



FINANCIAL STABILITY OVERSIGHT COUNCIL

Report on Climate-Related Financial Risk

2021

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Preamble: The Financial Stability Oversight Council and its Consideration of Climate-related Financial Risk

The Financial Stability Oversight Council (FSOC or Council)¹ was established by the Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank Act).² One of the purposes of the Council under the Dodd-Frank Act is to respond to emerging threats to the stability of the U.S. financial system.³ The duties of the Council under the Dodd-Frank Act include monitoring the financial services marketplace in order to identify potential threats to U.S. financial stability; monitoring financial regulatory proposals and developments, and making recommendations in such areas that will enhance the integrity, efficiency, competitiveness, and stability of the U.S. financial markets; facilitating information sharing and coordination among Council member agencies and other federal and state agencies; recommending to the Council member agencies general supervisory priorities and principles reflecting the outcome of discussions among the member agencies; and identifying gaps in regulation that could pose risks to U.S. financial stability.⁴

The Council seeks to identify and address vulnerabilities in the U.S. financial system so that abrupt and unpredictable shocks to economic or financial conditions do not impair the ability of the financial system to provide needed services, including the clearing of payments, the provision of liquidity, and the availability of credit. Vulnerabilities include, for example, excessive leverage, excessive valuations, inadequate liquidity, contagion, or concentration.⁵ Such vulnerabilities have the potential to amplify the effects of adverse shocks as they propagate through the financial system and create systemic risks. Conversely, limiting vulnerabilities makes the financial system more robust and better able to respond when shocks arise.

The Council first discussed climate-related financial risks at its March 2021 meeting, at which members highlighted a broad set of work underway, or beginning, at individual agencies and organizations. The Council views climate-related financial risks as an emerging

1 The Council is composed of ten voting members who head the U.S. Department of the Treasury, the Board of Governors of the Federal Reserve System (Federal Reserve Board or FRB), the Office of the Comptroller of the Currency (OCC), the Consumer Financial Protection Bureau (Bureau or CFPB), the Securities and Exchange Commission (SEC), the Federal Deposit Insurance Corporation (FDIC), the Commodity Futures Trading Commission (CFTC), the Federal Housing Finance Agency (FHFA), and the National Credit Union Administration (NCUA), along with the independent member with insurance expertise, plus five nonvoting members. Two of the nonvoting members head the Office of Financial Research (OFR) and the Federal Insurance Office (FIO). The other three nonvoting members are a state insurance commissioner, a state banking supervisor, and a state securities commissioner designated by their peers.

2 Pub. L. No. 111-203, 124 Stat. 1376.

3 See Dodd-Frank Act section 112(a)(1)(C), 12 U.S.C. § 5322(a)(1)(C).

4 See Dodd-Frank Act section 112(a)(2), 12 U.S.C. § 5322(a)(2).

5 See, e.g., FSOC, *2020 Annual Report*, at <https://home.treasury.gov/system/files/261/FSOC2020AnnualReport.pdf>.

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threat to the financial stability of the United States. By working together, Council members⁶ can accelerate their understanding of climate-related financial risks and take necessary steps to ensure the resilience of the financial system to such risks.

This report is issued in response to the directive in Executive Order 14030, *Climate-Related Financial Risk*, to the Secretary of the Treasury to engage FSOC members on this topic and report on FSOC's activities.⁷

The work of the Council on climate-related financial risks is an important component of the government's efforts to address the potential adverse effects of climate change. Council members will continue their efforts to address climate-related financial risks consistent with their mandates, focusing on the safety and soundness of regulated institutions, the integrity of financial markets, investor and consumer protection, financial stability, and other measures necessary to ensure the resiliency of the financial system to climate-related risks. These efforts will assist the ability of consumers, investors, financial institutions, insurers, and other market participants to make decisions that better reflect future climate-related financial risks. Economic and financial decisions that account for climate-related financial risks contribute to greater stability and resilience to climate risks across the broader economy, and help promote alignment of financing and capital towards a future with lower greenhouse gas emissions.

6 As used in this report, the terms “Council members,” “FSOC members,” and “members” mean either the individual voting and nonvoting members of the FSOC, or the agencies and organizations that these individuals represent, as applicable.

7 Exec. Order No. 14,030, 87 Fed. Reg. 27967 (May 20, 2021), at <https://www.federalregister.gov/documents/2021/05/25/2021-11168/climate-related-financial-risk>.

The Secretary of the Treasury, as the Chair of the Financial Stability Oversight Council (FSOC), shall engage with FSOC members to:

- (iii) issu[e] a report to the President within 180 days of the date of this order on any efforts by FSOC member agencies to integrate consideration of climate-related financial risk in their policies and programs, including a discussion of:
 - (A) the necessity of any actions to enhance climate-related disclosures by regulated entities to mitigate climate-related financial risk to the financial system or assets and a recommended implementation plan for taking those actions;
 - (B) any current approaches to incorporating the consideration of climate-related financial risk into their respective regulatory and supervisory activities and any impediments they faced in adopting those approaches;
 - (C) recommended processes to identify climate-related financial risk to the financial stability of the United States; and
 - (D) any other recommendations on how identified climate-related financial risk can be mitigated, including through new or revised regulatory standards as appropriate.

Executive Summary

Climate change is an emerging threat to the financial stability of the United States. In the United States and across the globe, climate-related impacts in the form of warming temperatures, rising sea levels, droughts, wildfires, intensifying storms, and other climate-related events are already imposing significant costs upon the public and the economy. The United States has made a commitment to lowering U.S. greenhouse gas (GHG) emissions by 50-52 percent from 2005 levels by 2030 and set a goal of a net-zero emissions economy by 2050. While overall U.S. GHG emissions have been trending downwards since 2005,⁸ meeting these targets will require significant changes across the economy. Sectors of the economy that are GHG-intensive, which include the energy, transportation, manufacturing, and agricultural sectors, likely need to undergo significant structural changes. These changes will likely require technological innovations and complementary policy actions that incentivize transitions to low-GHG methods of production. These could include regulation of GHG emissions, tax policies, or other measures that would incentivize or require reductions in GHG emissions. The necessary structural changes are likely to broadly affect households, communities, and businesses.

The impacts of climate change on the U.S. economy and the economic adjustments necessary to reduce GHG emissions present risks, as well as opportunities, to the financial system. It is the responsibility of the Council and its members to ensure the financial system's resiliency to climate-related financial risks.⁹ This report represents an initial review by the Council of current efforts by its members to incorporate climate-related financial risk into their regulatory and supervisory activities, enhance climate-related disclosures, and assess climate-related risks to the financial stability of the United States. FSOC members have accelerated their efforts to consider and address climate-related financial risks over the past year. These efforts include those underway to understand, assess, and manage climate-related risks to the entities or markets within their statutory jurisdiction, as well as assessing implications of climate-related risks for financial stability and identifying measures that can help promote resilience to these risks.

While progress has been made, there is a substantial amount of work yet to be done. The Council recognizes the critical importance of taking prompt action to improve the availability of data and measurement tools, enhance assessments of climate-related financial risks and vulnerabilities, and incorporate climate-related risks into risk management practices and supervisory expectations for regulated entities, where appropriate. In addition, FSOC members should also promote consistent, comparable, and decision-useful disclosures that

8 See Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2019* (April 2021), p. 2-1, at https://www.epa.gov/sites/default/files/2021-04/documents/us-ghg-inventory-2021-main-text.pdf?VersionId=wEy8wQuGrWS8Ef_hSLXHy1kYwKs4.ZaU. (“Overall, net emissions decreased 1.7 percent from 2018 to 2019 and decreased 13.0 percent from 2005 levels,” and the “decline reflects the combined impacts of many long-term trends, including population, economic growth, energy market trends, technological changes including energy efficiency, and carbon intensity of energy fuel choices.”)

9 Climate-related financial risks are risks to the financial system and its participants from the impacts of climate change.

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allow investors and financial institutions to take climate-related financial risks into account in their investment and lending decisions.

Investors, market participants, and regulators need better data and information, including enhanced and transparent disclosures, to assess climate-related financial risks and their potential effects on the financial system. This information will be used to help gauge risks to individual institutions and markets and to financial stability. While a variety of tools are a part of this process, scenario analysis conducted by regulators to measure risk across a broad set of institutions is important. Scenario analysis is a forward-looking projection of risk outcomes that provides a structured approach for considering potential future risks associated with climate change. Experience in other countries suggests that scenario analysis also helps institutions, regulators, and supervisors to identify data and modeling needs.

Through these actions, financial regulators can both promote the resilience of the financial system and help it support an orderly, economy-wide transition toward the goal of net-zero emissions.

The adverse effects of climate change are likely to be disproportionately borne by financially vulnerable communities, including low-income communities, communities of color, and Native-American communities.¹⁰ These communities may also have fewer resources to recover from, or adapt to, adverse impacts. Certain actions to address climate-related financial risks could impact financially vulnerable communities in the form of higher insurance and credit costs or the inability to obtain insurance or credit. The Council acknowledges that addressing the impacts of climate change on disadvantaged communities will require thoughtful and balanced policy responses developed through a coordinated approach involving stakeholders across the public and private sectors.

This report includes recommendations that FSOC and its members can adopt to strengthen the financial system and make it more resilient to climate-related shocks and vulnerabilities, summarized in **Box A**. The recommendations reflect the review and analysis in the report chapters.

Chapter 1: Introduction discusses climate-related financial risks, a framework for how climate risks can increase risks to financial stability, and how the approach of the Council to these issues is aligned with the Council's core mission and statutory responsibilities.

Chapter 2: Regulatory and Supervisory Engagement with Climate-related Financial Risk reviews the work underway across FSOC members on climate-related financial risks and financial stability.

¹⁰ See, e.g., Solomon Hsiang, Robert Kopp, Amir Jina, et al., "Estimating Economic Damage from Climate Change in the United States," *Science* (June 30, 2017), 30;356(6345):1362-1369, doi: 10.1126/science.aa14369; Jeremy Hoffman, Vivek Shandas, and Nicholas Pendleton, "The Effects of Historical Housing Policies on Resident Exposure to Intra-Urban Heat: A Study of 108 US Urban Areas," *Climate* (2020), 8(1), 12; <https://www.science.org/doi/10.1126/science.aa14369>.

Chapter 3: Climate-related Financial Risk—Data and Methods highlights the data and methodological challenges associated with measurement of climate-related financial risks and potential approaches to meeting these challenges.

Chapter 4: Climate-related Disclosures discusses the critical role of consistent, comparable, and decision-useful climate-related disclosures for investors, financial institutions, regulators, and the public in the measurement of climate-related financial risks.

Chapter 5: Implications for Financial Stability Assessments presents key issues for assessments of the effect of climate-related financial risks on financial markets and institutions, emphasizing the need for measurement tools to assess such risks and the important role that scenario analysis can play in the development and deployment of these critical assessments.

Chapter 6: Council Recommendations synthesizes the analysis of the report through a set of recommendations that begin to address the challenges and needs identified throughout the report.

Box A. Council Recommendations

1. Building capacity and expanding efforts to address climate-related financial risks

Recommendation 1.1: The Council will form a new staff-level committee, the Climate-related Financial Risk Committee (CFRC), within 60 days of the publication of this report. The CFRC will identify priority areas for assessing and mitigating climate-related risks to the financial system and serve as a coordinating body, where appropriate, to share information, facilitate the development of common approaches and standards, and facilitate communication across FSOC members and interested parties. The committee will provide updates to the Council at least semi-annually on the status of the Council's and its member's efforts to identify and address climate-related financial risks, including efforts by the Council and its members to incorporate climate-related financial risks into their regulatory and supervisory programs, improve data and methods, enhance climate-related disclosures, and assess climate-related risks to the financial stability of the United States. The Council will include a summary of progress in addressing climate-related financial risks in its Annual Report based on these updates and related information.

Recommendation 1.2: The Council will form a Climate-related Financial Risk Advisory Committee (CFRAC). The advisory committee, reporting to the CFRC, will help the Council gather information on and analysis of climate-related financial risks from a broad array of stakeholders. Members of the CFRAC should be considered for selection from among: climate science experts; non-governmental research institutions; academia; the financial services industry; commercial businesses; consumer, investor, environmental, and labor groups; government agencies with climate expertise; and other stakeholders as appropriate.

Recommendation 1.3: The Council recommends that, consistent with their budget processes and mandates, FSOC members should prioritize internal investments to expand their respective capacities to define, identify, measure, monitor, assess, and report on climate-related financial risks and their effects on financial stability. This should include investments in staffing, training, expertise, data, analytic and modeling methodologies, and monitoring.

Recommendation 1.4: The Council recommends that FSOC members include descriptions of their activities related to climate-related financial risks in their annual reports and consider incorporating climate-related financial risks in relevant risk reports that they publish, as appropriate. Such communication will inform the public about FSOC members' efforts to assess and address these risks within the context of each member's mandate and authority.

Recommendation 1.5: The Council recommends that FSOC members make climate-related data for which they are the custodians freely available to the public, as appropriate and subject to any applicable data confidentiality requirements.

Recommendation 1.6: The Council recommends that its members, where applicable, coordinate the analyses of climate-related financial risks conducted in the supervisory and regulatory functions of their agencies and organizations with their efforts to understand impacts on communities and households. FSOC members should, as applicable, integrate these analyses into the public reports discussed in *Recommendation 1.4*. FSOC members should use the CFRC to share information regarding these efforts, as appropriate.

Recommendation 1.7: The Council recommends that the Federal Insurance Office (FIO) should act expeditiously to analyze the potential for climate change to affect insurance and reinsurance coverage, particularly in regions of the country affected by climate change, in consultation with the States, in a manner consistent with Executive Order 14030.

Recommendation 1.8: The Council recommends that its members, consistent with their mandates and authorities, evaluate climate-related impacts and the impacts of proposed policy solutions on financially vulnerable populations when assessing the impact of climate change on the economy and the financial system.

Recommendation 1.9: The Council recommends that the Treasury Department engage other members of the Financial Literacy and Education Commission (FLEC) to analyze and understand the impact of climate change on the financial well-being of financially vulnerable populations. FSOC members that are also FLEC members should actively participate in this analysis.

2. Filling climate-related data and methodological gaps

Recommendation 2.1: The Council recommends that its members promptly identify and take the appropriate next steps towards ensuring that they have consistent and reliable data to assist in assessing climate-related risks through:

- Identifying the data needed to evaluate the climate-related financial risk exposures of regulated entities and financial markets within the context of each FSOC member's mandate and authorities;
- Performing an internal inventory of currently collected and procured data and its relevance for climate risk assessments; and
- Developing a plan for procuring necessary data through data collection, data sharing arrangements described in *Recommendation 2.2*, and information purchased from data providers or other sources.

Recommendation 2.2: The Council recommends that its members use existing authorities to implement appropriate data- and information-sharing arrangements to facilitate the sharing of climate-related data across FSOC members and non-FSOC member agencies to assess climate-related financial risk, consistent with data confidentiality requirements.

Recommendation 2.3: The Council recommends that FSOC work with its members through the CFRC to coordinate efforts, as appropriate, to address data gaps, including prioritizing data sets and coordinating data acquisition, in order to avoid duplication of effort and facilitate the improvement and coordinated use of data and models across FSOC members.

Recommendation 2.4: The Council recommends that the Office of Financial Research (OFR), in coordination with the CFRC, provide data services—including identifying, hosting, and procuring data—and analytical tools to facilitate members' assessment of climate-related financial risks, including scenario analysis.

Recommendation 2.5: The Council recommends that its members, coordinating through the CFRC, move expeditiously to develop consistent data standards, definitions, and relevant metrics, where possible and appropriate, to facilitate common definitions of climate-related data terms, sharing of data, and analysis and aggregation of data.

Recommendation 2.6: The Council recommends that its members continue to coordinate with their international regulatory counterparts, bilaterally and through international bodies, as they identify and fill data gaps, address data issues, and develop definitions, data standards, metrics, and tools.

3. Enhancing public climate-related disclosures

Recommendation 3.1: The Council recommends that its members review their existing public disclosure requirements and consider, as appropriate, updating them to promote the consistency, comparability, and decision-usefulness of information on climate-related risks and opportunities, consistent with their mandates and authorities.

Recommendation 3.2: The Council recommends that its members, consistent with their mandates and authorities, consider enhancing public reporting requirements for climate-related risks in a manner that builds on the four core elements of the Task Force on Climate-Related Financial Disclosure (TCFD), to the extent consistent with the U.S. regulatory framework and the needs of U.S. regulators and market participants.

Recommendation 3.3: The Council recommends that its members, consistent with their mandates and authorities, evaluate standardizing data formats for public climate disclosures to promote comparability, such as the use of structured data using the same or complementary protocols, where appropriate and practicable.

Recommendation 3.4: The Council understands that information on greenhouse gas (GHG) emissions promotes a better understanding of the exposures of companies and financial institutions to climate-related financial risks. The Council recommends that, consistent with their mandates and authorities, FSOC members issuing requirements for climate-related disclosures consider whether such disclosures should include disclosure of GHG emissions, as appropriate and practicable, to help determine exposure to material climate-related financial risks.

Recommendation 3.5: The Council recommends that its members continue to coordinate with their international regulatory counterparts, bilaterally and through international bodies, as they assess requirements for climate-related disclosures.

Recommendation 3.6: Public Issuer Disclosures—The Securities and Exchange Commission (SEC) staff are developing a proposal on disclosure requirements for public issuers related to climate-related risks for the SEC's consideration. The Council is encouraged by the SEC's work on this critical issue and supports its efforts to consider enhanced climate-related

disclosures to provide investors with information that is consistent, comparable, and decision-useful.

Recommendation 3.7: Banks—The Council recommends that federal banking regulators, consistent with their mandates and authorities, continue to review banks' public regulatory reporting requirements to assess whether enhancements are needed to provide market participants with information on institutions' climate-related financial risks, taking into account a bank's size, complexity, and activities.

Recommendation 3.8: Insurers—The Council supports continued efforts by FIO and insurance regulators to work together to enhance the existing climate-related disclosures for the insurance sector.

Recommendation 3.9: Asset Managers—The SEC staff are evaluating requirements for registered funds and investment advisers related to Environmental, Social, and Governance (ESG) factors, including ESG claims and related disclosures, for the SEC's consideration. The Council is encouraged by the SEC's work on this issue and supports its efforts in this area.

Recommendation 3.10: State and Local Finance—The Council encourages its members to review their authorities to consider how disclosure of climate-related risks related to municipal securities can be enhanced.

Recommendation 3.11: Accounting and Audit Standards—The Council welcomes the work of the International Financial Reporting Standards (IFRS) Foundation Trustees in laying the foundation for the formation of an international sustainability standards board (ISSB) to promote the development of sustainability reporting standards focused on enterprise value creation that could lead to consistent and comparable disclosures that can be used as building blocks across jurisdictions.

4. Assessing and mitigating climate-related risks that could threaten the stability of the financial system

Recommendation 4.1: The Council recommends that its members collaborate with external experts to identify climate forecasts, scenarios, and other tools necessary to better understand the exposure of regulated entities to climate-related risks and how those risks translate into economic and financial impacts.

Recommendation 4.2: FSOC members should continue to coordinate with their international regulatory counterparts, bilaterally and through international bodies, as they assess climate-related financial stability risks.

Recommendation 4.3: The Council recommends that its members use scenario analysis, where appropriate, as a tool for assessing climate-related financial risks, taking into account their supervisory and regulatory mandates and the size, complexity, and activities of regulated entities.

FSOC members may execute this recommendation in a variety of ways, linked to different goals and mandates. Regulators and supervisors can use scenario analysis by regulated entities in evaluations of the risk management processes of regulated entities, taking into account the nature of entities under consideration, as expectations for larger and more complex institutions may be different than expectations for smaller institutions. Scenario analysis of this type can be a building block for assessing the impact of climate-related risks on key sectors of the financial system and the financial system as a whole. Finally, scenario analysis performed by individual firms can contribute to the assessment and disclosure of climate-related financial risks by firms that have significant exposure to climate-related

impacts. To develop and use scenario analysis most effectively to understand the effects of climate-related financial risks on financial stability, Council members will benefit from coordination amongst themselves, external experts, and their international counterparts..

Recommendation 4.4: The Council recommends that its members should, consistent with their mandates and authorities, consider using common scenarios that build on existing work, including scenarios developed by the Network of Central Banks and Supervisors for Greening the Financial System (NGFS) and work at the Financial Stability Board (FSB), as appropriate for the institutions and markets under consideration.

Recommendation 4.5: The Council recommends that, to help inform interagency assessments of the systemwide effects of climate change, the CFRC should serve as a forum for FSOC members to share data and methodologies and leverage the expertise needed to perform scenario analysis and share results.

Recommendation 4.6: FSOC members should continue their efforts to consider the incorporation of climate-related risks into their regulatory and supervisory programs and update those programs as necessary, consistent with their mandates and authorities. As part of this work, they should review regulated entities' efforts to address climate-related risks and clarify or enhance risk management requirements for regulated entities where necessary to promote appropriate consideration of climate-related financial risks.

Recommendation 4.7: FSOC members, consistent with their mandate and authorities, should review existing regulations, guidance, and regulatory reporting relevant to climate-related risks, including credit risks, market risks, counterparty risks, and other financial and operational risks, to assess whether updates are necessary to appropriately address climate-related financial risks.

Recommendation 4.8: FSOC members should evaluate whether additional regulations or guidance specific to climate-related risks is necessary to clarify expectations for regulated or supervised institutions regarding management of climate risks, taking into account an institution's size, complexity, risk profile, and existing enterprise risk management processes.

Recommendation 4.9: FSOC members should continue to coordinate with their international regulatory and supervisory counterparts, bilaterally and through international bodies, as they review their regulatory and supervisory tools to mitigate climate-related financial risks.

Chapter 1: Introduction

Over the past decade, there has been growing attention from financial regulators, business leaders, investors, and policy makers around the world to the threat climate change poses to financial systems and economies at global, national, and local scales. The intensity and frequency of extreme weather and climate-related disaster events are increasing and already imposing substantial economic costs.¹¹ Such costs to the economy are expected to increase further as the cumulative impacts of past and ongoing global emissions continue to drive rising global temperatures and related climate changes, leading to increased climate-related risks to the financial system.

The Council is charged with identifying and responding to risks that pose a threat to the financial stability of the United States. The increasing economic effects of climate change imply that climate-related financial risks are an emerging threat to the financial stability of the United States. The Council and its members have the responsibility to assess the magnitude of these risks and take appropriate measures to ensure the resiliency of the financial system. Current data, measurement tools, and expertise are not sufficient to fully assess these risks, and FSOC members must prioritize efforts to build capacity and expertise to identify, measure, and monitor risks from climate change to the financial sector and financial stability. In addition, the Council and its members must identify and implement necessary policy actions to appropriately address identified risks.

Even with the efforts currently underway and additional steps to accelerate progress, achievement of these goals will take time. This report discusses efforts by the Council and its members to address issues related to data, disclosures, and financial stability assessments. It summarizes current regulatory and supervisory oversight efforts of FSOC members and recommends next steps. Council members recognize that the need for better data and tools cannot justify inaction, as climate-related financial risks will become more acute if not addressed promptly. Council members also acknowledge that regulatory actions must carefully consider and attempt to mitigate potential adverse impacts to households, communities, and businesses, especially financially vulnerable communities.

FSOC member agencies are taking action to address climate-related financial risks within the scope of their mandates and authorities and working to improve the resiliency of the financial system to those risks. However, a key driver of climate change is the failure to account for the externalities associated with GHG emissions, or in other words, the failure of market prices in the economic system to incorporate the social costs of emissions, i.e., the cost of damages

¹¹ See U.S. Global Change Research Program, *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II* (2018), [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA; IPCC, *Climate Change 2021: The Physical Science Basis, Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (August 2021), at https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report.pdf. (The IPCC is the United Nations body for assessing the science related to climate change.)

resulting from GHG emissions.¹² Policy responses by the Administration and Congress also must play an important role in addressing these externalities and reducing emissions to meet the targets the United States has set for reducing GHG emissions. If appropriate policy actions are not taken by U.S. and global policy makers, the risks of both climate-related impacts to the financial system and of a disorderly transition will increase.

Climate Change as a Threat to Financial Stability

There is broad scientific consensus that climate change is driven by GHG emissions caused by human activity. According to the Intergovernmental Panel on Climate Change (IPCC), climate change is impacting every region of the Earth's climate, these impacts are intensifying,¹³ and some of these impacts, such as sea-level rise, are likely to be irreversible.¹⁴ Increasing adverse effects from climate change to households, communities, and businesses will exacerbate climate-related risks to the U.S. and global financial systems if not addressed.

According to the National Oceanic and Atmospheric Administration's (NOAA's) National Centers for Environmental Information (NCEI), 2020 was a "historic year of extremes" for the United States. The year 2020 witnessed 22 billion-dollar-or-greater weather and climate disasters, a record number of such events, which caused a combined \$95 billion in damages.¹⁵ Moreover, the 2020 experience reflected a long-running trend, as the frequency and costs of severe weather-related events have been rising over the last two decades (**Figure 1.1**). This trend reflects the impact of climate change, as well as other factors, such as increased economic development in high-risk areas.

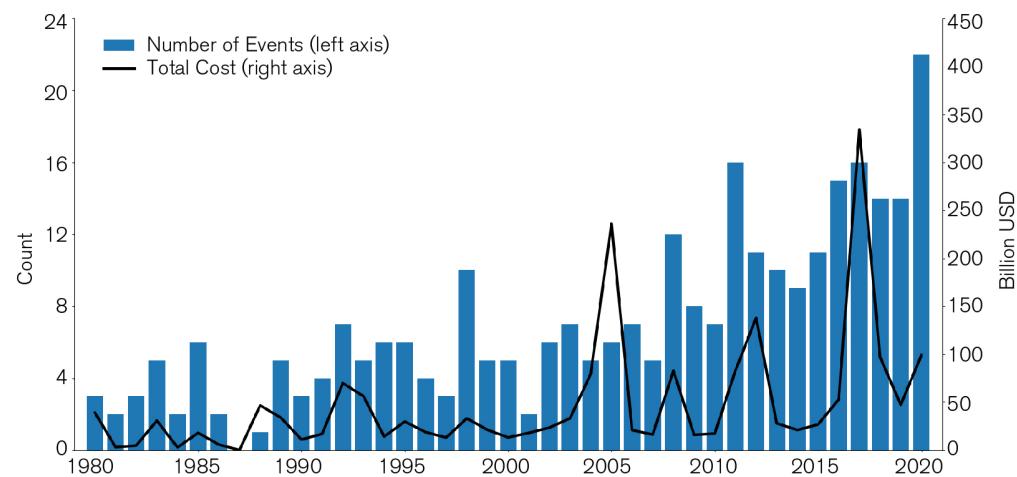
12 See, e.g., EPA, "Economics of Climate Change," at <https://www.epa.gov/environmental-economics/economics-climate-change#regulating>; and Ryan Nunn, Jimmy O'Donnell, Jay Shambaugh, et al., "Ten Facts about the Economics of Climate Change and Climate Policy" (2019), at https://www.brookings.edu/wp-content/uploads/2019/10/Environmental-Facts_WEB.pdf.

13 See IPCC 2021, pp. 10-13.

14 See IPCC 2021, pp. 28-29.

15 NOAA, "Billion-Dollar Weather and Climate Disasters: Overview," at <https://www.ncdc.noaa.gov/billions/>.

Figure 1.1: Billion-dollar Climate and Weather Disaster Events, United States



Note: Event counts and total cost estimates reflect weather and climate disaster events with costs exceeding one billion in CPI-adjusted 2020 dollars.

Source: NOAA NCEI, "Billion-Dollar Weather and Climate Disasters."

An Emerging Consensus Framework for Climate-related Financial Risks

FSOC seeks to identify and respond to vulnerabilities in the U.S. financial system so that abrupt and unpredictable shocks to economic or financial conditions do not impair the ability of the financial system to provide needed services, including the clearing of payments, the provision of liquidity, and the availability of credit.¹⁶ Climate change will likely be a source of shocks to the financial system in the years ahead, and the FSOC and its members will continue to monitor the financial stability implications of such shocks.

Climate-related financial risks can be grouped into two broad categories: physical risks and transition risks.¹⁷

Physical risks refer to the harm to people and property arising from acute, climate-related disaster events such as hurricanes, wildfires, floods, and heatwaves as well as longer-term chronic phenomena such as higher average temperatures, changes in precipitation patterns, sea-level rise, and ocean acidification.

16 FSOC, *2020 Annual Report*, p. 4, at <https://home.treasury.gov/system/files/261/FSOC2020AnnualReport.pdf>.

17 See, e.g., Basel Committee on Banking Supervision, *Climate-related Risk Drivers and Their Transmission Channels* (April 2021), at <https://www.bis.org/bcbs/publ/d517.pdf>; Financial Stability Board, *The Implications of Climate Change for Financial Stability* (November 23, 2020), at <https://www.fsb.org/wp-content/uploads/P231120.pdf>; and Market Risk Advisory Committee of the Commodity Futures Trading Commission, *Managing Climate Risk in the U.S. Financial System* (September 9, 2020), at <https://www.cftc.gov/PressRoom/PressReleases/8234-20>.

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Transition risks refer to stresses to certain institutions or sectors arising from the shifts in policy, consumer and business sentiment, or technologies associated with the changes necessary to limit climate change. One key category of policy changes associated with transition risks are those directed at incentivizing or requiring reductions in GHG emissions. A variety of economic mechanisms, including carbon pricing, taxes or subsidies, or regulation, could be used to lower GHG emissions. For example, a key element of the Administration’s plan to reduce GHG emissions is a Clean Electricity Standard.¹⁸ Such a regulatory mechanism could potentially raise the implicit or shadow price of carbon depending on the stringency of the standard and related incentives, subsidies, or penalties. This can incentivize the transition of GHG-intensive production processes, products, or services to lower-GHG states, facilitating the achievement of climate-related goals while also potentially creating climate-related financial risks.

As the United States and other countries undertake the transition to a less GHG-intensive economy, public policy, adoption of new technologies, and shifting consumer and investor preferences have the potential to impact the allocation of capital in their economies. If these changes occur in a disorderly way owing to substantial delays in action or abrupt changes in policy, their impact on firms, market participants, individuals, and communities is likely to be more sudden and disruptive.

FSOC’s approach to identifying risks and responding to emerging threats to financial stability is well suited to integrating climate-related physical and transition risks because these stresses manifest as traditional risks to financial institutions such as credit risk, liquidity risk, market risk, and operational risk, which have long been the focus of prudential supervision and regulation by FSOC members.

From Framework to Assessment—Critical Steps

The framework used to organize discussion of climate-related financial risks has been developing in recent years and there remain significant challenges to assessments of risks to financial stability from climate change. These challenges reflect the complex transmission channels linking transition and physical risks to the economy and financial sector.

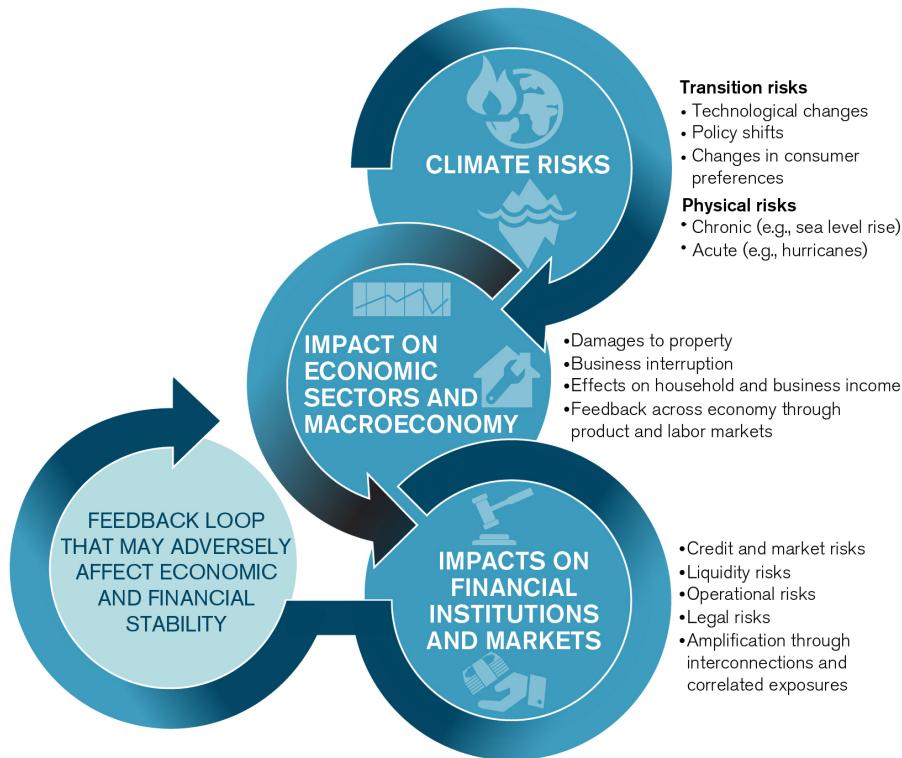
Figure 1.2 outlines the transmission channels from climate-related risks to effects on climate-related financial risks and, potentially, to financial stability. Transition and physical risks associated with climate change will affect households, communities, businesses, and governments—damaging property, impeding business activity, impacting income, and altering the value of assets and liabilities. These shifts may be propagated through interconnections throughout the economy and financial system. As a result, the financial sector may experience credit and market risks associated with loss of income, defaults and changes in the values of assets, liquidity risks associated with changing demand for liquidity, operational risks associated with disruptions to infrastructure or other channels, or legal risks.

¹⁸ The White House, “FACT SHEET: The Bipartisan Infrastructure Investment and Jobs Act Advances President Biden’s Climate Agenda” (August 5, 2021), at <https://www.whitehouse.gov/briefing-room/statements-releases/2021/08/05/fact-sheet-the-bipartisan-infrastructure-investment-and-jobs-act-advances-president-bidens-climate-agenda/>.

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Each of these dangers may lead financial institutions to pull back from credit provision or other financial services, potentially amplifying the initial climate-related shock and harming financial stability.

Figure 1.2: Transmission Channels Linking Climate Risks to Financial Stability



Source: Figure created by FSOC.

Given these complex transmission channels, the assessment of climate-related financial risks involves a series of steps.

- **Defining the climate change risks and how they may affect the financial sector:** Changes in policy, technology, and the behaviors of households, businesses, and governments will be required to reduce GHG emissions and place the economy on a sustainable path. These transitions—especially if delayed or uneven in application and therefore requiring more abrupt economic shifts—may lead to sharp changes in the values of certain assets or liabilities, impacting nonfinancial activity and the financial sector. At the same time, changes in the climate driven by past and prospective GHG emissions will likely lead to more frequent and extreme severe weather events and climate-related disasters, including droughts, wildfires, floods, and elevated windspeed. Such increased acute physical risks will be accompanied by a higher level of chronic physical risks, such as those associated with sea-level rise.
- **Quantifying the effect of climate risks on economic activity:** Climate science and economic analysis must be applied in concert to quantify how climate shifts will drive the physical risks that impact the economy. The size and speed of

climate change and related transitions, the associated scope of potential policy and technological shifts, and the impact of these shifts on economic sectors are all important factors for quantifying the range of transition risks that may impact economic sectors and the broader economy.

- **Evaluating the links between economic impacts and financial risks:** In order to accurately measure credit, liquidity, and other risks to financial institutions or sectors, quantified economic impacts of transition and physical risks must be linked to changes in the values of financial sector assets and liabilities. Many of these linkages may be familiar—for example, links between losses in income and credit losses may follow patterns used in financial modeling. However, the dynamic patterns of the economic impacts of climate risks may differ sizably from those of typical business cycle shocks, requiring development of new modeling approaches. Other risks, such as certain operational and legal risks, may be more difficult to quantify, necessitating a qualitative evaluation.
- **Assessing financial stability:** Finally, there are significant challenges to combining individual institution or market assessments or to executing systemwide approaches to form an assessment of financial stability. As in other such exercises, the assessment would have to consider the potential for an adverse feedback loop between financial stress at institutions and markets and economic activity.

Currently, methods to quantify each of these steps are under development.¹⁹ For example, the Financial Stability Board (FSB) has developed a roadmap laying out the disclosure standards, data, and measurement tools that need to be developed to support systematic ongoing monitoring.²⁰ An overview of the FSB’s work on climate-related financial risks, and that of other international organizations and standard-setting bodies, is provided in **Box B**.

Box B. Overview of International Work on Climate-related Financial Risk

Given the global, cross-border nature of climate change and associated financial risks, significant work is currently underway at international organizations and standard-setting bodies (SSBs) to address climate-related financial risks. As outlined below, U.S. financial regulators continue to play a vital role in these various international workstreams.

Financial Stability Board (FSB)

The FSB promotes international financial stability through coordination of national financial authorities and international standard-setting bodies as they work toward developing regulatory, supervisory, and other financial sector policies. The FSB has 73 members, including finance ministries, central banks, supervisors, and market regulators across 25 jurisdictions as well as four international financial institutions and six international standard-setting,

¹⁹ This sequence of steps, with slight differences in emphasis, is familiar from other descriptions of climate scenario analysis by financial regulators. See BCBS 2021, *Climate-related Risk Drivers and Their Transmission Channels*.

²⁰ FSB, *FSB Roadmap for Addressing Climate-related Financial Risks* (July 7, 2021), at <https://www.fsb.org/wp-content/uploads/P070721-2.pdf>.

regulatory, supervisory, and central bank bodies. U.S. members include the FRB, the SEC, and the Treasury Department. The FSB's *Roadmap for Addressing Climate-related Financial Risks* identifies priority work on disclosures, data, vulnerability analysis, and supervisory and regulatory approaches. This work is being implemented across the FSB, SSBs, International Monetary Fund (IMF), World Bank, Organization for Economic Cooperation and Development (OECD), and the Network of Central Banks and Supervisors for Greening the Financial System (NGFS). The FSB will help coordinate work identified in the Roadmap and report annually on progress to the G20.

Basel Committee on Banking Supervision (BCBS)

The BCBS is the primary global standard-setter for the prudential regulation of banks and provides a forum for regular cooperation on banking supervisory matters among its 45 members across 28 jurisdictions. U.S. membership includes the FRB, the Federal Reserve Bank of New York (FRBNY), the OCC, and the FDIC. In February 2020, the BCBS established its Task Force on Climate-related Financial Risks (TFCR), which is charged with contributing to the BCBS' mandate of enhancing global financial stability by identifying effective supervisory practices to mitigate climate-related financial risks.

International Organization of Securities Commissions (IOSCO)

IOSCO serves as the international standard-setting body for securities and futures market regulators and includes the SEC and CFTC as U.S. members. IOSCO established a Sustainable Finance Task Force (STF) in 2020 with a mandate to address transparency and promote investor protection in relation to sustainability issues—two high-priority areas identified by the organization's Sustainable Finance Network (SFN), which serves as a forum for members to exchange experiences and gain a better understanding of sustainability issues through structured discussions. In particular, the STF has been focused on improving sustainability-related disclosures by issuers and asset managers and providing decision-useful information for investors.

International Association of Insurance Supervisors (IAIS)

The IAIS is an international standard setting body for insurance regulators with over 200 members from 140 jurisdictions. Representatives from U.S. federal and state agencies and entities include the insurance supervisors from all 50 states, the District of Columbia, American Samoa, Guam, Northern Mariana Islands, Puerto Rico, and the U.S. Virgin Islands as well as FIO, the FRB, and the National Association of Insurance Commissioners (NAIC). FIO represents the United States at the IAIS. Recent and upcoming work includes regular monitoring and assessment of climate-related risks in the global insurance sector, capacity building, and a gap analysis of how climate change is addressed in existing supervisory material.

Sustainable Insurance Forum (SIF)

Launched in December 2016, the SIF is an international network of insurance supervisors and regulators committed to working together on sustainability challenges facing the insurance sector. Accordingly, its areas of concern are broader than just climate change issues. SIF has 33 members, including FIO; NAIC; and the state insurance supervisors from California, New York, Vermont, and Washington. SIF has three climate-related workstreams: (1) climate-related risks in insurable assets; (2) sustainability beyond climate change; and (3) climate risks in actuarial processes. Regarding its climate-related risks in insurable assets workstream, SIF intends to focus on approaches taken by insurers and regulators to mitigate

climate-related risks while offering affordable insurance products. As part of these efforts, it will support the introduction of new products to address climate risk protection gaps; private-public partnerships to minimize the effect of weather-related disasters; disclosures concerning climate-related risks and insurability; and the improvement of building codes to enhance mitigation and adaption efforts.

International Monetary Fund (IMF)

The IMF is an organization of 190 member countries that works to foster global monetary cooperation, secure financial stability, facilitate international trade, promote high employment and sustainable economic growth, and reduce poverty around the world. The Secretary of the Treasury serves as the U.S. Governor to the IMF. The IMF is working to include climate change in its macroeconomic and financial sector surveillance and to help members address the challenges of climate change. The IMF also publishes research on the economic and financial implications of climate change and provides policy guidance to members on mitigation, adaptation, and the transition to a low-carbon economy.

Network of Central Banks and Supervisors for Greening the Financial System (NGFS)

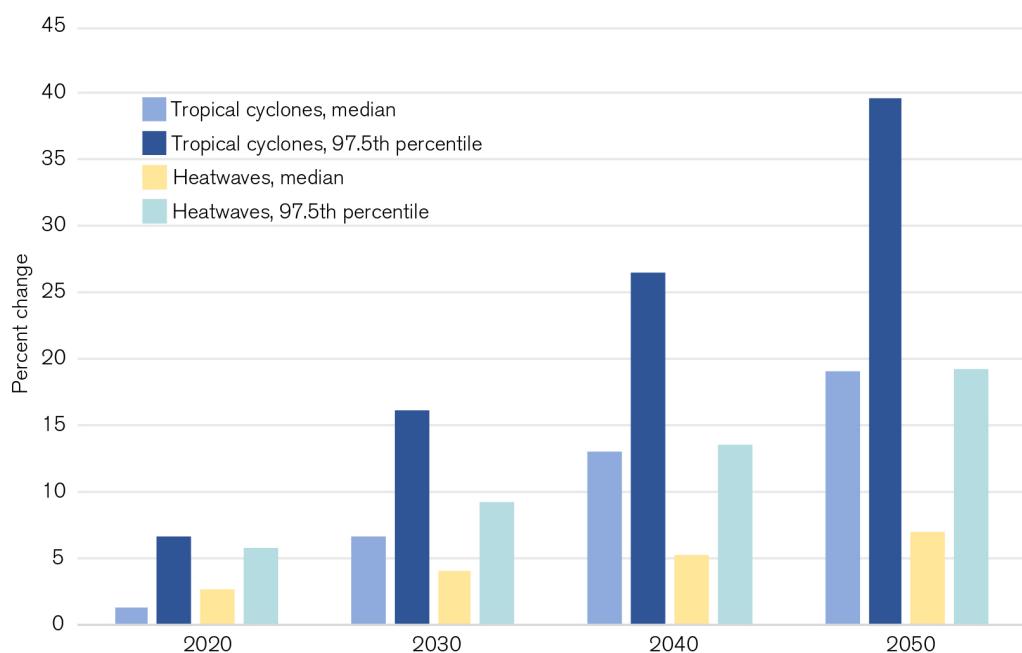
The NGFS is a group of 95 member authorities from approximately 75 jurisdictions that, on a voluntary basis, exchange experiences, share best practices, contribute to the development of environment and climate risk management practices in the financial sector, and help mobilize mainstream finance to support the transition toward a sustainable economy. U.S. members are FRB, OCC, and New York State Department of Financial Services (NYSDFS). The NGFS currently comprises five workstreams: Microprudential/Supervision, Macrofinancial, Scaling Up Green Finance, Bridging the Data Gaps, and Research.

From Climate-related Physical Risks to Financial Risks

Increased frequency and severity of acute physical risk events such as hurricanes, wildfires, floods, and heatwaves, as well as longer-term chronic phenomena associated with climate change, are expected to lead to increased economic and financial costs.²¹ For example, the NGFS scenario for potential outcomes under current policies shows a substantial increase in the segment of the U.S. population annually subject to heatwaves, with consequent potential effects on productivity and other factors, and shows a sizable increase in the annual damages associated with tropical storms (**Figure 1.3**).

²¹ See USGCRP, *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II* (2018), [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA.

Figure 1.3: Changes in Climate-related Risks in NGFS Current Policies Scenario



Note: Tropical cyclones: annual damages, percent change relative to 2020; Heatwaves: fraction of population affected, percent change relative to 1986–2006 average. The NGFS data is available under a Public License, at <https://data.ene.iiasa.ac.at/ngfs/#/license>.

Source: NGFS CA Climate Impact Explorer (June 2021), at <http://climate-impact-explorer.climateanalytics.org/>.

Physical risks have direct effects on households, communities, businesses, and other entities where those risks are realized, as well as to the financial institutions and investors to which they are linked, thereby creating a variety of climate-related financial risks. For example, insurers of property, hazard, flood, and other property-related risks are directly exposed to these risks. To reduce their potential losses, insurers may seek to increase premiums or withdraw from at-risk markets, which may lead to reduced affordability or availability of insurance coverage in vulnerable regions of the country. Such responses by insurers may affect the economic and financial health of households, businesses, and governments in these communities.

In addition, increased actual damages to properties associated with physical risks may lower the value of collateral or the income generated by such properties, posing credit and market risks to banks, insurers, pension plans, and others. Increased liquidity, legal, and operational risks may also occur. In response, creditors may pull back from impacted regions, amplifying the initial harmful impact of the climate-related disaster events and creating further financial and economic strains. The economic impacts resulting from this complex interplay of responses to physical risks may threaten financial stability and are discussed further in Chapter 5.

From Climate-related Transition Risks to Financial Risks

As countries transition to a low-GHG economy, changes in public policy, adoption of new technologies, and shifting consumer and investor preferences all have the potential to impose added costs on some firms and communities even as they reduce overall climate risks. As a result, impacted firms may have less ability to meet their financial obligations. Economic sectors that produce the majority of GHG emissions—the transportation sector (including household and business motor vehicles), electricity generation, and heavy manufacturing, for example—may witness sizable shifts in modes of production. This process may lead some businesses to experience losses and decline, while other businesses may succeed in adapting to new modes of production and expand. The shifts in economic and financial risks will likely be broadly felt, as, for example, sectors most directly affected by reductions in GHG emissions pass on increased costs through supply chains and to consumers.

As a result, the economic effects associated with transitions may be transmitted through the financial sector and the economy in ways that weaken the resilience of financial institutions or the financial sector. Financial risks associated with climate transitions likely increase if such transitions are delayed and occur in an unanticipated, abrupt manner. In such a scenario, financial markets could experience dramatic movements in response to unexpected changes, potentially involving a large decline in the values of assets.

Financial Risks Associated with a Disorderly Transition

A disorderly transition to a low-GHG economy increases risks to financial stability. A disorderly transition could occur because of delays in action to address the drivers of climate change, large and unpredictable policy changes, or sharp differences in approaches across countries, among other possibilities. To highlight potential considerations, the NGFS has developed two disorderly scenarios.²² One scenario involves delays in policy steps to mitigate climate change, which may boost uncertainty regarding the ultimate impact of possible policy changes on economic activity and asset values. Moreover, delays and years of complacency eventually require larger, more disruptive policy adjustments in the scenario, which would likely have more dramatic effects on economic activity and asset values. A second disorderly transition scenario presented by NGFS contemplates divergent policy approaches across countries that sow confusion or create large inefficiencies, thereby possibly straining the financial system.

These examples highlight two important considerations for the Council and its members in formulating next steps. The first consideration is the potential benefits from predictable and consistent policy action that addresses climate risks in a manner that allows for economic adjustments to occur over time. If a transition to a low-GHG economy is well anticipated, estimates indicate that the impact on asset prices would be relatively contained.²³ In other

22 NGFS, *NGFS Climate Scenarios for Central Banks and Supervisors* (June 2021), at https://www.ngfs.net/sites/default/files/media/2021/08/27/ngfs_climate_scenarios_phase2_june2021.pdf.

23 For example, see Financial Stability Board, *The Implications of Climate Change for Financial Stability* (November 23, 2020), at <https://www.fsb.org/wp-content/uploads/P231120.pdf>.

words, risks to financial stability would likely be most contained if policies to facilitate the transition begin early, are communicated clearly, and follow an orderly, predictable path, thereby helping the market anticipate the transition.²⁴ It is considerably more difficult to judge the magnitude of risks to financial stability in a disorderly transition in which the economy and markets are forced to react to large, unanticipated changes in policy.

The second consideration is the importance of measuring potential risks to individual markets and institutions from a disorderly transition. Analysis and preparation for such a scenario are needed in light of the current lack of international or even domestic agreement on a coherent set of policies for achieving stated climate objectives. Financial authorities around the world have recognized the need to consider a disorderly transition in analyzing climate-related financial risks. For example, the French Autorité de Contrôle Prudentiel et de Résolution considered two disorderly scenarios in its 2021 assessment, and the Bank of England's 2021 Biennial Exploratory Scenario on financial risks from climate change included a late transition that highlighted the attendant risks.²⁵

While risks associated with the transition to a net-zero economy are a critical part of analyzing climate-related financial risks, the transition will also present opportunities for investors and financial institutions; the box on electric vehicles provides an example (**Box C**).

Box C. Transition is Both a Risk and an Opportunity: Electric Vehicles

The transportation sector has traditionally been reliant on oil products, which is the key factor driving the sector's large contribution to GHG emissions.²⁶ Adjustments in the transportation sector may pose risks to incumbent vehicle producers and transportation companies, as such businesses transition to providing transportation services with reduced GHG emissions. However, these transitions—as is typical with economic shifts—provide opportunities for incumbent businesses and new entrants to develop products that meet the transportation needs of consumers and businesses while reducing emissions. Investors and financial institutions are exposed to this mix of risks and opportunities.

A central element of the expected transportation transition is the electrification of motor vehicles. Battery technology is already relatively commercially competitive in light vehicles, reflecting declines of almost 90 percent in battery costs over the past decade. As a result, sales of electric passenger cars have risen by 40 percent, on average, over the past five

24 This point has long been emphasized in discussions of climate change and financial stability; see Mark Carney, “Breaking the Tragedy of the Horizon—Climate Change and Financial Stability” (September 2015), at <https://www.bis.org/review/r151009a.pdf>.

25 See Autorité de Contrôle Prudentiel et de Résolution, *Scenarios and Main Assumptions of the ACPR Pilot Climate Exercise*, at <https://acpr.banque-france.fr/en/scenarios-and-main-assumptions-acpr-pilot-climate-exercise>; and Bank of England, *Key Elements of the 2021 Biennial Exploratory Scenario: Financial Risks from Climate Change*, at <https://www.bankofengland.co.uk/stress-testing/2021/key-elements-2021-biennial-exploratory-scenario-financial-risks-climate-change>.

26 International Energy Agency, *Net Zero by 2050: A Roadmap for the Global Energy Sector* (May 2021), at <https://www.iea.org/reports/net-zero-by-2050>.

years.²⁷ Progress in heavy trucking has been slower, reflecting high energy and power requirements and the need to meet long driving ranges.

Domestically, a transition to electric vehicles would likely lead to broad shifts across the motor vehicle industry, including in the design, production, distribution, and maintenance of light vehicles.²⁸ All-electric vehicles do not require a conventional engine and transmission, implying sizable changes in the number of parts and time required to build a vehicle with potential implications for industry employment and geography. These effects likely depend in part on the degree to which producers that have dominated production of gas-powered vehicles are able to take advantage of the opportunities associated with electric vehicles. It is not clear that batteries and electric motors will be produced where conventional vehicle engines and transmissions are presently made. All three carmakers historically associated with Detroit (General Motors, Ford, and Stellantis—formerly Chrysler/Fiat) have plans to expand their electric vehicle offerings. At the same time, more than 75 percent of U.S. all-electric (battery-powered) light vehicles sold in 2020 were produced by Tesla, a relatively new entrant to light vehicle production. It is difficult to forecast which firms will be most successful in adapting their business models. A corollary of this is that it is hard to judge the risk to financial institutions associated with exposures to firms or sectors where climate transitions may be significant. The process of creative destruction is unpredictable.

Financially Vulnerable Populations

The Council recognizes that climate change disproportionately affects financially vulnerable populations potentially including lower-income communities, communities of color, Native American communities, and other disadvantaged or underserved communities. For example, the EPA's Climate Change Impacts and Risk Analysis (CIRA) project examined disproportionate impacts of climate-related risks on certain socially vulnerable groups.²⁹ The 2021 CIRA report found that Black and African American individuals are 40 percent more likely than non-Black and non-African American individuals to live in areas with the highest projected increases in mortality rates due to climate-driven changes in extreme temperatures. Black and African American individuals are also notably more likely to live in areas with the highest projected increases in childhood asthma diagnoses due to climate-driven changes in particulate air pollution. Hispanic and Latino individuals and American Indian and Alaska Native individuals were substantially more likely than non-Hispanic and non-Latino individuals to live in areas with the highest projected labor hour losses in weather-exposed industries due to climate-driven increases in high-temperature days. American Indian

27 IEA 2021, *Net Zero by 2050*.

28 For additional information, see Thomas H. Klier and James Rubenstein, "Charging Ahead—The Electrification of the Auto Industry," Chicago Fed Insights, Federal Reserve Bank of Chicago (June 2021), at <https://www.chicagofed.org/publications/blogs/chicago-fed-insights/2021/charging-ahead-electrification-auto-industry>.

29 The EPA examined climate-related impacts related to: air quality and health, extreme temperature and health, extreme temperature and labor, coastal flooding and traffic, coastal flooding and property, and inland flooding and property. See EPA, *Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts* (September 2021), p. 6, at https://www.epa.gov/system/files/documents/2021-09/climate-vulnerability_september-2021_508.pdf.

and Alaska Native individuals are much more likely than non-American Indian and non-Alaska Native individuals to live in areas where the highest percentage of land is projected to be inundated due to sea-level rise. While the EPA report is not meant to be definitive or predictive, it offers evidence-based insight into some potential disproportionate impacts of climate change to which certain vulnerable populations may be exposed.

The adverse effects of climate change on financially vulnerable populations may generate long-term impacts on delinquent debts, bankruptcies, credit scores, employment, incomes, and wealth, exacerbating existing inequities.³⁰ Financially vulnerable households, businesses, and communities are less likely to have the resources to protect and guard against damage to their properties or adequately deal with loss of income from an adverse climate or weather event. Recovery in the aftermath of a disaster is likely to be more difficult and to take longer for these households, businesses, and communities. Such hardships can adversely affect the economic and financial strength of regions of the country and aspects of the financial system.

While the Council recognizes that vulnerable populations may be more exposed to climate-related risks, it also recognizes that actions to address climate-related financial risks could disproportionately impact financially vulnerable communities, exacerbating existing inequities. For instance, as a result of direct adverse climate-related impacts, they could face higher insurance and credit costs or be unable to obtain insurance or credit. The Council acknowledges that the impacts of climate change on financially vulnerable communities will require thoughtful and balanced policy responses. Developing these responses will require a coordinated approach involving stakeholders across the public and private sectors. The Council and its members are committed to working with these stakeholders to develop balanced policy solutions within the scope of their mandates and authorities.

As one example of this engagement, the Secretary of the Treasury has asked the Financial Literacy and Education Commission (FLEC) to analyze the financial risks to households and communities, especially low-income and historically disadvantaged communities, of climate change and climate transition, and evaluate what tools and best practices could contribute to resilience. The FLEC, which is composed of more than 20 federal agencies (including many members of the FSOC), seeks to improve the financial literacy, education, and well-being of all Americans. The Secretary of the Treasury serves as the Chair.³¹

30 Caroline Ratcliffe, William Congdon, Alexandra Stanczyk, *et al.*, *Insult to Injury: Natural Disasters and Residents' Financial Health*, Urban Institute Research Report, (April 11, 2019); and Kelly D. Edmiston, *Financial Vulnerability and Personal Finance Outcomes of Natural Disasters*, Federal Reserve Bank of Kansas City (September 2017).

31 For more information on the FLEC, see Treasury, "Financial Literacy and Education Commission," at <https://home.treasury.gov/policy-issues/consumer-policy/financial-literacy-and-education-commission>.

The Approach of the Council

Current Impediments Faced by FSOC Members

FSOC members face impediments to assessing and addressing climate-related financial risk. These impediments include:

- **Data Limitations:** While significant data related to climate change already exists, there remain gaps in connecting the science of climate change to financial risk assessments and real-world economic impacts. The ability of regulators and supervisors to build this expertise will be important to quantifying and assessing climate-related financial risk.
- **Time Horizon:** Some impacts of climate change have already materialized, while others will manifest over a longer time horizon than businesses traditionally consider. For example, evidence from climate science suggests that certain physical climate impacts are already locked-in due to past emissions but may not materialize for many years.³² As a result, even though there is broad consensus that climate change will bring heightened risks to financial markets and participants, businesses may not have processes in place for assessing and managing these longer-term risks. In contrast, transition risks may materialize sooner, but the magnitude of such risks is highly uncertain and depends on the degree to which economic transitions begin early and in a predictable manner.
- **Complexity and Uncertainty of Climate Risk:** The impacts of climate change, and accordingly climate-related risk, are non-linear and complex. While the general trajectory of climate change is clear, there is a high degree of uncertainty across the range of potential environmental and physical impacts. This uncertainty makes forecasting the frequency and intensity of severe climate events challenging, as the severity of extreme events is expected to exceed that which has been historically experienced and may materialize unevenly, for example, in different regions of the country. In addition, it is particularly difficult to translate temperature, emissions, and other climate-related pathways into economic and financial variables at a granular level, and to assess the interlinkages across the financial system.
- **Policy and Economic Uncertainty:** A stable and clearly communicated policy framework can promote business planning and market dynamics to address climate risk. Conversely, uncertainty surrounding future potential policy changes can impede progress in understanding, assessing, and managing the financial risks of climate change.
- **Trade-offs:** Some FSOC members may face trade-offs between climate-related financial risk mitigation measures and their other mandated objectives. For example, enhanced climate-risk management could result in regulated institutions limiting products and services (e.g., lending and insurance) in regions subject to physical

³² See IPCC 2021, pp. 28-29.

risks, but this could hinder other objectives related to low- and moderate-income community development. As a result, FSOC members should consider approaches that will achieve both climate-related financial risk objectives while also achieving other relevant aspects of their mission.

The depth and breadth of these challenges is described in more detail in Chapters 3, 4, and 5.

The Path Forward

The Council's approach is designed to address these challenges and to take action to improve the resilience of the financial system to climate-related risks. FSOC's financial stability assessment is well suited to integrating climate-related physical and transition risks because these stresses tend to manifest as traditional risks to financial institutions such as credit risk, liquidity risk, market risk, and operational risk. For example, weather-related physical losses may impair the value of real-estate collateral, leading to higher credit risk for mortgage lenders. In addition, policies aimed at slowing GHG emissions may increase operating costs to carbon-intensive sectors, reducing the market value of investments in those sectors. Credit, liquidity, market, and operational financial risks to institutions have long been the focus of prudential supervision and regulation by FSOC members, and there is a well-developed set of tools to address these risks.

In order for FSOC members to measure, and when appropriate, address climate-related financial risks within their mandates, this report emphasizes four key areas of work:

- **Expanding capacity across FSOC and its members:** FSOC and its members are at different stages in enhancing their ability to address climate-related financial risks, and all members plan to invest further to build capacity and expertise. They also can benefit from enhanced research efforts, including through committees, such as the recommended Climate-related Financial Risk Committee, to help coordinate and promote knowledge sharing.
- **Improving measurement through better data:** Climate-related financial risks will manifest in forms familiar to financial institutions and regulators, such as credit, liquidity, operational, and legal risks. However, the nature of climate risks is less familiar to financial institutions and regulators, and such risks are changing and increasing. As a result, better integration of climate, economic, and financial data is needed, as well as efforts to fill data gaps. FSOC members will also seek to coordinate with other government agencies (non-FSOC member agencies) that have climate-related data to integrate that data into their risk management, supervisory, and regulatory frameworks.
- **Enhancing information through company disclosures:** Investors, financial markets, and financial entities can manage risk more effectively if information on such risks is provided in a consistent, comparable, and decision-useful manner. Members should take steps, within their regulatory mandates, to ensure that company disclosures on climate-related risks meet these criteria.

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- **Making progress on climate-related financial risk assessment:** While there are measurement challenges, initial assessments of the magnitudes of climate-related financial risks are critical to prioritizing future analyses and regulatory action. Given the uncertainty about future climate and policy developments, scenario analysis is a useful tool to facilitate assessments under a range of scenarios to understand risks and prioritize next steps.

Chapter 2: Regulatory and Supervisory Engagement with Climate-related Financial Risk

Introduction

Climate-related financial risks are a key priority area for the Council and its members. FSOC members generally agree that their current knowledge and resources must be expanded, and they are working towards improving their capacity to define, identify, measure, assess, and monitor these risks. They are taking or planning to take steps to standardize definitions, inventory data and identify key data gaps, determine decision-useful metrics, understand and address adverse impacts on vulnerable households and communities, enhance disclosures, and review their supervisory and regulatory tools. Given their different mandates, differences in approach by FSOC members are warranted. Although these initial actions are important steps, the size and scope of the challenge requires increased agency prioritization, staffing, and investment in data and tools to adequately assess and address climate-related financial risks. Given common challenges, it is also imperative that FSOC and its members collaborate closely. The recommendations in Chapter 6 detail additional actions that should be taken by FSOC members to bolster the resiliency of the financial system to climate-related risks.

The remainder of this chapter describes the initial steps that FSOC members are taking to incorporate climate-related financial risks into their regulatory and supervisory activities, acknowledging that additional efforts are necessary.

Treasury Department

Treasury is focused on a broad range of climate-related policy work connected to climate transition finance, climate-related economic and tax policy, and climate-related financial risks. As part of this strategy, Treasury created a Climate Hub and appointed a Climate Counselor to coordinate and lead many of its efforts to address climate change.

Treasury coordinates much of its domestic efforts on climate-related financial risks with FSOC. Internationally, Treasury plays a key role in U.S. engagement on financial stability and regulatory matters. It represents the United States at the G7 and G20 (with the FRB), at the FSB (with the FRB and the SEC), and at other key institutions and forums, such as the IMF. Treasury works with the FRB, SEC, and other U.S. financial authorities as appropriate to coordinate and advance U.S. policy views on how best to promote a strong and resilient global financial system. Executive Order 14008, *Tackling the Climate Crisis at Home and Abroad*,³³ clarified that this role extends to climate change, instructing the Secretary of the Treasury to “ensure that the United States is present and engaged in relevant international forums and institutions that are working on the management of climate-related financial risks.” The FSB is coordinating many international workstreams on climate-related

³³ Exec. Order No. 14,008, 86 Fed. Reg. 7619 (January 27, 2021), at <https://www.federalregister.gov/documents/2021/02/01/2021-02177/tackling-the-climate-crisis-at-home-and-abroad>.

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financial risks and is a central focus of U.S. international engagement on this topic.³⁴ (See **Box B** for an overview of international workstreams on climate-related risks.) As it does for other FSB work, Treasury will work with the FRB and SEC, and other U.S. financial authorities as appropriate, to coordinate engagement across the workstreams captured in the FSB Roadmap. Treasury through FIO also participates in insurance-specific international organizations that are addressing climate-related financial risk, including the IAIS and the SIF.

Treasury also plays an active role in assessing climate-related financial risks to critical infrastructure. As the Sector Risk Management Agency³⁵ for the financial services sector and chair of the Financial and Banking Information Infrastructure Committee (FBIIC),³⁶ Treasury leads collaborative efforts among the public and private sectors to identify, assess, and manage operational risks to sector critical infrastructure, including those arising from climate change. Building on the existing efforts within the FBIIC and across the U.S. government, Treasury is developing a risk management program to provide a methodology for assessing sector operational risk, including risk resulting from dependencies with other critical infrastructure sectors, such as energy and telecommunications. Complementing Treasury's risk analysis capabilities, the SECURE integrated tool suite will provide a data collection, modeling, and visualization platform to identify the operational links among financial institutions and supporting infrastructure, and support analysis of how physical hazards to critical infrastructure may impact financial sector operations. Together, these capabilities will enable analysis of the linkages between operational impacts, financial stability, and other climate-related effects and inform Treasury, U.S. government (including other FSOC members), and public-private efforts to mitigate climate-related operational risk.

Depository Institution Regulators: FDIC, FRB, OCC, NCUA, and State Banking Supervisors

Regulators and supervisors of depository institutions—the FDIC, FRB, OCC, NCUA, and state banking supervisors (depository institution regulators)—expect supervised institutions to manage all material risks and undertake steps to operate in compliance with laws and regulations and in a safe and sound manner. As noted previously, climate-related financial

³⁴ FSB, *FSB Roadmap for Addressing Climate-related Financial Risks*.

³⁵ A Sector Risk Management Agency (SRMA) is a federal department or agency, designated by law or presidential directive, with responsibility for providing institutional knowledge and specialized expertise of a critical infrastructure sector, as well as leading, facilitating, or supporting programs and activities related to risks and hazards in that sector, in coordination with the Department of Homeland Security. The SRMAs lead federal engagement with their sectors and are responsible for coordinating information sharing, incident management, risk management, and security and resilience programs to support critical infrastructure owners and operators.

³⁶ Chartered under the President's Working Group on Financial Markets, FBIIC, consisting of 18 state and federal financial regulators, coordinates efforts to improve reliability and security of financial institutions by enhancing coordination and communication among financial regulators, promoting public-private partnerships within the financial sector, and leading efforts to enhance the resiliency of the financial sector overall. See FBIIC, at <https://www.fbiic.gov/index.html>.

risks may manifest through traditional prudential risk categories that are supervised under safety and soundness mandates.

As part of their supervisory activities, the depository institution regulators expect to review within traditional prudential risk categories, as relevant, how effectively institutions incorporate climate-related financial risks into their risk management systems and frameworks, appropriate to their size, complexity, risk profile, and location. Some depository institution regulators are incorporating climate-related financial risks into their areas of focus for monitoring and assessment. For example, some are developing or planning to develop methodologies and tools to support risk assessments that estimate exposures and vulnerabilities of institutions to climate-related financial risks, including considerations for size, complexity, risk profile, and location.

As their understanding of climate-related financial risks develops, depository institution regulators are assessing whether any policy actions, specific regulations, or principles-based supervisory guidance in response to the financial risks of climate change should be adopted. For an overview of international examples of climate-related supervisory guidance and expectations, see **Box D**.

Federal Deposit Insurance Corporation

The FDIC has regularly assessed environmental risk as part of the semiannual Regional Risk Committee (RRC) process since its inception in 2006 and has performed research on the potential implications of climate-related financial risks. RRCs gauge the level of concern and level of exposure to a variety of risks to determine the supervisory actions and strategies needed to address the issues. In addition to general environmental risk, RRCs have also added specific climate-related risks such as hurricanes and drought when these events are relevant to a particular area. Following the RRCs, representatives from each region gather for the Risk Roundtable to discuss the most important risks from the regional meetings, including environmental concerns when pertinent. In addition, the FDIC has conducted research on the effects of climate events on local economic and banking conditions as part of its assessment of climate-related financial risks, including a review of six of the most severe weather events in U.S. history.³⁷ Internationally, the FDIC is participating in the BCBS' TFCR.

Federal Reserve Board

The FRB recently established two new committees—the Supervision Climate Committee (SCC) and the Financial Stability Climate Committee (FSCC)—to bring together senior staff from the FRB and the Reserve Banks on climate-related issues. The committees help

³⁷ The research, which also looked at the impact on low- and moderate-income (LMI) areas before and after each climate event, suggests that climate events can be economically damaging to a local area, particularly if the affected area's economy is struggling prior to the event or has a smaller, less diverse economy. Conversely, underlying economic strength prior to a negative climate event contributes to the strength and speed of the recovery after the event. For most events analyzed, effects on bank performance were modest. Insurance proceeds and government support help to insulate community banks and borrowers. There were no failures of banks that were headquartered in the impacted areas during the time periods analyzed.

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facilitate work directed at better understanding climate-related risks to supervised institutions and the stability of the financial system. The goal is to incorporate climate-related financial risks into the FRB's supervision of financial firms through the work of the SCC and into its financial stability framework through the FSCC.

From a microprudential perspective, the FRB's *Supervision and Regulation Report* discusses how the effects of climate change can manifest in the financial system via traditional channels like credit, market, operational, and legal risks that affect the safety and soundness of individual firms.³⁸ The SCC is undertaking a broad workplan of internal analysis and public engagement, including discussions with the largest, most complex financial institutions, to better understand how climate-related risks impact financial institutions, and how institutions identify, measure, monitor, and manage the financial risks of climate change. This type of engagement and ongoing analytical work will inform the FRB's assessment of its supervisory program and consideration of whether additional policy measures may be needed. As with all supervisory undertakings, the FRB will tailor its approach and resources to account for the relative risks faced by supervised firms.

From a macroprudential perspective, the *Financial Stability Report* outlines how climate change could increase financial shocks and financial system vulnerabilities that could further amplify shocks.³⁹ The FSCC is working to identify and measure links between climate change and financial stability, including by improving analysis of how the economic effects of a changing climate will affect financial assets and institutions, investigating how climate change can increase financial sector vulnerabilities, and looking for climate-related amplification channels like mispricing of assets. The FSCC, together with the SCC, is also working to build its understanding of scenario analysis by engaging with other central banks and institutions.

In addition to the two climate committees, an internal working group, the System Climate Network, has been formed to collaborate and develop capacity to engage on the topic of the financial risks from climate change across the Federal Reserve System.

FRB and Reserve Bank economists are pursuing research to better understand the intersection of economic conditions and the financial risks of climate change. Board staff is in contact with members of the U.S. Global Change Research Program, which includes multiple federal agencies. The Federal Reserve is exploring ways in which additional scientific data, models, and other information can be used to supplement the Board's existing data on weather, disasters, and climate-related risks.

The FRB also continues to engage in both domestic and international discussions around the financial risks from climate change. FRB staff meet regularly on an interagency and bilateral basis with other domestic regulatory agencies, and the FRB is a member of the NGFS. It participates on a number of NGFS workstreams to formulate options and guides on the

38 See FRB, Supervision and Regulation Report (November 2020), at <https://www.federalreserve.gov/publications/files/202011-supervision-and-regulation-report.pdf>.

39 See FRB, Financial Stability Report (November 2020), at <https://www.federalreserve.gov/publications/files/financial-stability-report-20201109.pdf>.

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management of climate-related financial risks and to learn from the experiences of other central banks and supervisors. The FRB also co-chairs the BCBS' TFCR. In addition, the FRB contributes to various working groups under the FSB focused on climate-related risks.

Office of the Comptroller of the Currency

To coordinate and lead the OCC's climate change-related activities, the OCC recently created the position of Climate Change Risk Officer. This position has expanded the OCC's capacity to collaborate with stakeholders and to promote improvements in climate change risk management practices in banks. Furthermore, the OCC's National Risk Committee (NRC), which monitors systemic and supervision risks facing the federal banking system, receives quarterly briefings on climate-related financial risk to ensure that this risk is assessed appropriately under the agency's risk framework. More recently, the NRC formed the Climate Risk Implementation Committee, chaired by the Climate Change Risk Officer, to identify weather- and climate-related financial risks to OCC-supervised institutions and provide recommendations to senior OCC leadership on the integration of these risks into OCC policy, supervision, and research. In addition, the OCC has established a senior leadership roundtable for OCC decision-makers to discuss climate change-related issues affecting the OCC and banks. To assist in all these efforts, OCC economists are conducting research into how the physical and transition risks of climate change translate into financial risks to the banking system, how these risks may create differential community impact and disproportionately affect certain groups, and how the OCC can develop an independent view of rating a bank's exposure to climate risk.

The OCC will produce regular internal OCC-wide staff briefings to communicate agency activities and projected next steps to inform all OCC staff as to how severe weather events and long-term climate change may impact the safety and soundness of the federal banking system.

The OCC recently joined the NGFS. Membership in this group allows the agency to collaborate with central banks and peer supervisors from 95 countries to share best practices and contribute to the development of climate risk management in the financial sector. The OCC participates in a number of the NGFS workstreams. Like the FDIC and the FRB, the OCC also is an active member of the TFCR.

The OCC continues to conduct regular outreach with a variety of private sector stakeholders to exchange information and gain knowledge of bank efforts to measure and monitor climate risk.

National Credit Union Administration

The NCUA recently established a Climate Financial Risk Working Group with the goal of further incorporating climate-related financial risks into the agency's risk-monitoring framework. The working group, which is composed of senior staff members from across the agency, is focusing on several major workstreams.

Initial efforts are aimed at developing internal expertise on the financial risks associated with climate change and their implications for credit unions, credit union members, and the

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National Credit Union Share Insurance Fund (NCUSIF). To advance this goal, the NCUA plans to solicit information from credit unions and other stakeholders about whether and how extreme weather events and climate change factor into their risk-monitoring framework, business strategy, and product offerings.

The working group is also taking stock of the agency's existing regulatory tools, policies, and examination procedures and assessing whether the current risk-monitoring framework is sufficient for capturing and addressing climate-related financial risks. A separate workstream will consider how to model and estimate risks to the NCUSIF. Input collected from credit unions and stakeholders responding to the agency's request for information will be a crucial component of both workstreams. The ultimate goal of this broad approach is to establish the infrastructure necessary to ensure that the credit union system and NCUSIF remain resilient to climate-related financial risks.

State Bank Supervisors

Climate-related financial risk initiatives are being pursued both individually and collectively with other state bank supervisors, including through the Conference of State Bank Supervisors (CSBS). State bank supervisors are also exploring opportunities to collaborate with one another on climate-related initiatives, including through district-level meetings and the formation of multi-state forums facilitated by CSBS. In addition, state bank supervisors are exploring opportunities to engage with their federal and international counterparts, for instance, by joining the NGFS. As part of its coordination efforts, the CSBS has collected reports, guidance, and other resources related to climate-risk management and made them available to state bank supervisors as a training resource.

Several states have recently issued guidance on climate-related financial risks. In 2020, the New York State Department of Financial Services issued an Industry Letter to all New York-regulated banking organizations as well as other New York-regulated financial institutions outlining its expectations related to addressing climate-related financial risks.⁴⁰ Similarly, in 2021, the Washington Department of Financial Institutions issued an alert to Washington-regulated financial institutions announcing that it would begin the process of evaluating current strategic plans and risk management systems of depository institutions, given the potential threat climate-related financial risks pose to institutions as well as vulnerable and disenfranchised communities.⁴¹

⁴⁰ Such expectations encompass the integration of climate-related financial risks into governance frameworks, risk management processes, and business strategies, including by conducting an enterprise-wide risk assessment to evaluate climate change and its impacts on traditional risk factors. See New York State Department of Financial Services, *Climate Change and Financial Risk* (October 29, 2020), at https://www.dfs.ny.gov/industry_guidance/industry_letters/il20201029_climate_change_financial_risks.

⁴¹ Washington Department of Financial Institutions, *DFI Alert on Systemic Risk of Climate Change and Related Financial Risks* (July 7, 2021), at <https://dfi.wa.gov/sites/default/files/climate-change-alert.pdf>.

Box D. International Examples of Climate-related Supervisory Guidance and Expectations

As U.S. financial regulators continue to develop climate-related supervisory guidance and expectations for financial institutions, they may find it useful to refer to the guidance and expectations already set out by financial authorities in some jurisdictions. In April 2020, a BCBS review of members' existing regulatory and supervisory initiatives on climate-related financial risks showed that approximately two-fifths of members had issued, or were in the process of issuing, principles-based guidance regarding climate-related financial risks. A similar survey by IOSCO published in April 2020 found that about half of industry members and market participants considered more regulation to be necessary, and more than three-quarters of respondents saw a need for more guidance. In May 2021, the IAIS released an application paper, which provided guidance, but did not establish standards or expectations, on how IAIS supervisory material may be used to manage climate-related financial risks.⁴²

To date, most authorities structure their guidance or supervisory expectations around governance, strategy, risk management, and disclosure. The Bank of England Prudential Regulation Authority (PRA) was the first central bank and supervisor to issue climate-related supervisory guidance. It issued a Supervisory Statement on enhancing banks' and insurers' approaches to managing the financial risks from climate change in April 2019.⁴³ The statement outlines supervisory expectations for firms to consider climate-related financial risks in their governance arrangements, incorporate such risks in their existing risk management practices, use scenario analysis to inform strategy setting and risk assessment processes, and develop disclosure practices.

In November 2020, the European Central Bank (ECB) published its own guide to climate-related and environmental risks.⁴⁴ It explains ECB supervisory expectations for banks related to their business models and strategy, governance and risk appetite, risk management, and disclosure. The ECB plans to ask banks to conduct self-assessments based on these supervisory expectations in early 2021 and develop action plans accordingly. The ECB will then conduct a full supervisory review of banks' practices in 2022 and conduct that year's supervisory stress test on climate-related risks.

With its geographic vulnerabilities and status as a global financial hub, Singapore has been particularly active in its efforts to address climate-related financial risks. The Monetary Authority of Singapore, which is both the country's central bank and integrated financial regulator, issued its *Guidelines on Environmental Risk Management* in December 2020, which set out environmental risk management expectations across banks, insurers, asset

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- 42 International Association of Insurance Supervisors and Sustainable Insurance Forum, *Application Paper on the Supervision of Climate-related Risks in the Insurance Sector* (May 25, 2021), at <https://www.iaisweb.org/page/supervisory-material/application-papers//file/97146/application-paper-on-the-supervision-of-climate-related-risks-in-the-insurance-sector>.
- 43 Bank of England, *Enhancing Banks' and Insurers' Approaches to Managing the Financial Risks from Climate Change* (April 15, 2019), at <https://www.bankofengland.co.uk/prudential-regulation/publication/2019/enhancing-banks-and-insurers-approaches-to-managing-the-financial-risks-from-climate-change-ss>.
- 44 ECB, *Guide on Climate-related and Environmental Risks* (November 2020), at <https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm.202011finalguideonclimate-relatedandenvironmentalrisks-58213f6564.en.pdf>.

managers, and other supervised financial institutions.⁴⁵ The guidelines for all institutions cover governance and strategy, risk management, and disclosure of environmental risk information. Guidelines for insurers also cover underwriting and investment, while guidelines for asset managers also cover stewardship, research, and portfolio construction.

Market Regulators: SEC, CFTC, and State Securities Regulators

Securities and Exchange Commission

The SEC has taken, and is considering taking further, regulatory and supervisory action on climate-related financial risks. The SEC is also involved in various climate-related international workstreams, including at the FSB and IOSCO.

Climate Disclosures

In March 2021, the then-Acting Chair asked SEC staff to evaluate the SEC's disclosure rules and requested public comment on ways to improve climate disclosure. The SEC received more than 575 unique comment letters as of September 2021. The SEC Chair indicated in July 2021 that staff were developing a rulemaking proposal on mandatory climate risk disclosure by public issuers for the Commission to consider. The proposal will be aimed at making disclosures more consistent, comparable, and decision-useful to help inform investors' decisions.

The SEC had previously addressed climate-related disclosures in its 2010 interpretive guidance, in which it "remind[ed] companies of their obligations under existing federal securities laws and regulations to consider climate change and its consequences as they prepare disclosure documents to be filed with us and provided to investors."⁴⁶ The 2010 guidance provided that climate change disclosure might be required in a company's description of its business, legal proceedings, risk factors, and management's discussion and analysis of the company's financial condition and results of operations.⁴⁷ The guidance identified certain climate-related issues that companies should consider, including the direct and indirect impact of climate-related legislation or regulations, international agreements, indirect consequences of business trends (including changing demand for goods), and the physical impacts of climate change. In September 2021, the SEC's staff issued a sample comment letter that provided examples of some of the types of climate-related comments the staff might issue in the course of its review of public company filings. This sample comment letter highlighted the continuing applicability of the SEC's 2010 climate disclosure guidance.

⁴⁵ Monetary Authority of Singapore, *Guidelines on Environmental Risk Management for Banks* (December 8, 2020), at <https://www.mas.gov.sg/regulation/guidelines/guidelines-on-environmental-risk-management>.

⁴⁶ SEC, *Commission Guidance Regarding Disclosure Related to Climate Change*, Release Nos. 33-9106; 34-61469 (February 2, 2010), at <https://www.sec.gov/rulesinterp/2010/33-9106.pdf>.

⁴⁷ The 2010 guidance also applies to corresponding disclosure requirements in Form 20-F by Foreign Private Issuers.

Investment Advisers and Funds

In the investment management industry, investors have demonstrated significant interest in investments that consider ESG factors, including climate-related impact.⁴⁸ In light of the investor demand for ESG investment products, SEC staff has stated that its examination priorities include oversight of investment advisers and funds offering ESG products and services.⁴⁹ SEC's oversight regarding climate-related disclosures, often included in the ESG factors, is primarily based on general anti-fraud provisions of the federal securities laws applicable to investment advisers and funds, as well as specific disclosure requirements that apply to investment advisers and funds.⁵⁰ Investment advisers and funds are prohibited from misleading investors and are required to follow any disclosed or client-mandated ESG investment strategies in the management of their portfolios. Investment advisers are also required, when they vote proxies, to do so in the best interest of their clients, including on votes relating to ESG issues.⁵¹ In July 2021, SEC staff began to review whether fund managers should disclose the criteria and data used related to their ESG and green marketing.⁵²

Enforcement Focus

In light of increasing investor focus and reliance on climate- and ESG-related disclosure and investment, the SEC's Division of Enforcement announced a task force to proactively evaluate potential ESG-related misconduct. The task force is focused on potential violations of the securities laws, with a particular emphasis on any material misstatements or omissions in issuers' disclosure of climate-related risks. It is also evaluating disclosure and compliance issues relating to investment advisers' and funds' ESG strategies, in coordination with other offices to support the SEC's effort to address risks to investors.⁵³

Examination Focus

A number of entities directly regulated by the SEC, including clearinghouses, exchanges, broker-dealers, and investment advisers, are required to establish plans to address business

48 See, e.g., GAO, *Public Companies Disclosures of Environmental, Social, and Governance Factors and Options to Enhance Them* (July 2020), at <https://www.gao.gov/assets/710/707967.pdf>; CFA Institute, *Future of Sustainability in Investment Management: From Ideas to Reality* (December 1, 2020), at <https://www.cfainstitute.org/-/media/documents/survey/future-of-sustainability.ashx>.

49 SEC Division of Examinations, *2021 Examination Priorities*, at <https://www.sec.gov/files/2021-exam-priorities.pdf>.

50 See, e.g., Items 4(a) and (b) of Form N-1A; Item 8 of Part 2A of Form ADV.

51 See SEC Division of Examinations, *The Division of Examinations' Review of ESG Investing*, Risk Alert (April 9, 2021), at <https://www.sec.gov/files/esg-risk-alert.pdf>.

52 Chair Gary Gensler, "Prepared Remarks Before the Principles for Responsible Investment 'Climate and Global Financial Markets' Webinar" (July 28, 2021), at <https://www.sec.gov/news/speech/gensler-pri-2021-07-28>.

53 SEC, "SEC Announces Enforcement Task Force Focused on Climate and ESG Issues" (March 4, 2021), at <https://www.sec.gov/news/press-release/2021-42>.

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continuity and disaster recovery. The SEC's Division of Examinations' 2021 Examination Priorities include a review of such plans. This review includes an evaluation of whether such plans, particularly those of systemically important registrants, contribute to the growing physical and other relevant risks associated with climate change. The scope of these examinations is similar to the post-Hurricane Sandy work of the Division and other regulators, with a heightened focus on the maturation of, and improvements to, these plans over the intervening years. As climate-related events become more frequent and more intense, the Division will review whether systemically important registrants are considering effective practices to help improve responses to these events.

Commodity Futures Trading Commission

In March 2021, the CFTC established the Climate Risk Unit (CRU), a cross-disciplinary unit composed of staff from the CFTC's operating divisions and focused on the role of derivatives in understanding, pricing, and addressing climate-related risk in the financial system and the transition to a net-zero economy.⁵⁴ The CRU's focus is to accelerate CFTC engagement in industry-led and market-driven processes in the climate and wider ESG spaces to ensure that new products and markets facilitate hedging, price discovery, and capital allocation. The CRU is also focused on ensuring existing CFTC-regulated markets adapt and respond to the challenges and opportunities posed by climate change and the transition to a net-zero economy.

The CRU is tasked with encouraging that risk management standards in CFTC-regulated markets are enhanced through disclosures, stress testing, and other traditional financial risk management techniques that are adapted to improve the ability of financial institutions regulated by the CFTC to withstand the challenges of climate change. Furthermore, the CRU will encourage the development of new financial instruments to assist in price discovery of climate-related financial risks and assist in capital allocation, such as water derivatives and voluntary carbon offset markets, and examine areas where refinements or modifications could be made either to climate-related products or to the CFTC's regulatory and supervisory approach. The CRU will also further expand CFTC participation in domestic and international forums aimed at building consensus for consistent standards, definitions, disclosures, and practices across derivatives products and markets, and coordinate efforts to support the development of reliable data resources.

The CFTC has also engaged on climate-related financial risk issues through its Market Risk Advisory Committee (MRAC). On September 9, 2020, the MRAC's Climate-Related Market Risk Subcommittee (Climate Subcommittee) issued a report entitled *Managing Climate Risk in the U.S. Financial System* (Climate Risk Report). The Climate Risk Report catalogued how United States regulators can address the growing impact of climate-related financial risk.⁵⁵ The Climate Risk Report was adopted unanimously by the Climate

⁵⁴ CFTC, "CFTC Acting Chairman Behnam Establishes New Climate Risk Unit" (March 17, 2021), at <https://www.cftc.gov/PressRoom/PressReleases/8368-21>.

⁵⁵ Market Risk Advisory Committee of the Commodity Futures Trading Commission, *Managing Climate Risk in the U.S. Financial System* (September 9, 2020), at <https://www.cftc.gov/PressRoom/PressReleases/8234-20>.

Subcommittee and, with 53 recommendations, provided a roadmap towards further measuring and managing climate-related financial risk. The report concluded that climate change poses a major risk to the stability of the U.S. financial system and its ability to sustain the American economy, and may exacerbate financial system vulnerabilities, including among historically disadvantaged communities. It noted that U.S. financial regulators must recognize this risk, and should move urgently and decisively to measure, understand, and address it, based on existing statutes which already provide wide-ranging and flexible authority. In addition, it highlighted that financial innovation is required to not only efficiently manage climate risk in the financial sector, but to facilitate the flow of capital to help accelerate the net-zero transition and increase economic opportunity.

Another CFTC federal advisory committee, the Energy and Environmental Markets Advisory Committee (EEMAC), held a public meeting in June 2021 exploring the role of carbon markets in the transition to a net-zero economy, and in particular the linkages between primary, secondary, and derivative carbon markets.

State Securities Regulators

State securities regulators are increasing their focus on climate change issues, including the physical risks presented by climate change. In July 2021, the Corporation Finance Section of the North American Securities Administrators Association (NASAA)—which develops and monitors NASAA’s statements of policy pertaining to the registration of securities under state law—expanded its responsibilities to include monitoring and responding to federal and state securities law developments regarding ESG issues, in order to determine whether any new NASAA guidance, statements of policy, or model rules are appropriate in light of such developments. In addition, NASAA’s Investor Education Section has published information to help investors understand ESG investing, including factors that investors should consider when evaluating the ESG characteristics of investments, and considerations that investors should evaluate in order to protect themselves from investment frauds that use ESG-related themes as inducements to invest.

State securities regulators also examine brokerage and investment adviser firms to ensure compliance with relevant securities laws, and state regulators have exclusive authority over the business conduct standards of state-registered investment advisers. In November 2020, NASAA adopted a “Model Rule for Investment Adviser Written Policies and Procedures under the Uniform Securities Acts of 1956 and 2002,” which *inter alia* recognizes the need for firms to focus on physical risks by requiring investment advisers subject to the rule to create and implement business continuity and succession plans for such events as the temporary or permanent loss of the firm’s principal place of business. NASAA anticipates that it can adapt this and other model rules as necessary to complement emerging disclosure requirements and business conduct standards that are developed to address the risks of climate change.

Many state securities regulators use a common platform administered by NASAA to conduct inspections of broker-dealers and investment advisers. The platform is comprised of examination modules developed by groups of regulators, on specific areas of compliance, for

the use of all participating regulators. NASAA, through its relevant committees, will explore developing modules that address firm policies and procedures that relate to climate change, either as a function of their operations or recommendations, for those states that may wish to include such reviews in their inspections.

Federal Housing Finance Agency

FHFA has recognized that the U.S. mortgage finance system may be exposed to climate change and natural disaster risk and has been actively working to ensure it is accounting for these risks in its prudential supervision and conservatorship oversight of Fannie Mae and Freddie Mac, and its prudential supervision of the Federal Home Loan Banks (the regulated entities). In May 2019, FHFA formalized its agency-wide Disaster Response Team (DRT), which had been meeting informally for years prior. The DRT has experience coordinating with the regulated entities, other government agencies, external parties, and internal FHFA stakeholders during natural disasters. It is guided by a natural disaster response and recovery framework developed by FHFA in coordination with its regulated entities to support borrowers and renters affected by natural disasters. This framework incorporates forbearance and workout options for borrowers in areas impacted by natural disasters, tailoring options to their specific circumstances.

FHFA has since established several agency-wide working groups to coordinate its climate-related activities. In 2020, FHFA established its Climate and Natural Disaster Risk working group to (1) improve FHFA's understanding of climate and natural disaster risks and their impacts on the regulated entities, the national housing market, and on historically underserved and vulnerable communities; (2) review the regulated entities' risk management approaches designed to assess and address these risks; and (3) ensure they continue to operate in a safe and sound manner and fulfill their critical missions to serve the nation's housing finance system.

In March 2021, FHFA also established an ESG Working Group to coordinate FHFA's ESG efforts, including identifying opportunities to incorporate the principles and practices of diversity, equity, and inclusion within the ESG framework and monitoring its regulated entities' ESG-related activities, such as voluntary reporting, SEC disclosures, and green, social, and sustainable bond issuances.

In January 2021, FHFA issued a *Climate and Natural Disaster Risk Management Request for Input* (RFI).⁵⁶ The RFI requested information on a wide range of topics, including data availability, gaps, and data linkages; physical and transition risk; FHFA's supervisory and regulatory responsibilities; financial disclosures; affordability; and fairness and equity. FHFA received more than 60 responses from a variety of stakeholders and is reviewing and

⁵⁶ FHFA, "Climate and Natural Disaster Risk Management Request for Input" (January 2021), at <https://www.fha.gov/Media/PublicAffairs/Documents/Climate-and-Natural-Disaster-RFI.pdf>.

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synthesizing the responses. FHFA also hosted a *Public Listening Session* on this critical topic, with 19 external speakers and nearly 200 attendees.⁵⁷

FHFA added a natural disaster assessment for Fannie Mae and Freddie Mac (the Enterprises) for the 2021 Conservator Scorecard.⁵⁸ The agency monitors the Enterprises' performance and has established a regular meeting schedule to discuss climate change and natural disaster-related activities, industry developments, and concerns with each entity. FHFA also maintains ongoing communication with the Federal Home Loan Banks (FHLBanks) and conducts risk-focused reviews of the FHLBanks that include natural disaster-related activities.

FHFA's Fall 2020 Econ Summit focused on natural disaster risk and COVID-19 impacts on housing. The Summit discussed the role that biases play in preparing for pandemics and other disasters, flood risk perceptions and their effects on home prices, the link between property damage and mortgage credit risk, and the role social vulnerability indices can play in tailoring mitigation strategies for those most in need.

FHFA regularly meets with external stakeholders to discuss ESG efforts and the impacts of climate-related risks. These external stakeholders represent a diverse range of perspectives and include the U.S Global Change Research Program; federal government agencies, such as the Department of Housing and Urban Development, the Federal Emergency Management Agency (FEMA), and NOAA; federal, state, and local regulators; banks; non-profits; climate scientists and researchers; and others.

FHFA is developing its climate change research agenda and strengthening its analytical capabilities to identify and assess the current and future exposure of the Enterprises and the FHLBanks to climate change and natural disasters.

Consumer Financial Protection Bureau

The CFPB established a climate working group this summer to better assess the impact of climate change on consumer financial well-being and on the markets for consumer financial products and services. This working group is charged with developing a research, public engagement, and policy agenda for the CFPB and will collaborate with other agencies, consumer advocates, academics, and industry participants. The working group will identify the data, resources, and expertise that will be necessary for the CFPB to carry out its agenda. The CFPB's efforts will give particular focus to the adverse impacts of climate change on historically underserved and disadvantaged communities and households.

⁵⁷ A video of the listening session and accompanying materials is at <https://www.fhfa.gov/Videos/Pages/FHFA-Public-Listening-Session-on-Climate-and-Natural-Disaster-Risk-Management-at-the-Regulated-Entities.aspx>.

⁵⁸ See FHFA, *2021 Scorecard for Fannie Mae, Freddie Mac, and Common Securitization Solutions* (February 2021), at <https://www.fhfa.gov/AboutUs/Reports/ReportDocuments/2021-Scorecard.pdf>. The annual Conservator Scorecard is FHFA's mechanism for communicating its priorities and expectations for the Enterprises and providing transparency to the public about these expectations.

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The CFPB has published research on credit reporting before and after national disasters.⁵⁹ The working group will assess the potential for further Bureau research in this space. The Bureau has also developed consumer content aimed at helping consumers prepare for and recover from climate-related disaster events and emergencies.⁶⁰ The working group will consider enhancements to this content and a broader public engagement strategy. Finally, the working group will consider CFPB policy responses to climate risks. Such policy responses could potentially include consideration of enhanced consumer disclosures for physical risks or incorporation of climate-related risks into its supervisory approach.

Office of Financial Research

Executive Order 14030 instructs the Secretary of the Treasury to direct OFR “to assist the Secretary of the Treasury and the FSOC in assessing and identifying climate-related financial risk to financial stability, including the collection of data, as appropriate, and the development of research on climate-related financial risk to the U.S. financial system.”⁶¹

The OFR has taken several steps to address the Executive Order’s directives. First, OFR is performing a survey of relevant commercial data vendors, government agency data sets, academic data hubs, and other key sources to identify, categorize, and share climate data with FSOC and its members. Second, OFR is identifying data gaps linking climate change and financial stability and evaluating how to potentially close those gaps. Third, OFR is working with FSOC members to identify ways to provide climate data sources. This work includes a pilot program OFR has initiated for OFR to serve as a climate data hub with another FSOC member. OFR has opened climate data discussions through the FSOC Data Committee. Fourth, OFR has met with FSOC members to discuss the potential impact of climate change and continues to monitor various sectors of the economy for impacts to financial stability. Fifth, OFR is developing a research agenda around the risks that climate change may present to financial stability.

Insurance Authorities: State and Federal

State Insurance Regulators

U.S. insurance regulation is largely a state-based system in which state insurance regulators are the primary supervisors and regulators of insurers that are domiciled and operate within

59 See CFPB, *Natural Disasters and Credit Reporting, Quarterly Consumer Credit Trends* (November 2018), at https://files.consumerfinance.gov/f/documents/bcfp_quarterly-consumer-credit-trends_report_2018-11_natural-disaster-reporting.pdf.

60 See CFPB, “Preparing, Recovering, and Rebuilding after Disasters and Emergencies,” at <https://www.consumerfinance.gov/consumer-tools/disasters-and-emergencies/>.

61 Exec. Order No. 14,030, 87 Fed. Reg. 27967 (May 20, 2021), at <https://www.federalregister.gov/documents/2021/05/25/2021-11168/climate-related-financial-risk>.

their respective states.⁶² Approximately 15 state insurance regulators have individually taken preliminary steps to expressly address climate-related financial risks. In addition, the National Association of Insurance Commissioners (NAIC) has provided forums in which states may discuss proposals for addressing climate-related financial risks. In 2020, the NAIC identified climate change as one of its top five regulatory priorities and created a new Climate and Resiliency Task Force. This new task force has five workstreams: Pre-disaster Mitigation, Solvency, Climate Risk Disclosure, Innovation, and Technology.

In general, the current work and discussions by the state regulators and the NAIC that are intended to address climate-related financial risks focus on four areas: (1) climate-related disclosure activities, (2) supervisory activities on risk and solvency, (3) market conduct and mitigation activities, and (4) data, measurement, and metrics, including scenario analyses.

Climate-related Disclosure Activities

Between 2009 and 2020, a varying number of states—never more than eight—required that insurers licensed by or operating in their state that write \$100 million or more in direct premiums annually must disclose high-level information about their climate-related financial risks and activities on an annual basis using an NAIC survey, the Insurer Climate Risk Disclosure Survey. In 2021, the number of jurisdictions requiring certain insurers to complete this survey increased to a total of 14 states plus the District of Columbia. There are currently no nationwide disclosure requirements regarding insurers' climate-related financial risks and activities. For a more detailed discussion of the Insurer Climate Risk Disclosure Survey and proposals for additional climate-related disclosures by insurers, please see Chapter 4: "Climate-related Disclosures, Current State of Public Climate-related Disclosures in the United States, Financial Institutions, Insurance Companies."

Supervisory Activities on Risk and Solvency

All 50 states, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands have adopted laws or regulations that are based on an NAIC model law and regulation, requiring medium and large insurers to conduct annually an Own Risk and Solvency Assessment (ORSA), as part of the insurers' Enterprise Risk Management (ERM) framework.⁶³ In an ORSA, an insurer must analyze all reasonably foreseeable and materially relevant risks affecting its ability to meet its obligations to its policyholders. The baseline requirements for an ORSA, as set forth in the NAIC's ORSA model law, do not currently mandate that insurers estimate any particular risk, such as climate risk. The Solvency Workstream of the NAIC's Climate and Resiliency Task Force is considering whether the ORSA requirements should be modified to incorporate climate-related financial risks as one of the foreseeable

62 NAIC and The Center for Insurance Policy and Research, *State Insurance Regulations* (2011), p. 2, at https://www.naic.org/documents/topics_white_paper_hist_ins_reg.pdf.

63 ORSA requirements apply to medium- and large-size insurance companies, which are defined as those that write more than \$500 million of annual direct written and assumed premium, and medium- and large-size insurance groups, which are defined as those that collectively write more than \$1 billion of annual direct written and assumed premium.

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risks that insurers must address. In the meantime, New York already requires insurers to explicitly consider climate-related financial risks in their ORSAs.⁶⁴

Though states generally do not explicitly require any insurers to analyze climate-related financial risks as part of an ORSA, many insurers writing certain types of business typically choose to evaluate certain climate-related risks as part of their ORSAs, such as underwriting, credit, market, and operational risks.⁶⁵

At least three states—New York, Connecticut, and Vermont—are in the process of implementing laws or regulations that would require insurers domiciled in their states to integrate climate-related risks into their risk management strategies. The proposed actions, which differ across the three states, include, among other things, potentially requiring insurers to integrate consideration of climate-related financial risks into their governance structures, risk management practices, and business strategies.

Another area where consideration of some climate-related financial risks has been addressed is the risk-based capital (RBC) formula for property and casualty (P&C) insurers. RBC is a method for calculating the minimum amount of capital appropriate for an insurer to support its business operations given its size and risk profile. The P&C RBC formula used by state insurance regulators includes a specific capital charge for hurricane risk. This charge, however, is only applicable for insurers operating in states and territories affected by hurricanes. The RBC formula does not delineate distinct capital charges for other climate-related perils, such as wildfire, flood, and convection storms. The NAIC is considering expanding the P&C RBC formula to include frameworks for such other climate-related perils.

Market Conduct and Mitigation Activities

States in regions that are already experiencing an increase in the frequency and severity of weather-related disasters, such as hurricanes and wildfires, are considering actions aimed at addressing how those disasters may be negatively affecting the availability and affordability of insurance products and services. In total, 34 states and the District of Columbia offer some sort of residual market (a source of insurance coverage that is the last resort for firms and individuals that have been unable to obtain insurance from the private market) for property owners for certain risks, such as wildfires and hurricanes.⁶⁶ Even with such residual markets, however, the U.S. climate-related protection gap (that is, the portion of total economic losses

64 New York State Department of Financial Services, Insurance Circular Letter No. 15 (Sept. 22, 2020), at https://www.dfs.ny.gov/industry_guidance/circular_letters/cl2020_15 [NYSDFS Ins. Circular Letter 15]; 11 NYCRR § 82.2(a)(9) (amended to require insurers to address “climate change” as one of the reasonably foreseeable and relevant materials).

65 Property/casualty insurers that underwrite policies for extreme weather events that are being exacerbated by climate change, such as hurricanes, wildfires, and convection storms, are the ones that are most likely to include climate-related financial risks to some degree in their ORSAs.

66 Insurance Information Institute (III), *Residual Markets*, 2019, at <https://www.iii.org/publications/a-firm-foundation-how-insurance-supports-the-economy/a-50-state-commitment/residual-markets>. The National Flood Insurance Program, administered by FEMA, fulfills a similar function at the federal level by providing insurance for flooding.

from climate-related disasters that is not covered by insurance) was \$45 billion (38 percent) of the U.S. climate-related economic losses for 2020.⁶⁷ Further information on federal and state programs designed to mitigate the size of this gap may be found in **Box M**.

Some states are also considering actions that will encourage insurers to take steps to foster mitigation of climate-related financial risks and facilitate adaptation to a low-carbon economy. For example, Vermont's Department of Financial Regulation announced in June 2021 that it plans to support the development and marketing of innovative insurance products and services that support a reduction in GHG emissions.⁶⁸ In addition, Connecticut enacted a law in July 2021 that requires the Connecticut Insurance Department to pursue, in the department's regulatory and supervisory actions, reducing levels of emissions of GHG to a level at least 80 percent below the level emitted in 2001 by January 1, 2050. The Pre-disaster Mitigation, Technology, and Innovation Workstreams of the NAIC Climate and Resiliency Task Force also are considering potential actions concerning the mitigation of climate-related financial risks and adaption to a low-carbon economy.

Data, Measurement, and Metrics, including Scenario Analysis

To date, no state or federal regulator has conducted a nationwide data collection or scenario analysis of insurers' exposure to climate-related financial risks. Three states—California, New York, and Vermont—have undertaken actions to collect data on the investment exposures to climate-related financial risks of insurers operating in their respective states. Two states—California and New York—worked with 2 Degrees Investing Initiative (2DII), an independent, non-profit think tank, to analyze certain investment exposures of insurers operating in their respective states using 2DII's Paris Agreement Climate Transition Assessment (PACTA).⁶⁹ The 2DII assessments for California and New York also included scenario analyses with a 5-year time horizon. California also conducted a Fossil Fuel Data Call in 2016.⁷⁰ In 2021, the Vermont insurance regulator issued a report, *The Impact of Climate Change on Vermont's Insurance Industry*, and announced that it was considering

67 Aon, *Weather, Climate & Catastrophe Insight Annual Report 2020* (2021), p. 39, at https://www.aon.com/global-weather-catastrophe-natural-disasters-costs-climate-change-2020-annual-report/index.html?utm_source=region&utm_medium=africa&utm_campaign=natcat21.

68 State of Vermont, Department of Financial Regulation, "DFR Releases Report Examining the Impacts of Climate Change on Vermont's Insurance Industry," press release (June 28, 2021), at <https://dfr.vermont.gov/press-release/dfr-releases-report-examining-impacts-climate-change-vermonts-insurance-industry>.

69 2 Degrees Investing Initiative, *2° Scenario Analysis: Insurance Companies Operating in California*, 2019, at https://interactive.web.insurance.ca.gov/apex_extrpl/cdi_apps/r/250/files/static/v54/2018_full_report.pdf [California 2° Scenario Analysis]; New York State Department of Financial Services and 2 Degrees Investing Initiative, An Analysis of New York Domestic Insurers' Exposure to Transition Risks and Opportunities from Climate Change, June 20, 2021, at https://2degrees-investing.org/wp-content/uploads/2021/06/DFS_2DII_report_NY-Insurers-Transition-Risks.pdf [NYSDFS & 2DII Transition Risk Analysis].

70 The California Department of Insurance (CDI) Fossil Fuel Data Call included over 1,200 insurers doing business in California to determine what the insurers had already done to divest from fossil fuels and whether they planned to further divest from thermal coal holdings and making future investments. CDI, *Trial by Fire: Managing Climate Risk Facing Insurers in the Golden State* (September 2018), pp. 26-27, at <https://www.law.berkeley.edu/wp-content/uploads/2018/09/Trial-by-Fire-September-2018.pdf>.

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guidance on, among other things, whether to encourage or require insurers to conduct stress tests and scenario analyses, and include climate-related financial risks in their ERM processes.⁷¹ The NAIC Climate and Resiliency Task Force presently has three workstreams (Solvency, Disclosure, and Technology) that are considering actions that may enhance data collection, measurements, metrics, and predictive modeling tools, including stress testing and scenario analyses. For a more detailed discussion of the California and New York scenario analyses, see Chapter 5: “Implications for Financial Stability, Exposures to Sectors Most Affected by the Transition.”

Federal Insurance Office

FIO regularly engages with state insurance regulators, insurers, policyholder groups, and other stakeholders on climate-related issues as part of its statutory authorities to monitor all aspects of the insurance sector and to monitor the extent to which traditionally underserved communities and consumers have access to affordable non-health insurance products. FIO’s 2021 annual report describes FIO’s work on climate-related issues, including its ongoing work on mitigation and post-disaster resilience.⁷²

Executive Order 14030 instructs the Secretary of the Treasury to direct FIO “to assess climate-related issues or gaps in the supervision and regulation of insurers, including as part of the FSOC analysis of financial stability, and to further assess, in consultation with States, the potential for major disruptions of private insurance coverage in regions of the country particularly vulnerable to climate change impacts.”⁷³ FIO is currently taking steps to implement the Executive Order’s directives and is focusing its efforts on three initial climate-related priorities (as noted in the RFI discussed below): (1) Insurance Supervision and Regulation: Assessing climate-related issues or gaps in the state insurance regulatory framework, including their potential impacts on U.S. financial stability; (2) Insurance Markets and Mitigation/Resilience: Assessing the potential for major disruptions of private insurance coverage in U.S. markets that are particularly vulnerable to climate change impacts, as well as facilitating mitigation and resilience for disasters; and (3) Insurance Sector Engagement: Increasing FIO’s engagement on climate-related issues and leveraging the insurance sector’s ability to help achieve climate-related goals.

71 Vermont Department of Financial Regulation, *The Impact of Climate Change on Vermont’s Insurance Industry* (June 2021), p. 3, at https://dfr.vermont.gov/sites/finreg/files/doc_library/dfr-report-climate-change-insurance-final.pdf.

72 FIO, *Annual Report on the Insurance Industry* (September 2021), pp. 64-73, at <https://home.treasury.gov/system/files/311/FIO-2021-Annual-Report-Insurance-Industry.pdf>.

73 Exec. Order No. 14,030, 87 Fed. Reg. 27967 (May 20, 2021), at <https://www.federalregister.gov/documents/2021/05/25/2021-11168/climate-related-financial-risk>.

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On August 31, 2021, FIO issued a request for information (RFI) to solicit information and public comment on the insurance sector and climate-related financial risks.⁷⁴ The RFI seeks public comment on FIO's three proposed priorities, as well as on a series of related questions. The RFI responses not only will help inform FIO's assessment of the implications of climate-related financial risks for the insurance sector, but also will help FIO to better understand: (1) which data elements are necessary to accurately assess climate risk; (2) which data elements remain unavailable; and (3) how FIO could collect this data under its statutory data collection authorities and make it available to stakeholders as needed.

FIO also has engaged on climate-related issues through coordination with international organizations and international insurance authorities. As a member of the Executive Committee at the IAIS, FIO is closely involved with IAIS sustainability-related policy determinations and workstreams. FIO also is a member of the OECD Insurance and Private Pensions Committee (IPPC), which is increasingly focused on climate-related issues. In March 2021, FIO became a member of SIF and FIO staff contributed to the SIF/IAIS paper on insurance supervision of climate-related risks published in May 2021. FIO has also engaged with international insurance authorities on various climate-related initiatives.

Box E. International Work to Promote Consistent and Effective Supervisory and Regulatory Approaches to Address Climate-related Financial Risks

U.S. financial regulators contribute meaningfully to ongoing work at a number of international organizations and SSBs to promote, as appropriate based on regulatory frameworks, consistent and effective supervisory and regulatory approaches and tools to address climate-related financial risks. The insurance, banking, and securities markets SSBs are all in the process of considering how climate-related financial risks are addressed in their supervisory and regulatory standards, and may develop further guidance as needed, in order to support consistent and effective supervision and regulation within their respective sectors. Complementary work at other organizations like the FSB, IMF, and NGFS will further support cross-border and cross-sectoral consistency as well as effective implementation of supervisory and regulatory approaches, while addressing transmission and amplification mechanisms of climate-related financial risks.

Financial Stability Board

Supervisory and regulatory approaches and tools are one of the four primary areas of work in the multi-year climate roadmap that the FSB delivered to G20 Finance Ministers and Central Bank governors in July 2021. An FSB report published in July 2020 showed that some financial authorities are currently integrating climate-related risks into their microprudential supervision of banks and insurance firms, including via requirements for firms' stress testing

⁷⁴ Federal Insurance Office Request for Information on the Insurance Sector and Climate-Related Financial Risks, 46 Fed. Reg. 48,814 (August 31, 2021), at <https://www.federalregister.gov/documents/2021/08/31/2021-18713/federal-insurance-office-request-for-information-on-the-insurance-sector-and-climate-related>.

and disclosure, but that such efforts are generally at an early stage.⁷⁵ FSB established a Working Group on Climate Risk to take stock of supervisory and regulatory approaches to climate risk and determine, where useful and appropriate, how FSB could support consistent and effective approaches across sectors that also incorporate interactions between sectors. The FSB plans to publish in 2022 a report addressing regulatory and supervisory approaches to address climate-related risks at financial institutions and supporting efforts to incorporate the interactions among sectors in regulatory and supervisory approaches, potentially including principles or recommendations.

Basel Committee on Banking Supervision

The BCBS' TFCR compiled an inventory of members' existing regulatory and supervisory initiatives on climate-related financial risks and found that a majority of members believe it is appropriate to address climate-related financial risks in their existing supervisory and regulatory frameworks.⁷⁶ While the vast majority of members had conducted research related to measurement of climate-related risks, several identified challenges related to data availability, methodological challenges, and difficulties in mapping of transmission channels. Subsequently, the TFCR undertook studies of these areas and published two reports in April 2021, one on transmission channels of climate-related financial risks to the banking system and one on measurement methodologies of such risks. These reports concluded that climate risk drivers can be captured in traditional financial risk categories, but that additional work is necessary to connect climate risk drivers to banks' exposures and reliably estimate these risks. The BCBS plans to investigate the extent to which climate-related financial risks can be addressed within the existing Basel Framework; identify potential gaps in regulation, supervision, and disclosure in the current framework; and consider possible measures to address them.

International Organization of Securities Commissions

In June 2021, IOSCO's STF published a public consultation report which proposes that securities regulators consider setting regulatory and supervisory expectations for asset managers regarding sustainability-related risks. To address existing skill gaps and the risk of regulatory fragmentation, the report puts forth recommendations across five areas, including (1) asset manager practices, policies, procedures, and disclosure, (2) product disclosure, (3) supervision and enforcement, (4) terminology, and (5) financial and investor education.

International Association of Insurance Supervisors and Sustainable Insurance Forum

On May 25, 2021, the IAIS and the SIF promulgated their *Application Paper on the Supervision of Climate-related Risks in the Insurance Sector*, which provides information on how insurance supervisors may apply the IAIS principles and standards to climate-related risks.⁷⁷ The Application Paper does not establish new requirements that insurance supervisors

⁷⁵ FSB, *Stocktake of Financial Authorities' Experience in Including Physical and Transition Climate Risks as Part of Their Financial Stability Monitoring* (July 2020), at <https://www.fsb.org/wp-content/uploads/P220720.pdf>.

⁷⁶ BCBS, *Climate-related Financial Risks: A Survey on Current Initiatives* (April 2020), at <https://www.bis.org/bcbs/publ/d502.pdf>.

⁷⁷ IAIS and SIF, *Application Paper on the Supervision of Climate-related Risks in the Insurance Sector* (May 2021), at <https://www.iaisweb.org/page/supervisory-material/application-papers//file/97146/application-paper-on-the-supervision-of-climate-related-risks-in-the-insurance-sector#>.

are expected to meet. Instead, the Application Paper focuses on how to apply the Insurance Core Principles (ICPs) to climate-related risks.

The IAIS also co-founded the Access to Insurance Initiative (A2ii) in 2009. A2ii functions as the implementing partner to the IAIS to advance access to insurance and inclusive insurance market developments. A2ii focuses on nine of the Sustainable Development Goals (SDGs) developed by the United Nations, including Sustainable Development Goal 13: Climate Change. In 2019, it issued its *Report: The Role of Insurance Supervisors in Climate Risk Insurance*.⁷⁸ In 2021, A2ii and IAIS held a Supervisory Dialogue on Supervision of Climate Related Risks in the Insurance Sector.

International Monetary Fund

Through its Financial Sector Assessment Program (FSAP), the IMF assesses the stability and soundness of countries' financial sectors, including the quality of microprudential and macroprudential frameworks, bank and nonbank supervision, and financial market oversight. In an IMF Policy Paper released in July 2021, IMF staff outlined a strategy to help members address climate change-related policy challenges, which envisions, among other strategic shifts, the inclusion of climate-related physical and transition risks in all FSAP assessments.⁷⁹ Under the new strategy, an FSAP assessment would include stress testing, or climate scenario analysis, as well as assessments of climate-relevant financial regulation and supervision based on sector-specific guides for banking and insurance to be developed by the IMF.

Network of Central Banks and Supervisors for Greening the Financial System

In May 2020, the NGFS published a guide for supervisors that draws on members' supervisory practices. It sets out five recommendations for banking and insurance supervisors to integrate climate-related and environmental risks into their work, including to (1) identify how climate-related risks are transmitted and how they are likely to be material to supervised entities, (2) develop a clear strategy that includes internal organization and adequate resources, (3) assess exposures of supervised entities and potential losses, (4) set supervisory expectations for financial institutions in line with supervisors' understanding of a prudent approach, and (5) ensure adequate risk management by financial institutions, taking mitigating action as appropriate. NGFS is expected to publish a progress report soon on the implementations of these recommendations, including a stocktake of members' progress integrating climate and environmental risks within their supervisory frameworks.

⁷⁸ A2ii, *Report: The Role of Insurance Supervisors in Climate Risk Insurance* (October 2019), at <https://a2ii.org/en/knowledge-center/climate-riskdisaster-insurance/the-role-of-insurance-supervisors-in-climate-risk-insurance>.

⁷⁹ IMF, *IMF Strategy to Help Members Address Climate Change Related Policy Challenges: Priorities, Modes of Delivery, and Budget Implications* (July 2021), at <https://www.imf.org/en/Publications/Policy-Papers/Issues/2021/07/30/IMF-Strategy-to-Help-Members-Address-Climate-Change-Related-Policy-Challenges-Priorities-463093>.

Chapter 3: Climate-related Financial Risk—Data and Methods

Introduction

Defining, identifying, measuring, and monitoring exposures to climate-related financial risks will necessitate investment in data and analytic capacity by FSOC members, other government agencies, and the private sector. Necessary steps for measuring and assessing climate-related financial risk include enhancing the availability of and access to relevant, comprehensive data and developing methods and metrics to effectively utilize climate-related data and financial data. FSOC members have begun taking necessary steps domestically, and several FSOC members have been involved in similarly-focused international workstreams aiming to improve the measurement and assessment of climate-related risks to the financial system. Two of these international efforts are highlighted in **Box F**.

Box F. International Workstreams on Data Needed to Assess Climate-related Financial Risks

Identification of the data needed to assess climate-related financial risks has been a priority in international forums focused on financial regulation and financial stability. This work underscores the fact that financial authorities across the globe face common challenges in measuring, monitoring, and mitigating climate-related financial risks. Two efforts particularly focused on financial stability have been underway at the FSB and the NGFS.

Financial Stability Board

In July 2021, the FSB delivered a report to the G20 on the availability of data to monitor and assess climate-related risks.⁸⁰ The report emphasizes that data limitations exist across several dimensions—including lack of internationally consistent reporting standards, inconsistent and non-granular data on physical risk exposures, and data that is not designed nor fit for the purpose of measuring exposures to transition risk—creating challenges for authorities to accurately monitor climate-related risks. The FSB concluded that the data necessary to assess climate-related risks to financial stability should: capture exposures of financial firms to climate-related risks; support a global comparison and aggregation of financial firms' exposures; allow for forward-looking assessments; and capture climate-related risk transfer and mitigation. The FSB stressed that work to address data gaps should focus on the drivers of climate risk, company disclosures to improve climate-related financial information for investors, financial institutions' exposures, forward-looking financial stability metrics, and risk transfer in the financial system.

Network of Central Banks and Supervisors for the Greening of the Financial System

In June 2020, the NGFS created a workstream to identify climate-related data requirements and data gaps and to propose policy recommendations to bridge such gaps. In the first phase of the work program, the NGFS completed a systematic literature review, undertook outreach to a variety of international organizations and stakeholders, and conducted a survey

⁸⁰ FSB, *The Availability of Data with Which to Monitor and Assess Climate-Related Risks to Financial Stability* (July 2021), at <https://www.fsb.org/wp-content/uploads/P070721-3.pdf>.

and closed-door workshops with banks and certain financial firms. Stakeholders called for more forward-looking data (for example, targets or emissions pathways), more granular data (for example, geographical data at entity and asset-levels), assurance about the quality of climate-related data through verification and audit mechanisms, and improvements in data accessibility. The NGFS suggested improving the availability of reliable and comparable data through global disclosure standards; coordination on risk and/or asset classification (e.g., taxonomies); and standardizing key metrics, certification labels, and data methodologies (e.g., for financed emissions). In addition, the workstream emphasized the importance of finding ways to better leverage already available data sources and approaches. The final NGFS report is due to be released in late 2021.

In their initial work, financial regulators have identified several sets of challenges. One set of challenges relates to cataloging and analyzing existing data sources, as climate-related data has not been extensively used by financial regulators and investments will be necessary to incorporate and utilize available data. Another set of challenges involves data gaps. For example, current collection of financial data associated with corporate loans may not include important details associated with climate-related risks, such as emissions-related information that may inform transition risks and detailed geographic information on production facilities that could inform exposure of such loans to physical climate risks. A third set of challenges involves combining different types of data (e.g., climate, economic, and financial) from different sources and in different formats. In many cases, data may be difficult to use or combine owing to, for example, inconsistencies, or the lack of definitions, taxonomies, reporting standards, and entity identification that facilitates aggregation and analysis.

The review of data issues in this chapter is organized into the following categories:

- Data on the climate risks (which drive climate-related financial risks);
- Data on the climate risk exposures of nonfinancial entities;
- Data on the climate risk exposures of financial entities; and
- Data required to assess systemwide resilience to climate-related financial risks.

Data on Climate Risks

Analyzing climate-related financial risks begins with measuring and assessing risks from climate impacts. To do this, data is needed that captures the drivers of physical and transition risks that could impact households, businesses, the economy, and the financial sector.

Data on Physical Risks

Physical risks associated with climate change arise from acute events such as hurricanes, floods, wildfires, and heatwaves, as well as more gradual, chronic phenomena such as sea-level rise. **Figure 3.1**, below, lists some examples of five broad categories of climate physical risks—extreme weather events, ecosystem impacts, ecosystem shifts, sea-level rise, and water scarcity.

Figure 3.1: Drivers of Physical Risk Resulting from Climate Change

General risk	Subcategories
Extreme weather events	<ul style="list-style-type: none"> • Hurricanes • Floods • Summer/Winter Storms • Heat Waves • Wildfires • Hailstorms
Ecosystem impacts	<ul style="list-style-type: none"> • Soil degradation • Surface water system changes • Marine system changes
Ecosystem shifts	<ul style="list-style-type: none"> • Fisheries • Agriculture • Deforestation • Desertification • Population shifts/displacement • Biodiversity changes
Sea-level rise	<ul style="list-style-type: none"> • Chronic sea-level rise • Sea or lake surges
Water scarcity	<ul style="list-style-type: none"> • Droughts • Insufficient water supply

Source: Adapted from NGFS, *Overview of Environmental Risk Analysis by Financial Institutions*.

U.S. government agencies make available significant data on many of these risk factors. For example, NOAA has a large collection of climate and weather data. NOAA's NCEI is a significant repository for environmental data, and manages one of the largest archives of atmospheric, coastal, geophysical, and oceanic research in the world.

Other U.S. government agencies similarly have extensive data. For example, FEMA provides open access to climate-related disaster data, the U.S. Geological Survey provides data on water surface levels and flows useful for flood risk analysis, and the U.S. Army Corps of Engineers provides data on water control across areas of the country.

While a large amount of potentially relevant data for climate-related physical risks currently exists, more work is needed to improve access to this data and incorporate it into financial risk assessments. These data were not created to be used within a financial risk management framework and, as such, public sector custodians of environmental data have generally not invested in the capacity to integrate environmental data into financial analysis, such as standardized formats tailored to the needs of entities engaged in financial risk analysis. Based on a review of 70 U.S. and international agency data sources, climate-related data is available in a variety of formats and may be accessed in different ways, including via application programming interface (API),⁸¹ graphical user interface (GUI), portable document file (PDF), spreadsheet tables, or unstructured data.

This data is not standardized in a way that facilitates the aggregation of datasets across entities or industry sectors and may require extensive work before it is usable. There is an acute need for data that is “interoperable”—data that can easily be linked and combined to generate actionable insights. Different data sets may cover different time periods and use different

⁸¹ In computing, an API is a set of rules that allows programmers to develop software for a particular operating system without having to be completely familiar with that operating system.

time intervals, depending upon the purposes for which the data were collected. For example, some agencies that provide climate-related data focus primarily on current data while others focus on historical data stretching back decades. Related sets of data maintained separately can overlap or conflict or require efforts to clarify apparent overlaps or conflicts. Just as there is no catalog of data resources across government agencies, neither is there an ontology or taxonomy for the data.⁸²

Researchers and firms are still learning which data may be most relevant for climate-related financial risk analysis. Assessments of climate-related financial risks require a forward-looking approach that examines how climate change may lead to different patterns of risk in the future than it has in the past. Historical datasets alone cannot provide such information unless they are combined with climate projections to produce metrics needed for risk assessment.

Progress is being made to overcome these challenges. For example, private data providers are currently using available government data to provide useful information to financial and nonfinancial firms. The breadth of vendor offerings varies. Vendors often specialize by focusing on specific risk categories, and data acquisition costs can be significant. A growing number of open-source data providers have launched to help the private sector assess its climate exposure.⁸³ These offerings may help smaller institutions with smaller data budgets.

Data on Transition Risks

Transition risks refer to disruptions that may arise from the shift to a low-GHG economy. Potential risk drivers include policy changes that may impact the value of different economic activities and related assets and liabilities, especially if such policy changes are introduced in a disruptive manner, without adequate time to anticipate constraints and changing costs. Other risk drivers include technological innovations and changes in business models that address climate change risks but disrupt existing economic activities. Shifts in consumer behavior and investor preferences similarly alter the value of economic activities, assets, and liabilities. Examples are listed in **Figure 3.2**.

82 In the context of data science, an ontology encompasses the representation, formal naming and definition of the categories, properties and relationships of data within a set or domain. A data taxonomy is a classification framework for the data into categories and sub-categories. Typically, data definitions and hierarchies for agency data sets are specific to particular sets of data.

83 For example, OS-Climate offers open-source data for climate-related financial risks and a number of software tools to help institutions measure their climate impact. See OS-Climate, at www.os-climate.org

Figure 3.2: Drivers of Transition Risks Resulting from Climate Change

General risk	Subcategories
Public Policy Change	<ul style="list-style-type: none"> • Clean energy transition • Pollution controls, e.g., GHG Caps • Emissions Taxes
Technological Change	<ul style="list-style-type: none"> • Clean energy technologies • Energy saving technologies • Clean transportation • Emissions removal or capture • Other green technologies
Changing Investor and Consumer Demand	<ul style="list-style-type: none"> • Investor demand or preferences for green investments • Consumer demand for green products
Disruptive Business Models	<ul style="list-style-type: none"> • New business models that can capitalize on low-carbon technologies and disrupt existing business models.

Source: Adapted from NGFS, *Overview of Environmental Risk Analysis by Financial Institutions*.

By their nature, transition-risk drivers require consideration of prospective changes in conditions. The forward-looking nature of transition risks requires the analysis of different climate-related scenarios. Therefore, one of the data inputs required to assess transition risks are scenarios that relate to the drivers discussed in Figure 3.2. Consideration of such scenarios likely requires that financial institutions and regulators understand and maintain data on factors related to these scenarios that cover past experience. Work to develop these is underway and will facilitate the use of scenario analysis. The role of scenario analysis as a tool for managing climate-related financial risks is discussed in Chapter 5.

Data on Exposures of Nonfinancial Entities

Climate-related physical and transition risks to the financial system often stem, in part, from climate impacts on households and businesses. It is necessary to assess and quantify the climate-related impacts on these stakeholders in order to understand, model, and address climate-related financial risks faced by financial institutions and investors.

Physical Risks

Households may be affected by physical risk through a variety of channels. Disruptions in local economic activity associated with acute physical risk events (e.g., flooding or wildfires) will affect household income and the ability to repay obligations. Property damage—for example, damage to homes associated with flooding, windspeed, or other perils—will impact the value of homes and the mortgages collateralized by household-owned real estate. Quantification of such risks to households and their potential impacts requires several types of data. While not meant to be exhaustive, some examples are:

- Local estimates of exposures and projected perils and damages based on geographic location and climate trends;

- Data on physical characteristics of property and structures;
- Data on credit and insurance exposures; and
- Data on replacement costs.

To determine impacts on financially vulnerable populations, other factors, such as household income, race, ethnicity, and other characteristics of disadvantaged or underserved communities, are also necessary.

As one example, flood risk is primarily driven by location, but even nearby properties may face substantially different flood risk owing to differences in land and building elevation, as well as the structural features of the building. Another challenge related to the use of this type of data is protecting the privacy of individuals and entities. Given the personal nature of such data, government collection and use of such data must incorporate appropriate safeguards, especially as datasets may be linked or combined, and different agencies may seek to share data.

Similarly, nonfinancial businesses may be exposed to physical risks due to the geographic location of a firm's business operations, assets, and supply chains. As with data for households, existing data may be difficult to use or lack important information. For example, information on the geographic location of a company's facilities and those of its key suppliers are not a standard component of data collections associated with lending, and collection of such data would likely require consideration of new reporting requirements.

Transition Risks

The exposures of nonfinancial firms to transition risks are influenced by various factors, notably including the degree to which reductions in GHG emissions affect industries, regions, or individual firms through, for example, losses on existing assets (including stranded assets), shifts in business operations or supply chains, or other changes in market conditions. These effects may be challenging to measure and project given the uncertainty of future developments. It will be necessary to consider the full range of plausible scenarios regarding future changes to policy, technology, and household preferences. A primary element for measuring transition risk is data on the direct and indirect emissions of companies and financial institutions that helps inform the link between climate-risk drivers and financial risks across economic sectors, regions, and firms.

Measuring GHG Emissions

To assess transition risk, entities must consider their emissions footprint. The Greenhouse Gas Protocol⁸⁴ (GHG Protocol) is the global standard for how entities can quantify this. The GHG Protocol segments an organization's emissions into three categories: Scope 1, Scope 2, and Scope 3 emissions.

⁸⁴ World Business Council for Sustainable Development and World Resources Institute, "The Green House Gas Protocol: A Corporate Accounting and Reporting Standard--Revised Edition" (March 2004).

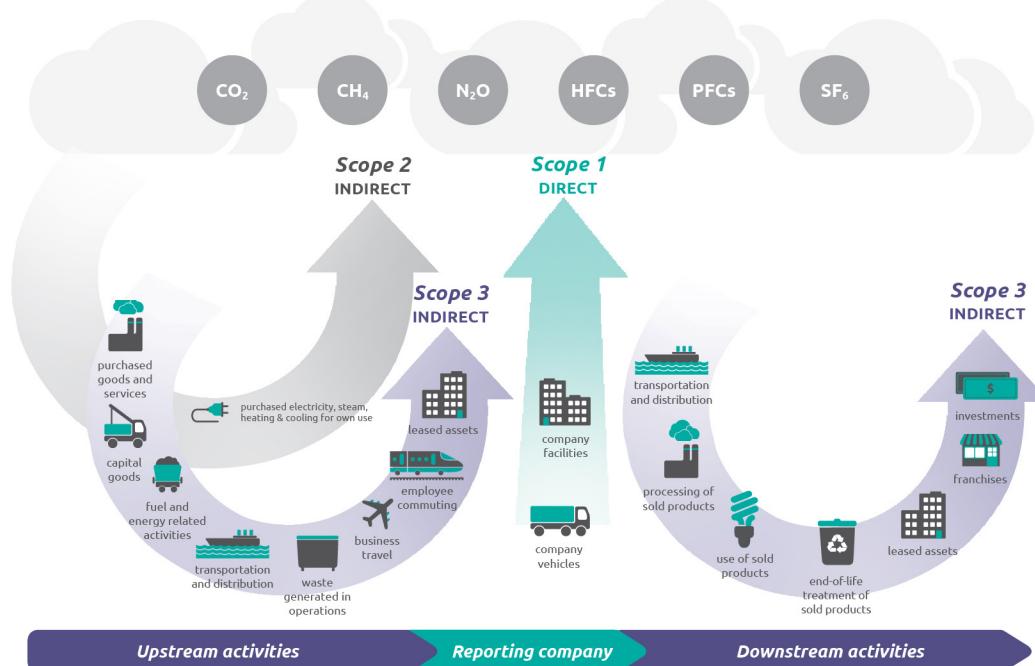
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Scope 1 emissions are defined as direct emissions from an organization's activities and owned facilities. These can be emissions from manufacturing processes such as steel production, or emissions from a fleet of company cars or delivery vehicles.⁸⁵

Scope 2 emissions are emissions created from the production of a business's acquired electricity, steam, heat, and cooling.⁸⁶

Scope 3 emissions include all indirect emissions in the value chain of an organization's activities (apart from those accounted for as Scope 2 emissions).⁸⁷ The GHG Protocol defines 15 categories for Scope 3 emissions, which are included in **Figure 3.3** below. These include investment-related activity, which is also known as "financed emissions."⁸⁸ Financed emissions are particularly important for assessing the climate-related risks of financial institutions.

Figure 3.3: Scope 1, 2, and 3 Emissions



Source: Greenhouse Gas Protocol, *Corporate Value Chain (Scope 3) Accounting and Reporting Standard*.

85 EPA, "Scope 1 and Scope 2 Inventory Guidance," at <https://www.epa.gov/climateleadership/scope-1-and-scope-2-inventory-guidance>.

86 EPA, "Scope 1 and Scope 2 Inventory Guidance," at <https://www.epa.gov/climateleadership/scope-1-and-scope-2-inventory-guidance>.

87 See Greenhouse Gas Protocol, *Corporate Value Chain (Scope 3) Accounting and Reporting Standard*, p. 141, at https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporting-Standard_041613_2.pdf. The GHG Protocol defines "value chain" as "[A]ll of the upstream and downstream activities associated with the operations of the reporting company, including the use of sold products by consumers and the end-of-life treatment of sold products after consumer use."

88 See, e.g., PCAF, *The Global GHG Accounting and Reporting Standard for the Financial Industry, First edition* (November 2020), p. 20, at <https://carbonaccountingfinancials.com/files/downloads/PCAF-Global-GHG-Standard.pdf>.

Methodologies for Measuring Emissions

A precursor to effective reporting of Scope 1 through 3 emissions is conducting a GHG inventory based on an analysis of potential sources of GHG emissions throughout an organization and its value chain.

Scope 1 emissions are often calculated by measuring the amount of fossil fuel or other GHG-related products used in manufacturing, research and development, or corporate fleets, and multiplying it by a global warming factor, noting that certain greenhouse gases contribute more to global warming than others (e.g., carbon dioxide does not contribute as much to global warming as methane).⁸⁹ The data is then standardized for reporting by converting emissions in each GHG to carbon dioxide equivalent emissions. Scope 1 emissions account for stationary combustion of GHG-producing fuels, fugitive emissions, which are the emissions created by the leakage of refrigerants, and mobile combustion of GHG-producing fuels used by fleets of vehicles directly owned by an organization.

Scope 2 emissions are calculated based on electricity consumption and contractual arrangements. Organizations calculate their Scope 2 emissions using location-based factors, which account for the mix of fuels used to generate electricity in a given location, and the fuels' GHG intensity. Organizations also calculate market-based Scope 2 emissions using a methodology that considers contractual arrangements under which the organization procures power from specific sources, such as renewable or other generation facilities.

Scope 3 emissions can be challenging to measure, as they include all indirect emissions associated with a company's value chain. The GHG Protocol categorizes Scope 3 emissions first into upstream and downstream activities. Upstream activities transform an item from raw materials into the product produced by the organization, and incorporate the transportation associated with those supply chains, which can include employee commuting. Downstream activities occur after a finished product is produced, from logistics to end of life disposal. Each of the 15 Scope 3 categories can have its own measurement and quantification practices. Some categories may be measured directly while other categories may require estimation or modelling. Scope 3 emissions provide a more complete picture of the transition risks facing an organization, because it includes the risks of increased costs or restrictions throughout its value chain.

In the United States, the Environmental Protection Agency (EPA) collects data through the Greenhouse Gas Reporting Program (GHGRP), which requires public reporting of GHG data and other relevant information from large GHG emission sources, fuel and industrial gas suppliers, and CO₂ injection sites in the United States.⁹⁰ (See **Box G**). The GHGRP data does not represent total U.S. GHG emissions, but provides facility-level data for large sources of direct emissions, thus representing the majority of U.S. GHG emissions.⁹¹ Certain emissions data collected under GHGRP represent Scope 1 emissions.

89 See World Resources Institute, "Methodology," at <https://www.wri.org/sustainability-wri/dashboard/methodology>.

90 See 40 C.F.R. § 98.

91 The GHGRP data collected from direct emitters represent about half of all U.S. emissions. When including GHG information reported to the GHGRP by suppliers, emissions coverage reaches approximately 85 to 90 percent.

Box G. EPA's Greenhouse Gas Reporting Program (GHGRP)

Pursuant to the Clean Air Act,⁹² the EPA has implemented the GHGRP.⁹³ The GHGRP requires public reporting of GHG data and other relevant information from large GHG emission sources, fuel and industrial gas suppliers, and CO₂ injection sites in the United States.⁹⁴ Reporting under the GHGRP began in 2010. In 2020, more than 8,100 facilities reported their GHG emissions.

The program operates on a calendar-year basis; the reporting deadline for the year is generally March 31st of the following year (i.e., March 31, 2021 for reporting-year 2020). Data reported pursuant to the GHGRP is publicly available in the fall of each year through several data portals accessible via the EPA's GHGRP website.⁹⁵

The GHGRP collects annual GHG information from the top emitting sectors of the U.S. economy, including direct GHG emissions and GHG supply data.⁹⁶ Included among the 41 covered industrial source categories are upstream GHG suppliers (e.g., CO₂ and hydrofluorocarbon (HFC) suppliers).⁹⁷ The GHGRP is the only dataset containing facility-level GHG emissions data from large industrial sources across the United States. With seven consecutive years of reporting for most sectors, GHGRP data are providing important new information on industrial emissions, showing variation in emissions across facilities within an industry, variation in industrial emissions across geographic areas, and changes in emissions over time at the sector and facility level.⁹⁸

⁹² 42 U.S.C. §§ 7401 *et seq.*

⁹³ 40 C.F.R. § 98. The GHGRP has gone through a number of rule amendments since its first reporting year in 2010. See EPA, "Historical Rulemakings," at <https://www.epa.gov/ghgreporting/historical-rulemakings>.

⁹⁴ A summary of program coverage, including the threshold limitations (typically 25,000 metric tons of CO₂e) and links to lists of regulated industrial sources is available on EPA's GHGRP website. See EPA, "Learn About the Greenhouse Gas Reporting Program (GHGRP)," at <https://www.epa.gov/ghgreporting/learn-about-greenhouse-gas-reporting-program-ghgrp>.

⁹⁵ See EPA, "Data Sets," at <https://www.epa.gov/ghgreporting/ghg-reporting-program-data-sets>. At present, data are publicly available for 2010 through 2019.

⁹⁶ EPA has not implemented mandatory reporting requirements of GHGs emitted from livestock manure management systems. Historically, Congress has prohibited the expenditure of funds for this purpose. EPA does implement a collaborative program with USDA promoting the use of biogas recovery systems to reduce methane emissions from livestock waste. See EPA, "AgSTAR: Biogas Recovery in the Agriculture Sector," at <https://www.epa.gov/agstar>.

⁹⁷ Suppliers do not report direct emissions but instead report the quantity of GHGs that would be emitted if the fuels and industrial GHGs that they produce, import, or export each year were combusted, released, or oxidized. Emissions associated with these fuels and industrial gases do not occur at the supplier's facility but instead occur throughout the country, wherever they are used. See EPA, "GHGRP Supplier Highlights," at <https://www.epa.gov/ghgreporting/ghgrp-supplier-highlights>.

⁹⁸ The GHGRP includes most, but not all, U.S. emissions. In general, only large suppliers of greenhouse gas emitting products, or facilities that emit more than 25,000 metric tons of CO₂e per year (roughly equivalent to CO₂ emitted from the burning of 136 rail cars of coal), are required to report their annual greenhouse gas emissions. Some entire sectors, such as the agricultural and land-use sectors, are not required to report. Over 8,100 facilities and suppliers report greenhouse gas data to GHGRP, covering approximately 85-90% of total U.S. greenhouse gas emissions.

While GHGRP data is reported at the facility level, pursuant to a 2010 rule amendment,⁹⁹ certain parent company information is reported for reporting facilities.¹⁰⁰ The GHGRP does not, however, provide for aggregated corporate parent-level reporting.

Voluntary Reporting Initiatives

In addition to the GHGRP, the EPA also works directly with companies on GHG accounting and measurement on a voluntary basis through its Center for Corporate Climate Leadership. An important element of that work is to provide guidance on emissions reporting.¹⁰¹ For Scope 3 GHG emissions, the EPA references the GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard,¹⁰² which presents details on all Scope 3 categories and requirements and guidance on reporting Scope 3 emissions.

The EPA’s data collections on GHG emissions may prove difficult for financial firms and regulators to use for financial analysis, reflecting challenges with merging datasets and other factors. For financial analysis, a broader view of emissions intensity—encompassing the full spectrum of direct and indirect, or upstream and downstream, emissions—would provide a fuller picture and enable companies to generate enhanced climate-related disclosures.

Summary: Data on Exposures of Nonfinancial Entities

The impacts of climate risk on nonfinancial entities drive the climate-related risks faced by the financial sector. Households and businesses can be impacted by physical risk through a variety of channels, and further work is needed to better measure and assess this process. For transition risk, measuring GHG emissions provides a mechanism to assess, track, and mitigate entities’ contributions and exposures to climate risk. As a result, GHG emissions data is a key input to the assessment of climate-related financial risk to the financial sector, along with data associated with climate impacts on households and business entities.

Data on Risks to Financial Institutions and Markets

Understanding of how the climate-related financial risks of the nonfinancial sector translate into risks to financial institutions and markets is at an early stage. As recently noted by the BCBS:

There is a limited amount of research and accompanying data that explore how climate risk drivers feed into transmission channels and the financial risks faced

⁹⁹ Mandatory Reporting of Greenhouse Gases, 75 Fed. Reg. 57669 (September 22, 2010), at <https://www.govinfo.gov/content/pkg/FR-2010-09-22/pdf/2010-23674.pdf>

¹⁰⁰ Parent-level data is available on the GHGRP data sets page under Frequently Requested Data. See EPA, “Data Sets,” at <https://www.epa.gov/ghgreporting/ghg-reporting-program-data-sets>.

¹⁰¹ For information on Scope 1 and 2, see EPA, “Scope 1 and Scope 2 Inventory Guidance,” at <https://www.epa.gov/climateleadership/scope-1-and-scope-2-inventory-guidance>.

¹⁰² See EPA, “Scope 3 Inventory Guidance,” at <https://www.epa.gov/climateleadership/scope-3-inventory-guidance#resources>.

by banks. Existing analysis does not generally translate changes in climate-related variables into changes in banks' credit, market, liquidity or operational risk exposures or bank balance sheet losses. Instead, the focus is on how specific climate risk drivers can impact narrowly defined sectors of particular economies, individual markets, or top-down assessments of the macro economy as a whole. (Emphasis in original)¹⁰³

In addition, the current state of data reflects the historical approach of financial institutions to climate change. Financial institutions, like most businesses, have historically viewed climate change through a corporate social responsibility lens instead of a financial risk lens. In response to pressures from a variety of stakeholders, firms are beginning to take a broader approach. In general, U.S. banks appear to have started the process later than their European counterparts and smaller U.S. banks appear less far along than larger ones.¹⁰⁴ U.S. financial agencies are in the process of developing methodologies to capture and analyze the impact of climate risk to businesses, households, governments, and financial entities.

Data on Physical Risk Exposure

Granular portfolio data is needed to assess physical risk exposures accurately. For loans secured by real estate, some data on the specific location of the real estate asset is usually available. Other supplemental information relevant to the assessment of certain types of risks (e.g., weather-resistant building materials) and certain types of mitigants (e.g., flood insurance) would improve the quality of physical risk assessments. For corporate loans, physical risk assessments would be more precise if they contained complete disclosures of a company's exposures to physical risk based on the location of the company's production sites, its value chain, and projected future physical effects of climate change on those locations under different climate scenarios. For example, climate change may impact shipping and other infrastructure such as ports, railways, or highways. This type of comprehensive data on potential physical impacts is generally not readily available or easy to collect. Consequently, financial institutions and regulators will need to balance the benefits and costs of different approaches to data needs and exposure estimation, as well as potentially consider the availability of third-party data sources to help model future physical risk in different geographic areas.

Banks

Existing regulatory data could be leveraged to begin identifying current portfolio exposures of financial institutions to physical risks, including through use of the FR Y-14 filings used to assess the capital adequacy of large bank holding companies (BHCs) and U.S. intermediate holding companies (IHCs) and the less-detailed information on the balance sheets of all banks, including smaller banks, available through the Consolidated Reports of Condition and Income (Call Reports).

¹⁰³ BCBS 2021, *Climate-related Risk Drivers and Their Transmission Channels*, p. 2.

¹⁰⁴ Moody's Analytics, *How US Banks Are Addressing Climate Risk and Sustainability* (February 2021), at <https://www.moodysanalytics.com/articles/2021/how-us-banks-are-addressing-climate-risk>.

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In addition, the Home Mortgage Disclosure Act (HMDA) requires many financial institutions to maintain, report, and publicly disclose loan-level information about residential mortgages. Although the dataset provides the location of the property at the county level, it has potential shortcomings, including a lack of information on whether the loan was retained by the bank or sold. HMDA requirements only cover sales within the year of origination and there are significant delays until HMDA data is available for use.¹⁰⁵ Loan-level data on small business lending is available through data collected under the Community Reinvestment Act (CRA).¹⁰⁶ Further, securitization and other complex securities make it especially difficult to link loan-level climate risks to bank portfolios, particularly with respect to non-commercial loans.

Nonbank Lenders

Other lending institutions that are not depository institutions, referred to as nonbank lenders, originate about half of all mortgages in the country and service the majority of mortgages securitized through Ginnie Mae and the Enterprises.¹⁰⁷ Nonbank lenders are generally subject to prudential supervision by state regulators and are required to submit periodic reports to them. These reports may also be useful to inform assessments of climate exposures facing the residential real estate market as a whole. As with other forms of regulatory reporting, nonbank lenders' periodic reports may not provide sufficient information to assess nonbank lenders' physical risk exposures.

Federal Home Loan Banks, Fannie Mae, and Freddie Mac (GSEs)

The Federal Home Loan Banks, Fannie Mae, and Freddie Mac (GSEs)¹⁰⁸ are regulated by FHFA. The GSEs' primary exposure to physical risk from climate change arises from credit losses in the mortgage market. However, they may be subject to additional exposures, some of which are discussed below.

FHFA is in the process of evaluating publicly available data, its own proprietary data assets, third-party vendor data, and FEMA data to identify and close key data gaps, and link climate change, flood risk, and other disaster-related data with existing insurance, mortgage, and property data. FHFA is leveraging these data assets to define, identify, and measure climate-related financial risk to its regulated entities, while taking into account concerns about disparate impacts to historically underserved communities. FHFA is beginning with flood risk, but will also examine the impacts of other perils, such as wind damage, wildfires, and droughts.

The FHLBanks regularly report loan-level data to FHFA for mortgages they purchase from their members. The data includes individual loan performance and location data at

¹⁰⁵ HMDA data is made available annually and is not typically available until several months into the following year. For example, a loan originated in February 2021 may not show up in the data until June 2022, a 16-month lag.

¹⁰⁶ Housing and Community Development Act of 1977, 12 U.S.C. § 2901 et seq.

¹⁰⁷ See, e.g., FSOC, *2020 Annual Report*, at <https://home.treasury.gov/system/files/261/FSOC2020AnnualReport.pdf>.

¹⁰⁸ There are other GSEs; for example, the Farm Credit System is also a government-sponsored enterprise.

the census tract and postal code level. In addition, loan-level data includes demographic information. FHFA also collects household and aggregate information on the FHLBanks' Affordable Housing Programs and related programs that support low-income housing and community development projects. Location data can be combined with NOAA weather data or United States Postal Service zip codes to estimate climate risks for the mortgages as well as to vulnerable members of society. The Enterprises regularly report loan-level data to FHFA for new acquisitions and existing mortgages. This data includes location and loan performance information. This also includes flood risk exposure data of the mortgages at the time of origination, including whether a mortgage for a property is located in a Special Flood Hazard Area (SFHA), which has a one percent annual chance of being inundated by a flood event as defined by FEMA, and also whether the mortgaged property is covered by flood insurance.¹⁰⁹ The loan-level mortgage performance data can be matched with the publicly available National Flood Hazard Layer (NFHL), which contains FEMA's flood maps. However, whether a property is located in a SFHA at the time of origination is only one measure of an Enterprise's exposure to flood risk.¹¹⁰ Regularly updated data is needed to accurately assess flood risk over the life of the loan.¹¹¹

In addition to flooding, other perils, such as wildfires, droughts, and hurricanes, have the potential to pose serious physical risk, leading to potential structural damages to housing. Understanding the physical risk of climate and weather-related disaster events requires additional scientific data and analysis. Finally, to understand the ultimate financial risk to the GSEs, those structural damages must be translated into potential financial losses to the GSEs using models that take into account changes in market conditions, market participant behavior, and loss-absorbing mechanisms that are in place (e.g., hazard and flood insurance).

Additional data is needed to better understand the effect of physical risks on the GSEs, such as detailed data on perils and their associated risks, insurance for the underlying collateral throughout the lifetime of the loan, other physical risks to the GSEs from climate change, and physical risks for the GSEs' counterparties and other market participants. Moreover, increased analytical capacity and expertise is needed to generate predictions for both chronic risks, like sea-level rise, and acute risks, like wildfires or extreme rainfall events; damage functions for how physical risk translates to property damage; and models that translate those property damages to financial losses for the GSEs.

¹⁰⁹ For FEMA's definitions of flood-zones, including the SFHA, see FEMA, "Flood Zones," at <https://www.fema.gov/glossary/flood-zones>. The National Flood Insurance Reform Act of 1994 requires all mortgages for a property located in a SFHA and acquired by the Government-Sponsored Enterprises to hold flood insurance for the lifetime of the loan.

¹¹⁰ SFHA classification does not account for pluvial flooding (flooding from rain), only accounting for fluvial flooding (riverine flooding) and coastal flooding.

¹¹¹ See, e.g., *Flood Insurance Coverage of Federal Housing Administration Single-Family Homes* at <https://www.huduser.gov/portal/sites/default/files/pdf/MDRT-Flood-Insurance-Coverage-of-FHA-SFH.pdf>, which is a study conducted for HUD that illustrates gaps in flood insurance coverage can be non-trivial. Homes in SFHAs are required to have flood insurance to be eligible for purchase by the Enterprises and mortgage servicers are tasked with monitoring borrowers to ensure no lapses in coverage.

Insurance

Physical risks can affect both the asset and liability side of an insurer's balance sheet. On the asset side, insurers may be impacted by write-downs in the value of investments held in securities of companies exposed to the physical effects of climate change or from decreases in the value of collateral, such as real estate or agricultural-related assets. On the liability side, increases in the frequency, severity and geographical distribution of weather-related catastrophes could lead to higher direct losses from property damage, as well as indirect losses such as from business interruption.

Asset-side information on an insurer's bond, equity, real estate-related, and alternative asset holdings is found on Schedules A, B, BA, and D in annual state regulatory filings.¹¹² The first three of these schedules provide information about Real Estate (A), Mortgage Loans (B), and alternative real estate/private equity investments (BA). These three schedules provide asset-by-asset details on real estate related holdings, including: the description of the property, location (city/state), actual cost, and property value. The real estate-related schedules, however, do not provide the precise geographic location of an insurer's investments with its risk characteristics (e.g., building codes and construction materials).¹¹³

Schedule D may also provide information on insurers' investments exposed to climate risk since it lists holdings of bond and equities, which could include investments in mortgage-backed securities, infrastructure-related investment, municipal bonds, and corporations exposed to the physical effects of climate change. Schedule D provides a brief description of each security along with quantitative information on the investment, which includes cost, fair value, book value (bonds), and any unrealized gains and losses.

The liability side of an insurer's balance sheet includes reserves, which reflect obligations to make future payments to policyholders. Climate risks add complexity to the ability to quantify such future obligations in the underwriting process and designing reinsurance programs. Severe weather events over recent years have highlighted the difficulty in predicting future climate trends. Changing climate patterns could increase the frequency and severity of weather events, creating additional uncertainty around insurers' exposures. Insurers use both proprietary and third-party data and models to calibrate such risks, set premiums, and manage exposures.

For insurers, regulators, policymakers, and other stakeholders to better understand physical risks and how they might affect insurance liabilities, additional data on a variety of primary and secondary perils is needed. The increased frequency and severity of weather-related events, which can result in increasingly large insured losses, impacts the liabilities and net income of P&C insurers. In the short-term, physical risks arise for P&C insurers from the effects of more frequent and severe weather-related events such as floods, wildfires, and

¹¹² Kathleen C. Odomirok, Liam McFarlane, Gareth Kennedy, *et al.*, *Financial Reporting Through the Lens of a Property/Casualty Actuary* (2014), pp. 93-98, at https://www.casact.org/sites/default/files/database/studynotes_odomirok-etal_financial-reporting4.pdf.

¹¹³ Schedule B includes data on farm mortgage loans.

storms, and from longer-term events such as sea-level rise and chronic heat waves.¹¹⁴ As a result, natural catastrophe modeling is critical in order to evaluate and quantify climate-related physical risk for P&C insurers. A major challenge in this regard is that catastrophe models based on historical data are unlikely to capture potential future climate change-related shifts of extreme weather events. Moreover, long-term impacts of climate change (e.g., rise in temperatures and sea levels) may increase the frequency and severity of natural catastrophes and affect the assumptions used for risk assessment modeling. Data used to model primary perils may not be sufficiently predictive. Likewise, for secondary perils, the data may not be useful for risk assessment and modeling both because the data lacks granularity and because of the highly random geographic nature and size of these events. Another challenge in developing useful predictive models is that the degree of impact of weather-related events on insurers' property-related exposures depends, in part, on mitigating factors, such as changes to building codes, public policy, and other risk mitigation initiatives.

Funds and Asset Managers

Some funds' investment portfolios may be gauged for climate-related physical risks through an integration of portfolio holdings and climate risk drivers, provided the necessary data is available. Third-party solutions that integrate climate data and scenario analysis with funds' securities-level information are proliferating but face significant limitations in coverage and lack of standardization. Council members and other government agencies could work together to enhance available information or to facilitate greater private-sector development of needed data. For instance, detailed information on the geographic location of facilities associated with portfolio holdings may be required, and standard financial reporting of, for example, corporate debt or securities does not include such detail. This type of detailed information may be even more important in assessing exposure to physical risks associated with residential and commercial real estate exposures.

Critical Infrastructure

An assessment of physical risks also requires consideration of climate-related operational risks to financial sector critical infrastructure. Critical components of the assessment include quality climate assessment models and sector operations data, such as:

- **Location-based:** Data describing the physical location of firms, entities, institutions, and infrastructure performing and/or supporting sector operations, including infrastructure in other sectors supporting financial operations (e.g., electricity, telecommunications, transportation);
- **Operations-based:** Data describing the operations, activities, and/or functions conducted at each location; and

¹¹⁴ Anna Sweeney, "The Resilience of Insurers in a Changing Climate," presentation, Moody's Insurance Summit Webinar (September 2020); Oliver Wyman, "Infrastructure as an Asset Class," presentation, FACI, Washington, DC (May 11, 2017), at https://www.treasury.gov/initiatives/fio/Documents/3d-Oliver_Wyman_Infrastructure.pdf.

- **Relationship-based:** Data describing the direct relationships an owner/operator has with other market participants (e.g., other owner/operators, direct participants, etc.) and supporting third parties (e.g., technology service providers, etc.).

Council members and the private sector have an opportunity to build upon existing resilience work and prioritize climate change-related policies and programs to strengthen financial sector operational resilience. Treasury, as the Sector Risk Management Agency for the financial services sector and chair of the FBIIC, is well-positioned to lead public-private efforts to analyze climate-related operational risks and coordinate sector resiliency efforts. These efforts are at an early stage, but an assessment of climate-related operational risks could involve public and private sector collaboration to identify climate-related and operational data sources and models for use in assessing operational risk, sharing of expertise, and coordinated engagement with non-FSOC member agencies and data providers to develop the data and methodology necessary to perform operational risk analysis.

Data on Transition Risk Exposure

Assessing financial institutions' exposure to transition risk requires quantifying the portfolio exposures of individual financial institutions and ultimately the broader financial system to those companies or sectors most likely to be affected by the transition to a low-emissions economy. A starting point would be to use the current portfolio exposures (static balance sheet), but a more advanced analysis, like the pilot exercise conducted by the Banque de France,¹¹⁵ might ask financial institutions to forecast future exposures (dynamic balance sheet), allowing for portfolio reallocation in the medium-to-long term.

Financed Emissions

Financed emissions is a metric to help gauge climate-related transition risk for financial institutions. They are considered to be a subset of Scope 3 emissions under the GHG protocol. Financed emissions are an accounting of financial institutions' emissions footprint associated with their current financing and lending activities. Estimates of an institution's financed emissions can provide insight into the portion of its portfolio that may be most affected by the adjustment to a low-GHG economy, and thus assist in the identification of financial institutions' exposure to transition risks. Financed emissions may also indicate whether and how a financial institution's lending or financing activities may need to adapt over time and can demonstrate financial institutions' progress toward their own GHG reduction goals.

The use of financed emissions as a metric is an area of promise and has been rapidly developing. Some financial sector participants have begun to develop voluntary standards and methodologies for financed emissions that attempt to address some methodological

¹¹⁵ See Autorité de Contrôle Prudentiel et de Résolution (ACPR), “Analysis and synthesis (Analyses et synthèses) no. 122: The Main Results of the 2020 Climate Pilot Exercise,” Banque de France, at <https://acpr.banque-france.fr/en/main-results-2020-climate-pilot-exercise>. The ACPR conducted the climate pilot exercise between July 2020 and April 2021 to develop knowledge about supervising climate-related financial risks. The exercise was a bottom-up climate-related stress test exercise, based on a risk assessment directly conducted by the financial institutions under its responsibility on the basis of common assumptions.

questions relating to the accounting of financed emissions.¹¹⁶ For example, there are outstanding questions with respect to calculating financed emissions for different types of assets and institutions. If different methodologies are used across firms, comparisons can be difficult.

Banks and Nonbank Lenders

Existing regulatory reports include data that could help begin to identify current portfolio exposures of financial institutions to transition risks. For example, FR Y-14 filings include granular data on loans, securities, and trading assets for large BHCs and U.S. IHCs. Such data could be useful to inform assessments of transition risks using information on the GHG intensity of sectors and transition scenarios.

Smaller banks report similar, but less detailed information on their balance sheets, which are available through the bank Call Reports. The Call Report lists lending by broad category (e.g., commercial and industrial loans, real estate, etc.), but does not delineate lending by geography, industry, or borrower.¹¹⁷ Nevertheless, in the aggregate, individual bank Call Reports combined with other data sources might help inform assessments of climate exposures facing the banking sector as a whole, and in the context of climate-related financial risk, facilitate assessment of systemic risk.

Similarly, nonbank lenders are generally subject to prudential supervision by state regulators and generally required to submit regular reports to them. These reports may also be useful to inform assessments of climate exposures facing the financial sector as a whole, and in the context of climate-related financial risk, facilitate assessment of systemic risk.

Federal Home Loan Banks, Fannie Mae, and Freddie Mac (GSEs)

The GSEs are exposed to transition risks through all four channels: public policy, technological changes, consumer and investor preferences, and disruptive businesses. For example, changes in public policy that increase the costs of carbon-intensive industries, or require changes in heating sources, can lead to higher building costs. Technological changes could also increase the costs of homeownership, e.g., transitioning to alternative fuel sources may require replacing existing heating equipment, and shifting to electric vehicles might require homeowners to install equipment to charge them. Consumer and investor preferences and local economic conditions may change, inducing migration away from areas with high likelihoods of a climate or natural disaster event or higher average temperature as consumers become more aware of or are affected by climate impacts. Financially vulnerable communities may be disproportionately affected by changing economic and climate conditions, which necessitates careful consideration of the distributional impacts of transition risk.

¹¹⁶ For example, the Partnership for Carbon Accounting Financials (PCAF) “is a global partnership of financial institutions that work together to develop and implement a harmonized approach to assess and disclose the greenhouse gas (GHG) emissions associated with their loans and investments.” See PCAF, “About,” at <https://carbonaccountingfinancials.com/about>.

¹¹⁷ While Bank Call Report data has some potential for high-level analysis of climate-related financial risk, it could benefit from further enhancement and integration with other data sources.

There may also be changes in investor demand for certain types of mortgage-backed securities and related products, for example, changes in the appetite for green bonds offered by Fannie Mae and Freddie Mac. In recent years, the market for sustainable investing, or the use of ESG criteria and data to inform potential investments, has grown significantly.¹¹⁸ Global green bond issuance reached a record high of \$269.6 billion in 2020 and is set to exceed \$450 billion in 2021.¹¹⁹

There are likely many other pathways and mechanisms by which the GSEs are affected by transition risks and FHFA is currently working on identifying all such possibilities. Assessing additional transition risks to the GSEs will require not only data across a myriad of sources, but also complex modeling and assumptions about future climate-related changes. For example, FHFA currently monitors house price appreciation across the United States with its regularly published house price index (FHFA HPI®). FHFA intends to leverage its existing data and expertise in house price appreciation, combined with scientific data to develop its understanding of climate change and natural disasters' impacts on future home prices. Requesting climate-related stress tests and scenario analysis from its regulated entities could also inform FHFA's assessments. This reinforces the need for a common set of definitions and expectations of future changes among all financial regulators, such as agreed-upon climate scenarios, associated economic trajectories, and other key trends and assumptions. New data collection is required to better assess transition risk exposures. FHFA is currently assessing potential data sources, such as detailed data on the underlying collateral (e.g., age of building, heat source, etc.), which can assist in calculating transition costs. Additional data on industries upstream of the mortgage market that may face higher costs due to transition risks will be necessary as well. Changing consumer preferences need to be understood as they could increase housing prices in certain regions while decreasing housing prices in other regions.

Insurance

Annual state regulatory filings require insurers to provide detailed reporting of investments that may be vulnerable to transition risk.¹²⁰ This data is classified by several broad asset types on investment schedules included in the annual filing. The majority of such investments are reported on Schedule D in the annual filing, which consists of bonds (where corporate bonds are likely most exposed to transition risks), direct loans (e.g., direct loans, private placements), structured securities, preferred stock, and equity holdings. A brief description of each outstanding investment security must be provided along with quantitative information

¹¹⁸ See Greg Iacuri, "Money Invested in ESG Funds More than Doubles in a Year," *CNBC* (February 11, 2021), at <https://www.cnbc.com/2021/02/11/sustainable-investment-funds-more-than-doubled-in-2020-.html>.

¹¹⁹ Nina Chestney, "Global Green Bond Issuance Hit New Record Last Year," *Reuters* (January 24, 2021), at <https://www.reuters.com/business/sustainable-business/global-green-bond-issuance-hit-new-record-high-last-year-2021-01-25/>.

¹²⁰ Insurance companies are required to maintain accounts using statutory accounting principles (known as SAP or Stat). Life insurers also report a separate filing for investments held in the separate account.

on the investment, including cost, fair value, book value (bonds), and any unrealized gains and losses.

Schedule D does not, however, clearly identify the underlying security in certain instances (e.g., collateralized loan obligations, direct loans), and issuers are not mapped to industrial sectors. As a result, there may be challenges associated with identifying an insurance company's investment exposure to vulnerable sectors or gauging the risk characteristics of the underlying security from the annual statement entries alone. Also, no data is provided in Schedule D on the underlying loans or assets for investments in structured securities, such as asset-backed securities. For publicly-issued securities, however, such data are readily available from third-party platforms that are frequently reviewed by NAIC and state regulators.¹²¹ In addition, insurers also invest in a wide-range of climate-related alternative investments, including limited partnership interests in oil and gas production, which are reported on a separate Schedule BA and provide a limited degree of transparency.

Funds and Asset Managers

As with physical risks, funds' investment portfolios could be gauged for climate-related transition risks through an integration of portfolio holdings and climate risk drivers. Certain data, such as data from Form N-PORT, is available publicly and could be useful for assessing climate-related risk. Form N-PORT is the reporting form used for monthly reports of U.S. funds other than money market funds. Every quarter, funds report their monthly portfolio holdings as of the last business day or calendar day of the month. With the exception of the non-public portion of the form, the information reported on Form N-PORT for the third month of each fund's fiscal quarter is made publicly available.

Form N-PORT data items that could be useful for assessing a given fund's exposure to climate-related risks include, among others: a fund's monthly returns, investors' flow, and portfolio holdings identifying the name, identifier, currency, country of origin and asset type of individual securities. Form N-PORT data can be matched with other databases via CIK Number and LEI Number at the fund level, or CUSIP, LEI, Ticker or ISIN (if available) at the fund-holding level.

For example, by linking N-PORT portfolio CUSIP-level holdings data with Center for Research in Security Prices (CRSP) monthly stock files (which include both CUSIP and SIC codes), one could develop a proxy of transition risk based on funds' exposure to industries most likely affected by the transition to a low-carbon economy (e.g., oil and gas). The usefulness of this data would be improved with better data on GHG emission intensity. In addition, merging of datasets focused on climate-related information may require cleaning and efforts to link such data with standard financial data.

¹²¹ See New York Department of Financial Services, *An Analysis of New York Domestic Insurers' Exposures to Transition Risk and Opportunities from Climate Change* (June 2021), at https://www.dfs.ny.gov/system/files/documents/2021/06/dfs_2dii_report_ny_insurers_transition_risks_20210610.pdf.

Data to Assess System-wide Effects and Financial Stability

While there is no single approach to assessments of financial stability, stress tests of large financial institutions are an important input into such assessments in the United States and other countries. For example, the Federal Reserve's stress testing framework assesses whether the largest U.S. bank holding companies are sufficiently capitalized to absorb losses during a hypothetical recession, ensuring that they can continue to lend to households and businesses.¹²² Approaches to scenario analysis for climate-related financial risks that are currently under development are sufficiently advanced to be useful to assess climate-related financial risks on a preliminary basis, and are being used in a number of countries and discussed in Chapter 5. However, such approaches have not yet been used to impose direct supervisory or regulatory consequences, as is the case for other stress tests. Rather, scenario exercises have been used by regulated firms and regulators to develop and assess risk measurement, management capacity, and informational needs. Experience with scenario analysis has highlighted some of the data requirements for improved financial stability assessments of climate-related financial risks.

A prominent example is the set of scenarios developed and published by the NGFS, which incorporate physical and transition risk.¹²³ The NGFS scenarios provide a range of data on transition risk (e.g., carbon price, sectoral transitions for power generation, transportation, etc.), physical risk (e.g., mean temperature rise, sea-level rise), and economic impacts (e.g., output growth) associated with each scenario at a high level of aggregation. For a given scenario, exposure to transition and physical risk can vary significantly across countries or local areas. Quantifying the scenarios with an appropriate level of sectoral and geographic specificity is an important factor in climate-related financial risk assessment. Chapter 5 discusses scenario analysis in more detail.

Next Steps

Data is vital to improve our understanding of climate-related financial risks to financial institutions and markets. Enhancing data resources and analytic tools used by FSOC members and financial entities is key to achieving this goal.

While progress is being made, there are challenges in improving climate-related data so that it can more effectively measure and assess climate-related financial risks. These include identifying relevant data resources; building the capacity to gather, store, and use data; developing links across data sets created for different purposes; and balancing the benefits and costs of enhanced data. Coordination among FSOC members, as well as with other government agencies and stakeholders, will be key to ensure that data is accessible to and usable by a wide range of stakeholders, including the public. FSOC can play an important role in this undertaking, as discussed in the recommendations in Chapter 6.

¹²² FRB, *Dodd-Frank Act Stress Test 2021: Supervisory Stress Test Results* (June 2021), at <https://www.federalreserve.gov/publications/files/2021-dfast-results-20210624.pdf>.

¹²³ NGFS, *NGFS Climate Scenarios*. The NGFS effort provides a useful framework. Additional work would be needed to develop more granular scenarios suitable for use by individual firms to assess climate-related financial risk.

Chapter 4: Climate-related Disclosures

Public Disclosure of Climate-related Risks

Public, high-quality climate-related disclosures by companies that issue securities (issuers) or are regulated as a financial institution (financial institutions)¹²⁴ will better inform investors and market participants about the climate-related risks to those entities. In aggregate, these disclosures can also better inform market participants and regulators about climate-related risks to industry sectors and the financial system.

Demand for information about climate-related risks and opportunities has grown significantly, driven by investors and financial institutions that are interested in managing their exposure to climate risks and identifying climate opportunities in the market. However, existing disclosure requirements have not resulted in consistent, comparable, or decision-useful¹²⁵ information for investors and other market participants. Voluntary frameworks have helped advance climate-related disclosures, but they have also fallen short in providing consistent, comparable, and decision-useful information.

Under the current U.S. regulatory framework, issuers and financial institutions are required to make a variety of financial or risk disclosures (collectively, disclosures). These disclosure requirements are generally intended to inform investors and/or market participants about the financial risks to individual entities. However, they can come in different forms and reflect different purposes, depending upon the mandate and policy goals of the regulator imposing the requirements.¹²⁶

Like other risks, climate-related risks can impact the financial performance and position of companies over the short, medium, and long term. One of the most significant forms of public disclosure in the U.S. is that provided by publicly traded companies (public issuers).¹²⁷ Public issuer disclosures are an important source of information in the U.S. financial markets. Such disclosure, including disclosure of climate-related risks, is necessary to protect investors,

¹²⁴ For the purposes of the discussion in this report, an “issuer” is a company that issues securities. “Financial institution” will be used to refer generally to a company that is regulated by a federal or state financial regulator or predominantly engage in financial activities.

¹²⁵ Consistency, comparability, and decision-usefulness are often cited as important characteristics of financial reporting and other corporate disclosures. In financial reporting literature, consistency refers to the use of the same methods for a disclosure item, either from period to period within a reporting entity or in a single period across entities. Comparability is the qualitative characteristic that enables users to identify and understand similarities in, and differences among, disclosure items. Decision-useful is the concept that a disclosure item is likely to impact investing, lending, and other decisions related to the reporting entity. For a disclosure item to be useful, it must be relevant (capable of making a difference in the decision by users) and faithfully presented (complete, neutral, and free from error). See, e.g., Financial Accounting Standard Board, *Statement of Financial Accounting Concepts No. 8 As Amended* (August 2018), at https://www.fasb.org/jsp/FASB/Document_C/DocumentPage?cid=1176171111398

¹²⁶ Each FSOC member that issues requirements for climate-related risk disclosure must ensure that any requirements imposed are consistent with its mandate and authorities.

¹²⁷ Public issuers and regulations related to them will be discussed in more detail below.

and maintain fair, orderly, and efficient markets, as well as facilitate capital formation. Public disclosure is the primary means through which public issuers communicate their financial condition, business plans, risks, opportunities, and other information important to investors, who rely on these disclosures to make informed investment decisions in line with their own risk preferences.

Banks, insurance companies, funds, or other financial entities can be subject to public disclosure requirements that apply independently of, or in addition to, public issuer disclosure requirements, depending on the particular mandate and regulatory or supervisory purposes of the regulator issuing them. These will be discussed further below.

Public Disclosure of Climate-related Risks and Financial Stability

The resiliency of the financial system is, in part, dependent upon the resiliency of the firms that comprise it. In general, an individual firm is more resilient when it has sound processes for assessing risks and applies appropriate risk management practices. The disclosure of risks, and plans for managing them, can help foster the resilience of the financial system by allowing investors and market participants to factor that risk into their decision-making. This, in turn, facilitates better pricing of that risk information into financial markets. This pricing of climate-related risk can help reduce the likelihood of a financial shock associated with a sudden repricing of assets exposed to climate-related risks.

As appropriate to their authorities and mandates, financial regulators can also use the information that they require through disclosures to assess the resiliency of both non-financial and financial firms to risks in the economy and the financial system. For example, information about climate-related financial risks contained within disclosures has the potential to help prudential regulators assess threats to the safety and soundness of individual financial institutions and the financial system more broadly. Through these mechanisms, climate-related disclosures can help support financial stability.

Current State of Public Climate-related Disclosures in the United States

Existing U.S. Regulatory Framework Relevant for Climate-related Disclosures

Disclosure requirements arise under different statutory mandates and often reflect different regulatory and supervisory purposes. FSOC members are at different stages in their development of their disclosure requirements concerning regulated entities, as reflected in the discussion below. Understanding the scope of existing public disclosure requirements can offer insight into how climate-related disclosure requirements could be enhanced to be more consistent, comparable, and decision-useful for investors and other market participants, as relevant to each FSOC members' mandate and authorities.

Public Issuers

The SEC is charged with: protecting investors; maintaining fair, orderly, and efficient capital markets; and facilitating capital formation. Companies offering or selling securities must either register the offering under the Securities Act of 1933 (Securities Act) or qualify for an exemption under the Securities Act.¹²⁸ A public issuer is an issuer or company that has securities registered under the U.S. Securities Exchange Act of 1934 (Exchange Act) or is required under the Exchange Act to file periodic and current reports. This reporting provides shareholders and the markets with important information about the company, its performance, and its prospects.¹²⁹

SEC Regulation S-K provides narrative disclosure requirements and Regulation S-X provides financial statement disclosure requirements for registration statements used in public issuer offerings under the Securities Act and for ongoing reporting by public issuers under the Exchange Act. Regulation S-K requires companies to disclose information important to an investment decision, including a description of their business and properties, material legal proceedings, risks associated with an investment in the company or offering, certain financial information, and management's discussion and analysis of the company's financial condition and results of operations (MD&A). MD&A requires a discussion and analysis of, *inter alia*, "material events and uncertainties known to management that are reasonably likely to cause reported financial information not to be necessarily indicative of future operating results or of future financial condition."¹³⁰

Investors have increasingly requested access to information about the risks posed to companies' properties and supply chains due to increasing severe weather events, sea-level rise, drought, or other physical effects of climate change. In addition, investors have requested information about companies' exposure to transition risk linked to their GHG emissions footprint. Investors want to know whether companies have developed strategies to mitigate the risks associated with climate change, such as whether and how they are preparing to shift from carbon-intensive energy sources, or have measures in place to address other transition risks, such as potential changes in policy that may increase the cost of using GHG-intensive energy or other inputs. Public disclosures of climate-related risks also inform other companies in the disclosing company's value chain that are exposed to the risks of the disclosing company, such as asset managers, lenders, insurers, and commercial counterparties. This allows companies that are exposed to the disclosing company's risks to

128 See Section 5 of the Securities Act.

129 See Section 13 and 15(d) of the Exchange Act. The periodic and current filing requirements include Form 10-Q, Form 10-K, and Form 8-K. Public issuers are also commonly referred to as "publicly traded companies" or "publicly listed companies."

130 Item 303(a) of Regulation S-K (17 CFR § 229.303(a)). In addition, the term "material," when used to qualify a requirement for the furnishing of information as to any subject, limits the information required to those matters to which there is a substantial likelihood that a reasonable investor would attach importance in determining whether to buy or sell the securities registered (Rule 12b-2 of the Exchange Act (17 CFR § 240.12b-2) and Rule 405 of the Securities Act (17 CFR § 230.405)).

better assess, mitigate, and disclose their own risks. This, in turn, promotes efficient capital allocation and more orderly and resilient markets.

The transition to a low-GHG economy can also present opportunities for companies that are able to capitalize on them. Climate-related disclosures can improve investors' ability to identify firms well-positioned to succeed in a low-GHG or net-zero emissions future. This can further facilitate an orderly allocation of capital in response to growing physical and transition risks related to climate change.

Examples of climate-related opportunities include:¹³¹

- **Energy and resource efficiency:** Operating costs can be reduced by improving efficiency across energy and resource value chains, resulting in direct savings to organizations' operations over the medium to long term and reducing exposure to transition risks through a reduction in emissions.
- **Products and services:** Demand for low-emission products and services and risk-mitigation strategies may increase, thereby benefiting those who produce such products or offer such services. These might include the development of climate-related data and climate risk assessment services, the underwriting of green bonds and infrastructure, and the creation of new products such as electric vehicles.¹³²
- **Resilience:** Organizations may develop adaptive capacity to respond to climate change and to better manage the transitional and physical risks that may be associated with other external events.

As noted in Chapter 2, in 2010 the SEC issued interpretive guidance on climate-related disclosures.¹³³ Additional rulemaking by the SEC may provide additional climate-specific requirements for public issuers. In its Spring 2021 regulatory flexibility agenda,¹³⁴ the SEC announced its intention to issue a proposed rule mandating climate-specific disclosure requirements for public issuers, and the SEC Chair has indicated publicly that SEC staff is currently working on developing this proposal.¹³⁵

Private Issuers

Companies that have not conducted a registered offering under the Securities Act (either because they have not offered and sold securities or they have done so pursuant to an exemption from the registration requirements of Section 5 of the Securities Act), and

¹³¹ See Task Force on Climate-related Financial Disclosures, *Final Report: Recommendations of the Task Force on Climate-related Financial Disclosures* (June 2017), at <https://assets.bbhub.io/company/sites/60/2020/10/FINAL-2017-TCFD-Report-11052018.pdf>.

¹³² See, e.g., **Box C**.

¹³³ See Chapter 2, "Securities and Exchange Commission."

¹³⁴ Regulatory Information Service Center, "Agency Rule List – Spring 2021, SEC."

¹³⁵ See Chair Gary Gensler, "Prepared Remarks Before the Principles for Responsible Investment 'Climate and Global Financial Markets' Webinar" (July 28, 2021), at <https://www.sec.gov/news/speech/gensler-pri-2021-07-28>.

have not registered a class of securities under the Exchange Act, are typically referred to as “private issuers.”¹³⁶ Private issuers generally do not file periodic and current reports under the Exchange Act such as Forms 10-K, 10-Q, and 8-K. While private issuers generally are not subject to the disclosure requirements of public issuers, they sometimes disclose similar information to their investors on request, albeit not publicly.

While there are no comprehensive data describing the portion of the market comprised of private issuers, some statistics regarding the amount of capital raised in exempt offerings can provide insight into the potential size of this segment. In 2019, the SEC estimated that registered offerings accounted for \$1.2 trillion (30.8 percent) of new capital, compared to approximately \$2.7 trillion (69.2 percent) that the SEC estimated was raised through exempt offerings.¹³⁷

Financial Entities

Independent of the SEC’s requirements for public issuers, there also exist public disclosure requirements that apply to financial institutions. Currently, these disclosure requirements generally do not contain specific requirements related to climate-related risks. Further, it is important to note that to assess and quantify their own climate-related financial risks, particularly transition risks, financial institutions need access to climate-related risk information from the companies they are financing and investing in.¹³⁸ Where the companies that they are financing, or in which they are investing, are public issuers, the financial institutions will benefit from enhanced public disclosures related to those companies’ climate-related risks. Where the companies in which they are investing, or that they are financing are privately-held, the financial institutions will need to obtain this information through their own due diligence or underwriting processes or otherwise find ways to obtain useful information to inform their financing and investment decisions.

Asset Management

In the asset management industry, investors have demonstrated a significant interest in investments that incorporate ESG factors, including factors related to climate. In light of this investor demand and the attendant range of investment options offered to investors, SEC staff has stated that it will review the accuracy and adequacy of certain ESG disclosures made by investment advisers and funds.¹³⁹ The SEC has also issued a Risk Alert to highlight observations from recent exams of investment advisers, registered investment companies, and private funds offering ESG products and services.

¹³⁶ Private issuers are also commonly referred to as “private companies”.

¹³⁷ Facilitating Capital Formation and Expanding Investment Opportunities by Improving Access to Capital in Private Markets, 85 Fed. Reg. 17957 (March 31, 2020).

¹³⁸ See Chapter 3, “Climate-related Financial Risk—Data and Methods, Data on Risks to Financial Institutions and Markets.”

¹³⁹ SEC Division of Examinations, *2021 Examination Priorities*, at <https://www.sec.gov/files/2021-exam-priorities.pdf>.

While the rules and regulations governing the activities of investment advisers and registered funds are not climate-specific, the SEC's extensive disclosure and governance standards apply regardless of whether an investment adviser and registered fund employs sustainable investment strategies. In particular, like other types of public issuers, registered funds also are subject to extensive disclosure requirements. These funds are required to provide, for example, disclosure regarding their investment objectives, performance, risks, and other matters. A registered fund is also required to disclose in its prospectus its principal investment strategies, including the particular types of securities in which it will principally invest. Registered fund names, including the names of sustainable-focused funds, are subject to the antifraud provisions of the federal securities laws, which prohibit any fund from adopting as part of its name "any word or words that the Commission finds are materially deceptive or misleading." Moreover, Rule 35d-1, also known as the "Names Rule," specifically addresses certain broad categories of investment company names that are likely to mislead investors about an investment company's investments and risks.¹⁴⁰ Registered funds also are required to publicly report their proxy voting records annually.

Investment advisers are also subject to extensive disclosure and governance requirements. For an adviser offering investment advice that takes into account certain environmental or climate goals, its disclosures could include information about sustainability risks and opportunities depending on the facts and circumstances of the investment adviser's relationship with its client. Investment advisers are prohibited from misleading investors, and must therefore follow the ESG investment strategies they have set out in their disclosures or that have been specified by clients in managing portfolios. Registered investment advisers are also required to adopt and implement written policies and procedures reasonably designed to prevent violations of the Advisers Act, and therefore should manage clients' assets and vote client securities in accordance with the disclosures and client mandate.

In July 2021, SEC staff began to review whether fund managers should disclose the criteria and underlying data they rely on when applying ESG-related labels.¹⁴¹ SEC staff is also considering whether the SEC should take a holistic look at the Names Rule. In addition, in light of increasing investor focus and reliance on climate and ESG-related disclosure and investment, the SEC's Division of Enforcement announced a special task force to proactively identify ESG-related misconduct.¹⁴² The initial focus will be to identify any material gaps or misstatements in issuers' disclosure of climate risks under existing rules. It will also analyze disclosure and compliance issues relating to investment advisers' and funds' ESG strategies. The task force will work closely with other SEC Divisions and Offices to support SEC's efforts to address these risks to investors.

¹⁴⁰ Rule 35d-1 under the Investment Company Act of 1940.

¹⁴¹ Facilitating Capital Formation and Expanding Investment Opportunities by Improving Access to Capital in Private Markets, 85 Fed. Reg. 17957 (March 31, 2020).

¹⁴² SEC, "SEC Announces Enforcement Task Force Focused on Climate and ESG Issues" (March 4, 2021), at <https://www.sec.gov/news/press-release/2021-42>.

Derivatives Counterparties

The CFTC's disclosure regime is intended to protect the public from fraudulent or misleading behavior in the derivatives markets. Designated contract markets (derivatives exchanges) and designated clearing organizations (central counterparties) have been historically privately held, and the disclosure regime recognizes this by requiring them to disclose to the public potential risks of using their services. These disclosures can include operational risks that could prevent the entity from performing its services, such as cybersecurity risks, and potentially other business continuity concerns that could encompass climate-related risks, such as a natural disaster preventing a clearinghouse from clearing trades.

Financial intermediaries that solicit retail investors are required to disclose risks associated with operations and investment strategy. Often this is performed through a narrative disclose, with quantitative metrics including past performance and a break-even analysis. Swap dealers are required to disclose material risks related to swaps offered to their counterparties. These risks may include market, credit, liquidity, or other risks. While neither financial intermediaries nor swap dealers are currently required to explicitly analyze climate-related financial risks, climate change may influence investment returns or risk characteristics of a given swap.

Banks

In accordance with their statutory mandates, the OCC, FDIC, and FRB (U.S. banking agencies) require supervised institutions to provide reporting on a variety of indicators related to their financial condition and risks. Much of this information is publicly disclosed by federal banking agencies, in accordance with applicable law, or directly by supervised firms in the ordinary course of their business. For example, all supervised institutions are required to submit regulatory reports, with smaller institutions subject to streamlined reporting requirements.¹⁴³ Regulatory reports assist the federal banking agencies in fulfilling their supervisory mandates, and assist the public, state banking authorities, researchers, and bank rating agencies in understanding the condition of the banking sector.¹⁴⁴ Larger, more complex institutions subject to internal models risk-based capital requirements (otherwise known as advanced approaches capital requirements) are required to make additional public disclosures, which are intended to provide market participants with information about the institution's risk profile. Supervised institutions that are public issuers may also be required to provide financial statements and disclosures in accordance with the requirements of securities regulators and accounting standard-setting bodies.

Many large U.S. banking organizations are disclosing climate-related information using voluntary climate disclosure frameworks established by a number of international and non-governmental organizations, as discussed below. However, these disclosures are not included

¹⁴³ See, e.g., 12 U.S.C. § 1817(a) (Call Reports).

¹⁴⁴ For example, Call Report data serve a regulatory and public policy purpose by assisting the agencies in fulfilling their missions, including those of assessing and promoting the safety and soundness of financial institutions and the financial system, and protecting consumers.

in required U.S. banking disclosures and are not provided on a regular basis. Internationally, the BCBS, of which the U.S. banking agencies are members, is currently reviewing climate-related risk disclosures that may be relevant to banks to foster greater consistency, comparability, and reliability in disclosures across global banking organizations.¹⁴⁵

Insurance Companies

Currently, there is no nationwide requirement for the disclosure of climate-related financial risks for the entirety of the U.S. insurance industry, which is comprised of over 5,900 public and private insurers that are regulated by the states and territories. Insurers that are public issuers must comply with any climate-related risk disclosures required by the SEC, but in 2019, about 25 percent of insurers were public companies, comprising approximately 50 percent of direct insurance premium in the United States.¹⁴⁶

Some state insurance regulators have implemented climate-related risk disclosures for certain insurers, as noted in Chapter 2.¹⁴⁷ The states that do require high-level disclosures of climate-related financial risks and activities by insurers licensed by or operating within their states use the Insurer Climate Risk Disclosure Survey, adopted by the NAIC in 2010.¹⁴⁸ Since 2014, six states—California, Connecticut, Minnesota, New Mexico, New York, and Washington—have consistently required U.S. insurers or insurance groups that, on an annual basis, write more than \$100 million in direct premiums to complete the survey.¹⁴⁹ In recent years, the survey respondents have included companies that write approximately 70 percent of the direct insurance premiums written annually in the United States.¹⁵⁰ Eight additional states and the District of Columbia will require the insurers operating within them to complete the survey in 2021, which will increase survey participant coverage to approximately 78 percent of U.S. direct premiums written.¹⁵¹

The Insurer Climate Risk Disclosure Survey asks eight qualitative questions regarding climate risk governance, climate risk management, modeling and analytics, stakeholder engagement, and GHG management.¹⁵² Each of the questions require a yes/no answer and a narrative. Results are maintained on a California Department of Insurance (CDI) website and are

¹⁴⁵ FSB, *FSB Roadmap for Addressing Climate-related Financial Risks*.

¹⁴⁶ NAIC, “Number of Insurance Companies (2020),” p. 5, at https://www.naic.org/state_report_cards/report_card_wa.pdf; *NAIC, 2020 Premium Summary (2021)*.

¹⁴⁷ See Chapter 2, “State Insurance Regulators.”

¹⁴⁸ NAIC, Center for Insurance Policy and Research, *Assessment of and Insights from NAIC Climate Risk Disclosure Data* (Nov. 2020), p. 1, at <https://content.naic.org/sites/default/files/cipr-report-assessment-insights-climate-risk-data.pdf> [NAIC CIPR Survey Assessment].

¹⁴⁹ NAIC CIPR Survey Assessment, p. 6.

¹⁵⁰ NAIC CIPR Survey Assessment, p. 6.

¹⁵¹ The eight additional states are Delaware, Maine, Maryland, Massachusetts, Oregon, Pennsylvania, Rhode Island, and Vermont.

¹⁵² NAIC CIPR Survey Assessment, p. 1.

accessible to the public.¹⁵³ This disclosure is intended to provide support for consumers and investors looking to evaluate the efforts insurers have made to adopt sustainable practices.

Voluntary Climate-related Disclosures and U.S. Companies

U.S. companies, in response to investor demand, have begun to disclose climate-related risks using voluntary frameworks established by a number of international and non-governmental organizations. These voluntary frameworks seek to improve the quality and comparability of corporate disclosures to meet the growing demand for decision-useful data from investors and other market participants. Many of these frameworks focus on climate change, though some incorporate broader environmental concerns and other ESG factors as well. More information on ESG factors is provided in **Box H**.

Box H. Environmental, Social, and Governance Factors in Investments

Investment approaches emphasizing ESG factors have grown swiftly over the past few years, with an estimated \$17.1 trillion of US assets invested under ESG strategies, equivalent to 33 percent of total assets managed.¹⁵⁴ ESG investments address environmental concerns such as a company's emissions and pollution, social concerns such as diversity and inclusion and labor standards, or governance standards such as executive compensation and anti-bribery controls.¹⁵⁵ ESG investment has rapidly grown in the past decade due to both an increased investor demand for investment vehicles that serve a social purpose and the generally strong risk-adjusted performance of ESG investments.¹⁵⁶ Recent regulations have also presumably increased investor awareness of ESG investments, with regulations such as the European Union's Sustainable Finance Disclosure Regulation (SFDR) requiring fund managers to integrate sustainability into their investment processes and to report on what percentage of funds they operate according to a sustainable mandate.¹⁵⁷

While ESG factors appear to offer investors an opportunity to have a positive social impact while obtaining risk-adjusted returns, critics of ESG investing have noted concerns about the integrity of ESG scoring and the potential for 'greenwashing,' where companies mislead

¹⁵³ California Department of Insurance, "NAIC Climate Risk Disclosure Survey Results – Home," at https://interactive.web.insurance.ca.gov/apex_exprd/f?p=201:1::::: [CDI TCFD Database].

¹⁵⁴ US SIF, "2020 Report on US Sustainable and Impact Investing Trends," at https://www.ussif.org/files/Trends/2020_Trends_Onepager_Alternatives.pdf.

¹⁵⁵ CFA Institute, "CFA Investing and Analysis," at https://www.cfainstitute.org/en/research/esg-investing_CFA_Institute, "CFA Investing and Analysis," at <https://www.cfainstitute.org/en/research/esg-investing>.

¹⁵⁶ Nasdaq, "What is ESG Investing and Why is it Worth Trillions?" (July 15, 2021), at <https://www.nasdaq.com/articles/what-is-esg-investing-and-why-is-it-worth-trillions-2021-07-15>; and Hazel Bradford, "More Investors Adding ESG to Portfolios and Organizations — Survey," Pensions & Investments, September 14, 2021, at <https://www.pionline.com/esg/more-investors-adding-esg-portfolios-and-organizations-survey>.

¹⁵⁷ European Commission, "Sustainability-related Disclosure in the Financial Services Sector," at https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/sustainability-related-disclosure-financial-services-sector_en.

investors and/or consumers about the environmental credentials of their products.¹⁵⁸ An *Economist* study found that the largest 20 ESG funds had on average 17 investments in fossil-fuel producers.¹⁵⁹ *The Economist* also found that ESG ratings are poorly correlated across ESG data providers – in other words, they appear to have conflicting assessments of how well firms fulfill ESG criteria. In part, this is due to the subjectivity of how asset managers score various underlying companies in their ESG matrix.¹⁶⁰ While some providers consider the full supply chain in rating how sustainable a company is, others may consider only direct emissions.¹⁶¹ In addition, the lack of underlying data and use of different data sources may lead to different ESG ratings for the same company. Another concern involves the use of proxy data instead of direct measurement. For example, instead of measuring the diversity of a workforce, they may assess firms based on whether they have a policy on workforce diversity. Potential solutions to the discrepancies in ESG data involve standardization. Some observers have suggested greater disclosure or the use of taxonomies or other standardized classifications of assets, while others have suggested more granular data that allows ESG providers to offer more tailored products (such as climate funds that focus on extreme physical risk weather events).

In addition, many international organizations are starting to converge around the need for comparable disclosures for investor decision making, attempting to establish a global baseline for climate-related disclosures.

Various frameworks provide firms with standards and guidance with respect to how to incorporate ESG factors, including those related to climate change, as well as how to present this information to investors and the public. Multiple frameworks have emerged, in part, because each can provide different information or fulfill different functions when it comes to disclosing information related to climate-related risks or other ESG factors that may be important to investors.

These voluntary reporting frameworks generally promote acknowledgment of climate-related risks and a commitment by participating entities to address these risks. They often provide companies with methodologies for identifying, assessing, managing, and mitigating their risks. Frameworks may focus on target setting, scenario analysis, GHG and emissions

158 Tim Quinson, “How Wall Street is Gaming ESG Scores,” *Bloomberg*, September 8, 2021, at <https://www.bloomberg.com/news/articles/2021-09-08/how-fund-managers-are-gaming-esg-scores-instead-of-making-a-difference>.

159 “Sustainable Finance is Rife with Greenwash. Time for More Disclosure,” *The Economist*, May 22, 2021, at <https://www.economist.com/leaders/2021/05/22/sustainable-finance-is-rife-with-greenwash-time-for-more-disclosure>.

160 EDHEC Business School, “The Climate Deserves Better than 12%!,” at <https://www.edhec.edu/en/climate-deserves-better-12-0>.

161 Max Schanzenbach and Robert Sitkoff, “ESG Investing: Theory, Evidence, and Fiduciary Principles,” (September 2020), at http://www.law.harvard.edu/programs/olin_center/papers/pdf/Sitkoff_1038.pdf; and Florian Berg, Kölbel, Julian, and Rigobon, Roberto, “Aggregate Confusion: The Divergence of ESG Ratings” (May 17, 2020), at <https://ssrn.com/abstract=3438533> or <http://dx.doi.org/10.2139/ssrn.3438533>.

reporting (including measuring financed emissions), action steps to address climate risk, and high-level commitments. Many initiatives target a specific audience, whether financial market participants, investors, other stakeholders, or some combination. The purposes of some of the widely-used, voluntary frameworks are discussed below in **Box I**.

Box I. Description of Voluntary Frameworks

*Task Force on Climate-Related Financial Disclosure (TCFD).*¹⁶² In 2015, the FSB established the industry-led TCFD, which issued in 2017 a framework of recommendations for structuring disclosures related to governance, strategy, risk management, and metrics and targets. The framework is supported by recommended disclosures and guidance for implementation. Since the initial recommendations, the TCFD has issued annual reports documenting the support and implementation of the TCFD framework, and additional guidance materials to implement TCFD and transition plans. Use of the TCFD recommendations could help achieve more consistent, comparable, and decision-useful climate-related financial disclosures. The TCFD has over 2,600 supporters that acknowledge the financial risk presented by climate change.¹⁶²

*CDP (formerly the Carbon Disclosure Project).*¹⁶³ CDP is an international non-profit organization that helps companies and cities disclose their environmental impact through its annual surveys. Each year, CDP takes the information received in its annual questionnaires and scores companies and cities based on their disclosures. Through its scoring methodology it measures their progress on climate change and other sustainability issues. These climate questionnaires are aligned with the TCFD recommendations.

*Climate Disclosure Standards Board (CDSB).*¹⁶⁴ The CDSB is an international consortium of business and environmental NGOs that offers companies a framework for reporting environmental information. Its framework provides guidance on what information to include on climate and other environmental issues in companies' annual reports, and how to present this information. It does this by establishing guiding principles and reporting requirements in order to make annual reports more relevant to investors.

*Global Reporting Initiative (GRI).*¹⁶⁵ GRI developed a set of standards for organizations to report on their sustainability impacts in a consistent manner, with the goal of enhancing comparability and increasing organizations' transparency and accountability.

*Value Reporting Foundation.*¹⁶⁶ The Value Reporting Foundation supports key groups such as the IFRS Foundation and adopts the Sustainability Accounting Standards Board (SASB) Standards. The SASB Standards consist of industry-specific sustainability accounting standards for 77 industries, with the goal of enabling companies to communicate ESG information that is likely to affect a company's financial condition, operating performance, or risk profile.

¹⁶² For a current list of TCFD supporters, see TCFD, "Supporters," at <https://www.fsb-tcfd.org/supporters/>.

¹⁶³ CDP, "What We Do," at <https://www.cdp.net/en/info/about-us/what-we-do>.

¹⁶⁴ CDSB, "About the Climate Disclosure Standards Board," at <https://www.cdsb.net/our-story>.

¹⁶⁵ GRI, "Standards," at <https://www.globalreporting.org/standards/>.

¹⁶⁶ Value Report Foundation, "Resources Overview," at <https://www.valuereportingfoundation.org/resources/resources-overview/>.

Science Based Targets Initiative (SBTi) (target setting).¹⁶⁷ The SBTi seeks to drive climate action in the private sector by enabling companies to set science-based emissions reduction targets. It does this by defining and promoting best practice in emissions reductions and net-zero targets in line with climate science. The initiative also provides technical assistance and expert resources to companies that set targets that reflect the latest climate science.

Paris Agreement Capital Transition Assessment (PACTA) (scenario analysis).¹⁶⁸ PACTA is an open-source methodology and tool that measures financial portfolios' alignment with various climate scenarios consistent with the Paris Agreement.

Partnership for Carbon Accounting Financials (PCAF) (financed emissions).¹⁶⁹ The PCAF standard provides a standardized methodology for the measurement and disclosure of financed emissions, which as discussed in Chapter 3, are an accounting of financial institutions' emissions associated with their lending and financing activities. This can help to reveal financial institutions' exposure to transition risks through these activities and can demonstrate financial institutions' progress toward their own GHG reduction goals.¹⁷⁰

TCFD is one of the leading frameworks used by companies in the United States for structuring climate-related disclosures, and is being considered by U.S. regulators in the context of potential new disclosure requirements.¹⁷¹ Overall, the TCFD framework is intended to:

- be widely adoptable and applicable to organizations across sectors and jurisdictions;
- facilitate disclosures that can be included in financial filings;
- promote the disclosure of decision-useful, forward-looking information; and
- include a strong focus on physical and transition risks and opportunities.

The TCFD's framework, highlighted in **Figure 4.1** below, focuses on four broad recommendations or core elements to help structure climate-related disclosures: governance, strategy, risk management, and metrics and targets. These core elements are supported by 11 types of recommended disclosures, which are designed to help stakeholders understand how an organization evaluates and manages climate-related risks and opportunities. The guidance, some of which is sector-specific, is intended to support all organizations in developing climate-related disclosures.

¹⁶⁷ Science Based Targets, "How It Works," at <https://sciencebasedtargets.org/how-it-works>.

¹⁶⁸ PACTA, "Home," at <https://www.transitionmonitor.com/>.

¹⁶⁹ PCAF, "About," at <https://carbonaccountingfinancials.com/about>.

¹⁷⁰ Financial firms face particular challenges related to the climate-related financial risks associated with their lending and investment activity. PCAF developed the PCAF Standard to address these challenges and provide standardization around the assessment, measurement, and disclosure of financed emissions.

¹⁷¹ See, e.g., Department of the Treasury, "G7 Finance Ministers & Central Bank Governors Communiqué," press release (June 5, 2021), at <https://home.treasury.gov/news/press-releases/jy0215> and the SEC, *Prepared Remarks Before the Principles for Responsible Investment "Climate and Global Financial Markets" Webinar* (July 28, 2021), at <https://www.sec.gov/news/speech/gensler-pri-2021-07-28>.

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Figure 4.1: TCFD Recommendations

Governance	Strategy	Risk Management	Metrics and Targets
Disclose the organization's governance around climate-related risks and opportunities.	Disclose the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning where such information is material.	Disclose how the organization identifies, assesses, and manages climate-related risks.	Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material.
Recommended Disclosures	Recommended Disclosures	Recommended Disclosures	Recommended Disclosures
<ul style="list-style-type: none"> a) Describe the board's oversight of climate-related risks and opportunities. b) Describe management's role in assessing and managing climate-related risks and opportunities. c) Describe the resilience of the organization's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario. 	<ul style="list-style-type: none"> a) Describe the climate-related risks and opportunities the organization has identified over the short, medium, and long term. b) Describe the impact of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning. c) Describe the resilience of the organization's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario. 	<ul style="list-style-type: none"> a) Describe the organization's processes for identifying and assessing climate-related risks. b) Describe the organization's processes for managing climate-related risks. c) Describe how processes for identifying, assessing, and managing climate-related risks are integrated into the organization's overall risk management. 	<ul style="list-style-type: none"> a) Disclose the metrics used by the organization to assess climate-related risks and opportunities in line with its strategy and risk management process. b) Disclose Scope 1, Scope 2, and, if appropriate, Scope 3 greenhouse gas (GHG) emissions, and the related risks. c) Describe the targets used by the organization to manage climate-related risks and opportunities and performance against targets.

Source: TCFD, *Final Report: Recommendations of the Task Force on Climate-related Financial Disclosures*.

The TCFD's core elements and recommended disclosures offer a useful structure for promoting the consistency, comparability, and decision-usefulness of climate-related disclosures,¹⁷² and have been widely adopted, in whole or part, by financial regulators around the world. According to the TCFD's 2021 status report, more than 120 regulators and governmental organizations support the TCFD, including the governments of Belgium, Canada, Chile, France, Japan, New Zealand, Sweden, and the United Kingdom. The TCFD's recommendations are also incorporated in the European Commission's Guidelines on Reporting Climate-Related Information.

¹⁷² TCFD, *Final Report: Recommendations of the Task Force on Climate-related Financial Disclosures* (June 2017), at <https://assets.bbhub.io/company/sites/60/2021/10/FINAL-2017-TCFD-Report.pdf>.

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The TCFD core elements and recommended disclosures also inform much of the framework for the prototype standards that the IFRS Foundation is developing for consideration by its anticipated ISSB, as further discussed below. The TCFD framework has seen significant adoption by companies. The TCFD's 2021 Status Report evaluated 1,651 companies that issued climate-related reports under the TCFD in English (either in financial filings, annual reports, integrated reports, or sustainability reports).¹⁷³ The industry breakdown of companies issuing the climate-related reports is shown in **Figure 4.2** below.

Figure 4.2: Companies Issuing Climate-related Reports

Industry	Number
Banking	282
Insurance	132
Energy	267
Materials and Buildings	404
Transportation	158
Ag., Food and Forest Products	142
Technology and Media	106
Consumer Goods	160
Total	1,651

Source: TCFD, *Task Force on Climate-related Financial Disclosures: 2021 Status Report*.

Although the growth in voluntary frameworks and standards has been an important development in the climate-related disclosure space, the lack of common standards is a significant problem. There remains a great deal of variance in the quality, coverage, and comparability of the disclosed information, due in large part to the voluntary nature of the disclosure and lack of mechanisms to assure consistency, comparability, and decision-usefulness.¹⁷⁴ The insufficient quality and coverage of disclosures create difficulties for those using them to understand and compare companies' exposure to and management of climate

¹⁷³ TCFD, *Task Force on Climate-related Financial Disclosures: 2021 Status Report*, at <https://www.fsb.org/wp-content/uploads/P14102.1-1.pdf>.

¹⁷⁴ Even public, carbon-intensive companies may not be disclosing climate-related risk information. A recent review by the Carbon Tracker Initiative and Principles for Responsible Investment examined the disclosures of 107 public companies and their auditors. Of those 107 companies, “over 70% did not indicate that they had considered climate matters when preparing their 2020 financial statements.” See Carbon Tracker and Principles for Responsible Investment, *Flying Blind: The Glaring Absence of Climate Risks in Financial Reporting*, (September 2021), at <https://carbontracker.org/reports/flying-blind-the-glaring-absence-of-climate-risks-in-financial-reporting/>.

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risks. These challenges could continue to exacerbate mispricing of climate-related risks and misallocation of capital.¹⁷⁵

The TCFD's 2021 Status Report found, in reviewing companies' disclosures, that while disclosure of TCFD-aligned climate-related information increased, many fell short of covering all TCFD recommended disclosures. The recommended disclosure that appeared most frequently was how companies integrated climate-related risks into their overall risk management.¹⁷⁶ Still, that disclosure appeared in only 52 percent of disclosures. Relatedly, SASB's 2017 State of Disclosure report found that while the number of companies providing disclosure on sustainability topics was increasing, “[t]he most common form of disclosure across the majority of industries and topics was generic boilerplate language, which is inadequate for investment decision-making.”¹⁷⁷ A more recent report from the Carbon Tracker Initiative, which looked at 107 publicly-listed carbon-intensive firms, had similar findings. Carbon Tracker found little evidence that these companies incorporated material climate-related matters into their financial statements and that 72 percent of companies were inconsistent across their reporting of climate matters between their financial statements and their disclosure of climate-related risks in their other reporting.¹⁷⁸

Several framework and standard-setting bodies have acknowledged these challenges and, in September 2020, they jointly issued a “Statement of Intent to Work Together Towards Comprehensive Corporate Reporting.”¹⁷⁹ These organizations—GRI, SASB, CDP, International Integrated Reporting Council (IIRC), and CDSB—recognize that they guide the overwhelming majority of quantitative and qualitative sustainability disclosure.¹⁸⁰

175 The lack of a standardized framework can give rise to a great deal of variation in the interpretation of disclosures. For example, the (low) correlation across various ESG rating platforms can make it difficult to effectively signal to market participants about a firm's ESG and/or climate credentials. This can contribute to the mispricing of climate risk, and by extension, lead to misallocation of resources. See Florian Berg, Kölbel, Julian, and Rigobon, Roberto, “Aggregate Confusion: The Divergence of ESG Ratings” (May 17, 2020), at <https://ssrn.com/abstract=3438533> or <http://dx.doi.org/10.2139/ssrn.3438533>.

176 TCFD 2021, footnote 174.

177 SASB, *The State of Disclosures*, at <https://www.sasb.org/wp-content/uploads/2019/08/StateofDisclosure-Report-web112717-1.pdf>.

178 See Carbon Tracker and Principles for Responsible Investment, *Flying Blind: The Glaring Absence of Climate Risks in Financial Reporting*, (September 2021), at <https://carbontracker.org/reports/flying-blind-the-glaring-absence-of-climate-risks-in-financial-reporting/>.

179 Impact Management Project, *et al.*, “Statement of Intent to Work Together Towards Comprehensive Corporate Reporting: Summary of Alignment Discussions among Leading Sustainability and Integrated Reporting Organisations CDP, CDSB, GRI, IIRC and SASB” (September 2020), at <https://29kjwb3armds2g3gi4lq2sx1-wpengine.netdna-ssl.com/wp-content/uploads/Statement-of-Intent-to-Work-Together-Towards-Comprehensive-Corporate-Reporting.pdf>.

180 In the Governance & Accountability Institute's (G&A) Annual 2020 Flash Report, they found that 90 percent of S&P 500 Index companies published sustainability reports in 2019. G&A found that 51 percent of these companies use GRI, 14 percent presented alignment with SASB, 5 percent presented alignment with TCFD, and 65 percent responded to CDP's questionnaire. Governance & Accountability Institute Inc., *Flash Report 2020* (July 2020), at http://www.ga-institute.com/fileadmin/ga_institute/images/FlashReports/2020/G_A-Flash-Report-2020.pdf.

Together, their goal is to provide joint guidance on how firms and regulators can use their individual frameworks in a complementary and additive way, how they can complement the Generally Accepted Accounting Principles (GAAP) and serve as a starting point towards a more efficient reporting system, and how they can collaborate to achieve these goals while also engaging with all other interested stakeholders.

Some recent bilateral efforts that these institutions have taken include two joint publications by the SASB and CDSB that combine their frameworks to provide an integrated solution for companies seeking to follow the TCFD recommendations, a partnership between GRI and the IIRC to help companies adopt both frameworks, and a collaborative workplan between GRI and SASB to show how their standards can be used concurrently. Further, the SASB and IIRC recently merged to form the Value Reporting Foundation.

Box J. International Workstreams on Climate-related Risk Disclosures

U.S. financial regulators continue to work with a number of IOs and SSBs to foster consistent, comparable, and decision-useful climate-related risk disclosures globally.

International Organization of Securities Commissions

IOSCO's STF continues to carry out work on corporate sustainability disclosure, asset managers' disclosure and investor protection issues and the role of ESG data and rating providers. IOSCO published three reports in 2021: (1) the *IOSCO Report on Sustainability-related Issuer Disclosures*, (2) *IOSCO Recommendations for Sustainability-related Practices, Policies, Procedures and Disclosure in Asset Management*, and (3) *IOSCO Environmental, Social, and Governance Ratings and Data Providers*. The *Report on Sustainability-related Issuer Disclosures* identifies core elements of standard-setting that could help meet investor needs and provides guidance to the IFRS Foundation to develop recommendations based on existing efforts.¹⁸¹

International Financial Reporting Standards Foundation

The IFRS Foundation is working to establish an ISSB to sit alongside the International Accounting Standards Board (IASB). The IFRS Foundation published a consultation paper on sustainability-related reporting in September 2020. Feedback received from almost 600 respondents around the world indicated widespread support for the IFRS Foundation to play a key role in global sustainability reporting. The IFRS Foundation established a Technical Readiness Working Group to develop recommendations for the ISSB as it develops an initial climate reporting standard, building on the TCFD's recommendations and other existing voluntary principles, frameworks, and guidance. The IFRS Trustees will consider a prototype standard, which was proposed by a consortium of five sustainability reporting organizations as an approach to climate-related disclosures, as a potential basis for the new board to develop climate-related reporting standards. The Foundation is working towards finalizing the design of the new ISSB by November 2021.

¹⁸¹ IOSCO, *Report on Sustainability-related Issuer Disclosures* (June 2021), at <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD678.pdf>.

Financial Stability Board and Task Force on Climate-related Financial Disclosures

The FSB continues to promote climate-related disclosures through its own work and that of the industry-led TCFD. In July 2021, the FSB delivered its report on promoting climate-related disclosures to the G20. The report includes results from a survey in early 2021 that explored the practices of authorities from all 25 FSB member jurisdictions to promote climate-related disclosures. The report noted challenges regarding consistency and reliability in the existing climate-related disclosures, and provided recommendations on improving those two aspects of disclosures. The FSB Roadmap for addressing climate-related financial risk notes that “International consistency in supervisory and regulatory disclosure requirements is important for oversight of cross-border risks by financial authorities.” The FSB will continue to help coordinate international work on climate-related disclosure and work with other international bodies to report back annually to the G20.

International Association of Insurance Supervisors and Sustainable Insurance Forum

The IAIS and SIF are supporting supervisors in strengthening insurers' climate-related disclosures. In February 2020, the IAIS and SIF released an *Issues Paper on the Implementation of the Recommendations of the Task Force on Climate-related Financial Disclosures*, which identifies ways to strengthen climate-related disclosures through existing supervisory tools. The IAIS and the SIF's May 2021 *Application Paper on the Supervision of Climate-related Risks in the Insurance Sector* provides guidance on the application of Insurance Core Principle (ICP) 20 on Disclosure to climate-related risks. In addition to its work with IAIS, SIF intends to support, among other things, disclosures concerning climate-related risks and insurability.

Network of Central Banks and Supervisors for Greening the Financial System

In its comprehensive report from April 2019, NGFS encourages all companies issuing public debt or equity as well as financial sector institutions to make disclosures in line with the TCFD recommendations. The NGFS also encourages policymakers and supervisors to consider further actions to foster a broader adoption of the TCFD recommendations.¹⁸²

The Basel Committee on Banking Supervision (BCBS)

BCBS is conducting ongoing work to review climate-related financial disclosures relevant for the banking system. As the global prudential standard-setter for banks, the BCBS has implemented disclosures as part of the Basel framework to promote market discipline through regulatory disclosure requirements. These requirements enable market participants to access key information relating to a bank's regulatory capital and risk exposures in order to increase transparency and confidence about a bank's exposure to risk and the overall adequacy of its regulatory capital.

While these voluntary measures are steps towards a more robust and cohesive reporting environment, climate-related disclosures continue to lack the consistency, comparability, and decision-usefulness that investors have expressed a need for. This undermines the ability of investors and other market participants to be able to manage their exposure to climate-related

¹⁸² NGFS, *A Call for Action, Climate Change as a Source of Financial Risk* (April 2019), at https://www.ngfs.net/sites/default/files/menus/documents/synthese_ngfs-2019 - 17042019_0.pdf.

risks and degrades the ability of climate-related disclosure to protect investors and promote market efficiency.

Enhancing the Quality and Coverage of Climate-related Disclosures in the United States

The disclosure requirements that exist today for companies and financial entities with respect to climate-related risks do not result in disclosures that are consistent, comparable, and decision-useful. As previously discussed, some U.S. regulators are taking steps to consider enhanced climate-specific disclosure requirements. While each regulator must pursue such work within the scope of its own mandate, consultation among regulators who do issue climate-related disclosure requirements can help promote the consistency and comparability of disclosure across regulated entities where appropriate.

Enhancing the Quality of Climate-related Disclosures in the United States

As FSOC members assess the appropriateness of climate-related disclosure requirements, consistent with their mandate and authorities, they should consider how to promote the consistency, comparability, and decision-usefulness of any such disclosures.

Leveraging the TCFD Framework

The TCFD is recognized as the leading organizational structure for climate-related disclosure globally and is one of the leading frameworks used by companies in the United States. The TCFD’s four core elements for disclosure of governance, strategy, risk management, and metrics and targets could be a useful starting point for disclosure requirements to ensure the consistency, comparability, and decision-usefulness of disclosures across firms. Given the widespread adoption of TCFD globally, this could also help promote international consistency and comparability.

Disclosure of GHG Emissions

FSOC members considering climate-related risk-disclosure requirements should consider whether such disclosures ought to include appropriate information about an issuer’s or financial firm’s emissions footprint, taking into account such considerations as the size, complexity of operations, and GHG-intensity of the company’s products and services. Methodologies for measuring GHG emissions are discussed above in Chapter 3.¹⁸³

One important consideration for climate-related disclosures by financial institutions is the treatment of an institutions’ financed emissions.¹⁸⁴ Disclosure of financed emissions can provide insight to investors and market participants regarding the transition risks a financial institution faces from their investing and lending activities. Methodologies for assessing

¹⁸³ See Chapter 3: “Climate-related Financial Risk—Data and Methods, Data on Exposures of Nonfinancial Entities, Transition Risks, Measuring GHG Emissions.”

¹⁸⁴ See Chapter 3: “Climate-related Financial Risk—Data and Methods, Data on Risks to Financial Institutions and markets, Data on Transition Risk Exposure, Financed Emissions.”

financed emissions have evolved and robust frameworks for calculating financed emissions will help meet investors' demand for consistent, reliable, and decision-useful information, as well as facilitate regulators' assessments of financial institutions' transition risks. Engagement by the Council and its members with stakeholders could help facilitate progress in the measurement of financed emissions.

Helping Ensure Consistency, Comparability, and Decision-Usefulness

The Council believes that its members should consider the extent to which disclosures can help inform the decision-making of investors and other market participants. Standardizing data formats and promoting disclosures that are machine readable, could help promote the consistency, comparability, and decision-usefulness of climate-related disclosures. Council members that are considering new requirements related to climate-related disclosures should seek to coordinate their efforts, consistent with their mandate and authorities, to promote consistency and comparability, where appropriate, across different types of disclosures. This consistency will help make disclosures more usable for investors and other market participants, and also help FSOC and its members leverage the information to assess risks to the financial system.

Enhancing the Scope of Coverage of Climate-related Disclosures in the United States

Improving the scope of coverage of climate-related disclosures could require FSOC members and other financial regulators, where appropriate and consistent with their mandates, to issue climate-specific disclosure requirements.

As FSOC members undertake consideration of climate-related disclosures, the Council encourages them to consult with one another, consider how to avoid duplicative reporting requirements, and evaluate how to promote consistency and comparability across FSOC members and with international requirements, where appropriate. As part of this consideration, FSOC members may consider the size, complexity of operations, risk profiles, and GHG-intensity of regulated entities when considering disclosure requirements.

Limitations of the Existing U.S. Framework for Disclosures

Several areas of the financial system may be subject to fewer disclosure requirements under the existing U.S. regulatory framework for risk disclosures, which could result in gaps in the coverage of climate-related disclosures.

Private Issuers

As described above, the Council notes that requirements applicable to public issuers may not apply to the large number of private issuers not subject to those requirements, under the current statutory and regulatory framework. Such a gap could make it difficult for investors to assess the risks and opportunities facing specific companies or sectors. Investors in private issuers would need to negotiate directly with the private issuers or their owners for the provision of such information, and this information would most likely not be made public.

Such a statutory and regulatory gap could also impact the ability of financial institutions lending or investing in private issuers to consider climate-related risks in their lending and investing decisions. Similarly, companies that have private issuers in their value chains may lack access to the climate-related risk information from those private issuers they need to assess, disclose, and manage their own climate-related risk.

However, private issuers – and their investors – may choose to disclose more climate-related information as public issuers begin to provide more robust disclosures. For example, to the extent that some issuers are already voluntarily reporting their GHG-emissions data, including Scope 3 emissions, it impacts private issuers in their value chains. An issuer's Scope 3 emissions include indirect emissions associated with both upstream and downstream activities and assets. These emissions may fall under the direct control of privately-owned organizations. Should their value chain counterparties seek to collect emissions data to meet their own disclosure needs, these companies may experience a form of knock-on effect, and in turn need to produce emissions data as well.¹⁸⁵

Nevertheless, if data on private issuer emissions were not comprehensively available through disclosure by the private issuers or regulatory filings by registered entities, regulators and market participants would potentially lack the information needed to perform comprehensive assessments of the climate-related risks to regulated entities and the financial system.

Banks

Gaps in disclosure also exist with respect to banks. Not all banks or their holding companies are public issuers required to file SEC-related disclosures; therefore, they would not necessarily be subject to public issuer requirements. According to data the FRB collects, bank and savings and loan holding companies that are public issuers subject to SEC filing requirements represent 433 entities with about \$22.1 trillion in total assets. Bank and savings and loan holding companies not subject to SEC filing requirements represent 3,855 entities with about \$3.1 trillion in total assets.¹⁸⁶ Further, the majority of banks that are not part of a holding company are exempt from SEC-related disclosures.¹⁸⁷

Insurance Companies

Climate-related disclosures are critical in the identification and assessment of climate-related risks for insurers. However, creating effective disclosures for insurers while maintaining consistency across the sector and the financial services industry is a key challenge, given the 50 state regulators and the heterogeneity of the insurance markets in terms of company size and structure. Beginning in 2019, NAIC survey respondents had the option to submit a report using the TCFD framework instead of filing the Insurer Climate Risk Disclosure

¹⁸⁵ See CAIA Association, "Private Companies Should Prepare for Ripple Effects of Climate Disclosure Regulation" (August 8, 2021), at <https://caia.org/blog/2021/08/08/private-companies-should-prepare-ripple-effects-climate-disclosure-regulation>.

¹⁸⁶ These numbers were derived from confidential regulatory data collected and maintained by the FRB.

¹⁸⁷ For OCC-regulated entities, 233 institution with total approximate assets of \$80 billion are exempt from SEC-related disclosures.

Survey.¹⁸⁸ In 2020, only seven U.S. insurers opted to submit their report for 2019 using the TCFD Framework and, as of October 12, 2021, only 28 insurance groups have opted to submit their 2020 report using the TCFD Framework.¹⁸⁹ Climate-related disclosure in TCFD reports filed in the UK and the EU generally exhibit more sophistication and have fewer gaps than TCFD reports submitted to U.S. state insurance regulators in place of the Insurer Climate Risk Disclosure Survey.

Actions by state insurance regulators to require quantitative based climate-related disclosures, as well as additional assessment and monitoring of climate-related disclosures by FIO, offer the potential for enhancing both the quality and coverage of climate-related financial disclosure requirements in the insurance sector. Without sufficient quantitative-based climate-related disclosures, climate change-related risks could lead to increased credit risk to counterparties with which insurers transact business, including reinsurers (entities that provide a vital risk and capital management tool that enhances the solvency of insurers).¹⁹⁰

State and Local Finance and Climate-related Disclosures

Municipal securities have not been subject to the same level of regulation as other sectors of the U.S. capital markets. Municipal securities are largely exempt from the requirements of the Securities Act and the Exchange Act, except for certain antifraud requirements. Amendments enacted in 1975¹⁹¹ provided the SEC with rulemaking and registration authority over broker-dealers and municipal securities dealers transacting in municipal securities.¹⁹² The 1975 amendments also created a self-regulatory organization, the Municipal Securities Rulemaking Board (MSRB) and granted it authority to promulgate rules governing the sale of municipal securities by broker-dealers and municipal securities dealers. The Dodd-Frank Act required municipal advisors to register with the SEC and provided for regulation of municipal advisors by the MSRB.¹⁹³ Neither the 1975 amendments nor the Dodd-Frank Act created a regulatory regime for, or imposed any new requirements on, municipal issuers. Increased disclosure of material climate risks in the municipal market is of federal interest due to the essential services nature of state and local government activities and infrastructure and the increasing cost to the federal government of disaster recovery and climate impact mitigation.

¹⁸⁸ NAIC CIPR Survey Assessment, p. 32.

¹⁸⁹ For their 2019 report, the majority of TCFD disclosures came from insurers associated with seven groups—Allianz, American International Group, Assurant, Axa, Swiss Re, Travelers, and Zurich. CDI TCFD Database.

¹⁹⁰ Insurers purchase reinsurance to mitigate risk of losses above certain thresholds, which allows them to continue to provide insurance products to their customers.

¹⁹¹ Securities Acts Amendments of 1975, Pub. L. No. 94-29, 89 Stat. 131 (1975).

¹⁹² SEC, *Report on the Municipal Securities Market* (July 31, 2012), p. ii, at <https://www.sec.gov/news/studies/2012/munireport073112.pdf>.

¹⁹³ See Dodd-Frank Act, Section 975.

Next Steps

Currently, neither existing regulatory requirements nor voluntary frameworks have led to comparable, consistent, and decision-useful climate-related disclosures across U.S. companies and financial institutions. Enhanced climate-related disclosures can help fill this gap and can better inform investors and market participants about climate-related risks to firms. These disclosures can help mitigate climate-related risks by bringing transparency to climate-related risks that may otherwise not be well understood by investors or adequately priced into markets.

Some Council members have already announced efforts to consider enhancing climate-related disclosure requirements. All Council members should examine their existing authorities and disclosure requirements to determine if, consistent with their mandates, enhanced disclosure requirements are appropriate.

Chapter 5: Implications for Financial Stability Assessments

Introduction

This chapter describes key considerations for assessing climate-related financial risks and financial stability, emphasizing how transition and physical risks associated with climate change may impact financial institutions and markets. While financial stability analysis will require an understanding of climate-related impacts on individual institutions and markets, it will also require an assessment of the spillover effects across institutions and markets. Work to assess such risks is critical and should pursue a variety of approaches as part of a process to identify best practices. One approach that may accelerate identification of data and knowledge gaps, as well as steps to address such gaps, is scenario analysis. The recommendations for assessments in Chapter 6 highlight steps FSOC members can take in 2022 and beyond to measure, monitor, and address climate-related financial risks to financial stability. These assessments and recommendations build on the supervisory and regulatory work by FSOC members and the discussion of data, information, and measurement gaps in the previous chapters.

Approaches to Quantitative Assessment

An assessment of climate-related financial risks and their implications for financial stability is complex. Integrating climate-related risks into financial assessments is a new area of focus for which tools are under development. Furthermore, the spillovers across the financial system are complex and policymakers need to develop new approaches as part of the process of measuring, managing, and mitigating climate-related financial risks.

Assessments will require the investment in data and analytic capacity described in Chapters 2 and 3, as emphasized in the related set of recommendations in Chapter 6. These investments will provide the foundation for measuring exposures of financial institutions, financial markets, and the financial system to climate-related financial risks. Nonetheless, measurement of exposures against historical risks is insufficient, since climate change will bring changes in the nature, frequency, and severity of climate-related financial risks.

Scenario analysis is an emerging tool in the study of climate-related financial risks, and international work has used this tool as part of the process for developing and assessing the data and analytic capacity to measure current and potential future exposures. Scenario analysis considers a range of possible future climate pathways and associated economic and financial developments. For example, scenarios may include pathways associated with current or planned policies and expectations for technological developments as well as alternatives. A benefit of this approach is that it is explicitly forward looking and, hence, can explore manifestations of climate risk that differ from historical experience. At the same time, scenario analysis will likely be complex, involving multiple scenarios and models, and should be accompanied by other measurement approaches. As regulated entities and regulators

consider these issues, they may gain insights into the strengths and weaknesses of different approaches through exploratory exercises. For example, scenario analysis exercises may contribute to the development of data and models that broaden the set of tools used to assess climate-related financial risks.

Scenario Analysis as a Tool for Risk Management

Scenario analysis as a tool for risk management involves a set of scenarios describing potential future developments that are used to assess the impact of such developments on an institution, market, or group of institutions and/or markets. These potential impacts can inform decisionmakers on how alternative choices by the institution may impact its outcomes across a range of potential scenarios. Scenario analysis is a useful tool for risk management because scenarios that explore alternative risks can inform decisions regarding resilience to risks and actions to build such resilience. As a result, scenario analysis is widely deployed by financial institutions, other companies, and government policymakers.

Scenario analysis is similar to, but distinct from, stress testing as deployed by financial regulators, such as the supervisory Dodd-Frank Act Stress Tests of the Federal Reserve Board, OCC, and FDIC and the Comprehensive Capital Analysis and Review (CCAR) performed by the Federal Reserve Board on the largest banking organizations. One important difference between scenario analysis, in general, and stress tests performed by some financial institutions and regulators is that stress tests may be tightly linked to regulatory requirements and supervisory expectations in ways that directly impact decisions, such as required loss-absorbing capital, at regulated entities. In contrast, scenario analysis may be exploratory in nature, without direct regulatory implications. In addition, stress tests within the remit of regulators tend to focus on a shorter time horizon in order to determine the solvency and liquidity of an institution given an ‘extreme but plausible’ market risk or set of macroeconomic shocks, whereas scenario analysis of climate-related financial risks may contemplate much longer time horizons in order to assess medium- and long-term business model resilience against the changes in climate-related risks that may materialize over such longer horizons.

Given current knowledge and tools, exploratory scenario analysis provides a framework for assessing climate-related financial risks and next steps for regulators, as, for example, discussed in the *Climate Risk Report* of the Climate Subcommittee of the CFTC’s Market Risk Advisory Committee.¹⁹⁴ The Basel Committee on Banking Supervision also emphasized how scenario analysis can be a useful tool for assessing each of the steps needed to assess climate-related financial risks:

“Climate scenario analysis is a forward-looking projection of risk outcomes that is typically conducted in four steps: (1) Identify physical and transition risk scenarios; (2) Link the impacts of scenarios to financial risks; (3) Assess counterparty and/or sector

¹⁹⁴ MRAC 2020, Chapter 6

sensitivities to those risks; and (4) Extrapolate the impacts of those sensitivities to calculate an aggregate measure of exposure and potential losses.”¹⁹⁵

Each step is complex. Climate scenarios—such as those proposed by the IPCC—outline the changing nature of climate-related physical risk factors in coming decades associated with alternative pathways for GHG emissions (and other factors).¹⁹⁶ To bridge the gap between such climate scenarios and the broader economic and financial impacts that inform financial stability analysis, climate pathways and alternative scenarios for policy or technology developments are combined with scenarios for the economy. This combination involves a level of detail sufficient to assess the interaction between climate transitions and developments in sectors that may be significantly impacted (such as electricity generation, the fossil-fuel sector, heavy industry, transportation, and agriculture).

Construction of such integrated scenarios requires expertise and investment. For example, scenarios developed by the NGFS include a large number of climate and economic variables mapped to key themes of the climate transition, including rapid decarbonization of electricity, increasing electrification, more efficient uses of resources, and a spectrum of new technologies to tackle remaining hard-to-abate emissions. In addition, the scenarios explore a range of outcomes across different sectors and regions given the degree of uncertainty regarding climate, economic, and financial pathways. Construction of this wide range of economic variables may involve a broad set of economic tools: integrated assessment models, computable or dynamic general equilibrium models, input-output analyses, and/or reduced-form damage functions linking climate and economic outcomes.

Box K. Scenarios from the Network of Central Banks and Supervisors for the Greening of the Financial System (NGFS)

An important contribution of the NGFS has been the development of scenarios that the private and public sectors can use in their analysis of climate-related financial risks. For example, a private-sector company or financial institution could use an NGFS scenario to inform its assessment of the climate-related financial risks and related disclosures to the public, thereby voluntarily following the TCFD’s recommendation that public companies use scenario analysis in their financial disclosures. Financial regulators could also use such scenarios as the basis for their assessments of risks to financial stability. The Bank of England, in its 2021 Climate Biennial Exploratory Scenario analysis, and the scenario analysis released by the French Autorité de Contrôle Prudentiel et de Résolution in 2021, both used scenarios informed by the work of the NGFS.

The work of the NGFS has highlighted how scenario analysis of climate-related financial risks needs to consider a broad range of possible outcomes, reflecting uncertainty about climate

¹⁹⁵ BCBS, *Climate-related Financial Risks—Measurement Methodologies* (April 2021), at <https://www.bis.org/bcbs/publ/d518.pdf>.

¹⁹⁶ See IPCC 2021, pp. 10-13.

and economic policies, technology, and climate dynamics. The NGFS has developed six scenarios to illustrate a range of possible trajectories.¹⁹⁷

- **Net Zero 2050** limits global warming to 1.5°C through stringent climate policies and innovation, reaching global net-zero CO₂ emissions around 2050. Some jurisdictions such as the United States, EU, and Japan reach net zero for all GHGs.
- **Below 2°C** gradually increases the stringency of climate policies, giving a 67% chance of limiting global warming to below 2°C.
- **Divergent Net Zero** reaches net zero around 2050 but with higher costs due to divergent policies introduced across sectors leading to a quicker phase out of oil use.
- **Delayed transition** assumes annual emissions do not decrease until 2030. Strong policies are needed to limit warming to below 2°C. CO₂ removal is limited.
- **Nationally Determined Contributions (NDCs)** includes all pledged policies even if not yet implemented.¹⁹⁸
- **Current Policies** assumes that only currently implemented policies are preserved, leading to high physical risks.

In addition to this range of scenarios, the NGFS scenarios consider alternative climate pathways and risk factors as predicted by different climate (integrated assessment) models.

Despite this complexity, the NGFS scenarios remain a work in progress. For example, the scenarios treat transition and physical risks separately, and the treatment of physical risks largely focuses on chronic physical risks due to the difficulty of modeling acute physical risks on a long-term basis. Moreover, the scenarios' macroeconomic outcomes tend to focus on likely paths, and do not focus on the types of tail (extreme) outcomes common in stress testing of financial institutions (e.g., the scenarios do not consider the combination of climate risks contributing to a sharp contraction in economic activity, in part because of the focus on long horizons). Finally, the scenarios do not include financial impacts, such as how the climate transition may impact the value of financial assets. This omission partly reflects the fact that such impacts would depend on the sensitivity of economic and financial sectors to the transition and hence may need to be evaluated as part of a scenario analysis, and also underscores the need for more research in this area.

Objectives for Scenario Analysis of Climate-related Financial Risks

Effective scenario analysis requires a close link between the objectives and outputs of the analysis. **Figure 5.1** highlights possible objectives and outputs and the correspondence between these choices and the appropriate participants and frequency.

197 NGFS, *NGFS Climate Scenarios*

198 The NGFS based its NDC scenario on policies announced by the end of 2020 and hence do not include the recent revisions to NDCs, including the more ambitious NDC announced by the current U.S. Administration.

Figure 5.1: Potential Objectives and Outputs of Scenario Analysis of Climate-related Financial Risks

Objectives	Participants & Frequency	Output
<ul style="list-style-type: none"> • Institution-level risk management • Supervisory or regulatory assessment of governance or risk • Analysis of financial stability or other systemic consequences 	<ul style="list-style-type: none"> • Individual financial institutions & annual or ongoing • Financial institutions and/or their supervisors & annual or less frequent • Financial institutions and/or a set of supervisors or agencies, including FSOC & less frequent 	<ul style="list-style-type: none"> • Internal risk management and disclosures • Supervisory evaluation of risk management and possible supervisory action • Assessment of the potential evolution and state of the financial system

Source: Figure created by FSOC.

As noted above, scenario analysis is commonly used as part of risk management at the institution level. Such scenario analysis may be periodic or occur in response to events, and the frequency of such analyses may be linked to the type of risks considered. For example, the nature of climate-related risks may mean results would change only slowly over time, driven by the evolution of scientific views on climate impacts and shifts in an institution's exposures. In order to provide investors and other stakeholders, including regulators, with the information needed to evaluate risks, aspects of such scenario analysis may be disclosed to the public in a qualitative or quantitative manner. For example, the TCFD recommends disclosing scenario analysis methodology and results within their disclosure framework.

At the next level, supervisory and regulatory agencies may engage in scenario analysis with regulated institutions (or independently) to evaluate their risks or gauge the strength of their risk management practices and potentially could undertake supervisory action to address deficiencies. Such engagement is in its early stages in the United States and elsewhere, and hence has been largely exploratory. Finally, a systemwide analysis involving institutions, regulators, and other policymakers—such as a process that would involve the FSOC—can assess financial stability or other broad consequences for the financial system and stakeholders.

A number of authorities have conducted or plan to conduct such analyses, and the resulting assessments of financial stability may be tentative owing to the need for additional data and tools (see **Box L**). In such cases, the identification of next steps is an important component of the exercise. Indeed, the need for better data and tools has been a theme in analyses to date, and points to the potential value of expanding the use of scenario analysis in the United States, to assess similar needs. The set of issues associated with a systemwide assessment are complex and such assessments are unlikely to change at a high frequency. As a result, such assessments may be conducted less frequently.

In addition, systemwide consequences beyond the area of financial stability may emerge. For example, long-run climate scenario analysis may involve identification of the plans that

institutions have for adapting to climate change, which may reveal risks to households and other stakeholders. Property and casualty insurance may be an example: increased frequency and severity of weather-related events associated with climate change may lead some insurers to step away from offering products in certain regions of the country, particularly those most vulnerable to the effects of climate change. These market practices significantly impact those communities, and local, state, and federal government policymakers will need to consider options for ameliorating such effects. The “insurers of last resort” set up in some states and discussed in **Box M** are examples of such market dynamics. The Federal Insurance Office is analyzing these issues, consistent with Executive Order 14030, *Climate-Related Financial Risk*.

Risks Contemplated within a Scenario Analysis

Several design issues in scenario analysis for climate-related financial risks relate directly to the type of climate risks considered, irrespective of the objective, participants and frequency, and output of the exercise, and are summarized in **Figure 5.2**.

Figure 5.2: Key Design Considerations in Scenario Analysis

Climate risks considered	Horizon of analysis	Financial risks considered
<ul style="list-style-type: none"> • Transition risks • Chronic physical risks • Acute physical risks • All of the above 	<ul style="list-style-type: none"> • Long term (10 to 30+ years): Transition and chronic physical risks may evolve over decades • Medium term (3 to 10 years): Evolving physical risks, as well as some transition risks, may impact within this horizon 	<ul style="list-style-type: none"> • Credit risks are most commonly considered for both transition and physical risks • Operational risks likely more tightly linked to physical risks • Legal and liquidity risks may link to both types of climate risk

Source: Figure created by FSOC.

The first design consideration is the scope of climate risks considered: a scenario analysis may focus on transition risks, chronic and/or acute physical risks, or all of these. A comprehensive assessment—such as a systemwide exercise to assess potential risks to financial stability performed by regulators—would include both transition and physical risks. The process for such an assessment would include delineation of the scenarios for associated risk factors and mechanisms through which these factors may affect the economy, financial institutions, and markets as part of a combined assessment of financial stability in such scenarios. Scenario analysis for other objectives may consider only a subset of risks. For example, assessments by property and casualty insurers of acute physical risks (e.g., the potential impacts of floods, wildfires, hurricanes and other severe storms, etc.) may be conducted at a higher frequency and separately from analyses of transition and chronic physical risks, given the centrality of

acute physical risks to medium-term business planning versus the more gradual evolution of chronic physical risks (e.g., sea-level rise) or transition risks.

The time horizon for the scenario analysis is a second design consideration. The economic transitions associated with meeting climate goals will occur over decades. Scenarios over such time periods are needed to gauge the plausible range for such economic transitions across scenarios. In addition, near- or medium-term developments may reflect long-term transitions, especially for exercises in which a focus is placed on the possibility of a disorderly adjustment in financial markets. In such scenarios, discrete changes in policy or other aspects of the economy might alter the value of the assets or liabilities of certain economic sectors markedly and rapidly; that is, a reassessment of the present-discounted value of the income flows in such economic sectors impacted by a disorderly transition may occur early in the transition period. Long horizons are also appropriate for assessments of changes in chronic physical risks. Past and prospective GHG emissions will be accompanied by shifts in chronic risk factors—sea-level rise, drought, and wildfire risk, etc.—over the span of many decades. Somewhat shorter-term horizons may be appropriate when focusing only on acute physical risks, as regions of the United States are already witnessing increased acute physical risks. These observations call for scenario analysis in which risks are gauged against scenarios that move beyond historical experience.

A final key design consideration is determining the set of financial risks that are within scope for the scenario analysis. Changes in the values of assets and liabilities stemming from both transition and physical risks bear directly on the resilience of institutions to associated losses—that is, credit or underwriting risks. Operational risks could, in principle, be associated with transition risks, but operational risks more directly relate to the disruptions that could accompany acute and chronic physical risks. As a result, institutions and policymakers may view scenario analysis, or other tools to gauge and manage operational risks, as separate from scenario analysis for credit risks. Analysis of liquidity or legal risks may overlap with exercises focused on credit or operational risks. For example, credit losses stemming from a large physical risk event may lead to concerns over liquidity at affected institutions; alternatively, operational disruptions from such an event could lead to legal or reputational risk for the institutions.

Quantitative Scenario Analysis: Data and Modeling Needed for Effective Measurement

Another set of issues that must be addressed when conducting scenario analysis is associated with data and modeling needs—issues that overlap closely with the discussion of these challenges in Chapter 3. Individual financial institutions will need information on climate risks and data on the attributes of their assets or liabilities that are affected by such risks: for example, the GHG intensity of companies to which they lend and resulting exposure to transition risks, or the geographic location and other characteristics (e.g., elevation, building materials) that may affect exposure of real estate loans to physical risks. Such data must be complemented by models to gauge the impact of the climate risk factors on potential losses associated with affected assets and liabilities. The specification and parameterization of such

models is challenging, as future climate risks are likely to differ from historical patterns. In addition, the link from climate risk factors to other risk factors—economic and financial developments—must be described through data in the scenario or within associated models; these indirect impacts of climate risk factors on the financial sector may be as important as direct impacts. For example, shifts in physical risk factors may affect losses on real estate loans from actual damages and through changes in the value of real estate and/or economic activity in affected regions (e.g., declines in house prices in areas prone to floods or wildfires or declines in economic activity and employment in such areas).

Despite current challenges and shortcomings, scenario analysis is a leading approach to the assessment of climate-related financial risks at the individual institution level and to assessments of broad economic impacts, including financial stability assessments. While domestic regulators have not mandated such an approach, some have highlighted its usefulness for risk management. For example, the NYDFS' *Proposed Guidance for New York Domestic Insurers on Managing the Financial Risks from Climate Change* includes recommendations on how insurers should collect data and develop metrics, including scenario analyses.¹⁹⁹ The *Proposed Guidance* states that insurers are expected to embed climate change scenario analyses into the insurers' corporate governance structures and risk management practices. The insurers' scenario analyses should consider: (1) physical and transition risks; (2) the evolution of climate risks under different scenarios; (3) the fact that historical data may not fully reflect climate risks; and (4) how climate risks may materialize in the short, medium, and long term depending on the scenarios used.

Systemwide exercises performed by regulators are similarly valuable, although the data and modeling demands may be substantially higher, as regulators need to assess risks across institutions with diverse business models and, ultimately, potential financial stability implications. As noted in Chapter 3, significant data gaps and model development needs currently exist. This does not mean that scenario analysis cannot be used in the near term. In fact, scenario analysis can play an important role in assessing and filling data gaps, as well as developing necessary models and analytical processes. In this regard, the comparison between the Supervisory Capital Assessment Program (SCAP) of 2009 and the current CCAR process is informative. SCAP data and models were far more limited than current CCAR approaches, and the SCAP represented a first step on a long path to current stress testing practices that importantly shaped data collection and modeling efforts. Policymakers may find an exploratory scenario analysis of climate-related financial risks valuable for the same reason, especially as such an exploratory analysis would likely take a considerable period of time to complete. **Box L** discusses some examples of scenario analyses of climate-related financial risks and financial stability conducted by foreign authorities, highlighting some of the challenges that authorities have overcome in developing such exercises, and how future analyses may incorporate these lessons.

¹⁹⁹ New York State Department of Financial Services, “Proposed Guidance for New York Domestic Insurers on Managing the Financial Risks from Climate Change” (March 25, 2021), at https://www.dfs.ny.gov/system/files/documents/2021/03/proposed_ins_climate_guidance_2021_public_comment_1.pdf.

Box L. International Experiences and Work on Assessing Risk to Financial Stability using Scenario Analysis

Acknowledging the growing materiality of climate change-related risk to the financial system, an increasing number of overseas financial regulatory authorities are undertaking efforts to identify and quantify financial institutions' exposure to such risks. Several of these efforts have gone beyond a review of the issues and conducted (partial) quantitative evaluations of climate-related financial risks. Initial scenario analyses have been conducted by, for example, De Nederlandsche Bank (DNB) (2018), the Banque de France (2021), the Bank of England (2021), and the European Central Bank (ECB). Each of these has given the authorities, and the financial institutions themselves, a better understanding of the financial stability implications of climate risk as well as the degree of potential losses at individual institutions. The exercises also identified areas in need of improvement (e.g., translating climate scenarios into macro-financial outcomes, closing data gaps, and building expertise), and the authorities aim to work toward more sophisticated efforts in future. In addition to follow-up exercises planned by the Banque de France and Bank of England, climate change-risk reviews are underway in Australia, Canada, and South Africa, among others. The table below highlights some of the scenario and sensitivity analyses that have been conducted or are underway among advanced economies. These efforts can inform similar work by FSOC members, as recommended in the next chapter.

Institution	Expected completion date	Institutions covered	Climate risk covered
DNB	2018	Banks, insurers, and pension funds	Transition
EIOPA	2020	Insurers	Transition
ECB/DNB	2020	Banks and insurers	Transition
ECB/ESRB	2021	Banks, insurers, and investment funds	Physical and transition
ECB	2021	Banks	Physical and transition
EBA 2020	2021	Banks	Physical and transition
ESMA	2021	Investment funds	Transition
Deutsche Bundesbank	2021	Banks, insurers, investment funds	Transition
Banque de France/ACPR	2021	Bank and insurers	Physical and transition
Australian Prudential Regulation Authority	2021	Authorized deposit-taking institutions	Physical and transition

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Bank of England	2022	UK banks and insurers	Physical and transition
Bank of Canada	(not before end) 2021	Six banks and insurers	Physical and transition
Bank of Japan/ Financial Services Agency	2022	Three large banks and three large insurers	Physical and transition
ECB Supervision	2022	Banks	Physical and transition
Deutsche Bundesbank	2023	Banks, insurers, investment funds	Physical and transition

Note: ACPR refers to Autorité de Contrôle Prudentiel et de Résolution (Prudential Control and Resolution Authority) attached to the Banque de France; DNB refers to De Nederlandsche Bank; EIOPA refers to European Insurance and Occupational Pensions Authority; ESRB refers to European Systemic Risk Board; ECB refers to European Central Bank; EBA refers to European Banking Authority; ESMA refers to European Securities and Markets Authority.

Financial sector authorities confronted considerable challenges in conducting these pilot exercises. As discussed elsewhere, assessing climate-related impacts on the financial system requires a more demanding framework and inputs than traditional stress tests. First, the authorities must model climate variables and determine a set of scenarios to use before assessing the impact of these variables on real economic and financial variables, including the balance sheets of corporates, households, financial firms, and sovereigns. This step requires the identification of assets that are exposed to climate-related risks where data may not be available or sufficiently granular. In addition, given the required long-term horizon of climate-related scenario analysis, the authorities must also evaluate dynamic responses and interactions of the private and public sector rather than use a static approach.

Given divergences in scenarios undertaken and differing approaches the authorities used to address challenges, detailed results of the analyses are not directly comparable. The DNB concluded that, “total losses for financial institutions could be sizable...[but] the impact on supervisory ratios seems manageable”. The Banque de France exercise revealed a “moderate” exposure of French banks and insurers to climate risks, while the ECB/European Stability Risk Board concluded that “financial stability risks for the European financial system are manageable, but they are both concentrated and path dependent.” The authorities also concluded that policymakers and financial institutions could take action to help avoid unnecessary losses in the financial system, “with clear benefits to acting early” according to the ECB. Specifically, policymakers can implement timely, reliable, and effective climate policies, while financial institutions can better integrate climate risks into their financial risk assessment process.

Developing Multiple Assessment Tools Beyond Scenario Analysis

Because scenario analysis is forward-looking and can consider a range of potential climate scenarios, it is a valuable tool for assessments of climate-related financial risks. Nonetheless, scenario analysis of climate-related risks remains relatively new for financial regulators. Scenario analysis is also complex and may not be amenable to frequent application on a

broad or systemwide basis. Additional approaches should inform assessments of climate-related financial risks to ensure that financial institutions and regulators have a robust set of tools to capture the magnitude and effects of the range of physical and transition risks, as well as the uncertainties involving climate, economic, and financial impacts.

Currently, other approaches are limited, but financial institutions and regulators should consider the development of tools that report exposures to sectors most likely to be impacted by the climate transition or physical risks. For example, climate risk scores or ratings have been developed to differentiate risk exposure to assets, companies, or sectors.²⁰⁰ Researchers have considered climate value-at-risk (VaR) measurements, applying the traditional VaR framework to gauge the impacts of climate change on financial institutions balance sheets, and systemic risk indicators that combine financial market and institution data.²⁰¹ It is worthwhile to consider the value of these tools and related tools and approaches. Additional tools to assess systemwide risks based on the metrics highlighted above would need further development as those metrics focus on measures of risk to individual institutions.

Physical Risks

Tools such as scenario analysis deliver quantitative and qualitative results to inform discussions and policy responses. Such tools are still developing and require significant resources to conduct. As a result, an initial look at climate-related financial risks and their implications for financial stability may benefit from exploring the nature and potential magnitude of the climate transitions or shifts in physical risks and areas where exposures may be appreciable and require further analysis.

A complete analysis of physical risks to individual institutions and markets, as well as a financial stability assessment, will require investments in data, tools, and expertise across financial regulators. A review of the degree to which acute and chronic physical risks associated with climate change may impact the financial sector can highlight the issues and point to next steps.

The Evolving Nature of Physical Risks

Changes in the climate are leading to significant increases in chronic and acute physical risks. Chronic droughts in some regions may make economic activity in such areas less viable, undermining the value of real estate and other fixed assets in these regions and thereby affecting financial institutions exposed to such assets. Sea-level rise will likely similarly affect real estate and fixed assets. These and other chronic physical risks will continue to evolve over the course of many decades.

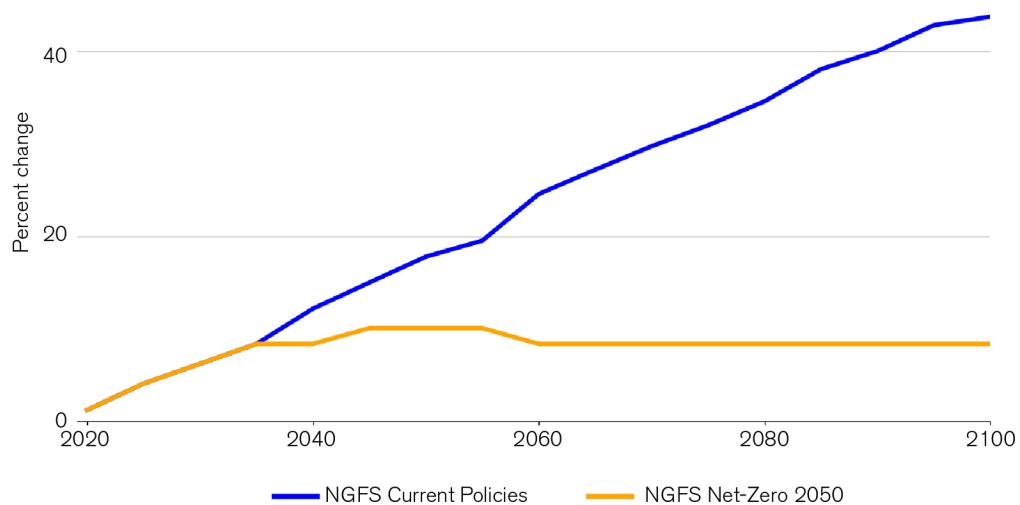
²⁰⁰ See Finance for Tomorrow, “Climate Risk in Finance—Concepts, Methods and Assessment Tools” (September 2019); and Carbone 4, “Climate Risk Impact Screening: a unique method to assess the impact of physical risks from climate change on financial assets” (November 2017).

²⁰¹ Simon Dietz, Alex Bowen, Charlie Dixon, and Philip Gradwell, “Climate Value at Risk of Global Financial Assets” (2016), LSE Research Online Documents on Economics 66226, London School of Economics and Political Science, LSE Library; and Hyeyoon Jung, Robert Engle, and Richard Berner (2021), “Climate Stress Testing,” Federal Reserve Bank of New York Staff Reports, no. 977 (September 2021).

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As discussed in Chapter 1, acute physical risks associated with climate change—adverse events that fluctuate from year-to-year—will also continue to increase. Floods will likely be more common, reflecting more frequent and intense storms, hurricanes, and sea-level rise. Other damages associated with hurricanes or severe storms, such as wind-induced damage, will likely increase as well. Wildfires will likely be more common and more intense in some regions of the country. To illustrate some of the issues these shifts raise for measuring financial risks, **Figure 5.3** presents the size of 1-in-100-year expected losses from hurricanes (tropical cyclones) projected within the current policies and net-zero scenarios from the NGFS highlighted earlier. Some insights associated with the likely increase in acute physical risks emerge from the figure. First, expected increases in risk in the near term are independent of policy action to address climate change, as past GHG emissions imply ongoing changes in the climate and policy changes will only affect the climate over the long term. Second (and relatedly), the projected increase in risk in the near term is more moderate—although this moderate effect in part reflects the projected impact on the nation as a whole, and there is some probability of some regions being more adversely impacted over a shorter horizon. Finally (albeit not shown in the figure), the degree of uncertainty is large, reflecting the challenges associated with long-term climate projections. These qualitative features of the evolving nature of climate risks are shared by other types of physical risk, such as wildfires, convection storms, and river and coastal flooding.

Figure 5.3: 1-in-100 Year Expected Damage from Tropical Cyclones



Note: Expected damages are expressed as percentage change from 2020 reference year. The NGFS data is available under a Public License, at <https://data.ene.iiasa.ac.at/ngfs/#/license>.

Source: NGFS CA Climate Impact Explorer (June 2021), at <http://climate-impact-explorer.climateanalytics.org/>.

The evolving nature of acute and chronic physical risks will affect economic activity. The financial sector will also likely be affected through direct losses to insurers associated with their underwriting activities, losses on loans or securities, and the indirect impacts that

flow through the economy and financial sector. The potential impact today on the financial sector through the spectrum of factors relevant for risk management is difficult to assess with precision.²⁰²

The Physical Risks of Climate Change and Operational Risk in the Financial Sector

The financial sector will face evolving operational risks from climate change's impact on the infrastructure required to maintain orderly sector operations.²⁰³ While the financial services sector has invested in business continuity, developed disaster recovery plans, and maintains robust capabilities to sustain critical operations during natural disasters, climate change is projected to increase the likelihood and severity of extreme weather events across the country, putting new strains on the critical infrastructure—both within and outside the financial services sector—necessary to maintain financial operations and financial stability. Meeting the challenge of climate change will require improved coordination across Treasury, financial regulators, the private sector, and U.S. government partners to understand and manage the resulting operational risk.

The financial services sector relies upon critical infrastructure that is exposed to physical hazards, such as flood, fire, and extreme weather, which creates a risk of operational disruptions to core sector operations. These hazards impact the financial services sector directly through impacts to sector-operated critical infrastructure, and indirectly through cascading impacts to critical infrastructure upon which the financial sector relies, particularly energy and telecommunications infrastructure. For instance, during Hurricane Sandy, the sector faced short-term operational disruptions. These included the closure of the equities and options markets on October 29 and October 30, 2012, resulting from direct impacts to sector facilities and widespread disruptions to supporting infrastructure, such as energy, telecommunications, and transportation.²⁰⁴ Similarly, Hurricane Maria caused substantial disruption to sector operations in Puerto Rico, also due to impacts to energy, telecommunications, and transportation infrastructure.²⁰⁵ Extreme weather may cause operational disruptions outside the immediately affected area as well, such as by impacting third-party service providers. For example, during the February 2021 Texas ice storm, Fiserv, a technology service provider for many financial institutions, suffered power outages

202 These developments are already affecting property values; see Stefano Giglio, Bryan Kelly, and Johannes Stroebel, "Climate Finance," *Annual Review of Financial Economics* (forthcoming), at <https://www.annualreviews.org/doi/abs/10.1146/annurev-financial-102620-103311>; and Harrison Hong, G Andrew Karolyi, José A Scheinkman, "Climate Finance," *The Review of Financial Studies*, Volume 33, Issue 3, March 2020, Pages 1011–1023, <https://doi.org/10.1093/rfs/hhz146>.

203 Operational risk is the risk of loss resulting from inadequate or failed internal processes, people, and systems or from external events. See BCBS, *Principles for the Sound Management of Operational Risk* (June 30, 2011), at <https://www.bis.org/publ/bcbs195.pdf>.

204 SEC, CFTC, and Financial Industry Regulatory Authority, "Joint Review of the Business Continuity and Disaster Recovery of Firms," at <https://www.sec.gov/about/offices/ocie/jointobservations-bcps08072013.pdf>.

205 RAND Corporation, "Hurricanes Irma and Maria: Impact and Aftermath," at <https://www.rand.org/hsrd/hsoac/projects/puerto-rico-recovery/hurricanes-irma-and-maria.html>.

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to servers in Texas that disrupted website and online banking access for credit unions nationwide.²⁰⁶ The increased frequency and intensity of extreme weather associated with climate change will lead to greater risk of infrastructure disruption and failure.

The implications of climate change for financial sector operational risk will be shaped by both the scope of climate impacts and how quickly they manifest, as well as by the policy, business, and risk management decisions of government agencies, financial regulators, and the private sector. Climate-related impacts will heighten risk to already vulnerable infrastructure, particularly in areas heavily impacted by climate change. For instance, the financial services sector may be heavily affected by rising sea levels and increasing flood risk. This problem may be especially acute in the northeastern United States, given the concentration of sector critical infrastructure in the New York City metro area, which is home to five of the current seven U.S.-based global systemically important banks and five of the current eight FSOC-designated financial market utilities.²⁰⁷ Given climate change's projected long-term impacts, businesses may opt to reinforce, alter, or geographically distribute critical infrastructure and operations to mitigate risk; these decisions will affect sector operational risk, without necessarily reducing it. The Fiserv case highlights the need to consider how climate change may influence extreme weather-related risk decision-making in locating facilities and mitigating operational risk, as well as the need to consider how climate change will impact third-party providers' infrastructure and financial entities' corresponding operational risk. Finally, climate change-related extreme weather will exacerbate existing frailties in the nation's critical infrastructure, increasing the risk of disruption or failure of essential services upon which the financial sector relies. Government and private sector decisions to invest in repairing and upgrading lifeline infrastructure like telecommunications and energy will shape the financial services sector's vulnerability to the impacts of climate change.

Initiatives to Strengthen Operational Resilience

Strengthening operational resilience to adapt to and mitigate climate change impacts will require an improved understanding of the financial system's sector-specific and cross-sector operational dependencies. Climate change will alter the operational risks the financial system faces and, alongside other physical and transition risks, will shape how climate-related financial risk impacts the financial system and financial stability. As these risks are interconnected, the Council and its members should strive to use common climate impact models and data sources across agencies to ensure coordinated and consistent risk analysis and risk management prioritization and develop shared approaches to linking data models and data sets to ensure consistent analysis across risk types.

²⁰⁶ Michael Ogden, "Storms Freeze Online Banking for Unclear Number of Fiserv Credit Unions," *Credit Union Times* (February 18, 2021).

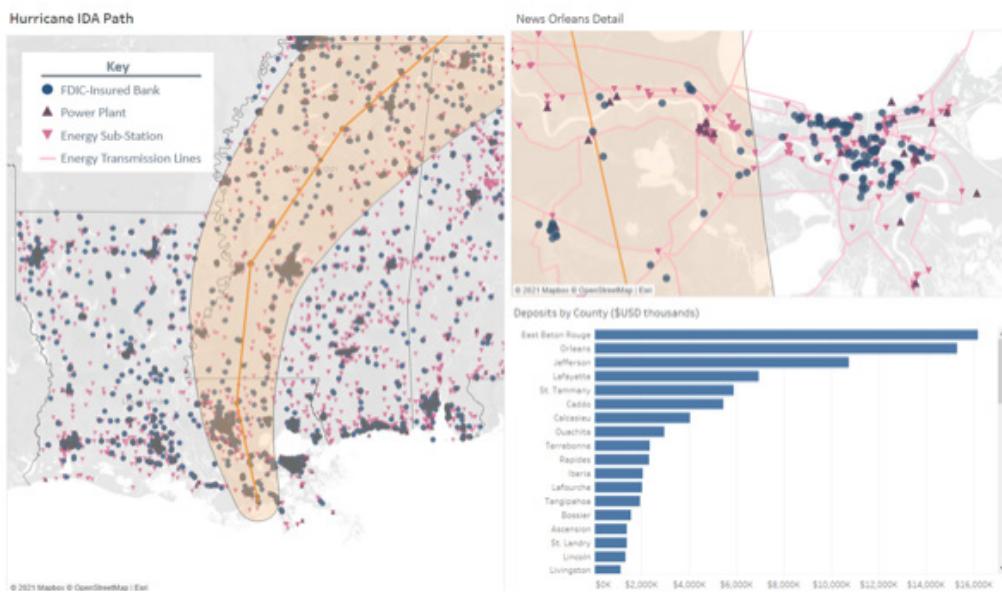
²⁰⁷ Dupigny-Giroux, L.A., E.L. Mecray, et al., *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II* [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 669–742.

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For operational risk, climate risk analysis must be underpinned by a clear understanding of the financial sector's operations, the entities performing such operations, the locations where these operations take place, any back-up sites, and cross-sector dependencies. A coordinated approach is needed as climate-related risks will cut across regulatory and organizational mandates. FSOC members require a holistic picture of sector operations, built on common climate impact models, shared operational data, and a flexible technology-based solution able to dynamically adapt to new data. Such a capability would enable the analysis and modeling of operational risks, hazards, and vulnerabilities, in a manner that allows FSOC members to understand both primary and secondary impacts, including those originating from cross-sector dependencies. Insights from these analyses could be shared with public and private sector partners to ensure a shared, collective understanding of risk, which in turn would enable risk monitoring and mitigation. These efforts would encompass a range of activities such as:

- Recommending Treasury, financial regulators, and/or U.S. Government policy to mitigate risk;
- Leading public-private efforts to develop risk mitigation approaches;
- Targeted sharing and distribution of information on identified risks;
- Incorporating identified risks into tabletop exercise programs; and
- Working with interagency partners to identify cross-sector risk mitigation efforts and prioritize federal resources to them.

Treasury's Office of Cybersecurity and Critical Infrastructure Protection's (OCCIP's) risk management program and SECURE tool suite provide a starting point for analyzing and modeling climate-related operational risk to the financial services sector. While in its early stages, OCCIP's risk management program will provide a standard methodology for assessing sector operational risk and enable analysis of the linkages between operational impacts, financial stability, and other climate-related effects. Complementing OCCIP's risk analysis, SECURE will provide a data collection, modeling, and visualization platform to identify the operational links among financial institutions and supporting infrastructure (e.g., energy and telecommunications), and support analysis of how physical hazards to sector and cross-sector critical infrastructure can create financial sector operational risk. **Figure 5.4** below illustrates what one such visualization could have looked like for Hurricane Ida, which made landfall in Louisiana on August 29, 2021.

Figure 5.4: Hurricane Ida's Path and Financial Institutions

Source: Treasury Office of Cybersecurity and Critical Infrastructure Protection (OCCIP).

Exposures to Physical Risks

The potential for sizable increases in operational risks to financial institutions and markets associated with climate change may be accompanied by increases in credit, market, liquidity, and underwriting risks from similar factors.

Insurers

Increases in underwriting risks faced by property and casualty insurers may be substantial. Management of such risks is among the core activities of such institutions. As a result, and as discussed in Chapter 3, state insurance regulators, the NAIC, and FIO are increasingly focused on these issues, as are the entities they regulate. Nonetheless, it is important for P&C insurers and their regulators to assess the adequacy of current approaches for measuring and mitigating risks at individual institutions. Regulators and policymakers should consider the potential for broader adverse economic impacts across communities, the economy, and the financial sector. For example, some regions of the country experiencing increased climate-related risks have witnessed declines in the availability or affordability of insurance coverage, which may presage broader impacts, as described in **Box M**.

The IMF's 2020 Financial System Stability Assessment illustrated potential risks to insurers' balance sheets. The IMF found that large, diversified P&C insurers are relatively resilient to weather-related events such as major hurricanes. The analysis indicated that a single major hurricane event, expected to occur every 50 years, would reduce capital of large firms by 8.1 percent, although the reduction is only 3.9 percent if reinsurance recoverables are included. For hurricanes with an occurrence expected every 500 years, capital (after reinsurance) would drop below the regulatory minimum for 18 out of 538 insurers and 14 small companies

would record a capital shortfall. These risks to insurers create potential counterparty risks for banks and other financial institutions.

Box M. Climate Change and Property and Casualty Insurance Coverage in Regions of the Country

Traditionally underserved communities and consumers, including minorities, and low- and moderate-income persons may face challenges in obtaining affordable property insurance to cover the risks posed by weather-related natural disasters, and further declines in available and affordable insurance could exacerbate the inequities that these persons face.²⁰⁸ States in regions that are already experiencing an increase in the frequency and severity of weather-related natural disasters are considering actions aimed at addressing the impacts of those disasters on the availability and affordability of insurance products and services. For example, California is considering over 30 laws, regulatory actions, and proposals to address the risks posed by wildfires through mitigation incentives, penalties, funding, and cancellations.²⁰⁹

The creation and expansion of insurers of last resort by individual U.S. states highlights one approach to this problem. For example, both California and Florida have created state-backed insurers of last resort to provide protection coverage when traditional insurance plans are no longer available.²¹⁰ California created the FAIR Plan Property Insurance to provide basic fire insurance coverage for high-risk homes when traditional insurers will not provide such coverage.²¹¹ Similarly, Florida created a not-for-profit, tax exempt, government entity, Citizens Property Insurance Corporation, to make available insurance to homeowners and businesses who are unable to obtain insurance coverage from a traditional insurance company.²¹²

Actions by Federal Agencies to Help Businesses and Consumers Access Available and Affordable Insurance Products Aimed at Climate-related Risks

In addition to efforts by state insurance regulators, NAIC, and FIO to examine and address the availability and affordability of insurance, some federal agencies or interagency groups offer insurance programs that help provide access to available and affordable insurance products aimed at climate-related risks.

FEMA and National Flood Insurance Program

Climate change is exacerbating flooding, along with other weather-related disasters. In 2020, flooding events comprised 14 of the 22 “billion-dollar or more” weather-related natural disasters in the United States.²¹³ Congress created the National Flood Insurance Program (NFIP) as a federal flood insurance and risk management program to provide homeowners

208 Rachel Morello-Frosch, Manuel Pastor, James Sadd, and Seth B. Shonkoff, *The Climate Gap: Inequalities in How Climate Change Hurts Americans & How to Close the Gap* (2018), p. 17, at https://dornsife.usc.edu/assets/sites/242/docs/ClimateGapReport_full_report_web.pdf.

209 AM Best, *Weather Conditions Portend Another Destructive Year of Wildfire Losses* (July 9, 2021), p. 6.

210 See FIO, *Report Providing an Assessment of the Current State of the Market for Natural Catastrophe Insurance in the United States* (Sept. 2015), at <https://www.treasury.gov/initiatives/fio/reports-and-notices/Documents/Natural%20Catastrophe%20Report.pdf>.

211 See California FAIR Plan Property Insurance, at <https://www.cfpnet.com/>.

212 See Citizens Property Insurance Corporation, “About Us: Who We Are,” at <https://www.citizensfla.com/who-we-are>.

213 NOAA, “Billion-Dollar Weather and Climate Disasters: Overview,” NOAA National Centers for Environmental Information, at <https://www.ncdc.noaa.gov/billions/>.

and businesses access to affordable flood insurance in 1968. The Federal Emergency Management Agency (FEMA) administers NFIP. FEMA has found it difficult to meet NFIP's two primary goals: (1) providing affordable flood insurance, and (2) keeping NFIP solvent. While the NFIP was largely solvent until the early 2000s, its financial condition has deteriorated since that time. To address this, FEMA is updating NFIP's pricing methodology to Risk Rating 2.0—Equity in Action, which is designed to use industry best practices to achieve rates that are more actuarially sound and equitable while better reflecting and pricing a property's flood risk.²¹⁴ Beginning October 1, 2021 new policies will be subject to Risk Rating 2.0 and existing policyholders eligible for renewal will be able to take advantage of it as well. All remaining policies renewing on or after April 1, 2022 will be subject to Risk Rating 2.0. FEMA began using reinsurance starting in 2016 to shift some risks to private sector insurers and investors. Subsequently, it began laying off a limited amount of risk through catastrophe bonds as well. FIO has provided technical insurance expertise on reinsurance and alternative risk instruments to FEMA in connection with the NFIP initiatives. The 2021 NFIP reinsurance program is substantially similar to past NFIP placements and covers a portion of NFIP losses above \$4 billion caused by a single flooding event. Thirty-two reinsurers are participating in the 2021 coverage.²¹⁵ NFIP's authorization will lapse on December 3, 2021 unless Congress reauthorizes it before that date.²¹⁶

The actions taken by certain states to date to mitigate the decreases in the availability and affordability of insurance largely reflect the impact of changes in climate and other socioeconomic factors (including building in areas where risk is high) that have already occurred. The effects on availability and affordability of insurance are expected to intensify with climate change, impacting the stability of communities and potentially of financial institutions and the financial system. For example, one study projects that total expected annual losses to residential property associated with flooding will increase 61 percent over the next 30 years.²¹⁷ A significant amount of these economic losses will likely not be insured. Another study estimates that the value at stake from climate-induced hazards could, conservatively, increase from about 2 percent of global GDP to more than 4 percent of global GDP in 2050.²¹⁸ Adjustments in business models and pricing may allow insurers to

²¹⁴ FEMA, “FEMA Updates Its Flood Insurance Rating Methodology to Deliver More Equitable Pricing,” news release (April 1, 2021), at <https://www.fema.gov/press-release/20210401/fema-updates-its-flood-insurance-rating-methodology-deliver-more-equitable>.

²¹⁵ FEMA, “FEMA Announces Reinsurance Program to Manage Future Flood Risk in 2021,” news release (Jan. 5, 2021), at <https://www.fema.gov/press-release/20210105/fema-announces-reinsurance-program-manage-future-flood-risk-2021>.

²¹⁶ FEMA, “Congressional Reauthorization,” at <https://www.fema.gov/flood-insurance/rules-legislation/congressional-reauthorization>.

²¹⁷ First Street Foundation, “Over 4 Million Homes Face Annual Financial Losses 4.5 Times the Cost of Their Estimated NFIP Premiums,” press release (February 22, 2021), at https://firststreet.org/press/aal_launch/.

²¹⁸ McKinsey, “Climate change and P&C insurance: The threat and opportunity” (November 19, 2020), at <https://www.mckinsey.com/industries/financial-services/our-insights/climate-change-and-p-and-c-insurance-the-threat-and-opportunity>.

adapt to these shifts in an orderly fashion, but enhanced information for investors and the public and strong regulatory expectations for risk management will be important aspects of facilitating a stable outcome. Moreover, the impacts on disproportionately affected communities should be assessed, as such communities may face increased costs of insurance and other financial services.

Financial Institutions (Effects on Credit Risk)

While repricing or other changes in insurance contracts over short time horizons may limit the financial risk to insurers associated with underwriting, the impact of physical risks on the value of assets, such as real estate, could impact a broad array of financial institutions. Moreover, financial institutions rely on insurance against physical risks to limit their exposures, and the importance of this factor in assessments of overall risks to the financial system has begun to be considered in scenario analyses, such as that concluded by the French Autorité de Contrôle Prudentiel et de Résolution in early 2021. Research has begun to assess the degree to which potential trajectories for the physical risks of climate change may affect asset values such as real estate.²¹⁹ An important consideration for financial stability would be the extent and concentration of such exposures. For example, damages from, or declines in property values associated with, a hurricane or wildfire would more severely affect institutions with concentrated exposures in the relevant geographic area. While this observation may point to manageable risks to financial stability, the absence of good quantitative information makes it difficult to assess.

A recent report highlights some of the challenges. Ceres used publicly available information on the syndicated loan holdings of large banks in a September 2021 report.²²⁰ The report, which evaluated the syndicated loan portfolios of large banks and projected forward various scenarios to 2080, indicated that increased physical risks showed material increases in expected losses on loans, although the magnitudes reported appear to be manageable given the loss-absorption capacity among the largest banks. This exercise is valuable as it illustrates several lessons. First, increasing physical risks may pose increased risk exposure to credit losses. Second, and equally importantly, this finding looks only at syndicated lending, and physical risks to other types of lending such as residential and commercial mortgages may also be appreciable. However, such risks are difficult for researchers to assess given limitations in available data and methodologies. Finally, the difficulties associated with data availability and methodologies (e.g., the use of economic computable general equilibrium models to analyze indirect effects) point to the value of regulators, in concert with academics, public interest groups, and the private sector, to invest in tools such as scenario analysis to improve understanding of climate-related financial risks.

²¹⁹ Markus Baldauf, *et al.*, “Does Climate Change Affect Real Estate Prices? Only If You Believe In It,” *The Review of Financial Studies*, Volume 33, Issue 3 (March 2020), pp. 1256–1295, at <https://doi.org/10.1093/rfs/hhz073>.

²²⁰ See Ceres, *Financing a Net Zero Economy: The Consequences of Physical Climate Risk for Banks* (September 8, 2021), at <https://www.ceres.org/resources/reports/financing-net-zero-economy-consequences-physical-climate-risk-banks>.

Effects on Market Risk

Both physical and transition risks present potential financial stability concerns in traded markets. Physical events such as natural disasters or heatwaves can lead to extreme volatility in commodity and energy markets, and this volatility is represented either through repricing of assets in securities markets or variation margin flows in derivatives markets.

Volatility is often seen in energy markets, such as the natural gas markets and heating oil markets, which are impacted by the demand for energy due to extreme weather events. In addition, heatwaves or climate-related disasters can impact the supply chains of commodities such as agricultural commodities (e.g., wheat) or energy commodities (e.g., refined oil). This price volatility, influenced by physical risk, can require market participants who are short positions in these commodities to pay large amounts in variation margin and lead to pressures on their solvency. Market volatility can potentially drive a second-order concern about funding and liquidity costs if a large number of market participants need to utilize revolving lines of credit at the same time.

Market participants in derivatives markets currently use short-term horizon stress tests, often between 1 to 5 days, to evaluate their resilience to extreme price moves, and often use historical scenarios, such as the price moves around the default of Lehman Brothers in 2008, to perform analysis on the funding they would need to weather a similar crisis. As seen with the COVID-19 crisis in March 2020, price moves in the future, especially if climate change accelerates, can overwhelm historical stress tests. Therefore, market participants should consider the impact of climate change and how it can lead to rapid repricing of assets, in creating risk management tools such as stress tests to ensure they will be resilient to that risk.

Box N. Global Surveillance of Climate-related Financial Risk

Individual jurisdictions' assessments of the financial stability implications of climate change are typically limited to their own economies, and do not analyze cross-border interlinkages or the global impact. Several international organizations and SSBs, however, have begun to conduct surveillance of the impact of climate change on global financial stability.

Financial Stability Board

The FSB is incorporating analysis and monitoring of climate-related financial vulnerabilities in its regular assessments and surveillance of financial stability. These regular vulnerability assessments help build an understanding of climate-related vulnerabilities over time. It will also help improve the identification of climate-related risk transmission channels, feedback loops of climate-related shocks, metrics, analytical techniques, and policy tools. The FSB also collaborates with the NGFS on scenario analysis work as well as on financial metrics needed for this analysis.

International Association of Insurance Supervisors

The IAIS Macroprudential Monitoring Working Group published its Global Insurance Market Report (GIMAR) in September 2021.²²¹ The report focused on climate-affected investments

²²¹ IAIS, *Global Insurance Market Report* (September 20, 2021), at <https://www.iaisweb.org/news/iais-global-insurance-market-report-provides-first-quantitative-study-on-the-impact-of-climate-change-on-insurers-investments>

of insurers and the potential impact of climate-related financial risks, including a set of scenario analyses using NGFS scenarios. The report gathered data from 32 IAIS members covering 75 percent of the global insurance market. The report found that more than 35 percent of insurers' investment assets²²² could be considered "climate-relevant," i.e., exposed to climate risks.²²³ The results of the scenario analyses indicated that scenarios appeared to have modest effects on insurers' solvency under an orderly transition, with moderately larger effects under a disorderly transition and more sizable effects in a scenario in which mitigation of climate risk was "too little, too late." However, the report also noted several shortcomings in the analysis that could affect results and deserve further analysis.

International Monetary Fund

The IMF prepares semi-annually the Global Financial Stability Report (GFSR), assessing systemic issues that could pose a risk to global financial stability and sustained market access by emerging market borrowers. In the April 2020 GFSR, the IMF assessed the physical risks associated with climate change and concluded that stress testing and better disclosure of exposures to climatic hazards are essential to better gauge physical risk. The IMF assessed transition risks in its October 2021 GFSR, emphasizing that policymakers should implement a climate policy consistent with an orderly transition and conduct scenario analysis to help mitigate potential financial stability risks stemming from the transition.

Transition Risks

As with physical risks, a complete analysis of transition risks to individual institutions and markets, as well as a financial stability assessment, will require investments in data, tools, and expertise across financial regulators. A review of the degree to which transition risks associated with climate change may impact the financial sector can highlight the issues and point to next steps.

The Transition to Net Zero

The first consideration in any analysis of transition risks is the scale of the climate transition. The necessary transitions are large: policymakers around the world have communicated their intent to pursue policies to limit the rise in average global temperatures to 1.5°C and the Administration has committed the United States to reducing its GHG emissions by 50-52 percent by 2035 and achieving net-zero emissions by 2050.

Climate analyses have presented a range of scenarios that highlight the scale of adjustments needed in lowering GHG emissions to achieve climate goals. As an example, **Figure 5.5** presents scenarios for carbon dioxide emissions (globally) consistent with the scenarios created by the NGFS (discussed in the box above). Limiting the increase in global temperature to 1.5°C by 2050 requires near elimination of carbon dioxide emission by 2050 (left panel). The scale of this economic adjustment is illustrated by the price of carbon in such scenarios, which rises from essentially zero per ton (globally) in 2020 to

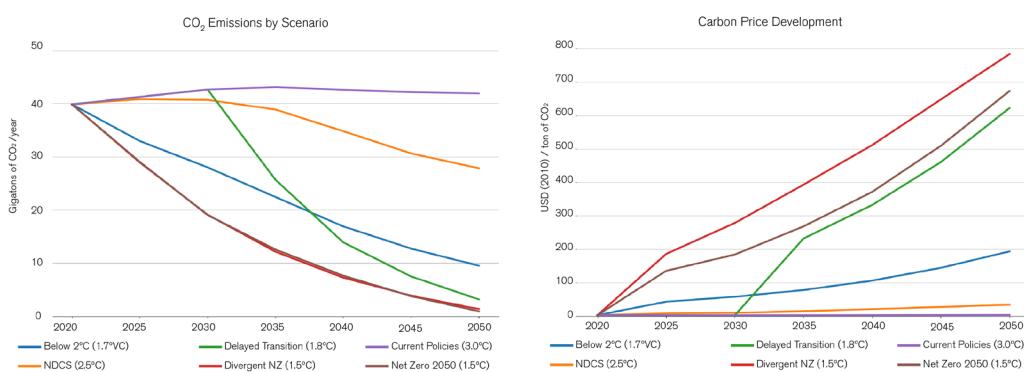
²²² Insurers' investment assets included equities and corporate debt, loans and mortgages, sovereign bonds, and real estate.

²²³ IAIS GIMAR, p. 5.

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approximately \$200 or more in 2030 (and much higher subsequently). This increase in the cost of carbon would impact many economic sectors. Importantly, the key transition is in lowering GHG emissions, which can be achieved through a variety of economic mechanisms including carbon pricing, taxes or subsidies, or regulation. For example, a key element of the Administration's plan to reduce GHG emissions is a Clean Electricity Standard. Such a regulatory mechanism would imply an increase in the implicit (or, as economists might denote, shadow) price of carbon, and the degree of such an increase would depend on the stringency of the standard and related incentives or subsidies. Nonetheless, adjustments in production of GHG-intensive products and services need to be substantial under any mechanism to achieve stated climate goals, and as a result such economic sectors need to transition, potentially creating climate-related transition financial risks.

Figure 5.5: Scenarios for the Carbon Transition



Note: The NGFS data is available under a Public License, at <https://data.ene.iiasa.ac.at/ngfs/#/license>.

Source: NGFS IIASA Scenario Explorer (June 2021), at <https://data.ene.iiasa.ac.at/ngfs>.

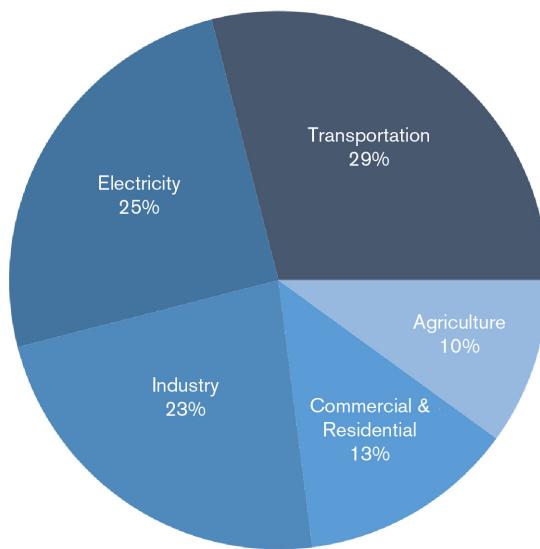
As emphasized in Chapter 1, a disorderly transition to a low-carbon economy may increase the risks of financial instability. Uncertainty or confusion associated with delayed policy actions or substantially different policy approaches internationally may lead to volatility in asset markets and business or household decisions, including potentially investments in assets that become “stranded” by future policy, preference, or technology shifts. Such volatility associated with a disorderly transition could adversely affect the economy and financial sector. This potential is a key reason why international authorities have begun to incorporate disorderly transition scenarios into their analysis. For example, the NGFS has developed two disorderly transition scenarios, the French Autorité de Contrôle Prudentiel et de Résolution considered two disorderly scenarios in its 2021 assessment, and the Bank of England's 2021

Climate Biennial Exploratory Scenario on financial risks from climate change included a late transition that highlighted the attendant risks.²²⁴

The Economic Sectors Most Directly Affected by the Necessary Transitions

At a high level, three sectors account for the nearly 80 percent of GHG emissions in the United States and will likely require undergoing the most significant adjustments: electricity and related fossil-fuel production, industry, and transportation (**Figure 5.6**).²²⁵ Agriculture is also an important economic sector that produces significant GHG emissions.

Figure 5.6: Total U.S. Greenhouse Gas Emissions by Economic Sector in 2019



Source: EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2019*.

The Electricity Transition

Changes in the production of electricity are central to achieving climate objectives, consistent with the Administration’s emphasis on the Clean Electricity Standard. These changes will require adjustments that may create risks and opportunities.

Figure 5.7 highlights two scenarios for electricity generation in the United States from the NGFS, and while scenarios from other sources may differ somewhat, the pattern is similar.²²⁶

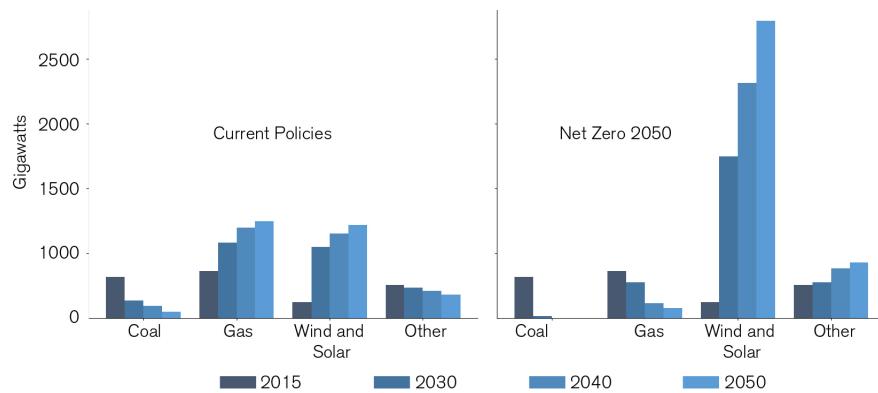
224 See Autorité de Contrôle Prudentiel et de Résolution, *Scenarios and Main Assumptions of the ACPR Pilot Climate Exercise*, at <https://acpr.banque-france.fr/en/scenarios-and-main-assumptions-acpr-pilot-climate-exercise>; and Bank of England, Key Elements of the 2021 Biennial Exploratory Scenario: Financial Risks from Climate Change, at <https://www.bankofengland.co.uk/stress-testing/2021/key-elements-2021-biennial-exploratory-scenario-financial-risks-climate-change>.

225 These sectors are broad. As discussed in more detail below, the sectors include electricity production, transportation (including shipping and the production of transportation vehicles), heavy industry including metals and various chemical industries, and a range of other sectors.

226 For example, a recent report from the IEA has broadly similar contours for its net-zero scenario. See IEA 2021, *Net Zero by 2050*.

First, coal is expected to decline in importance substantially. It is notable that the decline in coal is expected even under currently enacted policies—that is, even in the absence of needed steps to reach climate objectives. The decline in coal reflects the increased economic attractiveness of other approaches to electricity generation. As coal is expected to decline under any scenario, financial risks may be limited, as investors may already expect a decline in this industry and may have adjusted their exposures accordingly. Even so, thorough assessments are required and some institutions may have appreciable exposures. Moreover, these adjustments may have sizable impacts on some communities or regions in the United States, and policy steps by the Administration or Congress may be appropriate to address such impacts.²²⁷ The more sizable difference between the current policies scenario and the net-zero scenario lies in the use of natural gas. Under the current policies scenario, reliance on natural gas is expected to increase, whereas a scenario that achieves net zero by 2050 would require sizable reductions in the use of natural gas. This pattern suggests transition risks associated with disorderly adjustments in policies may affect the value of natural gas and assets more than, for example, coal assets. A thorough assessment of the potential for stranded assets in these sectors should be a priority for financial institutions in their risk management processes and a component of a regulatory scenario analysis. Finally, the climate transition represents opportunities for wind and solar generation, as well as other technologies that reduce GHG emissions. Financial market participants and institutions may benefit from such opportunities.

Figure 5.7: Electricity Generation Capacity Under Alternative Scenarios



Note: The NGFS data is available under a Public License, at <https://data.ene.iiasa.ac.at/ngfs/#/license>.

Source: NGFS IIASA Scenario Explorer (June 2021), at <https://data.ene.iiasa.ac.at/ngfs>.

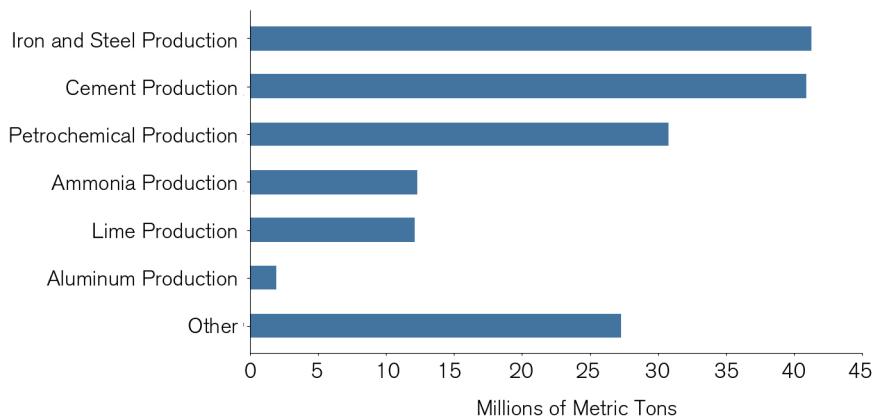
²²⁷ Academic research has pointed to a similar outlook for coal in the United States. See Rebecca Davis, J. Scott Holladay, and Charles Sims, “Coal-Fired Power Plant Retirements in the U.S.” (June 2021), at <https://www.nber.org/papers/w28949>. Some regions of the world may face larger adjustments given higher reliance on coal. See Erik Landry, C. Adam Schlosser, Y.-H. Henry Chen, et al., *MIT Scenarios for Assessing Climate-Related Financial Risk* (December 2019), at https://globalchange.mit.edu/sites/default/files/MITJPSGC_Rpt339.pdf.

Greenhouse Gas Intensive Manufacturing Industries

Several industrial sectors are particularly GHG intensive and account for more than 80 percent of carbon dioxide emissions by U.S. industry: steel and other metals, cement, and a number of chemicals industries (**Figure 5.8**). While the patterns of emissions differ somewhat for other GHGs, the set of broad industrial sectors accounting for most GHG emissions is similar to that presented for carbon dioxide.

The pattern of GHG intensity points to an important takeaway. The industrial sectors that account for sizable shares of GHG emissions are important inputs into other sectors. For example, steel and cement are inputs into construction (among other sectors), implying that any relative price shifts for steel and cement associated with cost changes that result from efforts to limit GHG emissions may alter relative prices or profitability in construction. Electricity and energy production in general are similarly inputs across the economy, implying similar effects. The degree to which such changes in costs, prices, and profitability impact the economy is likely complex and hard to gauge, although such impacts should be felt most acutely in sectors most directly exposed to the transition. This broad pattern of likely shifts in costs, prices, and profitability also differs in nature from discrete changes in the profitability associated with assets where policy or technological changes make such assets uneconomic. Such “stranded asset” effects would be most likely in sectors where policy choices are most pronounced. For example, a study by the MIT Joint Program on the Science and Policy of Global Change emphasizes the possibility of stranded assets associated with the fossil fuel sector, while noting that such stranded assets in the United States may be somewhat smaller relative to the size of the U.S. economy than in some other countries more reliant on coal.²²⁸ More broadly, research on the channels through which the necessary transitions may ripple across sectors, especially under a disorderly transition, is somewhat limited.

Figure 5.8: Major Industrial Sources of Carbon Dioxide Emissions, 2019



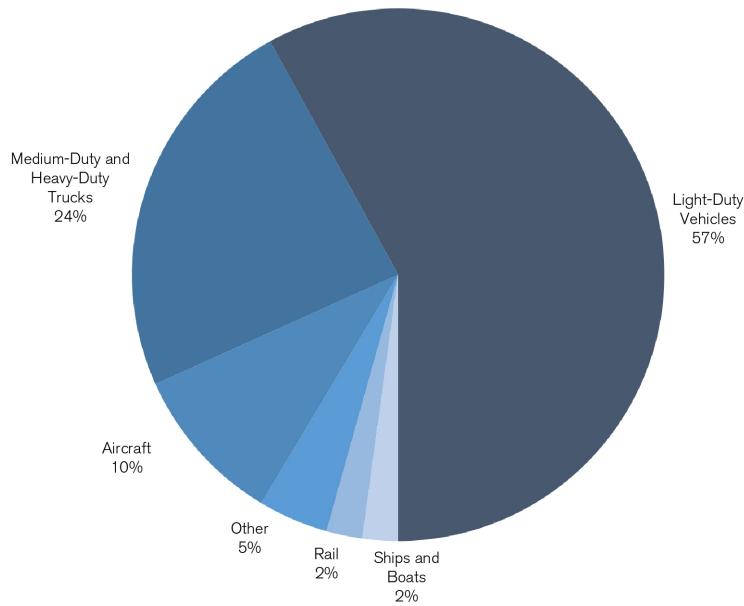
Source: EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2019*.

²²⁸ MIT Scenarios 2019.

Transportation Sector Emissions

Transportation is another broad sector contributing a large amount to U.S. GHG emissions. Most of these emissions stem from motor vehicles, with more than 50 percent of transportation-related emissions associated with light-duty motor vehicles (i.e., autos and light-duty trucks) and about 25 percent of transportation-related emissions associated with medium- and heavy-duty trucks (**Figure 5.9**).

Figure 5.9: 2019 U.S. Transportation Sector Greenhouse Gas Emissions by Source



Source: EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2019*.

Transitions from vehicles based on internal-combustion engines to electric (or other non-GHG technologies) will be broadly felt across the economy—by households, companies, and governments. The most directly affected assets (and hence those most likely to be stranded) would likely lie in the oil sector, motor vehicle production, and within transportation. These transitions also present opportunities for industry and the financial sector. The box on risks and opportunities associated with electric vehicles in Chapter 1 highlights these issues (**Box C**).

Exposures to Sectors Most Affected by the Transition

Financial institutions and investors with exposures to the economic sectors potentially most exposed to transition risks may face increased credit, market, or other risks during a transition. A full analysis would require a degree of specificity on the nature of transition risks, rather than simply the affected economic sectors, as might be outlined in a scenario analysis. A first look at risks facing financial institutions would consider their exposures to the most impacted sectors.

To guide such an analysis, **Figure 5.10** reviews the sectors most likely to be impacted by transitions and hence that may create transition risks to financial markets or institutions.

Figure 5.10. Sectors that may be Most Affected by Transitions to Achieve Climate Objectives

Climate risks considered	Energy-intensive Manufacturing	Transportation Related
<ul style="list-style-type: none"> • Electric utilities • Fossil fuel producers (mining and manufacturing), including coal, natural gas, and oil 	<ul style="list-style-type: none"> • Steel and other heavy metals • Concrete • Aluminum • Petro- and other chemical manufacturers 	<ul style="list-style-type: none"> • Motor vehicle production • Other transportation production, including aircraft • Transportation (road/air/rail/boat)

Source: Figure created by FSOC.

These directly affected sectors are only a portion of potential exposures to transition risks, as many other sectors use the output of these sectors and hence could be financially impacted should changes in policy, preferences, or other factors raise the costs of GHG-intensive goods or services. Economic analysis is well equipped to perform such analyses, using measurement tools such as input-output accounting and multisector models of the economy. However, such approaches are complex. Research has explored the potential exposure of financial institutions to transition risks through relatively straightforward estimation of the holdings of assets in the most GHG-intensive sectors, as in Battiston (2017).²²⁹ Some foreign regulators have built on this approach (e.g., European Central Bank, 2021), and found sizable but manageable direct exposures.²³⁰

While comprehensive assessments for U.S. financial institutions are not available, partial assessments of some financial institutions are possible. One example for banks, published by Ceres in a 2020 report, used publicly available information on the syndicated loan holdings of large banks.²³¹ Within the syndicated loan portfolios of large banks, the study found sizable exposures to fossil fuel producers, utilities, transportation, and energy-intensive manufacturing (at near 10 percent, 4 percent, 10 percent, and 25 percent of the portfolio, respectively); extrapolating these syndicated loan shares to the broader loan portfolio (in the absence of other information) implies sizable exposures.

Transition risk also leads to a set of market risks. Especially in the case of a disorderly transition (as discussed in Chapter 1), the potential of price volatility as regulatory changes and geopolitical events can lead to market volatility. This can include a sudden repricing of assets as regulatory changes in jurisdictions can lead to repricing of traded assets. Repricing can affect both emissions-intensive industries as well as secondary carbon markets, thereby affecting investors and financial institutions.

229 Stefano Battiston, Antoine Mandel, Irene Monasterolo, *et al.* “A Climate Stress-test of the Financial System,” *Nature Climate Change* 7, 283–288 (March 2017), at <https://doi.org/10.1038/nclimate3255>.

230 ECB, *ECB Economy-wide Climate Stress Test* (September 2021), at <https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op281-05a7735b1c.en.pdf>.

231 See Ceres, *Financing a Net-Zero Economy: Measuring and Addressing Climate Risk for Banks* (October 2020), at [https://www.ceres.org/resources/reports/financing-netzero-economy-measuring-and-addressing-climate-risk-banks](https://www.ceres.org/resources/reports/financing-net-zero-economy-measuring-and-addressing-climate-risk-banks).

Analyses of Insurers

Similar partial analyses have been conducted for certain insurers in the United States. As noted in Chapter 2 on “Regulatory and Supervisory Engagement with Climate-related Financial Risk”, two states – California and New York – have worked with 2DII to analyze the investment exposures of insurers operating in their respective states using 2DII’s PACTA tool.²³² Both the California and New York study focused primarily on insurers’ investments in corporate bonds and listed stocks. Neither attempted to assess insurers’ exposures from investments in private equity, hedge funds, derivatives, or real estate.

The California scenario analysis covered investments in fossil fuels, power, automotive, aviation and shipping, and steel and cement, but primarily focused on investments in fossil fuels, power, and automotive, which accounted for approximately 90 percent of the CO₂ emissions in the typical insurer’s portfolio.²³³ The California insurers included in the analysis had portfolios with larger exposures to the fossil fuel and power sectors than the fixed income market but lower exposures to the automotive sector than the fixed income market.²³⁴ Moreover, the insurers had portfolios with lower exposures to the fossil fuel, power, and automotive sectors than the listed equity market.²³⁵

The New York study examined the holdings of New York insurers in the fossil fuel, power generation, automotive, steel, cement, aviation, and shipping industries (collectively, the “carbon-intensive sectors”). The New York study found that the carbon- intensive sectors comprised approximately 17.2 percent of the insurers’ holdings in listed equities and corporate bonds while life insurers had greater exposure to these sectors, which made up about 20 percent of their corporate bond portfolios.²³⁶ As was the case with California insurers, there was a wide range of exposures among individual insurers. New York insurers’ corporate bond portfolios ranged from less than 1 percent exposure to carbon-intensive sectors to over 50 percent.²³⁷ New York insurers’ listed equities portfolios ranged from less than 1 percent exposure to carbon-intensive sectors to 100 percent.²³⁸

The IMF also considered exposures of insurers to carbon-intensive industries in its 2020 Financial System Stability Assessment of the United States. The IMF analysis concluded that

232 2 Degrees Investing Initiative, “2° Scenario Analysis: Insurance Companies Operating in California” (2019), at https://interactive.web.insurance.ca.gov/apex_exprd/cdi_apps/r/250/files/static/v54/2018_full_report.pdf [California 2° Scenario Analysis]; New York State Dept. of Fin. Services and 2 Degrees Investing Initiative, An Analysis of New York Domestic Insurers’ Exposure to Transition Risks and Opportunities from Climate Change (June 20, 2021), at https://2degrees-investing.org/wp-content/uploads/2021/06/DFS_2DII_report_NY-Insurers-Transition-Risks.pdf. [NYSDFS & 2DII Transition Risk Analysis].

233 California 2° Scenario Analysis, p. 3.

234 California 2° Scenario Analysis, p. 10.

235 California 2° Scenario Analysis, p. 10.

236 NYSDFS & 2DII Transition Risk Analysis, p. 9.

237 NYSDFS & 2DII Transition Risk Analysis, pp. 10-11.

238 NYSDFS & 2DII Transition Risk Analysis, p. 11.

carbon-intensive assets in a narrow sense (oil, gas, and mining) do not represent a major asset class. Transition risks could also arise for other exposures, e.g., transport or heavy industries, which were not included in the analysis.

Making Progress on Assessment of Transition Risks

Quantifying the exposures of financial institutions to economic sectors that may be most affected by transition risks is only a small component of assessing transition risks. The lack of easily available information on such exposures makes it difficult for regulators or the public to make assessments or conduct further research. As a result, regulators should make efforts to fill these gaps and then take the additional necessary steps to assess potential risk, including the impact of transition risks on these sectors, implications for loan performance, the resilience of individual financial institutions against potential poor loan performance, and spillovers across institutions and markets. These steps are discussed more fully in the recommendations in Chapter 6.

Next Steps

The challenges facing any assessment of the financial stability implications of climate-related financial risks are significant. Nonetheless, progress has been made, especially internationally, and this progress highlights a set of pathways to tackle and overcome the existing challenges.

All stakeholders need better information to assess climate-related financial risks and their potential effects on financial stability. Enhanced efforts to use existing data and identify data gaps, as discussed in Chapter 3, are part of this process. Enhanced and transparent disclosure by companies of climate-related financial risks is another part of this process. However, these initial steps to organize and collect information are likely insufficient, as such information needs to be processed and analyzed to gauge risks to individual institutions and markets and to financial stability. The efforts underway at FSOC members and implementation of the recommendations in Chapter 6 will help address these needs.

While a variety of approaches should be part of this process, the experiences of other countries suggest that scenario analysis conducted by regulators to measure risk across a broad set of institutions may be the best approach available currently. Scenario analysis is widely used in risk management and requires consideration of each step needed to assess potential risks to financial stability: specification of the nature of potential risks; a description of the impact of such climate risks on the economy and financial conditions; mapping such economic and financial factors to risks at institutions; and consideration of systemwide feedback loops that may amplify strains at individual institutions and contribute to financial strains across the system. Moreover, scenario analysis provides a structured framework within which institutions can identify data and modeling needs.

Chapter 6: Council Recommendations

The Council finds that the emerging threat to financial stability posed by climate change requires its members to take action to expand capacity, improve data and measurement, enhance disclosure of climate-related risks, assess the scale of potential vulnerabilities, and make appropriate adjustments in regulatory and supervisory tools. The recommendations in this chapter highlight necessary steps to do this. Implementation of the recommendations can strengthen the financial system and make it more resilient to climate-related shocks and vulnerabilities.

The analysis in the report highlights the need to expand capacity at FSOC and its members. FSOC members have taken initial steps to increase their capacity and analysis of climate-related financial risks. Additional investments can ensure that the United States is a leader in the measurement, monitoring, and mitigation of climate-related financial risks and in ensuring the resiliency of the financial system to those risks. These investments are discussed in the first set of recommendations.

In order to promote the resilience of the financial system to climate-related risks, FSOC members must fill climate-related data and methodological gaps, as discussed in the second set of recommendations. Further, better measurement and understanding of climate-related risks requires consistent, comparable, and decision-useful public climate-related disclosures, as outlined in the third set of recommendations.

Finally, assessing and mitigating climate-related risks to the financial stability of the United States requires action. The Council recommends that members pursue a range of approaches, in coordination with domestic and international partners. Among these steps, members should conduct scenario analysis of climate-related financial risks, where appropriate, and review the role of their regulatory and supervisory tools in mitigating potential risks, including the adequacy of existing supervisory guidance. These recommendations comprise the final set of actions identified by the Council for near-term prioritization.

1. Building Capacity and Expanding Efforts to Address Climate-related Financial Risks

Although the Council and its members have accelerated their efforts over the past year to assess and mitigate climate-related financial risks, further efforts related to data, measurement, assessment, supervisory and regulatory tools, and investments to increase expertise are needed to fully address these risks.

Increase expertise and resources focused on climate-related risks at FSOC: The Council has an important role to play in identifying climate-related financial risks, coordinating across U.S. regulatory agencies, and acting, as appropriate, to mitigate risks to financial stability.

Recommendation 1.1: The Council will form a new staff-level committee, the Climate-related Financial Risk Committee (CFRC), within 60 days of the publication of this

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report. The CFRC will identify priority areas for assessing and mitigating climate-related risks to the financial system and serve as a coordinating body, where appropriate, to share information, facilitate the development of common approaches and standards, and facilitate communication across FSOC members and interested parties. The committee will provide updates to the Council at least semi-annually on the status of the Council's and its member's efforts to identify and address climate-related financial risks, including efforts by the Council and its members to incorporate climate-related financial risks into their regulatory and supervisory programs, improve data and methods, enhance climate-related disclosures, and assess climate-related risks to the financial stability of the United States. The Council will include a summary of progress in addressing climate-related financial risks in its Annual Report based on these updates and related information.

Recommendation 1.2: The Council will form a Climate-related Financial Risk Advisory Committee (CFRAC). The advisory committee, reporting to the CFRC, will help the Council gather information on and analysis of climate-related financial risks from a broad array of stakeholders. Members of the CFRAC should be considered for selection from among: climate science experts; non-governmental research institutions; academia; the financial services industry; commercial businesses; consumer, investor, environmental, and labor groups; government agencies with climate expertise; and other stakeholders as appropriate.

Increase expertise and resources in climate-related risks at individual FSOC members: FSOC members are conducting climate-related work within their existing mandates and these efforts contribute to the resilience of the financial system. Members agree that they need to enhance their capacity for addressing climate-related financial risks.

Recommendation 1.3: The Council recommends that, consistent with their budget processes and mandates, FSOC members should prioritize internal investments to expand their respective capacities to define, identify, measure, monitor, assess, and report on climate-related financial risks and their effects on financial stability. This should include investments in staffing, training, expertise, data, analytic and modeling methodologies, and monitoring.

Enhance public communication of climate-related efforts: FSOC members often publish annual reports or recurring reports on risk topics. While discussion of climate issues in these reports has increased, it remains limited. As a result, and consistent with Executive Order 14030, the Council will continue its assessment of climate-related financial stability risks and include its analysis in upcoming Council annual reports. The Council will look for additional opportunities to provide updates to the public on its efforts to assess and address climate-related financial risks.

Recommendation 1.4: The Council recommends that FSOC members include descriptions of their activities related to climate-related financial risks in their annual reports and consider incorporating climate-related financial risks in relevant risk reports that they publish, as appropriate. Such communication will inform the public about FSOC members' efforts to assess and address these risks within the context of each member's mandate and authority.

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Recommendation 1.5: The Council recommends that FSOC members make climate-related data for which they are the custodians freely available to the public, as appropriate and subject to any applicable data confidentiality requirements.

Understand and address adverse impacts on financially vulnerable populations:

The adverse effects of climate change disproportionately impact financially vulnerable populations, potentially including lower-income communities, communities of color, and other disadvantaged or underserved communities. Financially vulnerable populations may also have fewer resources to recover from or adapt to adverse impacts. Addressing the impacts of climate change on financially vulnerable populations will require a coordinated approach involving stakeholders across the public and private sector to develop thoughtful and balanced policy responses.

Recommendation 1.6: The Council recommends that its members, where applicable, coordinate the analyses of climate-related financial risks conducted in the supervisory and regulatory functions of their agencies and organizations with their efforts to understand impacts on communities and households. FSOC members should, as applicable, integrate these analyses into the public reports discussed in *Recommendation 1.4*. FSOC members should use the CFRC to share information regarding these efforts, as appropriate.

Recommendation 1.7: The Council recommends that FIO should act expeditiously to analyze the potential for climate change to affect insurance and reinsurance coverage, particularly in regions of the country affected by climate change, in consultation with the States, in a manner consistent with Executive Order 14030.

Recommendation 1.8: The Council recommends that its members, consistent with their mandates and authorities, evaluate climate-related impacts and the impacts of proposed policy solutions on financially vulnerable populations when assessing the impact of climate change on the economy and the financial system.

Recommendation 1.9: The Council recommends that the Treasury Department engage other members of the FLEC to analyze and understand the impact of climate change on the financial well-being of financially vulnerable populations. FSOC members that are also FLEC members should actively participate in this analysis.

2. Filling Climate-related Data and Methodological Gaps

Measurement of climate-related financial risks requires additional data and methodologies that may be new to financial institutions, investors, market participants, and regulators. In addition, there may be gaps in available data or data may not be in a readily usable format, as has been concluded in a number of recent analyses by international regulatory or financial stability forums. Consequently, Council members have identified work on data and methodologies as a priority.

Fill data gaps: FSOC members and regulated entities generally face common challenges related to data gaps that make it difficult to analyze and quantify climate-related risks to individual institutions and the broader economy.

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Recommendation 2.1: The Council recommends that its members promptly identify and take the appropriate next steps towards ensuring that they have consistent and reliable data to assist in assessing climate-related risks through:

- Identifying the data needed to evaluate the climate-related financial risk exposures of regulated entities and financial markets within the context of each FSOC member's mandate and authorities;
- Performing an internal inventory of currently collected and procured data and its relevance for climate risk assessments; and
- Developing a plan for procuring necessary data through data collection, data sharing arrangements described in *Recommendation 2.2*, and information purchased from data providers or other sources.

Coordinate to address data issues: FSOC members are likely to face common data challenges and should work together, where appropriate, to address them.

Recommendation 2.2: The Council recommends that its members use existing authorities to implement appropriate data- and information-sharing arrangements to facilitate the sharing of climate-related data across FSOC members and non-FSOC member agencies to assess climate-related financial risk, consistent with data confidentiality requirements.

Recommendation 2.3: The Council recommends that FSOC work with its members through the CFRC to coordinate efforts, as appropriate, to address data gaps, including prioritizing data sets and coordinating data acquisition, in order to avoid duplication of effort and facilitate the improvement and coordinated use of data and models across FSOC members.

Recommendation 2.4: The Council recommends that the OFR, in coordination with the CFRC, provide data services—including identifying, hosting, and procuring data—and analytical tools to facilitate members' assessment of climate-related financial risks, including scenario analysis.

Data metrics and standardization: FSOC members will likely need to procure or collect and use data with which they may have limited experience, such as climate-related data, projections (or scenarios) of climate risks, and scenarios of financial and economic outcomes based on climate scenarios. FSOC members will need to take steps to ensure data is in a usable format—for example, addressing data inconsistencies or data aggregation challenges. They will also need to utilize new methodologies and metrics to quantify physical and transition risks that do not have generally accepted definitions and standards.

Recommendation 2.5: The Council recommends that its members, coordinating through the CFRC, move expeditiously to develop consistent data standards, definitions, and relevant metrics, where possible and appropriate, to facilitate common definitions of climate-related data terms, sharing of data, and analysis and aggregation of data.

Recommendation 2.6: The Council recommends that its members continue to coordinate with their international regulatory counterparts, bilaterally and through international bodies, as they identify and fill data gaps, address data issues, and develop definitions, data standards, metrics, and tools.

3. Enhancing Public Climate-related Disclosures

Transparency is central to the U.S. financial regulatory system. High quality climate-related disclosures that offer meaningful information about climate-related financial risks foster increased transparency into those risks. When disclosures are made publicly available, they protect investors and market participants by allowing them to better assess the climate-related financial risks of companies and investments. These disclosures can also facilitate market efficiency by allowing climate-related risks to be better priced into financial markets.

Enhanced climate-related disclosures: Climate-related disclosures are an important tool to facilitate the assessment of climate-related risks and opportunities for companies, investors, market participants, and regulators. However, additional efforts are needed to strengthen climate-related disclosures.

Recommendation 3.1: The Council recommends that its members review their existing public disclosure requirements and consider, as appropriate, updating them to promote the consistency, comparability, and decision-usefulness of information on climate-related risks and opportunities, consistent with their mandates and authorities.

Recommendation 3.2: The Council recommends that its members, consistent with their mandates and authorities, consider enhancing public reporting requirements for climate-related risks in a manner that builds on the four core elements of the TCFD, to the extent consistent with the U.S. regulatory framework and the needs of U.S. regulators and market participants.

Recommendation 3.3: The Council recommends that its members, consistent with their mandates and authorities, evaluate standardizing data formats for public climate disclosures to promote comparability, such as the use of structured data using the same or complementary protocols, where appropriate and practicable.

Recommendation 3.4: The Council understands that information on GHG emissions promotes a better understanding of the exposures of companies and financial institutions to climate-related financial risks. The Council recommends that, consistent with their mandates and authorities, FSOC members issuing requirements for climate-related disclosures consider whether such disclosures should include disclosure of GHG emissions, as appropriate and practicable, to help determine exposure to material climate-related financial risks.

Recommendation 3.5: The Council recommends that its members continue to coordinate with their international regulatory counterparts, bilaterally and through international bodies, as they assess requirements for climate-related disclosures.

Regulator- or sector-specific recommendations to enhance disclosures

Recommendation 3.6: Public Issuer Disclosures—The SEC staff are developing a proposal on disclosure requirements for public issuers related to climate-related risks for the SEC's consideration. The Council is encouraged by the SEC's work on this critical issue and supports its efforts to consider enhanced climate-related disclosures to provide investors with information that is consistent, comparable, and decision-useful.

Recommendation 3.7: Banks—The Council recommends that federal banking regulators, consistent with their mandates and authorities, continue to review banks' public regulatory reporting requirements to assess whether enhancements are needed to provide market participants with information on institutions' climate-related financial risks, taking into account a bank's size, complexity, and activities.

Recommendation 3.8: Insurers—The Council supports continued efforts by FIO and insurance regulators to work together to enhance the existing climate-related disclosures for the insurance sector.

Recommendation 3.9: Asset Managers— The SEC staff are evaluating requirements for registered funds and investment advisers related to ESG factors, including ESG claims and related disclosures, for the SEC's consideration. The Council is encouraged by the SEC's work on this issue and supports its efforts in this area.

Recommendation 3.10: State and Local Finance—The Council encourages its members to review their authorities to consider how disclosure of climate-related risks related to municipal securities can be enhanced.

Recommendation 3.11: Accounting and Audit Standards—The Council welcomes the work of the IFRS Foundation Trustees in laying the foundation for the formation of an international sustainability standards board (ISSB) to promote the development of sustainability reporting standards focused on enterprise value creation that could lead to consistent and comparable disclosures that can be used as building blocks across jurisdictions.

4. Assessing and Mitigating Climate-related Risks to Financial Stability

An assessment of climate-related financial risks and their implications for financial stability is complex and progress will require building on the growing set of domestic and international analyses. Tools remain under development, and future climate-related financial risks may manifest in new ways, owing to the changing nature of the climate, suggesting that assessments based on past experience are likely insufficient. Council members should work together and, where possible, in concert with climate experts across the government, academia, public-interest groups, and the private sector. While it will be important for members and the private sector to develop a range of tools as they assess climate-related financial risks and financial stability, scenario analysis is one useful tool that has been deployed by some regulators in other countries and within the private sector. Scenario analysis is also inherently forward-looking and thus can consider the implications of future climate outcomes and policies. Moreover, exploratory scenario analysis exercises provide a structured framework within which data and methodological issues can be actively identified and addressed.

Collaborate with climate science experts and international partners: Climate science is relatively new to financial regulators, so it will be important for FSOC members to coordinate with relevant experts in other government agencies, academia, and elsewhere. In

addition, the cross-border nature of climate change and the international activities of U.S. financial institutions necessitate international coordination.

Recommendation 4.1: The Council recommends that its members collaborate with external experts to identify climate forecasts, scenarios, and other tools necessary to better understand the exposure of regulated entities to climate-related risks and how those risks translate into economic and financial impacts.

Recommendation 4.2: FSOC members should continue to coordinate with their international regulatory counterparts, bilaterally and through international bodies, as they assess climate-related financial stability risks.

Scenario analysis: Scenario analysis is a useful tool for regulators and firms to assess the potential effects of climate impacts and help manage climate-related risks. It can be used for a range of objectives and using different approaches based on the underlying objective and available data and methods.

Recommendation 4.3: The Council recommends that its members use scenario analysis, where appropriate, as a tool for assessing climate-related financial risks, taking into account their supervisory and regulatory mandates and the size, complexity, and activities of regulated entities.

FSOC members may execute this recommendation in a variety of ways, linked to different goals and mandates. Regulators and supervisors can use scenario analysis by regulated entities in evaluations of the risk management processes of regulated entities, taking into account the nature of entities under consideration, as expectations for larger and more complex institutions may be different than expectations for smaller institutions. Scenario analysis of this type can be a building block for assessing the impact of climate-related risks on key sectors of the financial system and the financial system as a whole. Finally, scenario analysis performed by individual firms can contribute to the assessment and disclosure of climate-related financial risks by firms that have significant exposure to climate-related impacts. To develop and use scenario analysis most effectively to understand the effects of climate-related financial risks on financial stability, Council members will benefit from coordination amongst themselves, external experts, and their international counterparts.

Recommendation 4.4: The Council recommends that its members should, consistent with their mandates and authorities, consider using common scenarios that build on existing work, including scenarios developed by NGFS and work at the FSB, as appropriate for the institutions and markets under consideration.

Recommendation 4.5: The Council recommends that, to help inform interagency assessments of the systemwide effects of climate change, the CFRC should serve as a forum for FSOC members to share data and methodologies and leverage the expertise needed to perform scenario analysis and share results.

Review of supervisory and regulatory tools: Prudential and market regulators have a variety of tools that may be relevant to addressing climate-related financial risks within the context of their statutory mandates, such as enhanced supervisory scrutiny.

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Recommendation 4.6: FSOC members should continue their efforts to consider the incorporation of climate-related risks into their regulatory and supervisory programs and update those programs as necessary, consistent with their mandates and authorities. As part of this work, they should review regulated entities' efforts to address climate-related risks and clarify or enhance risk management requirements for regulated entities where necessary to promote appropriate consideration of climate-related financial risks.

Recommendation 4.7: FSOC members, consistent with their mandate and authorities, should review existing regulations, guidance, and regulatory reporting relevant to climate-related risks, including credit risks, market risks, counterparty risks, and other financial and operational risks, to assess whether updates are necessary to appropriately address climate-related financial risks.

Recommendation 4.8: FSOC members should evaluate whether additional regulations or guidance specific to climate-related risks is necessary to clarify expectations for regulated or supervised institutions regarding management of climate risks, taking into account an institution's size, complexity, risk profile, and existing enterprise risk management processes.

Recommendation 4.9: FSOC members should continue to coordinate with their international regulatory and supervisory counterparts, bilaterally and through international bodies, as they review their regulatory and supervisory tools to mitigate climate-related financial risks.

List of Acronyms and Abbreviations

2DII	2 Degrees Investing Initiative
A2ii	Access to Insurance Initiative
ACPR	Autorité de Contrôle Prudentiel et de Résolution
BCBS	Basel Committee on Banking Supervision
BHCs	Bank Holding Companies
CCAR	Comprehensive Capital Analysis and Review
CDI	California Department of Insurance
CDP	Carbon Disclosure Project
CDSB	Climate Disclosure Standards Board
CFPB	Consumer Financial Protection Bureau
CFRAC	Climate-related Financial Risk Advisory Committee
CFRC	Climate-related Financial Risk Committee
CFTC	Commodity Futures Trading Commission
CIRA	Climate Change Impacts and Risk Analysis (CIRA)
CO2	Carbon Dioxide
CRA	Community Reinvestment Act
CRSP	Center for Research in Security Prices
CRU	Climate Risk Unit
CSBS	Conference of State Bank Supervisors
DNB	De Nederlandsche Bank
DRT	Disaster Response Team
EBA	European Banking Authority
ECB	European Central Bank
EEMAC	Energy and Environmental Markets Advisory Committee
EIOPA	European Insurance and Occupational Pensions Authority
EPA	Environmental Protection Agency
ERM	Enterprise Risk Management
ESG	Environmental, Social, and Governance Factors
ESMA	European Securities and Markets Authority
ESRB	European Systemic Risk Board
FBIIC	Financial and Banking Information Infrastructure Committee
FDIC	Federal Deposit Insurance Corporation
FEMA	Federal Emergency Management Agency
FHFA	Federal Housing Finance Agency
FIO	Federal Insurance Office
FLEC	Financial Literacy and Education Commission
FRB	Federal Reserve Board

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FRBNY	Federal Reserve Bank of New York
FSAP	Financial Sector Assessment Program
FSB	Financial Stability Board
FSCC	Financial Stability Climate Committee
FSOC	Financial Stability Oversight Council
GAAP	Generally Accepted Accounting Principles
GHG	Greenhouse Gas
GHGRP	Greenhouse Gas Reporting Program
GIMAR	Global Insurance Market Report
GRI	Global Reporting Initiative
GSEs	Government-sponsored Enterprise
GSFR	Global Financial Stability Report
HFC	Hydrofluorocarbon
HMDA	Home Mortgage Disclosure Act
IAIS	International Association of Insurance Supervisors
IASB	International Accounting Standards Board
ICPs	Insurance Core Principles
IFRS	International Financial Reporting Standards
IHCs	Intermediate Holding Companies
IIRC	International Integrated Reporting Council
IMF	International Monetary Fund
IOSCO	International Organization of Securities Commissions
IPCC	Intergovernmental Panel on Climate Change
ISSB	International Sustainability Standards Boards
MRAC	Market Risk Advisory Committee
MSRB	Municipal Securities Rulemaking Board
NAIC	National Association of Insurance Commissioners
NASAA	North American Securities Administrators Association
NCEI	National Centers for Environmental Information
NCUA	National Credit Union Administration
NCUSIF	National Credit Union Share Insurance Fund
NDCs	Nationally Determined Contributions
NFHL	National Flood Hazard Layer
NFIP	National Flood Insurance Program
NGFS	Network of Central Banks and Supervisors for Greening the Financial System
NOAA	National Oceanic and Atmospheric Administration
NRC	National Risk Committee
NYSDFS	New York State Department of Financial Services

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OCC	Office of the Comptroller of the Currency
OCCIP	Office of Cybersecurity and Critical Infrastructure Protection
OECD	Organization for Economic Cooperation and Development
OFR	Office of Financial Research
ORSA	Own Risk and Solvency Assessment
PACTA	Paris Agreement Climate Transition Assessment
PCAF	Partnership for Carbon Accounting Financials
PRA	Prudential Regulation Authority
RBC	Risk-Based Capital
RFI	Request for Input
RRC	Regional Risk Committee
SASB	Sustainability Accounting Standards Board
SBTi	Science Based Targets Initiative
SCAP	Supervisory Capital Assessment Program
SCC	Supervision Climate Committee
SDGs	Sustainable Development Goals
SEC	Securities and Exchange Commission
SFDR	Sustainable Finance Disclosure Regulation
SFHA	Special Flood Hazard Area
SFN	Sustainable Finance Network
SIF	Sustainable Insurance Forum
SRMA	Sector Risk Management Agency
SSB	Standard-setting Bodies
STF	Sustainable Finance Task Force
TCFD	Task Force on Climate-Related Financial Disclosure
TFCR	Task Force on Climate-related Risks

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1500 PENNSYLVANIA AVENUE, NW | WASHINGTON, D.C. 20220