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Financial Stability Implications of Climate Change

Remarks by

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I want to thank Ceres for inviting me to join this discussion. Let me start by noting that these are my own views and do not necessarily reflect those of the Federal Reserve Board or the Federal Open Market Committee.¹

Climate change is already imposing substantial economic costs and is projected to have a profound effect on the economy at home and abroad.² Future financial and economic effects will depend on the severity of the physical effects of climate change and the nature and speed of the transition to a sustainable economy.³ Financial market participants that do not put in place frameworks to assess and address climate-related risks could face significant losses on climate-sensitive assets caused by environmental shifts, by a disorderly transition, or both. Conversely, robust risk management; scenario analysis; consistent, comparable disclosures; and forward plans can help ensure the financial system is resilient to climate-related risks and well positioned to support the transition to a sustainable economy.⁴

¹ I am grateful to Elizabeth Kiser of the Federal Reserve for her assistance in preparing this text.

² See David R. Reidmiller, Christopher W. Avery, David R. Easterling, Kenneth E. Kunkel, Kristin L. M. Lewis, Thomas K. Maycock, and Brooke C. Stewart, eds. (2018), *Fourth National Climate Assessment*, vol. II: *Impacts, Risks, and Adaptation in the United States* (Washington: U.S. Global Change Research Program), <https://dx.doi.org/10.7930/NCA4.2018>.

³ On the effects of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty, see Valérie Masson-Delmotte, Panmao Zhai, Hans-Otto Pörtner, Debra Roberts, Jim Skea, Priyadarshi R. Shukla, Anna Pirani, Wilfran Moufouma-Okia, Clotilde Péan, Roz Pidcock, Sarah Connors, J. B. Robin Matthews, Yang Chen, Xiao Zhou, Melissa I. Gomis, Elisabeth Lonnoy, Tom Maycock, Melinda Tignor, and Tim Waterfield, eds. (2018), *Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C Approved by Governments* (Geneva: Intergovernmental Panel on Climate Change), <https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments>.

⁴ See, for example, Financial Stability Board (2020), *The Implications of Climate Change for Financial Stability*, (Basel: FSB, November 23), <https://www.fsb.org/wp-content/uploads/P231120.pdf>; and Climate-Related Market Risk Subcommittee, Market Risk Advisory Committee, U.S. Commodity Futures Trading Commission (2020), *Managing Climate Risk in the U.S. Financial System* (Washington: CFTC, September 9), <https://www.cftc.gov/sites/default/files/2020-09/9-9-20%20Report%20of%20the%20Subcommittee%20on%20Climate-Related%20Market%20Risk%20-%20Managing%20Climate%20Risk%20in%20the%20U.S.%20Financial%20System%20for%20posting.pdf>.

Macroprudential and Microprudential Approaches

It is increasingly clear that climate change could have important implications for the Federal Reserve in carrying out its responsibilities assigned by the Congress.⁵ Given the implications of climate change for both individual financial institutions and the financial sector as a whole, we need a framework that incorporates both microprudential and macroprudential considerations.

The Federal Reserve created a new Supervision Climate Committee (SCC) to strengthen our capacity to identify and assess financial risks from climate change and to develop an appropriate program to ensure the resilience of our supervised firms to those risks.⁶ The SCC's microprudential work to ensure the safety and soundness of financial institutions constitutes one core pillar of the Federal Reserve's framework for addressing the economic and financial consequences of climate change.⁷

⁵ A recent survey of central banks found a large majority view it as appropriate "to act within their existing mandate to mitigate climate-related financial risks" that "could potentially impact the safety and soundness of individual financial institutions and could pose potential financial stability concerns for the financial system." See Basel Committee on Banking Supervision, Bank for International Settlements (2020), *Climate-Related Financial Risks: A Survey on Current Initiatives* (Basel: BCBS, April), <https://www.bis.org/bcbs/publ/d502.pdf>; see also Nick Robins, Simon Dikau, and Ulrich Volz (2021), *Net-Zero Central Banking: A New Phase in Greening the Financial System*, (London: Grantham Research Institute on Climate Change and the Environment at the London School of Economics and Political Science, March), <https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2021/03/Net-zero-central-banking-1.pdf>. For overviews of climate change and economic damage, see, for example, Maximilian Auffhammer (2018), "Quantifying Economic Damages from Climate Change," *Journal of Economic Perspectives*, vol. 32 (Fall), pp. 33–52; Solomon Hsiang and Robert E. Kopp (2018), "An Economist's Guide to Climate Change Science," *Journal of Economic Perspectives*, vol. 32 (Fall), pp. 3–32, <https://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.32.4.3>; and Solomon Hsiang, Robert Kopp, Amir Jina, James Rising, Michael Delgado, Shashank Mohan, D. J. Rasmussen, Robert Muir-Wood, Paul Wilson, Michael Oppenheimer, Kate Larsen, and Trevor Houser (2017), "Estimating Economic Damage from Climate Change in the United States," *Science*, vol. 356 (June), pp. 1362–69.

⁶ See Federal Reserve Bank of New York (2021), "Kevin Stiroh to Step Down as Head of New York Fed Supervision to Assume New System Leadership Role at Board of Governors on Climate," press release, January 25, <https://www.newyorkfed.org/newsevents/news/aboutthefed/2021/20210125>.

⁷ See Lael Brainard (2021), "The Role of Financial Institutions in Tackling the Challenges of Climate Change," speech delivered at the Institute of International Finance U.S. Climate Finance Summit: Financing a Pro Growth Pro Markets Transition to a Sustainable, Low-Carbon Economy, Washington, February 18, <https://www.federalreserve.gov/newsevents/speech/brainard20210218a.htm>.

Climate change and the transition to a sustainable economy also pose risks to the stability of the broader financial system. So a second core pillar of our framework seeks to address the macrofinancial risks of climate change. To complement the work of the SCC, the Federal Reserve Board is establishing a Financial Stability Climate Committee (FSCC) to identify, assess, and address climate-related risks to financial stability. The FSCC will approach this work from a macroprudential perspective—that is, one that considers the potential for complex interactions across the financial system.

From a microprudential perspective, the Federal Reserve’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, legal, and reputational risks that affect the safety and soundness of individual firms.⁸ From a macroprudential perspective, our *Financial Stability Report* outlines how climate change could increase financial shocks and financial system vulnerabilities that could further amplify shocks.⁹

Microprudential and macroprudential objectives are often aligned. For example, consistent disclosures are important not only to enable individual financial firms to measure and manage their exposure to climate-related financial risks, but also to support financial stability more broadly by helping the market to accurately price that risk. Given

⁸ See Board of Governors of the Federal Reserve System (2020), *Supervision and Regulation Report* (Washington: Board of Governors, November), <https://www.federalreserve.gov/publications/files/202011-supervision-and-regulation-report.pdf>.

⁹ See Board of Governors of the Federal Reserve System (2020), *Financial Stability Report* (Washington: Board of Governors, November), <https://www.federalreserve.gov/publications/files/financial-stability-report-20201109.pdf>.

the importance of consistent, comparable, and reliable disclosures to financial stability and prudential objectives, mandatory disclosures are ultimately likely to be important.¹⁰

There are situations, however, where microprudential and macroprudential goals do not fully align so that it is important to take into account the implications both for individual firms' safety and soundness and also for the broader financial system. For example, the use of climate-related risk mitigants such as insurance or financial derivatives may shift risk away from a particular financial institution but may not reduce or eliminate risk from the system as a whole. In developing a framework to address climate-related financial risks, we need to be mindful of this cascade of effects and the implications across the Federal Reserve's range of responsibilities.

Financial System Shocks and Vulnerabilities Arising from Climate Change

Our macroprudential work program is focused on assessing not only potential climate shocks, but also whether climate change might make the financial system more vulnerable in ways that could amplify these shocks and cause broader knock-on effects that could harm households, businesses, and communities. In some respects, climate change can be seen as similar to other financial stability shocks emanating from outside the financial system, such as COVID-19, which are difficult to predict with precision and can lead to an abrupt reassessment of a broad array of economic and financial outcomes, prices, and incentives. However, climate change shocks differ in a few important ways.

Unlike episodic or transitory shocks, climate change is an ongoing, cumulative process, which is expected to produce a series of shocks. Over time, these shocks can

¹⁰ See Allison Herren Lee (2021), "Public Input Welcomed on Climate Change Disclosures," public statement by the Acting Chair of the U.S. Securities and Exchange Commission, March 15, <https://www.sec.gov/news/public-statement/lee-climate-change-disclosures>.

change the statistical time-series properties of economic variables, making forecasting based on historical experience more difficult and less reliable. The physical properties of the earth’s atmosphere shown by scientific climate records and climatological forecasts include the risk of irreversible climate “tipping points,” which can cause as yet unseen disruptions in weather systems, regional water supplies, and the habitability of large land masses—at large magnitudes. Quantifying the risks and implications of potentially catastrophic climate-related tipping points for the economy and financial system is extremely difficult.

Second, there is substantial uncertainty about the nature and timing of the policy, behavioral, and technological changes that will occur during the transition to a sustainable economy. This uncertainty could create significant challenges for financial stability.

In addition, climate change might be expected to increase financial system vulnerabilities.¹¹ Financial system vulnerabilities could arise if intermediaries engage in financial contracts or take on leverage to shift climate risk in ways that leave the overall system vulnerable to the amplifying effects of shocks. In addition, even well-informed investors could underestimate the likelihood of large shocks related to climate change, resulting in systematic mispricing of risk. This mispricing could occur if the physical effects of climate change arrive sooner or with greater intensity than expected or investors systematically err in their expectations about the transition. Finally,

¹¹ See Celso Brunetti, Benjamin Dennis, Dylan Gates, Diana Hancock, David Ignell, Elizabeth K. Kiser, Gurubala Kotta, Anna Kovner, Richard J. Rosen, and Nicholas K. Tabor (2021), “Climate Change and Financial Stability,” FEDS Notes (Washington: Board of Governors of the Federal Reserve System, March 19), <https://www.federalreserve.gov/econres/notes/feds-notes/climate-change-and-financial-stability-20210319.htm>.

vulnerabilities could result if climate risks in the aggregate are systematically correlated across participants in the economy and financial system. These correlated aggregate exposures could be missed by risk models and difficult or impossible to mitigate fully.

It might be useful to consider some examples of climate-related risks that could manifest as shocks or increase financial system vulnerabilities or both.¹² One example is property and casualty insurance, which enables financial firms to engage in financial contracts to hedge climate-related risks. While reinsurance contracts and agreements among investors can shift risks across the global financial system, as I noted earlier, some level of risk is likely to remain.¹³ A lack of transparency across participants in the financial sector could cause climate-related risks to build up in hidden pockets, embedding vulnerabilities that could result in cascading losses in the event of large-scale adverse weather outcomes or other shocks to asset valuations.

We can already see examples of how such ripple effects might work. As physical risks manifest, insurers update the availability and pricing of coverage to more accurately reflect climate-related risks to real estate, physical facilities, and companies that are subject to these risks through financing arrangements or supply chains. As we have seen in California and in Florida, insurance companies can pull back from insuring properties

¹² See Brunetti and others, “Climate Change and Financial Stability,” in note 11; see also Sonia I. Seneviratne, Neville Nicholls, David Easterling, Claire M. Goodess, Shinjiro Kanae, James Kossin, Yali Luo, Jose Marengo, Kathleen McInnes, Mohammad Rahimi, Markus Reichstein, Asgeir Sorteberg, Carolina Vera, and Xuebin Zhang (2012), “Changes in Climate Extremes and Their Impacts on the Natural Physical Environment” in Matilde Rusticucci and Vladimir Semenov, eds., *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* (Cambridge University Press, Cambridge and New York), pp. 109–230.

¹³ See, for example, Antonio Grimaldi, Kia Javanmardian, Dickon Pinner, Hamid Samandari, and Kurt Strovink (2020), “Climate Change and P&C Insurance: The Threat and Opportunity,” *McKinsey Insights*, November 19, <https://www.mckinsey.com/industries/financial-services/our-insights/climate-change-and-p-and-c-insurance-the-threat-and-opportunity>: “. . . insurers could play a role in matching risk transfer solutions to alternative capital from investors with more risk appetite.”

and facilities in geographic areas subject to heightened flood or fire risk or seek to raise insurance rates on these properties and facilities to more accurately reflect risks.¹⁴

Although such changes may ultimately result in a more accurate assessment of actual risks, the abrupt changes to a wide range of contracts that embed systemic mispricing could initially amplify the shock.

It is also increasingly apparent that the value and, in some cases, the usability of real estate in many areas will be directly affected by the increased risks of floods, wildfires, severe storms, and sea-level rise associated with climate change. The direct effects on homeowners and businesses are geographically concentrated and can have severe effects on safety and the usability of properties. As climate risks grow over time, the mortgages on these properties may become riskier, along with financial instruments involving these mortgages that may embed opaque, concentrated climate-related risks. Sudden realizations of climate-related risks could cause rapid shifts in investor sentiment and shocks to asset prices, including to real estate prices in specific geographic locations.¹⁵

Federal, state, and local authorities are implementing policies to support transparency in climate-related risk associated with real estate to allow property owners, lenders, and investors to make better-informed investment decisions. Updated flood maps, coastal resilience programs, and managed retreat from flood-prone areas can

¹⁴ See, for example, Christopher Flavelle (2019), “As Wildfires Get Worse, Insurers Pull Back from Riskiest Areas,” *New York Times*, August 20; and Matt Sheehan (2020), “RenRe Could Pull Back in Florida if Rates Stay Low, Says CEO,” *Reinsurance News*, February 7.

¹⁵ The Federal Housing Finance Authority recently issued a request for input on natural disaster risk to the housing finance system; see Federal Housing Finance Agency (2021), “FHFA Issues RFI on Climate and Natural Disaster Risk Management at the Regulated Entities,” news release, January 19, <https://www.fhfa.gov/Media/PublicAffairs/Pages/FHFA-Issues-RFI-on-Climate-and-Natural-Disaster-Risk-Management-at-the-Regulated-Entities.aspx>.

reduce the extent of hidden climate risks. While such transparency is vital, financial system vulnerabilities could arise even in transparent markets—for example, through aggregate common exposures to climate risk.

Finally, climate-related physical risks are increasing financial burdens on local, state, and federal finances. Increasing physical damage to localities necessitates higher expenditures to repair damage from extreme weather and fire events and to build resilience to growing climate threats. Pullbacks in insurance coverage, the need to relocate or bolster infrastructure, and increased provision of service in the wake of disasters increase burdens on state, local, and federal finances. These rising burdens could place strains on municipal financing markets over time, particularly in areas of geographically concentrated climate risks, and create some risk of a cascade effect if a shock causes investors to pull back from similar exposures.

New Approaches and New Tools

We are building the requisite institutional capacity and knowledge to deepen our understanding of these risks and vulnerabilities. The new FSCC is a Systemwide committee charged with developing and implementing a program to assess and address climate-related risks to financial stability. The broad goals of the FSCC are to promote the resilience of the financial system to climate-related financial risks, to ensure coordination with the Financial Stability Oversight Council (FSOC) and its member agencies, and to increase the Federal Reserve's international engagement and influence on this issue. The FSCC will work in close coordination with the SCC—as well as with our community development, payments, international coordination, and economic

research and data areas—to build a coordinated approach to integrating climate-related risks where they affect our responsibilities.

To support the work of these committees and the broader work throughout the Federal Reserve System, we are investing in new research, data, and modeling tools. In light of the high uncertainty inherent in estimating climate-related shocks, scenario analysis may be a helpful tool to assess the effects on the financial system under a wide range of assumptions.¹⁶ Climate scenario analysis identifies climate-related physical and transition risk factors facing financial firms, formulates appropriate stresses of those risk factors under different scenarios, and measures their effects on financial intermediaries and the financial system. This analytic approach gives us a structured way of uncovering the parts of the financial system where physical, transition, and other risks may have outsized effects through potential spillovers. It also helps identify the limits of our knowledge.

For scenario analysis, we would anticipate long time horizons, substantial uncertainty, the use of qualitative elements, and reliance on external data and models. To capture the potential for complex interactions across the financial system, such scenario analysis would consider the effects on bank and nonbank financial intermediaries and financial markets broadly. We are informing ourselves about the scenario analysis work under way by policymakers in foreign jurisdictions, such as by the European Central Bank and the Bank of England, as well as the scenarios developed by the Network of Central Banks and Supervisors for Greening the Financial System (NGFS).¹⁷

¹⁶ See Brainard, “The Role of Financial Institutions in Tackling the Challenges of Climate Change,” in note 7.

¹⁷ See Luis de Guindos (2021), “Shining a Light on Climate Risks: The ECB’s Economy-wide Climate Stress Test,” *The ECB Blog*, March 18,

Collaboration across Jurisdictions and Sectors

Climate change is inherently a cross-border and cross-sectoral challenge, and we recognize the benefit of collaborating with other regulatory agencies, central banks, and international standard-setting bodies while taking into account the important differences across jurisdictions. In the United States, close coordination with the FSOC member agencies will be important. We are also working with member agencies of the U.S. Global Change Research Program to learn about scientific data, models, and other information to expand our analysis of the economic and financial effects of weather-related disasters and climate-related risks.¹⁸

We participate actively in the Financial Stability Board's (FSB) work on climate change. The FSB's membership, mandate, and relationship with the Group of Twenty (G-20) and the standard-setting bodies position it well to play a coordinating role in addressing the interdependencies among different workstreams and supporting the G-20—including the G-20 Sustainable Finance Study Group co-chaired by the U.S. Treasury. The FSB has been tasked by the G-20 to play a leadership role on data gaps and to identify recommendations to support the use of comprehensive, comparable, and auditable climate-related disclosure standards. In addition, the Federal Reserve is co-chairing one of the workstreams—the Basel Committee on Banking Supervision's Task Force on Climate-Related Financial Risks (TCFR).

<https://www.ecb.europa.eu/press/blog/date/2021/html/ecb.blog210318~3bbc68ffc5.en.html>; and Network of Central Banks and Supervisors for Greening the Financial System (2020), "NGFS Climate Scenarios for Central Banks and Supervisors" (Paris: NGFS, June), https://www.ngfs.net/sites/default/files/medias/documents/820184_ngfs_scenarios_final_version_v6.pdf.

¹⁸ See Reidmiller and others, *Fourth National Climate Assessment*, vol. II: *Impacts, Risks, and Adaptation in the United States*, in note 2.

We are actively gathering essential knowledge from a wide range of groups, including nongovernmental organizations such as Ceres, private-sector market participants, academic researchers, and others. The Federal Reserve recently became a member of the NGFS, which is sharing research and identifying best practices to improve the financial system's resilience to climate-related risks.

Conclusion

These are not easy problems, and they will not have easy solutions. Despite the challenges, it will be critical to make progress, even if initially imperfect, in order to ensure that the financial system is resilient to climate-related risks and well positioned for the transition to a sustainable economy. We are committed to building our capacity to understand and address the risks, complexities, and challenges related to climate change within the Federal Reserve's responsibilities. In working toward these goals, we will undoubtedly reach better outcomes if we tackle this challenge through open dialogue, information sharing, and transparency.