation and adaptation, complemented by South-South climate cooperation.



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Chapter 3

Roadmap to global carbon neutrality and China's actions

3.1. Introduction

Since the industrial revolution, human activities have increasingly become a major driver of global climate change. A new report released by the Intergovernmental Panel on Climate Change (IPCC) in August 2021, *Climate Change 2021: The Physical Science Basis*, provides unequivocal evidence that the wide use of fossil fuels, large scale land-use changes, and deforestation have led to a rapid increase of greenhouse gases (GHGs) in the atmosphere. This has changed the radiative balance on the earth's surface and resulted in global warming. Climate change has become the most critical environmental and development challenge that mankind is facing in the 21st century. Responding to climate change is the most important task the global community has to take on now, and for a considerable period of time in the future.

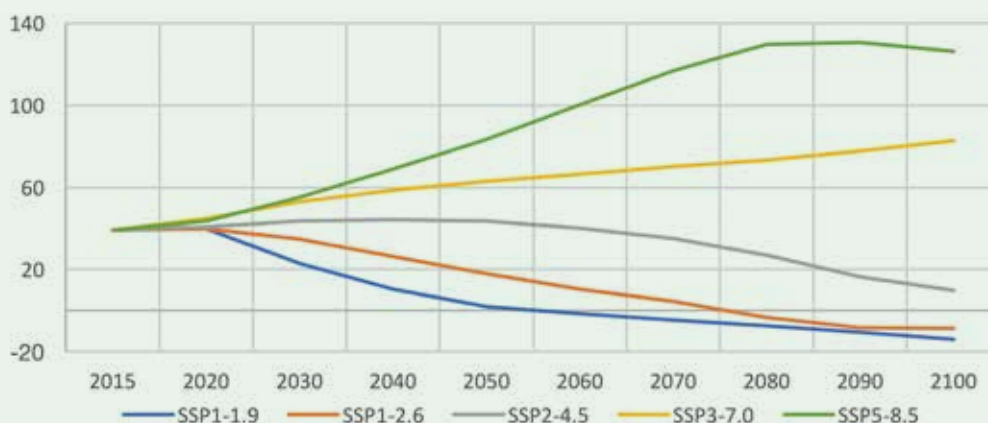
The adoption of the Paris Agreement on Climate Change in 2015 is a major milestone in the global fight against climate change. It clarified the global climate goal—limiting the temperature rise below 2°C above pre-industrial levels and pursuing efforts to limit it even further to 1.5°C—and outlined a roadmap for achieving this goal. The IPCC's special report (2018), *Global Warming of 1.5°C*,



shows that attaining the 1.5°C target requires global anthropogenic or human-caused carbon dioxide (CO₂) emissions to reach net-zero around 2050. Meanwhile, limiting global warming below 2°C requires CO₂ emissions to reach net-zero by around 2070. These are reconfirmed in the IPCC's latest report (2021) (Box 3.1). In recent years, especially since 2020, more and more countries have set medium- and long-term targets for emission reductions and timelines for achieving carbon neutrality and net-zero emissions. As a major contribution to global climate actions, China has recently announced that it will strive to peak CO₂ emissions before 2030 and achieve carbon neutrality before 2060. At the recent 26th United Nations (UN) Conference of Parties (COP) in Glasgow, United Kingdom, nearly 200 countries reaffirmed their commitment to the Paris Agreement and to accelerating mitigation actions, while agreeing the Glasgow Climate Pact to keep 1.5°C alive.

Box 3.1: IPCC’s CO2 emission pathways across five illustrative scenarios

Box Figure 3.1: CO2 emission pathways across five illustrative scenarios (GtCO2)



Source: Intergovernmental Panel on Climate Change. 2021. *Climate Change 2021: The Physical Science Basis*. <https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/>.

The Intergovernmental Panel on Climate Change’s 2021 report assesses the climate response to five illustrative scenarios that cover a range of so-called “Shared Socioeconomic Pathways” (SSP)—possible future development of anthropogenic drivers of climate change found in the literature. These include scenarios of high (SSP3-7.0) and very high (SSP5-8.5) greenhouse gas emissions (GHG) with carbon dioxide (CO2) emissions that roughly double from current levels by 2100 and 2050, respectively; scenarios of intermediate GHG emissions with CO2 emissions remaining around current levels until the middle of the century (SSP2-4.5); and scenarios of very low (SSP1-1.9) and low (SSP1-2.6) GHG emissions with CO2 emissions declining to net-zero around

or after 2050, followed by varying levels of net negative CO2 emissions. The “very low” scenario (SSP1-1.9) is consistent with a 1.4°C rise (best estimate, with a very likely range of 1.0°C to 1.8°C) in the global average surface temperature from 1850-1900 over 2081-2100; “low” (SSP1-2.6) is consistent with a 1.8°C increase (1.3°C to 2.4°C); “intermediate” level (SSP2-4.5) is consistent with a 2.7°C change (2.1°C to 3.5°C); “high” (SSP3-7.0) is consistent with a 3.6°C rise (2.8°C to 4.6°C); and finally, the “very high” scenario (SSP5-8.5) is consistent with a 4.4°C temperature change (3.3°C to 5.7°C). Limiting global warming below 1.5°C and 2°C in the 21st century also requires significant reductions in non-CO2 GHG emissions.

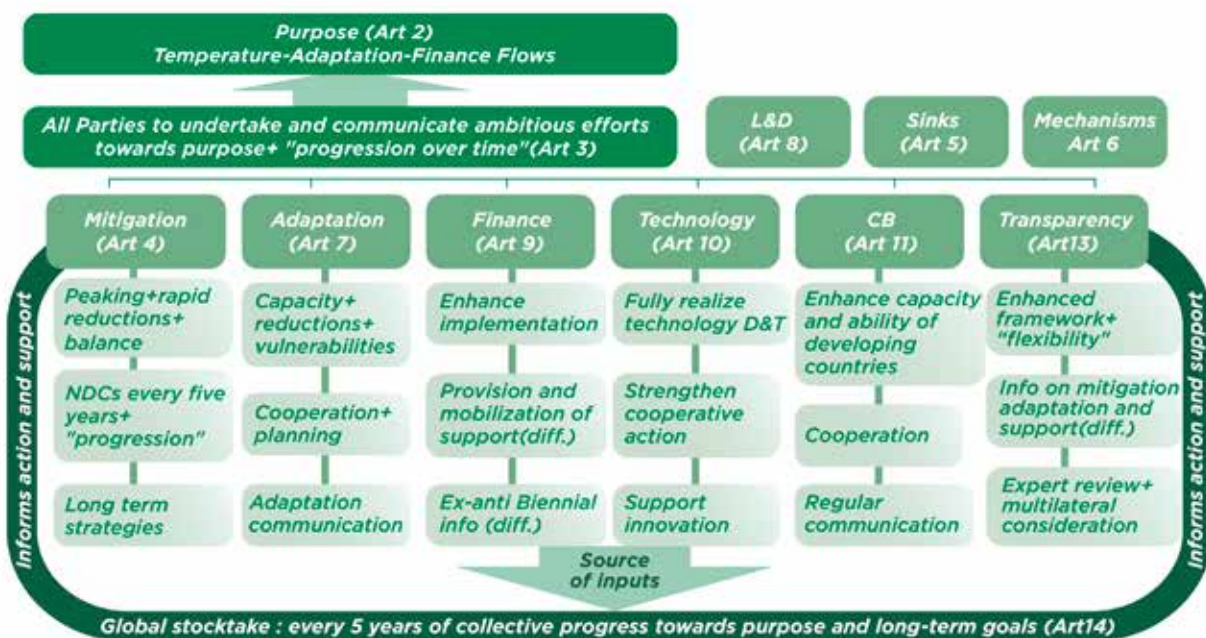
The purpose of this chapter is to provide an overview of the latest understanding on the actions needed to meet the Paris Agreement climate goal, and of selected studies on how China can contribute to the global actions and achieve carbon neutrality before 2060. Section 2 provides a brief introduction to the global climate goal under the Paris Agreement. Section 3 reviews the latest assessments on the required energy and industrial transformations, investments,

and policy measures to achieve the 2°C and 1.5°C targets, based on various reports of the IPCC and International Energy Agency (IEA). Section 4 surveys selected studies on the technical options available and discusses policy actions needed for China to achieve its carbon neutrality target. The final section concludes with brief discussions on how the global community should work together to overcome the challenges in meeting the Paris Agreement climate goal.

3.2. The global climate goal under the Paris Agreement

Since the world adopted the UNFCCC in 1992 (UN 1992), the global political process of addressing climate change has continued to advance, supported by deepening scientific knowledge. At the 21st Conference of Parties (COP21) of UNFCCC in Paris in December 2015, 196 countries adopted the Paris Agreement on Climate Change (hereafter referred to as “the Paris Agreement” or “Agreement”). The Paris Agreement clarified the long-term goal of the global response to climate change and put in place a “bottom-up” implementation mechanism that has at its core the increasingly ambitious “Nationally Determined Contributions” (NDCs) to emission reduction. It laid a legal foundation and injected new impetus for post-2020 global cooperation in addressing climate change. The Agreement came into force on 4 November 2016, 30 days after meeting the “double threshold”—ratifications by 55 countries that represent 55% of total global GHG emissions.

Figure 3.1: Key aspects of the Paris Agreement



L&D = loss and damage, Sinks = carbon sinks, CB = capacity building, D&T = development and transfer. Source: Compiled by the author on the basis of information in United Nations. United Nations Framework Convention on Climate Change. *The Paris Agreement*; <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>.

The Paris Agreement provides a long-term strategy for global responses to climate change (Figure 3.1). In mitigation, it aims to limit the global temperature rise this century below 2°C above pre-industrial levels, while pursuing efforts to limit it even further to 1.5°C. It recommends the worldwide peaking of GHG emissions as soon as possible and the achievement of net-zero emissions in the second half of this century. The IPCC's 2018 special report further clarifies that attaining the 1.5°C target requires global anthropogenic CO₂ emissions to reach net-zero around 2050, and that limiting global warming below 2°C requires CO₂ emissions to reach net-zero around 2070. In climate adaptation, the Paris Agreement aims to improve countries' capacity to adapt to the adverse effects of climate change and foster climate-resilient and low GHG emissions development in a manner that does not threaten food production. In funding, it aims to make financial flows consistent with pathways towards low GHG emissions and climate-resilient development.

To implement these actions, the Paris Agreement stipulated that all Parties—the countries participating in the conclusion of this Agreement—should communicate and update their post-2020 NDCs by 2020, and submit updated NDCs every five years thereafter. The Agreement and related resolutions also require countries to communicate, by 2020, to the Secretariat of UNFCCC their “mid-century, long-term low GHG emission development strategies,” outlining how they intend to achieve their emission reductions targets by 2050.

In addition, to prevent possible policy slippages, the Agreement requires all Parties to report on mitigation and adaptation actions and progress, using an enhanced transparency framework every two years, with international procedures in place for the review of the submitted reports. It has also introduced a mechanism of global stocktaking to assess the strength and progress of global climate actions every five years.

As of September 2021, the 197 Parties to the UNFCCC have all ratified or signed the Paris Agreement. About 192 Parties have submitted their first NDCs, while 11 have tendered their second NDCs. 32 Parties have submitted long-term low-emission development strategies. 136 countries including the European Union (EU), covering approximately 75% of the global carbon emissions, have formally adopted, announced, or are considering a concrete carbon neutrality target date. Among these, 124 are targeting to achieve carbon neutrality by 2050, 5 before 2050, and 5 by 2060, while 2 have already achieved the target (Table 3.1).

Among the members of the Group of 20 (G20)—which together account for 80% of global gross domestic product (GDP), 80% of global emissions and 60% of global population—Germany has set a legal target of net-zero emissions by 2045, while Canada, the EU, France, Japan, South Korea, and the UK have set a legal target of net-zero emissions by 2050. Argentina and Mexico are part of the UNFCCC Climate Ambition Alliance that works towards net-zero carbon emissions by 2050. South Africa aspires to achieve net-zero carbon emissions by 2050 as indicated in its long-term low emission development strategy submitted to the UNFCCC. Brazil has a target in its NDCs for 2060 and has announced its intention to bring it forward to 2050, while Indonesia is exploring opportunities to reach net-zero emissions by 2060. China has announced its target of carbon neutrality before 2060. For the United States (US), the Biden Administration is committed to the target of net-zero emission for 2050, reversing the policy shift of the previous administration.

Along with these policy developments, the climate-change-related markets, including renewable energy investment, emissions trading, and green bonds, have continued to expand (see Chapter Two of this report). Further, global cooperation in addressing climate change has become a platform for all countries to work together to promote green

growth and recovery, providing huge business opportunities.

Despite these encouraging developments, there is no room for complacency. The emission reduction commitments made under the NDCs globally so far are way below the levels consistent with the mitigation pathways to achieve the climate goal of the Paris Agreement. According to the data compiled by the Climate Action Tracker,⁹ of the 35 countries (including the EU) it monitors—which all together cover around 80% of global emissions, 6 countries’ emission reduction commitments under their current NDCs are considered as critically insufficient

(leading to a global temperature rise of more than 4°C if all countries are in this range); 7 are considered as highly insufficient (leading to a rise between 3°C and 4°C); and 12 are considered insufficient (leading to a rise between 2°C and 3°C). Only 6 are consistent with the 2°C target and 2 are compatible with the 1.5°C rise. The assessments by the United Nations Environment Programme (UNEP 2020) show that, to realize the 2°C target, annual global GHG emissions by 2030 must be 15 gigatons of carbon dioxide equivalent (GtCO₂e) lower than the level implied by the unconditional NDCs as of end-2020, while the gap to achieve the 1.5°C target is 32 GtCO₂e.

Table 3.1: List of countries with carbon neutrality targets (as of September 2021)

	BEFORE 2050	BY 2050	BY 2060
Achieved (2)	Bhutan, Suriname (2)		
In law (15)	Germany, Sweden (2)	Canada, Denmark, the EU, Fiji, France, Hungary, Ireland, Japan, Luxembourg, New Zealand, South Korea, Spain, the UK (13)	
Proposed for legislation (1)		Chile (1)	
In policy document (38)	Austria, Finland, Iceland (3)	Andorra, Argentina, Barbados, Brazil, Cabo Verde, Colombia, Costa Rica, Dominican Republic, Grenada, Italy, Jamaica, Lao PDR, Latvia, Malawi, Maldives, Marshall Islands, Mauritius, Monaco, Nauru, Nepal, Norway, Panama, Portugal, Slovakia, Slovenia, South Africa, Switzerland, Uruguay, the US, Vatican City (30)	China, Indonesia, Kazakhstan, Sri Lanka, Ukraine (5)
Target under discussion (80)		Afghanistan, Angola, Antigua and Barbuda, Armenia, Bahamas, Bangladesh, Belgium, Belize, Benin, Bulgaria, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Comoros, Cook Islands, Croatia, Cyprus, Czechia, Democratic Republic of Congo, Djibouti, Dominica, Ecuador, Eritrea, Estonia, Ethiopia, Gambia, Greece, Guinea, Guinea-Bissau, Guyana, Haiti, Kiribati, Lebanon, Lesotho, Liberia, Lithuania, Madagascar, Mali, Malta, Mauritania, Mexico, Micronesia, Mozambique, Myanmar, Namibia, Nicaragua, Niger, Niue, Pakistan, Palau, Papua New Guinea, Peru, Romania, Rwanda, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Solomon Islands, Somalia, South Sudan, Sudan, Tanzania, the Netherlands, Timor-Leste, Togo, Tonga, Trinidad and Tobago, Tuvalu, Uganda, Uzbekistan, Vanuatu, Yemen, Zambia (80)	

Sources: For Sri Lanka: Sri Lanka’s Ministry of Environment. Sri Lanka: Updated Nationally Determined Contributions <https://eciu.net/netzerotracker/map>; <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Sri%20Lanka%20First/NDCs%20of%20Sri%20Lanka-2021.pdf>; for Uzbekistan: Enerdata. 2021. *Uzbekistan Pledges to Reach Carbon Neutrality by 2050*; <https://www.enerdata.net/publications/daily-energy-news/uzbekistan-pledges-reach-carbon-neutrality-2050.html>; and for all others: Energy & Climate Intelligence Unit. Zero by 2050.

⁹ The Climate Action Tracker is a collaboration of two Berlin-based organizations specializing in climate science and policy research.

Of the 136 countries that have formally adopted, announced, or are considering a concrete carbon neutrality target, 13 have enshrined it into law, and 3 have proposed it for legislation. For the rest, the target was either announced in policy documents (38) or under discussion (80). In addition, of the 136 countries, only 28 have indicated clearly that the net-zero covers all GHGs; 4 targets at CO₂; while the rest are either undecided and have not indicated clearly (Energy and Climate Intelligence Unit n.d.). A review of the 31 long-term low-emission development strategies that have been submitted to the UNFCCC Secretariat also shows variations in the GHG coverage, implementation timelines, and sector breakdown.

3.3. Transforming energy and industrial systems to achieve the global climate goal

According to the IPCC's latest report (2021), from 2020 onwards, the remaining "carbon budget"—total additional emissions allowed to stay on track to reach a climate target—is 400 gigatons of carbon dioxide (GtCO₂) for the 1.5°C pathway and 1,150 GtCO₂ for the 2°C pathway.⁹ These budgets consider the warming from non-CO₂ drivers as well and can be higher or lower depending on the strength of reductions in non-CO₂ GHGs. Successfully keeping within these budgets and staying on track to reach the Paris Agreement climate goal require rapid, far-reaching and unprecedented changes in energy and industrial systems, infrastructure, and land, supported by large-scale deployment of carbon dioxide removal technologies.

The energy sector is the largest source of GHG emissions. Since 1990, associated with rapid economic growth and rising consumption of fossil fuels, global energy-related GHG emissions have accelerated. Carbon emissions from the use of fossil energy reached a record high of 38.0 GtCO₂ in 2019, accounting for 65% of the total global GHG emissions that year (UNEP 2020). Therefore, transition to a low-carbon energy system is critical to winning the battle against climate change.

Major emission reduction measures for the energy sector include, on the supply side, increasing the supply of zero- and low-carbon energy sources, namely, renewables, nuclear energy, bioenergy, and fossil energy combined with carbon capture, use and storage (CCUS) technology; and on the demand side, improving energy efficiency, reducing end-use energy demand, and increasing the electrification rate of end-use sectors. A fundamental shift is needed to gradually transform the energy system from one with fossil fuels as the mainstay and clean energy as the supplement to that with clean energy as the mainstay and fossil fuels as the supplement. Achieving this would require large investments in new infrastructure and low-carbon technologies and strong policy support.

⁹ These refer to carbon budget at a likelihood of 67%. The carbon budget for the 1.5°C scenario is 500 GtCO₂ at a likelihood of 50% and 300 GtCO₂ at a likelihood of 83%; for the 2°C scenario, it is 1,350 GtCO₂ at a likelihood of 50% and 900 GtCO₂ at a likelihood of 83%.

Significantly raising the share of low-carbon energy. According to the IPCC’s fourth assessment report (2014), to attain the Paris Agreement climate goal, the proportion of zero- and low-carbon energy in global primary energy consumption needs to increase from about 15% in 2010 to 50-70% by 2050 and to more than 90% by 2100. The IPCC’s 2018 special report further shows that attaining the 1.5°C climate goal requires the world to increase the share of non-fossil energy in total primary energy

consumption to 31% by 2030 and 65% by 2050 and to combine the residual fossil energy with CCUS technology by the mid-century (Figure 3.2). A more recent IEA study (2021a) shows that attaining the 1.5°C target by 2050 requires the world to increase the share of renewables and nuclear energy in global primary energy consumption to 67% and 11%, respectively; reduce the share of natural gas to 11%, oil to 8%, and coal to 4%; and to combine the residual fossil energy with CCUS.

Figure 3.2: Transition in global primary energy consumption to achieve the 1.5°C target (% of total)

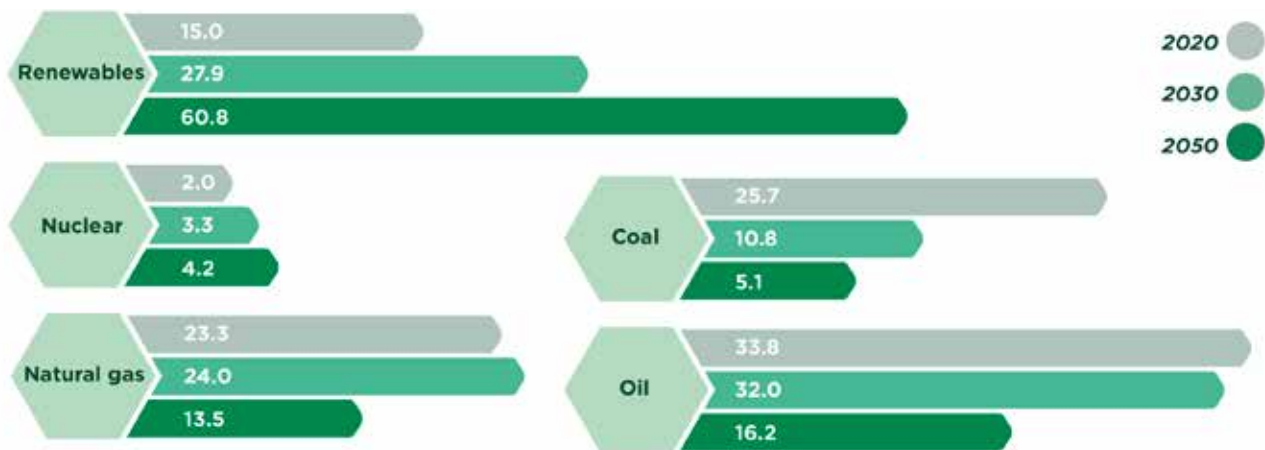
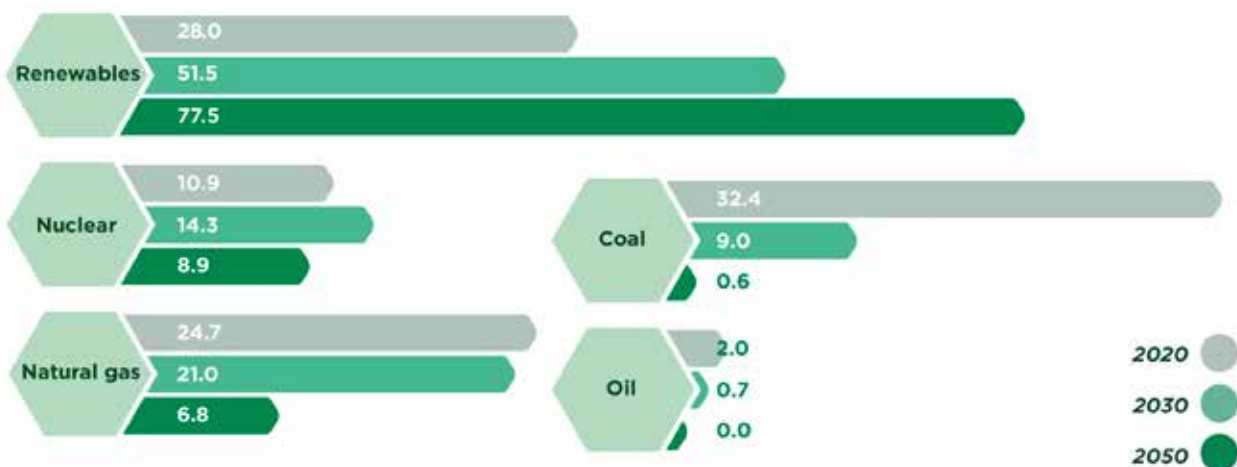


Figure 3.3: Transition in global electricity generation to achieve the 1.5°C target (% of total)



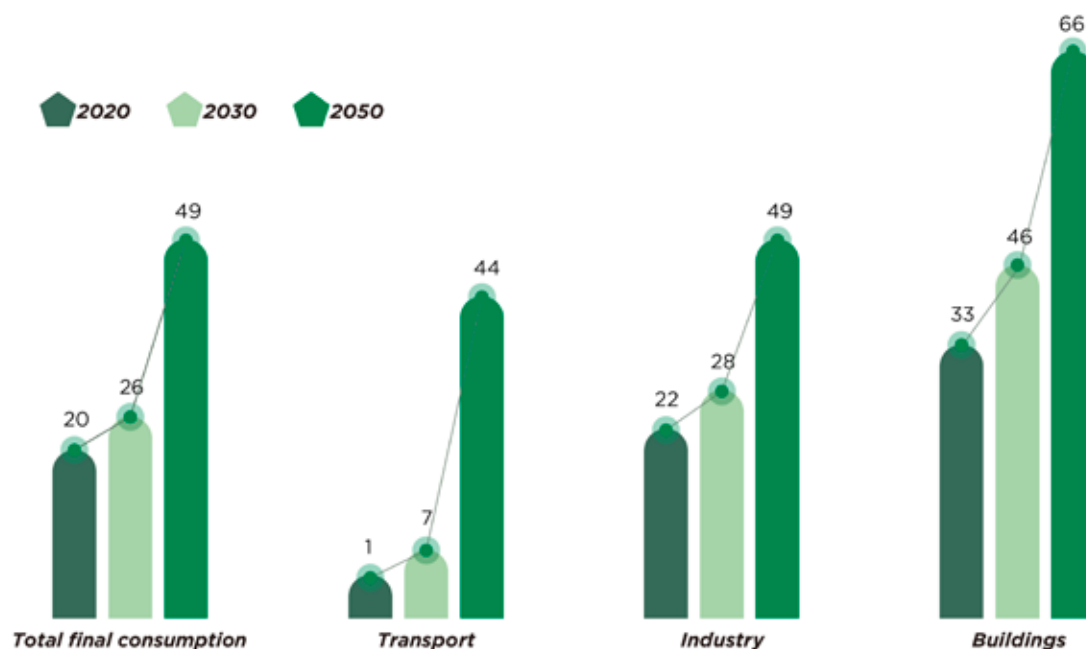
Note: Renewables include solar, wind, hydro, biomass, and other renewables. All the numbers refer to the median values of the 85 model assessments reviewed by the United Nations Intergovernmental Panel on Climate Change (UN IPCC). Source: UN IPCC. 2018. Global Warming of 1.5°C; https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Full_Report_High_Res.pdf.

Decarbonizing the power sector. Decarbonizing the power sector is critical for the low-carbon transition of the energy system. According to the IPCC (2018), under the 1.5°C pathway, the share of non-fossil energy in global power generation should increase to 66% by 2030 and 86% by 2050, while combining the residual fossil fuels with CCUS technology (Figure 3.3).⁹ A more recent IEA study (2021a) shows that attaining the 1.5°C target requires the world to increase the share of renewables in global power generation to 77%, nuclear energy to 16%, hydrogen to 3% by 2050; and to limit the share of natural gas to 1%, oil to nil, and coal to 2%; and combining the residual fossil fuels with CCUS. According to this study, by the mid-century, solar photovoltaic (PV) power should generate 23% of global electricity supply, wind 24%, hydro 8%, bioenergy 10%, and other renewables 11%. The power sector should also achieve zero-emission using only low-carbon technologies: fossil fuels with CCUS, nuclear power, renewables, and hydrogen.

Controlling energy consumption and promoting electrification on the demand side. Demand side management is indispensable for achieving the

global climate goal. Reducing energy demand is the key to reducing carbon emissions. The potential for emission reduction through energy conservation and energy efficiency improvement is huge. Examples of the former include reducing wastes; switching to cycling, walking and public transport; and material recycling. Examples of the latter include retrofitting buildings, switching to electric vehicles, and using more energy-efficient industrial equipment. Electrification in end-use sectors is critical too. IEA (2021a) estimates that under the 1.5°C scenario, the share of electricity in global final energy consumption should increase from 20% in 2020 to 26% by 2030 and 49% by 2050 (Figure 3.4). The IEA study also suggests that energy efficiency improvement, behavioral changes, and electrification have the potential to drive the global annual final energy consumption down, from 21.85 billion tons of coal equivalent (TCE) in 2020 to 11.75 billion TCE by 2050 or a reduction of 46%, while assuming the world maintains an annual population growth of 0.7% and annual GDP (at 2019 purchasing power parity) growth of 3.1% during that period.

Figure 3.4: Share of electricity in global final energy consumption (% of total)



Source: International Energy Agency. 2021. Net Zero by 2050. <https://www.iea.org/reports/net-zero-by-2050>.

⁹ All these numbers refer to the median values of available 85 model assessments reviewed by the IPCC (2018).

The IEA study also identifies some key milestones in moving towards global carbon neutrality by 2050. These include, among others, (i) from 2021, no new unabated coal-fired power plants and no new oil and gas fields are approved for development; (ii) by 2030, all new buildings are zero-carbon ready, 60% of global car sales are electric, and unabated coal is phased out in developed countries; (iii) by 2035, no new internal combustion engine cars are on sale; (iv) by 2040, net-zero emissions in power generation is achieved globally and all unabated coal and oil power plants are phased out; and (v) by 2050, 85% of buildings are zero-carbon ready and 70% of global power generation is from solar PV and wind. The report notes that all these emission reduction methods can be achieved by combining new and existing technologies and practices, as they have been validated technically to varying degrees. However, their large-scale applications may face various economic, capital, human resource, and institutional constraints.

Undertaking large investments in low-carbon energy systems and technologies. According to the IPCC (2018), attaining the 1.5°C climate target would require the world to invest \$1.4 trillion to \$3.5 trillion (in 2010 constant \$) on energy supply and \$640 billion to \$910 billion on the demand side annually on average from 2016-2050. Compared with the baseline scenario that only reflects climate policies already in place (as of 2016) without new commitments, the additional energy investment of pursuing the 1.5°C climate target is estimated to be in the range of \$150 billion to \$1.7 trillion. Compared with the 2°C scenario, the total energy-related investment under the 1.5°C scenario would be 12% higher (with a range of 3-24%).

Attaining the Paris Agreement climate goal also requires further deployment of technologies that are currently available and those that have not yet been commercialized or marketed. A large number of technologies, represented by photovoltaics, batteries,

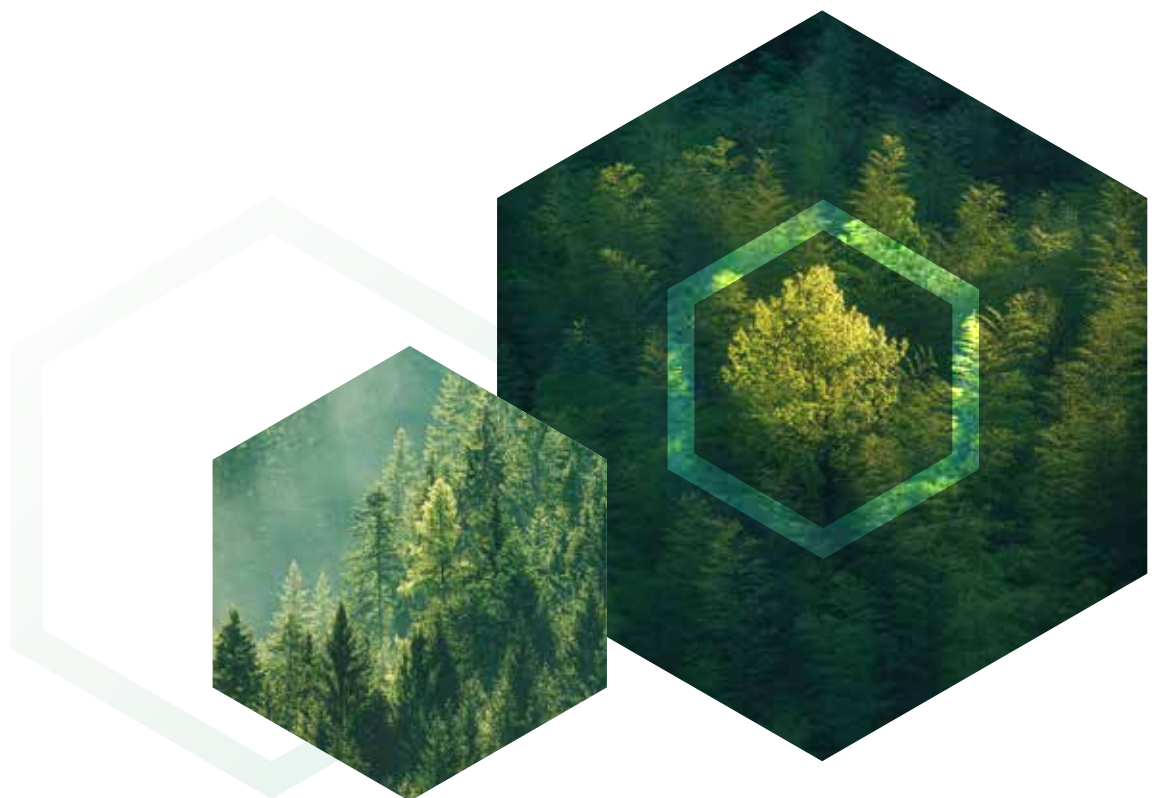
digitalization, etc., are changing the trend of climate mitigation. While these technologies have provided cost-effective options for decarbonization in the short term, more technological innovation will be needed for energy transition in the long run. The IEA predicts that most of the reductions in CO₂ emissions through 2030 can be achieved from deploying technologies already on the market today. But in 2050, almost half of the reductions will have to be achieved by utilizing technologies that are currently only at the demonstration or prototype phase. Thus, major innovation efforts are needed in order to bring these new technologies to market on time.

Putting in place a strong policy support system. Countries around the world have used a variety of policies to support mitigation actions. These policies can be classified into three categories: regulatory measures, economic measures, and measures that encourage general public participation. Examples of regulatory measures include setting legal limits on emissions or issuing binding energy efficiency standards. Economic measures involve using price mechanisms and economic incentives to influence the costs and profits of production and business activities that generate emissions, thus changing behavior of market players. Governments should also mobilize entire populations to participate in the transition towards a low-carbon society through education and awareness campaigns. What exact mitigation policy mix to choose often depends on a country's stage of development and the need to balance economic development, social harmony, and political stability with the goals of environment protection and global climate actions, taking into account efficiency, equity, and public support, among other factors. Importantly, climate actions should be integrated into a country's overall development strategy.

More specifically, mitigation policies for the energy sector have included abolishing fossil fuel subsidies, setting legal or voluntary renewable energy targets, imposing emission taxes, capping total emissions and carbon

trading, and providing financial incentives such as price subsidies, preferential loans, tax credits, and accelerated depreciation for investment in low-carbon energy sources. Mitigation policies for the building sector have involved setting energy efficiency standards and labeling for buildings and providing financial incentives for retrofiting. Mitigation policies for the transport sector have included providing financial incentives for switching from traditional to electric vehicles, setting fuel efficiency and emission standards, and encouraging low-carbon transport modes and travel patterns. For the industrial sector, mitigation policies have involved supporting industrial upgrading and adoption of energy-saving and energy-efficient technologies, fuel switching, issuing energy efficiency standards, and emission taxes and permits. Mitigation policies for the forest sector have included legal restrictions on deforestation, providing incentives for afforestation and reforestation, and public campaigns for tree planting.

Carbon pricing and developing carbon markets to reduce mitigation costs. Many countries have developed or are in the process of developing carbon markets as a key component of low-carbon development strategies. Not only can carbon trading help stimulate the voluntary emissions reduction of emitting firms, they can also reduce costs of climate mitigation for the entire economy, and facilitate flows of capital and technology to greener firms. Since 2005, the share of global emissions covered by carbon markets has tripled, reaching 16% by 2021 (including China's newly-launched national carbon market). As of 31 January 2021, there are 24 ongoing carbon markets worldwide, with the EU carbon market being the world's first and by far the largest, accounting for more than 75% of global carbon trading volume (Box 3.2). Eight additional markets are being planned for launch in the coming years. There are another 14 jurisdictions that are considering the role of carbon markets as a policy tool in their climate change policy portfolios (ICAP 2021).



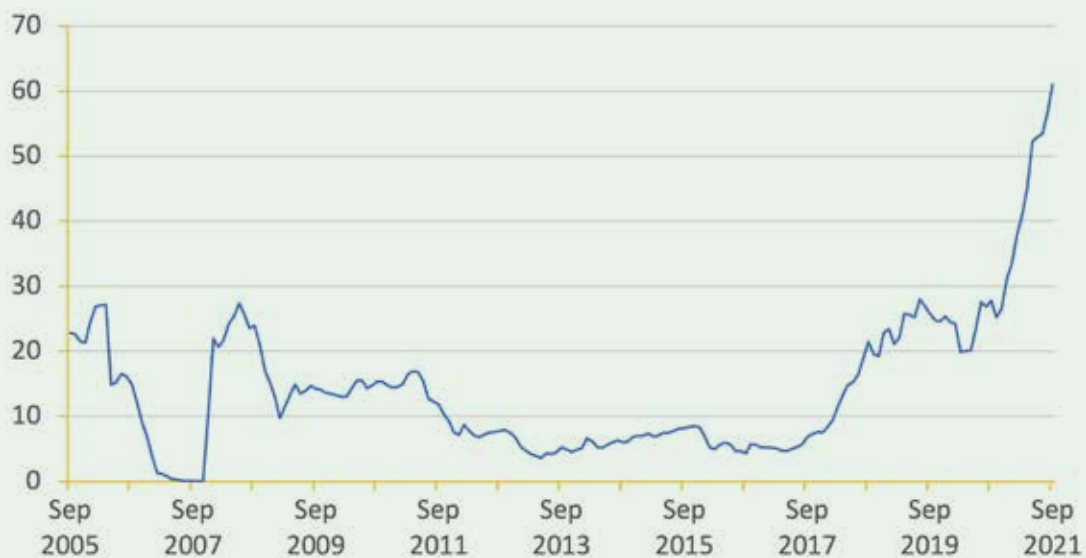
Box 3.2: The EU carbon market

The European Union’s Emissions Trading System (EU ETS) is a cornerstone of its climate policy and key tool to address climate change and reduce greenhouse gas (GHG) emissions cost-effectively. The system is the world’s first major and largest carbon emissions trading market in trading volume, accounting for more than 75% of the global total with a turnover of €169 billion in 2019. Installations covered by the EU ETS reduced emissions by about 35% between 2005 and 2019. Although the carbon price had plummeted in the past due to the surplus of emission allowances, it has climbed in recent years, as the cap is tightened under EU’s more ambitious emission reduction targets, reaching €69 (\$74) per ton of carbon dioxide by early September 2021.

Set up in 2005, the EU ETS operates in all EU countries plus Iceland, Liechtenstein,

and Norway. It limits emissions from around 10,000 installations in the power sector and manufacturing industry, as well as airlines operating between these countries. After several revisions, the EU ETS framework is now entering its fourth trading phase (2021-2030), covering around 40% of the bloc’s GHG emissions. To maintain the system’s alignment with the overarching EU climate policy objectives, revisions in the fourth phase include increasing the pace of annual reductions in the emission cap to 2.2% as of 2021; reinforcing the Market Stability Reserve; continuing the free allocation of allowances to energy-intensive industrial sectors at risk of carbon leakage; and helping the industry and the power sector meet the innovation and investment challenges of the low-carbon transition via dedicated funding mechanisms—the Innovation Fund and Modernization Fund.

Box Figure 3.2: EU ETS monthly average carbon prices (€ per ton)



Source: Trading Economics.



3.4. China's climate actions

3.4.1. Recent development of China's climate mitigation policy

China has a large population, complex climate, and a fragile ecosystem, and has been more severely affected by climate change. In recent years, its average surface temperature has risen nearly twice as quickly as the world average, and the sea level has also risen faster than the global average. According to China's Third National Assessment Report on Climate Change (2015), China's direct economic losses caused by climate change since the beginning of this century are estimated at an equivalent of 1.1% of its GDP every year on average, which is seven times higher than the global average in the corresponding period. Climate change has posed serious threats to China's food, water, ecological, energy, infrastructure, and production security and people's livelihood.

In recent decades, China has implemented a variety of climate mitigation actions and policy initiatives (Sandalow 2019):

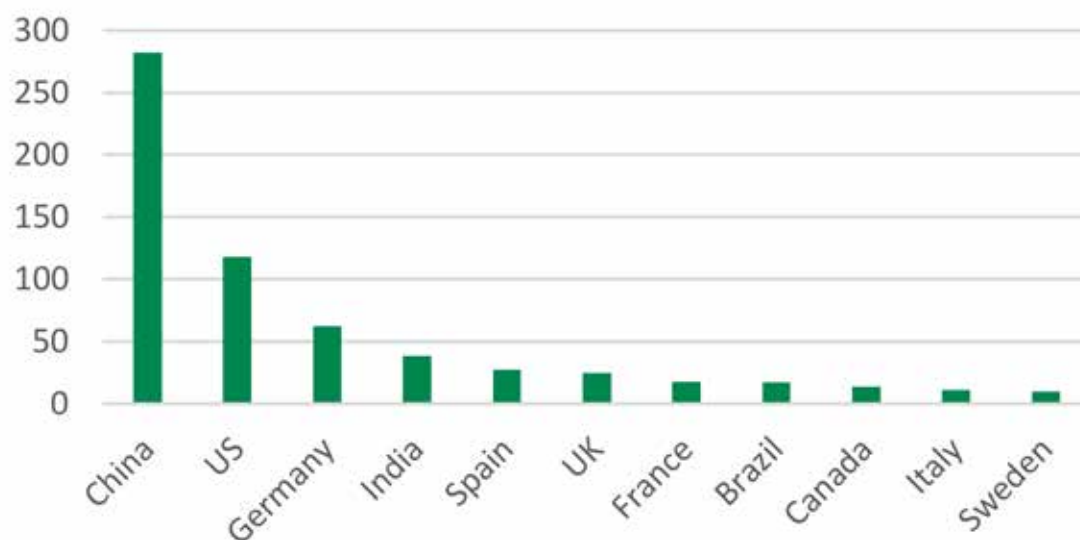
- Most five-year plans since the 1980s have included national energy intensity reduction targets. For example, the 13th Five-Year Plan (2016–2020) set a mandatory national target of 15% reduction in energy intensity (per unit of GDP) from the 2015 level by 2020, and the 14th Five-Year Plan (2021–2025) has set a reduction target of 13.5%. Over the years, the government has issued various energy efficiency standards for power plants, industrial installations, buildings, and household appliances.
- The government's support for renewable energy dates back to at least the 9th Five-Year Plan (1996–2000), which set targets for new and renewable energy, including solar power, wind power and hydro power. In 2005, the Renewable Energy Law was adopted. The 13th Five-Year Plan sets a target of increasing the share of non-fossil energy in primary energy consumption to 15% by 2020 and 20% by 2030.
- China has also promoted low-carbon transport by investing heavily in public transport and supporting the shift towards electric vehicles.
- China's Natural Forest Conservation Program is the largest forest conservation program in the world.
- In 2013, China launched pilot programs for carbon emissions trading in seven cities and provinces, and in July 2021, it launched the national emissions trading system, the largest in the world in terms of the emissions covered.
- China is a world leader in developing green finance in recent years, mobilizing private capital for low-carbon investment, including in Belt and Road countries.
- To support climate actions and low-carbon and green transition in other developing countries, China established the Climate Change South-South Cooperation Fund in 2014 (One Belt Road Energy Cooperation Network n.d.)

China’s CO2 emissions per unit of GDP fell by 18.8% from 2015 to 2020, exceeding the 18% binding target set in the 13th Five-Year Plan, and fell by 48.4% during 2005-2020, more than its international commitment of a 40%-45% reduction for the period. The 14th Five-Year Plan has set an emission intensity reduction target of 18% for 2021-2025. In 2020, non-fossil fuels accounted for 15.9% of the primary energy consumption, surpassing the target of 15%, and electricity generation from renewable and nuclear energy sources combined reached more than 32% (IEA 2021b). China now leads the world in installed solar and wind power capacities (Figures 3.5 and 3.6). In 2018, China’s forest cover increased to 220.67 million hectares, and its forest stock reached 17.56 billion cubic meters, an addition of 41.1 million hectares and 4.5 billion cubic meters, respectively, from the 2005 levels, making China the country with the largest increase in forest resources in the world during the same period. All these have laid a good foundation for China to further raise its NDCs and introduce more aggressive mitigation measures.

China has increasingly taken responding to climate change as a major strategic

opportunity to promote its own high-quality development as well as to lead the global green and low-carbon growth. Since September 2020, China has announced its commitment to peak CO2 emissions before 2030 and achieve carbon neutrality before 2060 (the dual carbon goals) in a number of important international occasions (Table 3.2). According its new NDCs announced last December at the Climate Ambition Summit, by 2030, China’s CO2 emissions per unit of GDP will be over 65% lower than that of 2005; non-fossil energy will account for about 25% of the primary energy consumption; forest stock will increase by 6 billion cubic meters from the 2005 level; and the total installed capacity of wind and solar power will reach more than 1,200 gigawatts (GW). Recent high-level government meetings have stressed that the country’s efforts to meet the dual carbon goals are important not only to the nation’s sustainable development, but also to the shared future of mankind, and that these require wide-ranging, profound, and systematic economic and societal transformations, and should be pursued forcefully as an integral part of China’s overall strategy for constructing ecological civilization.

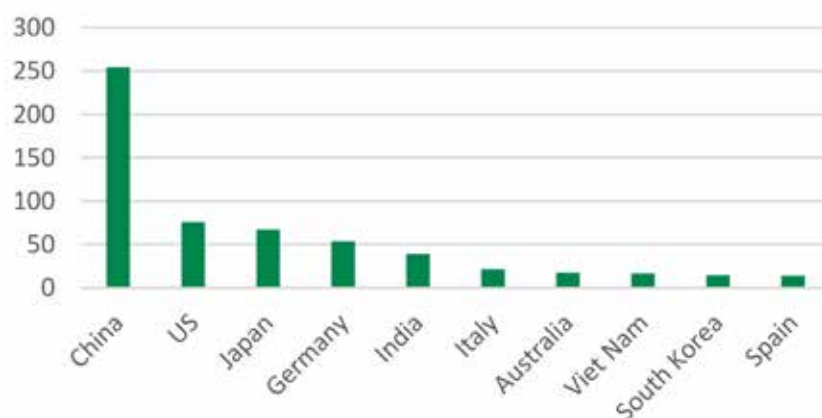
Figure 3.5: World’s top 10 countries in installed wind power capacity (GW), 2020



GW=gigawatt.

Source: International Renewable Energy Agency. 2021. Renewable Capacity Statistics. http://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/Apr/IRENA_RE_Capacity_Statistics_2021.pdf.

Figure 3.6: World's top 10 countries in installed solar PV power capacity (GW), 2020



GW=gigawatt.

Source: International Renewable Energy Agency. 2021. Renewable Capacity Statistics. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/Apr/IRENA_RE_Capacity_Statistics_2021.pdf.

Table 3.2: China's announcements on emission peak and carbon neutrality targets (as of September 2021)

Time	Occasion	Announcements
22-SEP-2020	The 75 th UN General Assembly	China will raise its NDCs and adopt more effective policies and measures. It will strive to peak CO2 emissions before 2030 and achieve carbon neutrality before 2060.
29-OCT-2020	Communiqué of the Fifth Plenary Session of the 19 th Central Committee of CPC	By 2035, China will broadly achieve its long-term goal of socialist modernization, including "having extensively developed green production systems and established green lifestyle, stabilized and reduced carbon emissions after peaking, fundamentally improved the ecological environment, and achieved the goal of building a beautiful China."
12-NOV-2020	The 3 rd Paris Peace Forum	China will raise its NDCs and strive to peak CO2 emissions before 2030 and achieve carbon neutrality before 2060 and China will formulate implementation plans to achieve these targets.
17-NOV-2020	The 12 th BRICS Summit	China is willing to assume international responsibilities commensurate with its own level of development and continue to make strenuous efforts to tackle climate change. China will raise its NDCs and adopt more effective policies and measures. China will strive to peak CO2 emissions before 2030 and achieve carbon neutrality before 2060.
22-NOV-2020	The G20 Riyadh Summit	China "will uphold the concept of a community of shared future for mankind and work together to meet the climate and environmental challenges and protect our blue planet." It will raise its NDCs and strive to peak CO2 emissions before 2030 and achieve carbon neutrality before 2060.
12-DEC-2020	Climate Ambition Summit	By 2030, China's CO2 emissions per unit of GDP will be over 65% lower than that of 2005; non-fossil energy will account for about 25% of the primary energy consumption; forest stock will increase by 6 billion cubic meters from the 2005 level; and the total installed capacity of wind and solar power will reach more than 1,200 gigawatts.
15-JAN-2021	World Economic Forum Virtual Event of the Davos Agenda	China will fully implement the 2030 Agenda for Sustainable Development of UN. [It] will strive to peak carbon emissions before 2030 and achieve carbon neutrality before 2060.
22-APR-2021	Leaders' Climate Summit	China will integrate carbon peaking and neutrality into its strategy for constructing the ecological civilization. China is in the process of preparing the action plan for carbon peaking and will support major industries and enterprises and localities which can take the lead in achieving carbon peaking. China will strictly control coal-fired power plant projects, and strictly control growth of coal consumption during the 14 th Five-Year Plan period and gradually reduce it during the 15 th Five-Year period (2026-2030)
21-SEP-2021	The 76 th UN General Assembly	China "will not build new coal-fired power plants abroad" while at the same time increasing its support for developing countries to pursue green and low-carbon development.

Source: Compiled by the author on the basis of available public information.

3.4.2. China's pathways towards the dual carbon goals: A review of selected studies

Achieving the dual carbon goals will be a significant challenge for China. It requires large emission reductions in all sectors, including power, transport, industry, buildings, agriculture and forestry, while maintaining strong economic growth to achieve its development goals. A key difference between China and the West—European countries and the US—is that, in the case of China, a large part of industrial capacity, infrastructure, and buildings are relatively new and most were constructed in the last 15-20 years. In this regard, financial costs will be large whether these are phased out or upgraded. Another challenge for China is that emission reduction technologies are developing rapidly, and opportunities in a few decades may be very different from those of today. An effective strategy should not just look at options and technologies currently available, but also foresee future advances.

Several independent studies have examined pathways towards the dual carbon goals, including, among others: (i) *China's Long-Term Low-Carbon Development Strategy and Transformation Pathways* produced by the Institute of Climate Change and Sustainable Development of Tsinghua University (ICCSA 2020); (ii) *Accelerating the Net-Zero Transition: Strategic Action for China's 14th Five-Year Plan* by the World Resources Institute China (WRI 2020); (iii) *China's Energy and Electricity Outlook 2020* by the Energy Research Institute of China State Grid (ERICSG 2020); (iv) *Investment Allocation under Carbon Neutrality* by Sinolink Securities (Sinolink 2021); and (v) *An Energy Sector Roadmap to Carbon Neutrality in China* by the International Energy Agency (IEA 2021b).

A common feature of these studies is that they are mostly based on some versions of the so-called integrated assessment models. These models look at energy technology choices, land-use changes, and economic and social trends that increase or prevent GHGs, and explore complex interplays between climate actions and development. The models generate pathways for emissions, the energy and power sector transitions, and development paths for decades to come under alternative scenarios representing different levels of climate mitigation efforts, taking both global and national perspectives.

The pathways towards the dual carbon goals, presented in three of the above five studies, assume that China's economy will grow at 4.2-4.5% annually on average during 2020-2050; its population will be maintained at around 1.33-1.4 billion; and it will achieve basic modernization by 2035 and become a fully developed nation by mid-century.⁴ Furthermore, all the studies assume that the Chinese economy will continue to undergo structural transformation to upgrade industries and move towards a greater share of the tertiary sector in GDP. In particular, Sinolink (2021) assumes that the share of the industrial sector in GDP will decline from 41.8% in 2019 to 36.6% in 2060; the share of agriculture will decline from 6.2% to 4.5%; and the share of services will increase from 52% to 58.9%.⁵ With these assumptions, the pathways show required transformations in the energy system on both supply and demand sides if China is to meet the dual carbon goals, as summarized in Table 3.3 below.

According to ICCSD (2020), the pathway to carbon neutrality before 2060 consistent with the 2°C target (while considering inertia in the economy and energy system)

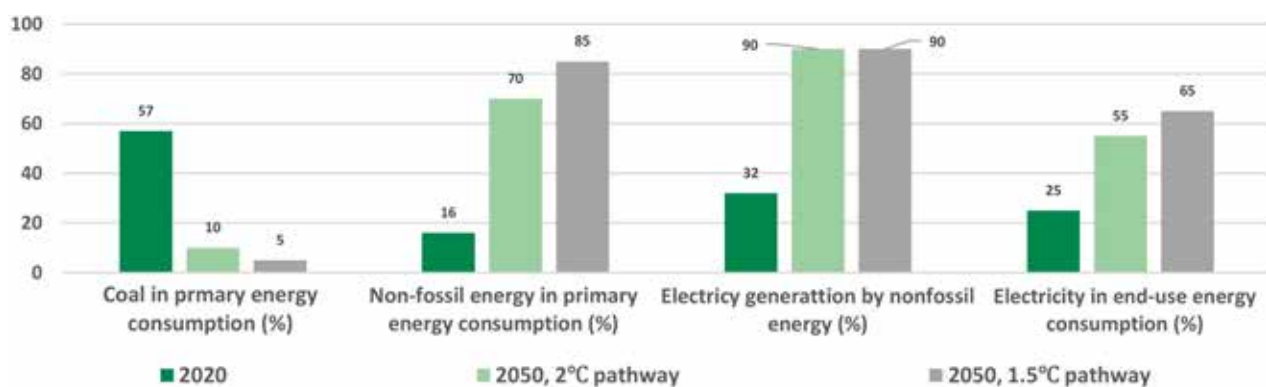
⁴ Sinolink (2021) and IEA (2021b) do not provide specific information on gross domestic product and population growth.

⁵ Other three studies do not report data in the sectoral composition of gross domestic product.

involves increasing the share of non-fossil energy in primary energy consumption to 29% by 2030, and maintaining coal consumption at the current level until 2025 and reducing it to 2.6 billion TCE or 45% of primary energy consumption by 2030. By 2050, coal in primary energy consumption will fall to 0.5 billion TCE or less than 10%; non-fossil energy will increase to 70% in primary energy consumption and more than 90% in power generation (Figure 3.7). The share of renewables in power generation will reach 73% and the electrification rate in end-use sectors is more than 55%. For the

pathway consistent with the 1.5°C target, by 2050, coal in primary energy consumption will fall to 0.3 billion TCE or less than 5%. Non-fossil energy in primary energy consumption will rise to more than 85% and in power generation to more than 90%. The share of renewables in power generation will reach 74% and the electrification rate in end-use sectors 65%. To attain these targets, the study calls for more and stronger mitigation actions during China's 14th Five-Year Plan period (2021-2025) than during the years covered by the previous five-year plans.

Figure 3.7: China's energy system transformation under 2°C and 1.5°C pathways



Source: Institute of Climate Change and Sustainable Development. 2020. *Comprehensive Report on China's Long-term Low-Carbon Development Strategy and Transformation Path*. Tsinghua University.

WRI (2020) looks at two scenarios: the current policy and strengthened policy, with the latter consistent with carbon peaking before 2030 and neutrality by 2060. Under the strengthened policy scenario, China will peak net CO₂ emissions at 10.3 GtCO₂ by 2026 and achieve net-zero CO₂ emissions by 2060. Non-fossil energy will account for 26% of China's primary energy consumption by 2030, coal consumption will be maintained at the current level until 2025 and fall to 2.3 billion TCE by 2030, and the share of non-fossil energy and renewables in power generation will increase to 50% and 42%, respectively, by 2030. By 2050, coal in primary energy consumption will fall to 0.3 billion TCE, the share of non-fossil energy in primary energy consumption will increase to 59% and in power generation to more than 90%, while the share of renewables in power generation will increase to 81%.

ERICSG (2020) looks at three scenarios: the traditional transition, accelerated electrification, and deep decarbonization, with the last consistent with carbon peaking before 2030 and neutrality by 2060. Under the deep decarbonization scenario, China will peak energy consumption-related CO₂ emissions in 2025 at 10.1 GtCO₂ and reach carbon neutrality by 2060. Non-fossil energy will account for 31% of China's primary energy consumption by 2030, coal in primary energy consumption will be maintained at the current level until 2025 and fall to 2.3 billion TCE by 2030, and the share of non-fossil energy and renewables in power generation will increase to 56% and 45%, respectively, by 2030. By 2050, coal in primary energy consumption will fall to 0.7-0.8 billion TCE, the share of non-fossil energy in primary energy consumption will increase to 69% and in power generation to 81%, and share of renewables in power generation will increase to 70%.

Sinolink (2021) looks at three scenarios: net-zero emission, carbon neutral, and high carbon. Under the carbon neutrality scenario, China will peak carbon by 2029 at

10.3 GtCO₂ and reach carbon neutrality by 2060. Non-fossil energy will account for 26% of primary energy consumption by 2030, coal in primary energy consumption will be maintained at the current level until 2025 and fall to 2.6 billion TCE or 44% by 2030, and the share of solar and wind combined in power generation will reach 28% by 2030. By 2050, the share of non-fossil energy in primary energy consumption will increase to 72%; coal in primary energy consumption will be 1.0 billion TCE; and the share of solar and wind combined in power generation will rise to 59%.

IEA (2021b) also looks at three scenarios: stated policies scenario, announced pledges scenario, and accelerated transition scenario. The announced pledges scenario sets out a pathway to carbon neutrality in energy sector in which emissions of CO₂ reach a peak before 2030 (falling to 11 GtCO₂ by 2030) and fall to net-zero in 2060, in line with China's dual carbon goals. Under this scenario, by 2030, China's non-fossil energy will account for 26% of primary energy consumption, coal in primary energy consumption will be 2.9 billion TCE or 49%, and the share of renewables—mostly solar PV and wind power—in power generation will increase to 40%. By 2060, non-fossil energy will account for 80% of primary energy consumption, coal in primary energy consumption will fall to 0.5 billion TCE or 12%, and the share of renewables in power generation will increase to more than 80%.

In sum, these studies show that, to achieve the dual carbon goals, China will need to transform its energy system such that (Table 3.3):

- By 2030, total primary energy consumption reaches 5.2-5.9 billion TCE, coal in primary energy consumption is reduced to 2.3-2.9 billion TCE or 41-50%, while the share of non-fossil energy is increased to 26-31%. In power generation, the share of non-fossil energy is increased to 49-56% and renewables to 40-45%, and the share

of coal is reduced to 40-50%. Further, the electrification rate in end-use sectors reaches 30%.

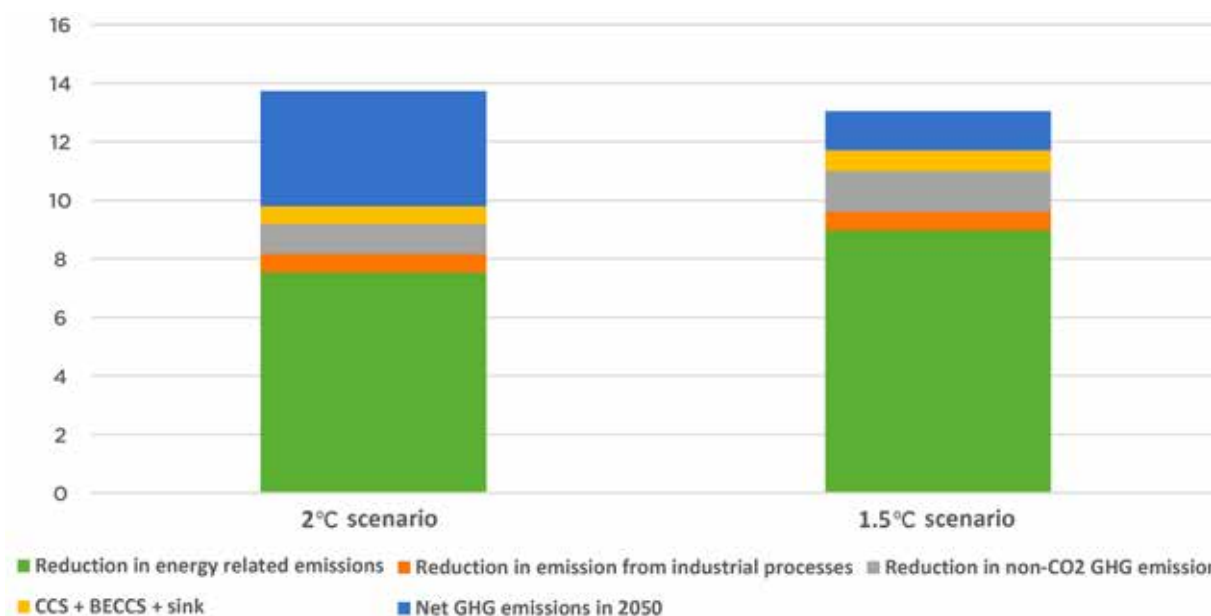
- By 2050, total primary energy consumption falls to 5-5.6 billion TCE, coal in primary energy consumption is reduced to 0.3-1.0 billion TCE or 5-18%, while the share of non-fossil energy is increased to 59-85%. In power generation, the share of non-fossil energy is increased to 81-90% and renewables to 70-81% and the share of coal is reduced to 8-12%, with residual fossil energy mostly combined with CCUS. Meanwhile, the electrification rate in end-use sectors will reach 50-65%. CCUS and carbon sink combined will capture or offset 1.2-2.7 GtCO₂ of emissions annually.

The major sources of emission reductions in China will be related to energy consumption. According to ICCSD (2020), under the 2°C scenario, from 2020 to 2050, 77% of China's total GHG emission reductions will have to

rely on mitigation in energy consumption, 10% on reduction in non-CO₂ GHGs, 7% on mitigation in industrial processes, and 6% on CCUS and carbon sink combined (Figure 3.8). Under the 1.5°C scenario, mitigation in energy consumption will account for 77%, reduction in non-CO₂ GHGs 12%, CCUS and carbon sink combined 6%, and industrial processes 5%.

Sinolink (2021) divides the next 40 years to achieve carbon neutrality into three stages: carbon peaking (2020-2030), rapid decarbonization (2030-2045), and deep decarbonization (2045-2060), and identifies four grippers of emission reduction required to achieve carbon neutrality, including reducing energy demand by end-use sectors, with a mitigation potential of 51%; optimizing energy supply, with a mitigation potential of 21%; CCUS, with a mitigation potential of 3%; and carbon sink, with a mitigation potential of 24%, as detailed in Table 3.4.

Figure 3.8: Sources of GHG emission reduction from the peak and net emissions in 2050, GtCO₂e



BECCS= Bioenergy with Carbon Capture and Storage

Source: Institute for Climate Change and Sustainable Development. 2020. *Comprehensive Report on China's Long-term Low-Carbon Development Strategy and Transformation Path*. Tsinghua University

Table 3.3: Selected studies on China's GHG emission and energy transition pathways towards the dual carbon goals

	ICCD (2020), 2°C scenario	ICCD (2020), 1.5°C scenario	WRI (2020), net-zero by 2060	ERICSG (2020), carbon neutral by 2060	Sinolink Securities, carbon neutral by 2060	IEA (2021b), announced pledges scenario
CO ₂ emissions	<ul style="list-style-type: none"> CO₂ emissions peaking by 2030 at 11.6 GtCO₂ and falling to 3.4 GtCO₂ by 2050 Net CO₂ emissions at 11 GtCO₂ in 2030 and 2 GtCO₂ by 2050 Power sector CO₂ emission 0.3 GtCO₂ by 2050 	<ul style="list-style-type: none"> CO₂ emissions peaking in 2030 at 11.3 GtCO₂ and falling to 1.7 GtCO₂ by 2050 Net CO₂ emissions at 10.4 GtCO₂ by 2030 and net-zero by 2050 Power sector negative emission by 2050 	<ul style="list-style-type: none"> Net CO₂ emissions peaking at 10.3 GtCO₂ by 2026 and falling to 3.7 GtCO₂ by 2050 Net-zero emissions by 2060 	<ul style="list-style-type: none"> Energy consumption-related CO₂ emissions peaking in 2025 at 10.1 GtCO₂ and falling to 1.7 GtCO₂ by 2050 Carbon neutral by 2060 Power sector near-zero emission by 2060 	<ul style="list-style-type: none"> CO₂ peaking by 2029 at 10.3 GtCO₂ and falling to 1.2 GtCO₂ by 2060 Power sector near-zero emission by 2060 	<ul style="list-style-type: none"> Energy-related emissions peaking before 2030 and falling to 0.61 GtCO₂ by 2060 Net energy-related emissions at 11 GtCO₂ by 2030 and net-zero by 2060 Power sector emissions peaking at 5.6 GtCO₂ by around 2025 and achieving net zero before 2055
Non-CO ₂ emissions	<ul style="list-style-type: none"> 2.8 GtCO₂e by 2030 and 1.8 GtCO₂e by 2050 	<ul style="list-style-type: none"> 2.7 GtCO₂e by 2030 and 1.3 GtCO₂e by 2050 	<ul style="list-style-type: none"> 1.8 GtCO₂e by 2050 	<ul style="list-style-type: none"> Non-energy CO₂ and non-CO₂ emissions combined at 1 GtCO₂ by 2060 	<ul style="list-style-type: none"> N.A. 	<ul style="list-style-type: none"> N.A.
Primary energy consumption	<ul style="list-style-type: none"> 5.9 billion TCE in 2030 and 5.2 billion TCE in 2050 Non-fossil energy 29% by 2030 and 73% by 2050. 	<ul style="list-style-type: none"> 5.9 billion TCE in 2030 and 5.0 billion TCE in 2050 Non-fossil energy 29% by 2030 and more than 85% by 2050 	<ul style="list-style-type: none"> 5.2 billion TCE in 2030 and 5.6 billion TCE in 2050 Non-fossil energy 26% by 2030 and 59% by 2050 	<ul style="list-style-type: none"> 5.6 billion TCE in 2030 and 5.1 billion TCE in 2050 Non-fossil energy 31% by 2030 and 69% by 2050 	<ul style="list-style-type: none"> 5.9 billion TCE in 2030, 5.4 TCE billion in 2050 and 4.7 billion TCE in 2060 Non-fossil energy 26% by 2030, 72% by 2050 and 87.3% by 2060 	<ul style="list-style-type: none"> 5.9 billion TCE in 2030 and 4.4 billion TCE in 2060 Non-fossil energy 26% by 2030 and 80% by 2060.
Coal in primary energy consumption	<ul style="list-style-type: none"> Maintained at the current level until 2025 and falling to 2.6 billion TCE or 45% by 2030; to 0.5 billion TCE or less than 10% by 2050 	<ul style="list-style-type: none"> Maintained at the current level until 2025 and falling to 2.6 billion TCE or 45% by 2030; to 0.3 billion TCE or less than 5% by 2050 	<ul style="list-style-type: none"> Maintained at the current level until 2025 and falling to less than 2.3 billion TCE or 44% by 2030; to 0.8 billion TCE or 15% by 2050 	<ul style="list-style-type: none"> Maintained at the current level until 2025 and falling to 2.3 billion TCE or 41% by 2030; to 0.7-0.8 billion TCE or 13-16% by 2050 	<ul style="list-style-type: none"> Maintained at the current level until 2025, falling to 2.6 billion TCE or 44% by 2030, to 1 billion TCE or 18% by 2050, and to 0.2 billion TCE or 6% by 2060 	<ul style="list-style-type: none"> 2.9 billion TCE or 49% by 2030; falling to 0.5 billion TCE or 12% by 2060
Power generation	<ul style="list-style-type: none"> Non-fossil energy more than 90% by 2050 Renewable 73% by 2050 Solar and wind 60% by 2050 Nuclear 18% by 2050 	<ul style="list-style-type: none"> Non-fossil energy more than 90% by 2050 Renewable 74% by 2050 Solar and wind 62% by 2050 Nuclear 16% by 2050 	<ul style="list-style-type: none"> Non-fossil energy 50% by 2030 and more than 90% by 2050 Renewable 42% by 2030 and 81% by 2050 Solar and wind 28% by 2030 and 64% by 2050 Nuclear 4% by 2030 and 9% by 2050 Coal 50% by 2030 and 8% (largely with CCUS) by 2050 	<ul style="list-style-type: none"> Non-fossil energy 56% by 2030 and 81% by 2050 Renewable 45% by 2030 and 70% by 2050 Solar and wind 27% by 2030 and 51% by 2050 Nuclear 11% by 2030 and 12% by 2050 Coal 40% by 2030 and 12% (largely with CCUS) by 2050. 	<ul style="list-style-type: none"> Solar and wind power 28% by 2030, 59% by 2050 and 87.1% by 2060 	<ul style="list-style-type: none"> Non-fossil energy increasing from 32% in 2020 to 49% by 2030 and 93% by 2060 Renewables increasing from 12% in 2020 to 42% by 2030 and more than 80% by 2060 Solar PV increasing from 4% in 2020 to 45% by 2060 Nuclear increasing from 5% in 2020 to 10% by 2060 Coal declining from over 60% today to 45% in 2030 and 5% in 2060
CCUS	<ul style="list-style-type: none"> 0.5 GtCO₂ annually by 2050 	<ul style="list-style-type: none"> 0.9 GtCO₂ annually by 2050 	<ul style="list-style-type: none"> 1.0 GtCO₂ annually by 2050 	<ul style="list-style-type: none"> Applied to all residual fossil energy use by 2060 	<ul style="list-style-type: none"> 0.42 GtCO₂ by 2060 	<ul style="list-style-type: none"> Applied to all residual energy-related CO₂ emissions by 2060
Carbon sink	<ul style="list-style-type: none"> 0.7 GtCO₂ by 2050 	<ul style="list-style-type: none"> 0.8 GtCO₂ annually by 2050 	<ul style="list-style-type: none"> 1.7 GtCO₂ annually by 2050 	<ul style="list-style-type: none"> 1.5 GtCO₂ annually by 2060 	<ul style="list-style-type: none"> 0.8 GtCO₂ by 2060 	<ul style="list-style-type: none"> N.A.
Electrification rate in end-use sectors	<ul style="list-style-type: none"> More than 55% by 2050 	<ul style="list-style-type: none"> 65% by 2050 	<ul style="list-style-type: none"> 30% by 2030 	<ul style="list-style-type: none"> 60% by 2050 	<ul style="list-style-type: none"> Increasing from current 27.7% to 52% by 2050 and 57% by 2060 	<ul style="list-style-type: none"> Over 50% by 2060
Annual average GDP growth, 2020-2050 (%)	<ul style="list-style-type: none"> 4.2 	<ul style="list-style-type: none"> 4.2 	<ul style="list-style-type: none"> 4.5 	<ul style="list-style-type: none"> 4.4 	<ul style="list-style-type: none"> N.A. 	<ul style="list-style-type: none"> N.A.
Population (billion)	<ul style="list-style-type: none"> 1.33 	<ul style="list-style-type: none"> 1.33 	<ul style="list-style-type: none"> N.A. 	<ul style="list-style-type: none"> 1.4 by 2060 	<ul style="list-style-type: none"> N.A. 	<ul style="list-style-type: none"> N.A.
Total energy investment (both supply and demand sides)	<ul style="list-style-type: none"> Annual average in 2020-2050: \$0.51 trillion (1.7% of GDP) 	<ul style="list-style-type: none"> Annual average in 2020-2050: \$0.71 trillion (2.4% of GDP) 	<ul style="list-style-type: none"> N.A. 	<ul style="list-style-type: none"> N.A. 	<ul style="list-style-type: none"> N.A. 	<ul style="list-style-type: none"> Annual: \$0.64 trillion (1.6% of GDP) in 2030 and \$0.9 trillion (1.1% of GDP) by 2060

Sources: Author's derivation on the basis of the following studies: (i) *China's Long-Term Low-Carbon Development Strategy and Transformation Pathways*, produced by the Institute of Climate Change and Sustainable Development of Tsinghua University (ICCD 2020); (ii) *Accelerating the Net-Zero Transition: Strategic Action for China's 14th Five-Year Plan*, prepared by the World Resources Institute China (WRI 2020); (iii) *China's Energy and Electricity Outlook 2020*, published by the Energy Research Institute of China State Grid (ERICSG 2020); (iv) *Investment Allocation under Carbon Neutrality* by Sinolink Securities (Sinolink 2021); and (v) *An Energy Sector Roadmap to Carbon Neutrality in China* (IEA: 2021b).

Table 3.4: Key grippers for achieving carbon neutrality in China

Key grippers			Mitigation potential
Reducing energy demand by end-use sectors	Upgrading economic structure	<ul style="list-style-type: none"> Developing high-tech and new industries Expanding modern services Eliminating excess capacities and increasing the scale economy Transition to a knowledge economy 	51%
	Energy conservation and efficiency improvement	<ul style="list-style-type: none"> Industry: improving energy efficiency of industrial equipment and processes, improved utilization of waste heat and pressure, and digitization Transport: investing in public transport, replacing traditional vehicles with electric vehicles, improving energy efficiency of transport equipment, and developing smart transport systems Building: improving energy efficiency of heating and aircon systems and improving building insulation 	
	Electrification in all end-use sectors	<ul style="list-style-type: none"> Heating systems for building Heat and steam generation in industrial processes Shifting to electric vehicles. 	
	Circular economy	<ul style="list-style-type: none"> Recycling materials 	
Optimizing energy supply	Decarbonizing the power sector	<ul style="list-style-type: none"> Expanding low- and zero-carbon and renewable power generation capacities, especially solar and wind power Improving the flexibility, stability, and safety of power systems by developing smart grids, digitization, and artificial intelligence technologies Developing efficient batteries and power storage technologies 	21%
	Developing hydrogen and promoting its use	<ul style="list-style-type: none"> Power generation Transport: cars, ships, and airplanes Heating and steam generation Steel-making 	
CCUS		<ul style="list-style-type: none"> Carbon capture, use and storage 	3%
Carbon sink		<ul style="list-style-type: none"> Stopping deforestation Reforestation Afforestation 	24%

Source: Sinolink Securities. 2021. *Investment Allocation under Carbon Neutrality*. https://pdf.dfcfw.com/pdf/H3_AP202103081469727203_1.pdf?1615227593000.pdf.



3.4.3. China's policy options to achieve the dual carbon goals

Policy options

While China achieving the dual carbon goals is critical for the global fight against climate change and for itself to pursue high-quality development and lead global green growth, the country faces tremendous challenges in working towards these goals.

Firstly, China is still a developing country and, in 2020, its per capita GDP was only 27.7% of the Organization for Economic Co-operation and Development's level and 16.5% of that of the US. It needs continued strong growth to improve living standards of its large population and narrow income gaps with the developed world. This makes it extremely difficult for China to reduce total energy consumption—the largest source of emissions, especially as in per capita terms, China's energy consumption and GHG emissions are still much lower than the developed world averages.⁶

Secondly, the time span from carbon peak to carbon neutrality proposed by China is significantly shorter than that of developed countries. For example, Germany, France, Britain and other European countries peaked GHG emissions in the 1970s and they have pledged to become carbon neutral by 2050, leaving them as long as 70 years for low-carbon transition in their economies and societies. Even in the US, the GHG emissions which peaked around 2005 will still have about 45 years to obtain carbon neutrality by the middle of this century. China is left with only about 30 years from striving to reach carbon peak to realizing its vision of carbon neutrality. This requires China to promote low-carbon transformation in energy, industry, cities and infrastructure, and land management in an unprecedented speed.

Thirdly, there are significant uncertainties over the availability of new energy technologies in the future. As mentioned earlier, globally, almost half of the emission reductions will have to be achieved by deploying technologies that are currently still at the demonstration or prototype phase, such as hydrogen, CCUS and carbon dioxide removal technologies, more advanced efficient batteries and electricity storage, and more efficient solar, wind, and nuclear power. China will have to make significant efforts in innovation to bring these new technologies to market on time.

To ensure that enterprises, households, and governments at all levels will actively pursue the dual carbon goals, the technical solutions highlighted earlier will have to be supported by strong policy actions. At a broad level, continued structural transformation, by shifting resources from labor-intensive production to technology- and knowledge-intensive production, by developing new and high-tech industries and modern services, and by moving up the value chains in all sectors, supported by research and development and innovation efforts, will go a long way towards reducing carbon emissions. This broad development strategy

⁶ According to OurWorldinData, in 2019, China's per capita fossil energy consumption and per capita CO₂ emission were 35% and 44% of the respective US levels.

needs be implemented in tandem with the following policy actions specifically targeted at the dual carbon goals:

- *Developing roadmaps to carbon peaking and neutrality.* Achieving the dual carbon goals requires developing a roadmap. The roadmap should break down overall emission reduction targets to sectors (power, transport, industries, and building), localities (provinces, regions and cities), and large firms. It should involve identifying sources of emissions, accurately measuring emissions, proposing mitigation options, setting verifiable performance indicators with timelines for implementation, and putting in place a monitoring, reporting and verification (MRV) system. The roadmap should identify priorities in the short-term and for the long-term, and strike a balance between the needs for emission reduction and ensuring energy and economic security. Localities at various levels should be encouraged to develop local roadmaps for low-carbon and green growth. Importantly, the roadmap should be integrated into China's medium- and long-term national development strategy.
- *Putting in place effective regulation.* Regulation may range from emission limits for power plants and standards for vehicles to energy efficiency requirements for industrial processes, buildings and household appliances. In some energy-intensive production processes, China's energy efficiency has reached internationally advanced levels, such as in thermal power generation, copper smelting, and plate glass-making. But in many others, its energy efficiency is still much lower, such as in coal mining, oil and gas extraction, steel-making, oil-refining, and in the production of many chemical products, paper, and building materials including cement (EFC 2019). Part of the reasons

for the lower efficiency is that China has a much smaller establishment size for many of these production processes than those for the world's advanced levels. Hence, regulation should also encourage increasing the establishment size for energy-intensive production to gain from the scale economy.⁷ Effective regulation requires strict enforcement with penalties for violations too.

- *Introducing strong economic incentives for emission reduction and green transition.* Economic incentives for emission reduction can include financial subsidies for investments in renewables, emission taxes and charges, and elimination of market distortions in fossil energy prices. One source of the market distortions is general fossil fuel subsidies. Although China has significantly reduced fossil fuel subsidies in the past 20 years, according to IEA estimation, these still amounted to \$25.5 billion in 2020, equivalent to 0.2% of GDP (IEA n.d.). General fossil fuel subsidies work against energy saving and conservation and weaken incentives for climate mitigation actions. Hence, they should be reduced or eventually eliminated. Target subsidies can be introduced to protect vulnerable groups.
- *Expanding the role of carbon pricing and trading.* China's launch of the national emissions trading system in July 2021 after a decade of planning and trials is a significant step to meeting the dual carbon goals. To realize its full potential, over time, China should (i) expand the coverage of carbon trading from the power sector only to emission-intensive industries such as steel and iron, cement, and chemicals; (ii) tighten emission caps and make the carbon price more in line with the dual carbon goals (Box 3.3); (iii) introduce auctions in allocating emission permits and reduce free

⁷ In 2018, China had 1000 blast furnace each with annual production of 0.771 million tons of iron, while Japan had 25 blast furnace each with annual production of 3.09 million tons of iron; China had 345 oil refineries each with an annual processing capacity of 2.42 million tons of oil, while South Korea had 6 oil refineries each with an annual processing capacity of 24.7 million tons of oil; China had 2,657 paper-making establishments each with annual production of 44,000 tons of paper and cardboard, while the average annual production per establishment for the developed countries was 0.3 million tons. See Energy Foundation China, 2019.

allowances; (iv) put in place mechanisms for risk management, enhanced liquidity, and price stability, including carbon futures and derivatives; and (v) strengthen the MVR system to ensure market integrity, with severe penalties for non-compliance and fraudulent acts. China can also explore the possibility of linking its carbon market with those of other countries based on the consideration of both benefits and costs. In sectors where the carbon market is not practical, such as transport, a carbon tax or charges can be applied.

- *Investment in green infrastructure and technology.* Realizing the vision of carbon neutrality requires large-scale investment in new low-emission infrastructure, ranging from non-fossil and renewable energy generation capacities, advanced power storage, hydrogen, CCUS technologies, to ultra-high voltage transmission networks and smart grids, more efficient electric vehicles, electricity charging poles, and zero-carbon and energy-efficient buildings. According to Energy Foundation China (2019), under the 1.5°C scenario, China's annual low-carbon investment needs will reach \$330 billion by 2035, more than double the 2015 level, and \$420 billion by 2050. Meanwhile, according to ICCSD (2020), total energy sector investment will be \$510 billion (CNY3.3 trillion) or 1.7% of GDP annually on average over the period of 2020-2050 under the 2°C pathway, and \$701 billion (CNY4.6 trillion) or 2.4% of GDP annually under the 1.5°C pathway (Figure 3.9).

o In the case of installed solar and wind power generation capacity, China is now targeting at reaching more than 1,200 gigawatts by 2030, an increase of 66.4 gigawatts each year on average from 2020. According to ICCSD (2020), to achieve the dual carbon goals, China's installed solar and wind power

generation capacity needs to increase from 536 gigawatts (26% of the total installed power generation capacity) in 2020 to 5,100 gigawatts (about 80% of the total) under the 1.5°C pathway, an increase of about 150 gigawatts per annum on average.⁹

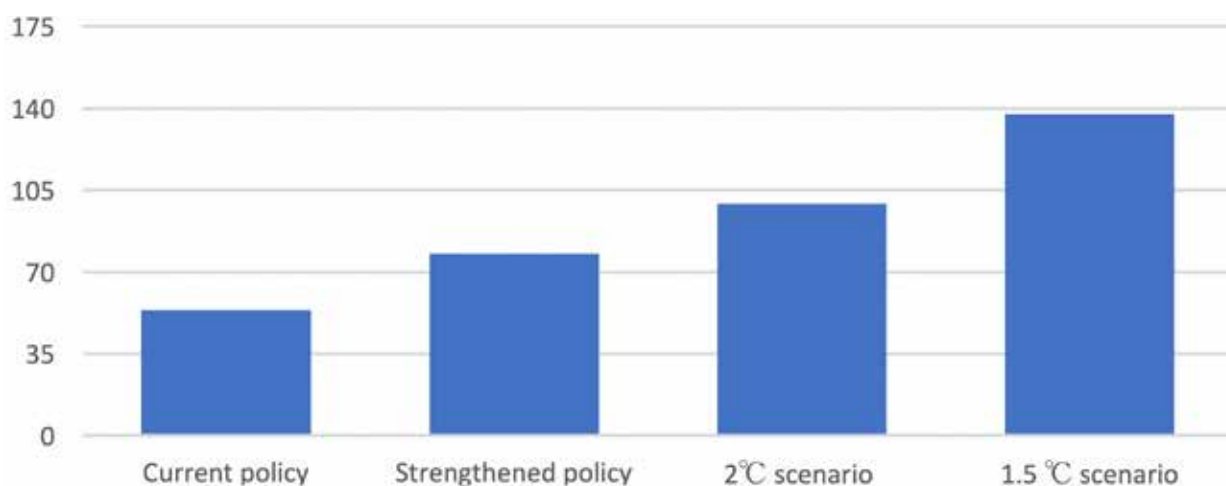
- *Green financing.* Large investment requirements to achieve carbon neutrality will bring the challenge of ensuring adequate funding. Public sector finance will not be sufficient, and it is vitally important that a large amount of private sector finance be channeled into green and low-carbon investment. In this regard, it is important for China to keep the momentum to develop green finance (see Chapter Two of this report).
- *Public awareness campaigns.* Achieving carbon peaking and neutrality and transition to green and low-carbon development require participation of the entire population. Actions such as raising the thermostat on air conditioners one degree higher, replacing old incandescent bulbs with compact fluorescent bulbs, choosing public transportation instead of private cars, and material recycling, to mention a few, are easy steps anyone can take but have an important role to play in climate mitigation. Investing in public awareness campaigns to promote energy savings and natural resources conservation including education and training has high payoffs in improving energy efficiency and reducing carbon emissions.
- *International cooperation.* To promote its own high-quality economic development as well as to lead the global green and low-carbon development, China should actively engage in international cooperation, for instance, by facilitating the building of a global consensus on the urgency to take climate actions; making fair contributions

⁹ Between 2019 and 2020, China's combined installed solar and wind power generation capacities increased by 122 gigawatts.

to global climate mitigation; supporting research and development and innovation related to green technologies and promoting cross-country knowledge and technology transfers; supporting research on climate science and economics;

supporting global climate initiatives in areas such as funding, investment, data collection and disclosure; and providing funding support for low income countries in climate mitigation and adaptation, including those along the Belt-and-Road.

Figure 3.9: China’s cumulative energy sector investment needs, CNY trillion (2015 prices), 2020-2050



Source: Institute for Climate Change and Sustainable Development. 2020. *Comprehensive Report on China’s Long-Term Low-Carbon Development Strategy and Transformation Path*. Tsinghua University, 2020.

Box 3.3: The carbon price in China

On 3 September 2021, the carbon price (per ton of emission permit) in China’s national emissions trading system stood at CNY44.7 or \$6.93. Globally, the carbon price varies significantly across countries—in early April 2021, for instance, it ranged from \$1.18 in Kazakhstan, \$15.89 in South Korea, and \$17.94 in California in the US to \$25.76 in New Zealand, \$31.83 in Canada (the federal OBPS), and \$49.78 in the EU. The carbon price in a country will also differ substantially over time. In the case of the EU ETS, the carbon price increased from close to zero in 2007 to about \$74 in early September 2021, as the bloc continues to increase its mitigation ambition and improve the design of the ETS.

The carbon price is determined by demand and supply in a carbon market. The supply of emission permits is determined by the cap on emissions, which is in turn decided by climate mitigation ambitions and policies. The demand is determined by the marginal abatement cost, which is affected by available emission reduction technologies and economic conditions (such as output growth, inflation and the interest rate). Where emission permits can be carried forward over time, the carbon price will be influenced by price expectations. And when a carbon market is linked with other markets, the carbon price will be affected by supply and demand in the other carbon markets too.

In a frictionless world, a uniform global carbon price could minimize global costs of climate mitigation by equating the marginal costs of abatement across countries. A survey of empirical studies, highlighted in IPCC (2018), suggests that under the 2°C pathway, such price (per tCO₂e) could range from \$15 to \$220 in 2030, from \$45 to \$1,050 in 2050, and from \$120 to \$1,100 in 2070 (all in 2010 constant dollar); under the 1.5°C pathway, the price would be higher (IPCC 2018). A Carbon Pricing Leadership Coalition report (2017), based on evidence from industry, policy experience, and relevant literature and taking into account the strengths and limitations of the respective information source, suggests smaller price ranges. According to this report, in a supportive policy environment, the explicit carbon-price level consistent with the Paris temperature target is at least US\$40–80/tCO₂e by 2020 and US\$50–100/tCO₂e by 2030.

The wide range of the predicted global carbon price is due to many factors, among others, projection methodologies, projected energy demand and prices, assumptions on technologies, socio-economic conditions, and policy assumptions. While a uniform global carbon price is efficient, it is not equitable, as it does not consider differential mitigation responsibility across countries. Addressing the equity issue requires making financial transfers from countries with large responsibilities (mainly developed countries) to those with smaller responsibilities (mainly developing countries). But such transfers require delicate international negotiations and may not be feasible any time soon—although there have been efforts to design a scheme for international cooperation in carbon pricing that is more likely to be agreed upon, for instance, by setting differentiated price floors for a small number of large emitting countries (IMF 2021). Therefore, for the foreseeable future, carbon markets will be country-based or region-based when a group of countries with similar circumstances agree to jointly set up a common trading system, an example being the EU ETS. Nevertheless, the estimated global carbon prices show how

carbon prices around the world could evolve over time.

There are a number of sources that provide projections on China's future carbon prices, with some based on market surveys and some based on marginal abatement cost estimates generated from assessment models. In the Box Table 3.1, the projected carbon price for China is in a narrow range of \$13–\$24.6/tCO₂e for 2030. However, the carbon price projection for 2050 differs significantly between the market-based survey, at \$25.7/tCO₂, and model-based estimates, at \$115–\$210/tCO₂e. Notably, the projected carbon price for 2030 is at the low-end of the global price range reported in IPCC (2018), reflecting the fact the key focus of the coming decade for China is to peak carbon emissions and many available mitigation options have relatively low costs (such as energy conservation and efficiency improvement). The model-based carbon price projections for 2050 are more in line with the global price range reported in IPCC (2018), suggesting that after 2030, as China moves into the deep decarbonization phase, mitigation options will become more and more costly.

It is difficult to predict the precise levels of the carbon price in China in the coming years and decades, as it will depend on many uncertain factors as discussed earlier. What is certain, however, is that the carbon price will have to increase significantly from the current low level if China is to achieve carbon neutrality in a cost-effective way. This would require tightening caps on emissions in line with the dual carbon goals gradually. China can also improve the design of carbon market over time, including expanding the coverage to emission-intensive industries, introducing auctions in allocating emission permits, putting in place mechanisms for risk management, enhanced liquidity, and price stability, including carbon futures and derivatives; strengthen the monitoring, reporting and verification (MRV) system; and explore the possibility of linking with other carbon markets.

Box Table 3.1: Selected projections of China’s future carbon price per ton of CO₂e

	Methodology	2030	2050	2060
CCF (2020)	Market-based	CNY93 (\$14.3)	CNY167 (\$25.7)	n.a.
Refinitiv (2021)	Market-based	CNY160 (\$24.6)	n.a.	n.a.
ICCSA (2020)	Model-based	CNY126 (\$19.4)	CNY1,364 (\$210)	n.a.
Zhang (2020)	Model-based	\$13	\$115	\$327

Note: Slater, et.al. (2020) and Refinitiv (2021) refer to market prices and CNY is converted to \$ at CNY6.5/\$; ICCSD (2020) refers to the 2011 constant price and CNY is converted to \$ at CNY6.5/\$; and Zhang (2020) refers to 2011 constant \$.

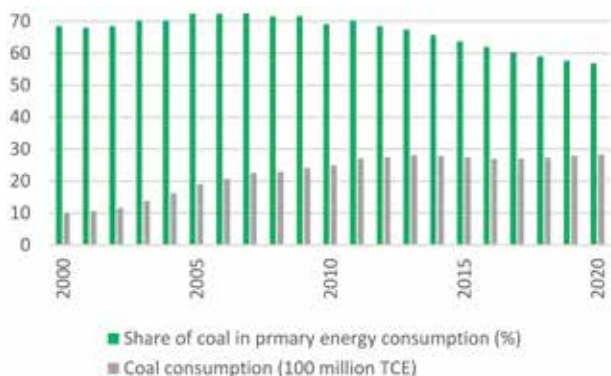
Sources: Institute of Climate Change and Sustainable Development (ICCSA). 2020. Comprehensive Report on China’s Long-Term Low-Carbon Development Strategy and Transformation path. Tsinghua University; Refinitiv. 2021. China’s National Carbon Market Exceed Expectations. <https://www.refinitiv.com/perspectives/future-of-investing-trading/chinas-national-carbon-market-exceeds-expectations/>; Slater, et.al. 2020 China Carbon Pricing Survey. China Carbon Forum. Beijing <http://www.chinacarbon.info/wp-content/uploads/2020/12/2020-CCPS-EN.pdf>; Zhang, Xiliang. 2020. Low-carbon Energy Transition Scenarios Under the 2060 Carbon Medium Target. Institute of Energy, Environment, and Economy, Tsinghua University. <http://www.csee.org.cn/pic/u/cms/www/202102/0215054225qp.pdf>.

Managing the challenge of reducing and phasing-out of coal

A critical issue for China is when to peak carbon emissions before 2030. On one hand, because of the inertia in the energy system and the economy, it is difficult to peak the emissions immediately without slowing down economic growth. On the other hand, peaking the emissions too late will lead to “locking in emissions” and significantly increase the cost of achieving carbon neutrality later. The key to peaking the emissions is to control coal in primary energy consumption and

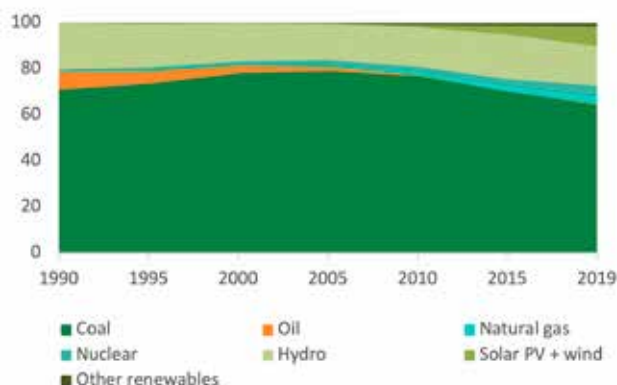
power generation. China’s share of coal in primary energy consumption fell from 70.2% in 2010 to 56.8% in 2020, by 1.34 percentage point per year (Figure 3.10); and in power generation, it declined from 77% to 64.6% during 2010-2019, by about 1.38 percentage point per year (Figure 3.11). At these paces, by 2030, China’s share of coal in primary energy consumption can be reduced to 44% and in power generation to 49%. These are more or less in line with the needed energy system transformations highlighted by the studies reviewed in this chapter in order to achieve the dual carbon goals.

Figure 3.10: Coal in China’s primary energy consumption



Sources: China’s National Statistical Bureau. *Statistical Yearbook 2019*; and Statistical Communiqué of the People’s Republic of China on the National Economic and Social Development for 2018, 2019 and 2020.

Figure 3.11: Energy sources of China’s power generation (%)



Source: International Energy Agency. Data and Statistics. <https://www.iea.org/data-and-statistics>.

However, China’s coal consumption in absolute level reached 2.83 billion TCE in 2020. To ensure that it can be reduced to a level in line with the needed energy system transformation by 2030, China will have to strictly control its growth from now onwards. The largest user of coal in China is the power sector. China recently announced that it will strictly control coal-fired power plant projects, strictly regulate growth of coal consumption during the 14th Five-Year Plan period, and gradually reduce coal consumption during the 15th Five-Year Plan period (NDRC 2021). It will also discontinue investment in coal-fired power plants overseas. These clearly show China’s determination to pursue green and low-carbon growth. However, reducing and phasing out coal will not be easy and can be painful at time, as the recent power shortages experienced by

many provinces in China show (although these are not entirely due to mitigation actions).

Despite the challenges China faces (Box 3.4), reducing and phasing out coal is critical to achieving the dual carbon goals. It is an essential part of the global actions needed to achieve the climate goal of the Paris Agreement of which China is a signatory. Reducing and phasing out coal and more broadly achieving the dual carbon goals will bring significant benefits to China that will far exceed costs. It will reduce pollution, foster a green environment, improve the quality and sustainability of economic growth, and raise the quality of life for the Chinese people. It is an inevitable step towards realizing the vision of “Beautiful China”. It also presents an opportunity for China to lead the global green development.

Box 3.4: Challenges in reducing and phasing out coal in China

China faces tremendous challenges in reducing and phasing out coal consumption domestically:

First, coal is China’s largest source of energy at present: it accounted for 56.8% of the total primary energy consumption in 2020 and

64.6% of power generation in 2019. China is only left with 40 years to reduce coal in primary energy consumption to 5% or less in order to achieve its carbon neutrality target. No country in history has ever managed to make such a rapid energy transition. The fact that China needs to continue its strong

economic growth to narrow down the income gap with developed countries and that it requires cost-effective and secured energy supply make the energy transition even more challenging.

Second, China's dependence on coal is largely due to its energy reserves. Coal accounts for more than 90% of the country's verified fossil fuel energy reserves (Naiqian 2019). Rich in coal and poor in oil and gas is China's energy reserve endowment, making coal the most economical and reliable energy source. Switching from coal to alternative energies will incur large costs for producers and consumers, also raise economic and energy security issues, and require careful planning and strong policy interventions.

Third, while China is leading the world in developing renewables for power generation, accommodating high penetration of intermittent electricity from wind and solar requires substantial grid management, including maintaining sufficient amount of reliable baseload generation capacity to complement the intermittent sources (Cui, et al. 2021), which in the case of China means coal⁹. Further, China's geographic location of solar and wind power, mostly in the west and mid-west areas, requires large investment in grid transmission and distribution connecting the economically vibrant coastal areas. While hydrogen and advanced electricity storage may provide alternative solutions, these new technologies are still not yet commercially proven and are subject to high uncertainty.

Fourth, it is estimated that coal contributes more than 15% to China's gross domestic product (Xie, et al. 2012). Although employment at coal power plants is only a small share of total employment, jobs created by coal mining is much larger, especially in

certain regions where local economies and communities are heavily reliant on coal. Further, China's coal fleet is relatively young, compared with the global average. A majority of the existing coal plants in China have operated for less than 15 years and have a long remaining lifetime. Rapid retirement of coal-fired power plants will lead to high levels of stranded assets with significant negative implications for banks' balance sheets and the financial system. Thus, reducing and phasing out coal requires carefully managing the associated economic, social, financial and energy security risks.

Despite these challenges, reducing and phasing out coal is critical and an inevitable step to meeting China's dual carbon goals. It is an essential part of the global actions needed to achieve the climate goal of the Paris Agreement of which China is a signatory. Reducing and phasing out coal and more broadly achieving the dual carbon goals will bring significant co-benefits to China that will far exceed costs. It will reduce pollution, foster a green environment, improve the quality and sustainability of economic growth, and raise the quality of life for the Chinese people.

Reducing and phasing out coal requires the participation by all the stakeholders—enterprises, households, financial institutions, and government agencies at all levels. It should be carried out in an orderly manner and avoid using the campaign-style measures. It requires acting on both supply and demand sides, identifying priority areas, and focusing on energy- and emission-intensive firms. It has to be matched with significantly scaling up investments in renewable and low-carbon energy sources and in green technologies. And it should let market and price signals play a major role in incentivizing voluntary actions.

⁹ China's self-sufficiency rate of high-quality fossil energy is very low. According to the China National Petroleum Corporation, in 2018, its crude oil import dependency stood at 70.9% and gas import dependency at 45.3%.

3.5. Concluding remarks

Climate change is one of the biggest challenges of our times. Increasing droughts, floods, and extreme weather events and rising sea levels have brought suffering to millions of people and caused losses of hundreds of billions of dollars every year worldwide. If no urgent action is taken, the impact of climate change will only intensify, and the poor and low-income people will be the most affected. Encouragingly, the global community is now united to take drastic actions to reduce GHG emissions, with more than 100 countries now committed to achieve carbon neutrality by the mid-century. China's pledge to achieve carbon neutrality before 2060 is a significant boost to the world confidence to win the battle against climate change. Going forward, there are many priorities the world needs to consider and take actions on. This report would like to highlight the following.

The first is to maintain the political momentum towards climate actions. Strong political will is a key guarantee for achieving the carbon neutrality by the mid-century and limiting the global temperature rise to 1.5°C above pre-industrial levels in this century. It is vitally important that there are no policy backtracks, reversals, or slippages, most importantly by major emitting nations, and by others as well. With current NDCs way below what are needed to meet the 1.5°C climate target, an important step for many countries is to increase the level of commitments and make their NDCs more ambitious.

The second is to mobilize adequate finance for low-carbon investment. The investment need is huge to achieve carbon neutrality by the mid-century. The public sector finance alone will not be sufficient. It is critically important to mobilize private capital to low-carbon and green investment. The recent rapid growth of green finance and green bonds is reflecting private investors' strong interest in green investment. However, the current share of green finance in total global finance is still small. To facilitate its development, one priority is for governments around the world to work together to develop uniform international standards for green finance products, adequate market infrastructure for green finance, and conducive environment for green investment (see Chapter 2 of this report). Carbon markets can help channel funding to areas and firms with most needs for low-carbon investment and can also reduce climate mitigation costs and should be developed by more and more countries.

The third is to promote innovation in low-carbon technologies. Effective and efficient low-carbon technologies are a key condition for realizing the vision of carbon neutrality by the mid-century. While there has been rapid progress in recent years in developing low-carbon technologies, it is widely agreed that the current available technologies are not sufficient, and greater advances are needed in areas such as batteries and power storage, solar PV and wind turbines, hydrogen production, smart grid, advanced nuclear power, CCUS and bioenergy with carbon capture, utilization and storage, and electric vehicles. Many technologies, while technically feasible, need to be commercialized on a large scale. In this regard, sound commercial models should be developed for technological innovations.

The fourth is to encourage wide participation in climate actions by general

public. Public participation is one of the key conditions for implementing the Paris Agreement. Climate change affects everyone's life, whether old or young, men or women, and rich or poor, and climate actions are everyone's business. It is critically important to embed energy conservation and emission reductions in everyone's conscious actions. Greater public participation will also help to build political momentum for climate actions. Enhancing public access to information and knowledge on climate change is one important step in promoting public participation. Public access to information also covers the "feedback loops and mechanisms that connect decision-makers, practitioners, and those directly impacted by the adverse impacts of climate change to share their understanding and experience" (UNFCCC n.d.).

The last, but not least, is to strengthen international cooperation on climate actions. Climate change is a global challenge that has no borders and to combat it requires coordinated work by all countries.

International cooperation, in coordinating climate policy, mobilizing climate finance, developing and sharing green technologies, and building capacity for green transition, is critical to meeting the Paris Agreement climate goal. The Paris Agreement has provided a basic framework for international cooperation on climate actions, by devising NDCs following the principle of common but differentiated responsibilities. To ensure the NDC mechanism works effectively, it is very important for advanced countries to provide adequate financial assistance, technology and knowledge transfers, and capacity building to developing countries, especially low-income and lower-middle-income countries, to enable them to take adequate climate actions. The Paris Agreement has envisaged annual funding support from advanced countries for climate mitigation and adaptation in developing countries to reach \$100 billion by 2020 and a higher level by 2025. Developed countries should fulfill their pledges despite the difficulties due to the COVID-19 pandemic.



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IFF Global Finance and Development Report (IFF GFDR) 2021

IFF GFDR aims to provide an annual assessment of global economic trends and prospects, financial development and innovation, and long-term challenges and policy issues, based on cross-country data, with a view to contributing to global policy discussions. The inaugural issue of IFF GFDR contains three chapters. Chapter 1 provides the latest updates on the COVID-19 pandemic and recent global economic development, and assesses the economic outlook, risks, and policy priorities. Chapter 2 focuses on global developments of green finance, and presents results of the Global Green Finance Development Index (GGFDI), jointly developed by International Finance Forum (IFF) and International Institute of Green Finance of Central University of Finance and Economics in China, along with country rankings. Chapter 3 looks at the latest understanding on the actions needed to meet the Paris Agreement climate targets, and reviews selected studies on China's roadmaps to achieve its dual carbon goals.

About the International Finance Forum (IFF)

The IFF is an independent, non-profit, non-governmental international organization founded in Beijing in October 2003, established by financial leaders from more than 20 countries, regions and international organizations including China, the United States, the European Union, and the United Nations. IFF is a long-standing, high-level platform for dialogue and communication, as well as a research network in the financial realm, and has been upgraded to F20 (Finance 20) status. It strives to build the Finance 20 forums through joint efforts. IFF has continuously demonstrated its commitment to be a driving force in economic recovery and prosperity. It will continue to serve as a platform for exchanges among financial and economic leaders and play the role of a strategic think tank for financial diplomacy.



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