



Financial Stability Oversight Council

STAFF PROGRESS REPORT

July 28, 2023

Climate-related Financial Risk: 2023 Staff Progress Report

This is a progress report from the staff of Council member agencies that participate in the Climate-related Financial Risk Committee (CFRC). The report represents only the views of staff. The Council has expressed no view regarding the analysis, findings, or conclusions contained herein.

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1. Executive Summary

In October 2021, the Financial Stability Oversight Council (FSOC or Council) published its Report on Climate-Related Financial Risk (Climate Report),¹ which identified climate change as an emerging risk to financial stability. The Climate Report also included a set of recommendations for the Council and its member agencies² to bolster the resiliency of the financial system to climate-related risk. Since the publication of the Climate Report, the Council and its members have made progress in advancing these recommendations, including by taking significant actions to address capacity building, disclosure, data, and assessment and mitigation of risks. This CFRC Staff Progress Report, written by the staff of the Council members who participate in the Council's Climate-related Financial Risk Committee (CFRC), provides an update on these efforts since the publication of the 2021 Climate Report. This report is a follow-up to the fact sheet on agency progress³ published last year.

The staff-level CFRC serves as an active forum for interagency information sharing, coordination, and capacity building on climate-related financial risks. Through individual agency action and coordination through the CFRC, there have been notable developments in the past year among the major thematic areas of the Climate Report, including the following:

Filling climate-related data and methodological gaps:

- The Office of Financial Research (OFR) launched a new platform—the Joint Analysis Data Environment (JADE)⁴—to improve regulators' access to data, high-performance computing tools, and analytical and visualization software. Two CFRC working groups coordinated among Council member agencies to ensure that the data and analytical tools needed by the agencies are incorporated into JADE. Once fully operational, JADE will support broad-based financial-stability research by providing a platform to access and analyze a broad spectrum of financial and other relevant data and by facilitating data sharing and collaboration among Council member agencies. The OFR anticipates that it will release the initial version of JADE during the second half of 2023.
- On October 18, 2022, the U.S. Department of the Treasury's Federal Insurance Office (FIO) issued a request for comment⁵ on a proposed collection of data from property and casualty insurers regarding current and historical underwriting data on homeowners' insurance at the ZIP Code level to assess the potential for major disruptions of private insurance coverage in regions of the country that are particularly vulnerable to the impacts of climate change. This proposed data collection would provide consistent, granular, and comparable insurance data to help assess the challenges to insurance availability in certain areas of the country.

Assessing and mitigating risks:

- The dedicated CFRC climate scenario analysis (CSA) working group composed of Council member staff provides a forum for Council members—including the Federal Reserve, the Commodity Futures Trading Commission (CFTC), the Federal Deposit Insurance Corporation (FDIC), the Federal Housing Finance Agency (FHFA), and the Office of the Comptroller of the Currency (OCC)—to explore the use of scenario analysis by regulators and regulated firms.
- The dedicated CFRC Risk Assessment Working Group (RAWG), which is composed of Council member staff, is developing a robust framework to identify and assess climate-related financial risk and is iteratively identifying a preliminary set of risk indicators for banking, insurance, and financial markets.

- Many agencies are also taking individual actions on assessing and mitigating risk. For example, OCC,⁶ FDIC,⁷ and the Federal Reserve⁸ each released for public feedback or comment a set of draft principles for climate-related financial risk management for certain large financial institutions. These agencies have indicated their intention to work together to promote consistency in the supervision of large banks through final interagency guidance, after carefully reviewing comments received.
- FIO released a report titled “Insurance Supervision and Regulation of Climate-Related Risks,”⁹ which assesses climate-related issues and gaps in the supervision and regulation of insurers and issues a set of policy recommendations.
- The Federal Reserve launched a pilot CSA exercise for six large bank holding companies.¹⁰

The Council and its member agencies continue to view climate-related financial risk as a key priority and will advance the recommendations of the Climate Report. As an interagency body, the Council plays an important role in assessing financial-stability risks that flow across the financial system. Staff from member agencies have highlighted cross-cutting issues including coordinating on data and risk assessment, which will continue to be a focus area. In addition, the intersection of physical risk, real estate, banking, insurance, and household finances is emerging as a shared area of interest and potential future work. As detailed in the Council’s 2022 Annual Report,¹¹ climate-related events like wildfires and flooding may result in damage that can reduce the value of real estate, reducing insurance profitability via higher-than-expected underwriting losses,¹² and affecting the cost and availability of insurance coverage for households and businesses,¹³ with the potential to spill over to other parts of the financial system and real economy. Given the critical role of real estate in the economy and the financial system and how it affects the remits of multiple Council member agencies, the intersection of physical risk, real estate, and insurance is emerging as a particular priority for future analysis for the CFRC.

2. Introduction

In October 2021, the Council published its Climate Report,¹⁴ which included 35 recommendations to U.S. financial regulators on how to identify and address climate-related risks to the financial system.

The Climate Report identified climate change as an emerging risk to financial stability. Climate-related financial risks can be grouped into two broad categories: physical risks and transition risks. Physical risks refer to the harm to people and property from acute, climate-related disaster events such as hurricanes, wildfires, floods, and heatwaves, as well as longer-term chronic phenomena like higher average temperatures, changes in precipitation patterns, sea level rise, and ocean acidification. Transition risks refer to disruptions that may occur from a shift to a low-greenhouse gas economy. The physical and transition risks associated with climate change could contribute to financial instability through numerous channels, including financial intermediaries experiencing significant losses, the impairment of financial market functioning, the sudden and disruptive repricing of assets, or legal risks. These physical and transition risks can manifest as traditional risks to financial institutions such as credit risk, liquidity risk, market risk, and operational risk. As such, they are a familiar focus of prudential supervision and regulation by FSOC members and can be integrated into existing financial stability frameworks.

Since the publication of the Climate Report, the Council and its members have made progress in advancing the recommendations identified in the Climate Report, including significant actions taken by members to address capacity building, disclosure, data, and assessment and mitigation of risks. This CFRC Staff Progress Report provides an update on these efforts since the Climate Report’s publication, focusing primarily on

interagency efforts through the Council and certain key developments from member agencies. This report is organized around the main thematic areas of the Climate Report—building capacity (Section 3), assessing and mitigating risks (Section 4), and filling climate-related data and methodological gaps (Section 5).

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

Over the past year, the Council and its members have increased their efforts to build capacity and increase expertise to address climate-related financial risks. Key among these efforts, and consistent with Recommendation 1.1 of the Council’s Climate Report,¹⁵ is the Council’s formation of a new staff-level committee in February 2022, the CFRC, with representation from all 15 Council member agencies. The CFRC serves as an active forum for interagency information sharing, coordination, and capacity building. Given the gaps in climate-related financial data identified in the Climate Report, the continuing evolution in methodologies to assess risk, and the challenges of translating climate data into potential financial impacts, the CFRC plays an important role in enabling Council members to learn about emerging best practices from one another.

To facilitate progress, the CFRC established four working groups: one on scenario analysis (detailed in Section 4.A), one on risk assessment (detailed in Section 4.B), and two on data (detailed in Sections 5.A and 5.B). Figure 1 below provides an overview of the working groups.

Figure 1. Climate-related Financial Risk Committee (CFRC) Working Groups

Working Group	Objective
Scenario Analysis Working Group (SAWG)	Facilitate information sharing and capacity building for Council member agencies to conduct scenario analysis.
Risk Assessment Working Group (RAWG)	Develop a more robust framework around identifying and assessing climate-related financial risks and vulnerabilities.
Data Infrastructure Working Group (DIWG)	Work closely with the OFR to establish new infrastructure for agencies to find, obtain, share, and analyze data.
Data Requirements Working Group (DRWG)	Identify Council member agencies’ data needs to assess and address climate-related risks that are aligned with the agencies’ authorities and mandates.

In addition to the staff-level CFRC, the Council formed an external advisory committee in October 2022—the Climate-related Financial Risk Advisory Committee (CFRAC).¹⁶ Consistent with Recommendation 1.2 of the Council’s Climate Report, the CFRAC helps the Council receive information and analysis on climate-related financial risks from a broad array of stakeholders. The duties of the CFRAC include:

- identifying information gaps and data inconsistencies, and recommending options for addressing these issues, to support the Council’s collection of information pertaining to climate-related risks to the financial system;
- gathering and analyzing information on climate-related risks to the financial system;
- providing advice and recommendations to the CFRC on identifying, assessing, and mitigating climate-related risks to the financial system; and
- performing other duties that the CFRC, the Council’s Deputies Committee, or the Council may assign.

The duties of the CFRAC are solely advisory and will extend only to the submission of advice and nonbinding recommendations to the CFRC. The CFRAC's initial slate of members includes stakeholders from a wide range of backgrounds, including the financial services industry, nongovernmental research institutions, climate-related data and analytics providers, nonprofit organizations, and academia. CFRAC members' climate data and analytical expertise support the Council's efforts to understand the economic and financial impacts of climate-related risks.

All Council member agencies have been building capacity and/or focusing their efforts to address climate-related financial risk, consistent with their mandates. This activity includes assigning staff to work on the topic and, for many, investing in staffing and training, consistent with Recommendation 1.3 of the Climate Report. Many members have developed internal working groups to support such efforts, and several public documents show how the staff of Council member agencies are helping to advance collective understanding of climate-related financial risks, including in the form of external publications and conferences (see **Box A**).

Some Council member agencies are also engaging with their counterparts abroad through multilateral international organizations on climate-related financial risks. These organizations include the Network of Central Banks and Supervisors for Greening the Financial System (NGFS),¹⁷ the Financial Stability Board (FSB),¹⁸ the Basel Committee on Banking Supervision (BCBS),¹⁹ and the International Association of Insurance Supervisors (IAIS).²⁰

Box A: Capacity-building Efforts

Recommendation 1.3 of the Climate Report suggests that Council members expand their respective capacities to define, identify, measure, monitor, assess, and report on climate-related financial risks and their effects on financial stability, including investments in data, analytic and modelling methodologies, and monitoring. Council member agencies and their staff²¹ have published research and external documents on a range of climate-related financial risk issues, some of which are highlighted as follows:

Banking: Research on U.S. banks' exposures to climate transition risks,²² whether banks are sufficiently capitalized to absorb losses from climate transition risk,²³ how credit unions can increase preparedness for climate-related risks,²⁴ and credit union exposure to physical risks.²⁵

Insurance: A FIO report on insurance supervision and regulation of climate-related risks,²⁶ meeting materials of the National Association of Insurance Commissioners (NAIC) Climate and Resiliency task force,²⁷ consumer views on extreme weather and property insurance,²⁸ and analysis from the New York State Department of Financial Services (NYDFS) of responses to the NAIC climate risk survey.²⁹

Financial Markets: Evidence that climate regulatory risks causally affect bond credit ratings and yield spreads,³⁰ and the effects of climate-related risks as pertinent to the derivatives markets and underlying commodities markets.³¹

Real Estate Markets: Research on the effects of quasi-mandatory flood insurance on mortgage lending,³² how flood maps may have inadvertently clustered those households financially least able to bear the consequences of a disaster into areas that may still pose a significant flood risk,³³ and how historical policies like redlining may have put the assets of affected populations at a disproportionate climate risk,³⁴ a synopsis of information on the effects of climate on the national housing finance system,³⁵ and a box topic on climate-related risks in mortgage securitization.³⁶

Microprudential and Macroprudential Policy: The design of stress tests to assess and manage the macroprudential risks from climate change in the financial sector.³⁷

In addition to research and publications from Council member agencies and their staff, some Council members have hosted conferences to benefit from external expertise, consistent with recommendation 4.1 of the Climate Report.

The **OFR** hosted the OFR Climate Implications for Financial Stability Conference on September 9, 2022, to present research and hold panel discussions on topics including macroprudential issues, asset valuations, credit markets, stress testing, and financial system externalities.³⁸

OCC hosted a meeting on June 6-7, 2022, as a forum for presentations from academics and regulators on climate change and the financial system.³⁹

FHFA hosted an Economic Summit on climate risk on November 1, 2022, with sessions on climate stress testing and academic research on impacts on vulnerable communities.⁴⁰

NAIC included a Natural Catastrophe Risk and Resiliency track at the 2020, 2021, and 2022 NAIC Insurance Summits.

4. Assessing Climate-related Financial Risks

Authoritative assessment of climate-related financial risks and their implications for financial stability requires new data and analytical tools, and continued progress in this area will require building on emerging domestic and international work on this topic.⁴¹ Analytical tools continue to be developed, and future climate-related financial risks may manifest in new ways because of the changing nature of the climate, suggesting that assessments based on past experience are likely insufficient. Advancing these analytical tools and methods is a key focus area of the CFRC, including targeted working groups on scenario analysis and risk assessment.

4.A. Scenario Analysis

The unprecedented nature of climate change means that anticipating its potential effects on the safety and soundness of financial institutions and on financial stability requires forward-looking analyses. One such approach is climate scenario analysis (CSA). A *climate scenario* posits a potential future path of important climate-related factors, allowing analysts to explore the resulting effects on the economy and financial system. Different climate scenarios can embody different assumptions about how the future will unfold, thus helping illustrate how different risks may evolve and allowing an exploration of their potential implications.

Member agencies are in different stages of their engagement with CSA, as set out in more detail below. Given the varying stages of progress, the main function of the Scenario Analysis Working Group (SAWG) is to facilitate information sharing and capacity building for Council member agencies to conduct scenario analysis, by providing a forum to exchange views and explore areas of shared interest—for example, through presentations from external experts and relevant researchers from Council members. This function is consistent with Recommendations 4.1 and 4.5 of the Climate Report. This section describes some of these initial discussions and gives a sense of where the agencies currently are in their engagement with the topic.

a. Background on CSA

For the purposes of CSA in the context of financial risk, analysts need to bridge a divide between geophysical and socioeconomic models for future climate change paths and outcomes and convert them into outcomes of financial and economic interest. Analysts can take the outputs of climate models—for example, future projected emissions and associated physical damages, or carbon pricing under transition pathways consistent with specific temperature outcomes—and use them as inputs for economic and

financial models, such as credit loss models, or undertake other statistical methods to explore implications for individual banks, insurers, and other financial institutions. Some scenario analyses explore longer-run outcomes, such as how sea level rise might affect coastal property values over the life of a mortgage. Other analyses focus on shorter-run outcomes, such as the immediate economic and financial effects of a change in climate policy.

CSA is distinct and separate from stress tests, which are generally designed to assess financial institutions' resilience to specific shocks in the short run and generally inform supervisory and regulatory assessments for financial institutions, including regulatory capital requirements for banks. Scenario analysis, in this context, is typically more exploratory in nature and can help both firms and regulators understand the resilience of the largest financial institutions to a range of uncertain climate outcomes.

CSA has its limitations. The climate, economic, financial, and technological systems represented in climate scenario development and analysis are highly complex and can evolve rapidly. In addition, climate-related financial risks may differ from traditional financial shocks, such as those associated with macroeconomic and credit cycles, around which current credit loss models are calibrated. For example, climate shocks may be more persistent than business cycle shocks, and they may flow through sectoral channels or regional impacts rather than through macroeconomic variables. Accordingly, CSA is best considered as one useful analytical tool to better understand the range of potential impacts.

Scenario analysis has been deployed usefully by regulators in other countries and within the private sector; however, it will be important for Council members and the private sector to develop a range of tools as they assess climate-related financial risks and financial stability.

b. Agency Efforts on Scenario Analysis

Council member agencies are in various stages of development of work with regard to advancing scenario analysis, ranging from conducting foundational research to engaging or coordinating with their domestic and international counterparts. Some examples are highlighted in this subsection.

In 2021 and 2022, OCC⁴², FDIC⁴³, and the Federal Reserve⁴⁴ each issued for public feedback or comment draft principles for climate-related financial risk management for certain large financial institutions (or banks) (see **Box C** for more details). These principles note how CSA offers a useful forward-looking perspective and can help identify data and methodological limitations and uncertainty in climate-related financial risk management practices.

Federal Reserve: In January 2023, the Federal Reserve launched a pilot CSA exercise with six large bank holding companies.⁴⁵ The Federal Reserve is conducting this exercise to learn about large banking organizations' climate risk-management practices and challenges and to enhance the ability of both large banking organizations and supervisors to identify, measure, monitor, and manage climate-related financial risks (See **Box B** for additional details). This pilot CSA exercise will support the Federal Reserve's responsibility to ensure that supervised institutions are appropriately managing all material risks, including financial risks related to climate change.

OCC: OCC is conducting exploratory reviews of banks under OCC supervision with over \$100 billion in total consolidated assets. The objective of these reviews is to develop a baseline understanding of the banks' management of climate-related financial risks, including their current use of and future plans for scenario analysis as a tool to identify and measure climate risk, model risk management, data capabilities and related challenges in obtaining data, and data limitations.

FDIC: The FDIC has identified CSA as an emerging and important approach for identifying, measuring, and managing climate-related financial risk. As the FDIC expands its efforts to address climate-related financial risk, it will continue to engage with domestic and international counterparts, as well as other stakeholders, to further understanding of how CSA can be used as part of an effective climate-related financial risk management framework.

CFTC: Risk surveillance staff within CFTC's Division of Clearing and Risk (DCR) use a broad set of stress-testing scenarios to ensure that registered entities are prepared to meet their financial obligations during periods of elevated market risk. DCR is exploring the inclusion of historical and hypothetical climate events—such as hurricanes, extreme temperatures, and floods—that are relevant to derivatives markets and could directly affect the supply of and demand for energy, agricultural, and environmental commodities. As part of their work to broaden scenarios included in stress-testing analysis, DCR risk surveillance staff intend to monitor the growth of derivatives markets that may be affected by physical or transition risk over time and identify areas where additional or adjusted scenarios may be needed.

FHFA: FHFA is working with its regulated entities to ensure they are on a path to have the capacity to run several climate-related scenarios. The objective of running these scenarios is to understand how they may affect the safety and soundness and mission achievement of FHFA's regulated entities. Owing to the difficulties and uncertainties involved in this work, FHFA expects this project to span several years. FHFA also expects the types of scenarios and the interpretation of the results to evolve as FHFA and its regulated entities gain additional knowledge of the data, assumptions, and methodologies needed to conduct the analysis and evaluate the results of different scenarios.

NAIC: In 2022, the NAIC developed a revised climate risk disclosure survey aligned with the Financial Stability Board's Task Force on Climate-related Financial Disclosures. The new survey requires annual reporting from at least 85% of the U.S. insurance market and includes questions regarding insurers' use of scenario analysis to assess and manage their underwriting and investment risk. Review of the public disclosures provides insight into the processes insurers use to conduct scenario analysis, including the tools insurers use the most. To support state insurance regulators' efforts to understand more fully the processes insurers employ to assess and manage their climate-related risks, the NAIC established a Catastrophe Modeling Center of Excellence. Climate-conditioned models allow insurers to produce loss estimates based on scenarios, aligned with various representative concentration pathways (RCPs). The NAIC collects modeled loss detail within the Risk-based Capital framework, providing quantitative data on the physical risk exposure of insurers under various natural-hazard event scenarios. In addition to the bottom-up approach of collecting information from insurers, the NAIC's Solvency Workstream of the Climate and Resiliency Task Force is exploring methods of climate scenario analysis employed internationally and is considering the need for a coordinated approach among state insurance regulators.

Council members will continue to exchange views and coordinate, as appropriate, as this work develops.

Box B: Federal Reserve Pilot CSA Exercise

As noted above, the Federal Reserve launched a pilot CSA exercise with six large bank holding companies in January 2023.

The Federal Reserve designed the pilot CSA exercise to gather qualitative and quantitative information about the climate risk-management practices of large banking organizations. Over the course of the exercise, the Federal Reserve is engaging with participants to understand their approaches and challenges with respect to the financial risks of climate change. Information collected and discussed with participants will include detailed documentation

of governance and risk-management practices, measurement methodologies, data challenges and limitations, estimates of the potential impact on specific portfolios, and lessons learned from this exercise.

The pilot CSA exercise comprises two separate and independent modules: a physical risk module and a transition risk module. For both modules, the Federal Reserve described forward-looking scenarios to participating large banking organizations, including core climate, economic, and financial variables, where appropriate. In selecting scenarios for this exercise, the Federal Reserve leveraged work by the Intergovernmental Panel on Climate Change (IPCC) and the NGFS. The IPCC provides projections of how the climate and related hazards may change under different trajectories of greenhouse gas concentrations. NGFS provides modeling projections of how economic and financial variables may evolve under different scenarios of climatic disruption and transition to a low-carbon future. As previously noted, these climate scenarios are neither forecasts nor policy prescriptions, but they include a range of plausible future outcomes that can help build understanding of how certain climate-related financial risks could manifest for large banking organizations and how these risks may differ from those of the past.

Participants will estimate the effects of these scenarios on a relevant subset of their loan portfolios over a future time horizon. For each loan, participants will calculate and report to the Federal Reserve credit risk parameters, such as probability of default (PD), internal risk rating grade (RRG), and loss given default (LGD), as appropriate. Participants will respond to qualitative questions describing their governance, risk-management practices, measurement methodologies, results for specific portfolios, and lessons learned. Focusing on changes to risk metrics like PD, RRG, and LGD, rather than on estimates of losses, will provide information about how the relative riskiness of exposures within participants' credit portfolios may evolve over time in response to different climate scenarios. Loss estimates would involve additional assumptions around the evolution of participants' balance sheets and business models and would be incomplete given the partial nature of the exercise, which focuses on specific regions and certain portfolios for six participants.

The six U.S. bank holding companies (BHCs) that are participating in this pilot exercise are Bank of America Corporation; Citigroup Inc.; Goldman Sachs Group, Inc.; JPMorgan Chase & Co.; Morgan Stanley; and Wells Fargo & Company. These six banking organizations will submit completed data templates, supporting documentation, and responses to qualitative questions to the Federal Reserve by July 31, 2023.

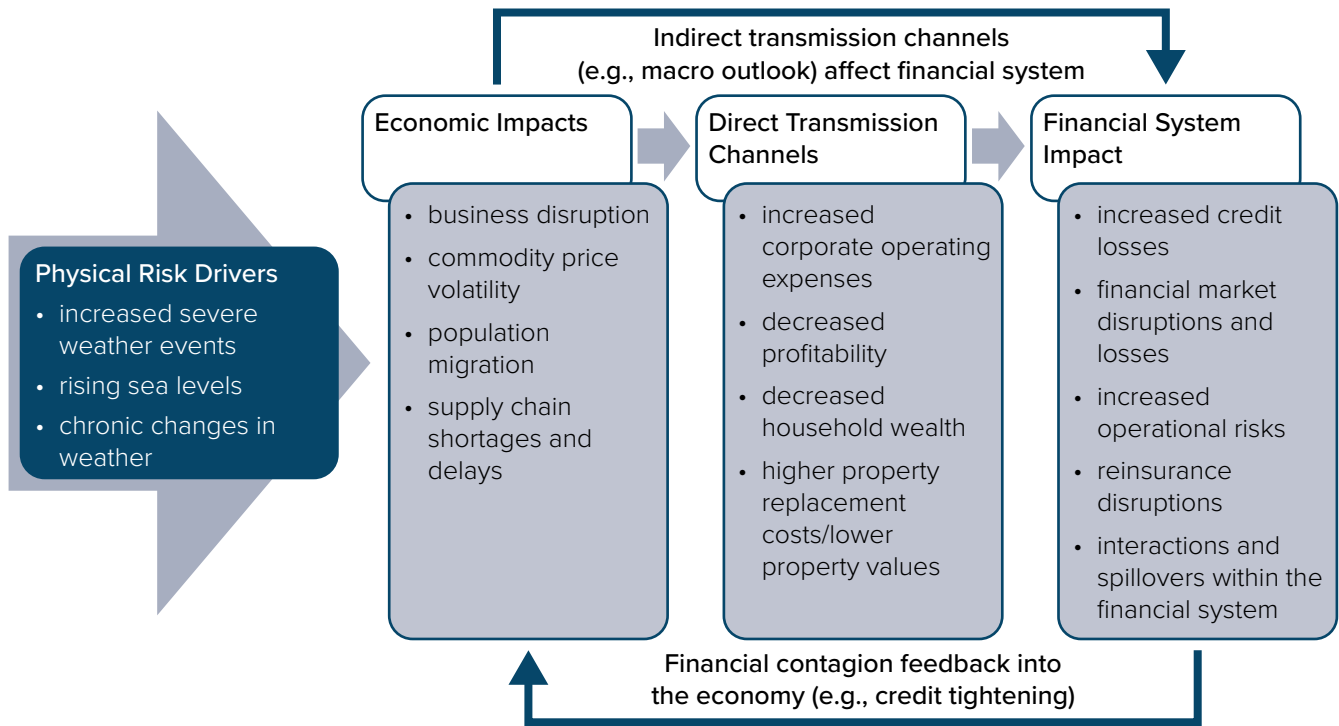
The Federal Reserve anticipates publishing the insights gained from this pilot exercise around the end of 2023. The Federal Reserve expects to disclose aggregated information about how large banking organizations are incorporating climate-related financial risks into their existing risk-management frameworks. Consistent with the objectives and design of the pilot exercise, the Federal Reserve does not plan to disclose quantitative estimates of potential losses resulting from the scenarios included in the pilot exercise. No firm-specific information will be released.

4.B. Risk Assessment

Consistent with Recommendations 2.5 and 4.1 of the Climate Report, the Risk Assessment Working Group (RAWG) is developing a risk framework to identify and assess climate-related financial risk and is using the framework to iteratively identify a preliminary set of risk indicators. The proposed risk framework starts with physical and transition risk drivers,⁴⁶ assesses how these risk drivers translate into economic impacts, and identifies the transmission channels from these economic impacts to the financial system⁴⁷ (see **Figure 2** for a visualization of the framework for physical risk and **Figure 3** for a visualization of the framework for transition risk).

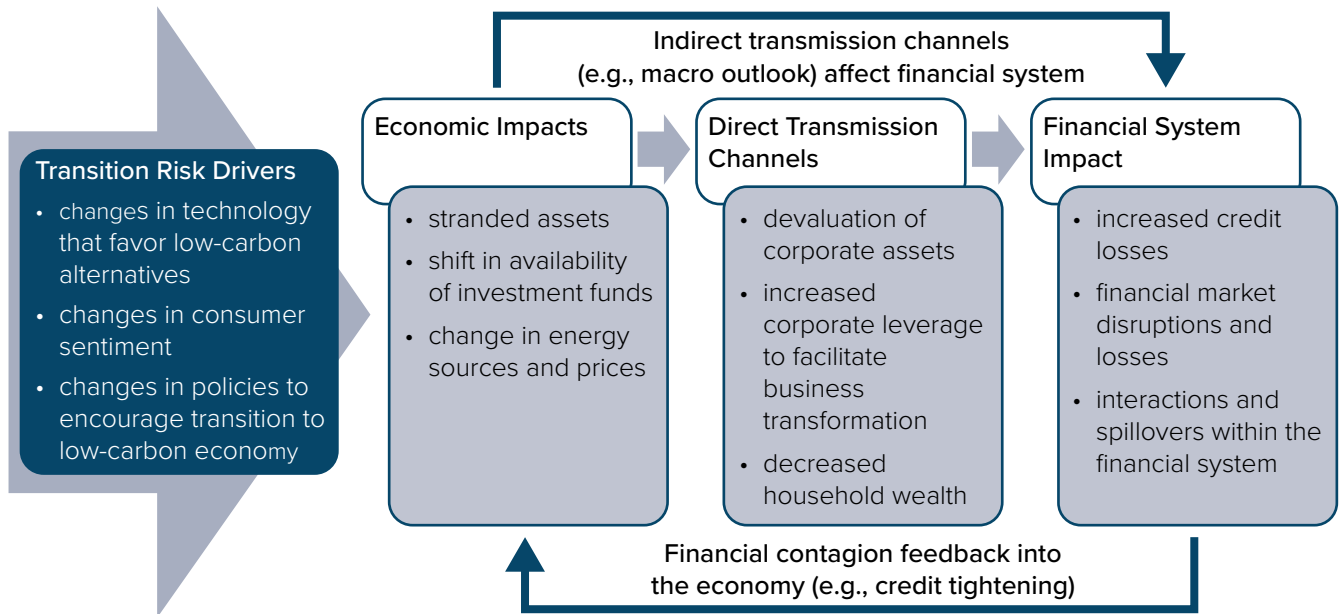
This proposed framework builds on previous work on climate-related financial risk, notably the framework used in the Climate Report, the work of the NGFS,⁴⁸ and the framework previously proposed by the Bank for International Settlements (BIS).⁴⁹ The proposed framework is also in line with more general financial-stability monitoring frameworks that look at underlying shocks to the system, identified financial system vulnerabilities, and propagation mechanisms.⁵⁰

Figure 2: Examples of Transmission of Physical Climate Risk Drivers to Financial Risks



Source: Council visualization, based on NGFS⁵¹

Figure 3: Examples of Transmission of Transition Climate Risk Drivers to Financial Risks



Source: Council visualization, based on NGFS⁵²

The ultimate aim of this proposed framework is to provide a tool for identifying vulnerabilities in the financial system through assessment of the financial system impact of these physical and transition risk drivers. There are various approaches to sizing the potential impacts, including the development of risk indicators, which are frequently used in systemic risk assessment.⁵³ The RAWG's development of risk indicators is an iterative process that will continue to evolve as the available research and data mature and deepen the staff's understanding of climate-related financial risks. The RAWG and the SAWG have areas of shared interest in quantifying forward-looking climate impacts (for example, the use of scenario analysis to quantify potential future losses), and as such, the work of the two groups is complementary.

a. Risk Indicators

To advance its goal of developing risk indicators as part of an overall risk assessment framework, the RAWG formed three workstreams: banking, insurance, and financial markets. Each of these workstreams focuses on a specific sector of the financial system, but all three work closely together because the interplay among banking, insurance, and financial markets may amplify climate-related risks.

i. Banking

The RAWG banking workstream was formed to identify potential risk indicators for regulated banking institutions, including banks, bank holding companies, thrifts, and credit unions. Climate-related risk drivers—including physical and transition risks—can manifest as and amplify traditional risks, including credit, liquidity, market, strategic, reputation, legal, compliance, operational, and other risks. For example, physical risks may be correlated across assets on a banking institution's balance sheet, which can result in unidentified concentrations of risks in loans or deposits. Transition risk may result in increased credit or market risk if new technologies or policies designed to promote a transition to a low-carbon economy reduce a banking institution's ability to rely on existing models to predict loan losses or the timing of repricing events.

Figure 4 provides examples of climate risk drivers that may manifest as or amplify traditional risks. The examples in Figure 4 are not exhaustive. They represent a few of the traditional risk types as well as some possible risk drivers, transmission channels, potential effects on the financial system, and indicators that could be used for monitoring.

Figure 4: Examples of Possible Banking Climate Risk Indicators

Category of Risk	Risk Driver → Transmission Channel → Impacts on Banks	Example of Possible Banking Indicators
Credit	Physical: Increased acute severe weather events → Damages to real estate → Increasing loan defaults	Total loan balances of mortgages held by banks that are exposed to acute physical risk ⁵⁴
	Transition: Policies requiring energy efficiency retrofits to existing buildings → Decline in real estate values for less energy-efficient properties → Higher default rates	Total loan balances of mortgages held by a bank with low energy efficiency ratings, in jurisdictions with mandated energy efficiency policies
Market	Physical: Increased incidence of severe weather → Repricing of assets highly exposed to severe weather → Balance sheet losses	Estimated value-at-risk of trading book assets exposed to physical risk
	Transition: Sudden shift in market expectations around future of technology, policy, or consumer preferences → Repricing of assets dependent on carbon-intensive energy production or other emissions-intensive technologies	Estimated value-at-risk of assets on trading book exposed to transition risk
Operational	Physical: Increased frequency and severity of severe weather → Disruptions of data centers → Increased costs for financial firms with locations exposed to physical risk	Exposure (%) of financial firms' physical locations in areas of high physical risk
	Transition: Introduction of regulatory regimes with differing transition requirements → Increasing complexity of locating operations and serving customers across multiple jurisdictions → Higher operating costs	Number of differing legal jurisdictions a financial firm is operating in

Given the RAWG’s objectives, the workstream has not limited potential climate-related financial risk indicators to those that can be measured with currently available data but continues to contemplate future iterations contingent on closing data gaps, conducting complex modeling, or other changes in available information.

As recommended in the Climate Report, the banking workstream is also considering how climate-related financial risk affects low- and moderate-income consumers and other underserved communities.⁵⁵ The banking workstream has incorporated these elements into its risk assessment process and continues to consider metrics that may measure disparate impacts on these communities.

The banking workstream also recognized significant challenges in measuring and monitoring potential risks. Assessing climate-related financial risk requires forward-looking perspectives that incorporate how firms and households are responding to climate change. At present, there are material data and measurement limitations; these include reliance on multiple data sources that require significant analysis to ensure accurate comparisons, incomplete data related to the transmission of climate-related financial risk, and data gaps related to geographical and industry exposures in current financial reporting. A holistic view of banking institutions also includes their relationships with nonbank financial institutions (NBFIs), including nonbank lenders and financial intermediaries. Given data gaps related to NBFI relationships, analysis may understate climate-related risk to the overall financial system. The banking workstream also

noted challenges in measuring sectoral exposure to transition risk and regions that are most vulnerable to physical risk.

ii. Insurance

The RAWG insurance workstream was formed to develop risk indicators for the insurance sector. The insurance sector, including reinsurance,⁵⁶ is unique in that it both faces climate-related financial risk itself and plays a critical role as a manager of climate-related financial risk for other financial institutions, companies, and consumers, including encouraging adaptation measures in response to physical risks. Given their role in mitigating climate-related risks for other actors, insurers and reinsurers are closely interconnected with other financial institutions, including banking institutions, mortgage lenders, and other capital market participants such as asset managers and alternative investment vehicles.

The workstream leveraged a dashboard used by the NAIC in its Macroprudential Risk Assessment system⁵⁷ as it developed its initial views on risk indicators. Figure 5 summarizes some of the initial thinking on these indicators, following a roughly similar framework to that of the banking workstream by laying out how risk drivers can result in impacts on the insurance sector. These risk drivers are broadly organized around the categories of physical risk, transition risk, and impacts on insurance coverage.⁵⁸ The examples below are not exhaustive and represent some possible risk drivers, transmission channels, potential effects on the insurance sector, and indicators that could be used for monitoring.

Figure 5: Examples of Possible Insurance Climate Risk Indicators

Category of Risk	Example Risk Driver → Transmission Channels → Financial System Impact	Example of Possible Climate Risk Indicators
Physical	Increased acute severe weather events → Damages to insured assets → Insurance company losses → Insolvencies	Insured losses; number of insurer insolvencies over time (caused by natural catastrophes)
Transition	A shift in market expectations around future of technology, policy, or consumer preferences → Repricing of assets dependent on carbon-intensive energy production or other emissions-intensive technologies → Losses on asset side of insurers’ balance sheets	Estimated value-at-risk of assets exposed to transition risk
Coverage	Increased frequency and severity of severe weather → Higher insurance premiums → Availability, adequacy of insurance coverage and increased costs for households and businesses	Nonrenewals (ratio of nonrenewals to policies in force) by insurers and/or policyholders

Potential indicators related to physical risk include natural catastrophe frequency and severity, insurer insolvencies, and modeled loss data based on widely used industry catastrophe models. Much of the discussion of transition risk analysis so far has focused on risk that insurers may be exposed to through their investment portfolios and potential metrics for measuring this exposure.

In addition to developing potential risk indicators for the insurance sector, the insurance working group is also looking at the work of FIO, the NAIC, and state insurance regulators to identify and analyze trends in coverage and availability of insurance based on recent, high-level, publicly available information, such as MCAS-market conduct annual statement-ratio of non-renewed to policies in force and information from industry consultants like Swiss Re that contain information on rate increases, economic and insured losses, and other measures, since this can affect households, businesses, and by extension the broader financial system.

In addition to the efforts by the insurance workstream, FIO, the NAIC, and state insurance regulators are considering or engaged in other initiatives to more effectively measure and assess climate-related impacts on the insurance industry. These initiatives include a proposed data collection by FIO,⁵⁹ the NAIC's Catastrophe Modelling Center of Excellence,⁶⁰ and the NAIC's Climate Risk Disclosure Survey (which is required by 15 states and the District of Columbia).⁶¹

iii. Financial Markets

The financial markets group was formed to identify climate-related financial risk indicators that affect the financial system outside of the entities encompassed by the banking and insurance workstreams. This system includes a wide range of NBFIs, including asset owners (such as mutual funds) and financial service providers (such as broker-dealers). Given the potential breadth, the financial markets workstream first had to define the scope of its work, and it decided to focus on stratifying risk according to individual asset classes (such as equities, fixed income, and derivatives) and services (such as payments providers and prime brokers).

The financial markets workstream has preliminarily identified potential risk indicators, even if they cannot currently be measured due to data, methodology, or other limitations, though this work is still in early stages due to the scope of financial entities and instruments covered. The workstream is currently focused on identifying potential risk metrics that can be used across multiple products and services and that can be calculated with currently available data and methodologies.

b. Next Steps for the Development of Risk Indicators

Despite progress, challenges remain, and risk indicators are in early development. Monitoring the potential effects that climate-related financial risk drivers may have on the financial system requires a broad understanding of the transmission channels and risk amplifiers. As agencies seek to build this understanding and incorporate climate-related financial risks into a risk-monitoring framework, they face challenges related to data gaps and fragmentation, inconsistencies in measurement techniques and assumptions, and a paucity of academic research exploring the financial stability implications of climate-related financial risks.

Given these challenges, identifying and monitoring climate-related financial risk indicators will likely be an iterative process that will develop over time with ongoing dialogue between Council member agencies and with external stakeholders.

4.C. Agency Efforts on Assessing and Mitigating Climate-related Financial Risk

In addition to participating in the work underway via CFRC working groups, individual agencies are taking action to assess and mitigate climate-related risks, as appropriate within their respective mandates.

For example, as summarized in **Box C**, OCC, FDIC, and the Federal Reserve have each issued draft principles for the management of climate-related financial risk by large financial institutions. State regulators are also taking action. For example, NYDFS has issued guidance to insurance companies and banks outlining its expectations related to addressing the financial risks from climate change.⁶²

Box C: Principles for Climate-related Financial Risk Management for Large Financial Institutions

In 2021 and 2022, OCC⁶³, FDIC⁶⁴, and the Federal Reserve⁶⁵ each requested feedback or public comment on draft principles for climate-related financial risk management for certain large financial institutions (or banks), with an eye to providing a high-level framework for the safe and sound management of exposures to climate-related financial risks. These principles would address key aspects of how applicable financial institutions with consolidated assets greater than \$100 billion should evaluate and manage climate-related financial risks.

The principles would cover six areas: (1) governance; (2) policies, procedures, and limits; (3) strategic planning; (4) risk management; (5) data, risk measurement, and reporting; and (6) scenario analysis. The draft principles also describe how climate-related financial risks can be addressed in specific prudential risk areas including credit, liquidity, other financial risks, operational, legal and compliance, and other nonfinancial risks.

The draft principles from OCC, FDIC, and the Federal Reserve are substantially similar, and the agencies have indicated their intention to work together to promote consistency in the supervision of large banks through final interagency guidance after carefully reviewing comments received.

5. 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 are gaps in available data, or data may not be in a readily usable format.⁶⁶ Consequently, Council members have identified work on data and methodologies as a priority, and the CFRC has formed two working groups to support this priority: the Data Infrastructure Working Group and the Data Requirements Working Group, consistent with Recommendations 2.1 to 2.5 of the Climate Report.

5.A. Building the Infrastructure for Data Sharing

The Data Infrastructure Working Group (DIWG) has been facilitating the sharing of climate-related data among Council members and coordinating with the OFR on the Joint Analysis Data Environment (JADE).⁶⁷

JADE is a collaborative environment developed by the OFR and designed for use by all Council member agencies (see **Box D** below). Once fully operational, JADE will support comprehensive financial-stability research by providing a platform to access and analyze a broad spectrum of data. Climate-related financial risk is the first use case the Council has identified for JADE. The OFR has onboarded climate data sets prioritized by the CFRC and Council member agencies, and it continues to add climate, financial, and demographic data to JADE based on their research plans.

Box D: Climate Data and Analytics Hub and Joint Analysis Data Environment (JADE)

In July 2022, the OFR announced the launch of its Climate Data and Analytics Hub (Hub), a new pilot platform to help certain financial regulators assess risks to financial stability stemming from climate change. This environment was designed to test the OFR's ability to improve regulators' access to climate and financial data, high-performance computing tools, and analytical and visualization software.

Access to the phase one pilot was limited to the Federal Reserve and FRBNY. The Climate Data and Analytics Hub allowed pilot participants to integrate data from across the federal government—including wildfire, crop condition,

flood, precipitation, and other climate-related data—for a more precise view of the relationship between climate change factors. The Hub was also equipped with statistical and visualization applications to allow deeper insight into climate-related financial risks and vulnerabilities.

Given the success of the pilot, the OFR announced in April 2023 that it is moving forward with the development of an expanded and enhanced version of the platform, which was named the Joint Analysis Data Environment, or JADE. Once fully operational, JADE will support comprehensive financial-stability research by providing a platform to access and analyze a broad spectrum of financial and other relevant data.

Currently, JADE includes the following publicly available data:

- National Flood Insurance Program Policies and Claims (FEMA, Public Version)
- Individual Assistance Data (FEMA)
- National Flood Hazard Layer (FEMA)
- Hazard Mitigation (FEMA)
- Disaster Declaration Summaries (FEMA)
- Climate Prediction Center (NOAA)
- Toxics Release Inventory Program (EPA)
- U.S. Drought Monitor (University of Nebraska-Lincoln)
- Wildfire Risk (USDA)
- Crop Conditions (USDA)
- Modern-Era Retrospective Analysis for Research and Applications, Version 2 (NASA)
- National Risk Index (FEMA)
- Home Mortgage Disclosure Act (CFPB, Public Version)
- Census Boundary Data – TIGER/Line Geodatabases (Census)

The OFR anticipates that the initial version of JADE will be released during the second half of 2023 and made available to users from at least four agencies by the end of the calendar year. The OFR plans to gradually expand JADE's features, give access to other Council regulators, and include additional data.

To assist the OFR in developing the Hub and JADE, the DIWG worked with input from all member agencies to create an inventory of data infrastructure needs, including assessing agency requirements for computing tools, analytical software, visualization software, collaboration tools, and mapping tools. The DIWG also provided input to the OFR on other relevant topics, including metadata management, storage, access, security considerations, degree of resolution, and user configurations. These efforts have facilitated a collaborative plan and roadmap for the OFR's development of JADE.

5.B. Identifying Shared Data Needs

To complement the work of the DIWG, the Data Requirements Working Group (DRWG) focused on identifying shared data needs, gaps, and limitations among Council members. To do so, the DRWG created an inventory of datasets that have been collected or identified as relevant for assessing climate-related financial risks. DRWG then conducted a gap analysis of these datasets and prioritized them by their criticality to assessing climate-related financial risks. This gap analysis and prioritization work informed the OFR's acquisition process for public, nonpublic, and commercial data to be loaded onto JADE. While the entirety of currently loaded datasets is public, these exercises have informed the nonpublic and commercial datasets that the CFRC and its partners have sought to acquire. There is also a series of

nonpublic and commercial holdings in the process of being onboarded. Current datasets residing on JADE are listed in **Box D**.

In many cases, however, data acquisition is impeded by limited data quality or availability. In some cases, data identified by member agencies as key for future analysis of financial stability do not exist at a sufficiently granular level, or there may be limitations in the quality of currently available data. For example, data relating to asset-level insurance coverage for flood and other hazards were highlighted by several agencies as being critical for assessing the aggregate exposure of financial institutions to physical impacts of climate change, but there are gaps in data for insurance coverage at the level of individual assets. Where desired data are not available, have not yet been collected, or have not been consistently aggregated, new or enhanced data collections may improve the efficacy of future climate-related financial risk analyses.

Additionally, in order to conduct analysis, member agencies would require access to both climate and nonclimate data, since the climate-related datasets often need to be combined with financial, socioeconomic, insurance, or regulatory data for monitoring and supervisory purposes. To the extent that the necessary climate-related data already exist (and efforts are underway to improve data availability—see, for example, **Box E**), integrating them with financial data is relatively novel and a lengthy process.

Box E: Enhancing Public Climate-related Disclosures

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 enable investors and market participants 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.

In March 2022, the Securities and Exchange Commission (SEC) proposed rule changes that would require registrants to include certain climate-related disclosures in their registration statements and periodic reports, including information about climate-related risks and their actual or likely material impacts on their business, results of operations, or financial condition; the registrant’s governance of such risks; certain climate-related financial statement metrics; the registrant’s greenhouse gas emissions; and climate-related targets, goals, and transition plans.⁶⁸ Following the publication of the rule for public consultation, the SEC has been reviewing the comments received and working to finalize the rule.

The NAIC aligned its Climate Risk Disclosure Survey with FSB’s Task Force on Climate-related Financial Disclosures (TCFD) last year.⁶⁹ In 2022, over 1,500 insurers submitted either a completed Survey or a TCFD report. The reports are publicly available. The NAIC’s Center for Insurance Policy and Research has partnered with the Society of Actuaries to review insurers’ methods of assessing, monitoring, and managing their climate-related risks and exposure to associated macroeconomic trends.

6. Next Steps: Continuing to Enhance Coordination and Build Capacity on Climate-related Financial Risks

The Council and its member agencies continue to view climate-related financial risks as a key priority and will advance the recommendations from the Climate Report. As an interagency body, the Council plays an important role in assessing financial stability risks that flow across the financial system. In addition to supporting the continued use of the CFRC for interagency engagement and coordination, staff from member agencies have particularly highlighted cross-cutting issues as priority areas—including continuing

coordination on data and the development of key risk indicators for risk assessment. In addition, the intersection of physical risk, real estate, banking, insurance, and household finances is emerging as a shared area of interest and potential future work. As laid out in more detail in the Council's 2022 Annual Report,⁷⁰ climate-related events like wildfires and flooding may result in damage that can reduce the value of real estate, affecting, for example, insurance profitability via higher-than-expected underwriting losses,⁷¹ as well as the cost and availability of insurance coverage for households and businesses,⁷² with potential to spill over to other parts of the financial system and real economy. Given the critical role of real estate in the economy and the financial system, and how it affects the remits of multiple Council member agencies, the intersection of physical risk, real estate, and insurance is emerging as a particular priority for future analysis for the CFRC.

Endnotes

- 1 FSOC. Report on Climate-Related Financial Risk. (October 21, 2021). <https://home.treasury.gov/system/files/261/FSOC-Climate-Report.pdf>.
- 2 As used in this progress report, the terms Council members and members mean either the individual voting and nonvoting members of the Council or the agencies and organizations that these individuals represent, as applicable.
- 3 FSOC. Fact Sheet on FSOC Progress in Addressing Climate-Related Financial Risk. (July 28, 2022). https://home.treasury.gov/system/files/261/FSOC_20220728_Factsheet_Climate-Related_Financial_Risk.pdf.
- 4 OFR. "OFR Advances Data-and-Analytics Platform Following Successful Pilot." (April 6, 2023). <https://www.financialresearch.gov/press-releases/2023/04/06/ofr-advances-data-and-analytics-platform-following-successful-pilot/>.
- 5 FIO. "Treasury's Federal Insurance Office Takes Important Step to Assess Climate-related Financial Risk – Seeks Comment on Proposed Data Call." (October 18, 2022). <https://home.treasury.gov/news/press-releases/jy1030>.
- 6 OCC. Principles for Climate-Related Financial Risk Management for Large Banks. (December 16, 2021). <https://www.occ.gov/news-issuances/bulletins/2021/bulletin-2021-62a.pdf>.
- 7 FDIC. "Request for Comment on Statement of Principles for Climate-Related Financial Risk Management for Large Financial Institutions." (March 30, 2022). <https://www.fdic.gov/news/financial-institution-letters/2022/fil22013.html>.
- 8 Federal Reserve. Principles for Climate-Related Financial Risk Management for Large Financial Institutions. (December 2, 2022). <https://www.federalreserve.gov/newsevents/pressreleases/files/other20221202b1.pdf>.
- 9 FIO. "Treasury's Federal Insurance Office Releases Report Assessing Climate-Related Risk, Gaps in Insurance Supervision." (July 28, 2023). <https://home.treasury.gov/news/press-releases/jy1579>.
- 10 Federal Reserve. "Pilot Climate Scenario Analysis (CSA) Exercise: Participant Instructions." (January 2023). <https://www.federalreserve.gov/publications/climate-scenario-analysis-exercise-instructions.htm>.
- 11 FSOC. FSOC 2022 Annual Report. (Dec 21, 2022); pp. 75-77. <https://home.treasury.gov/system/files/261/FSOC2022AnnualReport.pdf>.
- 12 Last year, the property and casualty insurance market in the United States experienced a net underwriting loss of \$27 billion, the largest since 2011, due in part to the increasing incidence of extreme weather, among other factors, including inflation. See Insurance Journal. "Near \$27B Underwriting Loss in 2022 Largest for U.S. P/C Insurers Since 2011." (March 30, 2023). <https://www.insurancejournal.com/news/national/2023/03/30/714476.htm>.
- 13 See, e.g., Kamin, Debra. "Home Insurance Premiums Rise as Americans Flock to Weather-Worn States." (May 5, 2023). New York Times. <https://www.nytimes.com/2023/05/05/realestate/home-insurance-climate-change.html>; Eaglesham, Jean. "Home Insurers Including AIG Curb New Policies in Risky Areas Nationally." (June 8, 2023). Wall Street Journal. https://www.wsj.com/articles/home-insurers-curb-new-policies-in-risky-areas-nationally-c93abac0?mod=markets_featst_pos1; Asher-Schapiro, Avi. "CORRECTED-FEATURE-Home insurance coverage falters as California wildfires worsen." (May 17, 2023). Reuters. <https://www.reuters.com/article/climate-change-insurance-california/corrected-feature-home-insurance-coverage-falters-as-california-wildfires-worsen-idUSL8N36V0A4>.
- 14 FSOC. Financial Stability Oversight Council Identifies Climate Change as an Emerging and Increasing Threat to Financial Stability. (October 21, 2021). <https://home.treasury.gov/news/press-releases/jy0426>.
- 15 For the full list of recommendations, see FSOC. Report on Climate-Related Financial Risk. (October 21, 2021): pp. 5-9. <https://home.treasury.gov/system/files/261/FSOC-Climate-Report.pdf>.
- 16 FSOC. "Financial Stability Oversight Council Establishes New Climate-related Financial Risk Advisory Committee." (October 3, 2022). <https://home.treasury.gov/news/press-releases/jy0987>.
- 17 For more information on the NGFS, see NGFS. "Network for Greening the Financial System." <https://www.ngfs.net/en>.
- 18 For more information on the FSB, see FSB. "Financial Stability Board." <https://www.fsb.org/>.
- 19 For more information on the BCBS, see BSCBS. "The Basel Committee – overview." <https://www.bis.org/bcbs/>.
- 20 For more information on the IAIS, see IAIS. "International Association of Insurance Supervisors." <https://www.iaisweb.org/activities-topics/climate-risk/>.
- 21 Note that research and publications by staff do not represent official positions of their respective agencies.
- 22 FRBNY. U.S. Banks' Exposures to Climate Transition Risks. (April, 2023). <https://www.newyorkfed.org/medialibrary/media/re>

[search/staff_reports/sr1058.pdf?sc_lang=en.](#)

23 FRBNY. “CRISK: Measuring the Climate Risk Exposure of the Financial System.” (April 20, 2023). <https://libertystreeteconomics.newyorkfed.org/2023/04/crisk-measuring-the-climate-risk-exposure-of-the-financial-system/>.

24 NCUA. “Webinar on Climate-Related Preparedness.” (September 15, 2022). <https://ncua.gov/news/events/2022/register-now-webinar-climate-related-preparedness>.

25 NCUA. “NCUA Research Examines Credit Union Exposure to Climate-Related Physical Risks.” (April 19, 2023). <https://ncua.gov/newsroom/press-release/2023/ncua-research-examines-credit-union-exposure-climate-related-physical-risks#:~:text=The%20NCUA%27s%20research%20showed%3A,at%20the%20end%20of%202021>.

26 FIO. “Treasury’s Federal Insurance Office Releases Report Assessing Climate-Related Risk, Gaps in Insurance Supervision.” (June 27, 2023). <https://home.treasury.gov/news/press-releases/jy1579>.

27 NAIC Climate and Resiliency Taskforce. “Climate and Resiliency (EX) Task Force.” https://content.naic.org/cmte_ex_climate_resiliency_tf.htm.

28 NAIC and CIPR. Extreme Weather and Property Insurance: Consumer Views. (July, 2021). https://content.naic.org/sites/default/files/CIPR%20Consumer%20property%20ins%20report%208-21_0.pdf.

29 NYSDFS. New York Domestic Insurers’ Management of the Financial Risks from Climate Change. (July, 2021). https://www.dfs.ny.gov/system/files/documents/2021/09/naic-survey-analysis-report-2021_final_0.pdf.

30 FRBNY. Climate Regulatory Risks and Corporate Bonds. (April 2022). https://www.newyorkfed.org/research/staff_reports/sr1014.html.

31 CFTC. Request for Information on Climate-Related Financial Risk. (June 8, 2022). <https://www.cftc.gov/sites/default/files/2022/06/2022-12302a.pdf>.

32 FRBNY. Unintended Consequences of “Mandatory” Flood Insurance. (April 2022). https://www.newyorkfed.org/research/staff_reports/sr1012.html.

33 FRBNY. “Moving Out of a Flood Zone? That May Be Risky!” (April 2022). <https://libertystreeteconomics.newyorkfed.org/2023/04/moving-out-of-a-flood-zone-that-may-be-risky/>.

34 See CFPB. “Climate risk should be considered in housing decisions.” (April 8, 2022). <https://www.consumerfinance.gov/about-us/blog/homebuyers-homeowners-renters-should-consider-climate-risks-in-decisions-about-future/>.

35 See FHFA. Synopsis of Climate and Natural Disaster Risk Management RFI Responses. (2022) https://www.fhfa.gov/Media/PublicAffairs/Documents/2022_RFI-Summary.pdf.

36 See OFR. Annual Report 2022. (January 12, 2023): pp. 99-102. <https://www.financialresearch.gov/annual-reports/files/OFR-Annual-Report-2022.pdf>.

37 FRBNY. Climate Stress Testing. (April 2023). https://www.newyorkfed.org/research/staff_reports/sr1059.

38 OFR. “Climate Implications for Financial Stability Conference.” (September 9, 2022). <https://www.financialresearch.gov/conferences/2022/09/09/climate-implications-for-financial-stability-conference/>.

39 See OCC. “OCC Solicits Academic Papers, Research on Climate Risk in Banking and Finance.” (December 3, 2021). <https://www.occ.treas.gov/news-issuances/news-releases/2021/nr-occ-2021-126.html>.

40 See FHFA. FHFA Econ Summit Agenda. (November 1, 2022). <https://www.fhfa.gov/Media/Documents/FHFA-Econ-Summit-Agenda-Fall-2022.pdf>.

41 See section 3 above for additional information on FSOC member agencies’ capacity-building efforts and international engagement on climate-related financial risk.

42 See OCC. OCC Principles for Climate-Related Financial Risk Management. (December 16, 2021). <https://www.occ.gov/news-issuances/bulletins/2021/bulletin-2021-62.html>.

43 See FDIC. Request for Comment on Statement of Principles for Climate-Related Financial Risk Management. (March 30, 2022). <https://www.fdic.gov/news/financial-institution-letters/2022/fil22013.html>.

44 See Federal Reserve. Principles for Climate-Related Financial Risk Management for Large Financial Institutions. (December 8, 2022). <https://www.federalregister.gov/documents/2022/12/08/2022-26648/principles-for-climate-related-financial-risk-management-for-large-financial-institutions>.

45 Federal Reserve. “Pilot Climate Scenario Analysis (CSA) Exercise: Participant Instructions.” (January 2023). <https://www.federal->

[reserve.gov/publications/climate-scenario-analysis-exercise-instructions.htm](https://www.federalreserve.gov/publications/climate-scenario-analysis-exercise-instructions.htm).

46 As defined by BIS, risk drivers are climate-related changes that could lead to financial risks. BIS. Climate-related risk drivers and their transmission channels. (April 2021). <https://www.bis.org/bcbs/publ/d517.pdf>.

47 As defined by BIS, transmission channels are “causal chains that explain how climate risk drivers impact banks directly and indirectly through their counterparties, assets, and the economy in which they operate.” See endnote 46.

48 NGFS. First comprehensive report: A call for action Climate change as a source of financial risk. (April 17, 2019). https://www.ngfs.net/sites/default/files/medias/documents/ngfs_first_comprehensive_report_-_17042019_0.pdf.

49 BIS. “Climate-related risk drivers and their transmission channels.” (April 2021). <https://www.bis.org/bcbs/publ/d517.pdf>.

50 See, e.g., Financial Stability Board. FSB Financial Stability Surveillance Framework. (April 2021). <https://www.fsb.org/wp-content/uploads/P300921.pdf>.

51 See NGFS. First comprehensive report: A call for action Climate change as a source of financial risk. (April 17, 2019); p. 14. https://www.ngfs.net/sites/default/files/medias/documents/ngfs_first_comprehensive_report_-_17042019_0.pdf.

52 See NGFS. First comprehensive report: A call for action Climate change as a source of financial risk. (April 17, 2019). https://www.ngfs.net/sites/default/files/medias/documents/ngfs_first_comprehensive_report_-_17042019_0.pdf.

53 See, e.g., OFR. “Financial System Vulnerabilities Monitor.” <https://www.financialresearch.gov/financial-vulnerabilities/#/>. Another commonly used approach is scenario analysis, as discussed in Section 4.A.

54 As noted below, there is a general challenge in defining exposure to physical and transition risks, which requires forward-looking assumptions about future policy pathways, expected climate impacts under different emissions scenarios, and mitigating measures taken by households.

55 The Financial Literacy and Education Commission is also assessing the impact of climate change on households and communities: Financial Literacy and Education Commission. “Treasury Launches Effort to Study Impact of Climate Change on Households and Communities.” (October 13, 2021). <https://home.treasury.gov/news/press-releases/jy0404>.

56 When an insurer arranges to transfer all or part of a risk to another insurer to provide protection against the risk of the first insurance.

57 For more on this NAIC system, see NAIC. NAIC Macroprudential Risk Assessment. https://content.naic.org/sites/default/files/inline-files/Macroprudential%20Risk%20Assessment_0.pdf.

58 This is in line, for example, with the IAIS approach, which looks at physical and transition risks as broad categories that affect market and underwriting risk. See IAIS and SIF. Issues Paper on Climate Change Risks to the Insurance Sector. (July, 2018). https://www.insurancejournal.com/research/app/uploads/2018/08/IAIS_and_SIF_Issues_Paper_on_Climate_Change_Risks_to_the_Insurance_Sector_-1.pdf.

59 FIO. “Agency Information Collection Activities; Proposed Collection; Comment Request; Federal Insurance Office Climate-Related Financial Risk Data Collection.” (October 21, 2022). <https://www.federalregister.gov/documents/2022/10/21/2022-22880/agency-information-collection-activities-proposed-collection-comment-request-federal-insurance>. In October 2022, FIO published a Federal Register Notice (FRN) with a request for comments on a proposed nationwide data collection from certain property & casualty (P&C) insurers regarding their current and historical underwriting data on homeowners’ insurance that will assist FIO’s assessment of climate-related exposures and their effects on insurance availability for policyholders. See also endnote 5. The comment period closed in December 2022.

60 See NAIC. Catastrophe Modeling Center of Excellence. <https://content.naic.org/research/catastrophe-modeling-center-of-excellence>. The Catastrophe Modeling Center of Excellence provides state insurance regulators with technical training and expertise regarding catastrophe models and information regarding their use within the insurance industry; it also conducts research utilizing outputs from catastrophe models to assess the risk of loss from natural hazards.

61 Illinois Department of Insurance (IDOI). “IDOI Calls on Insurers to Disclose Climate-Related Risks.” (October 13, 2022). <https://doi.illinois.gov/news/press-release.25558.html>. The jurisdictions requiring the survey in 2023 for the 2022 reporting year are California, Connecticut, Delaware, the District of Columbia, Illinois, Maine, Maryland, Massachusetts, Minnesota, New Mexico, New York, Oregon, Pennsylvania, Rhode Island, Vermont, and Washington. Insurers doing business in those jurisdictions and that annually write \$100 million or more in direct premiums nationwide must complete the survey by August 30, 2023.

62 The information is available on the agency’s website: NYSDFS. Climate Change. https://www.dfs.ny.gov/industry_guidance/climate_change.

63 See OCC. OCC Principles for Climate-Related Financial Risk Management. (December 16, 2021). <https://www.occ.gov/news->

[issuances/bulletins/2021/bulletin-2021-62.html](https://www.fdic.gov/news/bulletins/2021/bulletin-2021-62.html).

64 See FDIC. Request for Comment on Statement of Principles for Climate-Related Financial Risk Management. (March 30, 2022). <https://www.fdic.gov/news/financial-institution-letters/2022/fil22013.html>.

65 See Federal Reserve. Principles for Climate-Related Financial Risk Management for Large Financial Institutions. (December 8, 2022). <https://www.federalregister.gov/documents/2022/12/08/2022-26648/principles-for-climate-related-financial-risk-management-for-large-financial-institutions>.

66 See FSOC. Financial Stability Oversight Council Identifies Climate Change as an Emerging and Increasing Threat to Financial Stability. (October 21, 2021): Ch. 3. <https://home.treasury.gov/system/files/261/FSOC-Climate-Report.pdf>.

67 See OFR. “OFR Advances Data-and-Analytics Platform Following Successful Pilot.” (2023). <https://www.financialresearch.gov/press-releases/2023/04/06/ofr-advances-data-and-analytics-platform-following-successful-pilot/>.

68 For additional detail, see SEC. Fact Sheet: Enhancement and Standardization of Climate-Related Disclosure. (March 21, 2022). <https://www.sec.gov/files/33-11042-fact-sheet.pdf>.

69 See NAIC. “NAIC Climate Risk Disclosure Survey.” (2023). <https://www.insurance.ca.gov/0250-insurers/0300-insurers/0100-applications/ClimateSurvey/>.

70 See FSOC. FSOC 2022 Annual Report. (2022): pp. 75-77.

71 Insurance Journal. “Home Insurance Premiums Rise as Americans Flock to Weather-Worn States.” (May 5, 2023). <https://www.insurancejournal.com/news/national/2023/03/30/714476.htm#:~:text=The%20U.S.%20P%2FC%20industry,according%20to%20the%20rating%20agency>. Last year, the property and casualty insurance market in the United States experienced a net underwriting loss of \$27 billion, the largest since 2011, due in part to the increasing incidence of extreme weather, among other factors including inflation.

72 See for example: Kamin, Debra. “Home Insurance Premiums Rise as Americans Flock to Weather-Worn States.” (May 5, 2023). New York Times. <https://www.nytimes.com/2023/05/05/realestate/home-insurance-climate-change.html>; Eaglesham, Jean. “Home Insurers Including AIG Curb New Policies in Risky Areas Nationally.” (June 8, 2023). https://www.wsj.com/articles/home-insurers-curb-new-policies-in-risky-areas-nationally-c93abac0?mod=markets_featst_pos1; and Asher-Schapiro, Avi and David Sherfinski. “CORRECTED-FEATURE-Home insurance coverage falters as California wildfires worsen.” (May 17, 2023). <https://www.reuters.com/article/climate-change-insurance-california/corrected-feature-home-insurance-coverage-falters-as-california-wildfires-worsen-idUSL8N36V0A4>.