

# **21ST CENTURY ECONOMY: PROTECTING THE FINANCIAL SYSTEM FROM RISKS ASSOCIATED WITH CLIMATE CHANGE**



S. HRG. 117–214

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**HEARING**  
BEFORE THE  
**COMMITTEE ON**  
**BANKING, HOUSING, AND URBAN AFFAIRS**  
**UNITED STATES SENATE**  
**ONE HUNDRED SEVENTEENTH CONGRESS**

FIRST SESSION

ON

EXAMINING THE RISK CLIMATE CHANGE POSES TO OUR ECONOMY

MARCH 18, 2021

Printed for the use of the Committee on Banking, Housing, and Urban Affairs





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## **21ST CENTURY ECONOMY: PROTECTING THE FINANCIAL SYSTEM FROM RISKS ASSOCI- ATED WITH CLIMATE CHANGE**

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**THURSDAY, MARCH 18, 2021**

U.S. SENATE,  
COMMITTEE ON BANKING, HOUSING, AND URBAN AFFAIRS,  
*Washington, DC.*

The Committee met at 10 a.m., via Webex, Hon. Sherrod Brown,  
Chairman of the Committee, presiding.

### **OPENING STATEMENT OF CHAIRMAN SHERROD BROWN**

Chairman BROWN. The hearing of the Banking, Housing, and  
Urban Affairs Committee will come to order.

This hearing is in the virtual format. For those joining remotely,  
a few reminders.

Once you start speaking, there will be a slight delay before you  
are displayed on the screen. To minimize background noise, please  
click the mute button until it is your turn to speak or to ask ques-  
tions.

You should all have one box on your screens labeled “Clock” that  
will show you how much time is remaining. For all Senators, the  
5-minute clock still applies for your questions. At 30 seconds re-  
maining, you will hear a bell ring to remind you your time has al-  
most expired. It will ring again when your time has expired.

If there is a technology issue, we will move to the next Senator  
until it is resolved. To simplify the speaking order, Senator Toomey  
and I have agreed to go by seniority for this hearing.

Today the Banking and Housing Committee is holding its first-  
ever hearing on the risk climate change poses to our economy.

It makes it the first time our Committee will consider all the eco-  
nomic opportunities that exist by addressing climate change.

More than ever, people in Ohio and Pennsylvania and around the  
country are experiencing how climate change affects their lives—  
from devastating hurricanes to raging wildfires, from harmful algal  
blooms in my beloved Lake Erie, to landslides in Cincinnati, to er-  
atic farming seasons across the Midwest.

People are not stupid. They see what is happening; they know it  
threatens not only their air and their water, but it threatens their  
homes and their livelihoods.

They know also that there are all sorts of opportunities in com-  
munities in every State that come with taking climate change seri-  
ously.

They see the wind turbines across the Great Plains made with steel made in Pennsylvania or Ohio or Illinois. They see people installing solar panels made in Toledo at one of the biggest solar energy manufacturers in the country.

We cannot have a 21st century economy built on a 19th century model. That does not make environmental sense.

It also does not make economic sense.

If we want an economy that creates jobs and improves infrastructure in all our communities and allows our businesses and our workers to compete around the world, then instead of running from these opportunities, we have to seize them.

I want to be clear: It is not the role of this committee to vilify—or for that matter, to prop up—any specific technology or any source of energy. The work of coal miners in eastern Ohio, in Belmont County, has every bit as much dignity as the work of a battery manufacturer in Fremont, Ohio.

We show those workers no respect if we do not plan now for how we are going to protect their communities from flooding and drought and economic upheaval, and how we are going to protect their retirement and their children's college savings from risky investments.

On this Committee, we are charged with looking at anything that could hurt the stability of our economy.

This is a set of issues my Democratic colleagues have talked about for a long time.

And a lot of what we will talk about today got a jump start last year when now-Acting CFTC Chair Rostin Behnam created his Climate-Related Market Risk Subcommittee.

The Subcommittee put out an important report, "Managing Climate Risk in the U.S. Financial System."

Just yesterday he announced he is establishing a Climate Risk Unit in CFTC to focus on the role of derivatives in understanding, pricing, and addressing climate-related risk.

I would like to ask unanimous consent to enter the CFTC subcommittee report, "Managing Climate Risk in the U.S. Financial System", into the record for this hearing. Without objection, it is entered.

Being on the lookout for risk is our job here. We cannot always predict what it might be. It could be the business decisions of a few bad actors in a particular industry. Or we might be forced to act because of events beyond our borders.

In this case, though, we can predict something that is going to hurt the economy. We know—underscore "know"—that climate change threatens the country's financial stability.

And the financial sector and the Government agencies that oversee it are going to have to reckon with the consequences of decades of risky investments in industries that fuel natural disasters and threaten people's paychecks and threaten their retirement security.

For years, the biggest corporations have fought Government action on climate change because CEOs could make a lot of money in the short term by endangering our planet in the long term. And then those corporations and these CEOs expect workers and their families to foot these very expensive bills.

We cannot protect the economy—and the people who make it work—if we do not start by identifying the risks.

We know far too little about how much climate-related risk is sitting on the books of banks and insurance companies.

It is not a surprise that Wall Street is trying to hide just how heavily they have invested in corporate polluters. This lack of transparency about the largest U.S. banks' significant investments in long-term fossil fuel projects here and abroad hides potential financial risks.

These are risks that workers and families investing their pensions and 401(k)s will likely pay the price for.

We need to know where Wall Street is investing people's hard-earned savings. And if it is invested in shrinking industries that threaten their jobs and their communities, we need to know about it.

That means looking at stronger transparency rules. It means looking at whether the tools that financial watchdogs already have can help us shine a light on these risks.

While some large banks and other companies have voluntarily disclosed some of their investments, not enough of them have. They are not moving fast enough.

We needed this years ago.

Look around. Climate-related disasters are already here, already grinding some local economies to a halt, already forcing some out of work, already destroying some communities.

The second polar vortex in a decade to cripple Texas is not far behind us. We are already approaching what some are predicting will be an above-average hurricane. Those are economic risks.

Persistent drought leaves the Mountain West dealing with wildfires that rack up multi-billion-dollar economic losses year after year, in fire seasons that are so constant they have ceased to be seasons. That is an economic risk.

Farmers in the Plains States lost an entire planting season because of wet fields or flooding that once would have been shocking, but now is all too common. That is also an economic risk.

A 3-day downpour flooded 100,000 homes in Houston, forced hundreds of thousands of people out of their homes, ground commerce to a standstill at one of the three busiest ports in the country. With effects like that, it is hard not to think that the only way you could fail to see an economic risk, is if you are being paid not to see one.

It is also not enough to just think about the climate risks to companies' balance sheets or stock prices. The financial industry and our Government have to take into account the risks to people's livelihoods, the communities they live in, the food they eat, the investments they have made for their retirement.

And as we look for opportunities, we need to make sure that American industry—steel and aluminum, paper and autos, and beyond—can access the capital they need to reduce or eliminate emissions.

And when we increase transparency across the financial sector and take into account the clear economic costs of climate change, then lenders and industry and workers will be rewarded by making those capital investments.

Today we will hear from five witnesses who will share their insights and expertise on these risks and the opportunities we have to protect and rebuild our economy. I hope my colleagues, all of us, will keep an open mind about all of this.

Every day we delay is another missed opportunity to invest in new technologies, in new industries, to make our businesses more competitive, to create jobs in communities that have so often been left behind. The Ranking Member and I have many places in our States that feel that way.

If we do not tell people the truth and take this seriously, we know who pays the price. It is never CEOs. It is never the corporate boards. It is never people that work at think tanks. It is never Senators who pay the price.

It is going to be the ranchers in North Dakota and South Dakota, the line cook in New Orleans, the kindergartner with asthma in Las Vegas, the steel worker in Cleveland, the clerk in New Hampshire.

It is their jobs, their savings, and their futures on the line. It is our job to be on their side.

Senator Toomey is recognized for 5 minutes or whatever you need.

#### **OPENING STATEMENT OF SENATOR PATRICK J. TOOMEY**

Senator TOOMEY. Thank you, Mr. Chairman.

The title of today's hearing is "21st Century Economy: Protecting the Financial System from Risks Associated with Climate Change," which begs the question: Who is supposed to protect the financial system from these risks, and how?

In the view of at least some of my Democratic colleagues, the answers seem to be the Fed, the SEC, and other—

Chairman BROWN. Your volume is off. There we go.

Senator TOOMEY. Can you hear me now? Can you hear me, Mr. Chairman? Can you hear me now? I am not on mute, according to my screen.

Senator SMITH. I can hear you, Senator Toomey. This is Senator Smith.

Senator TOOMEY. OK. Thank you, Senator Smith. Cameron, can you hear me?

Mr. RICKER. Yes, sir, I can hear you.

Senator TOOMEY. OK.

Chairman BROWN. Everybody else hears you but me. I do not know quite what is wrong. Sorry about that.

Senator TOOMEY. Why don't I resume?

Chairman BROWN. Go ahead.

Senator TOOMEY. OK, I will resume. And what I want to do is offer a different perspective.

Just as we would not task the EPA with auditing corporate books even of energy companies, financial regulation and supervision is not meant for advancing environmental policy. As Fed Chairman Powell himself has said, "Society's broad response to climate change is for others to decide, in particular elected leaders. If Congress believes current environmental policies do not adequately address climate risk, then changes should be enacted through the legislative process, not through financial regulation."

Of course, this should be the responsibility of Congress. It is Congress that is accountable to the American people and would take responsibility for the costly tradeoffs if, for instance, we decided to rely more on expensive renewable energy rather than less expensive conventional energy.

Regarding the Fed, the climate policy is clearly beyond the scope of its mission and authorities. The Fed was created to be independent and free from political influence. As one of today's witnesses, John Cochrane, has observed, "A central bank in a democracy is not an all-purpose do-good agency to subsidize what it decides to be worthy, defund what it dislikes, and force banks and companies to do the same."

The Fed's recent actions on climate, however, suggest that this is the direction that some at the Fed would like to pursue. For example, the Fed's newly created committee that is focused exclusively on climate risk raises a number of questions. Although it was announced nearly 2 months ago, we still do not have any details on its objective or how it intends to achieve them. Similarly, Fed Governor Lael Brainard has suggested the Fed may require banks to engage in "climate scenario analysis," but she has not provided any specificity on the purpose or rationale or process for such an exercise. And this is in spite of the fact that banks already evaluate their risks and respond accordingly. By straying from its core mission and authorities in support of vague and ill-defined climate goals, the Fed's actions threaten to undermine its credibility and to betray its independence.

Climate policy is also beyond the scope of the Fed's expertise. We know there are significant shortcomings and gaps in climate models and data. The Fed has acknowledged that historical climate data is insufficient to make accurate predictions of future climate scenarios. And climate researchers themselves have warned that their models are built for 100-year simulations, not projections of the immediate years or even decades ahead.

Given the uncertainty within the climate community itself, why should we believe that the Fed has a greater understanding of climate risks than regulated institutions? The answer is we should not.

One recent paper by a group of climate researchers found that current climate models cannot provide financially meaningful information. The Fed should not become a climate soothsayer any more than they should start regulating based on the risk of domestic instability, widespread famine, or other black swan events. As one of today's witnesses, Ben Zycher, will explain in more detail, the Fed is not in a position to navigate the enormous uncertainties and complexities underlying climate models. Financial regulators just have no experience or expertise in environmental policy, and any attempt to impose new requirements will only result in the Government picking winners and losers.

The Fed should not follow the example of some other regulators engaged in mission creep, nor should the SEC. I have warned that many on the left want the SEC to use its regulatory powers to advance a progressive social agenda, including on climate change. Now under the SEC's Acting Chair, the agency is beginning to do exactly that.

For example, earlier this month, the SEC announced the creation of a Climate and ESG Task Force to scrutinize issuers' disclosure of climate risk. And on Monday, the Acting SEC Chair proposed a chilling and authoritarian idea. She argued the SEC should force companies to disclose any type of political advocacy spending because firms may, and I quote, "state that they support climate-friendly initiatives but have donated substantial sums to candidates with climate voting records inconsistent with such assertions."

Well, inconsistent according to whom? I mean, what this really means is that these green friendly companies may support some Republicans, and that is unacceptable. These actions represent a clear abuse of power and a politicization of the SEC's disclosure standard. The concept of materiality is the cornerstone of the disclosure-based regime under Federal securities laws, and what matters is whether an issue is financially material to a reasonable investor.

The real objective here seems to be to punish politically disfavored industries. By straying from beyond their mandates into the climate arena, financial regulators will pressure banks not to serve politically disfavored industries such as fossil fuel companies. But who is next? Gun manufacturers? Conservative media? Religious-minded businesses like Hobby Lobby? This is a wholly inappropriate use of financial regulation in an attempt to substitute political favoritism for private business decisions.

Radical policies to force banks to cutoff capital to these companies would not have a meaningful impact on the climate, as Dr. Zycher will testify, but will only raise energy prices for consumers.

So I began my statement by asking, Who is supposed to protect the financial system from risks associated with climate change and how? Or you could simply ask, Exactly what risks? The major threat to energy-related assets is not financial risk caused by weather-related events. It is the risk that unelected, unaccountable, woke regulator will misuse the levers of power in ways never imagined to remake society according to their politics. That result, political favoritism caused by regulatory abuse, that is what we really need to protect the financial system, business, and workers from.

Chairman BROWN. Thank you, Senator Toomey, and I apologize for the beginning. I guess all of you could hear and for some reason we could not. I apologize for interrupting like that. So thank you for your words.

I will introduce today's witnesses. We will hear from five witnesses.

Gregory Gelzinis is the associated director for economic policy at the Center for American Progress. At CAP, Mr. Gelzinis focuses primarily on financial institutions, financial markets, and consumer finance policy. His experience includes stints at Swiss Re, the Federal Home Loan Bank of Atlanta, and on Capitol Hill.

Dr. Nat Keohane is the senior vice president, climate, the Environmental Defense Fund. He is a Ph.D. economist, leads EDF's climate program. He is an adjunct professor at the New York University School of Law where he teaches a seminar on climate change policy. During the Obama administration, Dr. Keohane was ap-

pointed to be a Special Assistant to the President for Energy and Environment on the National Economic Council and Domestic Policy Council.

Ms. Marilyn Waite is the climate and clean energy finance program officer at the William and Flora Hewlett Foundation. She manages the foundation's grantmaking and other activities in the foundation's climate and clean energy finance portfolio. Prior to joining Hewlett, she worked on clean energy venture investment and economic development on four continents.

Dr. John Cochrane is the Rose-Marie and Jack Anderson Senior Fellow at the Hoover Institution at Stanford University. Prior to Stanford, Dr. Cochrane taught first in the Economics Department, later in the Booth School of Business at the University of Chicago, where he was the AQR Capital Management Distinguished Service Professor of Finance.

And, last, Dr. Benjamin Zycher is a resident scholar at the American Enterprise Institute. Dr. Zycher researches and writes on energy and environmental policy for AEI. Prior to joining them, Dr. Zycher ran his own public policy research firm, served in the Office of Economic Analysis, Bureau of Intelligence and Research at the U.S. Department of State. He taught economics at UCLA and at Cal State, Channel Islands. He has been a senior economist at RAND and the Jet Propulsion Lab, was a senior staff economist of the Council of Economic Advisers for President Reagan.

We are fortunate to have such an esteemed panel of experts to discuss a topic that I believe Banking and Housing is frankly overdue tackling, namely, potential impacts on our economy from climate change and climate-related risks to the financial system. I welcome all five of our witnesses. I thank you all for agreeing to appear before our Committee.

Mr. Gelzinis, I welcome you to give your opening remarks, and we will follow with other witnesses in the order I have introduced you this morning. So, Mr. Gelzinis, if you would begin. Thank you.

**STATEMENT OF GREGORY GELZINIS, ASSOCIATE DIRECTOR,  
ECONOMIC POLICY, CENTER FOR AMERICAN PROGRESS**

Mr. GELZINIS. Thank you. Chairman Brown, Ranking Member Toomey, and Members of the Committee, thank you for the opportunity to testify before the Committee on this critical issue. My name is Gregory Gelzinis. I am an associate director for economic policy at the Center for American Progress, where I research, and advocate for, policies that would create a safer, more stable, and less predatory financial system—one that is well positioned to support long-term economic growth.

The coronavirus pandemic has proven to be a terrifying reminder that our collective livelihoods can be upended by catastrophic exogenous shocks, seemingly at a moment's notice. It is incumbent on policymakers to use this experience as a catalyst toward addressing the impending exogenous shock that will likely disrupt our lives on a much greater scale: climate change.

The climate crisis has profound implications for life and health, as it challenges our very ability to sustain a habitable planet. Climate change is also going to have a fundamental impact on every

sector of our economy, including the sector we are here to discuss today: the financial sector.

The increase in frequency and severity of extreme weather events and long-term environmental shifts threatens an array of real assets and financial assets. From commercial and residential real estate exposures along the coast to agricultural lending in the Midwest, climate change could severely impair the value of physical collateral, disrupt supply chains, limit economic activity, increase financial uncertainty, and strain profitability. These effects would reduce real estate and commodity values, lower corporate equity prices, and limit the ability of businesses and households to repay debt.

In addition, the financial system is exposed to transition-related risks. If policymakers take the legal and regulatory actions necessary to meet emissions and temperature targets, financial institutions whose balance sheets do not align with the transition could face significant losses. Financial instruments tied to carbon-intensive sectors could face a severe repricing as policies restrict and raise the costs of emissions. Technological advancements and shifts in investor sentiment could also trigger such losses in advance of any legal or regulatory actions.

Under certain scenarios, financial institutions could adjust to these transition effects abruptly, bursting the carbon bubble and creating what former Bank of England Governor Mark Carney has coined a “climate Minsky moment.”

Climate change does not only present risks to individual financial institutions. It also poses a systemic threat due to the potential magnitude of the physical and transition-related risks, the wide array of financial institutions and markets exposed to these risks, and the speed with which these possibly correlated risks could materialize. These risks are not theoretical. In just the past 2 years, we have seen arguably first climate bankruptcy in PG&E and witnessed energy companies like BP and Total, write down the value of stranded assets, as energy price assumptions are recalibrated.

The financial sector is finally starting to adjust to these risks, and recent net-zero commitments from the largest Wall Street banks are a welcome development, although such commitments have been light on details and lack near-term plans to meet those long-term goals. But it is critical for regulators to step in and account for these risks in the supervision and regulation of the financial system. We cannot let Wall Street write the rules and rely upon the disproven strategy of self-regulation, especially as these firms continue to finance the very drivers of the climate crisis that put their own balance sheets, as well as those of responsible firms, at risk.

Financial regulators have broad responsibilities under existing law to mitigate these climate-related risks. Markets regulators have a responsibility to protect investors, to promote transparency, and to foster healthy markets for securities and derivatives. Prudential regulators have a statutory mandate to ensure the safety and soundness of financial institutions and to promote the stability of the financial system.

Climate change clearly falls within these mandates, and a failure to mitigate climate-related risks would violate the duties Congress

bestowed upon the financial regulators. Thankfully, over the past few months a bipartisan collection of U.S. financial regulators have acknowledged that climate change falls within their remit. Even though the U.S. is several years behind its international peers, recent actions and announcements by the White House, Treasury Department, Fed, SEC, CFTC, FHFA, FDIC, and State-level regulators signal that momentum is building. Like many economic variables, these risks will not be easy to model or quantify, given the inherent uncertainty climate change entails. But the potential magnitude of the risk demands regulators employ a precautionary principle and safeguard the financial system from the worst outcomes.

Integrating climate change into corporate and financial disclosure requirements, fiduciary obligations, stress testing, supervision, capital requirements, and systemic risk oversight would bolster the resilience of the financial system and position it to serve as a source of strength to the economy during the low-carbon transition. If regulators fail to act with sufficient speed or refuse to use their full panoply of tools, it is imperative for Congress to insist that they do so. The stakes are simply too high.

Thank you, and I look forward to your questions.

Chairman BROWN. Thank you very much, Mr. Gelzinis.  
Dr. Keohane.

**STATEMENT OF NATHANIEL KEOHANE, SENIOR VICE  
PRESIDENT, CLIMATE, ENVIRONMENTAL DEFENSE FUND**

Mr. KEOHANE. Thank you. Chairman Brown, Ranking Member Toomey, and honorable Members of the Committee, thank you for inviting me to testify with such a great group.

My name is Nat Keohane, and I am the senior vice president for climate at Environmental Defense Fund, a global, U.S.-based, non-profit environmental organization with over 2 million members and activists. This is a timely and urgent hearing as the impacts of climate change grow more visible every year.

I would like to make three main points.

First, climate change poses significant risks to the U.S. economy and financial system. I was a member of the Climate-related Market Risk Subcommittee of the Commodity Futures Trading Commission that Chairman Brown mentioned and the co-author of that report, which was unanimously approved by the subcommittee's 34 members drawn from a range of industries and civil society. The report conveys a stark message to financial institutions, regulators, and policymakers: Climate change poses serious risks that, if ignored, will undermine the financial system's ability to support the American economy.

As the report shows, climate risk extends throughout the economy, covering sectors including agriculture, airlines, automobile manufacturers, hospitality, power generation, and a wide range of industrial sectors like concrete and steel. The report highlights some specific examples of financial institutions and assets that are particularly vulnerable to climate risk. Here are a few.

Regional and community banks, whose loan books are typically dominated by commercial real estate loans in a given area. As a result, local financial institutions in areas of climate risk, coastal

areas or areas vulnerable to hurricanes, are particularly vulnerable to climate risk and to the financial risk it conveys.

Second, agricultural banks, which also face correlated risk because of their concentrated loans in particular geographic areas and in the agricultural businesses, a credit-stressed agricultural lending system, which we have already seen signs of in the Midwest in recent years, would decrease farmers' access to affordable credit and make it harder to recover from climate shocks.

Municipal bonds are a third example. An analysis from BlackRock Institute demonstrated that municipalities threatened by climate change could face significant losses of GDP, impairing their ability to service their obligations, and raising financial risk to bond holders.

In other words, this is not just about big banks on Wall Street. This is about everyday transactions on Main Street: commercial real estate loans, farm credit, and small business loans that underpin the U.S. economy and that depend on a stable financial system.

How likely are these climate risks? The scary answer is we do not know because we are not tracking them and getting the information we need. Members of the financial community who ignore climate change, whether they are banks, investors, or regulators, do so at their peril.

So this leads to my second point, which is that financial regulators have a clear responsibility to address climate risk, particularly with respect to mandatory climate disclosure. It is important to note that the duties and authorities of regulators remain the same as they have been. What is new is the magnitude and materiality of climate risk.

The most important recommendation for regulators is that the SEC should strengthen mandatory climate risk disclosure in order to drive comparable, specific, and decision-useful information from regulated entities rather than the boilerplate climate reporting that is all too common. Better disclosure of climate risk would benefit investors, companies, and the American public and improve the functioning of markets.

My third and last point is that there is significant demand and opportunity to channel private capital into low-carbon and climate-friendly investment opportunities. Over the past 5 years, we have seen private demand increase dramatically for this kind of lending. The Climate Action 100+ Initiative, designed to support transition to net-zero business strategies, now has nearly 550 investors and \$52 trillion in assets under member management.

In this area of opportunity, the single most important thing that policymakers could do in order to ensure that private capital flows more efficiently to low-carbon economies is to implement a fair and effective price on carbon across the economy. This is a core recommendation as well of the CFTC report that I mentioned at the beginning.

In conclusion, climate change poses significant risks to the U.S. financial system, but well-designed policies, particularly including strengthening mandatory climate risk disclosure rules and implementing a price on carbon, could help to manage and mitigate those risks.

Thank you for your attention.

Chairman BROWN. Thank you, Dr. Keohane.

Ms. Waite, you are recognized for 5 minutes. Thank you for joining us.

**STATEMENT OF MARILYN WAITE, CLIMATE AND CLEAN ENERGY FINANCE PROGRAM OFFICER, THE WILLIAM AND FLORA HEWLETT FOUNDATION**

Ms. WAITE. Chairman Brown, Ranking Member Toomey, and Members of the Committee, thank you for inviting me to testify today.

I am a program officer for climate and clean energy finance at the William and Flora Hewlett Foundation where my work involves setting and implementing securities to mobilize capital for climate change solutions. I focus primarily on venture capital, asset management, and bank lending, including the market rules needed to decarbonize the financial system. Prior to the foundation, I worked in nuclear and renewable energy and venture capital for clean transportation.

In 2020, the United States experienced almost two dozen separate climate-related disasters, exacerbating the economic toll of COVID-19 and costing \$95 billion. As climate change continues, we will see a number of sectors hurt from aviation—think of crippling heat grounding planes in Arizona—to agriculture, with heavy rain and snow overwhelming the Western farms.

As both climate-related physical and transition risks indicate, the financial system and the real economy will be devastated as the planet continues to warm, with real losses already manifesting in some sectors and assets classes. The challenge goes far beyond just protecting the financial system from climate risk. In fact, finance is an essential part of solving climate change and can do so while creating jobs and innovation. The U.S. must bring our annual 6 gigatons of carbon emissions down to zero, which requires roughly \$250 billion of additional investment annually.

Taken together, the following practical policy actions endorsed by key finance experts can unlock the capital needed. After all, we have \$15 trillion sitting in our everyday account as deposits. Mobilizing less than 2 percent of that will allow us to achieve a net-zero goal.

First, we must get our measurement house in order for transparency and accountability. Policymakers, including the SEC and OCC, should require financial institutions to measure and disclose the carbon emissions of their loans and investments. This should be done on an annual basis with very clear reduction targets. Banks and asset managers representing over \$25 trillion, including credit unions in Montana and trillion-dollar banks in North Carolina, are already doing so. Yet to protect the entire financial system and real economy, Government must step in and mandate this accounting for all.

Second, we must climate-proof the Nation's balance sheet. The Federal Reserve must use the absolute emissions data provided by banks to increase the risk rates for loans in climate change-driving assets.

Third, we have to enable community-focused lenders to scale climate-friendly loans. Communities of color bear the brunt of envi-

ronmental pollution and are likely to be disproportionate impacted by unabated climate change. The good news is that there are over 100 MDIs, 1,000 CDFIs, 5,000 credit unions, and 5,000 deposit-taking banks that stand ready to support communities in wealth-building decarbonization. Treasury should provide secondary capital into community-focused lenders to support long-term climate resiliency.

Fourth, we can deploy trillions without public spending through mandates mirrored after the Community Reinvestment Act. Not only can the existing CRA be strengthened to explicitly provide credit for climate-friendly loans, Congress can instate a new mandate that incentivizes banks to invest in climate-friendly infrastructure.

Fifth, we must enable consumer finance for climate action. Just as mobile number portability in telecommunications and the automated customer account transfer service in broker-dealers lowered the barriers to customer choice, so too can new policies by the CFPB lower the cost of closing and switching bank accounts.

Finally, policymakers at all levels of Government, including the SEC, FINRA, and the Department of Labor, should modernize fiduciary duty definitions to align with climate risk and impact. DOL should issue rules to require ERISA plan managers to adopt and implement sustainable climate-friendly investment policies.

In summary, the market rules that enable a climate-safe economy should be as robust, pervasive, and serious as the climate crisis itself. Financial regulation and congressional mandates should ensure that the recovery is one that brings prosperity to all.

Thank you.

Chairman BROWN. Thank you, Ms. Waite.

Dr. Cochrane, you are recognized for 5 minutes. Thank you for joining us.

**STATEMENT OF JOHN H. COCHRANE, SENIOR FELLOW,  
HOOVER INSTITUTION, STANFORD UNIVERSITY**

Mr. COCHRANE. Thank you. Chairman Brown, Ranking Member Toomey, and Members of the Committee, thank you very much for the opportunity to testify today.

Climate change is a very important challenge. But climate change poses no measurable risk to the financial system. "Risk" means unforeseen events. We know exactly where the climate is going over the horizon that financial regulation can contemplate. Weather is risky, but even the biggest floods, hurricanes, and heat waves have essentially no impact on our financial system, and they are well modeled.

Moreover, the financial system is only at risk when financial institutions as a whole lose so much, and so suddenly, that they blow through their capital, and a run on short-term debt erupts. That climate may cause a sudden, unexpected, and enormous economic effect which could endanger the financial system is a fantasy.

Now, sure, we do not know what will happen in 100 years. But banks did not fail in 2008 because they bet on radios, not TV, in the 1920s. Financial regulation does not try to look past 5 or 10 years or so. Sure, a switch to renewables might lower oil company profits. Oil stockholders might lose money. But risk to the financial

system cannot mean that nobody ever loses any money. Tesla could not have been built if people could not take risks.

So why is there a push for regulators to take on fictitious climate risks? These proposals aim simply to defund the fossil fuel industry before alternatives are available and to steer funds to fashionable but unprofitable investments, by regulatory subterfuge rather than aboveboard legislation or transparent agency rulemaking.

This goal is not a secret. For example, the NGFS, which the Federal Reserve recently joined, states plainly its goal is to “mobilize mainstream finance to support the transition toward a sustainable economy.” But financial regulators are not allowed to mobilize the financial system to projects they choose and to defund projects they disfavor. So regulators must pretend that they are dispassionately finding risks to the financial system, and oh, we just happen to stumble on climate here.

There are plenty of genuine severe risks to the financial system. Imagine a new pandemic, one that kills 10 percent of people and lasts for years without a vaccine. Suppose China invades Taiwan or a nuclear bomb goes off. Suppose there is a sovereign debt crisis. What happens if Treasury cannot roll over its big debts and banks no longer take Treasury collateral? Suppose a massive cyber attack wipes out the accounts at a major bank and everybody rushes for cash everywhere. These would indeed be genuine financial system catastrophes. Yet of all of these large, obvious, and plausible risks, our financial regulators want to focus on just one, a fictitious climate risk. Why? Well, obviously, the end justifies the means.

Climate is really important. Climate is too important to let financial regulators play with it. Climate needs clear-headed, science-based, steady, transparent policy, with explicit cost-benefit analysis. Underhandedly funding and defunding financial regulators’ enthusiasms will produce counterproductive feel-good policies.

True climate answers might include nuclear power, geoengineering, carbon capture, hydrogen fuel cells, genetically engineered foods, zoning reform, a carbon tax, as Dr. Keohane suggested, and other approaches, which financial regulators will never envision. If we had done this 10 years ago, we would not have hydraulic fracking and natural gas, which means the U.S. is leading the world in carbon reductions and without which Russia, Iran, and Saudi Arabia would be rolling in the money and America would be in much worse economic shape.

Financial regulation is too important to be eviscerated on the altar of defunding fossil fuels. Financial regulation needs to get back to making sure that financial institutions have capital to withstand all sorts of shocks which nobody can foresee. It is hard work and it is boring work. You do not get invited to Davos. Industry hates being told to get more capital. But that is their job, and there is plenty to do.

The financial system is in peril. Last year was an abject failure. Despite 12 years of intensive regulation and stress tests and centuries of experience, financial regulators never thought a pandemic might come. We made it through the last year by one more massive bailout, not regulatory prescience, and now they want to soothsay the climate?

Do not let the EPA regulate banks. Do not let our financial regulators dream up climate policy. You will get bad climate policy and a more fragile and sclerotic financial system if you do.

Chairman BROWN. Thank you, Dr. Cochrane.

Dr. Zycher is recognized for 5 minutes.

**STATEMENT OF BENJAMIN ZYCHER, RESIDENT SCHOLAR,  
AMERICAN ENTERPRISE INSTITUTE**

Mr. ZYCHER. Thank you, Chairman Brown and Ranking Member Toomey.

Neither Government agencies nor financial institutions are in a position to evaluate climate phenomena with respect to which the scientific uncertainties are vastly greater than commonly asserted. The range of alternative assumptions about central parameters is too great to yield clear implications for the climate “risks” attendant upon the allocation of financial capital among economic sectors. Those central parameters include choices among climate models, the assumed sensitivity of the climate system, the assumed future increase in greenhouse gas concentrations, and many others.

If the Federal Reserve and the financial institutions opt to use similar sets of analytic assumptions, a very real danger would arise of more or less homogeneous predictions inconsistent with the evidence on climate phenomena. If instead opt to use differing sets of assumptions, the ensuing predictions about future climate phenomena—that is, risks—would vary substantially, yielding very large uncertainties in terms of attendant implications.

Financial institutions would have powerful incentives to undertake climate analysis driven not by the actual evidence and the peer-reviewed literature. Instead, they will be driven to undertake such analysis under assumptions and methodologies distorted by regulatory directives, political pressures, and litigation threats.

The aggregate benefits—that is, the positive risks—of increasing greenhouse gas concentrations, as reported by NOAA and in the peer-reviewed literature, almost certainly will be excluded from the analyses of climate risks. Such analyses will exclude also the risks of climate themselves, prominent among which are the large and adverse implications of artificial increases in energy costs. Such policy risks are likely to be greater when implemented by bureaucracies insulated from democratic accountability.

In any event, the major integrated climate and economy model used by the U.S. Government suggests that the future aggregate economic risks of anthropogenic climate change are much smaller than many assert. Anthropogenic climate change is real, increasing atmospheric concentrations of greenhouse gases have yielded effects that are detectable, but they are much smaller than commonly asserted, and there is no evidence—none—in support of the climate crisis argument. We can discuss this later if any members of the Committee deem it appropriate to do so.

Moreover, temperature trends are driven by both natural and anthropogenic influences that peer-reviewed literature suggests the anthropogenic effects are responsible for about one-third of the overall temperature increase observed since the end of the Little Ice Age. The mainstream climate models have predicted the actual

temperature trend in recent decades correlate, consistently overstating that trend by a factor of more than two.

Application of the EPA climate model predicts that climate policies, whether implemented by the U.S. Government alone or as an international cooperative policy, would have temperature effects by 2100 that would be virtually undetectable. Such policies cannot satisfy any plausible benefit-cost test.

The incorporation of climate “risks” into the business decisions of financial institutions would weaken the materiality standard for disclosures by those institutions. “Materiality” always has meant the disclosure of information directly relevant to the financial performance of the bank or other institution. When “risk” analysis becomes an arbitrary function of difficult choices among complex assumptions, the traditional materiality standard inexorably will be diluted and rendered far less useful for the financial markets, an outcome diametrically at odds with the ostensible objectives of those advocating the evaluation of climate “risks.”

The reality is that a climate risk disclosure requirement would be deeply speculative, and the level of detail and the scientific sophistication that would be needed to satisfy such a requirement are staggering. Such disclosures and supporting analysis and documentation would take up many thousands of pages, with references to many thousands more, and the premise that this disclosure requirement would facilitate improved decisionmaking by the financial sector is difficult to take seriously.

A far wiser approach would entail allowing market forces to make such risk determinations in a bottom-up fashion, thus avoiding an obvious politicization of the allocation of capital.

These proposals represent a blatant effort to distort the allocation of capital away from economic sectors disfavored by certain political interest groups pursuing ideological agendas. This would represent the return of Operation Choke Point.

Thank you again, Chairman Brown and Ranking Member Toomey. I will be pleased to address any questions that members of this Committee may have.

Chairman BROWN. Thank you, Dr. Zycher.

Mr. Gelzinis, I will start with you. What should financial regulators do to make sure banks meet their 2030 and 2050 low-carbon goals? Should regulators have a responsibility to protect the banking system and responsible financial institutions from banks that fund activity that contributes to climate change?

Mr. GELZINIS. Yes, thank you for the question, Mr. Chairman. In terms of meeting 2030 and 2050 targets that banks are setting, I think regulators can use stress testing, transition risk adjustments to our risk-rated capital framework, and risk management standards that include actionable transition plans. And just to be clear, these policies are not intended to achieve climate goals. They are intended to bolster the resilience of banks in the face of the inevitable decarbonization of our economy.

And I am glad you asked the question, Mr. Chairman, about banks that are financing, you know, emissions-driven sectors. On banks that fund that climate change activity, Dodd-Frank is quite clear that regulators should not only focus on the risks a financial institution is facing, but also the risks that its ongoing activities

are creating for other financial firms. So those banks funding significant emissions should have to internalize the costs they are placing on other banks.

Chairman BROWN. Thank you.

Dr. Keohane, banks have made a number of commitments to supporting a transition to a low-carbon 21st century economy. What steps should these banks take to show that this just is not a PR campaign and that the banks will take the steps they need to take to make good on these promises?

Mr. KEOHANE. Thank you, Mr. Chairman. I can identify three areas where I think banks can do more, and I will just open by saying I think it is—and I mention this in my written testimony. I think it is a welcome sign that a number of major banks, including Bank of America, Citi, Goldman Sachs, JPMorgan Chase, Morgan Stanley, Wells Fargo, they have all made net-zero commitments, and I just want to make a point. They have done that not because of some regulatory requirement or some regulator in Washington or bureaucrat in Washington. They have done it because there is enormous demand from their customers to do this. And so I just want to make that point because that is—when we talk about what banks are doing, we talk about how they are responding to the demand of their customers. From our point of view, we think there is more that they should do, and I think that is reflected because they are hearing that from their customers.

The first point is transparency. We have seen a lot of pledges. That is valuable. Now we need to see the plans. We need to see how they are going to measure and report their financed emissions, how they are going to reduce their own emissions, but more importantly, how they see reducing the emissions in their portfolios. And, you know, we need to see what their plans are for reducing or compensating for remaining emissions. So that transparency piece is the first.

The second is engagement. In particular, we see lots of room for engagement. For example, with oil and gas companies, during the transition to a low-carbon future, we need to be addressing methane emissions from the oil and gas sector. This is the easiest and cheapest way to cut warming now. And there is a lot that banks can do and companies can do to engage with oil and gas companies. This is already happening, and we need to see more of it.

Finally, policy advocacy. One thing I would like to see banks do is call for and support mandatory climate risk disclosure. They acknowledge that climate risk is material, but too many of them or too many companies are still putting boilerplate comments together. We would like to see more robust disclosure.

Chairman BROWN. Thank you, Dr. Keohane.

Ms. Waite, you discussed enabling community-focused lenders to lead in your testimony as a way low-income and middle-class communities and communities of color can take advantage of the opportunities that come with addressing climate change. Expand, if you would, on what community-focused lenders can do to improve the lives of those they serve and mitigate the effects of both climate change and the industrial pollution that they have endured for so long. What are the opportunities you see for both banks and for businesses?

Ms. WAITE. Thank you, Chairman. Community-focused lenders are already helping communities mitigate and build wealth through energy savings. They are providing affordable loans for electric vehicles, healthy and efficient HVAC systems, and rooftop solar. In its first 3 years of operation, the Clean Energy Federal Credit Union, for example, has recorded zero delinquencies and has sown loan participation across the U.S., including Tennessee, Wyoming, Pennsylvania, and Montana.

As a low-income-designated cooperative bank, they are already teaching other credit unions how to value this asset class. Remember that for some lenders who have a high exposure to the dwindling taxi medallion industry, the clean energy asset class provides an opportunity for diversification.

For businesses, which do not have credit scores, community-focused lenders who know local operations are well positioned to provide products and services as they transition their assets to low carbon. At the same time, we see the need for injection of long-term low-cost capital to enable rapid scaling of these lending capacities.

Chairman BROWN. Quickly, a couple of yes-or-no questions to Dr. Cochrane and Mr. Gelzinis, if you would answer. Dr. Cochrane, regardless of climate change, I understand that you believe banks, the largest banks, should have much higher capital requirements than they do currently. Is that correct?

Mr. COCHRANE. For all risks, not just climate, yes.

Chairman BROWN. Right. The Federal Reserve weakened the supplemental leverage ratio last year, effectively lowering capital standards. Do you think the Fed should extend that exemption past the end of this month?

Mr. COCHRANE. Yes, I do, because leverage is not capital.

Chairman BROWN. Thank you.

Senator Toomey is recognized.

Senator TOOMEY. Thank you, Mr. Chairman.

Dr. Cochrane, you correctly noted that the far-reaching postcrisis financial regulatory framework that was imposed on financial institutions completely failed to consider the possibility of a global pandemic disrupting the financial system. Do you think the financial regulators would correctly anticipate the way that climate change will affect different regions of the country in the course of the next 3 or 4 or 5 years?

Mr. COCHRANE. No.

Senator TOOMEY. I do not think so either.

Mr. COCHRANE. I cannot expand on that one.

[Laughter.]

Senator TOOMEY. A yes-no answer is OK. Let me ask you this: You also noted that central banks and certainly the Fed has no authority to steer credit to areas they like and to defund areas that they disfavor. Could you talk a little bit about some of the risks if the Fed were to take it upon itself to become an allocator of credit even if it did so indirectly?

Mr. COCHRANE. Well, it is going to send things into whatever pet projects the Fed decides are fun than into things that it does not.

I should clarify a previous answer. The reason is because there is no risk of climate within 4 or 5 years to different regions of the country. "Risk" means things you do not know what is going to

happen. We know what the weather is going to be like for the next 4 or 5 years.

Senator TOOMEY. And with respect to extreme weather events, to what extent do financial institutions already consider the applicable risks associated with weather? So, for instance, if you are a bank and you lend money for the development of condominiums on the waterfront in South Florida, do you think it occurs to that bank to think that maybe a hurricane will come along at some point?

Mr. COCHRANE. Yeah, there is a big confusion here of climate versus weather, and banks like that understand they are exposed to weather risks, and they understand what the big weather risks are, and they provision for them. And big weather events just have had no effect on our financial system and will continue not to have any effect on our financial system, because people know that is coming.

Senator TOOMEY. Thank you.

Dr. Zycher, your testimony recognizes the enormous complexities underlying climate models and projections. Is there any reason at all to believe that the Fed is in a better position to navigate these uncertainties and resolve these challenges as opposed to other public and private sector entities?

Mr. ZYCHER. No, there is no reason at all. Neither the Fed nor the SEC nor other financial regulatory institutions have particular expertise in this area. Inevitably, they would rely upon analyses conducted at the EPA or other agencies' analyses that themselves are deeply politicized as they have been, you know, through the last several decades. And I think that there is no particular reason to believe the Fed would add to the stock of knowledge on these matters.

Senator TOOMEY. And do the climate models, as you know of them, are they capable of telling us anything meaningful about near-term financial risks?

Mr. ZYCHER. Well, the climate models are not designed to do that. They are designed to incorporate a set of assumptions yielding predictions about temperatures and other climate phenomena—sea levels and the rest—over a horizon of between 50 and 300 years. That is what the climate models do. And with one or two exceptions, they do it very poorly.

Senator TOOMEY. Now, if weather risks are material for any particular public company, isn't it true that current SEC regulations require full disclosure of those material risks?

Mr. ZYCHER. Well, I am not really an expert on the SEC materiality requirements, but my understanding is that the answer is yes; if there is strong data suggesting that there is a risk to profitability, then the SEC framework requires that those be disclosed.

Senator TOOMEY. And do you think it would be a good idea for the SEC to require nonmaterial risks, nonmaterial in the sense that they do not bear any risk to the financial performance of the company?

Mr. ZYCHER. No, I do not believe that would be wise at all, and the broader point is that the disclosure of climate risks is so speculative that it is difficult to define it as material. That is the central point.

Senator TOOMEY. All right. Thank you very much.

Thank you, Mr. Chairman.

Chairman BROWN. Thank you, Senator Toomey.

Senator Tester of Montana is recognized.

Senator TESTER. Thank you, Chairman Brown. I want to thank all the witnesses for being here today. There have been multiple hearings going on today, so it is tough to be in two places at once.

But this is an important issue for me. I am a third-generation farmer. I have a real job outside the Senate, and I will tell you that I have seen the impact of climate change firsthand. It is undeniable: longer, hotter summers; flooding; droughts. I have been on the farm since 1978, and I have seen things happen the last 25 years that my father never saw happen, and my grandfather certainly did not either. And I think that it is something that is real, and I think it is something that does impact people's financial decisions and banks' financial decisions as to whether they are going to loan money or not. And if we do not at least make some strides toward how we are going to deal with climate, I think we are going to lose family farms. I think we are going to lose our ability to feed this Nation, and that is not a pretty sight, in my opinion.

So this is a question for Mr. Gelzinis. Could you describe to me the impacts we have already seen in the financial sector from severe climate-related events? Or have we not seen any impacts in the financial sector?

Mr. GELZINIS. It is a great question, Senator. So one of the impacts that we have seen is on insurance company losses. So over the past 5 years, on average, there have been over \$100 billion of losses for insurers. If you go back, you know, 40 years, the annual average was less than \$50 billion. So that has significantly increased.

So one of the reasons why I bring up insurance is because if those insurance companies start pulling out of business lines or geographies, given the 1-year policies, then all of a sudden the bank that thought it was protected against some of these risks because it had a good insurance policy on its longer-term asset no longer is. So we are starting to see those physical risks, you know, creep in, and there are examples on the coast as well.

Senator TESTER. So I want to talk to you about an area that you may or may not be familiar with, and that is crop insurance that is something that is backed by the American taxpayer. Something that, by the way, as a farmer, is absolutely necessary that we have this, especially with climate change.

Can you tell me moving forward, from your point of view, is the taxpayer going to be putting more and more money into crop insurance? Or do you think that will be static because of climate?

Mr. GELZINIS. So that is a little big outside my remit, but I am happy to follow up with you and your staff, Senator.

Senator TESTER. I appreciate it. I can tell you that with the uncertainty that I see, I think that it is going to require more and more subsidy moving forward. But I would love to hear your opinion on that moving forward.

Look, I think we need to do a better job understanding the risks posed to our economy by climate. We need to have information on how to address these challenges that come along with climate change. Consumers and investors deserve to know how companies

are exposed to these risks, what they are doing to mitigate climate risks, and that means looking to the future.

I think disclosure and transparency is very, very important, whether it is corporate political spending or the impacts of climate change on businesses.

Mr. Gelzinis, how important do you think access to information about potential impacts of climate change is for investor decision-making?

Mr. GELZINIS. It is critical. Think about the SEC's mission to protect investors, to promote fair, efficient, and orderly markets, and, you know, from capital formation, how are investors supposed to do that if they do not have the necessary information on climate-related risks that are of such a magnitude that if they do not have those risks and those risks are hidden, we are going to get overinvestment in certain areas, underinvestment in others. You know, capital is going to be inefficiently allocated, and folks are going to lose confidence in both the transparency and resilience of our capital markets.

Senator TESTER. Are you concerned about the risks posed to our economy by the climate change issue?

Mr. GELZINIS. Absolutely. Nearly every sector of our economy is going to be impacted in one way or another.

Senator TESTER. All I would like to say is—well, I just came from a Senate Veterans' Affairs Committee meeting when I turned it on, and it may be nomenclature, but the first thing I heard was, "We know what the weather is going to be like for the next 4 or 5 years." Hell, I do not know what the weather on my farm is going to be like for the next 4 or 5 days. So we have got some challenges out there.

I want to thank all the witnesses for being here on this panel.

Chairman BROWN. Thank you, Senator Tester.

Senator Hagerty from Tennessee is recognized for 5 minutes.

Senator HAGERTY. Chairman Brown, Ranking Member Toomey, thank you for holding this important hearing, and I want to thank all of our witnesses who are present today to give us their perspectives on climate change.

A lot of so-called environmental, social, and governance—ESG—focused investing is concerned with climate change. So this hearing is also a really good opportunity to point out the hypocrisy of many of these supposedly ESG-focused funds when they fund through their investments the Chinese Communist Party's human rights violations against the Uyghur ethnic minority population, as well as funding China's economic practices that distort global markets and China's companies that lack transparency and accountability.

Our financial regulators should certainly be focused on the resilience of our financial system, but as others have noted, they do not have the jurisdictional authority nor do they have the institutional capacity to regulate in the area of climate change.

We should not be imposing any unnecessary constraints on our financial institutions' lending or excess costs on our public markets participants. Nor should we be enacting policies that would undercut hard-won American energy independence that would raise our energy costs or that would eliminate American jobs. This is espe-

cially the case now as we look to continue to fully rebound from this pandemic- induced economic recession as quickly as possible.

What I would like to do is turn my questions to Dr. Zycher and Dr. Cochrane. I appreciate your focus on ensuring that regulatory oversight in our financial system is not used to advance a simple liberal socialist agenda. We currently have deep and sophisticated pools of private capital and private markets to deal with potential catastrophic risks that are both weather- and climate- related.

For example, our property and casualty reinsurance markets underwrite hundreds of billions of premiums annually. In fact, according to S&P, most of the top 20 global reinsurers increased their exposure to property catastrophic risk last year. So I am going to ask these questions of both of you, Dr. Zycher first, then Dr. Cochrane.

In your view, whether through risk-sharing instruments or other long-term capital planning devices, does the private sector have tools and incentives for making sound business and risk management decisions concerning potential climate risks?

Mr. ZYCHER. You know, I see no reason to believe that the private sector has inefficient incentives in terms of adjusting to perceived risks. What is being advocated by many people is a top-down approach to forcing the evaluation of these risks by the financial sector. I think it would be much wiser to use a bottom-up approach in which the market makes whatever judgments about these risks that it deems appropriate and then prices those into the products for insurance services or other things that prove efficient.

Senator HAGERTY. Dr. Cochrane.

Mr. COCHRANE. You know, weather comes and goes. We do not know if it is going to rain or snow tomorrow, but we know pretty much what the range of weather can be. Climate is about changes in that range of weather, and we know that in the next 5, 10, even 20 years, the change in weather is not going to be that big. People whose businesses depend on the weather make pretty good assessments of how bad the weather can be. And weather is just a small part of the U.S. economy. So the risk is small, and it is well modeled by people who have that risk.

Senator HAGERTY. Yeah, in fact, the sophistication of those that do model the risk—and, again, billions of dollars are moved into capital markets to address weather- related risk—very highly sophisticated modeling that takes place.

My second question, again, to Dr. Zycher first, then I will come back to you, Dr. Cochrane: Ranking Member Toomey already touched on this a little bit earlier with you. Are you more comfortable with financial regulators wading into this area or with, again, for example, private insurers that have expertise in modeling and assessing catastrophic risk exposures, educating shareholders on risk, and creating tailored solutions? Which would you be more comfortable with: financial regulators or the private market participants that are in this business?

Mr. ZYCHER. You know, I do not think there is much question that such risk evaluation by the private sector would be much more unbiased and much more efficient. Insurance companies and others have powerful incentives to evaluate these risks and are much less subject to political pressures, litigation threats, and regulatory

mandates than is the case for the Fed or the SEC and other top-down agencies issuing edicts in a top-down fashion.

Senator HAGERTY. Yeah, well put. Dr. Cochrane.

Mr. COCHRANE. I would not mind if our financial regulators were looking at all sorts of the out-of-box risks, but they are not looking at all the big ones, and they are looking at one that is basically made up.

Let us also remember financial regulation is not about the proposition that nobody can ever lose money. Financial regulation has to be just about will banks fail, will there be a crisis, and we seem to have slipped into the idea that nobody can ever bear any risk anymore.

And, finally, remember, the worst-case economic scenarios for climate is 7 percent to 10 percent of GDP in 100 years, a tenth of a percent per year. And that is the worst case. Ben will explode with how much that has the thumbs on the scale. So over the horizon we can think about things, this is a small risk to the U.S. economic and financial system. Sorry. That is a fact.

Mr. ZYCHER. Senator, if I may add something, the major integrated climate economy assessment model predicts that by the end of the century, across policy scenarios, the differences in GDP for the U.S.—not GDP growth but GDP—in absolute dollars would be about 3 percent by the end of the century. The effect of these risks is much smaller than is commonly asserted.

Senator HAGERTY. Thank you.

Chairman BROWN. Thank you, Senator Hagerty.

We will go next to Senator Menendez. I am going to duck out for 5 to 10 minutes to go to the Finance Committee, so it will be Senator Menendez, then Senator Daines of Montana, then Senator Warner of Virginia. So that will be the order if I am—when I get back. So please proceed, Senator Menendez, for 5 minutes.

Senator MENENDEZ [presiding]. Thank you, Mr. Chairman.

More than 8 years ago, Superstorm Sandy crashed onto New Jersey's shoreline, causing the greatest natural disaster in our State's history. It caused billions of dollars in damage, including some sustained damage to home values. A large share of homeowners' wealth is locked up in their homes, and homeownership is the most important and accessible way to build wealth. And climate change increases the frequency and intensity of storms like Sandy and endangers, I think, the cornerstone of wealth building. If due to climate change these homes become uninsurable and unmarketable, the value of these homes and the wealth of homeowners is at risk.

So, Mr. Gelzinis, as storms like Sandy increase in frequency and severity, do you expect coastal homes to lose value relative to the balance of homeowners' mortgages, causing these mortgages to become financially underwater?

Mr. GELZINIS. Thank you for the question, Senator. So to the extent that they are exposed to rising sea levels and increasingly severe frequent floods and extreme weather events like Sandy, those homes will lose value as the physical impacts of climate change intensify and threaten to damage those properties. There is some evidence that those risks are starting to make their way into house prices in certain coastal geographies already. And, of course, whether a specific home is driven underwater will depend on the

level of home equity and the extent of the damage the home is vulnerable to, but it is certainly possible, especially under the most severe warming pathways, that climate effects could drive up a large swath of coastal homes and put them underwater financially.

Senator MENENDEZ. Well, according to one report, New Jersey has lost \$4.5 billion in home value since 2005, a time period covering Sandy, because of flooding related to sea level rises. So it is just one dimension, I think, of the challenge before us.

Under current rules, public companies are not required to disclose political spending to shareholders. As a result, corporate executives can spend investor money on political causes without any consideration for shareholder views or the company's public commitments to climate-friendly initiatives.

Mr. Gelzinis, should shareholders of public companies that make carbon-neutral or other climate-friendly pledges expect their company to act in a manner consistent with that stated company policy?

Mr. GELZINIS. Yes, Senator, a public company's shareholders should absolutely expect that a company's actions will align with pledges or other public commitments.

Senator MENENDEZ. Well, in 2017, while companies publicly stated that the U.S. should remain in the Paris climate accord, many spent shareholder money to oppose the very essence of what they were saying; and because there are no disclosure requirements, their shareholders had no way to know.

So do shareholders have the right to know whether their company's political donations contradict their public commitments and whether those companies may be supporting outcomes that might pose a material risk to the company's bottom line.

Mr. GELZINIS. Senator, shareholders do have the right to know whether the company's political spending is consistent with the publicly stated policy of the company. We have seen plenty of examples of companies that have said one thing publicly and spent shareholder dollars to advance contradictory goals in the political process. That creates material reputational harm and can certainly impact performance. And I would just note that your efforts around the Shareholder Protection Act have been critical. The bill would give investors both the transparency they need and the ability to hold companies accountable.

So the SEC really must center disclosure requirements on the information investors need, and investors have made it abundantly clear that this information is important to them.

Senator MENENDEZ. Thank you. Now, when we talk about systemic financial risk due to climate change and ensuring that companies are transparent about those risks in various filings and disclosures, we are really talking about two kinds of risks. There are risks to physical assets that can be impacted by various climate events, like extreme weather and sea level rise, as well as risks associated with our transition away from a dirtier, more polluting form of energy toward a clean 21st century economy. That transition brings some extraordinary opportunity to create new middle-class jobs and reinvigorate our manufacturing and energy sectors. But at the same time, investors and financial institutions have to understand the market risks associated with carbon-intensive in-

dustries as the U.S. and the rest of the world moves toward a zero emission economy.

Dr. Keohane, as the SEC looks to revamp its climate risk disclosure requirements, how can these rules better speak to both physical and transitional risks associated with climate change? And how do we best quantify those risks?

Mr. KEOHANE. Well, thanks very much Senator, for the question. The first thing I want to say is the reason we focus so much on climate risk disclosure is because transparent information is a fundamental aspect and a requirement, a condition, for an efficient market. I think Dr. Cochrane and Dr. Zycher know this, but we are not talking about directing allocation of capital. We are talking about allowing investors to know what they are investing in and to give them that information.

And to your question, Senator Menendez, we focus on three criteria that we think the SEC should look to when it strengthens mandatory disclosure of climate risk.

The first is information should be comparable. Investors need to know how corporations compare with one another in terms of the risk and performance both with respect to that transition risk, Senator, as well as with respect to exposure to physical risk.

Second, the disclosure needs to be specific, the information that is particular to the corporation. Too often we just see generic language and sort of boilerplate language. That has been the result of several studies that have found that.

And the third is decision-useful. It needs to be relevant to the decisions that investors are making, and so comparable specific decision-useful information is what the SEC should mandate companies disclose.

Senator MENENDEZ. Thank you.

I understand by the Chairman's order Senator Lummis is next.

Senator LUMMIS. Thank you very much.

My first question is for all of our witnesses, and it is a simple yes-or-no answer. The question is: Did Operation Choke Point damage our financial system? And I will start with Dr. Cochrane.

Mr. COCHRANE. I have not studied it enough to be able to comment for you. Sorry.

Senator LUMMIS. Thank you. Dr. Zycher.

Mr. ZYCHER. Yeah, I think that Operation Choke Point was deeply corrosive to the rule of law and our constitutional institutions. It was a blatant attempt to bypass Congress and implement a politicized allocation of credit in a way that disfavored politically unpopular industries.

Senator LUMMIS. Thank you.

Ms. Waite, do you have an opinion about Operation Choke Point?

Ms. WAITE. I also have not studied it enough to have an opinion about this. Thank you.

Senator LUMMIS. Mr. Keohane? And excuse me if I have butchered your name.

Mr. KEOHANE. That is OK, Senator. I am afraid I am in the same boat as Dr. Cochrane and Ms. Waite.

Senator LUMMIS. And, Mr. Gelzinis.

Mr. GELZINIS. Senator, I cannot speak to the Department of Justice portion, nor the specifics of some of the financial regulatory ac-

tions. I would just say, though, that it is important to remember that reputational risk is financial risk.

Senator LUMMIS. Well, thank you. I am going to then ask Dr. Zycher to respond further on this point. To me, the climate change-related proposals being discussed sound a lot like Operation Choke Point, and so to Dr. Zycher—actually, it was Dr. Cochrane, wasn't it, who responded earlier? Why is that? Why do these sound so much alike?

Mr. COCHRANE. I am not good on the details of Operation Choke Point. I am going to be hard pressed to make a comparison. I can fulminate all you would like on proposals of regulating and disclosing fictitious climate risks on their own basis.

Senator LUMMIS. So it is Dr. Zycher that I want to ask to respond. You can see the tie I am trying to make, I hope, Dr. Zycher.

Mr. ZYCHER. Yes. I made the point in my formal statement submitted to this Committee and in very brief passing during my oral comments a few minutes ago that the risk disclosure requirement, given the biases to which the financial sector would be subjected, amounts to a blatant effort to distort the allocation of the capital away from certain industries on the basis of the ideological goals of certain political interest groups. That is exactly what we observed during Operation Choke Point, and so the proposals being made here today by some of the Senators and some of the witnesses that the Fed and that financial institutions be required to disclose climate risks is an indirect but obvious way to distort the allocation of the capital away from the fossil fuel industry and perhaps others that are politically disfavored by certain ideological groups.

Senator LUMMIS. And, further, do you believe that there is consensus on how we should mitigate climate risk in the financial system?

Mr. ZYCHER. No, there is no consensus on the extent to which climate change is caused by man or is the result of natural phenomena. It is a combination of both. And I do not think there is any consensus certainly if we look at the disagreement being exposed during this hearing today about how risks should be measured, how they should be disclosed, what implications they should carry, et cetera, et cetera.

Senator LUMMIS. Dr. Cochrane, would you also weigh in on this point? Do you think there is a lot of consensus?

Mr. COCHRANE. Climate change poses no risk to the financial system. This is a made-up risk. So there is no consensus in the sense that we are just asking banks to make up numbers to please regulators, and once banks are making up numbers of fictitious climate risks, then we lose the integrity of the financial regulation system. So there is consensus by people who want to push a particular agenda, but, you know, we are talking about a fiction here, not a fact. So you cannot have consensus on how to measure a fiction.

Senator LUMMIS. Well, thank you all, witnesses, and for those of you who are unfamiliar with Operation Choke Point, which I confess I was unfamiliar with it, too, you might go back and look at it because I think that it is something worth referring to, and it is a cautionary tale as we engage in this discussion.

Thank you, Mr. Chairman. I yield back.

Chairman BROWN [presiding]. Thank you, Senator Lummis.

Senator Warren from Virginia—or Warner, from Virginia—I am sorry—is recognized for 5 minutes. I know the difference.

Senator WARNER. I know you sometimes get us mixed up, Sherrod. Listen, I appreciate the diversity of opinion on the panel, but I am little bit stunned by some of the commentators' indication that somehow climate is made up or fictitious. I am not going to fully engage on this other than the fact that I would clearly urge them to talk to the United States Navy, which is not viewed as kind of an out-of-the-ballpark group who—we are blessed in Virginia to have the largest naval base, and it is—we spend hundreds of millions of dollars a year raising the piers because of the threat from sea level rise. Whether you call that climate change or sea level rise, I do not call what you call it; it is affecting our naval base, Hampton Roads, the resiliency level. This is an issue that everyone of every political persuasion who lives this risk each and every day—and I am astonished that there are so-called experts that are denying the validity of what is happening real-time in my State. Again, we ought to have a lot of different opinions.

I would like to go to the market questions now, and, Mr. Chairman, I have got right here—I am trying to make sure I am watching my numbers. This is the GAO study that I requested back in 2018. It came out in 2020. I ask unanimous consent that it gets submitted for the record.

Chairman BROWN. Without objection, so ordered.

Senator WARNER. Mr. Chairman, this GAO study uncovered that 12 out of 14 institutional investors seek information on ESG—environmental, societal, and governance—metrics to understand risk and assess long-term financial performance. These institutional investors find that as they look at the long-term financial risk—and these are not mandated by the SEC, although I am happy to say that the SEC is doing a study on this matter. But they have not mandated. These are institutional investors who say, “We need this information because we believe as institutional investors that climate is providing a long-term financial risk.”

As a matter of fact, BlackRock just last night, BlackRock that I know, Mr. Chairman, is one of your favorite organizations, somebody that you have not always agreed with, but BlackRock came out last night saying they think we ought to have mandatory financial reporting on environmental risks. So while I know some of the members of the panel may want to dismiss this science or somehow say that it is simply being promoted by the political interests, I actually call BlackRock and 12 out of the 14 institutional investor groups of the GAO study examples of where the market is demanding this information so that institutional investors on behalf of their long-term pension shareholders and others can have this information as they make the kind of long-term assessments, because, otherwise, the rate of return to those investors is going to be diminished by the effects of what we call climate change, sea level rise, weather changes. You call it and name it, but it is out there and it is real.

Mr. Gelzinis, you have talked in your testimony about the need for ESG metrics. Can you talk about how not having robust disclo-

sure requirements on ESG actually puts American companies at a competitive disadvantage against other companies around the world that have to make these kind of reports?

Mr. GELZINIS. Thank you for the question, Senator. So if the SEC fails to integrate climate-related risks into its core regulatory framework, investors will be exposed to risks that were not sufficiently disclosed to them, capital will be inefficiently allocated, and our markets will be anything but orderly. And that will serve as a drag on capital formation due to a loss of investor confidence in the resilience and transparency of our markets.

So essentially a failure to address these issues here in the United States would undermine the health and attractiveness of our capital markets globally. But if other major markets in the world are modernizing and providing investors with the information they need to efficiently allocate capital and we are not, it is going to put U.S. companies at a disadvantage.

Mr. COCHRANE. Can I just—as a matter of fact, nobody on this panel denied climate change. We all agree that climate change is real.

Senator WARNER. Mr. Cochrane, all I know is I just—I had not heard your whole commentary, but I heard you and Mr. Zycher indicate that somehow factoring in these standards would distort the market. And respectfully, sir, I could not—and I have spent—I get a lot of criticism from my Democratic colleagues as being too pro-market-oriented, and I can take you to parts of Virginia where we are grappling with this risk. And I think, quite honestly, when groups like BlackRock, when 12 out of 14 institutional investors say we need these kind of metrics, and when we fail to have metrics that are actually commonly measurable between companies, we put American companies at a disadvantage.

Thank you, Mr. Chairman. I hope that we will come back and be able to revisit this because I think it is a critically important issue.

Chairman BROWN. Thank you, Senator Warner.

Senator Daines from Montana is recognized.

Senator DAINES. Yes, thank you, Chairman. Let me first say this hearing comes just weeks after the Biden administration canceled the Keystone Pipeline, and as a chemical engineer, somebody who believes in science, it is jaw-dropping. This is such classic virtue signaling, even though the pipeline is the safest way and most environmentally sound way to move oil, in fact, has the least amount of carbon emissions, because here is what is going to happen. If there is not a pipeline, it is going to be either through rail or by truck, which emits more carbon. I just wanted to lay that out there. We want to stay focused, I agree, on the science and the data as we look at this issue of climate and of risk. I urge the President to reverse this decision. It is reckless, it is devastating, it is bad for the climate, and it is even worse for our communities.

I am concerned that what is really under discussion today is really not an effort to protect the financial system from climate risks but, rather, to establish conditions by which certain businesses deemed politically unfavorable can be starved of capital and shut out of the financial system. I joined Senator Cramer in introducing the Fair Access to Banking Act, which would prevent banks,

prevent financial services providers from discriminating against law-abiding businesses such as oil, gas, and coal producers. In fact, we introduced this legislation after seeing private institutions succumbing to political pressure. That is wrong.

I worry that a historically bipartisan agency such as the SEC might move away from its mission that is supposed to protect investors, maintain fair and orderly efficient markets, and facilitate capital formation, and instead act to reshape the financial system in ways that I do not think themselves have really fully thought through.

Dr. Zycher, can you tell me how mandatory climate disclosures will by itself decrease climate-related risks in the financial system?

Mr. ZYCHER. I do not think that mandatory disclosures would have any such effect at all because it is not quite clear what would be required to be disclosed. What model would a financial institution use? What assumption would it make or be required to make about the sensitivity of the climate system to growing greenhouse gas atmospheric concentrations? What concentration would be assumed for the year 2100?

The disclosure requirement being proposed would turn out to be so speculative and so subject to political pressures and litigation threats and other similar distortions that no useful information would, in fact, be provided to the market.

Senator DAINES. Thank you. I know this is not going to be a debate on climate change, and I think all of us agree there is climate change. It is a dynamic environment. It has never been static. It is either always going through natural cooling or warming trends. The real question is in this multivariable equation—and I guess I pride myself of having spent a lot of time studying thermodynamics, physics, chemistry, and so forth. What component of this is human-caused? It is very much one of the components. Let us all agree there are multiple variables in this equation.

But I want to switch and ask a question of Dr. Cochrane. Can you tell me what ESG means in practice when it comes to index funds? Is there a standardized definition or is this just jargon?

Mr. COCHRANE. Well, it is marketing, and you can sell indulgences and charge a high fee. I think to your previous question, I just wanted to comment as well. I think you hit the nail on the head. We might be able to get companies to disclose carbon indirectly, but the proposal is to get them to disclose financial risks due to carbon, and that is the part that is made up.

Senator DAINES. Let me go to these ESG index funds. I have got a follow-up question. If we looked at the data from FactSet, exchange-traded funds explicitly focus on socially responsible investments and have a 43-percent higher fee than widely popular standard ETFs. And, in fact, the environmental, social, and governance funds' average fee was 0.2 percent at the end of last year, while your standard ETFs are at the 0.14 percent average. That has a real impact on investors' bottom lines. In fact, according to one recent analysis, over a 10-year period \$10,000 in an ESG fund would be about 44 percent smaller compared with an investment in an S&P 500 tracking fund.

Either Dr. Zycher or Dr. Cochrane, because I am running out of time here, why do ESG funds on average charge much higher fees than standard broad-based index funds?

Mr. COCHRANE. Because people are willing to pay them. You know, if people want to pay to feel good, that is their business. I am for free markets always.

Mr. ZYCHER. I am not quite as cynical as John, even though he is so much younger than I am. I mean, an ESG fund by definition has to be actively managed in order to make sure that the underlying assets satisfy the politicized requirements of the ESG objectives. That means fees have to be higher than those charged for an index fund, which is not actively managed. And so if we believe the standard hypothesis, which I do, that securities prices always reflect all available information, it is very difficult to beat the market, and individual investors can approach that goal by minimizing fees—in other words, by investing in index funds. That is the central message from Burton Malkiel and other analysts. And I think that it is obvious why ESG funds charge higher fees. They are charging a fee to actively manage a fund in order to achieve a politicized goal.

Senator DAINES. Thank you. I am out of time.

Thank you, Mr. Chairman.

Chairman BROWN. Thank you, Senator Daines.

Senator Van Hollen is recognized for 5 minutes.

Senator VAN HOLLEN. Thank you, Mr. Chairman. Can you hear me OK?

Chairman BROWN. Perfectly.

Senator VAN HOLLEN. Good. Well, let me thank all the witnesses. Thank you, Mr. Chairman, for holding this hearing. And I agree that markets work best when investors and consumers have all available information, which is why it is troubling to hear some witnesses suggest that we should not be providing investors with information about the risks from climate change. As someone who would make an investment, I would think that we would want everybody to have information about what risks they are taking. That is why I am pleased to see the SEC moving forward, and the CFTC, and what they are doing is moving forward to study how best to measure those risks, because obviously we do need to standardize that approach. You are already seeing a lot of financial institutions in Europe begin to take those risks into account. They are real.

Here is a quote from somebody who has been involved with the American Property Casualty Insurance Association: “‘The alarm bells are now ringing loudly,’ says Karen Collins, who handles home insurance and other personal lines for the American Property Casualty Insurance Association. ‘Climate change is leading to skyrocketing costs to insure and rebuild.’”

You know, this is a statement from somebody who is directly involved in having to price in these risks, and it would seem to me that we would want everybody involved in that area to be informing investors and consumers about those risks, which are real.

Mr. Keohane, I would like to ask you about the insurance companies because from Lloyd’s of London to others, they have been very clear that prices are going to go up, but we do not know if they

are yet at a place where they capture all the risk. Can you talk a little bit about the insurance industry, property and casualty insurance industry, and why it is important that we calculate these climate change risks?

Mr. KEOHANE. Absolutely. Thank you, Senator, and I want to just express a note of appreciation for what you said about the importance of choice. We are talking about informing investors. We are talking about investor choice. I think it is puzzling to see folks saying we should not allow investors to have the information they need to make the choices they want.

With respect to insurance, Senator, that was raised earlier, I think, by a couple of the other witnesses on the panel. I found that ironic that insurance was raised, private insurers were raised as the solution here. If you ask folks in California, they will tell you wildfire insurance is essentially no longer available. The California State government had to step in because wildfire insurance was not going to be offered anymore by private insurers. Why is that? It is because the uncertainties and the risk around climate change are changing—or as a result of climate change, are changing in ways that the insurers do not understand. With all due respect to Dr. Cochrane, the probability distributions are shifting. And when that happens the insurers, their response is, “I do not know how to price this. I am going to get out.”

So we are looking at—across a range of sectors, we are looking at what happened, frankly, with flood insurance in the 1960s when the private insurers stepped out, and then the Federal Government has to step in. And what that ends up doing, when the Federal Government or a State government, as in California, is the last resort, that puts taxpayers on the hook for these risks. Obviously, someone needs to insure, but it would be much better if we had a system where there was clear and transparent information that investors need and that insurers need and that people making decisions about insurance, that they need as well.

Senator VAN HOLLEN. Well, that is right, and if that risk is not priced into these products, as you say, when the companies are unable to pay out on the insurance claims, it is the taxpayers who end up picking up the bill. We have already seen that when it comes to the flood insurance, and that is just getting even more so in that area.

Let me ask you, Mr. Gelzinis, about stress testing other financial institutions like banks for this kind of a risk. Sarah Bloom Raskin, who is a Rubenstein Fellow at Duke University, has said that regulators should begin to collect data and create models that would enable them to carry out meaningful climate-related stress tests, again, to see if there are hidden risks which could explode and require taxpayers potentially to pick up the bill, at least if they are systemically important entities.

So could you comment a little bit on that idea?

Mr. GELZINIS. Yeah, I think stress tests could be a really important tool here, and I want to be very clear about what stress tests are and what they are not. Stress tests are not meant to predict the future, so a lot of what banks that have brought up opposing the establishment of these tests say, well, climate change is really hard to model and predict, so why should financial regulators try?

The point is not to predict the precise outcomes here. The point is to test bank balance sheets against extreme but plausible scenarios. And so I think that is a hurdle the Federal Reserve and other financial regulators could meet to make sure bank balance sheets are resilient to these risks.

Senator VAN HOLLEN. Right. I think when we are talking about all this, we are trying to create standard models that are broadly accepted for assessing risk.

Thank you all, and thank you, Mr. Chairman.

Chairman BROWN. Thank you, Senator Van Hollen.

Senator Tillis from North Carolina is recognized for 5 minutes.

Senator TILLIS. Thank you, Chairman Brown. Can you hear me?

Chairman BROWN. Yes.

Senator TILLIS. Thank you. Actually, I want to follow on a bit to the last conversation for Dr. Zycher and Dr. Cochrane. A 2020 survey by the International Basel

Committee on Banking supervision found that 10 of 15 jurisdictions indicated, "Current data are not sufficiently granular or reliable to feed into potential assessment models."

And another article in Nature Climate Change journal finds that, "Calls for the integration of climate science into risk disclosure and decisionmaking across many levels of economic activity has leapfrogged the current capabilities of climate science and climate models by at least a decade."

There was another Politico article that was just talking about the reliability of information and transparency, accessibility to information that could help with certain assessments.

So, Dr. Zycher and Dr. Cochrane, what sources are the relevant domestic and international regulators currently using to model climate risk?

Mr. ZYCHER. Well, I think that what most public officials both in the U.S. and around the world are reduced to using are the reports from the Intergovernmental Panel on Climate Change. The assessment reports, the last of which came out in 2013, and the next one, the sixth report, will come out in 2022, and those reports are peer-reviewed; they are written by serious people, and there is enormous uncertainty, and to a significant degree, the conclusions both in terms of policy and climate science can be questioned quite significantly.

There are other IPCC-type reports, for example, the 1.5 Degree report that came out in 2019 that some people rely upon, it is just rather silly, frankly, in all kinds of ways and is not to be taken seriously.

I think that the IPCC work is primarily what is used along with various Government reports and analyses by various agencies.

Mr. COCHRANE. I might add that they are making it up, because what we are talking about here is risk to the financial system, not even economic risk. And I think following the discussion you can see—so we talked about—Senator Menendez talked about \$4.5 billion of home value and some homes that went under in New Jersey. The stock market did not crash; banks did not fail. We talked about wildfires in California, which, yeah, that is a problem, almost all due to horrible forest management. Banks did not fail; the stock

market did not crash. And we are ignoring the real risks—pandemic, war, Treasury failure, cyber attack.

So the idea that it is a financial risk—and you can see it in the regulators. They are kind of floating around. It is mostly that we need to regulate this, but they really have no idea how.

Senator TILLIS. So what risk do we run if we move too quickly in modeling climate risk when there are questions about actionable and reliable data?

Mr. ZYCHER. Well, we run the risk of leading the financial system toward distorting the allocation of capital in ways that are not productive, away from the fossil fuel industry and away from other sectors in response to analyses that are seriously distorted. That is one set of risks.

We risk also ignoring the benefits of anthropogenic climate change, greening of the planetary ecosystem, greater water efficiency, greater agricultural production. There are benefits from increasing greenhouse gas concentrations, and we will ignore also, as I mentioned in my testimony, the risks of Government policies. Government policies cannot be predicted uniformly to yield positive results. Forgive me, Senators, but that is simply reality. And the central thrust of climate policy is an increase in energy costs. There is no way around that, and that will carry implications for the economy and, indeed, for the financial system that are not salutary.

Mr. COCHRANE. I would add we pollute financial regulation. Look, an honest bank, the size of the big banks, which is what is dangerous for the financial system, they put up the numbers correctly, they have to say, "Look, climate does not pose any risk to us over the foreseeable horizon of our risks. But the regulators want to see something, so we have got to cook up some fictitious financial risks to make them happy and to give the answers they want."

Well, now the books have been cooked, and financial regulation against the real risks, the big ones that they do not see coming, then we will lose the power to do that, too. So it pollutes financial regulation as much as distorts the economy.

Senator TILLIS. I agree. Thank you.

Thank you, Mr. Chair.

Chairman BROWN. Thanks, Senator Tillis.

Senator Warren from Massachusetts is recognized for 5 minutes.

Senator WARREN. Thank you, Mr. Chairman, and thank you for holding this hearing.

There is just no more room to dance around here. The evidence is undeniable that climate change threatens our economy. In a speech last month, Federal Reserve Governor Lael Brainard said that climate change is already imposing substantial economic costs and is projected to have a profound effect on the economy at home and abroad.

So, Mr. Gelzinis, how about if you connect the dots for us here? How does climate change put our financial system at risk?

Mr. GELZINIS. Yes, thank you for the question, Senator. So the physical effects of climate change could devalue a range of real assets and financial assets, including commercial and residential real estate, corporate bonds and loans in certain sectors and geog-

raphies, municipal debt, commodities, and the derivatives tied to instruments. Then, in addition, the inevitable low-carbon transition could severely impair the value of financial instruments tied to carbon-intensive sectors. And both of these types of risks have not only microprudential implications for individual institutions, but also pose a broader systemic threat just given the magnitude of the risk, the types of firms exposed, and the potential speed with which these losses can materialize.

Senator WARREN. Thank you. You know, these risks are real, and they affect the safety and soundness of our financial system. The Federal Reserve currently supervises some of the country's largest banks, including the banks that have been designated as "too big to fail."

So, Mr. Gelzinis, if the health of one or more of these banks was at risk due to climate change, would the Federal Reserve be stepping outside its mandate or expanding its mission if it treated climate change the same way it treats other risks to the financial system?

Mr. GELZINIS. Absolutely not, Senator. It is clearly within their mandate.

Senator WARREN. Good. In other words, because the Fed's mandate includes the safety and soundness of the too-big-to-fail banks, it is within the Fed's responsibility to deal with climate risk. And by ignoring climate risk, the Fed and other banking agencies are allowing politics rather than science to determine the course of their action. Is that a fair statement, Mr. Gelzinis?

Mr. GELZINIS. Yes. I mean, the risks would violate the very responsibilities Congress handed down to the regulators.

Senator WARREN. And the biggest banks seem to realize what is happening, so they have started to brag about how great they have been doing to solve this problem all on their own. Last month, for example, JPMorgan committed to achieving net-zero carbon emissions by 2050.

Now, I appreciate that commitment. I do. But we also know that JPMorgan has financed close to \$270 billion in fossil fuel projects since 2016 and has yet to announce any clear steps as to how it will wind down its significant participation in oil and gas drilling, in fracking, and in other contributions to climate change.

So let me ask: Mr. Gelzinis, is voluntary self-regulation from big banks sufficient to protect our financial system from climate risks?

Mr. GELZINIS. So, Senator, when you were warning about a potential housing crash in the early 2000s, financial regulators and Wall Street executives at the time hailed the merits of self-regulation and cast aside the warnings of "alarmists" since bank risk models and decisionmaking was so advanced that crises, you know, really were a thing of the past. Then the predictable catastrophe struck, and it was not those banks that caused the crash or regulators who were asleep at the wheel who suffered the consequences. It was communities across the country and the Government that picked up the tab.

So financial firms simply do not have the incentive to self-insure against these risks, particularly against the worst outcomes, partly because of their near-term focus on quarterly profits and partly be-

cause they do not bear the full cost of the risks that, you know, their activities are placing on the system.

So I guess my fear is that, you know, similar to 2008, while the music is playing, financial firms will get up and dance while they can still make short-term profits. They will continue to overengage in climate-risky activities until catastrophe strikes yet again and we relearn the painful lesson of self-regulation.

So, anyway, that is just why I think it is so vital for financial regulators to step in here and ensure the financial system is resilient.

Senator WARREN. Right, and it is a powerful reminder of this analogy. You know, we need to take seriously the threat that climate change presents to our financial system, and that means using our regulatory tools to mitigate that threat. And every day that the Fed and other regulators refuse to do their jobs and ignore these risks, they put both our planet and our economy at risk.

Thank you. Thank you for being here. And thank you, Mr. Chairman.

Chairman BROWN. Thank you, Senator Warren.

The Senator from Minnesota, Senator Smith, is recognized for 5 minutes.

Senator SMITH. Thank you, Mr. Chair, and thank you to all the panelists.

I am finding this conversation quite interesting, and I want to just start with a point here. I hear some of our panelists saying that it is so important, even some of my Republican colleagues saying how important it is that we address this from a public policy perspective, which I, of course, agree with. And so I would like to invite my colleagues on both sides of the aisle to join in the work that we have to do to address climate change from a public policy perspective.

I am excited about the work that I am doing around a clean electricity standard, which would be a great example of the kind of thing that we could do to address climate change and get us to the clean green economy that I think that we know that we need.

But let me turn to the topic here of this conversation, and I am going to direct this question I think to Mr. Gelzinis, and then, Ms. Waite, I have a question for you afterwards I would like to try to get to.

Recently, our Republican colleagues sent a letter to Chair Powell questioning the need for assessing climate-related risk, saying, and I quote, "Financial regulation does not and should not seek to guard against every type of unforeseen event."

So, Mr. Gelzinis, is climate change an unforeseen event?

Mr. GELZINIS. No. It is a high-impact, high-probability event.

Senator SMITH. And will climate change affect asset valuations in the market?

Mr. GELZINIS. Absolutely. It already is. And because of climate change's nonlinear effect, it is only going to get worse?

Senator SMITH. And is this a small risk, as some of our panelists have been posing? Or is it big?

Mr. GELZINIS. No, it is a massive risk that impacts a wide range of asset markets, a wide range of financial institutions.

Senator SMITH. And isn't it the job of the SEC to protect investors and to maintain a fair and orderly efficient market? And wouldn't understanding that climate risk be an important part of their job, therefore?

Mr. GELZINIS. Absolutely. Climate change intersects with each aspect of that mission that you just outlined.

Senator SMITH. And isn't it the job of the Federal Reserve to promote the soundness of financial institutions? And wouldn't that include understanding climate risk?

Mr. GELZINIS. Absolutely. Both the safety and soundness of individual firms, which are undoubtedly exposed to these risk—think, you know, a \$20 billion bank in the oil patch or, you know, a \$50 billion bank overly exposed to coastal real estate, but also given the magnitude, the stability of the banking system and financial sector as a whole.

Senator SMITH. Well, thank you for that. I think it is just important to clarify and understand what it is that we are talking about here. And so I appreciate that.

Let me turn to Ms. Waite. You in your work at the foundation are talking about mobilizing private capital to address climate risk, and I want to just get your take on this. How would standardized climate risk disclosures support more efficient deployment of private capital to address the climate crisis? What impact would that have on how we are efficiently deploying private capital?

Ms. WAITE. So thank you for your question, Senator. Both investors and lenders rely on information to make decisions. So having this climate disclosure that the tons of carbon dioxide equivalent for each financial assets class disclosed—measured, disclosed, and reduced, that would enable investors and lenders to make better decisions to manage away from the carbon-intensive assets toward the low-carbon ones.

Senator SMITH. Now, I think heard one of the panelists here today saying that some attempt to assess climate risk would—first of all, that—he kept using the word “fantasy,” but what he seemed to be saying was that assessing climate risk would in some way distort the market. Could you explain—what do you think about that view?

Ms. WAITE. To the contrary, it would actually help protect the market and make better decisions so that we support those activities and financing those activities that do not put our financial system in danger. So it is actually the contrary. Actually, the market has spoken. One out of every \$3 now invested in sustainable funds, investors are calling out for the ESG, ETFs have doubled in 2020 alone. Over 100 financial institutions or banks and asset managers are now measuring and disclosing the carbon emissions of their loans and investments. So this is happening.

Now, it is the regulators' opportunity and job to actually step in and make sure that all institutions are doing this so that the entire system can work for this transition.

Senator SMITH. Well, thank you. I could not agree more. I appreciate all of you being here, and thank you very much, Mr. Chair.

Chairman BROWN. Thank you, Senator Smith.

Senator Cortez Masto from Nevada is recognized for 5 minutes.

Senator CORTEZ MASTO. Thank you, Mr. Chair. I appreciate this conversation.

Let me start with Mr. Keohane and then follow through. Isn't it really true that at this juncture it is the investors that are demanding to know how companies are confronting the risks and opportunities posed by our changing climate and environment? Isn't that true that is what is happening today, right?

Mr. KEOHANE. Yes, that is true. That is exactly right, Senator.

Senator CORTEZ MASTO. And so really it is the investors demanding—no matter what we want to say here as politicians in this room, it is the investors that are demanding to know this. Aren't they entitled to have this information?

Mr. KEOHANE. Well, I certainly think so, Senator. As an economist, I think, you know, the free and transparent flow of information is critical to well-functioning markets and to investor choice. And I would say the only reason that disclosure would result in reallocation of capital away from fossil fuel companies is because investors might think there is a pretty big risk associated with investing in fossil fuel companies.

But nobody is demanding that reallocation. It would be the result of investors making free and informed choices.

Senator CORTEZ MASTO. Thank you. Now, I am from Nevada, and our hospitality industry and tourism industry has been so devastated. Can you explain how investments in hospitality and tourism might be affected by physical and transition risk due to the extreme weather events brought on by climate change?

Mr. KEOHANE. Well, Senator, I would be happy to get back to you with specifics around your State and hospitality. I will say in general that it is the shifting risks and uncertainties that have to do with climate change that present this risk. What we see—maybe one point I will draw on in this regard that the CFTC report I cited makes very clear. It is not only a question of risk to the entire economy, risk, you know, to big banks. It is also a question of concentrated geographical risk, what the report called "sub-systemic risk," whether that is agricultural lenders, whether that is commercial real estate and small banks in coastal areas, or whether that is something like the hospitality industry in places that rely heavily on it.

So it is those concentrated risks that mean there can be vulnerability and, I think Greg used the word, "microprudential" issues associated with particular sectors or regions that are vulnerable to climate risk, and that is where there is a need for greater information and disclosure and regulation.

Senator CORTEZ MASTO. Thank you. And let me ask Mr. Gelzinis and Ms. Waite, do we actually have the modeling technologies we need to adequately evaluate the climate-related risk?

Mr. GELZINIS. I will go first. I think they are certainly improving, but we will not get there if we do not get the underlying data that needs to fit into those models, which is another reason why disclosure is so important. And we certainly will not get there if regulators are not building up their own capacity.

Senator CORTEZ MASTO. Right. Ms. Waite, what do you think?

Ms. WAITE. I agree, and I would also add that in order to get the models in shape, the regulators have to request and demand the

data. So the tons of CO2 for each financial asset class has to be disclosed for models to be built that actually gives a better sense of what is happening in the real economy through investments made by lenders and other investors.

Senator CORTEZ MASTO. Thank you. Thank you for this incredible conversation today.

Mr. Chairman, I yield the remainder of my time.

Chairman BROWN. Thank you, Senator Cortez Masto.

Senator Warnock from Georgia is recognized for 5 minutes.

Senator WARNOCK. Thank you so very much, Mr. Chairman, for having this important and timely hearing on how we can address the impact of climate change on our financial system. I am grateful for all the panelists.

I wanted to talk more about the climate-related impact on housing, particularly among communities of color. As you know, many Black and brown communities were once forced to purchase homes in less desirable neighborhoods and an unlawful practice that is known as “redlining” is a way in which that continues. These same communities are at higher risk of losing their homes to flooding caused by climate change. I think folks knew for a long time prior to Hurricane Katrina what happened in the old 9th Ward was predictable. We knew that when a storm, the right storm, came through that those folks were in an incredibly vulnerable position. And, again, communities of color were forced into these areas.

A recent report examined nearly 40 metropolitan cities and concluded that homes purchased in these redline areas were 25 percent more likely to suffer from climate-related flood damage compared to homes in non-redlined areas. Not only did the findings in this report confirm the racial disparities within our housing market, they also confirmed that these unjust lending practices have now presented significant concerns to our financial system.

And so my question is for Mr. Gelzinis, Dr. Keohane, and Ms. Waite. How can Congress and Federal regulators— what can we do to lessen the climate-related economic impact on historically disadvantaged communities and also on our overall financial system? What should we be doing in terms of public policy right now to take this issue seriously?

Mr. GELZINIS. Great. Thank you, Senator. I just want to reiterate your point that it is all too clear that climate change just simply magnifies and exacerbates the racial injustice that is already embedded in our economic systems. So the same communities of color that were historically redlined now face the most severe physical risks like the flood risk that you mentioned, but also temperatures. Redlined parts of major metropolitan areas are several degrees warmer than other neighborhoods due in part to the lack of green space there.

So in terms of policies, I think the Community Reinvestment Act is critical, and climate resilience and adaptation mitigation efforts should be integrated into the Community Reinvestment Act. I think the Community Development Financial Institution Fund that Treasury, the appropriation there could be increased and green criteria added as well to make sure community finance, particularly in communities of color, are helping finance the transition.

Then it is outside the scope of my work, but I would just note that public finance and fiscal policy have a huge role to play here as well. And if disproportionate harms go to communities of color, then disproportionate funding needs to go to those communities of color as we build this new economy.

Senator WARNOCK. Yes, Ms. Waite.

Ms. WAITE. So I will mention two things. The first is that the Federal Housing Finance Authority can do a lot. Fannie Mae's remarkably successful Multifamily Green Mortgage Program accounts for just over 20 percent of their multifamily mortgages. So the FHFA can expand these commitments to addressing climate change and climate resiliency.

The second is to really ensure that the existing CRA, Community Reinvestment Act, explicitly calls out climate resiliency and climate change mitigation efforts. The other thing would be to create a new CRA mirror-like mandate on banks and other lenders so that they must lend a certain percentage of their assets into climate infrastructure in disadvantaged communities and communities that are likely to be impacted by climate change.

Mr. KEOHANE. I will just basically echo what my colleagues on the panel have said, Senator. I think it is critical that we make more investment, both public investments with Government funds but also help leverage private investment, into investing in those communities, communities of color that have been historically burdened, that are more vulnerable to climate change, as you have said, but also have been historically burdened by pollution and toxic chemicals.

So I think there is a huge amount of need there to direct funds and to make investments in coastal infrastructure and resilience, as my colleagues have said.

Senator WARNOCK. Thank you very much. We have seen more recently financial regulators take more seriously the impact of climate on our larger financial system, but as you point out, we have got to do much more. So thank you for your insights.

Chairman BROWN. Thank you, Senator Warnock.

Senator Toomey, before I close, do you have comments or another question or two?

Senator TOOMEY. Mr. Chairman?

Chairman BROWN. Yes?

Senator TOOMEY. Yeah, if you are going to make a closing statement, I would just make a brief statement.

Chairman BROWN. Sure.

Senator TOOMEY. Would you like me to do that now?

Chairman BROWN. Yeah, sure. Please proceed. Thank you.

Senator TOOMEY. Thanks for doing this hearing. Let me just say, you know, I believe that climate change is real. I think human activity is an important cause. But as Dr. Cochrane reminded us, climate change is not some unforeseen risk. It does not pose a risk to our financial system. And financial regulators who have no legal authority to regulate climate and have no expertise regarding climate change should not attempt to regulate a non-risk to our financial system.

Let us be clear what this is really all about. This is about undermining the independence of regulators so that they can be pres-

sured to allocate credit as the political left would like it to be allocated. Now, if people get their way on this and we start to have a political allocation of capital, that will result in slower economic growth, fewer jobs, lower wages, and a diminished standard of living. That is why this is a bad idea.

Thank you, Mr. Chairman.

Chairman BROWN. Thank you. I will close in a moment. I have one more question. But we have heard about a lot of complex topics in this hearing. It is a big, complicated issue, of course. But to be clear, the Fed and other agencies cannot just care about what partners on Wall Street or professors at business schools or people at think tanks think is important. They have to look at factors outside the movement of money between and among banks. Look at something like cybersecurity. The Fed is not staffed with computer programmers, but we all agree it is part of their job—and several have said that in this hearing—to take on cyber risk.

I want to end by bringing us back to why all this matters in people's lives. It is what I try to do at every hearing, on Tuesday with housing and again today, what it means when somebody is foreclosed on, what it means to a family.

We know what climate can mean to paychecks and savings and communities. In Ohio, the combination of wetter springs and heavier rains and hotter summers has increased algae blooms across Lake Erie. It is the shallowest of the Great Lakes, and it is the most vulnerable in that way. Fewer tourists rent cottages or charter fishing boats, less money going to small business and supporting local communities in places like Sandusky, local economies and communities in places like Sandusky and Clinton and Lorain and Toledo. I hear it in conversations with people at Put-in-Bay on Lake Erie. It means less and less money in their pockets every summer.

So I will close with asking Ms. Waite and Mr. Gelzinis and Dr. Keohane, could each of you just briefly, very briefly, talk about the moment you realized that climate change is going to affect people's jobs and local economies, and probably sooner than we think? Think back to the moment you first thought that and describe it briefly to us. Ms. Waite, if you would start?

Ms. WAITE. Yes, thank you, Senator, Chairman, for the question. I remember quite clearly in August 2005 when Hurricane Katrina hit, and that cost exceeded \$150 billion. That was the first time I recognized that this was going to be extremely important for the economy and for the financial system.

Chairman BROWN. Thank you, Ms. Waite.

Mr. GELZINIS. So for me personally, Mr. Chairman, it was really a compounding effect of the increasingly severe and frequent extreme weather events around us and really coming to understand that decarbonization was going to fundamentally restructure the economy. So I think when you have an issue as wide-ranging and of that magnitude, anyone working in public policy should ask: Does this issue intersect with my work? And the answer here was quite clearly yes.

Chairman BROWN. Dr. Keohane.

Mr. KEOHANE. Thank you, Chairman. I have devoted my career to working on climate, but I guess if there was one particular in-

stance that made me really realize the nature of extreme weather, it was Superstorm Sandy. I live in New York City. The city shut down, and then we saw the devastation out on Long Island and in New Jersey, which Senator Menendez referred to. So that was for me a moment where it really hit home.

Chairman BROWN. Thank you very much, Mr. Keohane.

Senator Ossoff has appeared, and he will have the last 5 minutes for questions. Senator Ossoff from Georgia, please proceed.

Senator OSSOFF. Thank you, Chairman Brown, and thank you to our panel.

Mr. Gelzinis, what do you assess to be the most significant risks to financial stability or the financial system that are associated with climate change?

Mr. GELZINIS. So the issue that I think, you know, would really be catastrophic is a simultaneous or near-simultaneous transition and physical risk event. So let us say, unfortunately, policymakers or regulators delay taking the necessary legal and regulatory steps to decarbonize; climate change continues to get worse; and then we have a brutal string of natural disasters and extreme weather events over, let us say, 18 months across the country, starting to erode the resilience of financial institutions. And then that spurs public action to rapidly decarbonize the economy and make up for the lost time that occurred before, devaluing a whole host of carbon-intensive assets that financial institutions had not started to wean down and bolster their resilience to, and so you would have both physical and transition effects impacting the financial system at the same time, potentially destabilizing it.

That is the thing that would scare me the most.

Senator OSSOFF. Thank you. Could you please unpack in a little bit more detail the chain of events and financial instruments, mechanisms, asset classes, relationships that in such a high-stress event could cause there to be systemic risk to the stability or solvency of major financial institutions?

Mr. GELZINIS. Yes, there are multiple ways that this could play out. So, first off, any risk to a systemically important financial institution, a too-big-to-fail bank, automatically becomes a macroprudential concern or a financial stability risk concern, because if one of those big banks failed, it is going to bring down the rest of the system with it.

But you could also have correlated stress across a range of financial institutions, so let us say you had, you know, a range of \$70 billion to \$300 billion banks that were overly exposed to carbon-intensive sectors that led to, you know, as former Bank of England Governor Mark Carney noted, a “climate Minsky moment” where the carbon bubble bursts. There are rapid sell-offs and fire sales, impaired assets. Creditors start to run from the institutions that they think are exposed to those risks but may not have the transparency to know which institutions they are, so they pull out from a lot of institutions. And then that creates the first and second order effects that we know occur with, you know, financial crises and would impact financial institutions that were not even exposed to that climate-related shock in the first place.

Senator OSSOFF. Thank you. And in what ways and for what reason do you believe that markets are not currently accurately pricing such risks?

Mr. GELZINIS. So I would say two things about that, Senator. So the first is institutional investors, when they are polled on this, all—I think it was over 90 percent said that they do not think that these risks are being appropriately priced in because they do not have the data and the information to price them in.

The second point I would make is that even if risks were priced in, there would still be an important role for financial regulators to play around tail risks. So if you think about what it means to price in a risk, it means you have, you know, a weighted distribution of probabilities, and oversimplifying here, but you pick the median expected outcome and price it based on that. So financial regulators would still have a role to play in some of the tail scenarios that could play out with both the physical and transition risk that, you know, climate change poses.

Senator OSSOFF. I want to return to the previous question briefly, and I think one of the things I am trying to unpack here is whether we are talking about addressing risks to financial stability resulting from shocks associated with climate change or whether we are talking about economic policy and macroprudential policy as a means of mitigating and combating climate change, both of which I think could have merit as policy strategies.

But can you please unpack for me again, with a little bit more specificity, how, for example, a series of severe weather events or climate-associated shocks could cause such stress in financial markets or such a precipitous reduction in the value of certain assets that it could pose a threat to systemic financial stability?

Mr. GELZINIS. Sure. So one example that I would use is go back to Hurricane Andrew in the early 1990s. Insurance companies were looking—you know, they did not have advance catastrophe risk models at the time. They were kind of ballparking prices based on what they had always priced that risk at. Then all of a sudden, something happened that they were not expecting, and it wiped out 16 insurance companies. At the time we did not really have global interconnected insurance companies like AIG, but imagine if, you know, some sort of climate event on a much larger scale, if we had a couple hurricanes in the Southeast, wildfires raging in the West, and droughts and pests reducing crop yields in the Midwest. If that erodes the resiliency and drives losses at systemically important interconnected financial institutions like an insurance company or a major Wall Street bank, then the risk factor would be very similar to the financial crises we have seen in the past in terms of runs, fire sales, and a credit contraction for the real economy.

Senator OSSOFF. Thank you. I appreciate that. I am sadly out of time. Something I would like to address to all the panelists for the record, you mentioned crop yields, and I think that one of the things I would like to unpack a bit more is the impact on price stability and the impact on political stability that could result from effects on agriculture from some of the modeled climate scenarios. But, alas, I do not have the time right now, and I see Mr. Cochrane is shaking his head, eager to address that question for the record. So you will all have the opportunity to do that.

I thank you again for being here today, and I yield back, Mr. Chairman.

Chairman BROWN. Thank you, Senator Ossoff.

Thanks to the witnesses for being here today and providing testimony. For Senators like Senator Ossoff who wish to submit questions for the record, those questions are due 1 week from today, on Thursday, March 25th. For witnesses, you have 45 days to respond to these questions.

Thank you all for your participation and your civic-mindedness. The Committee is adjourned.

[Whereupon, at 12:12 p.m., the hearing was adjourned.]

[Prepared statements, responses to written questions, and additional material supplied for the record follow:]

# PREPARED STATEMENT OF CHAIRMAN SHERROD BROWN

Today, the Banking and Housing Committee is holding its first-ever hearing on the risk climate change poses to our economy.

That also makes it the first time our Committee will consider all the economic opportunities that exist by addressing climate change.

More than ever, people in Ohio and around the country are experiencing how climate change affects their lives—from devastating hurricanes to raging wildfires, from harmful algal blooms in Lake Erie, to landslides in Cincinnati, to erratic farming seasons across the Midwest.

People aren't stupid. They see what's happening, and they know it threatens not only their air and their water, but their livelihoods and their homes.

And they also know that there are all sorts of opportunities, in communities in every state that come with taking climate change seriously.

They see the wind turbines across the Great Plains made with American steel. They see people installing solar panels made in Toledo at one of the biggest solar energy manufacturers in the country.

We can't have a 21st Century economy built on a 19th Century model—that doesn't make environmental sense. It also doesn't make economic sense.

If we want an economy that creates jobs and improves infrastructure in all communities, and allows our businesses and our workers to compete around the world, then instead of running from these opportunities, we have to seize them.

I want to be clear: it's not the role of this committee to vilify—or even prop up—any specific technology or any source of energy. The work of coal miners in Belmont County, Ohio has every bit as much dignity as the work of a battery manufacturer in Fremont, Ohio.

We show those workers no respect if we don't plan now for how we're going to protect their communities from flooding and drought and economic upheaval, and protect their retirement and kids' college savings from risky investments.

On this Committee, we're charged with looking at anything that could hurt the stability of our economy.

This is a set of issues my Democratic colleagues have talked about for a long time.

And a lot of what we'll talk about today got a jump start last year when now-Acting CFTC Chairman Rostin Behnam created his Climate-Related Market Risk Subcommittee.

The Subcommittee put out an important report, "Managing Climate Risk in the U.S. Financial System."

And just yesterday he announced he's establishing a Climate Risk Unit (CRU) in CFTC to focus on the role of derivatives in understanding, pricing, and addressing climate-related risk.

I would like to ask unanimous consent to enter the CFTC subcommittee report, "Managing Climate Risk in the U.S. Financial System," into the record for this hearing.

Being on the lookout for risk is our job here.

We can't always predict what it might be—it could be the business decisions of a few bad actors in a particular industry. Or we might be forced to act because of events beyond our borders.

In this case, though, we can predict something that's going to hurt the economy. We know that climate change threatens the country's financial stability.

And the financial sector, and the government agencies that oversee it, are going to have to reckon with the consequences of decades of risky investments in industries that fuel natural disasters, and threaten people's paychecks and their retirement security.

For years, the biggest corporations have fought government action on climate change because CEOs could make a lot of money in the short term by endangering our planet in the long term. And then these corporations and these CEOs expect workers and their families to foot the bill.

We can't protect the economy—and the people who make it work—if we don't start by identifying the risks.

We know far too little about how much climate-related risk is sitting on the books of banks and insurance companies.

It's not a surprise that Wall Street is trying to hide just how heavily they've invested in corporate polluters. This lack of transparency about the largest U.S. banks' significant investments in long-term fossil projects here and abroad hides potential financial risks.

Those are risks that workers and families investing their pensions and 401Ks are going to pay the price for.

We need to know where Wall Street is investing people's hard-earned savings. And if it's invested in shrinking industries that threaten their jobs and their communities, we need to know about it.

That means looking at stronger transparency rules, and it means looking at whether the tools financial watchdogs already have can help us shine a light on these risks.

While some large banks and other companies have voluntarily disclosed some of their investments, not enough of them have, and they aren't moving fast enough. We needed this years ago.

Look around—climate-related disasters are already here, and they're already grinding local economies to a halt, forcing people out of work, and destroying their communities.

The second polar vortex in a decade to cripple Texas is not far behind us, and we're approaching what some are predicting will be an above-average hurricane—those are economic risks.

Persistent drought leaves the Mountain West dealing with wildfires that rack up multibillion dollar economic losses year after year, in fire seasons that are so constant they've ceased to be seasons—that's an economic risk.

Farmers in the Plains states lost an entire planting season because of wet fields or flooding that once would have been shocking, but now is all too common—that's an economic risk.

A three-day downpour flooded more than 100,000 homes in Houston, forced hundreds of thousands of people out of their homes, and ground commerce to a standstill at one of the three busiest ports in the country—with effects like that, it's hard not to think that the only way you could fail to see an economic risk, is if you're being paid not to see one.

It's also not enough to just think about the climate risks to companies' balance sheets or stock prices—the financial industry, and our government, has to take into account the risks to people's livelihoods, the communities they live in, the food they eat, and the investments they've made for their retirements.

As we look for opportunities, we need to make sure that American industry—steel and aluminum, paper and autos—can access the capital they need to reduce or eliminate emissions.

And when we increase transparency across the financial sector and take into account the clear economic costs of climate change, then lenders, industry, and workers will be rewarded by making these capital investments.

Today we'll hear from five witnesses who will share their insights and expertise on those risks, and the opportunities we all have to protect and rebuild our economy. I hope my colleagues will keep an open mind.

Every day that we delay is another missed opportunity to invest in new industries and technologies, to make our businesses more competitive, and to create jobs in communities that are so often left behind.

And if we don't tell people the truth and take this seriously, we know who is going to pay the price.

It's never CEOs. It's never the corporate boards. It's never senators.

It's going to be the ranchers in North and South Dakota, and the line cook in New Orleans, and the kindergartner with asthma in Las Vegas, and the steel worker in Cleveland.

It's their jobs and their savings and their futures on the line. And it's our job to be on their side.

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#### **PREPARED STATEMENT OF GREGORY GELZINIS**

ASSOCIATE DIRECTOR, ECONOMIC POLICY, CENTER FOR AMERICAN PROGRESS

MARCH 18, 2021

Chairman Brown, Ranking Member Toomey, and Members of the Committee: Thank you for the opportunity to testify before the Committee on this critical issue. My name is Gregory Gelzinis. I am an Associate Director for Economic Policy at the Center for American Progress, where I research, and advocate for, policies that would create a safer, more stable, and less predatory financial system—one that is well-positioned to support long-term economic growth.

The coronavirus pandemic has proven to be a terrifying reminder that our collective livelihoods can be upended by catastrophic exogenous shocks, seemingly at a moment's notice. It is incumbent on policymakers to use this experience as a catalyst towards addressing the impending exogenous shock that will likely disrupt our

lives on a much greater scale: climate change. The climate crisis has profound implications for life and health, as it challenges our very ability to sustain a habitable planet. Climate change is also going to have a fundamental impact on every sector of our economy, including the sector we are here to discuss today: the financial sector.

The increase in frequency and severity of extreme weather events and long-term environmental shifts threatens an array of real assets and financial assets. From commercial and residential real estate exposures along the coast to agricultural lending in the Midwest, climate change could severely impair the value of physical collateral, disrupt supply chains, limit economic activity, increase financial uncertainty, and strain profitability. These effects would reduce real-estate and commodity values, lower corporate equity prices, and limit the ability of businesses and households to repay debt.

In addition, the financial system is exposed to transition-related risks. If policymakers take the legal and regulatory actions necessary to meet emissions and temperature targets, financial institutions whose balance sheets don't align with the transition could face significant losses. Financial instruments tied to carbon-intensive sectors could face a severe repricing as policies restrict and raise the costs of emissions. Under certain scenarios, financial institutions could adjust to these transition effects abruptly, bursting the carbon bubble and creating what former Bank of England Governor Mark Carney has coined a "climate Minsky Moment."

Climate change does not only present risks to individual institutions. It also poses a systemic threat due to the potential magnitude of the physical and transition-related risks, the wide array of financial institutions and markets exposed to these risks, and the speed with which these possibly correlated risks could materialize.

These risks aren't theoretical. In just the past two years we've seen arguably the first climate bankruptcy in PG&E and witnessed energy companies, like BP and Total, write down the value of stranded assets, as energy price assumptions are recalibrated.

The financial sector is finally starting to adjust to these risks and recent net-zero commitments from the largest Wall Street banks are a welcome development, although such commitments have been light on the details and lack near-term plans to meet those long-term goals. But it is critical for regulators to step in and account for these risks in the supervision and regulation of the financial system. We can't let Wall Street write the rules and rely upon the disproven strategy of self-regulation, especially as these firms continue to finance the very drivers of the climate crisis that put their own balance sheets, as well as those of responsible firms, at risk.

Financial regulators have broad responsibilities under existing law to mitigate these climate-related risks. Markets regulators have a responsibility to protect investors, to promote transparency, and to foster healthy markets for securities and derivatives. Prudential regulators have a statutory mandate to ensure the safety and soundness of financial institutions and to promote the stability of the financial system. Climate change clearly falls within these mandates and a failure to mitigate climate-related risks would violate the duties Congress bestowed upon the financial regulators.

Thankfully, over the past few months a bipartisan collection of U.S. financial regulators have acknowledged that climate change falls within their remit. Even though the U.S. is several years behind its international peers, recent actions and announcements by the White House, Treasury Department, Fed, SEC, CFTC, FHFA, FDIC, and state-level regulators signal that momentum is building.

Like many economic variables, these risks won't be easy to model or quantify, given the inherent uncertainty climate change entails. But the potential magnitude of the risk demands regulators employ a precautionary principle and safeguard the financial system from the worst outcomes. Integrating climate change into corporate and financial disclosure requirements, fiduciary obligations, stress testing, supervision, capital requirements, and systemic risk oversight would bolster the resilience of the financial system and position it to serve as a source of strength to the economy during the low-carbon transition. If regulators fail to act with sufficient speed or refuse to use their full panoply of tools, it is imperative for Congress to insist that they do so. The stakes are too high.

### **Climate Change Poses Significant Risks to Financial Institutions and Markets.**

Climate change has fundamental implications for every sector of the economy, including the financial sector. Physical risks and transition risks are the two primary transmission channels through which climate change could impair financial institutions and markets. Physical risks stem from the increase in frequency and severity of extreme weather events and long-term environmental changes.<sup>1</sup> Transition risks

refer to the potential impact that climate policy interventions, clean energy technological advancements, and shifts in consumer and investor sentiment can have on carbon-intensive financial exposures.

#### *Transition risks*

In order to stabilize global temperatures and mitigate the chances of catastrophic climate impacts on the planet, climate policymakers must take legal and regulatory steps to drastically decrease greenhouse gas (GHG) emissions. The Paris Agreement, signed by the U.S. and 190+ other parties in 2015, aims to limit global temperatures to well-below 2 degrees Celsius above preindustrial levels, and ideally 1.5 degrees Celsius.<sup>2</sup> The Intergovernmental Panel on Climate Change's special report in 2018 underscored the imperative to keep warming to 1.5 degrees Celsius, given the severe consequences associated with even 2 degrees of warming.<sup>3</sup> The scientific projections suggest that global emissions must reach net-zero by 2050 to plausibly hit the 1.5 degree Celsius temperature target.<sup>4</sup> Achieving these climate goals requires a fundamental restructuring of the economy. This low-carbon transition isn't several decades away. In many respects, it has already begun. But further robust policy changes are required in the near-term to hit these targets and avoid catastrophic impacts on communities and the economy. Emissions must decline by at least 45 percent from 2010 levels by 2030 to remain on track.<sup>5</sup> The U.S. presently derives roughly 20 percent of its energy from clean sources, while 80 percent is derived from fossil fuels.<sup>6</sup> President Biden has committed to put the U.S. on a path to achieve 100 percent clean energy by 2050.<sup>7</sup>

If climate policymakers implement the legal and regulatory actions necessary to meet these emissions and temperature targets, financial institutions whose balance sheets don't align with the transition could face significant losses. Financial instruments tied to carbon-intensive sectors, e.g., fossil fuel companies, fossil-driven utilities, transportation, agriculture, chemical production, and mining and metals, could face a severe repricing as policies restrict and raise the costs of emissions. Companies engaged in high-carbon activities would face increased costs and the potential for fully or partially "stranded assets".<sup>8</sup> For example, the implementation of rigorous energy efficiency standards and other policy interventions that limit emissions would severely diminish the value of hydrocarbon reserves. Fossil fuel companies would have to write down the value of those stranded assets on their balance sheets, impairing their financial condition and reducing their ability to meet their financial obligations. This dynamic would create losses for their equity investors, creditors, and counterparties. Moreover, bank loans to fossil fuel companies are often secured by hydrocarbon reserves. Transition-related risks can therefore increase the likelihood of the loan's default, as well as the loss to the bank if the loan defaults, since the collateral would lose value.<sup>9</sup> This risk is not theoretical, as companies are beginning to face the prospects of transition-related write-downs. For example, British Petroleum wrote down \$17.5 billion in assets in June 2020 after lowering its long-term fossil fuel price assumptions and Total SE took a \$7 billion hit on Canadian oil sands assets in July 2020.<sup>10</sup>

The magnitude of potential financial losses and the prospect for broader stability issues in the banking system increase if the transition is "disorderly". Under such a scenario, policymakers slow-play the actions necessary to meet emissions and temperature targets, before eventually taking more aggressive and rapid actions to make up for lost time. Financial losses in the energy sector alone could reach \$1-4 trillion, depending on the extent to which the transition is disorderly.<sup>11</sup> Taking a broader view of transition-related risks, an estimate from IRENA suggests an abrupt and disorderly transition could cause upwards of \$20 trillion in financial losses.<sup>12</sup> Technological advancements and changes in investor sentiment could also quickly trigger many of these dynamics in advance of any actual legal or regulatory changes.

In either an orderly or disorderly scenario, financial institutions whose holdings and exposures are not aligned with a low-carbon economy could face severe losses, increasing risks to the economy, communities, and public funds. Research suggests that the direct and indirect exposures to carbon-intensive sectors could propagate stress throughout the financial system and disrupt financial stability.<sup>13</sup> These transition-related risks impact credit, market, reputational, operational, and liquidity risks.<sup>14</sup> If financial institutions do not adjust to these transition-effects in a timely manner, the crystallization of losses could occur abruptly, bursting the carbon bubble and creating what former Bank of England Governor Mark Carney has coined a "climate Minsky Moment".<sup>15</sup>

A survey of institutional investors suggests the financial system is not reflecting these risks in asset prices, as 93 percent responded that the implications of climate change had yet to be priced into markets.<sup>16</sup> Research surrounding the projected

physical impacts of climate change and scenario analyses probing transition-related impacts support this view held by institutional investors.<sup>17</sup> There are several reasons that investors have yet to price the impacts of climate change into valuations for a range of assets. These include a lack of granular, comparable, and reliable corporate disclosure of climate-related risks; backwards-looking pricing models that are not fit for purpose when analyzing forward-looking risks; and the temporal mismatch between short-term corporate thinking and medium-to-long term climate risk materialization.<sup>18</sup>

It's important to note that the low-carbon transition also provides incredible opportunities for financial institutions to finance clean energy projects and an array of green assets. It's going to take both public and private finance to fund the decarbonization of the economy and banks and companies that are safeguarded from transition-related risks will be best positioned to take advantage of these opportunities.

#### *Physical risks*

The current concentration of greenhouse gases in the atmosphere is significantly higher than it has been at any point in the last 800,000 years.<sup>19</sup> To maintain stable temperatures, energy coming into the planet must be balanced by energy leaving it. Greenhouse gases, particularly carbon dioxide, allow energy into the atmosphere, but trap energy as it attempts to leave-skewing the balance and increasing global temperatures. To this point, the earth has warmed by 1 degree Celsius, above pre-industrial levels. As a result, sea-levels are rising at an unprecedented rate-driven by melting ice sheets and the expansion of seawater as ocean temperatures rise.<sup>20</sup> Not only are sea-levels rising, but oceans are becoming significantly more acidic.<sup>21</sup> These environmental changes are driving more frequent and severe extreme weather events across the globe. The physical impacts of climate change have severe implications for life and health, and the overall ability to sustain a habitable planet. And, directly relevant to this hearing, they also pose risks to various economic sectors and the real and financial assets tied to them.

Under severe warming scenarios, the physical impacts of climate change could drive at least \$2 trillion in losses to GDP annually (in today's dollars) by 2100, or loosely speaking, the economic equivalent of the 2008 financial crisis every 5 years.<sup>22</sup> Even under more moderate warming pathways, macroeconomic impacts could be severe.<sup>23</sup> The real-estate sector faces some of the most acute physical risks. Improved flood data, for example, shows that over 14 million properties could be at risk from 100-year floods.<sup>24</sup> The outdated FEMA maps estimate that only 8.7 million are at risk.<sup>25</sup> Zillow mapped flood risk data onto its real estate data and estimated that roughly \$900 billion in homes face serious risk from rising sea-levels, and that was prior to the publication of the aforementioned research on flood risk.<sup>26</sup> Climate change is already impacting agriculture.<sup>27</sup> Climate change erodes the quality of soil, increases invasive species and crop diseases, and leads to more frequent droughts and floods.<sup>28</sup> These physical impacts drive down crop yields and drive commodity price volatility. The fishing sector is also impacted by warmer and more acidic oceans.<sup>29</sup> The physical risks of climate change also impact the retail and tourism sectors and will have effects on a wide range of businesses and industries in affected geographic areas.<sup>30</sup>

The impact of sea-level rise, warming global temperatures, and more frequent and severe floods, hurricanes, droughts, wildfires, and other natural disasters could drive up losses for insurance companies, banks, private funds, investment companies, pension funds, and other market participants invested in exposed assets.<sup>31</sup> These risks threaten to reduce the value of a range of real assets and financial instruments tied to commercial and residential real-estate, agricultural lending, commercial and industrial lending, municipal and corporate bonds, and commodities. Physical risks can impair physical property, disrupt supply chains, limit economic activity, increase financial uncertainty, and strain profitability, which reduce real-estate and commodity values, lower equity prices, and limit the ability of borrowers to repay debt.<sup>32</sup> They can also directly damage and reduce the value of collateral that secures credit extended in some of these markets. In addition to the credit and market risks posed by the physical effects of climate change, they threaten to significantly increase claims for an array of property and casualty insurance business lines. Some may argue that many of these real assets and financial assets are or could be insured, protecting the financial institution or investor from losses.

Insurance companies, however, may, and in some cases have already started, to reduce the availability of insurance in certain geographies and business lines.<sup>33</sup> That would leave other financial actors increasingly exposed to physical-risk losses. Even if insurance companies stay in these impacted markets or geographies, the difficulty in modeling the non-linear effects of climate change could leave insurance

companies themselves overly exposed to physical risks.<sup>34</sup> Similarly, given the non-linear nature of the risks, the credit default swap and debt markets will continue to have difficulty accurately pricing these risks, which can impact single issuers, geographic regions, or whole industries. Rapid re-pricings of debt securities may also impact equity and options holdings of the underlying issuers. Put simply, financial instruments tied to the fates of companies and municipalities, which may be held by public or private fund investors, pensions, and even individuals, may suffer significant losses.

These risks are not theoretical, and they are not far off in the distance. They are already here. Severe weather events have caused \$106 billion in damage a year on average over the past 5 years, significantly higher than the 1980-2019 average of \$43.9 billion.<sup>35</sup> Based on the projected intensification of these events, they could trigger trillions of dollars in losses for financial institutions and investors exposed to these assets in the coming years and decades.<sup>36</sup> Many have labeled the wild-fire driven bankruptcy of the utility company PG&E in 2019 as the first climate-related bankruptcy, initially wiping out around \$20 billion in market capitalization (roughly 85 percent of the late 2018 level).<sup>37</sup> Even if policymakers are successful in limiting warming to 1.5 degrees Celsius above pre-industrial levels, extreme weather events will be substantially more severe and frequent than they are today and long-term environmental shifts will continue to progress. Today, the world has warmed about 1 degree Celsius above pre-industrial levels and the destructive impacts are clear. Another 50 percent increase in warming will meaningfully exacerbate the physical impacts of climate change—and that's under the best-case scenario. It's worth underscoring that low- and moderate-income communities and communities of color are likely to be the hardest hit by physical risks and the least able to financially bear the resulting costs. Meanwhile, it is these very same communities that disproportionately suffer the consequences of the industrial pollution produced by the very drivers of the climate crisis.<sup>38</sup>

**Financial regulators have a statutory responsibility to mitigate climate-related risks to financial institutions, investors, and the stability of the financial system.**

A few years ago, it was a common refrain among some financial regulators that climate change fell outside their core mandates. To be clear, financial regulators are not being asked to set climate policy. That is the responsibility of Congress and other executive agencies. Financial regulators are simply being asked to do the jobs Congress assigned—to protect the financial system and broader economy from damaging financial risks.

Thankfully, many financial regulators—both Democrats and several Republicans appointed by President Trump—now acknowledge that climate-related financial risks fall squarely within their statutory mandates.<sup>39</sup> It is rapidly becoming a broadly bipartisan issue. But the original refrain, and the idea that efforts to get financial regulators to focus on climate-related risks are “the left” pushing a social engineering project, still appears in some corners.<sup>40</sup> It is therefore worth briefly clarifying how the aforementioned climate-related financial risks intersect with the mandates and authorities of various regulators. The specific policies that financial regulators can and should implement to mitigate climate-related financial risks are discussed in greater detail in Section IV of this testimony.

*Markets regulators*

The Federal securities laws were created to ensure that investors and the public have essential information about companies so as to promote the efficient allocation of capital and protect investors. As Congress explained when adopting the Securities Act of 1933,

Whatever may be the full catalogue of the forces that brought to pass the present depression, not least among these has been this wanton misdirection of the capital resources of the Nation . The bill closes the channels of such commerce to security issuers unless and until a full disclosure of the character of such securities has been made.<sup>41</sup>

The Securities and Exchange Commission (SEC) was established in 1934 to promote the effective implementation and oversight of the new rules. Its mission is to protect investors; maintain fair, orderly, and efficient markets; and facilitate capital formation.

Information about companies and their risks is essential to facilitating the efficient allocation of capital and protecting investors. The climate-related financial risks outlined above intersect with that mission in several important ways. The Commission has broad authority to require disclosures by issuers to ensure that in-

vestors and the broader public have the information necessary to accomplish those statutory goals.<sup>42</sup> Over the years, corporate issuers and their allies have sought to constrict the Commission's disclosure framework to a narrowly defined "materiality" framework that is essentially tied to whatever the company itself (or its management) believes to have a significant impact on the company's finances. But the SEC's statutory authority is not limited to that constricted view.<sup>43</sup> Rather, the disclosure obligation must center the needs of investors and the public interest—as its statutory authorization makes clear. Corporations should not be deciding what information investors or the public require to make prudent capital allocation decisions or protect the public interest.<sup>44</sup> The physical and transition risks associated with climate change have implications for the ongoing operations of companies in every sector of the economy, both positive and negative. Understanding a company's direct and indirect greenhouse gas emissions, energy consumption, fixed-asset and supply chain exposure to extreme weather disruptions, and other climate-related factors are necessary for investors to make prudent capital allocation decisions. Investors have made it very clear that they want this information. A lack of transparency could drag on economic growth with overinvestment in certain sectors or companies, and underinvestment in others.

Whether and to what extent the SEC requires comprehensive, reliable, and comparable information from issuers of securities will have profound impacts on whether and how companies and investors are efficiently allocating capital and assessing risks. For example, much of the corporate debt securities markets are currently exempt from SEC disclosure obligations. If a large fossil fuel company sells billions of dollars in debt securities that are not due for 15 years or more, what are the climate-related risks of those securities?

The SEC also oversees registered investment advisers and investment companies. A broad range of investors are looking for fund products that both limit their climate-related exposures and direct investment towards green climate solutions.<sup>45</sup> The SEC has a statutory responsibility to ensure that funds holding themselves out as "green" are not misleading investors, but these investors (as well as banks, insurance companies, pension funds, and others) can only manage their portfolios to meet these "green" expectations if they are getting comprehensive, reliable, and comparable information from the companies in which they invest.<sup>46</sup> To go back to the example above, how can an investment adviser assess the risks to its funds holding of a fossil fuel company's debt securities if the party best positioned to identify and disclose them hasn't done so?

Furthermore, as climate risk impacts the price outlook for various investments, entities with a fiduciary obligation overseen by the SEC must increasingly take such risks into account when providing investment advice to meet those obligations, regardless of their investment strategies.<sup>47</sup> Put simply, fiduciaries cannot ignore these risks. Climate change impacts other institutions under the SEC's jurisdiction, including broker-dealers, credit rating agencies, and auditing and accounting firms.<sup>48</sup> Broker-dealers are exposed to market risk posed by transition and physical risks, credit rating agencies will need to update their rating methodologies to ensure climate related risks to fixed-income issuances are factored in, and auditing and accounting firms will be increasingly essential to ensure that climate risks are accurately accounted for and company disclosures are reliable. If the SEC fails to integrate climate-related risks into its core regulatory framework, it will fall short of its statutory mission. Investors will be exposed to risks that were not sufficiently disclosed to them, capital will be inefficiently allocated, our markets will be anything but orderly, and it will serve as a drag on capital formation due to a loss of investor confidence in the resilience and transparency of markets.

The SEC's recent announcement under Acting Chair Allison Herren Lee that the agency's Division of Examinations team is focusing on companies' disclosures and compliance with the agency's 2010 climate risk-related guidance<sup>49</sup> and investment advisers' claims and practices regarding sustainable investing is a great step towards ensuring accountability under the existing rules. So, too, was the announcement of the SEC's creation of a Taskforce on Climate and ESG within the Division of Enforcement. However, the SEC's expectations for companies, investment advisers, broker-dealers and other essential market participants need to be modernized to reflect the magnitude of the risks and impacts of climate change on seemingly every aspect of our economy.

The Commodity Futures Trading Commission (CFTC) is the primary derivatives regulator in the U.S. and is responsible for promoting the integrity, resilience, and vibrancy of derivatives markets. The agency has authority to impose disclosure requirements, margin and capital rules, risk management standards, and other safeguards on the firms and products under its jurisdiction.<sup>50</sup> The physical and transition risks caused by climate change could impact the value and volatility of com-

modity prices and drive losses at the market participants exposed to these assets, including through derivatives. For example, chronic droughts and an increase in crop diseases in the Midwest could impact corn prices and rising temperatures in the Mississippi Delta could impact rice yields. Moreover, the clean energy transition necessary to stabilize global temperatures will have a considerable impact on fossil fuels and metals commodities. Increased risk and volatility in these and other commodities markets could impact futures commission merchants, central counterparties, and other market participants. The CFTC also oversees swaps dealers and major swaps participants. Credit default swaps on a basket of energy companies or a commercial mortgage-backed security index, for example, could be affected by climate-related risks. The 2008 financial crisis showed the costs of an underregulated derivatives market, and it is imperative for the CFTC to appropriately account for climate-related risks in its regulatory and supervisory framework.

*Prudential regulators and the Financial Stability Oversight Council*

The prudential banking regulators, the Federal Reserve Board (Fed), Federal Deposit Insurance Corporation (FDIC), and Office of the Comptroller of the Currency (OCC) have a statutory responsibility to ensure the safety and soundness of the banking organizations under their respective jurisdictions and to promote the overall stability of the banking system. The banking regulators play a critical function in our economy. Reducing the chances and severity of banking crises, protecting depositors and the public funds that stand behind insured deposits, and ensuring our banking system is supporting productive economic investment instead of speculation all help to orient our economy towards long-term, sustainable, and equitable growth. When these regulators fall short, we've all-too-recently seen the resulting economic devastation that bank failures, fire-sales, runs, and a contraction of credit can have on businesses and households across the country. Congress has afforded banking regulators broad writs of authority to execute this critical mission in several statutes, including the Federal Deposit Insurance Act, the Bank Holding Company Act, the International Lending Supervision Act, and most recently, the Dodd-Frank Wall Street Reform and Consumer Protection Act, among others.<sup>51</sup> Through these statutes, regulators have significant authority to use supervisory tools, capital and liquidity requirements, stress testing, recovery and resolution planning, risk management requirements, and other prudential tools that they deem appropriate to address any risks to individual institutions—microprudential risks—as well as risks to the overall functioning of the banking system—macroprudential risks.

Climate change poses microprudential risks to banks, including credit, market, liquidity, reputational, and operational risks. All banks, large and small, receive special public privileges due to the inherent fragilities of the banking business model and the key role banks play in providing credit, offering payment services, and most importantly, issuing deposits. These privileges include deposit insurance and access to the Fed's discount window, but also come with a regulatory and supervisory framework to mitigate moral hazard and the externalities failures can impose. Even though the failure of a \$10 billion bank won't create a systemic crisis, regulators still have a responsibility to ensure the safety and soundness of the bank, since it still receives these public privileges, and its failure could still have a harmful impact on the local or regional economy. Individual banks are exposed to varying degrees of climate-related risk depending on the types of assets they hold and the geographic location of those assets. For example, a bank with a high concentration of coastal commercial real-estate exposure could face severe losses from rising sea-levels. A bank that finances agricultural loans could face losses if droughts, floods, and pests decrease the crop yield for a farmer who then can't meet her financial obligations. Moreover, a bank in the oil patch that focuses on reserve-based lending to oil and gas exploration and production companies could face losses if hydrocarbon reserves are devalued as a result of the clean energy transition, increasing both the likelihood of default on the loan and the loss to the bank if the loan does, in fact, default.

The prudential regulators not only have a responsibility to mitigate climate-related risks for individual institutions. They must also address the macroprudential risks created by climate change—that is, the risks to the overall functioning of the banking system and broader financial sector. As Federal Reserve Board Governor Lael Brainard has noted, "Climate change could pose important risks to financial stability. That is true for both physical and transition risks."<sup>52</sup> Climate change is a systemic threat due to the potential magnitude of the physical and transition-related risks it poses, the wide array of financial institutions and markets exposed to these risks, and the speed with which these possibly correlated risks could materialize.<sup>53</sup> Climate-related shocks could impair the normal functioning of the financial system and inflict damage on the broader economy. A physical or tran-

sition shock could cause severe losses at a systemically important financial institution or correlated losses across a string of financial institutions, leading to fire sales of impaired assets, creditor runs from distressed institutions, and second-order counterparty losses and contagion at institutions that may not have been directly exposed to the initial shock.<sup>54</sup> These first- and second-order effects could create vicious feedback loops, undermine confidence in the financial system, and ultimately trigger a credit contraction and a broad increase in the cost of financial intermediation.

SEC Acting Chair Allison Herren Lee has cautioned that climate-driven financial stability disruptions “can also spread in ways that are less predictable because climate risk is unique in terms of its scope, breadth, and complexity.”<sup>55</sup> In a particularly troubling financial stability scenario, a physical shock could trigger a near-simultaneous transition shock. After delaying robust and orderly decarbonization, a brutal string of natural disasters could spur policymakers to take aggressive and disorderly steps to stabilize global temperatures. In short, climate-related shocks could be immediately amplified by and transmitted throughout the financial system, disrupting the normal functioning of the system and leading to spillover effects on the real economy.<sup>56</sup> Another macroprudential concern short of a systemic crisis is that physical and transition risk-related losses could chronically erode the resilience of financial institutions over time and leave the system vulnerable to other shocks.

In addition to the macroprudential responsibilities and authorities afforded to the prudential banking regulators, the Dodd-Frank Act created a new financial stability watchdog—the Financial Stability Oversight Council (FSOC). Although the United States is notable for having many financial regulatory agencies, before the 2008 financial crisis, no one regulator or regulatory body was responsible for looking out across the financial system and addressing systemic risks. Financial regulators focused on their respective jurisdictions, while significant risks built up across jurisdictions and outside of any one regulator’s purview. Risky financial activities and products sprouted in the cracks of the financial regulatory infrastructure as regulatory arbitrage, intentionally exploiting its fragmentation. The FSOC was structured to mitigate some of these regulatory design flaws. It is chaired by the secretary of the U.S. Department of the Treasury and brings together the heads of all eight federal financial regulators,<sup>57</sup> and a voting member with insurance expertise, around one table.<sup>58</sup> The FSOC’s goal is to improve coordination across agencies and tackle emerging financial sector risks and vulnerabilities before they trigger or amplify another financial crisis. Climate change has implications for every part of the financial system and, in turn, every financial regulator. It is the exact type of cross-cutting risk that the FSOC was designed to address. The FSOC can use its research and coordinating functions to drive better climate-related risk analysis, monitoring tools, and risk-mitigating policies at primary regulators. When necessary, it can also use its powerful statutory tools to directly address certain climate-related risks and push primary regulators to act.

It’s important to note that the banking regulators and FSOC are not supposed to focus solely on the microprudential or macroprudential risks to which financial institutions are exposed. They also have a responsibility to mitigate risks created or exacerbated by financial institutions that could then drive losses elsewhere in the financial system. For example, Section 165 of the Dodd-Frank Act directs bank regulators to develop macroprudential regulations to “prevent or mitigate risks to the financial stability of the United States that could arise from the material financial distress or failure, or *ongoing activities*, of large, interconnected financial institutions . . .” (emphasis added).<sup>59</sup> That principle is embedded throughout the Dodd-Frank Act.<sup>60</sup> In the context of climate change, prudential regulators and the FSOC have a statutory mandate to mitigate climate-related risks created or exacerbated by financial institutions’ ongoing activities. Notably, financial institutions that are major financiers of carbon-intensive activities are facilitating increased GHG emissions and intensifying climate change. Exacerbating the climate crisis will increase both the physical and transition risks of climate change and inflict larger losses on the financial system. With respect to physical risks, higher GHG emissions lead to higher global temperatures, which in turn cause more frequent and severe extreme weather events and damaging environmental changes.<sup>61</sup> The more significant the physical effects of climate change, the more likely and severe the financial system’s associated losses will be. Furthermore, increased emissions today drive up projected warming pathways and increase the likelihood that a rapid and disruptive transition is required to stabilize global temperatures.<sup>62</sup>

#### *Other Regulators*

This testimony focuses primarily on markets regulators, prudential banking regulators, and the FSOC, but climate change has implications for other state and fed-

eral regulators as well. Credit unions, which receive a distinct charter and are regulated by the National Credit Union Administration (NCUA), face similar micro-prudential risks as banks. The NCUA, likewise, has similar tools to promote the safety and soundness of credit unions. As mentioned earlier, the physical effects of climate change—particularly sea-level rise—poses significant risks to the commercial and residential real-estate markets. The Government Sponsored Enterprises (GSEs), Fannie Mae, Freddie Mac, and the Federal Home Loan Banks, have significant exposure to these markets. In fact, there is increasing evidence that banks are off-loading substantial flood risk to Fannie and Freddie.<sup>63</sup> The Federal Housing Finance Agency (FHFA) is the prudential regulator for the GSEs and has broad authority to ensure their ongoing safety and soundness. Similarly, the Public Company Accounting Oversight Board (PCAOB), the Municipal Securities Rulemaking Board (MSRB), and the Financial Industry Regulatory Authority (FINRA) each have important roles to play. For example, to the extent that the SEC requires companies to make climate related estimates and disclosures, the PCAOB will have an essential role in ensuring that those estimates and disclosures are comparable and reliable. The Consumer Financial Protection Bureau could help consumers hold banks accountable on issues of sustainability, effectively empowering them to “vote with their deposits” by making it easier to seamlessly switch their bank accounts, something that is surprisingly challenging to do today.<sup>64</sup>

Finally, the insurance sector is arguably the most acutely exposed to the physical risks of climate change, since the core business model for property and casualty insurers involves guaranteeing the value of physical assets. Insurers’ investments are also exposed to physical and transition-related risks. Insurance is primarily regulated at the state-level, meaning state insurance regulators have a critical role to play in mitigating these risks. But the FSOC and Federal Insurance Office (FIO) must closely monitor such risks and use their own tools to address them, when necessary.

**The U.S. is behind its international peers in addressing climate-related financial risks, but there are recent signs of progress.**

International regulators have acknowledged the severity of climate-related risks and the need for financial regulators to act urgently to mitigate such risks. The Network for Greening the Financial System (NGFS) was established in December 2017 by eight central banks as a coordinating body for those central banks and supervisors committed to tackling climate-related financial risks. Since then, the NGFS membership has expanded to 83 members and 13 observers, representing about 75 percent of global GDP and the vast majority of the world’s systemically important financial institutions.<sup>65</sup> The NGFS has put out multiple research reports, sample supervisory guidance, model stress testing scenarios, and more over the past several years.<sup>66</sup> Many NGFS members have begun, in turn, to adapt their core regulatory and supervisory frameworks accordingly. The Basel Committee on Banking Supervision published the results of its climate-related stock take of how member jurisdictions are approaching climate-related risks.<sup>67</sup> Of the 27 jurisdictions surveyed, 24 had conducted climate-related research, 23 had raised the issue directly with banks, and 6 had issued supervisory guidance (with 5 more in the process of doing so).<sup>68</sup> Some jurisdictions have advanced mandatory climate disclosure frameworks and have implemented, or are in the process of implementing, climate-related stress testing and scenario analysis regimes.<sup>69</sup> In many jurisdictions, this activity has been driven by regulators under existing authority, while legislative bodies in certain jurisdictions have set comprehensive frameworks.<sup>70</sup>

The U.S. has made little progress on addressing climate-related risks, while U.S. financial institutions are lagging their international counterparts in curbing climate-risky activities. The tide is shifting, however, and recent actions are cause for optimism. In September 2020, the CFTC Climate-Related Market Risk Subcommittee, established by Commissioner Rostin Behnam, published the first official-sector commissioned report in the U.S. on climate-related financial risks.<sup>71</sup> In November 2020, the Fed included climate-related risks in both its Supervision and Regulation Report and Financial Stability Report, before ultimately joining the NGFS in December.<sup>72</sup> This was welcome news, as Governor Lael Brainard has been talking about the need for the Fed to focus on climate change for years.<sup>73</sup> Additionally, the Fed recently created a Supervision Climate Committee to evaluate and mitigate the microprudential risks posed by climate change.<sup>74</sup> SEC Acting Chair Allison Herren Lee has taken steps over the past two months to better integrate climate-related risk in the Commission’s disclosure, examination, and enforcement functions.<sup>75</sup> FDIC Chair Jelena McWilliams announced that focusing on climate change’s impact on the financial sector was recently added to the agency’s performance goals for the first time.<sup>76</sup> FHFA Director Mark Calabria recently issued a fairly

comprehensive public request for information regarding how the agency should integrate climate-related risks into its core functions.<sup>77</sup>

The Biden administration has also signaled that addressing climate-related financial risks would be a key priority within the all-of-government approach to the climate crisis. A recent executive order directed the Treasury Secretary to ensure the U.S. was present at international fora working on climate-related financial risks and the executive order reinforced the Paris Agreement's goal to align capital flows with a 1.5-degree Celsius warming pathway.<sup>78</sup> Secretary Yellen has repeatedly emphasized the importance of this issue for multiple Treasury core functions, including the Secretary's role as Chair of the FSOC. She has even committed to establishing a "climate hub" at the Department.<sup>79</sup> Certain state-level regulators have also started to make real progress on this issue. The New York Department of Financial Services, in particular, has taken some nation-leading steps on this front.<sup>80</sup> The California Department of Insurance, under Dave Jones' leadership, also made notable progress during his tenure.<sup>81</sup>

The U.S. is behind our international counterparts. The building momentum, though, suggests the next few years could be a "leapfrog moment" for our country, as Sarah Bloom Raskin, former Treasury Deputy Secretary and a global leader on climate-related financial issues, has characterized the present opportunity for action.<sup>82</sup>

**Financial regulators have the tools to advance a robust policy agenda to mitigate climate-related financial risks.**

The U.S. is moving beyond merely the identification and evaluation phase of this effort, but not fast enough. A bipartisan set of regulators acknowledge that climate change poses risks to the financial system and, therefore, falls within their statutory remit. We cannot, however, fall victim to the calls for self-regulation of these risks. It is welcome news that large U.S. banks are making net-zero commitments and that more companies are utilizing myriad voluntary disclosure frameworks, but many of these commitments do not set clear short-term goals and rely too heavily on promises of future emission offsets. In any event, these developments do not absolve regulators of their responsibility to ensure that firms are resilient to these risks and that investors have the information they need to appropriately allocate capital. The U.S. has tried selfregulation in the past, and that hands-off approach has proven catastrophic for workers, small businesses, and communities across the country. Private financial institutions do not have sufficient incentives to voluntarily self-insure against climate-related risks, especially tail risks. It is therefore critical for regulators to step in and ensure these risks are accounted for in regulatory and supervisory frameworks. Moreover, the absence of climate-related safeguards provides a hidden subsidy to the banks exposed to, and exacerbating, these risks. Banks that are not creating or exposed to these risks bear those costs.

Regulators have the tools to mitigate these risks.<sup>83</sup> The question now is how urgently will regulators move to mitigate these risks and what specific safeguards will they employ? If regulators pursue a robust climate finance agenda, the U.S. financial system will be wellpositioned to handle future climate shocks and to take advantage of the significant opportunities that the transition to a low-carbon economy presents. Meanwhile, the public will be spared the high costs of future bailouts and will benefit from a stable financial system.

One of the most important lessons policymakers should have learned from the 2008 financial crisis is the importance of deploying a precautionary principle when regulating the financial system. As Professor Hilary Allen describes it, "This principle is essentially a more sophisticated version of the old adage, 'better safe than sorry,' counseling regulators to err on the side of regulating an activity when the outcome of that activity is uncertain, but potentially irreversible and catastrophic."<sup>84</sup> In the run-up to the 2008 crisis, many policymakers assumed financial crises were a thing of the past and did not cast a skeptical eye towards the development of new complex financial products and systemic interconnections.<sup>85</sup> A laissez-faire deregulatory approach, the opposite of the precautionary principle, dominated the three decades leading up to the crisis and set the stage for the resulting catastrophe. Regulators must have humility about their ability to predict the precise causes and complex effects of financial crises, which are high impact and low probability events that carry substantial inherent uncertainty. Regulators must act to ensure the financial system is resilient to extreme, but plausible, tail risk scenarios. The severe and lasting economic and social damage wrought by instability in the financial system warrants this type of precautionary approach to regulation—one that favors proactive and robust safeguards in the face of uncertain, but potentially catastrophic, risks.

Certainty regarding the near-term private costs of regulation and uncertainty regarding the precise value of social benefits from such regulation—which nevertheless are likely to be great in magnitude—should not unduly hamstring regulators. Climate-related financial risks are a special case that warrant a particularly proactive approach.<sup>86</sup> Climate change is itself a high impact and high probability phenomenon. It will certainly have significant negative effects on the planet, economy, and financial system. There is no doubt about the likelihood of climate change and no doubt about the general magnitude of its damaging impacts under various warming scenarios. It is also clear that the transition to a low-carbon economy, which is necessary to stabilize global temperatures, is going to impact financial institutions and markets. There is significant uncertainty, however, regarding the timeline of climate-related financial stability risks, the precise magnitude of the economic value at risk, and the exact manifestation of those risks on a range of financial assets, markets, and institutions. The answers to many of these questions hinge on the level of emissions going forward and the resulting warming pathway, as well as the future actions taken by policymakers, technological advancements, and shifts in market sentiment. The uncertainty is fueled by difficulties modeling climate change and its impacts, including its non-linear nature, the existence of tipping points, and the interactions with complex environmental systems.<sup>87</sup> It is clear, however, that climate-related risks could have a catastrophic impact on financial institutions and markets, and ultimately disrupt financial stability.

This policy effort will be an iterative process. Given the urgency of the issue and the magnitude of the risk, it is important for regulators to not let the perfect be the enemy of the good and to act with urgency. As Fed Governor Lael Brainard recently stated, “Despite the challenges, it will be critical to make progress, even if initially imperfect, in order to ensure that financial institutions are resilient to climate-related financial risks and well-positioned for the opportunities associated with the transition to a more sustainable economy.”<sup>88</sup> Regulators should advance a comprehensive and vigorous agenda to mitigate climate-related financial risks—an agenda that embodies the precautionary principle.

#### *Markets regulators<sup>89</sup>*

##### *Disclosure*

The SEC should establish a mandatory climate risk disclosure framework.<sup>90</sup> Investors need reliable, consistent, and comparable data on climate-related risks. The myriad voluntary disclosure frameworks that have developed over the past several years have helped get the ball rolling on this important issue, but only a mandatory standardized regime can provide the reliable, consistent, and comparable information necessary for investors to make prudent decisions when they allocate capital. The disclosures should include both specific line-item requirements and additions to the narrative-based disclosures in the management discussion and analysis, such as those called for by the Task Force on Climate-related Financial Disclosures.<sup>91</sup>

The line-item disclosure should at least include clear metrics regarding the exposure of corporate assets, facilities, supply chains, services, and products to water stress, natural disasters and environmental shifts, water insecurity, heat stress, and additional physical risk-related factors.<sup>92</sup> Companies should also be required to disclose metrics regarding their energy consumption, scope 1, 2, and 3 emissions, and their transition-related emissions targets. For financial institutions, the Commission should require disclosure of the emissions financed by the firm.<sup>93</sup> Moreover, the management discussion and analysis should include transition plans and the board and management strategy for addressing climate-related risks. This is not a comprehensive list of all of the necessary elements of a corporate climate risk disclosure framework, but the aforementioned metrics should be core components. Additionally, climate disclosures should not be considered in a vacuum. Investors have been asking for a broad array of ESG information, much of which intersects with how companies are thinking about their climate risk. SEC Acting Chair Lee recently spoke to the interconnected nature of ESG factors, saying, “We know climate presents heightened risks for marginalized communities, linking it to racial justice concerns.”<sup>94</sup> Lee also pointed out the risk to investors from companies that make public commitments regarding carbon neutral policies, but secretly donate to political candidates with anti-climate justice records. It’s important that climate risk disclosure be part of a comprehensive ESG disclosure regime.

##### *Restoring the Application of Securities Laws*

The SEC must also ensure that this framework applies to all large companies and offerings. Over the past several decades, and particularly since the passage of the Jumpstart Our Business Startups (JOBS) Act, ever larger companies and offerings are proliferating outside of the SEC’s disclosure and accountability framework. That should be reversed.<sup>95</sup>

Efforts to promote the disclosure and accountability of the public markets could include limiting the application of Rule 506 and requiring additional disclosure requirements on issuers making use of the exemption, as well as eliminating or modifying Rule 144A.<sup>96</sup> Without restoring the primacy of the public capital markets, the SEC's efforts to promote transparency will be severely undermined and climate risks will continue to be insufficiently identified, assessed, and addressed.

#### *Restoring Rights*

For years, long term investors have engaged with companies and their management teams to promote better identification, assessment, and management of risks, including climate risks. Oftentimes, investors have used shareholder proposals and their powers to vote to hold companies and their executives accountable. Unfortunately, these tools have been undermined in recent years. The SEC should promote investor engagement, including through easing submissions for shareholder proposals and expanding the ability of investors to shape corporate action, such as by reducing dual class share structures and adopting universal proxy ballots. Investors can and must be empowered to protect their interest in corporate sustainability.

#### *Fiduciary Requirements*

The SEC and Department of Labor should require investment fiduciaries to develop and implement policies and procedures that clearly outline how the adviser identifies, evaluates, and addresses climate-related risks and opportunities. SEC Acting Chair Allison Herren Lee has suggested the Commission could pursue this type of requirement under existing law and that there is precedent for requiring "policies and procedures around a specific topic of particular importance."<sup>97</sup> This type of sustainable investment policy would help provide clarity to investors as to how fiduciaries are integrating climate-related considerations into the advice they are providing, without dictating outcomes that fiduciaries would be required to follow.<sup>98</sup> Relatedly, the SEC could require investment advisers and broker dealers to ascertain the climate-related preferences of investors and factor those preferences into their investment decisions.

#### *Additional tools*

Capital markets regulators have an array of additional tools that could be used to mitigate climate-related risks to the firms and markets under their jurisdiction.<sup>99</sup> The SEC should (i) require credit rating agencies to disclose how they are integrating climate-related risk into their rating methodologies and ensure they are applying those models consistently; (ii) enforce existing accounting standards with respect to climate-related risks and expand those standards to more fully integrate the risks; (iii) ensure that auditors have the skills and knowledge necessary to audit for compliance with accounting standards as they relate to climate risks; and (iv) establish and enforce a clear taxonomy that promotes standardized labeling for "green" or "ESG" funds and securities to prevent greenwashing.<sup>100</sup> In addition, the CFTC should adapt its margin and capital requirements to account for climate-related risks to specific entities and markets under its jurisdiction.<sup>101</sup>

#### *Prudential regulators*

##### *Stress Testing*

The Federal Reserve should establish climate-related stress tests for the largest banks in the country.<sup>102</sup> The stress tests would probe how bank balance sheets would be impacted by hypothetical severely adverse climate scenarios over the next 15-30 years. The time horizon of the climate-related stress tests should be much longer than the nine-quarter horizon for the annual macro stress tests to allow regulators to explore how the worst effects of climate change could impact bank balance sheets. The scenarios should include both physical and transition risks. Banks should then be required to submit detailed remediation plans that outline how they plan to adjust their balance sheets and financing activities over time to mitigate their exposure to these risks. Unlike the annual macroeconomic bank stress tests, these tests should not quantitatively set capital requirements. The inherent difficulties in projecting losses over such a lengthy time horizon make these stress tests ill-suited for setting bank-by-bank capital requirements immediately.

Even though the quantitative results of the tests shouldn't directly set capital requirements, it is critical for the stress tests to have teeth and not become a box checking exercise of little value. Regulators should therefore include a qualitative objection component in the climate-related stress tests. If the remediation plans are inadequate in scale or granularity, or if climate change is insufficiently integrated into banks' internal controls, governance, risk management, or capital planning processes, the Fed should invoke the qualitative objection and restrict banks' planned capital distributions today. The climate-related stress tests would provide transparency regarding banks' climate-risk exposure, force banks to embed climate risk into their core business functions and require them to provide regulators with

actionable plans to adjust their balance sheets over time to limit climate-related risks.

Conducting several iterations of the climate-specific stress tests should improve regulators' understanding of climate-related variables, scenario design, and modeling. Ultimately, near-term climate-related variables and shocks should be introduced into the severely adverse scenario of the nine-quarter annual macroeconomic stress tests, the Comprehensive Capital Analysis and Review (CCAR). These annual stress tests directly feed into banks' capital requirements, as regulators use both static and dynamic tools to ensure capital adequacy.<sup>103</sup> Adding climate variables and shocks to these tests would help integrate climate considerations into the bank capital framework.

Banks have pushed back against the creation of climate-related stress tests.<sup>104</sup> They have argued that there is significant uncertainty around climate-related shocks and their effects, and that they'd be tough to model. It is true that there is substantial inherent uncertainty around climate-related risks and potential warming and transition pathways. But stress tests are not designed to predict the future. They are used to test bank balance sheets against extreme, but plausible, scenarios. That's a threshold the Fed should be able to meet. There are certainly data, modeling, and scenario decisions that the Fed will have to weigh carefully. Those challenges are by no means insurmountable given the purpose and role of stress testing. Moreover, banks have lamented the long time horizon of the scenarios as it relates to assumptions regarding bank balance sheets. It is certainly true that a bank's balance sheet could look very different in 2045 than it does in 2021. Stressing a bank's 2021 balance sheet against longer-term risks, however, demonstrates just how significantly a bank may have to adjust its balance sheet over time to avoid catastrophic climate-related losses. The Fed could then ensure banks are, in fact, adjusting their balance sheets over time to avoid these long-term risks. It's also important to note that while the most severe climate-related risks may take decades to materialize, there are potential risks in the more immediate future—particularly with respect to transition risks. In order to hit 2050 emissions and warming targets, rigorous action is required in the near-term. Those legal and regulatory developments, or technological advancements and shifts in investor sentiment, could crystallize transition-related losses in the short-term and should be included in CCAR at some point soon.

The arguments banks are making against climate-related stress tests rhyme with the arguments they deployed against the initial stress tests in 2009, the Supervisory Capital Assessment Program, and the annual macroeconomic tests that were developed in the wake of the crisis, CCAR.<sup>105</sup> For 12 years banks have fought tooth and nail with the Fed over what constitutes appropriate or realistic scenarios, models, and assumptions. One particular example is instructive. In CCAR, the Fed included an assumption that bank balance sheets would grow during the stress testing time horizon. This was a prudent assumption, since regulators want banks to be capitalized enough to serve as a source of strength during a downturn and historical evidence suggested that there would be pressure on bank balance sheets to expand as businesses and households sought liquidity. While it may be prudent from a micro-prudential standpoint to assume banks could keep a static balance sheet or shrink to conserve capital during a stress period, that would lead to a severe contraction in credit if a range of banks all took that approach. After years of pressure from banks, the Fed relented and watered down the balance sheet growth assumption and changed it to assume a flat balance sheet.<sup>106</sup> Then, in early 2020, the global financial system experienced a real-life stress test due to the COVID-19 shock and bank balance sheets grew significantly.<sup>107</sup> Banks were not pushing the Fed to adopt a flat balance sheet because it was more realistic or grounded in historical evidence. They did so because a flat balance sheet assumption weakened the stress tests by reducing required capital. Similarly, when it comes to climate-related stress tests, banks will continue to advance arguments that seek to reduce the severity of projected losses or the procedural consequences of the stress tests. Regulators must see the arguments for what they are.

#### *Supervision*

Banking regulators should clearly define climate-related supervisory expectations for banks. As Governor Lael Brainard stated recently, "Supervisors have a responsibility to ensure that financial institutions are resilient to all material risks—including those related to climate change—both currently and into the future."<sup>108</sup> It is critical for banks to integrate climate risk into their governance, risk management, internal controls, capital planning, and self-run scenario analyses. The banking regulators should integrate these expectations into supervisory guidance, supervisory manuals, and the supervisory ratings systems.

**Governance:** The board of directors and senior management should clearly assign responsibilities for climate-related risks within the bank's governance structure. This issue requires attention at the highest levels of the bank to ensure that climate-related factors are being appropriately integrated throughout the bank's core business and risk functions.

**Risk Management:** Banks should have the policies and procedures in place to identify, evaluate, report, and mitigate climate-related risks. Both the physical and transition-related risks associated with climate change pose serious credit, market, liquidity, reputational, and operational risks for many banks. It is vital for banks to account for all of these risks in their core risk management frameworks.

**Internal Controls:** It is important for banks to have the policies and procedures in place to effectively monitor the integration of climate-related factors into core risk and business functions. Strong internal controls can help the bank evaluate the effectiveness of climate-related risk management, governance, capital planning, model use, compliance, audit and other functions, and address any clear deficiencies in a timely manner.

**Capital Planning:** As part of the normal capital planning process, in which banks evaluate their capital needs and determine how to manage their capital resources, banks should take climate-related risks into account.

**Scenario Analyses:** While the Fed should establish supervisory stress tests, banks should be expected to conduct their own company-run stress tests and scenario analyses. The Fed will only use a handful of the thousands of potential climate-related scenarios that could play out. It's important for banks to think through and attempt to model a wide range of potential scenarios.

#### *Capital Requirements*<sup>109</sup>

Banking regulators should use capital requirements to address both the microprudential and macroprudential risks posed by climate change.

Banking regulators should first focus on the credit and derivative exposures that face the most pronounced transition-related risks: fossil fuel assets and infrastructure. Bonds, loans, and derivative transactions for companies that derive a meaningful portion of their revenue from the extraction, exploration, transportation, storage, exporting, or refining of oil, natural gas, or coal should be the top priority. The risk-weights should be calibrated based on several factors, including: (i) the extent to which the company generates revenue from fossil fuel-related activities; (ii) differentiation in transition risk intensity among oil, gas, and coal exposures; and (iii) the length of the exposure. Regulators could also incorporate additional variables, such as treating financing for new and existing fossil fuel reserves and infrastructure differently, but should not spend years trying to over-engineer the risk-weights and adding needless complexity. Next, banking regulators should use the information gleaned from enhanced corporate climate risk disclosure and climate-related stress testing to make additional transition risk adjustments to the risk-weighted capital framework. Financial instruments tied to other carbon intensive sectors are also susceptible to transition risks, including the utility, transportation, mining, chemical production, and metal and mining, building materials, and agricultural sectors.<sup>110</sup> In addition, regulators could use stress testing and engagement with climate scientists and climate economists to improve modeling approaches regarding the physical risks of climate change and increase risk-weights for the most exposed assets accordingly.

In order to bolster big banks' resilience to the systemic risks they are inflating, and to require them to internalize these external costs they are placing on others, banking regulators should also implement a macroprudential climate risk contribution capital surcharge. This additional riskweighted and leverage capital buffer should apply to bank holding companies with more than \$100 billion in assets and nonbank financial companies designated by the Financial Stability Oversight Council (FSOC) as systemically important. The climate capital surcharge should be calibrated based on a firm's climate risk contribution score, which would measure the bank's level of financed GHG emissions, including emissions from its lending, underwriting, trading, and off-balance sheet activities.

The capital surcharge that applies to global systemically important banks (G-SIBs) provides a useful conceptual example of how bank capital requirements can be used to mitigate a financial externality.<sup>111</sup> The basic formula for the expected losses that a bank places on the financial system and broader economy is a function of the bank's probability of default, or its likelihood of failure, and its loss-given default, or the losses that would be placed on the financial system or economy if it failed. The failure of a large, complex, and interconnected bank would have a much greater negative impact on the financial system and broader economy than the failure of a smaller bank.<sup>112</sup> Thus, the loss-given default of a larger bank is much higher than that of a smaller bank. Assuming the probability of default is generally

equal, the expected loss of a large systemic bank is higher than that of a small bank. The G-SIB surcharge was designed to bring the expected loss for systemic banks in line with those of smaller banks by lowering their probability of default through raising their capital requirements. When the G-SIB surcharge rule was finalized, former Federal Reserve Chair Janet Yellen stated, “A key purpose of the [G-SIB] capital surcharge is to require the firms themselves to bear the costs that their failure would impose on others.”<sup>113</sup> The Fed also noted that a related goal of the G-SIB surcharge was to “create incentives for SIFIs to shrink their systemic footprint, which further reduces the risks these firms pose to financial stability.”<sup>114</sup>

Using the expected loss framing, financing emissions is effectively contributing to an increase in the probability of default, and expected loss, of the financial system as a whole. Banks that are major financiers of carbon-intensive activities are facilitating increased GHG emissions and intensifying climate change. Exacerbating the climate crisis will increase both the physical and transition risks of climate change and inflict larger losses on the financial system. With respect to physical risks, higher GHG emissions lead to higher global temperatures, which in turn cause more frequent and severe extreme weather events and damaging environmental changes.<sup>115</sup> The more significant the physical effects of climate change, the more likely and severe the financial system’s associated losses will be. Furthermore, increased emissions today drive up projected warming pathways and increase the likelihood that a rapid and disruptive transition is required to stabilize global temperatures.<sup>116</sup> Firms should be required to internalize these costs and the capital surcharge would disincentivize risky carbon-financing activities.

#### *Community Reinvestment Act*

The banking regulators should also look to their obligations under the Community Reinvestment Act to help drive mitigation and adaptation efforts in low- and moderate-income communities, and communities of color. Regulators should use race and environmental justice metrics to better target CRA assessment areas.<sup>117</sup> Regulators should also clarify the types of adaptation and mitigation activities that qualify for credit under the CRA, including energy efficient affordable housing, community solar projects, and green infrastructure.<sup>118</sup> It is also vital for regulators to strengthen the overall enforcement and accountability of the CRA to ensure it is meeting the needs of these communities, as intended by the statute.

#### *State insurance regulation*

State insurance commissioners should require insurance companies operating in their state to disclose their fossil fuel investments and underwriting activities. This disclosure would improve regulators’, investors’, and the public’s understanding of insurers’ exposure and contribution to the climate crisis. Regulators should ensure companies set targets and pathways to reduce those high-emissions activities. The FIO should issue a data call to collect this information from the insurance industry if state insurance commissioners do not use their authorities to act.

Commissioners should establish climate-risk stress tests and scenario analyses to help quantify climate-related risks on an industry-wide and company-by-company basis and create stronger risk management rules and supervision based on the results. The stress tests should gauge the short- and medium-term resiliency of insurers’ balance sheets in the face of both physical and transition risks. Longer term scenario analyses could complement the stress tests by probing how insurance companies plan to shift their asset allocation and business practices to align with different warming scenarios over a longer time horizon. The FIO should evaluate these stress testing frameworks and make recommendations to state insurance regulators on best practices around scenario design and supervisory models, where appropriate.

Climate-related risks should also be integrated into the risk-based capital (RBC) framework for insurers. The RBC requirements are meant to ensure the resilience of insurers and are calculated based on the riskiness of their assets and underwriting activities. Increasing the loss-absorbing capital required for assets and underwriting activities that are most exposed to climate-related risks would help promote the stability of the sector. This policy should focus on insurers’ fossil fuel investments and underwriting, which both expose insurers to transition-related losses and increase the physical risks that will be borne by others in the future. In addition, regulators should require insurers to include climate-related risks in their Own-Risk and Solvency Assessments.

#### *Financial Stability Oversight Council*

As a start, the FSOC should embed a focus on climate change and climate-related capabilities into its operating structure. Chartering a Climate Risk Committee to handle the portfolio of ongoing climate-related work would be a good initial step toward this end. Relatedly, the FSOC should work with the director of the Office of

Financial Research (OFR) to establish a Division of Climate Risk Analysis. The OFR should spearhead the FSOC's data collection, analysis, and research priorities on climate-related financial risks, working with member agencies on their needs. These recommendations would complement Secretary Yellen's important commitment to establish a "climate hub" at Treasury. FSOC member agencies should then make it an early priority to coordinate on the development of agency-specific commitments to integrate climate-related risks into their respective core functions. These clear and actionable goals could be developed after consultation with the public through an agency request for information and announced in advance of the U.N. Climate Change Conference (COP26) in November 2021, which features a robust private finance agenda.<sup>119</sup>

Over the long term, the FSOC should use its statutory authorities to address any identified gaps with respect to climate-related financial risks. The FSOC's Section 120 authority to issue recommendations to primary regulators could help pressure regulators to act where they have the existing authority to do so. Primary regulators have substantial authority to use disclosure requirements, stress testing, capital frameworks, supervision, fiduciary obligations, and more to mitigate climate-related risks and align the financial system with the low-carbon transition. These tools have the power to improve the resilience of the financial system to climate-related shocks and to facilitate the decarbonization of the economy. The FSOC should stand ready to push unwilling regulators to act, or go further, when necessary.

Furthermore, the FSOC should integrate climate-related risk as a factor into its designation guidance.<sup>120</sup> There are currently two statutory standards under which a nonbank financial company can be designated as systemically important. If a firm's material financial distress could destabilize the financial system, it can be designated under the first standard. That standard is agnostic to the cause of the material distress, so there is not an obvious climate-related intersection. Under the second standard, designation can occur if "the nature, scope, size, scale, concentration, interconnectedness, or mix of the activities" of the nonbank financial company could threaten financial stability.<sup>121</sup> Under this standard, therefore, the FSOC could evaluate a firm's contribution to climate-related financial risks through its carbon-financing activities. Financing high-emission activities intensifies climate change and increases physical and transition risk-related losses for financial institutions and the economy in the future, exacerbating systemic risk. It is unlikely that the FSOC would designate any firm solely based on climate-related risk considerations, but the council could reasonably add these considerations to the calculus under the second standard.

Separately, the Federal Reserve should apply robust climate-related prudential regulation to nonbank financial companies that are designated as systemically important under either standard, regardless of whether climate considerations are factored into the decision to designate them. Depending on the former primary regulator of the designated company, it may or may not have faced climate-related financial regulation previously. As the new primary prudential regulator, the Fed is responsible for bolstering the resilience of designated nonbank financial companies, and it is important that these systemic firms can weather climate-related shocks, among other risks.

#### *Role of Congress*

Congress has an important role to play in ensuring our financial system is resilient to climate-related shocks and is positioned to support the low-carbon transition. First, stringent congressional oversight of the financial regulators will prove crucial. As outlined in this testimony, financial regulators have wide-ranging authority under existing law to address climate-related risks. Through letters, hearings, investigations, and other mechanisms, Congress can press regulators to act with appropriate speed and to deploy their full suite of tools to rigorously address these risks. Several members of this Committee have been pushing regulators for years, which is one of the reasons progress has been made in the past few months.

Second, if regulators fail to act swiftly enough or refuse to implement a robust agenda around climate financial risks, Congress should step in and insist they do so. In advance of the 2008 financial crisis, regulators refused to use the tools at their disposal to address the risks financial institutions were creating and the risks to which the financial system was exposed. Several important provisions in Dodd-Frank did not create new authorities *per se*—they required regulators to implement policies that could have been implemented under precrisis law. If regulators again fail to check a build-up of risk in the financial system, Congress should direct them to do so in advance of another catastrophe. Several important bills, including those authored or cosponsored by members of this Committee, have been introduced in the past few years. Some notable recent bills include:

- The Climate Risk Disclosure Act, introduced by Senator Warren and Representative Casten, would direct the SEC to develop a comprehensive mandatory climate risk disclosure framework.<sup>122</sup>
- The Climate Change Financial Risk Act, introduced by Senator Schatz and Representative Casten, would require the Fed to establish a climate-related stress testing framework.<sup>123</sup>
- The Addressing Climate Financial Risk Act, introduced by Senator Feinstein and Representative Casten, would direct the banking regulators to develop climate-related supervisory guidance, direct the FSOC to update its nonbank designation guidance to include climate risk, require a report from the Federal Insurance Office on climate risk, among other provisions.<sup>124</sup>

Finally, Congress could consider additional policy measures or adjustments to financial regulators' mandates to more intentionally align private capital flows with explicit climate-related targets. Regulators have broad responsibilities to bolster the resilience of the financial system to climate-related risks and, if used appropriately, those authorities will ensure the financial system serves as a source of strength for the economy as it decarbonizes. But the "risk" framing is somewhat of a constraint and Congress could more directly mobilize private capital to achieve climate-policy ends. For example, banks could be given green-finance mandates as one of the obligations that comes with the special public privileges they are afforded.<sup>125</sup>

### **Conclusion**

Climate-related risks are building in the financial system and financial institutions themselves are exacerbating these risks. It is incumbent on U.S. financial regulators to step in and perform the jobs Congress assigned to them. Integrating climate-related risks into the regulatory and supervisory framework through mandatory disclosure, stress testing, supervision, capital requirements, fiduciary obligations, and more would bolster the resilience of the financial system, mitigate the risks created by financial institutions, and position the financial system to support the low-carbon transition. These risks are not theoretical, and they are not far off in the distance. They are here. Regulators have a chance to address these risks head on, before catastrophe strikes. It is critical to learn the lessons of the 2008 crisis, move urgently, and avoid a climate-driven financial crisis.

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<sup>121</sup> See Section 113 of the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010.

<sup>122</sup> Office of U.S. Senator Elizabeth Warren, “The Climate Risk Disclosure Act of 2019: One pager,” available at <https://www.warren.senate.gov/imo/media/doc/The%20Climate%20Risk%20Disclosure%20Act%20of%202019%20-%20One%20Pager.pdf>.

<sup>123</sup> Office of U.S. Senator Brian Schatz, “Schatz introduces new legislation to ensure U.S. financial system is prepared for climate change.”

<sup>124</sup> Office of U.S. Senator Dianne Feinstein, “Feinstein Introduces Bill to Minimize Climate Change Risk in Financial System,” Press Release, December 17, 2020, available at <https://www.feinstein.senate.gov/public/index.cfm/press-releases?ID=27A04819-E44D-435C-AB06-FBC9D6051EB2>.

<sup>125</sup> For an example of this type of legislation, see Climate Protection and Sustainable Communities Act of 2020, H.R. 9059, 116 Cong. 2 sess., available at <https://www.congress.gov/bills/116/congress/house/bills/9059?q=-%7B%22search%22%3A%5B%22kenedy%22%5D%7D&s=5&r=1>.

**PREPARED STATEMENT OF NATHANIEL KEOHANE**  
 SENIOR VICE PRESIDENT, CLIMATE, ENVIRONMENTAL DEFENSE FUND  
 MARCH 18, 2021

**Introduction**

Climate change is one of the defining challenges of our time. Its impacts become more visible every year, not only in hotter temperatures, rising seas, and melting glaciers but also in extreme weather: wildfires, heat waves, hurricanes, floods, droughts. The economic consequences of these impacts loom large, amounting to hundreds of billions of dollars every year to the United States alone from current emissions.

As the world's second-largest emitter and largest historical emitters, the United States has an obligation to lead the world in addressing climate change by taking action across the U.S. economy. To help reduce the risk of catastrophic climate change, in line with the latest climate science and with the objectives of the Paris Agreement on climate change, the U.S. should achieve net zero emissions across the entire economy—the point at which we emit no more carbon pollution than we can remove from the atmosphere—by no later than 2050, including an interim target of cutting emissions at least 50 percent below 2005 levels by 2030. A range of recent analyses demonstrate these goals are achievable with well-designed government policies and investments to reduce greenhouse gas emissions from sectors including electric power generation, transportation, industry, buildings, and fossil fuel production; manage forests, croplands, and rangelands to store carbon; and increase the resilience of natural and physical infrastructure, especially in coastal areas.<sup>1</sup>

The good news is that study after study has shown that the investments needed to put the U.S. economy on a path to net zero emissions will also help to strengthen the nation's economy, ensure good jobs, and enhance America's competitiveness in the global clean energy economy.

In addition to the massive aggregate economic damages mentioned above, there is a growing realization that climate change poses a significant risk to the U.S. financial system as well—both potentially to the financial system as a whole, as well as to specific types of financial institutions in particular sectors and regions. In this context, policy makers and financial and prudential regulators have a range of tools available that could help to significantly mitigate the risk to the financial system, particularly by ensuring greater transparency around the nature, magnitude, and distribution of climate risk and requiring that regulatory bodies and private companies more thoroughly incorporate climate change into their risk management and decision making. In addition, in light of the enormous and growing demand from private investors for sustainable and climate-friendly investing, policy makers and regulators can take steps to reduce the barriers to such investing.

With this context in mind, my testimony makes three main points.

First, climate change poses significant risks to the U.S. financial system. In detailing these potential risks, I draw extensively on a recent report published by the Climate-Related Market Risk Subcommittee of the Commodity Futures Trading Commission's Market Risk Advisory Committee, of which I was a co-author.

Second, financial regulators have a clear responsibility to address climate risk under their foundational duties and authorities. I put special emphasis on the importance of mandatory climate risk disclosure, and also discuss a range of other recommendations related to incorporating climate risk into risk management practices of regulated firms, increasing the relevant expertise of regulators, and improving data availability.

Third, there is significant demand—and opportunity—to channel private capital into low-carbon and climate-friendly investment. In addition to noting the rising demand among private investors for such opportunities, I highlight the single most important thing policy makers could do to ensure that private capital flows more efficiently to low-carbon opportunities: namely, implementing a fair and effective price on carbon across the U.S. economy.

<sup>1</sup>See National Academies of Sciences, Engineering, and Medicine, *Accelerating Decarbonization of the U.S. Energy System* (Washington, DC: The National Academies Press, 2021), <https://doi.org/10.17226/25932>; E. Larson, C. Greig, J. Jenkins, E. Mayfield, A. Pascale, C. Zhang, J. Drossman, R. Williams, S. Pacala, R. Socolow, E.J. Baik, R. Birdsey, R. Duke, R. Jones, B. Haley, E. Leslie, K. Paustian, and A. Swan, *Net-Zero America: Potential Pathways, Infrastructure, and Impacts*, interim report (Princeton University, 2020). <https://perma.cc/Z2ZT-BHLM>; Environmental Defense Fund, "Recapturing U.S. Leadership on Climate: Setting an Ambitious and Credible Nationally Determined Contribution" (Environmental Defense Fund, 2021), <https://perma.cc/3UXP-2EPM>.

## Climate-Related Risks to the U.S. Economy and the Financial System

### *Economic damages and financial risk*

The impacts of climate change on the U.S. financial system were the focus of the Climate-Related Market Risk Subcommittee of the Market Risk Advisory Committee of the Commodity Futures Trading Commission, on which I served. Along with the other subcommittee members, I was a co-author of the subcommittee's report, *Managing Climate Risk in the U.S. Financial System*, which was the first of its kind to be released under the auspices of a U.S. financial regulator.<sup>2</sup> The report was unanimously approved by the subcommittee's 34 members—experts representing banks, asset managers, agribusiness, the oil and gas sector, academia and environmental organizations. In this section, I draw extensively on that report to discuss climate-related risks to the U.S. financial system.

The report conveys a stark message to financial institutions, regulators, and policy makers: climate change poses serious risks that, if ignored, will undermine the financial system's ability to support the American economy.

Other reports have clearly documented the economic damages from climate change. The science has improved tremendously over the past decade, to the point where we can clearly link severe weather events like hurricanes, wildfires, floods, and drought to a warming planet. One recent study calculated \$1.75 trillion in damages from severe weather events since the 1980s.<sup>3</sup> The National Oceanic and Atmospheric Administration (NOAA) estimates that the United States has already experienced over \$500 billion in direct economic costs from extreme weather events since 2015.<sup>4</sup> Climate change is driving more frequent and damaging extreme weather events; 22 high-cost events were recorded in this past year alone, with each causing over \$1 billion in direct economic damage.<sup>5</sup>

Peer-reviewed economic research suggests that by the end of the century, total economic damages to the United States from climate change could amount to roughly 1 percent of U.S. GDP annually for each 1 degree Celsius of global mean temperature rise.<sup>6</sup> Given expected economic growth rates, that amounts to a few trillion dollars per year in damages by the end of the century in real terms. Those damages would be felt across the economy—reducing crop yields in agriculture, threatening infrastructure, damaging coastal real estate, reducing labor productivity, and increasing heat-related mortality.

But even very large economic damages do not necessarily translate into risk to financial institutions. One of the main contributions of the CFTC report is to explore the potential financial risks in detail.

### *Pathways for climate-related risk to financial institutions*

At the macro—or “systemic”—level, the report discusses how climate impacts could conceivably contribute to a financial crisis by propagating throughout the economy and undermining the value of financial assets, as previously hidden risks are suddenly taken into account.

The report also highlights the possibility that climate-related risks may well produce “sub-systemic” shocks, defined as those that affect financial markets or institutions, or a particular sector, asset class or region, but without threatening the stability of the financial system as a whole. For example, climate-related extreme weather events could pose a risk to financial market operations, via liquidity disruptions (as could occur in agricultural commodity futures markets, say, as a result of price volatility triggered by drought or other extreme weather events in major agricultural states) or by threatening the operation of financial market utilities (the flooding of a vault of the Depository Trust and Clearing Corporation (DTCC) during Superstorm Sandy provides a cautionary tale).<sup>7</sup>

Financial institutions that hold assets likely to be particularly vulnerable to climate change could also be at risk—especially where the impacts of climate change are relatively concentrated. The report highlights examples of risks to various types of financial institutions or asset classes:

<sup>2</sup> Commodity Futures Trading Commission (CFTC), *Managing Climate Risk in the U.S. Financial System*, Report of the Climate-Related Market Risk Subcommittee of the Market Risk Advisory Committee (2020), <https://perma.cc/UT9M-FG2Y>.

<sup>3</sup> Marcy Lowe and Rebecca Marx, *Climate Change-Fueled Weather Disasters: Costs to State and Local Economies* (Datu Research, 2020), <https://perma.cc/N459-SDH4>.

<sup>4</sup> Nat'l Oceanic and Atmospheric Admin., *Billion-Dollar Weather and Climate Disasters: Summary Stats*, <https://perma.cc/57XB-638E> (last visited Jan. 27, 2021).

<sup>5</sup> *Id.*

<sup>6</sup> Solomon Hsiang et al., *Estimating Economic Damage from Climate Change in the United States*, *Science* 365:1362 (2017), <https://perma.cc/UN9D-PRYS>.

<sup>7</sup> CFTC, *Managing Climate Risk in the U.S. Financial System*, 30.

- Banks with international loan portfolios in climate-vulnerable regions.<sup>8</sup> A scenario analysis conducted by 10 major international banks found that water stress resulting from climate-induced drought could lead to increased loan default losses or credit downgrades for bank portfolios.<sup>9</sup>
- Regional and community banks in coastal areas and other climate-vulnerable regions.<sup>10</sup> Regional and community banks held 30 percent of commercial real estate loans in 2019.<sup>11</sup> These loans tend to be geographically concentrated and make up nearly a third of the loan books of small banks (Figure 1). As a result, climate-related disasters that affect commercial real estate in a particular region—such as a severe hurricane season—can have a disproportionate impact on local financial institutions.
- Agricultural banks.<sup>12</sup> Nearly half of all agricultural loans are held by lenders with at least one-quarter of their portfolio concentrated in farm-related areas, such as operating loans or real estate loans (Figure 2). Many of these lenders also have correlated risks because of loan concentrations in particular geographies or related agricultural businesses. Following severe flooding in the spring of 2019, for example, lenders in the Midwest reported to the Federal Reserve Bank of Chicago that 70 percent of their borrowers were moderately or severely affected by extreme weather events. That year, the portion of the region's agricultural loan portfolio reported as having “major” or “severe” repayment problems hit the highest level in 20 years. Such occurrences are likely to become more frequent and severe as climate impacts continue to grow. A credit-stressed agricultural lending system would decrease farmers' access to affordable credit and increase the difficulty in recovering from climate-related shocks.

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<sup>8</sup> CFTC, Managing Climate Risk in the U.S. Financial System, 33.

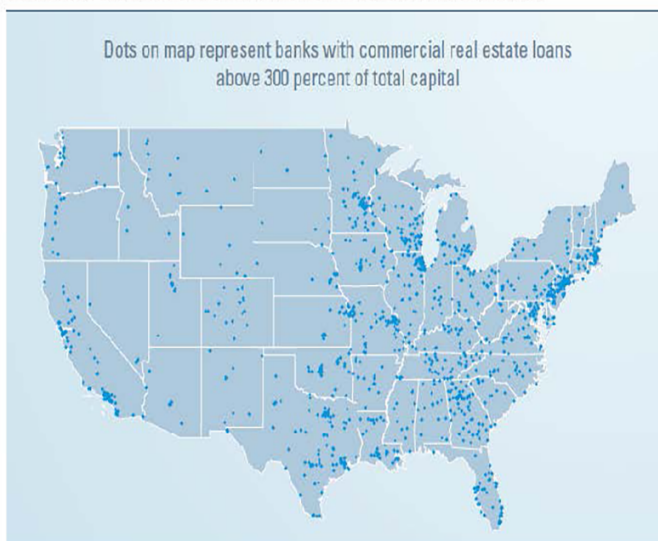
<sup>9</sup> Laurence Carter and Stephen Moss, Drought Stress Testing: Making Financial Institutions More Resilient to Environmental Risks (U.N. Environment Programme Financial Initiative, 2017), <https://perma.cc/3BRF-CDPV>.

<sup>10</sup> CFTC, Managing Climate Risk in the U.S. Financial System, 33.

<sup>11</sup> Federal Deposit Insurance Corporation, 2019 Risk Review (Washington, DC: Federal Deposit Insurance Corporation, 2019). <https://www.fdic.gov/bank/analytical/risk-review/full.pdf>.

<sup>12</sup> CFTC, Managing Climate Risk in the U.S. Financial System, 35.

**Figure 1: Regional exposure to commercial real estate lending.** *Source: CFTC, Managing Climate Risk in the U.S. Financial System, Figure 3.3.*



**Figure 2: Regional exposure to agricultural lending.** *Source: CFTC, Managing Climate Risk in the U.S. Financial System, Figure 3.4.*



- Municipal bonds.<sup>13</sup> Municipal bonds, used to help finance local governments and held by a wide variety of mutual funds, banks, insurance companies, households, and non-profit organizations, could also be at risk in climate-vulnerable regions. An analysis by BlackRock estimated that in roughly the next decade, municipalities issuing more than 15 percent of the S&P National Municipal Bond Index could face climate-related GDP losses of 0.5 to 1 percent annually—with that figure rising to 40 percent of municipalities suffering losses of 3 percent or more by the end of the century.<sup>14</sup> These impacts could have significant implications for the ability of municipalities to service their obligations—raising the financial risk to bondholders.

**Table 1: Categories of assets exposed to climate change impacts.** *Source: CFTC, Managing Climate Risk in the U.S. Financial System, Table 3.1.*

Categories	Examples
Financial assets directly tied to real property	<ul style="list-style-type: none"> <li>Commercial mortgage-backed securities (CMBS)</li> <li>Commercial real estate (CRE) bank loans</li> <li>Government-sponsored enterprise (GSE) Credit Risk Transfer securities</li> <li>Real Estate Investment Trusts (REITs)</li> <li>Residential mortgage-backed securities (RMBS)</li> <li>Residential mortgages</li> </ul>
Financial assets tied to infrastructure	<ul style="list-style-type: none"> <li>Debt and equities of power and water utilities and communications companies</li> <li>Debt and equities of public and private transportation infrastructure</li> </ul>
Financial assets tied to companies with businesses models or operations likely to be impacted by physical or transition risk	Equities and debt of firms in the following sectors: <ul style="list-style-type: none"> <li>Agriculture</li> <li>Airlines and the broader transportation sector</li> <li>Automobiles</li> <li>Cement, steel, chemicals, plastics</li> <li>Energy, including coal, oil, and gas production</li> <li>Hospitality</li> <li>Metals and mining</li> <li>Power generation</li> <li>Service and infrastructure providers to oil and gas</li> <li>Tourism</li> </ul>
Financial assets tied to insurance coverage providers	<ul style="list-style-type: none"> <li>Insurance and reinsurance company debt and equities</li> <li>Insurance linked securities (ILS)</li> </ul>
Financial assets tied to streams of government revenue	<ul style="list-style-type: none"> <li>Municipal bonds</li> <li>Sovereign bonds</li> </ul>

Table 1 on the previous page, taken from the CFTC report, presents a comprehensive list of assets exposed to climate change. It reveals the breadth of climate risk,

<sup>13</sup> CFTC, Managing Climate Risk in the U.S. Financial System, 36.

<sup>14</sup> Ashley Schulten et al., Getting Physical: Scenario Analysis for Assessing Climate-Related Risks (BlackRock Investment Institute, 2019), <https://perma.cc/3J5C-7DK6>.

including assets like mortgage-backed securities, real estate investment trusts (REITs), utility debt, insurance equities, and bonds; and sectors including agriculture, airlines, automobile manufacturers, hospitality, power generation, and concrete and steel.

Who bears these risks? Some risk is borne by regular investors—those without the information, analytical resources, or access to proprietary data to allow them to identify and respond to hidden risks from climate change. Some risk is borne by the regional financial institutions and the people who depend on them: small businesses with commercial real estate mortgages, farmers needing loans from agricultural credit institutions, and so on. In other words, this isn't just about big banks on Wall Street; this is about everyday transactions on Main Street: the home mortgages, commercial real estate loans, farm credit, and small business loans that underpin the U.S. economy—and that depend on a stable financial system.

How likely are those risks? The scary answer is: We don't know. The report shows a range of scenarios for how climate change could threaten the U.S. financial system, but we don't know when or how those scenarios could occur—because we are not requiring businesses and financial institutions to assess, measure, manage, and disclose those risks. Recent research from the Brookings Institution, aptly titled “Flying Blind,” makes the same point: investors don't know the actual climate risks to their portfolios.<sup>15</sup> Members of the financial community who ignore climate change—whether they are banks, investors or regulators—do so at their own peril.

That's precisely why measuring and managing climate risk should be an essential part of the actions regulators take to protect the financial system. I now turn to the role of regulators.

### **The Duties and Authorities of Financial Regulators To Respond to the Risks of Climate Change**

#### *Climate change and the foundational duties and authorities of financial regulators*

Effective financial regulation relies upon multiple and overlapping federal and state regulatory regimes and regulators, each working to achieve a diversity of statutory goals and objectives. Those duties and obligations vary, but generally require agencies to ensure “market efficiency and integrity, consumer and investor protections, capital formation or access to credit, taxpayer protection, illicit activity prevention, and financial stability.”<sup>16</sup> These broad statutory obligations require financial regulators to ensure a variety of safeguards are present. Transparent and fairly enforced market rules support market integrity. Reducing information asymmetries, ensuring accurate and comprehensive information, and requiring robust disclosure improves efficiency. Preventing losses to the American taxpayer is likewise of crucial importance. And financial stability, considered in the context of systemic risk and synergistic events, is core to regulatory responsibility.

Climate change is highly relevant to the various statutory obligations for financial regulators identified above: market efficiency and integrity can only be maintained when market participants are aware of climate risks to regulated entities and investments; taxpayer losses can only be prevented when the effects of climate change are considered; and financial stability can only be maintained when systemic risks like climate change are proactively addressed. More generally, risk identification, reduction, and allocation guide regulatory oversight and should extend to consideration of climate impacts. For these reasons, financial regulators should take proactive action to consider how the consequences of climate change implicate their statutory duties and authorities.

The consequences of climate change increasingly implicate these and other statutory duties of financial regulators. Put simply: Asserting that financial regulators have an obligation to regulate climate risk is not based on a reinterpretation of the duties of those regulators. Those duties remain the same. What is “new” is the magnitude of the risk posed by climate change.

#### *The need for mandatory disclosure of climate-related financial risk*

As described above, financial regulators have long required requisite levels of transparency and accountability from regulated entities. Safeguards to ensure accurate and comprehensive information are necessary to the U.S. economy and convey critical benefits across stakeholders. Duties and authorities under federal securities law serves as one pressing example, with the SEC statutorily obligated to protect

<sup>15</sup>Parker Bolstad et al., *Flying Blind: What do Investors Really Know About Climate Change Risks in the U.S. Equity and Municipal Debt Markets?* (Brookings Institute, 2020), <https://perma.cc/8LNV-BEGK>.

<sup>16</sup>Marc Labonte, “Who Regulates Whom? An Overview of the U.S. Financial Regulatory Framework” (Congressional Research Service, 2020), <https://perma.cc/NXT4-V3RU>, ii.

investors, facilitate capital formation, and maintain fair, orderly, and efficient markets.<sup>17</sup>

To discharge these core duties, the SEC requires, among other things, that regulated entities disclose material risks. As demonstrated in section 2, climate change increasingly poses a material risk to a broad swath of the economy. The consequences of climate change are already creating significant and foreseeable financial harms, and disclosure is necessary to ensure investors are aware of the physical and transition risks that corporations they invest in may face, as well as the potential implications of that exposure.

Although climate related financial risks are growing, current disclosure regimes in the United States have not kept pace. SEC guidance in 2010 was important and pathbreaking but has proven insufficient, with resulting disclosures lacking in specificity, submitted with boilerplate language, or missing entirely.<sup>18</sup> In the absence of effective regulation, voluntary standards and frameworks have emerged. Although these efforts, including those by the Task Force on Climate-related Financial Disclosures (TCFD) and the Sustainability Accounting Standards Board (SASB) have been critical to advancing climate risk disclosure, they are insufficient. Recent study has found that although climate risk disclosure has increased, “[m]ore firms are disclosing more general information that is essentially of no utility to the marketplace.”<sup>19</sup> In addition, disclosure varies across sectors and some sectors that are particularly vulnerable to climate impacts, such as agriculture, are lagging in their assessment and disclosure of climate risks.<sup>20</sup>

To address this vulnerability, the SEC should take action to strengthen mandatory climate risk disclosure. Doing so furthers the Commission’s statutory duties and provides benefit not only to investors, but to regulatory companies, the market, and the American public. First, investors benefit generally when risks are disclosed, insofar as “investors can only price the risks that they are aware of,” and understanding climate risk exposure “requires more granular data than is currently disclosed in financial reporting.”<sup>21</sup> Useful climate risk information thus serves an investor’s interest in effectively allocating capital on the basis of a robust understanding of reward and risk. Second, companies benefit in at least three ways: “the improved ability: (i) to identify, assess, manage, and adapt to the effects of climate change on operations, supply chains and customer demand; (ii) to relay risk and opportunity information to capital providers, investors, derivatives customers and counterparties, markets, and regulators; and, (iii) to learn from competitors about climate-related strategy and risk management best practices.”<sup>22</sup>

Third, strengthened climate risk disclosure benefits markets themselves, and climate risk disclosure is relevant to facilitating capital formation and maintaining fair, orderly, and efficient markets. As noted above, prices that incorporate all information about a corporation’s financial prospects improve investors’ ability to distribute capital to its highest value use. Without sufficient disclosure, widespread mispricing can occur, an outcome that puts market structures at risk, where in the absence of accessible and accurate information the likelihood of a sudden shift in price correction may occur. Financial experts have warned that consequent “sharp changes in valuations” of corporate entities could in turn lead to cascading instability across the financial sector.<sup>23</sup>

Fourth, climate risk disclosure also conveys crucial benefit to the American public: transparent disclosure of climate risk and incorporation of that information supports public planning; better understanding of physical climate risk and thoughtful resilience planning can reduce damage; and strengthened climate risk disclosure has the potential to support mitigation efforts.<sup>24</sup>

<sup>17</sup> National Securities Markets Improvement Act of 1996, Pub. L. No. 104-290, 110 Stat. 3425 (adding 15 U.S.C. §77b(b) to the Securities Act of 1933 and 15 U.S.C. §78c(f) to the Securities and Exchange Act of 1934).

<sup>18</sup> Sustainability Accounting Standards Board, *The State of Disclosure 2017: An Analysis of the Effectiveness of Sustainability Disclosure in SEC Filings* (2017), <https://perma.cc/USC8-2HN2>, p. 2.

<sup>19</sup> Parker Bolstad et al., “Flying Blind”, 3.

<sup>20</sup> Agricultural lenders cite their largest risks as commodity prices, production costs, farmland values and global market issues. U.S. Bd. of Governors of the Fed. Reserv. Sys., Div. of Banking Supervision and Regul., SR 11-14: Supervisory Expectations for Risk Management of Agricultural Credit Risk (2011), <https://perma.cc/LT4G-2D6T>.

<sup>21</sup> Madison Condon, *Market Myopia’s Climate Bubble*, 2021, *Utah L. Rev.* (forthcoming 2021) (manuscript at 6-7), <https://papers.ssrn.com/sol3/papers.cfm?abstract-id=3782675>.

<sup>22</sup> CFTC, *Managing Climate Risk in the U.S. Financial System*, 87.

<sup>23</sup> Mark Carney, Gov., Bank of England, Chair, Fin. Stability Bd., *Resolving the Climate Paradox*, Arthur Burns Memorial Lecture (Sept. 22, 2016), <https://perma.cc/6GPS-VWVU>.

<sup>24</sup> Benedikt Downar, Jurgen Ernstberger, Stefan Reichelstein, Sebastian Schwenen, and Aleksandar Zaklan, “The Impact of Carbon Disclosure Mandates on Emissions and Financial

For these reasons, the consequences of climate change should be brought level with other forms of financial risk and mandatory disclosure rules strengthened. Boilerplate filings are not adequate, and disclosure should drive comparable, specific, and decision-useful information from regulated entities. These three tentpoles of strengthened disclosure necessarily overlap, but each conveys particular meaning: comparability enables benchmarking and risk relational across companies; specificity encourages granular analysis particular to that entity; and decision-useful design, meant to broadly contemplate not only investment determinations but also, for example, ownership, engagement, and proxy voting-related decisions, is crucial.<sup>25</sup>

The SEC has recently taken positive and important steps to consider where and how climate change implicates its statutory duties and obligations, including focusing staff attention on the subject and requesting public input on climate risk disclosure.<sup>26</sup> These efforts should lead to mandatory comparable, specific, and decision-useful climate risk disclosure.

*Additional recommendations for incorporating climate risk into financial regulation*

As described above, climate change implicates multiple financial regulators and a variety of statutory obligations and duties. In this context, a few additional examples of specific agencies actions are identified below. These actions are described here to highlight the varying ways in which climate change interacts with regulatory responsibility and identify a few potential priorities, without representing an exclusive list.

*Add climate risk expertise*

First, the Treasury Department and the Financial Stability Oversight Council (FSOC) should act swiftly to add climate risk expertise. The consequences of climate change as a systemic risk could be explicated through these bodies, and FSOC may additionally serve as an entity well-suited to convene an interagency working group to consider climate scenario analyses. Such action would have precedent: FSOC has previously created interagency working groups to better understand potential risks of specific activities and actions to financial stability.<sup>27</sup>

Likewise, the Federal Reserve should continue efforts to improve its internal expertise on climate risk. In its 2020 Financial Stability Report, the Federal Reserve classified climate change as a “near-term risk to the financial system that will likely increase financial shocks and financial system vulnerabilities.”<sup>28</sup> Similarly, the Fed has recently stated that “Federal Reserve supervisors are responsible for ensuring that supervised institutions operate in a safe and sound manner and can continue to provide financial services to their customers in the face of all types of risks, including those related to climate change.”<sup>29</sup>

*Require bank and nonbank financial firms to incorporate climate risk more broadly*

Under its supervisory authority, the Federal Reserve should require financial institutions to incorporate consideration of climate-related financial risk into existing risk management and governance frameworks. As recommended in the CFTC report, the Fed should also begin to explore incorporating climate risk into stress testing, for example through a pilot climate risk stress testing program in conjunction with financial institutions—following the lead of other jurisdictions such as the U.K., and drawing on the work of the Central Bank and Supervisors Network for Greening the Financial System (NGFS).<sup>30</sup>

*Promote broader availability and consistency of climate data*

To inform these stress tests and help ensure consistency in reporting, regulators should work with a range of stakeholders to support the widespread public availability of consistent, comparable, and reliable climate data and analysis, including

Operating Performance”, (Stanford Steyer-Taylor Center for Energy Policy and Finance, 2020), <https://law.stanford.edu/publications/the-impact-of-carbon-disclosure-mandates-on-emissions-and-financial-operating-performance/>.

<sup>25</sup>Madison Condon et al., Mandating Disclosure of Climate-Related Financial Risk (NYU Institute for Policy Integrity and Environmental Defense Fund, 2021), <https://perma.cc/2USW-MMXF>, p. 11.

<sup>26</sup>Acting Chair Allison Herren Lee, Public Input Welcomed on Climate Change Disclosures, U.S. Securities and Exchange Comm’n (Mar. 15, 2021), <https://perma.cc/U9VA-RZW3>.

<sup>27</sup>Press Release, Dep’t of Treasury, Financial Stability Oversight Council Releases Statement on Review of Asset Management Products and Activities (Apr. 18, 2016), <https://perma.cc/M9T9-M9J5>.

<sup>28</sup><https://www.federalreserve.gov/publications/2020-november-financial-stability-report-near-term-risks.htm>

<sup>29</sup>“Supervision and Regulation Report”, Board of Governors of the Federal Reserve System, November 2020, <https://www.federalreserve.gov/publications/files/202011-supervision-and-regulation-report.pdf>.

<sup>30</sup>CFTC, Managing Climate Risk in the U.S. Financial System, 44-45 and 51-52.

via open source platforms, and to develop standardized, consistent, broadly applicable climate scenarios.<sup>31</sup>

### **Opportunities for Moving Private Capital to Address Climate Change**

#### *The role of the private sector in promoting climate-friendly and sustainable investment*

Over the past five years, private capital has increasingly flowed towards climate-friendly assets, as part of a broader shift to take environmental, social, and governance (ESG) factors into account in investing. Between 2016 and 2018, ESG investing (often referred to as “sustainable” investing) in the US grew by more than 38 percent.<sup>32</sup> Sustainable investments now account for approximately one third of all assets under professional management in the US, totaling \$17.1 trillion as of November 2020.<sup>33</sup> These trends are driven in large part by increasing demand: 85 percent of investors across all age groups express interest in sustainable investing. This number rises for younger populations: 95 percent of millennials have a stated interest in sustainable investing and 89 percent actively expect their financial advisors to assess a company’s ESG profile before making an investment recommendation.<sup>34</sup>

Much of the rising demand in ESG and sustainable investing is driven by a particular focus on climate change, motivated by an interest in helping to combat the physical and transition risks presented by climate change as well as the opportunities to generate value from low-carbon and climate-friendly investment. The Climate Action 100+ initiative, designed to support transition to net-zero business strategies, continues to grow, with nearly 550 investors and \$52 trillion in assets under member management.<sup>35</sup> These trends highlight the immense momentum driving private capital towards climate solutions.

Asset managers and banks also understand that climate change poses short-, medium-, and long-term financial risks. As BlackRock CEO Larry Fink succinctly wrote in 2020, “climate risk is investment risk.”<sup>36</sup> BlackRock is not alone; investors increasingly allocate private capital to climate-friendly assets to minimize risk and maximize returns.<sup>37</sup> Indeed, these same underlying forces have prompted leading financial institutions to commit to achieving net zero finance emissions by 2050. JPMorgan, Morgan Stanley, Goldman Sachs, and Citigroup among others have all pledged to slash their financed emissions over the coming decades. These commitments portend even more climate-aligned capital allocation in the future. However, more action is needed.

Banks and asset managers can begin reducing financed emissions in the immediate term by engaging with companies in carbon-intensive sectors such as oil and gas and transportation. In oil and gas, firms can monitor, for example, methane emissions, flaring intensity, capital expenditures, lobbying, and governance to track progress and allocate investment to those that perform well. By establishing time-bound climate benchmarks with consequences for high impact sectors, investors can accelerate the deployment of private capital to climate solutions.<sup>38</sup> Banks and asset managers should also direct financing towards activities that simultaneously reduce greenhouse gas emissions and build the underlying asset’s climate resilience. For example, private investments in climate-resilient agricultural production can reduce agriculture’s greenhouse gas emissions while reducing production risks from severe weather impacts.<sup>39</sup>

#### *The role of government policies in channeling private capital into climate solutions*

##### *Carbon pricing*

The most important step that government could take to help channel private capital into low-carbon investment is to implement policies that put a fair and effective

<sup>31</sup> See discussion of data needs and scenario analysis in CFTC, Managing Climate Risk in the U.S. Financial System, Chapters 5 and 6.

<sup>32</sup> US SIF, Sustainable Investing Basics, <https://perma.cc/2E9F-PTEN>.

<sup>33</sup> US SIF, The US SIF Foundation’s Biennial “Trends Report” Finds that Sustainable Investing Assets Reach \$17.1 Trillion (Nov. 16, 2020, 3:24 PM), <https://perma.cc/DM2C-YBCX>.

<sup>34</sup> MSCI, Swipe to Invest: The Story Behind Millennials and ESG Investing 7 (2020), <https://perma.cc/ZSQ6-PQ6N>.

<sup>35</sup> “Climate Action 100+”, Ceres, <https://www.ceres.org/initiatives/climate-action-100>.

<sup>36</sup> Larry Fink, Larry Fink’s 2020 Letter to CEOs: A Fundamental Reshaping of Finance, BlackRock (Jan. 14, 2020), <https://perma.cc/8TA7-VGUM>.

<sup>37</sup> Jon Hale, Morningstar, Sustainable Funds U.S. Landscape Report: More Funds, More Flows, and Impressive Returns in 2020 (2021), <https://perma.cc/9SFJ-7NE5>.

<sup>38</sup> Ben Ratner and Erin Blanton, Five Key Climate Metrics for the Oil and Gas Sector’s Next Five Years, World Economic Forum (Nov. 2, 2020), <https://perma.cc/U3RL-KMXF>.

<sup>39</sup> Maggie Monast, Financing Resilient Agriculture: How Agricultural Lenders Can Reduce Climate Risk and Help Farmers Build Resilience (Environmental Defense Fund, 2020), <https://perma.cc/BF4G-A55W>.

price on carbon emissions. Every ton of carbon dioxide and other greenhouse gases imposes a cost on society as a whole. Using the U.S. government's current central estimate of the social cost of carbon—the estimate economic damages from a ton of carbon dioxide emitted today, calculated into the future and discounted back to today—is \$51 per ton.<sup>40</sup> Given total U.S. CO<sub>2</sub> emissions of more than 5 billion tons, that implies an annual cost on the order of a quarter of a trillion dollars per year. Moreover, there are strong reasons to think that the current estimate of the social cost of carbon is too low.<sup>41</sup> In the absence of effective government policies, however, that cost is not reflected in market prices—and therefore is missing from the financial returns to investors.

As a result, without a price on carbon, private markets will fail to direct capital efficiently. In the words of the CFTC report:

Without an effective price on carbon, financial markets lack the most efficient incentive mechanism to price climate risks. Therefore, all manner of financial instruments—stocks, bonds, futures, bank loans—do not incorporate those risks in their price. Risk that is not quantified is difficult to manage effectively. Instead, it can build up and eventually cause a disorderly adjustment of prices.<sup>42</sup>

For this reason, the CFTC report recommends that

The United States should establish a price on carbon. It must be fair, economywide, and effective in reducing emissions consistent with the Paris Agreement. This is the single most important step to manage climate risk and drive the appropriate allocation of capital.<sup>43</sup>

*Supporting climate-focused and sustainable investing*

While interest in ESG and sustainable investing is increasing, the data underlying ESG products remains inconsistent in terms of quality and availability. ESG investing remains relatively opaque, with no shared industry definition on “sustainability.” As a result, ESG-branded products can contain companies that perform poorly on climate, and comparability between ESG rating systems is difficult to achieve.<sup>44</sup> More generally, investors face difficulties engaging companies on decarbonization strategies when they lack relevant climate information. Strengthened mandatory disclosure by the SEC, as described above, could help address these issues, driving more private capital to climate-friendly assets.

Government policies should also acknowledge the relevance of ESG factors, including climate-related factors, to investors and allow them to be better integrated into retirement planning. Demand for sustainable retirement funds is high; 74 percent of employees feel that having socially responsible investment options in their 401(k) plans is important. Roughly 2/3rds of all millennials would increase their retirement plan contribution if they knew their investments were doing social good. Retirement plans are a significant vehicle for individual investors to realize their goals: while only 14 percent of Americans are directly invested in individual stocks, over half have access to 401(k) plans.<sup>45</sup> Yet despite clear interest in sustainable investment, less than 3 percent of 401(k) plans include an ESG option and only .1 percent of 401(k) assets are ESG-aligned.<sup>46</sup>

Promoting better integration of ESG and climate-focused factors in the \$6.6 trillion 401(k) market would provide millions of Americans with access to funds that generate superior long-term returns, align with their values, and protect the planet. The Department of Labor (DOL), under the Employee Retirement Income Security Act (ERISA), oversees minimum standards for retirement plans in the United States, and should consider rulemaking and/or other actions that could support cli-

<sup>40</sup> United States Government Interagency Working Group on Social Cost of Greenhouse Gases, Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990 (February 2021), <https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument-SocialCostofCarbonMethaneNitrousOxide.pdf>.

<sup>41</sup> K.D. Daniel, R.B. Litterman, and G. Wagner, Declining CO<sub>2</sub> price paths, Proceedings of the National Academy of Sciences 116(42) (2019), 20886-20891; R.L. Revesz, P.H. Howard, K. Arrow, L.H. Goulder, R.E. Kopp, M. Livermore, and T. Sterner, Global warming: Improve economic models of climate change, *Nature*, 508(7495) (2014), 173.

<sup>42</sup> CFTC, Managing Climate Risk in the U.S. Financial System, 4.

<sup>43</sup> CFTC, Managing Climate Risk in the U.S. Financial System, 9.

<sup>44</sup> Dane Christensen et al., “Why is Corporate Virtue in the Eye of the Beholder? The Case of ESG Ratings”, 96 *The Acct. Rev.* (forthcoming 2021), <https://perma.cc/Q8X3-5QUV>.

<sup>45</sup> <https://www.pewresearch.org/fact-tank/2020/03/25/more-than-half-of-u-s-households-have-some-investment-in-the-stock-market/>

<sup>46</sup> Greg Iacurci, Climate Funds Hold Less Than 1 percent of 401(k) Money. Here's Why, CNBC (Dec. 14, 2020), <https://perma.cc/D892-JMEN>.

mate-aligned investment by better integrating ESG and sustainability factors in ERISA plans. In particular, DOL should consider formally acknowledging existing evidence that climate-related risks are financially material, in order to clarify existing regulations for plan fiduciaries and reduce uncertainty that can hinder the inclusion of climate-relevant factors into plan offerings.

### Conclusion

Climate change poses significant risks to the U.S. financial system—but well-designed policies can help to manage and mitigate those risks. As policy makers consider how to address the challenge of climate change and position the U.S. economy for robust, inclusive growth in coming decades, they have a range of tools available. Given the central importance of accurate, consistent, and up-to-date information, regulators should put particular importance on mandatory climate risk disclosure, as well as incorporating climate risk into risk management practices of regulated firms, increasing the relevant expertise of regulators, and improving data availability. In addition, well-designed policies can help remove barriers that limit the flow of private capital into low-carbon and climate-friendly investment opportunities, responding to the significant and growing demand from investors. In that respect, the most important step policy makers can take would be to implement a fair and effective price on carbon across the U.S. economy.

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### PREPARED STATEMENT OF MARILYN WAITE

CLIMATE AND CLEAN ENERGY FINANCE PROGRAM OFFICER, THE WILLIAM AND FLORA HEWLETT FOUNDATION

MARCH 18, 2021

### Climate Urgency

The year 2020 marked a turning point in planetary systems—it was the warmest year on record, with Death Valley in California reporting a maximum temperature of 130 degrees F in August.<sup>1</sup> The United States experienced 22 separate billion-dollar weather and climate-related disasters, exacerbating the economic toll of COVID-19 and costing \$95 billion in damages in a single year.<sup>2</sup>

As climate change pushes towards higher average global temperatures, we will continue to see a variety of sectors hurt: from grounded planes in Arizona because it's simply too hot to take off, to a dwindling food supply because heavy rain and snow storms in the Midwest blanket agricultural land. In an Economic Brief from the Federal Reserve Bank of Richmond, researchers explained that rising temperatures could reduce overall growth of U.S. economic output by as much as one-third by 2100.<sup>3</sup> The impacts of climate change are deep and widespread, with no one industry exempt.

In 2018, the Intergovernmental Panel on Climate Change (IPCC) outlined the impacts of climate change at 2.7 degrees F (or 1.5 degrees C). The report, which involved 91 authors and drew upon 6,000 research papers, emphasized the time-sensitive nature for mitigating climate change—we must accelerate action over the next decade to avoid significant loss of human, economic and ecosystem life.<sup>4</sup> In order to avert unprecedented upheaval, the global average temperature increase from pre-industrial levels must stay at or below 1.5 degrees C. To remain within this limit, the global economy must cut annual global greenhouse gas emissions 45 percent below 2010 levels by 2030 and reach net zero (also known as becoming carbon neutral) by 2050. At the global level, this means that, in aggregate, all sources of anthropogenic GHG emissions that currently total up to 55 GT of CO<sub>2</sub> equivalent (CO<sub>2</sub>e) per year must reach zero. For the United States, which represents about 15 percent of the world's GDP and GHG emissions, this equates to roughly 6 GT of CO<sub>2</sub>e annually.<sup>5</sup>

If warming is allowed to increase to 4 degrees C in the business-as-usual scenario, global economic losses from climate change are conservatively estimated to be \$23 trillion per year—three to four times the scale of the 2008 financial crisis and more than three times the predicted contraction of global GDP due to COVID-19.<sup>6</sup> That estimate is conservative partly because it does not account for the effects of wildfires and other extreme events.

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<sup>1</sup>Laura Newberry. *L.A. Times*, Aug 16, 2020. "Death Valley Hits 130 Degrees, Thought To Be Highest Temperature on Earth in Nearly a Century". <https://www.latimes.com/california/story/2020-08-16/death-valley-hits-130-degrees-thought-to-be-earths-highest-temperature-in-more-a-century>

But we have choices. Another modelled estimate finds the economic cost of failing to cut emissions adds up to a burden of between \$150 and \$792 trillion by 2100, whereas the net benefit of climate change mitigation, on top of avoiding those losses, could be between \$127 and \$616 trillion by 2100.<sup>7</sup>

In short, it's cheaper to solve the climate crisis than to allow it to persist.

According to a comprehensive study by Princeton University, the U.S. must invest an additional \$250 billion each year, compared to business-as-usual, for the next ten years at a minimum to reach net zero by 2050. These investments would target energy supply, industry, buildings, and vehicles and could create 1 million new jobs.<sup>8</sup>

### **Climate-Related Financial Risks**

The impacts of climate change to the financial system manifest in multiple ways and can be grouped in both physical and transition risks.

Physical risk includes damage to properties and assets from the changing climate and related extreme weather events. Physical risks, whether acute or chronic, can lead to increased capital costs (e.g., damage to facilities), reduced revenues from lower sales/output, write-offs and early retirement of existing assets (e.g., damage to assets in "high-risk" locations), and increased operating costs (e.g., inadequate water supply for hydroelectric plants or to cool nuclear and fossil fuel plants). Physical risks include both demand and supply-side shocks to the financial system. For instance, rising sea levels may decrease demand for coastal real estate; saline intrusion of wells may impact drinking water supplies.

Transition risks are losses arising from the transition from a fossil fuel-based economy to a clean energy economy. The risks include credit risk (loan defaults from stranded assets, technology substitution of existing products and services with lower emissions options) and market risk (such as impairment of capital market assets), and can result in reduced demand for products and services and repricing of assets. Transition risks also capture the indirect effects of climate change, such as higher prices of raw materials, which may lead to less competition among firms, which in turn may lead to greater unemployment, which could result in greater insecurity. Taken together, once risks have manifested at the institutional and retail level, they reach the financial markets, through the classic market, credit, liquidity and operational risks.<sup>9</sup>

Worth special attention is the creation of stranded assets. This term describes an asset, such as a piece of equipment or a resource, which falls in value or can no longer produce revenue as a result of technological developments, market shifts or changing societal habits.<sup>10</sup> For example, by the early 20th century, the market for whale oil and oil lamps all but disappeared with the advent of electric lighting. The whaling industry's ships and the existing stock of oil lamps therefore became stranded assets. Today the term is often used to describe oil and gas resources that remain in the ground but appear as assets on a firm's balance sheet. Yet stranded assets are not only a problem for companies involved in fossil fuel extraction; businesses that use fossil fuels as production inputs, or are otherwise energy or carbon intensive could also be heavily impacted by climate legislation, technological breakthroughs, and a shift in demand as the global economy transitions away from fossil fuels.

In some sectors, such as coal, the stranding of assets has already begun due to the relative cost competitiveness of renewables. For example, globally, power generation from wind and solar installations are now less expensive to operate than coal—with almost 30 percent of new coal plants estimated to enter the market cash flow negative from their first day of operation.<sup>11</sup> Furthermore, investors and governments alike could find themselves with \$630 billion worth of stranded assets if the current global pipeline of new coal plant construction was to proceed.<sup>12</sup> If investing continues along a business-as-usual path, and the financial system fails to incorporate climate risks into its decision-making framework—businesses will inevitably end up with stranded assets across numerous sectors.

As the financial system and the real economy will both be devastated if the planet warms much more, and with real losses already manifesting in some sectors and asset classes, the challenge goes far beyond just protecting the financial system from climate risk. Investors and policymakers must choose if and why they should finance and back assets that are fundamentally unworkable, inconsistent with international agreements such as the Paris Agreement, and are likely to be stranded. In the case of coal, it would be wise for policymakers to plan now for the retirement of coal assets over the coming 10 years to minimize the financial risk of a disorderly energy transition.<sup>13</sup> The financial system, through new market rules, must integrate a shift from the single materiality of risk management to the double materiality of risk and impact management; this double materiality includes financial materiality and environmental and social materiality.<sup>14</sup>

### Role of Finance in Solving Climate Change

Finance is absolutely essential. There will not be a transition to a low carbon economy without a way to finance the vast number of infrastructure, retrofit, new technology research, and various other projects needed. We saw annual climate investment flows rise to \$579 billion, on average, over the 2-year period of 2017-2018, with increases concentrated in low-carbon transport, North America, and East Asia. Nevertheless, this figure is not enough to maintain a well-below 2 degrees C of warming target. Estimates of the global investment required to achieve that goal range from \$1.6 to 3.8 trillion annually, for supply-side energy system investments alone.<sup>15</sup> However policymakers as well as businesses know that investments are not only associated with costs, they also bring returns and benefits. Therefore, while climate change is a significant crisis, it is also a significant opportunity to create jobs, wealth, and long-term economic prosperity-especially in the context of the ongoing U.S. economy's recovery from COVID-19.

In 2018 alone, the U.S. advanced energy industry generated \$238 billion in revenue, which is roughly equal to that of aerospace manufacturing and double that of the biotech industry. The market for climate-smart technology is expected to grow significantly over the coming decade, estimated to be worth \$23 trillion by 2030. Clean energy installations are also a steady source of state and local taxes-for example, wind farms paid \$761 million to state and local governments in 2018 in addition to \$289 million to farmers and landowners who leased their land to wind turbine operators. Investing \$4 billion annually into reforestation and sustainable forest management could support an estimated 150,000 jobs per year, which is three times as many jobs as the logging industry provides.<sup>16</sup>

At the Hewlett Foundation, we've taken a lead on committing significant resources to climate initiatives—and for the first time in 2018-2023, we dedicated \$75 million to Climate Finance and Investment grantmaking. This falls within our broader commitment of \$600 million for climate-focused grantmaking across four key geographies (the United States, China, India and Europe) within five sectors including Electricity, Transportation and Cities, Industry, Finance/Investment, and Technology, Innovation and R&D.

In developing our Climate Finance Strategy, we studied the financial system to better understand where capital was allocated, who owned or controlled it, and what the barriers were to financing more zero emissions energy, transportation, industry, and land use projects. What we found was nearly \$250 trillion worth of commercial capital available globally in five primary capital pools including: Asset Owners, Retail Bank Deposits, Development Finance Institutions (DFI)/Multilateral Development Banks (MDB), Private Equity and Venture Capital. Broadly speaking, each of these pools of capital seek different risk/return profiles, comply with different regulations in different markets, and perform distinct functions in the global capital markets.<sup>17</sup>

The data clearly show that the problem is not lack of capital. Moreover, recent responses to COVID-19 have mobilized trillions from national budgets and the capital markets have re-bounded since March 2020, shifting trillions of dollars from retail and institutional investors to listed companies. Yet an estimated one-third of fixed income and public equity assets are still linked to climate change causing industries.<sup>18</sup> Therefore, the real challenge is moving those trillions to low-carbon investments. Numerous factors hold back this investment-entrenched beliefs, thinking, and processes associated with traditional methods of investment decision-making hamper action. For some investment professionals, false perceptions about investing in climate-friendly projects or technologies are common. For others, a lack of data or tools makes it too challenging to apply the consideration of the impacts and risks associated with climate change to their portfolio.

Through interviews, research and analysis, we identified eight key barriers that inhibit the expansion of opportunities to access and mobilize finance for climate-friendly activities. These include:

1. Limited Sources of High-Risk Capital
2. Pricing of Perceived Risks
3. Deal Size Preferences
4. Lack of Transparent Data
5. Policy Uncertainty
6. Timing of Climate Risk Impacts
7. Lack of climate-friendly investment guidelines
8. Short-term investment horizons

**Limited Sources of High-Risk Capital:** Early-stage investments provide the bridge between the research and development of a technology and scaling up. Typically, Venture Capital (VC) funds fill this gap and are an integral resource for early-stage investments and helping companies scale. Yet VC cleantech investments are heavily skewed towards late-stage projects concentrated around energy efficiency, transportation and smart grid. As such, 87 percent of VC cleantech investments went to late stage projects in 2016.

**Pricing of Perceived Risks:** Risks that apply to climate-friendly investments are often perceived by investors in vastly different ways. This results in a wide variation in pricing and capital availability. For example, energy efficiency projects are universally identified as critical to solving climate change; yet the inability to finance these projects based on the strength of their energy savings has limited their deployment. Investors' opinions, not always data, sometimes lead to an over reliance on the financial strength of the project hosts, which can lead to requiring credit enhancements or complicated structures to satisfy investors' concerns over the durability of energy savings.

**Deal Size Preferences:** The market for larger, centralized projects with vetted technologies initiated and supported by utilities, governments, corporations and other long-term credit worthy counterparties is well known and quite active. Yet, smaller, distributed projects-including solar photovoltaic, energy efficiency, electric vehicles, and others at the residential, small commercial and industrial sectors often have challenges accessing sufficient levels of long-term capital. This typically occurs because large institutional investors, such as pension funds, traditionally participate in utility scale deals on a significantly grander scale-where deals are worth \$50 million or more. This preference for large deals means that relatively smaller projects worth \$10,000, \$100,000, or even \$1,000,000 often get left out.

**Lack of Transparent Data:** A lack of consistent, transparent, and available data that reports the technical performance, energy production, and environmental impact of climate projects and other important factors limits the ability of potential investors to evaluate past performance of similar projects. This often results in higher risk premiums, which increase interest rates and return requirements and simultaneously decreases the number of interested investors. An inability to thoroughly assess projects increases hesitation among investors as they are further unable to evaluate and reduce perceived risk premiums for climate-friendly projects.

**Policy Uncertainty:** Further dissuading long-term investment in climate-friendly activities is the uncertainty associated with policies around climate change. Governments' shifting and sometimes unclear commitments to climate-related policy or regulations help to fuel investors' unease with entering the sector.

**Timing of Climate Risk Impacts:** Many professionals making investment decisions do not view climate change as a significant short-term risk that requires the adjustment of investment and credit considerations. The indefinite timing and magnitude of climate change impacts are often cited as key impediments to investors' ability to consider the financial risks of climate change in near term decision making and portfolio allocation methods.

**Lack of Climate-Friendly Investment Guidelines:** There is no unified definition for climate/ green/sustainable investments; or for climate finance activities that provide direct funding towards reaching climate goals and reducing GHG emissions. Practically speaking, this means that investors cannot easily compare different investment opportunities labeled 'green' or climate friendly. For example, securities can only be listed on the Bloomberg Barclays MSCI Green Bond Index if they fall within at least one of six MSCI-defined eligible environmental categories: Alternative Energy, Energy Efficiency, Pollution Prevention and Control, Sustainable Water, Green Building, and Climate Adaptation.<sup>19</sup>

**Short-Term Investor Horizons:** Many investment decisions are focused on near-term risks and returns. For example, the hold period for investments is typically five to seven years, and therefore investors minimize risks further off into the future. There is also the expectation by many investors for maximum returns over each period they hold an investment. This pressure can lead investment managers to "chase" quarterly returns and not properly or fully analyze risk.

We structured our approach in the Climate Finance Strategy to foster and select projects that address one or more of these barriers. What we have learned from this work is that there are limits to what any one lender, asset owner or asset manager can do within its four walls and financial supply chain to enact the changes necessary to protect the financial system from climate-related downfall and support the low carbon economic transition. Fortunately, there are a number of actions that financial regulators and policymakers can take to safeguard the planet and people and provide adequate market rules to curb climate change.

### Financed Emissions Disclosure

Step one is to mandate more information, but not just any information. Financial institutions must be required to measure and disclose the carbon emissions of their financial portfolios.<sup>20</sup> This list includes, but is not limited to sovereign bonds, listed equity, project finance, mortgages, commercial real estate, corporate debt: bonds, business loans, indirect investments, and auto-loans.

An open access, open source, widely used methodology for measuring and disclosing financed emissions comes from the Partnership for Carbon Accounting Financials (PCAF). PCAF is an international, industry-led initiative that enables financial institutions (FIs) to measure and disclose GHG emissions financed by loans and investments. A group of banks and investors launched PCAF during Climate Week in New York in September of 2019. Currently, over 100 FIs have joined and committed to assess and disclose their portfolio's GHG emissions, representing more than \$25 trillion of assets under management (AUM).<sup>21</sup> The members of PCAF have harmonized an approach to assess and disclose the greenhouse gas (GHG) emissions of their loans and investments, accompanied by an emissions factor database.

There is global precedent for mandating financed emissions disclosure. For example, in March 2021, The European Banking Authority (EBA) issued a draft standard on the prudential disclosures on ESG risks, stating that European financial institutions should disclose the carbon footprint and scope 3 emissions<sup>22</sup> of their collaterals by June 2024.<sup>23</sup> The European Central Bank (ECB) published, in Section 7.2 of its final guide on climate-related and environmental risks for banks, that financial institutions are "expected to disclose the institution's financed scope GHG emissions" and references the use of PCAF by a number of financial institutions in line with the GHG Protocol.<sup>24</sup>

Corporate disclosure of climate-related risks and opportunities will help investors fulfill their fiduciary obligations to integrate material climate considerations into their investment actions. Investors need consistent, comparable data, in a machine-readable format, so that they can efficiently and effectively aggregate and analyze climate-related financial disclosures. The Securities and Exchange Commission must update existing disclosure requirements to require that reporting companies disclose this data.

### Enabling Community-Focused Lenders to Lead

Communities of color in the country bear the brunt of environmental degradation and pollution, and similar to the impacts of COVID-19, are likely to be disproportionately impacted by unabated climate change. The National Academy of Sciences found that the largest environmental health risk factor in the U.S., fine particulate matter (PM<sub>2.5</sub>), is disproportionately caused by consumption of goods and services mainly by the non-Hispanic white majority, but disproportionately inhaled by Black and Hispanic minorities.<sup>25</sup> Due to the increased air pollution burden, higher likelihood of living in climate risk zones (such as flood zones, isolated rural areas, and urban heat islands), higher likelihood of living in areas with aging and poorly maintained infrastructure, low-income groups, communities of color, and some immigrant populations are highly vulnerable to the health impacts of climate change.<sup>26</sup>

In addition to living in communities disproportionately affected by pollution and vulnerable to climate change, both rural and urban low-income households spend three times as much of their income on energy than non-low-income households, a phenomenon known as energy burden.<sup>27</sup> In 2015, an estimated 17 million households received an energy disconnect/delivery stop notice and 25 million households had to forgo food and medicine to pay energy bills.<sup>28</sup> To help low or moderate income (LMI) households mitigate the effects of climate change and access renewable energy technologies, community-focused lenders and other community-based financing schemes can be leveraged.

There are over 100 minority depository institutions (MDIs), over 1,000 community development financial institutions (CDFIs), over 5,000 credit unions, and over 5,000 deposit-taking banks that are poised to serve climate-impacted communities in the United States. However, the federal government has a critical role to play in ensuring the successful alignment of these institutions with solving climate change. There are a number of existing federal programs that need to be updated in the short-run to align financial incentives with the clean energy transition. For example, the creation of a dedicated clean energy grant program as a part of the CDFI fund would be beneficial. There is precedence for this approach, with CDFI Funds already having dedicated grant program award 'buckets' to efforts outside of traditional awards, such as the Healthy Foods Financing Initiative and Disability Funds Financial Assistance.<sup>29</sup> This approach would ensure that more CDFIs focus on financing clean energy, which in turn boosts innovation and impact. As such, dedicated clean energy

awards could be structured to assist CDFIs to fund solar and energy efficiency loans.<sup>30</sup>

Credit unions are another powerful source of financing that can be deployed to help communities access funds for everything from home solar to energy efficiency retrofits and electric vehicles. However, what they lack is the technical assistance and the patient capital to be able add the ‘clean energy asset class’ to their loan books. A key challenge is access to secondary capital for loss absorption. Unlike banks, which have different instruments available to them, secondary capital for credit unions has historically been provided by philanthropic organizations or as loans—with demand significantly outstripping supply.<sup>31</sup>

The National Credit Union Administration (NCUA) should expand access to secondary capital, including equity, for credit unions engaging in climate mitigation and green opportunity financing, and allow credit unions to service small businesses for climate mitigation related lending, similar to the current rule for low-income lending. At the same time, we see the need for an injection of long-term, low-cost capital to enable rapid scaling of credit union’s lending capacities in the communities most impacted by COVID-19 and climate change. Therefore, Treasury should provide direct investment of secondary capital into credit unions to support the lending needed for economic recovery and long-term climate change mitigation.<sup>32</sup> Note that this approach is not without precedent either. In 2010, Treasury made an investment of \$70 million to secondary capital for CDFI-certified credit unions—where every dollar invested resulted in \$60 worth of loans over the intervening years.<sup>33</sup>

Some credit unions such as the Clean Energy (Federal) Credit Union and Inclusiv (a network of community development credit unions) are already focusing on clean energy and seeing success. For example, in its first three years of operations the Clean Energy Credit Union has reported zero delinquencies and has sold loan participations across the U.S. including Texas, Oklahoma, and Montana. As a low-income designated cooperative bank, they are already teaching other credit unions the value of this asset class. Similarly, Inclusiv offers green lending training for all community-focused lenders along two tracks: commercial/project finance and residential/consumer loans. Importantly, these existing lenders are financially stable—meaning they pass the regulatory tests set by the FDIC and NCUA on an annual basis.

#### **A Bank Mandate for Climate-Mitigating Lending**

An important way to unlock trillions of dollars with zero public spending is through mandates, a series of incentives and penalties for lenders to meet climate change mitigation lending amounts. The Community Reinvestment Act (CRA) provides a precedent for such action. The existing CRA can be strengthened to explicitly provide credit for climate and clean energy loans. A new mandate that requires banks to invest a certain percentage of their assets into climate friendly infrastructure can also be instated.

The CRA seeks to ensure that banks meet the credit needs of their entire service territory, including low- and moderate-income neighborhoods. The OCC, FDIC and Federal Reserve Board enforce the CRA by evaluating depository institutions according to size-differentiated rubrics; large banks are scored on the basis of lending, investment and service and receive one of four grades: outstanding, satisfactory, needs to improve, and substantial noncompliance.<sup>34</sup>

While the CRA has been largely beneficial to LMI communities, up until now it has not focused on addressing environmental justice. Incorporating sustainability metrics for LMI communities into the CRA would drive new investments and loans to help mitigate disproportionate negative impacts and increase LMI community access to the benefits of clean energy. The CRA should explicitly include climate-friendly investments as allowable activities; this would provide banks and financial regulators with better data on how many investments are being made and in what areas, which in turn will also likely increase these types of investments.<sup>35</sup> The following specific changes to the existing CRA would enable more climate capital in underserved communities that can serve both wealth-building and climate resiliency purposes: 1) extend CRA coverage to non-banks, including credit unions, which would expand access to credit in banking deserts,<sup>36</sup> 2) measure financial institution performance by outcomes, including carbon emission levels and other criteria for climate justice, 3) create a stronger focus on geographic racial and ethnic disparities due to the disproportionate impact of climate change on zip codes with high concentrations of people of color, and 4) mandate that affordable housing (including mixed income units) be sustainable and energy-efficient for CRA credit.

In addition to CRA modifications, the following interventions would also create climate resiliency and wealth creating opportunities for LMI communities: fostering a municipal green bond market that meets the Principles of Environmental Justice<sup>37</sup> and climate-focused New Markets Tax Credits.<sup>38</sup>

The CRA is estimated to mobilize about \$300 billion annually to LMI communities. Climate is another area of underinvestment and thus warrants a CRA-style mandate. Congress can instruct financial institutions (FIs), especially SIFIs, to lend and invest in GHG-reducing activities across financial asset classes. The FIs would be rated and these ratings would be taken into account for regulatory approvals, including mergers and acquisitions. In addition, FIs that fail to meet minimum thresholds for decarbonization could incur fees.

### **The Nation's Balance Sheet**

During the 2020 economic disruption provoked by the COVID-19 pandemic, the Federal Reserve made 83 percent of the oil and gas industry's mostly below investment grade debt eligible for cheap refinancing.<sup>39</sup> Coal, oil and gas companies received nearly \$3.9 billion in government aid.<sup>40</sup> The financial regulators, including the Fed, thus ignored sound risk management by failing to incorporate climate-related financial risks. The Fed is prohibited from making investments into companies that are insolvent or likely to become so,<sup>41</sup> yet by extending corporate bond purchases to 'junk bonds,' the nation's balance sheet has been put in peril. Fossil fuel energy companies make up 13 percent of the lowest-rated, riskiest kind of corporate debt.<sup>42</sup> This climate change-causing sector also disproportionately relies on heavily leveraged loans, collateralized loan obligations, and other low-rated debt.<sup>43</sup>

Climate risk should be incorporated into Dodd Frank Act stress tests in order to have a more accurate picture of financial stability. However, the Federal Reserve and other financial regulators should not wait on the results of such tests to enact climate finance regulations. To lead to material shifts away from the dirty economy towards a clean one, a 'precautionary' financial policy approach is required. This approach takes into account that climate related financial risks are different from others—they are endogenous and systemic, irreversible, pervasive, and have a high level of uncertainty in terms of very specific points of impact.<sup>44</sup>

The business of risk analysis is generally based on forward-looking projections that build on past data and as such, the future is conceived as a replication of the past. Climate impacts, which are multidimensional, non-linear, and attached to underlying socio-economic realities, do not work that way—they exist in the realm of uncertainty, whereby the future is "unknowable and unpredictable."<sup>45</sup>

Taking a precautionary approach to climate financial policy, policymakers at all levels of government can enact regulations to limit the financing of climate change causing activities and incentivize climate change solving ones. Therefore, the country's bank, the Federal Reserve, and other financial regulators should ensure that the financial system is working for climate mitigation. Tools include a differential interest rate for carbon intensive lending, different capital requirements for carbon intensive lending, and a corporate equity and bond purchasing policy that is negatively screened for carbon. Not only should policymakers such as the SEC and OCC instruct banks and asset managers to measure and disclose their financed emissions, but The Federal Reserve itself should also measure and disclose the greenhouse gas emissions that it is financing through its operations, starting with its emergency lending portfolio in response to the coronavirus crisis.<sup>46</sup> Asset managers and insurance companies, through a designation as non-bank SIFIs by the FSOC, can also come under supervision and regulation by the Federal Reserve.<sup>47</sup> The Federal Reserve can also take the following measures: 1) require banks that own coal, oil and gas assets to retire them, 2) limit banks' ability to own and run nonfinancial businesses, and 3) implement higher risk-weighted bank capital requirements for assets that are sensitive to the price of carbon such as fossil fuels, deforestation, and internal combustion engine vehicles.<sup>48</sup> On the latter, the minimum ratios of capital to assets, known as risk-based capital, should reflect the potential for losses due to physical and transition climate risks. Risk weights could be increased for loans and investments in climate change-driving assets, such as the financing of the industries that account for most global industrial greenhouse gas emissions in coal, oil, gas, and agribusiness tied to deforestation.<sup>49</sup>

### **Fiduciary Duty**

The market has spoken when it comes to the financial benefit of incorporating environmental, social and governance (ESG), including climate impact factors, into investment decisions. The majority of ESG funds outperform non-ESG counterparts and ESG ETFs doubled in 2020.<sup>50</sup> ESG, including climate mitigation strategies, are preferred by investors for a number of reasons, including that this information allows for better decision making, better management and mitigation of risks, and ultimately the generation of risk-adjusted returns. Sustainable investing assets now account for \$17.1 trillion-or 1 in 3 dollars-of the total US assets under professional management. This represents a 42 percent increase over 2018.<sup>51</sup>

Investment in climate change causing industries, such as fossil fuels, poses a long-term risk to generating strong returns for a diversified portfolio. In the last ten years, the S&P energy sector gained just 1 percent as low oil prices, high operational costs and changing consumer preferences spurred selling. However, in the same time period, the broader market gained 212 percent. Investors and lenders now require higher hurdle rates for climate change-causing industries since they produce a lower return on investment capital. If we look at hurdle rates, coal projects need 40+ percent whereas developed market solar and wind need just 10+ percent.<sup>52</sup> Policymakers should therefore protect worker's savings and maximize returns by instructing ERISA fiduciaries to incorporate ESG risks and opportunities, explicitly climate considerations, into investment options.

Climate change is always material. Fiduciaries, as those responsible for acting in their client's best financial interest, would be unfit should they not consider such an important and pervasive risk as climate change. Climate pollution is not like other sources of air, water and land point-source contaminants—GHG emissions are omnipresent and impacts are widespread, including in transportation, energy, real estate, food production, water and wastewater infrastructure. By neglecting climate factors, investors will likely misprice risk and poorly allocate assets; this is in part why globally there are over 730 policies across 500 policy instruments that support or require the incorporation of ESG issues in the fiduciary process.<sup>53</sup>

Policymakers at all levels of government, including state pension fund regulators, the SEC, FINRA, and the Department of Labor (DOL), should modernize fiduciary duty definitions to align with ESG, including climate risk and impact. Climate specific fiduciary regulations should include retirement fiduciaries (including pension plans), investment advisers registered with the SEC, broker-dealers and other financial intermediaries (subject to federal securities laws), asset managers that are not registered with the SEC, and non-profit asset owners. Trustee boards and investment committees should demonstrate the consideration of climate and ESG impacts in the investment process and through the investment policy. DOL should (1) issue guidance that explicitly calls out climate factors as “pecuniary” and therefore important considerations for ERISA fiduciaries and (2) issue a rule to clarify that climate factors are material and require ERISA plan fiduciaries adopt and implement sustainable investment policies. FINRA should enact reforms to the KYC rules to include seeking information about customer ESG-related preferences. The SEC should at a minimum (1) implement a rule under Section 203(c)(1)(C) under the Investment Advisers Act of 1940 requiring the Form ADV to require investment advisers to adopt and implement sustainable investment policies that incorporate climate risk and impact and (2) implement a rule under the Investment Company Act to require a fund to disclose on its prospectus and statement of additional information how the fund identifies, assesses, and addresses key climate issues, votes and otherwise engages with companies of portfolio securities consistent with sustainable investment policies, and has been audited for compliance with the policies.

### **Unlocking Consumer Finance**

Demand deposits are a bedrock of the financial system. Banks leverage consumer deposits to make loans and purchase assets; these accounts also create a customer relationship that results in fees for bank services and other product sales such as credit cards and auto loans. Domestic demand deposits in FDIC-insured banks and savings institutions are roughly at \$15 trillion.<sup>54</sup> If only 1.7 percent of these deposits were mobilized annually for climate solutions, the nation would surpass the additional investment amount needed to reach net zero by 2050 and avert a climate-induced financial crisis. Only 1.7 percent of capital sitting in our everyday bank accounts.

Unfortunately, it is currently cumbersome for consumers to align their deposits with a people and planet-friendly economy. Opening a new account and closing an old account is “rarely easy and is usually hard.”<sup>55</sup>

Switching bank accounts should be as easy as switching broker dealers and telephone providers. U.S. consumers now own their phone numbers, allowing them to easily choose a provider that suits their needs. This was enabled by the 1996 Telecommunications Act that required all carriers to offer mobile number portability (MNP). MNP allows consumers to contact a new carrier, who then transfers the account and service by contacting the consumer's current carrier. After receiving consumer complaints about transferring brokerage accounts, FINRA helped establish the Automated Customer Account Transfer Service; implemented in 2006, this allows consumers to transfer accounts and common assets such as cash or stocks from one broker-dealer to another, usually within a week.<sup>56</sup>

Allowing retail and institutional consumers to own their bank account number and developing a system that allows for seamless switching would also enable con-

sumers to have full rights and choice. There is international precedent and best practice for government enabling consumer switching. The United Kingdom implemented the Current Account Switch Service (CASS) in 2013 to provide seamless and quick switches in current accounts.<sup>57</sup> The current barriers to switching accounts include the following processes: 1) needing to gather several pieces of information that one may not immediately have, such as the login details for current accounts and a driver's license number 2) the tediousness of needing to input information in poorly designed print or online forms, 3) the multiplicity of needing to switch direct deposit, linked cards, linked apps, and auto-pay, and 4) the lack of incentive or deadline to finish the process.<sup>58</sup>

With 93 percent of households in the U.S. having a bank account and 7 in 10 supporting government action to solve climate change,<sup>59</sup> democratizing the ability to switch to climate-friendly bank accounts is a policy imperative. There is a growing movement of depository institutions, such as those listed in the Bank for Good campaign,<sup>60</sup> that are limiting their exposure to climate risk and supporting the real economy in clean energy lending. Numerous examples of consumer behavior leading to significant market shifts include hundreds of millions moved to Black owned banks and Bank of America and other banks announcing that they would no longer charge a monthly fee for debit card holders after intense consumer pushback.<sup>61</sup>

In order to enhance consumer choice in banking, policymakers can enact a number of changes, including: 1) reducing transactions costs through account portability rules, 2) mandating transparency for consumers around a bank's ESG practices, including the carbon footprint of loans and investments, and 3) lowering costs associated with closing and switching accounts. For the third change, the CFPB could set standards for lenders and third-party platforms that facilitate switching accounts, including eliminating the need to hold funds in two accounts at the same time.<sup>62</sup>

## Conclusion

All sectors of the economy will be impacted by climate change if the financial system does not work for the low carbon transition. These impacts will be especially acute in energy, transportation, and agriculture across the United States.<sup>63</sup> Climate change, if left unabated, is expected to transform the regions of the U.S. in some of the following ways:

- West and Northwest: changed precipitation patterns (including drought) and snow pack, increased risk of wildfires.
- Great Plains and the Midwest: increased frequency and severity of flooding and drought.
- Northeast and Mid-Atlantic: increased storms and sea level rise.
- South and Southwest: decreased precipitation levels, leading to less water resources for agriculture, industry and households.
- Southeast: warmer temperatures with more extreme heat waves, increased sea level rise, increased hurricane intensity and associated impacts to coastlines.
- Hawaii: increased sea level rise, loss of coral reefs, and increased drought.
- Puerto Rico: increased sea level rise, loss of coral reefs, increased frequency and intensity of hurricanes.
- Alaska: declined sea ice, earlier breakup of river ice in the Spring, and thawing of permafrost.

In order to avert economic disaster, the financial system must incorporate climate risk and impact into the market rules. The following changes will enable the system to finance less of the GHG emitting activities and more of the GHG reducing activities, all while supporting millions of new well-paid jobs that do not harm communities and help build wealth: mandating annual carbon accounting for financial institutions and reduction targets to reach net zero, providing patient capital to community-focused lenders to scale climate-friendly loans, adjusting capital requirements and risk weights for banks based on carbon emissions, implementing a climate-friendly grading system for SIFIs modeled after the CRA, and mandating the incorporation of ESG, including climate impact, into investment management.

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<https://www.nytimes.com/2011/11/02/business/bank-of-america-drops-plan-for-debit-card-fee.html>

<sup>62</sup> Divya Vijay and Andy Green. Center for American Progress. *Switching to Responsible Banking How Empowering Consumers to Switch Accounts Can Boost Bank Accountability to Consumers, Workers, and the Planet*. February 26, 2021. <https://www.americanprogress.org/issues/economy/reports/2021/02/26/496444/switching-responsible-banking/>

<sup>63</sup> Matthias Ruth, Roy F. Weston, Dana Coelho, and Daria Karetnikov. Center for Integrative Environmental Research (CIER) at the University of Maryland. *The Economic Impacts of Climate Change and the Costs of Inaction*. <http://cier.umd.edu/climateadaptation/>

**PREPARED STATEMENT OF JOHN H. COCHRANE**  
 SENIOR FELLOW, HOOVER INSTITUTION, STANFORD UNIVERSITY

MARCH 18, 2021

Chairman Brown, Ranking Member Toomey, and Members of the Committee: Thank you for the opportunity to testify today.

I am John Cochrane. I am an economist, specializing in finance and monetary policy. My comments do not reflect the views of my employer or any institution with which I am affiliated.

Climate change is an important challenge. But climate change poses no measurable risk to the financial system. This emperor has no clothes. “Risk” means unforeseen events. We know exactly where the climate is going over the horizon that financial regulation can contemplate. Weather is risky, but even the biggest floods, hurricanes, and heat waves have essentially no impact on our financial system.

Moreover, the financial system is only at risk when banks as a whole lose so much, and so suddenly, that they blow through their reserves and capital, and a run on their short-term debt erupts. That climate may cause a sudden, unexpected and enormous economic effect, in the next decade, which could endanger the financial system, is an even more fantastic fantasy.

Sure, we don’t know what will happen in 100 years. But banks did not fail in 2008 because they bet on radios not TV in the 1920s. Banks failed over mortgage investments made in 2006. Trouble in 2100 will come from investments made in 2095. Financial regulation does not and cannot pretend to look past 5 years or so, and there is just no climate risk to the financial system at this horizon.

Sure, a switch to renewables might lower oil company profits. Oil stockholders may lose money. But “risk” to the “financial system” cannot mean that nobody ever loses any money! Tesla could not have been built if people could not take “risks.” Yes, we are in a transition to a decarbonized economy, but the transitions from horses to cars, and from trains to planes, from typewriters to computers did not cause even blips in the financial system. Companies and industries come and go all the time.

So why is there a push for regulators to force financial firms to “disclose” absurdly fictitious “climate risks,” and change investments to avoid them? These proposals aim simply to defund the fossil fuel industry before alternatives are in place, and to steer funds to fashionable but unprofitable investments and away from unfashionable ones, by regulatory subterfuge rather than above-board legislation or transparent environmental agency rulemaking. This goal isn’t a secret. For example, The Network of Central Banks and Supervisors for Greening the Financial System (NGFS), which the Federal Reserve recently joined,<sup>1</sup> states plainly its goal is to “mobilize mainstream finance to support the transition toward a sustainable economy.”<sup>2</sup>

But financial regulators are not allowed to “mobilize” the financial system, to choose projects they like and de-fund those they disfavor. Thus regulators must pretend that they are dispassionately finding “risks” to the financial system, and oh, just happen to stumble on climate.

The climate focus proves the dishonesty. There are plenty of genuine risks to the financial system that our regulators largely ignore. Imagine a new pandemic, one that kills 10 percent not less than 1 percent, and that lasts years with no vaccine. Suppose China invades Taiwan, or a nuclear weapon goes off in the Middle East. Another financial collapse can come. Imagine a global sovereign debt crisis. Suppose that the US Treasury runs out of room to borrow, is downgraded or defaults, and financial institutions no longer accept Treasury collateral. Imagine a massive cyberattack—all the accounts at Citibank are wiped out by North Korean hackers, and people rush for cash everywhere. These would indeed be financial system catastrophes. Yet of all of these large, obvious and quite plausible risks, our financial regulators want to focus on just one, a fictitious climate “risk.” Why? Obviously, the end justifies the means.

Some advocates are a bit more honest: They recognize there is no financial risk due to climate itself, but climate regulation could come along and “strand” assets or hurt companies. The Godfather would be proud: Nice business you’ve got there, it would be a shame if something should happen to it. But think about it. This view posits that our environmental regulators are so bone-headed, so ignorant of basic cost-benefit analysis, that they might suddenly and dramatically not just wipe out industries and millions of jobs, but do it in a way that causes colossal bank failures

<sup>1</sup> <https://www.federalreserve.gov/newsevents/pressreleases/bcreg20201215a.htm>

<sup>2</sup> <https://www.ngfs.net/en>

like 2008. And if we go down this path, here too, why just climate-related risk? There is lots of political and regulatory risk. Regulate and disclose tech exposure, in case the FTC breaks up big companies. Regulate steel exposure, always on the edge of tariffs one way or another. Uber could be outlawed by labor legislation tomorrow. An honest list of all the ways Congress or the agencies might plausibly destroy industries would make good reading. But we're not doing that, are we? The reason is obvious.

Climate is really important. Climate is too important to let financial regulators play with it, inspired by what's fashionable at Davos cocktail parties. Climate needs clear-headed, science-based, steady, and transparently-enacted policy, with explicit cost-benefit analysis. Underhandedly funding and defunding financial regulators' momentary enthusiasms will repeat corn ethanol, switchgrass, an absurdly expensive rail line from Merced to Bakersfield that comes online just as all cars and trucks are electric, and other counterproductive feel-good policies. The US leads the world in carbon reduction today because of natural gas produced by fracking, which no regulator "mobilized." Climate answers may include nuclear power, geoengineering, carbon capture and storage, hydrogen fuel cells, genetically engineered foods, zoning reform, a carbon tax, and other approaches, which financial regulators will never even envision let alone implement.

Financial regulation is really important. Financial regulation is too important to be eviscerated on the altar of de-funding fossil fuel and subsidies to pet projects. Once regulators cook up fantasy "climate risks," the books remain cooked, and financial regulation loses whatever any ability to perceive and to offset genuine risks. Once financial regulators demand funding of today's fashionable green projects, the political allocation of credit will expand.

Financial regulation and the financial system are in peril, and not because of climate. Contemplate the abject failure sitting in front of us. Despite 12 years of Dodd-Frank regulation, stress tests, and armies of embedded regulators, despite centuries of experience, ARS, H1N1, Ebola, Aids, 1918, and many federal pandemic plans, financial regulators failed to consider that a pandemic might come along. We made it through the last year by one more massive bail-out, not by regulatory prescience. The financial system remains far too leveraged and far too reliant on an even larger bailout that may not come in the next crisis. And now they want to soothsay climate?

We need to get financial regulation back to its job: making sure that run-prone financial institutions have adequate capital to withstand all sorts of shocks, which none of us, not least the regulators, can pretend to foresee. It's boring. You don't get invited to Davos to talk about it. Industry hates being told to get more capital. But that's its job and there is plenty to do.

Don't let the EPA regulate banks, and don't let our financial regulators dream up climate policy. You will get bad climate policy, and an even more fragile and sclerotic financial system if you do.

#### **PREPARED STATEMENT OF BENJAMIN ZYCHER**

RESIDENT SCHOLAR, AMERICAN ENTERPRISE INSTITUTE

MARCH 18, 2021

Thank you, Chairman Brown and Ranking Member Toomey, for this opportunity to offer my views on the topic of the financial system and anthropogenic climate change, one now receiving substantial attention from policymakers and many interested observers. The Statement below makes a number of observations that I hope will prove of interest to this Committee. I begin with a summary of my arguments, and then proceed to discuss them in more detail in the ensuing sections:

1. Climate Uncertainties and Choices Among Crucial Assumptions.
2. The Evidence on Climate Phenomena and the Effects of Climate Policies in the EPA Climate Model.
3. Observations on the Materiality of Climate "Risks."
4. Additional Observations and Conclusions.

#### **Summary**

- Neither the Federal Reserve or any other bank regulator, nor banks or other financial institutions, are in a position to evaluate climate phenomena, whether ongoing or prospective, with respect to which the scientific uncertainties are vastly greater than commonly asserted.

- The range of alternative assumptions about central parameters is too great to yield clear implications for the climate “risks” attendant upon the allocation of financial capital among economic sectors.
- Those central parameters include the choices among climate models, the assumed sensitivity of the climate system to increases in the atmospheric concentration of greenhouse gases (GHG), the assumed future increase in that GHG concentration through, say, 2100, and the analytic assumptions underlying calculations of the effects of aerosol emissions on cloud formation, about which surprisingly little is known. That short list is far from exhaustive.
- If the Federal Reserve and the financial institutions opt to use the same (or similar) sets of assumptions about central parameters, a very real danger would arise of more-or-less homogeneous predictions inconsistent with historical, ongoing, and prospective climate phenomena. If the Federal Reserve and the financial institutions opt to use sets of assumptions that differ in important dimensions, the ensuing predictions about future climate phenomena (risks) would vary substantially, yielding very large uncertainties in terms of policy implications.
- It is reasonable to hypothesize that financial institutions will have powerful incentives to undertake climate analysis driven not by the actual evidence and the peer-reviewed literature on climate phenomena. Instead, they will be driven to undertake such analysis, whether in response to regulatory directives or to political pressures, under assumptions and methodologies insulating them from adverse regulatory actions and litigation threats.
- It is reasonable to hypothesize also that the aggregate benefits (that is, positive “risks”) of increasing GHG concentrations, as reported by the National Oceanic and Atmospheric Administration and in the peer-reviewed literature, will be excluded from such analytic efforts.
- It is reasonable to hypothesize further that such analyses will exclude the risks of climate policies, prominent among which are the large and adverse implications of artificial increases in energy costs. Such policy risks are likely to be greater when implemented by bureaucracies insulated from democratic accountability.
- Anthropogenic climate change is “real” in that increasing atmospheric concentrations of GHG have yielded effects that are detectable. But they are much smaller than commonly asserted; and there is no evidence in support of the ubiquitous assertions of a climate “crisis,” whether ongoing or looming, and no evidence in support of the even more extreme “existential threat” argument. Moreover, the available analysis suggests that the financial risks of anthropogenic climate change in the aggregate are much smaller than many assert.
- The mainstream climate models have a poor track record in terms of predicting the actual temperature trend of recent decades, having consistently overstated that trend by a factor of over two.
- Application of the Environmental Protection Agency climate model suggests strongly that climate policies, whether implemented by the U.S. Government alone or as an international cooperative policy, would have temperature effects by 2100 that would be virtually undetectable or very small. Such policies cannot satisfy any plausible benefit/cost test.
- Because the perceived “climate risks” confronting the financial sector are dependent upon crucial choices among alternative assumptions, the evaluation of such “risks” would be largely arbitrary given that the “correct” assumptions are very far from obvious. This means that a requirement, whether formal or informal, that climate “risks” be incorporated into the business decisions of financial institutions would weaken the materiality standard for disclosures by those institutions. “Materiality” always has meant the disclosure of information directly relevant to the financial performance of the bank or other institution. When “risk” analysis becomes an arbitrary function of choices among assumptions complex, opaque, and far from obvious, the traditional materiality standard inexorably will be diluted and rendered far less useful for the investment and financial markets, an outcome diametrically at odds with the ostensible objectives of those advocating the evaluation of climate “risks.” Moreover, the “risks” of anthropogenic climate change are far from the only such mass-geography “risks.” A bias toward focusing only on climate “risks” would distort the allocation of capital.
- Because the uncertainties attendant upon the future effects of increasing atmospheric concentrations of GHG are so great, a top-down policy approach for the

evaluation of any attendant “risks” is itself very risky. A wiser approach would entail allowing market forces to make such “risk” determinations in a bottom-up fashion, thus avoiding an obvious politicization of the allocation of capital.

- Proposals that the Federal Reserve enforce a mandate that financial institutions evaluate climate “risks” represent a blatant effort to distort the allocation of capital away from economic sectors disfavored by certain political interest groups pursuing ideological agendas. This would represent the return of Operation Choke Point, a past attempt to politicize access to credit, one deeply corrosive of our legal and constitutional institutions.
- Protection of those institutions is consistent only with formal policymaking by the Congress through enactment of legislation, rather than with powerful pressures, whether formal or informal, exerted by the Federal Reserve or other regulatory agencies. This institutional protection would preserve the traditional roles of the private sector and of the government, respectively, as part of the larger permanent objectives of maximizing the productivity of resource use under free market competition, and preserving the political accountability of the policymaking process under the institutions of democratic decisionmaking as constrained by the constitution.

### Climate Uncertainties and Choices Among Crucial Assumptions

Notwithstanding ubiquitous assertions that climate science is “settled,” that a crisis is upon us or looming large, and that government policies must address the “existential threat” posed by anthropogenic climate change, in reality the uncertainties attendant upon the prospective effects of increasing atmospheric concentrations of greenhouse gases (GHG) are very substantial. Moreover, no evidence supports the “crisis” narrative, as discussed below. These realities are illustrated by the ranges of various estimates published by the Intergovernmental Panel on Climate Change (IPCC) in its most recent Assessment Report, by the wide range of temperature paths projected by the mainstream climate models, and by the scientific literature more generally.<sup>1</sup>

The evaluation of climate “risks” to the financial system would require choices among the available climate models, choices among alternative assumptions about the path of future atmospheric concentrations of GHG, choices among assumptions about the effect of increasing GHG concentrations upon the climate system, that is, the “sensitivity” of the climate system, and deeply problematic assumptions about the effects of aerosol emissions on cloud formation, about which little is known.<sup>2</sup>

Let us note that the mainstream climate models have found it very difficult to predict the historical and current climate record; as an example, the models have been unable to explain the warming observed from 1910–1945.<sup>3</sup> That period of warming cannot have been the result of increased atmospheric concentrations of GHG, in that such concentrations had increased only from about 278 ppm in 1750 to about 295 ppm by 1910.<sup>4</sup> Another example: Every climate model predicts that increasing atmospheric concentrations of GHG should result in an enhanced heating effect in the mid- and upper troposphere over the tropics. The satellites have been unable to find that effect.<sup>5</sup> In the latest iteration of the suite of climate models, to

<sup>1</sup>See, e.g., Figure 2.5 in the IPCC Fifth Assessment Report (2013), on alternative paths for future temperature changes, at <https://www.ipcc.ch/report/ar5/syr/synthesis-report/>. On the wide range of temperature projections yielded by the mainstream climate models, see Figure 2 in the testimony of John R. Christy before the U.S. House Committee on Science, Space, and Technology, March 29, 2017, at <https://science.house.gov/imo/media/doc/Christy%20Testimony-1.pdf?1>. On the general state of scientific uncertainty in the context of climate phenomena, see e.g., Judith Curry, “Uncertainty About the Climate Uncertainty Monster,” *Climate Etc.*, May 19, 2017, at <https://judithcurry.com/2017/05/19/uncertainty-about-the-climate-uncertainty-monster/>.

<sup>2</sup>See, e.g., Judith Curry, “The Cloud-Climate Conundrum,” *Climate Etc.*, June 2, 2016, at <https://judithcurry.com/2016/06/02/the-cloud-climate-conundrum/>.

<sup>3</sup>See the HadCRUT5 reconstructions of temperature anomalies at <https://crudata.uea.ac.uk/cru/data/temperature/>. Interestingly enough, the Russian climate models from the Institute for Numerical Mathematics (models INM-CM4 and INM-CM4.8) do the best job of predicting the past and the present. See <http://www.gisaclimate.org/node/2220> and <https://www.researchgate.net/publication/329748540-Simulation-of-the-modern-climate-using-the-INM-CM48-climate-model>.

<sup>4</sup>See the NOAA reconstruction of carbon dioxide emissions and concentrations for 1750–2019 at <https://www.climate.gov/sites/default/files/CO2-emissions-us-concentrations-1751-2019-lrg.gif>.

<sup>5</sup>The tropics for the most part are water, and emissions of additional GHG would warm the earth slightly, resulting in an increase in ocean evaporation. In the climate models, as the water vapor rises into the mid troposphere, it condenses, releasing heat. This seems straightforward,

Continued

be applied in the next IPCC Assessment report, the average predicted tropospheric temperature increase for 1979–2019 is 0.40 degrees C per decade. The actual record as measured by the satellites: 0.17 degrees C per decade.<sup>6</sup> The climate models on average have overstated the temperature record by a factor of more than two.

Consider only the effect of varying assumptions about the future path of atmospheric GHG concentrations. IPCC in the latest (2013) Assessment Report uses four such alternative paths: Representative Concentration Pathways 2.6, 4.5, 6, and 8.5.<sup>7</sup> The following table illustrates the range of temperature effects (anomalies) by 2100 under the four RCPs.

Central Parameters of IPCC AR5 RCP Scenarios

Year 2100	-----Representative Concentration Pathway-----			
	2.6	4.5	6	8.5
GHG concentration (ppm)	490	650	850	1370
Average increase 2018-2100 (ppm)	1.1	3.0	5.5	11.9
Temperature anomaly 2100 (°C)	1.5	2.4	3.0	4.9

Source: G.P. Wayne, “The Beginner’s Guide to Representative Concentration Pathways,” *Skeptical Science*, August 2013.

Note: RCP 2.6 (sometimes denoted RCP3PD) predicts radiative forcing of 3 Wm<sup>2</sup> before 2100, declining to 2.6 Wm<sup>2</sup> by 2100. “PD” stands for “peak and decline.”

Neither the Federal Reserve or any other bank regulator, nor banks or other financial institutions, are in a position to evaluate the strengths and weaknesses of alternative RCP assumptions, or of the other crucial parameters underlying climate projections in the context of GHG emissions.<sup>8</sup> The IPCC in the 2013 Assessment Report provides a range of estimates for the equilibrium sensitivity of the climate system, from 1.5 degrees to 4.5 degrees, with a mean of 3 degrees.<sup>9</sup> Many of the more extreme or “alarmist” assertions of the effects of anthropogenic climate change assume RCP8.5 and a climate sensitivity of 4.5 degrees (or even higher). The numerous estimates reported in the peer-reviewed literature do not support that as-

but efforts to demonstrate this phenomenon with satellite measurements have proven very difficult. See Ross McKittrick and John R. Christy, “Pervasive Warming Bias in CMIP6 Tropospheric Layers,” *Earth and Space Science*, Vol. 7, Issue 9 (September 2020), at <https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2020EA001281>; and Ross McKittrick, “New Confirmation That Climate Models Overstate Atmospheric Warming,” *Climate Etc.*, August 25, 2020, at <https://judithcurry.com/2020/08/25/new-confirmation-that-climate-models-overstate-atmospheric-warming/>.

<sup>6</sup>See the Coupled Model Intercomparison Project, Phase 6, at <https://pcmdi.llnl.gov/CMIP6/>. See also, e.g., the recent presentation by Professor John R. Christy at <https://www.youtube.com/watch?v=D2Cd4MLUoN0>.

<sup>7</sup>The figures (2.6, etc.) are not temperature effects; they are theoretical calculations of “radiative forcings” in watts per square meter. For an introduction, see G.P. Wayne, “The Beginner’s Guide to Representative Concentration Pathways,” *Skeptical Science*, August 2013, at <https://skepticalscience.com/docs/RCP-Guide.pdf>.

<sup>8</sup>Note that RCP8.5 is a popular assumption among those advocating strong climate policies, but it is a scenario essentially impossible. Under RCP8.5, atmospheric concentrations of GHG rise at almost 12 parts per million (ppm) through 2100 as an annual average; the average for 1985-2019 was about 1.9 ppm, and the single largest increase was about 3 ppm in 2016. See the data reported by NOAA at <https://www.esrl.noaa.gov/gmd/ccgg/trends/global.html>. See Kevin Murphy, “Reassessing the RCPs,” *Climate Etc.*, January 28, 2019, at <https://judithcurry.com/2019/01/28/reassessing-the-rcps/>; and Judith Curry, “Is RCP8.5 An Impossible Scenario?,” *Climate Etc.*, November 24, 2018, at <https://judithcurry.com/2018/11/24/is-rcp8-5-an-impossible-scenario/>.

<sup>9</sup>The equilibrium sensitivity of the climate system is the temperature increase that would result from a doubling of atmospheric concentrations of GHG, after the climate system were to “finalize” all attendant adjustments.

sumption, instead supporting an assumption of 2 degrees or even less; the range estimated from the actual data is 1.5 to 2.3 degrees C.<sup>10</sup>

Again: Neither the Federal Reserve or any other bank regulator, nor banks or other financial institutions, are in a position to sort through such enormous complexities; government agencies and international bodies wholly dedicated to doing so find the task daunting. Instead, the Federal Reserve and financial institutions will be driven to adopt assumptions (or to retain consultants who will do so) minimizing the degree to which their analyses might subject them to political attacks, adverse regulatory actions, and litigation. This is very different from an objective effort to evaluate climate phenomena and a reasonable range of prospective effects of increasing GHG concentrations, that is, climate “risks.”

Instead, for example, they will have powerful incentives to use the Environmental Protection Agency climate model, used by most federal agencies to evaluate climate trends and the effects of climate policies; since that is the U.S. Government model, it would be difficult to attack a financial institution for choosing it.<sup>11</sup> For the earlier suite of climate models (CMIP-5), the EPA model provided predictions close to the average of those models under a given set of underlying assumptions, equilibrium climate sensitivity in particular. For the new suite (CMIP-6), the EPA model provides predictions cooler than the average of those models, not because the EPA model now is providing predictions more consistent with the historical evidence, but because the CMIP-6 models have incorporated a range of climate sensitivity assumptions and estimates higher on average than those in the CMIP-5 iteration. That range of climate sensitivity values in CMIP-6 also is wider than that in CMIP-5, meaning that the uncertainty of the climate models is increasing.<sup>12</sup>

Again, the Federal Reserve and the financial institutions will have powerful incentives to choose among assumptions on future emissions and atmospheric concentrations, climate sensitivity, and other crucial parameters so as to insulate themselves from political attack, adverse regulatory actions, and litigation. They thus will be led toward analytic homogeneity, yielding a very real danger of an artificial “consensus” among financial institutions regardless of the actual evidence, and perhaps largely inconsistent with it. Any such consensus would be an artifact of the political pressures to which the financial institutions would be subjected; it would have nothing to do with “science.”

If, implausibly, the Federal Reserve and the financial institutions were to opt to use models and/or sets of assumptions that differ in important dimensions, the ensuing predictions about future climate phenomena (risks) would vary substantially or hugely, yielding very large uncertainties in terms of policy implications. What would the Federal Reserve do under that condition, how would financial institutions respond, and—again—what would such decisions have to do with “science”?

Those political pressures will weigh against consideration of the benefits of increasing atmospheric concentrations of GHG, as reported by the National Oceanic and Atmospheric Administration (NOAA), and in the peer-reviewed literature. Examples are planetary greening, increased agricultural productivity, increased water use efficiency by plants, and reduced mortality from cold.<sup>13</sup> Nor will such analysis include the possible adverse impacts of government climate policies, which as a core imperative must have the effect of increasing energy costs artificially, notwithstanding common assertions that alternative energy sources are competitive in terms of costs.<sup>14</sup> More narrowly, government policies that lead financial institutions to incorporate climate “risks” into their decisions on lending and other parameters are likely to yield important distortions in capital markets, one of which is a weighting of climate “risks” above those posed by other important natural phenomena.

<sup>10</sup>See Patrick J. Michaels and Paul C. Knappenberger, *Lukewarming: The New Climate Science That Changes Everything*, Washington, DC: Cato Institute, 2016; and the recent presentation by Professor John R. Christy at <https://www.youtube.com/watch?v=D2Cd4MLUoN0>.

<sup>11</sup>This is the Model for the Assessment of Greenhouse Gas Induced Climate Change (MAGICC), at [www.magicc.org](http://www.magicc.org).

<sup>12</sup>Private communication with Professor John R. Christy, March 14, 2021. See CMIP-5 at <https://pcmdi.llnl.gov/mips/cmip5/>; and CMIP-6 at <https://pcmdi.llnl.gov/CMIP6/>.

<sup>13</sup>On the carbon dioxide “greening” effect see NOAA at <https://www.nasa.gov/feature/goddard/2016/carbon-dioxide-fertilization-greening-earth>. On the agricultural productivity effects, see, e.g., Goudriaan and Unsworth at <https://onlinelibrary.wiley.com/doi/abs/10.2134/soilscisocpub53.c8>. On water use efficiency by plants, see, e.g., <http://www.co2science.org/subject/w/summaries/wateruse.php>. On the beneficial impacts of moderate warming on mortality, see [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(14\)62114-0/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(14)62114-0/fulltext).

<sup>14</sup>See Benjamin Zycher, *The Green New Deal: Economics and Policy Analytics*, American Enterprise Institute, 2019, at <http://www.aei.org/wp-content/uploads/2019/04/RPT-The-Green-New-Deal-5.5x8.5-FINAL.pdf?x91208>.

### The Evidence on Climate Phenomena and the Effects of Climate Policies in the EPA Climate Model

The available body of evidence does not support the ubiquitous assertions that a climate “crisis” is upon us or looming large. This means in the context of this hearing that the asserted climate “risks” threatening the U.S. financial system are far less obvious than often assumed.

That anthropogenic climate change is “real”—that increasing GHG concentrations are having detectable effects—is incontrovertible, but that does not tell us the magnitude of the observable impacts, which must be measured empirically. Temperatures are rising, but as the Little Ice Age ended no later than 1850, it is not easy to separate natural from anthropogenic effects on temperatures and other climate phenomena.<sup>15</sup> The latest research in the peer-reviewed literature suggests that mankind is responsible for about half a degree of the global temperature increase of about 1.5-1.7 degrees C of global warming observed since 1850.<sup>16</sup>

The “crisis” assertions are unsupported by the evidence reported in the peer-reviewed, official, or scientific literature. There is little trend in the number of “hot” days for 1895-2017; 11 of the 12 years with the highest number of such days occurred before 1960.<sup>17</sup> NOAA has maintained since 2005 the U.S. Climate Reference Network, comprising 114 meticulously maintained temperature stations spaced more or less uniformly across the lower 48 States, 21 stations in Alaska, and two stations in Hawaii.<sup>18</sup> They are placed to avoid heat island effects and other such distortions as much as possible; the reported data show no trend over the available 2005-20 reporting period.<sup>19</sup> A reconstruction of global temperatures over the past one million years, using data from ice sheet formations, shows that there is nothing unusual about the current warm period.<sup>20</sup>

Global mean sea level has been increasing at about 3.3 mm per year since satellite measurements began in 1992. The tidal-gauge data before then show annual increases of about 1.9 mm per year, but that comparison does not show an acceleration because the two datasets are not comparable. The tidal gauges do not measure

<sup>15</sup> On the surface (land/ocean) temperature record, see UK Met Office, Hadley Centre/University of East Anglia Climatic Research Unit, “Tim Osborn: HadCRUT4 Global Temperature Graphs,” <https://crudata.uea.ac.uk/timo/diag/tempdia.htm>. On the Little Ice Age, see Michael E. Mann, “Little Ice Age,” in *Encyclopedia of Global Environmental Change*, Volume 1: The Earth System: Physical and Chemical Dimensions of Global Environmental Change, ed. Michael C. MacCracken, John S. Perry and Ted Munn (Chichester, England: John Wiley & Sons, 2002), <http://www.meteo.psu.edu/holocene/public-html/shared/articles/littleiceage.pdf>.

<sup>16</sup> See, for example, Ross McKittrick and John Christy, “A Test of the Tropical 200- to 300 hPa Warming Rate in Climate Models”; Nicholas Lewis and Judith Curry, “The Impact of Recent Forcing and Ocean Heat Uptake Data on Estimates of Climate Sensitivity,” *Journal of Climate* 31 (August 2018): 6051-71, <https://journals.ametsoc.org/doi/pdf/10.1175/JCLI-D-17-0667.1>; and John R. Christy and Richard McNider, “Satellite Bulk Tropospheric Temperatures as a Metric for Climate Sensitivity,” *Asia-Pacific Journal of Atmospheric Sciences* 53 (2017): 511-18, <https://link.springer.com/article/10.1007/s13143-017-0070-z>. For a chart summarizing the recent empirical estimates of equilibrium climate sensitivity as reported in the peer-reviewed literature, see Patrick J. Michaels and Paul C. Knappenberger, “The Collection of Evidence for a Low Climate Sensitivity Continues to Grow,” Cato Institute, September 25, 2014, <https://www.cato.org/blog/collection-evidence-low-climate-sensitivity-continues-grow>.

<sup>17</sup> For the reconstruction of the NASA data, see John R. Christy, “Average per Station (1114 USHCN Stations) 1895-2017: Number of Days Daily Maximum Temperature Above 100 F and 105 F,” <http://www.drroyspencer.com/wp-content/uploads/US-extreme-high-temperatures-1895-2017.jpg>.

<sup>18</sup> For the Climate Reference Network program description, see National Centers for Environmental Information, “U.S. Climate Reference Network,” <https://www.ncdc.noaa.gov/crn/>.

<sup>19</sup> For a visualization of a prototypical station, see Willis Eschenbach, “NOAA’s USCRN Revisited—No Significant Warming in the USA in 12 Years,” *Watts Up with That?*, November 8, 2017, <https://wattsupwiththat.com/2017/11/08/the-uscrn-revisited/>. For the monthly data and charts reported by the National Oceanic and Atmospheric Administration (NOAA), see National Oceanic and Atmospheric Administration, “National Temperature Index,” <https://www.ncdc.noaa.gov/temp-and-precip/national-temperature-index/time-series?datasets%5B%5D=uscrn&parameter=anom-tavg&time-scale=p12&begyear=2005&endyear=2020&month=8>.

<sup>20</sup> See R. Bintanja and R.S.W. van de Wal, “North American Ice-Sheet Dynamics and the Onset of 100,000-Year Glacial Cycles,” *Nature* 454, no. 7206 (August 14, 2008): 869-72, <https://www.researchgate.net/publication/23171740-Bintanja-R-van-de-Wal-R-S-W-North-American-ice-sheet-dynamics-and-the-onset-of-100000-year-glacial-cycles-Nature-454-869-872>. NOAA published the underlying data at R. Bintanja and R. S. W. van de Wal, “Global 3Ma Temperature, Sea Level, and Ice Volume Reconstructions,” National Oceanic and Atmospheric Administration, August 14, 2008, <https://www.ncdc.noaa.gov/paleo-search/study/11933>. For a chart showing the temperature record over one million years, see Institute for Energy Research, “Temperature Fluctuations over the Past Million Years,” <https://www.instituteforenergyresearch.org/wp-content/uploads/2020/03/temperature-fluctuations.png>.

sea levels per se; they measure the difference between sea levels and “fixed” points on land that in reality might not be fixed due to seismic activity, tectonic shifts, land settlement, etc. Accordingly, the data are unclear as to whether there is occurring an acceleration in sea level rise; it is reasonable to hypothesize that there has been such an acceleration simply because temperatures are rising, as noted above, and such increases should result in more melting ice and the thermal expansion of water. But because rising temperatures are the result of both natural and anthropogenic causes, we do not know the relative contributions of those causes to any such acceleration.<sup>21</sup>

The Northern and Southern Hemisphere sea ice changes tell different stories; the arctic sea ice has been declining, while the Antarctic sea ice has been stable or growing.<sup>22</sup> U.S. tornado activity shows either no trend or a downward trend since 1954.<sup>23</sup> Tropical storms, hurricanes, and accumulated cyclone energy show little trend since satellite measurements began in the early 1970s.<sup>24</sup> The number of U.S. wildfires shows no trend since 1985, and global acreage burned has declined over past decades.<sup>25</sup> The Palmer Drought Severity index shows no trend since 1895.<sup>26</sup> U.S. flooding over the past century is uncorrelated with increasing GHG concentrations.<sup>27</sup> The available data do not support the ubiquitous assertions about the dire impacts of declining pH levels in the oceans.<sup>28</sup> Global food availability and production have increased more or less monotonically over the past two decades on a per capita basis.<sup>29</sup> The IPCC itself in the Fifth Assessment Report was deeply dubious

<sup>21</sup> As a crude approximation, the data suggest that about two-thirds of such sea level increases are due to ice melt, and one-third to thermal expansion of water. See Judith Curry, “Sea Level and Climate Change,” Climate Forecast Applications Network, November 25, 2018, <https://curryja.files.wordpress.com/2018/11/special-report-sea-level-rise3.pdf>. Curry cites research from Xian Yao Chen and colleagues, the central finding of which is that “global mean sea level rise increased from 2.2 plus/minus 0.3 mm/year in 1993 to 3.3 plus/minus 0.3 mm/year in 2014.” See Xian Yao Chen et al., “The Increasing Rate of Global Mean Sea-Level Rise During 1993–2014,” *Nature Climate Change* 7 (June 26, 2017): 492–95, <https://www.nature.com/articles/nclimate3325>. Whether the trend from a 21-year period can yield important inferences is a topic not to be addressed here. For a different empirical conclusion from the tidal gauge record, see J.R. Houston and R. G. Green, “Sea-Level Acceleration Based on U.S. Tide Gauges and Extensions of Previous Global-Gauge Analyses,” *Journal of Coastal Research* 27, no. 3 (May 2011): 409–17, <https://meridian.allenpress.com/jcr/article-abstract/27/3/409/28456/Sea-Level-Acceleration-Based-on-U-S-Tide-Gauges?redirectedFrom=fulltext>. For an example of temporary rapid sea-level rise in the 18th century, see W.R. Gehrels et al., “A Preindustrial Sea-Level Rise Hotspot Along the Atlantic Coast of North America,” *Geophysical Research Letters* 47 (2020), <https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1029/2019GL085814>. For further reported evidence of an acceleration, see Hans-Otto Portner et al., *Special Report on the Ocean and Cryosphere in a Changing Climate*, Intergovernmental Panel on Climate Change, 2019, <https://www.ipcc.ch/srocc/>.

<sup>22</sup> See Patrick J. Michaels, “Spinning Global Sea Ice,” Cato Institute, February 12, 2015, <https://www.cato.org/blog/spinning-global-sea-ice>. It appears to be the case that the Antarctic eastern ice sheet—about two-thirds of the continent—is growing, while the western ice sheet (and the peninsula) may be shrinking. No agreed explanation for this phenomenon is reported in the literature.

<sup>23</sup> For the historical data reported by the NOAA, see National Ocean and Atmospheric Administration, “Historical Records and Trends,” <https://www.ncdc.noaa.gov/climate-information/extreme-events/us-tornado-climatology/trends>.

<sup>24</sup> For data on global tropical cyclone activity, see Ryan N. Maue, “Global Tropical Cyclone Activity,” updated March 16, 2021, at <http://climatlas.com/tropical/>.

<sup>25</sup> For the reported U.S. wildfire data, see National Interagency Fire Center, “Total Wildland Fires and Acres (1926–2019),” <https://www.nifc.gov/fireInfo/fireInfo-stats-totalFires.html>. On the decline in global area burned over past decades, see Stefan H. Doerr and Cristina Santin, “Global Trends in Wildfire and Its Impacts: Perceptions Versus Realities in a Changing World,” *Philosophical Transactions of the Royal Society of London, Series B, Biological Sciences* 371, no. 1696 (2016), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4874420/pdf/rstb20150345.pdf>.

<sup>26</sup> See US Environmental Protection Agency, “Climate Change Indicators: Drought,” <https://www.epa.gov/climate-indicators/climate-change-indicators-drought>; and US Department of Commerce, National Climatic Data Center, “Divisional Data Select,” <https://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp>.

<sup>27</sup> See R.M. Hirsch and K.R. Ryberg, “Has the Magnitude of Floods Across the USA Changed with Global CO<sub>2</sub> Levels?,” *Hydrological Sciences Journal* 57, no. 1 (2012): 1–9, <https://www.tandfonline.com/doi/full/10.1080/02626667.2011.621895?scroll=top&needAccess=true&>.

<sup>28</sup> See CO<sub>2</sub> Science, “Ocean Acidification Database,” <http://www.co2science.org/data/acidification/results.php>. See also Alan Longhurst, *Doubt and Certainty in Climate Science*, pp. 214–25, <https://curryja.files.wordpress.com/2015/09/longhurst-print.pdf>.

<sup>29</sup> See Food and Agriculture Organization of the United Nations, *World Food and Agriculture Statistical Pocketbook 2018*, 2018, Charts 28 and 46, <http://www.fao.org/3/CA1796EN/ca1796en.pdf>. See also Kevin D. Dayaratna, Ross McKittrick, and Patrick J. Michaels, “Climate Sensitivity, Agricultural Productivity and the Social Cost of Carbon in FUND,” *Environmental Economics and Policy Studies* 22 (2020): 433–48.

about the various severe effects often asserted to be looming as impacts of anthropogenic warming.<sup>30</sup>

If we apply the Environmental Protection Agency climate model, under sensitivity assumptions higher than those reported in the recent peer-reviewed literature, net-zero U.S. GHG emissions effective immediately would yield a reduction in global temperatures of 0.104 degrees C by 2100. That effect would be barely detectable given the standard deviation (about 0.11 degrees C) of the surface temperature record.<sup>31</sup> The entire Paris agreement: about 0.17 degrees C. Net-zero emissions by the entire Organization for Economic Cooperation and Development: 0.21 degrees C. A 35 percent reduction in global GHG emissions implemented immediately and maintained strictly would reduce global temperatures in 2100 by about half a degree.<sup>32</sup> Note that GHG emissions in 2020 fell by about 6.4 percent as a result of the COVID-19 economic downturn.<sup>33</sup> Can anyone believe that even larger GHG reductions are plausible politically? Is there a believable benefit/cost model that would justify such policies?

### Observations on the Materiality of Climate “Risks”

It is clear that those in support of the proposition that banks and other financial institutions evaluate the “risks” of anthropogenic climate change to the financial system view such analyses as “material” in terms of disclosures to investors.<sup>34</sup> Several problems are attendant upon that premise, in substantial part for the reasons discussed above. Any such projections of climate phenomena and resulting “risks” to the financial system—far into the future—are very far from trivial methodologically. Which climate model(s) should financial institutions use? Which assumptions about future emissions, about the sensitivity of the climate system, about policies to be adopted internationally, about the climate effects of those policies, ad infinitum, should financial institutions incorporate into those models? Are those financial institutions—even very large ones—in a position to do such analysis in a credible fashion? If not, whom should they retain to do that analysis for them, and how should they evaluate the differences among the available alternative providers of such analyses?

The reality is that a “climate risk” disclosure requirement would be deeply speculative, and the level of detail and the scientific sophistication that would be needed to satisfy such a requirement is staggering. Such “disclosures” and supporting analysis and documentation would take up thousands of pages, with references to thousands more, and the premise that this “disclosure” requirement would facilitate improved decision making by investors in the financial sector is difficult to take seriously.

If climate “risks” are deemed material in terms of disclosure requirements, why not others that are uncertain or speculative? Climate “risks” are hardly the only ones potentially relevant to the financial system but difficult to incorporate into business decisions. What about massive volcanic eruptions? Asteroid impacts? Powerful earthquakes? Tsunamis? The potential problem of mass contagion is one with which we are far more familiar now than was the case only a bit more than a year ago. The use of bioweaponry by terrorists, nuclear war, gamma ray storms, and on and on. Is climate “risk” the most important? If that is the hypothesis, what is the basis for it? Why are those others, and many more, not worthy of incorporation into financial decisions? What distortions would result from attention only to climate change and not others?

Because the perceived “climate “risks” confronting the financial sector are dependent upon crucial choices among alternative assumptions, the evaluation of such “risks” would be largely arbitrary given that the “correct” assumptions are very far from obvious. This means that a requirement, whether formal or informal, that climate “risks” be incorporated into the business decisions of financial institutions

<sup>30</sup> Julie M. Arblaster et al., “Long-Term Climate Change: Projections, Commitments and Irreversibility-Final Draft Underlying Scientific-Technical Assessment,” in Working Group I Contribution to the IPCC Fifth Assessment Report (AR5), Climate Change 2013: The Physical Science Basis, September 23-26, 2013, p. 12-78, <http://www.climatechange2013.org/images/uploads/WGIAR5-WGI-12Doc2b-FinalDraft-Chapter12.pdf>.

<sup>31</sup> See <https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1029/1999JD900835>.

<sup>32</sup> Author computations using MAGICC 5.3. The MAGICC model can be found at <http://www.magicc.org/>.

<sup>33</sup> See <https://www.nature.com/articles/d41586-021-00090-3>.

<sup>34</sup> See the Federal Reserve Financial Accounting Manual for Federal Reserve Banks at <https://www.federalreserve.gov/aboutthefed/files/BSTfinaccountingmanual.pdf>. The Securities and Exchange Commission final rule for materiality disclosure requirements for banks is at <https://www.federalregister.gov/documents/2020/10/16/2020-20655/update-of-statistical-disclosures-for-bank-and-savings-and-loan-registrants>.

would weaken the materiality standard for disclosures by those institutions. “Materiality” always has meant the disclosure of information directly relevant to the financial performance of the bank or other institution. When “risk” analysis becomes an arbitrary function of choices among assumptions complex, opaque, and far from obvious, the traditional materiality standard inexorably will be diluted and rendered far less useful for the investment and financial markets, an outcome diametrically at odds with the ostensible objectives of those advocating the evaluation of climate “risks.”

### Additional Observations and Conclusions

The available analysis suggests that the financial risks of anthropogenic climate change, at least in the aggregate, are much smaller than many assert. Consider the predictions from the central integrated assessment models, one of which is the Dynamic Integrated Climate and Economy Model, for which William D. Nordhaus won the Nobel Prize in Economics in 2018.<sup>35</sup> Under DICE, global gross domestic product (GDP) in 2100 varies by about 3 percent across policy scenarios, including no climate policies at all, a figure that is both very small and almost certainly not statistically significant given the vagaries of economic forecasting and the number of years remaining before the end of this century. (I exclude here Nordhaus’ “Stern discounting” policy scenario, as it assumes a discount rate effectively equal to zero, a fundamental analytic error.<sup>36</sup>) Per capita consumption varies only by about 1.3 percent across policy scenarios, also a very small number and almost certain not to be statistically significant.

Proposals that the Federal Reserve enforce a mandate that financial institutions evaluate climate “risks” represent a blatant effort to distort the allocation of capital away from economic sectors disfavored by certain political interest groups pursuing ideological agendas. This would represent the return of Operation Choke Point, an attempt to politicize access to credit, one deeply corrosive of our legal and constitutional institutions. Protection of those institutions is consistent only with formal policymaking by the Congress through enactment of legislation, rather than with pressures, powerful but informal, exerted upon and by the Federal Reserve and other regulatory agencies. Because the uncertainties attendant upon the future effects of increasing atmospheric concentrations of GHG are so great, a top-down policy approach for the evaluation of any attendant risks is itself very risky. A wiser approach would entail allowing market forces to make such “risk” determinations in a bottom-up fashion, thus avoiding an obvious politicization of the allocation of capital. It is reasonable to hypothesize that the market in its atomistic fashion has decided that it is the sum of decisions by financial institutions and investors that is the more reliable gauge of the highly uncertain business implications of evolving climate phenomena. So as to drive the appropriate responses from businesses, it is not necessary that all investors make such difficult judgments; it is necessary only that marginal investors do so. Financial institutions are not charities, and they are not government. The campaign for evaluation and disclosure of climate “risks” by the Federal Reserve and financial institutions is a clear effort to use private-sector resources for ideological purposes, in the context of the unwillingness of the Congress to enact such policies explicitly. The proper course in the context of climate phenomena is the preservation of the traditional roles of the private sector and of the government, respectively, as part of the larger permanent objectives of maximizing the productivity of resource use under free market competition, and preserving the political accountability of the policymaking process under the institutions of democratic decisionmaking as constrained by the constitution.

Thank you, Chairman Brown and Ranking Member Toomey, for this opportunity to offer my views on this prominent topic. I will be very pleased to address any questions that you or the other Members of this Committee may have.

<sup>35</sup> See William Nordhaus and Paul Sztorc, “DICE 2013R: Introduction and User’s Manual,” Yale University, Department of Economics, October 2013, Figure 4 and Table 1, <http://www.econ.yale.edu/nordhaus/homepage/homepage/documents/DICE-Manual-100413r1.pdf>.

See also Benjamin Zycher, “The Climate Left Attacks Nobel Laureate William D. Nordhaus,” monograph, American Enterprise Institute, July 2020, at <https://www.aei.org/wp-content/uploads/2020/07/The-Climate-Left-Attacks-Nobel-Laureate-William-D.-Nordhaus.pdf>.

<sup>36</sup> See, e.g., David Kreutzer, “Discounting Climate Costs,” Heritage Foundation, June 16, 2016, at <https://www.heritage.org/environment/report/discounting-climate-costs>. See Nicholas Stern, *The Economics of Climate Change: The Stern Review* (Cambridge, UK: Cambridge University Press, January 2007), <https://www.cambridge.org/us/academic/subjects/earth-and-environmental-science/climatology-and-climate-change/economics-climate-change-stern-review?format=PB>.

**RESPONSES TO WRITTEN QUESTIONS OF  
SENATOR CORTEZ MASTO FROM GREGORY GELZINIS**

**Q.1.** How are financial firms considering the increase of migration due to extreme climate change? How would a financial institution that has long served its community plan for a possible fire, tornado or flood wiping out the town and uprooting and dispersing residents?

**A.1.** Unfortunately, regulators and the public have little information on how financial firms are considering the potential effects of climate change on their balance sheets and operations, including the effects of climate-driven migration. It is critical for regulators to compel the production of this information and also ensure, through supervision and other prudential means, that financial firms are adequately integrating these risk factors into their governance, risk management, internal controls, and capital planning processes.

The damage caused by an extreme weather event can impair the value of physical assets and cause losses for the financial instruments tied to those assets. Migrations following extreme weather events or those driven by long-term environmental shifts can further reduce the value of real and financial assets in the region, e.g., a commercial loan to a small business that loses a large portion of its customer base or a mortgage in a housing market with depleted demand. Migration could also limit financial firms' ability to derive future business from the impacted region, reducing their profitability. These and other physical risks could threaten the safety and soundness of individual firms and further economically disrupt the communities they serve. Beyond this type of microprudential concern, physical risks could ultimately destabilize the broader financial system and inflict harm on the economy as a whole. Financial firms will not sufficiently address these risks on their own. Regulators must step in to improve the resilience of the financial system to these climate-related risks.

**Q.2.** We know that the insurance sector is particularly vulnerable to the physical impacts of climate change. We've seen fires, floods, tornadoes and other extreme weather events cause wide-scale devastation.

Have insurance commissioners identified specific Federal actions to mitigate large-scale losses?

How are State insurance commissioners ensuring that insurance firms consider and plan for risks?

**A.2.** The business model for property and casualty insurance companies, which guarantee the value of physical property against an array of perils, is acutely exposed to the physical risks of climate change. The increase in frequency and severity of floods, wildfires, hurricanes, and other extreme weather events threatens to drive unprecedented claims for insurers in impacted geographies and business lines. It is critical for state insurance commissioners to ensure the resiliency of these institutions. An increase in insurance company failures could threaten state guarantee funds, policyholders, counterparties, and the broader economy. Moreover, the less prepared an insurance company is for climate-related risks, the more likely it will rapidly pull back from certain geographies

and business lines after a climate-related shock. That may help limit the future solvency risk of the insurance company, but it will increase the risks borne by businesses, households, and other financial firms that rely on insurance for risk mitigation.

State insurance commissioners have generally refrained from identifying federal financial regulatory actions that could help mitigate climate-related risks to the financial system, given that insurers are predominantly regulated at the state level. A few state insurance regulators have taken initial steps, however, to identify and mitigate climate-related risks to insurers within their jurisdiction, but too few states have taken action on this front. California and New York have been two of the leading states. In 2016, CA Insurance Commissioner Dave Jones launched the Climate Risk Carbon Initiative to tackle climate-related insurance risks.<sup>1</sup> The effort included enhanced climate risk disclosure and stress testing, among other measures. In 2019, the New York State Department of Financial Services (NYDFS) was the first U.S. financial regulator to join the Network for Greening the Financial System. Since then, NYDFS has issued a circular and proposed a guidance document that outlines climate-related supervisory expectations for insurers.<sup>2</sup>

It is important for state insurance commissioners across the country that are lagging behind to pick up the pace of action. Climate risk disclosure, stress testing, supervisory guidance, and integrating climate considerations into the risk-based capital framework would improve the resiliency of the insurance sector. Moreover, despite the potential lack of support for federal action among most state insurance commissioners, the Federal Insurance Office (FIO) and Financial Stability Oversight Council (FSOC) have a vital role to play on this issue. The FIO and FSOC should push states to act and use their own federal tools to mitigate these risks, where appropriate.

**Q.3.** At the Securities and Exchange Commission, Acting Commissioner Lee has suggested improvements to disclosure related to investments

Do investors know the actual climate risks to their portfolios?

**A.3.** A survey of institutional investors suggests the financial system is not reflecting these risks in asset prices, as 93 percent responded that the implications of climate change had yet to be priced into markets.<sup>3</sup> Research surrounding the projected physical impacts of climate change and scenario analyses probing transition-related impacts support this view.<sup>4</sup> There are several reasons

<sup>1</sup> California Department of Insurance, “Climate Risk Carbon Initiative,” available at <http://www.insurance.ca.gov/0250-insurers/0300-insurers/0100-applications/ci/index.cfm>.

<sup>2</sup> New York State Department of Financial Services, “Superintendent Laceywell Announces Proposed DFS Guidance To New York Insurers On Managing The Financial Risks From Climate Change,” Press Release, March 25, 2021. Available at <https://www.dfs.ny.gov/reports-and-publications/press-releases/pr202103252>.

<sup>3</sup> *asset-allocation-finds-new-report-by-bny-mellon-investm.*

<sup>4</sup> Felix Suntheim and Jerome Vandenbussche, “Equity Investors Must Pay More Attention to Climate Change Physical Risk,” International Monetary Fund, May 29, 2020, available at <https://blogs.imf.org/2020/05/29/equity-investors-must-pay-more-attention-to-climate-change-physical-risk/>; See for example, De Nederlandsche Bank, “An energy transition risk stress test for the financial system of the Netherlands,” (2018), available at <https://www.dnb.nl/media/pdnpdalc/201810-nr-7-2018-an-energy-transition-risk-stress-test-for-the-financial-system-of-the-netherlands.pdf> and Irene Monasterolo, “Assessing climate risks in investors’ portfolios: a jour-

that investors have yet to price the impacts of climate change into valuations for a range of assets. These include a lack of granular, comparable, and reliable corporate disclosure of climate-related risks; backwards-looking pricing models that are not fit for purpose when analyzing forward-looking risks; and the temporal mismatch between short-term corporate thinking and medium-to-long term climate risk materialization.<sup>5</sup>

**Q.4.** Is it possible for investors to know the actual climate risk in their portfolios?

**A.4.** Investors need reliable, consistent, and comparable data to evaluate the climate-related risk in their portfolios. The myriad voluntary disclosure frameworks that have developed over the past several years have helped get the ball rolling on this important issue, but only a mandatory standardized regime implemented by the SEC can provide the information necessary for investors to make prudent decisions when they allocate capital. The disclosures should include both specific line-item quantitative requirements and additions to the narrative-based disclosures in the management discussion and analysis, such as those called for by the Task Force on Climate-related Financial Disclosures.<sup>6</sup>

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#### RESPONSES TO WRITTEN QUESTIONS OF SENATOR CORTEZ MASTO FROM NATHANIEL KEOHANE

**Q.1.** How does extreme weather events due to climate change pose risks to the hospitality and tourism sector? How should communities that rely on tourism and hospitality jobs plan for climate change impacts?

**A.1.** Extreme weather events caused by climate change can have severe consequences for local recreation and tourism industries, ranging from skiing to national park visitation to urban excursions. The scope and magnitude of these impacts on residents and out-of-state visitors—and the businesses that support them—are likely to grow in the future. They will also put increasing pressure on the budgets of the federal, state, and local agencies charged with managing park and recreation lands and facilities.<sup>1</sup>

Nevada in particular is already experiencing the effects of a changing climate. The state's average temperature is increasing, with 8 of the 10 warmest years since 1895 having occurred since 2000. Annual average temperature increases of 4-6 degrees Fahrenheit are projected across the state by 2050. Under a high-emis-

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ney through climate stress-testing," U.N. Principles for Responsible Investment, March 2, 2020, available at <https://www.unpri.org/pri-blog/assessing-climate-risks-in-investors-portfolios-a-journey-through-climate-stress-testing/5526.article>.

<sup>5</sup>Madison Condon, "Market Myopia's Climate Bubble," Boston University School of Law, Law and Economics Research Paper Forthcoming (2021), available at <https://papers.ssrn.com/sol3/papers.cfm?abstract-id=3782675>.

<sup>6</sup>Task Force on Climate-related Financial Disclosures, "Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures," (2017), available at <https://assets.bbhub.io/company/sites/60/2020/10/FINAL-TCFD-Annex-Amended-121517.pdf>; Alexandra Thornton and Andy Green, "The SEC's Time To Act" (Washington: Center for American Progress, 2021), available at <https://www.americanprogress.org/issues/economy/reports/2021/02/19/496015/secs-time-act/>.

<sup>1</sup>Van Houtven et al., 2020. Climate Change and North Carolina: Near-term Impacts on Society and Recommended Actions. RTI International. Available at: <https://www.edf.org/sites/default/files/content/NC-Costs-of-Inaction.pdf>.

sions scenario, most of central and northern Nevada could see increases of 10–12 degrees by the end of the century.<sup>2</sup>

Reno and Las Vegas are already experiencing particularly severe warming, due to the urban heat island effect—in which a city’s built infrastructure prevents heat from dissipating as temperatures cool overnight.

Nevada is also likely to experience increased droughts, snow loss, and flooding due to climate change. By 2050, 5-10 percent more of total precipitation could fall as rain rather than snow—with even higher numbers in the Tahoe basin and northwestern part of the state. Peak runoff rates are projected to rise more than 25-50 percent above the state’s historical rates by 2050, particularly around many mountain ranges and the Las Vegas Valley.<sup>3</sup>

These climate impacts stand to have significant implications for Nevada’s tourism, recreation, and hospitality sectors. For example:

- Shorter snow seasons and less reliable snowpack could affect Nevada’s ski season and reduce associated tourism in an industry that generates hundreds of millions in annual revenue.<sup>4</sup>
- Higher temperatures in the summer, coupled with increased dust caused by drought, can deter visitors and reduce the time available to be safely outside. By 2050, Great Basin National Park, for example, is projected to experience 58 days per year of temperatures over 90 degrees—up from the current average of 19.<sup>5</sup>
- Increased temperatures and heat waves are expected to lead to greater energy demand for air conditioning and cooling, placing additional cost pressures on local businesses. In Clark County, where Las Vegas is located, increased annual energy expenditures could reach between 15-20 percent by end-of-century under a pessimistic climate scenario (RCP8.5).<sup>6</sup>
- The labor supply of Nevada workers heavily exposed to outdoor temperatures is expected to decline between 1-2 percent by end-of-century under a pessimistic climate scenario (RCP8.5). Many of these jobs support tourism and recreation across the state.<sup>7</sup>
- More severe droughts have the potential to adversely affect a wide variety of water-based recreational activities as well as

<sup>2</sup>Nevada Climate Initiative, 2020. State Climate Strategy. Available at: <https://climateaction.nv.gov/wp-content/uploads/2021/01/NVClimateStrategy-011921.pdf>.

<sup>3</sup>Ibid. Both projections are 2050 estimates, under an RCP8.5 (i.e., high-emission) climate scenario.

<sup>4</sup>For example, a study from Patrick Tierney at SF State found the ski industry contributed \$564 million to the local Tahoe area economy during the 2013-14 winter season. Meanwhile, a report from Tourism Economics found that outdoor recreation accounted for \$966 million of visitor spending in Nevada in 2018.

<sup>5</sup>Kahn, 2016. “The Future of National Parks is Going to be a Lot Hotter.” Climate Central. Available at: <http://assets.climatecentral.org/pdfs/NationalParks-daysabove.pdf>.

<sup>6</sup>Hsiang, S., Kopp, R., Jina, A., Rising, J., Delgado, M., Mohan, S., Rasmussen, D.J., Muir-Wood, R., Wilson, P., Oppenheimer, M. and Larsen, K., 2017. Estimating economic damage from climate change in the United States. *Science*, 356(6345), pp.1362-1369. Available at: <https://science.sciencemag.org/content/sci/356/6345/1362.full.pdf>.

<sup>7</sup>Ibid.

the golfing industry, which supports more than a billion of annual revenue and 4,000 jobs.<sup>8</sup>

- Increased severity and frequency of droughts will likely result in more wildfires across the state. This would affect the state's extensive parks and recreation lands by reducing visitation and associated revenue.
- Increased flash flooding could cause disruptions in downtown areas of Reno and Las Vegas, while road closures due to flood and landslide risk can disrupt travel plans throughout the state.<sup>9</sup>

Many ski areas and mountain communities have responded to a changing climate by expanding their traditional tourist offerings—for example, by expanding their summer and traditional “mud season” offerings to include hiking, mountain biking, and adventure parks as a way to generate revenue during the off season. However, these solutions only offer short-term revenue patches, and they must be complemented by longer-term policy and investment decisions.

The most important way to protect such communities from the impacts of climate change is to enact policies that reduce emissions of carbon dioxide, methane, and other heat-trapping greenhouse gases that are responsible for climate change. While there is no substitute for Federal action on climate, state initiatives are essential to making critical near-term reductions, helping mitigation of greenhouse gas emissions and offering a roadmap for ambitious Federal action. For example, Nevada Governor Steve Sisolak recently announced new rulemaking to promote low- and zero-emissions vehicles, complementing the state's latest renewable portfolio standard requiring 50 percent carbon-free electricity by 2030.<sup>10 11</sup> Most recently, the Nevada Climate Initiative issued its inaugural State Climate Strategy in December, outlining several policy options to meet the state's 2050 decarbonization goals—including an enforceable cap on emissions.<sup>12</sup>

In addition, communities can plan for climate change impacts by making investments in stormwater management systems and other climate-resilient infrastructure; integrating projections of future climate impacts into land use planning and zoning (e.g., increasing green space can help reduce the “heat island” effect mentioned above that exacerbates warming); and, especially in semi-arid re-

<sup>8</sup> Repetto, 2012. Economic and Environmental Impacts of Climate Change in Nevada. Demos. Available at <https://www.demos.org/research/economic-and-environmental-impacts-climate-change-nevada#Climate-Change's-Impact-on-Tourism-in-Nevada>.

<sup>9</sup> Nevada Climate Initiative, 2020. State Climate Strategy. Available at: <https://climateaction.nv.gov/wp-content/uploads/2021/01/NVClimateStrategy-011921.pdf>.

<sup>10</sup> EDF, 2020. “Nevada Governor Sisolak Takes Important First Step Toward Transportation Electrification.” Available at <https://www.edf.org/media/nevada-governor-sisolak-takes-important-first-step-toward-transportation-electrification>.

<sup>11</sup> Morehouse, 2019. “Nevada Passes Bill for 50 percent Renewables by 2030, 100 percent Carbon Free by 2050.” Utility Dive. Available at <https://www.utilitydive.com/news/nevada-passes-bill-for-50-renewables-by-2030-100-carbon-free-by-2050/553138/>.

<sup>12</sup> EDF, 2020. “Nevada's State Climate Strategy Signals Need for More Ambitious Policies to Curb Pollution.” Available at <https://www.edf.org/media/nevadas-state-climate-strategy-signals-need-more-ambitious-policies-curb-pollution>.

gions like Nevada, integrating projections of climate impacts into long-range planning for water infrastructure and use.<sup>13</sup>

**Q.2.** At the Securities and Exchange Commission, Acting Commissioner Lee has suggested improvements to disclosure related to investments.

Do investors know the actual climate risks to their portfolios?

**A.2.** Investors in general do not currently know the actual climate risks to their portfolios—because the information needed for them to do so is not widely available with the consistency, quality, and specificity required. This conclusion emerges clearly from the report by the Climate-Related Market Risk Subcommittee of the Commodity Futures Trading Commission, of which I was a member.<sup>14</sup>

Climate change poses significant physical and transition risks for companies across economic sectors and geographic locations.<sup>15</sup> In light of that fact, the SEC promulgated its 2010 guidance confirming that climate-related risks should be disclosed in the same manner as other financial risks to companies,<sup>16</sup> and well over 1,000 companies have signed onto the TCFD voluntary framework for additional climate disclosure.<sup>17</sup>

However, a large proportion of companies are not making disclosures that would allow investors to meaningfully assess climate risk. A 2017 KPMG study of the annual financial reports of nearly 5,000 companies found that only 28 percent acknowledged financial risk of climate change at all.<sup>18</sup> Among the 250 largest companies, the rate of acknowledgment was higher but still under 50 percent.<sup>19</sup>

Furthermore, many reports that do reference climate risk have considerable limitations. Only 2 percent of the companies in the KPMG study that acknowledged climate risks quantified those potential risks in financial terms; a similarly low percentage modeled potential impacts using scenario analysis.<sup>20</sup> The TCFD's 2020 status report found that only 17 percent of companies discuss their process for integrating climate change into risk management, while only 7 percent of companies discuss their resilience strategies.<sup>21</sup>

In order for disclosures to be sufficient, they must be specific to the company, comparable to other companies, and useful in making decisions on investment, ownership, engagement, and proxy-vot-

<sup>13</sup> Several such policy options are outlined in Nevada Climate Initiative, 2020. State Climate Strategy. Available at: <https://climateaction.nv.gov/wp-content/uploads/2021/01/NVClimateStrategy-011921.pdf>.

<sup>14</sup> Commodity Futures Trading Commission (CFTC), Managing Climate Risk in the U.S. Financial System, Report of the Climate-Related Market Risk Subcommittee of the Market Risk Advisory Committee (2020), p. v, <https://perma.cc/UT9M-FG2Y> ("The existing disclosure regime has not resulted in disclosures of a scope, breadth, and quality to be sufficiently useful to market participants and regulators.")

<sup>15</sup> CFTC, Managing Climate Risk in the U.S. Financial System, 11.

<sup>16</sup> Commission Guidance Regarding Disclosure Related to Climate Change, Securities Act Release No. 9106, Exchange Act Release No. 61,469, 75 Fed. Reg. 6290 (Feb. 8, 2010).

<sup>17</sup> Parker Bolstad et al., "Flying Blind: What Do Investors Really Know About Climate Change Risks in the U.S. Equity and Municipal Debt Markets?" (Brookings Institute, 2020), p. 2, <https://perma.cc/8LNV-BEGK>.

<sup>18</sup> KPMG, "The Road Ahead: The KPMG Survey of Corporate Responsibility Reporting 2017", p. 30, <https://assets.kpmg/content/dam/kpmg/be/pdf/2017/kpmg-survey-of-corporate-responsibility-reporting-2017.pdf>.

<sup>19</sup> KPMG, "The Road Ahead", p. 31.

<sup>20</sup> KPMG, "The Road Ahead", p. 31.

<sup>21</sup> TCFD, 2020 Status Report, p. 11-12, <https://www.fsb.org/wp-content/uploads/P291020-1.pdf>.

ing.<sup>22</sup> Without broad access to specific, comparable, and decision-useful disclosures, investors are not able to reliably assess climate risks to their portfolios. At a system level, this lack of information has created the danger of a “climate bubble” through mispricing of risky assets.<sup>23</sup>

**Q.3.** Is it possible for investors to know the actual climate risk in their portfolios?

**A.3.** It is certainly possible to greatly improve the quantity and quality of climate risk information available to investors by “deploying new analytical tools, regulatory incentives, and business practices.”<sup>24</sup>

Tools for climate risk analysis are advancing rapidly. The Paris Agreement Capital Transition Assessment (PACTA), for example, aggregates corporate climate risk information to allow financial institutions to assess both asset-specific and portfolio-wide alignment with various climate scenarios. To date, over 3,000 financial institutions globally have used the PACTA tool.<sup>25</sup> The Climate Action 100+ Net Zero Benchmark and Transition Pathway Initiative, along with ESG ratings products from firms like MSCI and Sustainalytics, also provide investors with increasingly robust resources to model climate risk.

These tools can improve with enhanced corporate climate risk disclosure. Over the past three years, a growing consensus of investors have called for TCFD-aligned disclosure to better evaluate portfolio-wide climate-related financial risks.<sup>26</sup> That the number of companies reporting in line with the TCFD continues to increase annually suggests that enhancing climate risk analysis is achievable.<sup>27</sup> Additionally, the proliferation of downscaled climate projections can help make investor analysis of company-specific physical risks more sophisticated.<sup>28</sup>

Regulators can facilitate wider adoption of best practices through many avenues, including mandating climate risk disclosures, building climate expertise, requiring financial firms to consider climate

<sup>22</sup> Madison Condon et al., “Mandating Disclosure of Climate-Related Financial Risk”, NYU Institute for Policy Integrity and Environmental Defense Fund, 2021, p. 11, <https://perma.cc/2USW-MMXF>.

<sup>23</sup> Madison Condon, “Market Myopia’s Climate Bubble 2021” *Utah L. Rev.* (forthcoming 2021), <https://papers.ssrn.com/sol3/papers.cfm?abstract-id=3782675>.

<sup>24</sup> Parker Bolstad et al., “Flying Blind”, 4.

<sup>25</sup> 2 Degree Investing Initiative, “PACTA/Climate Scenario Analysis Program,” <https://2degrees-investing.org/resource/pacta/>.

<sup>26</sup> The Yale Center for Business and the Environment, Investors Push the Pace of Climate Risk Financial Disclosures (2018), p. 2, <https://www.erm.com/globalassets/documents/publications/2018/yalecbe-erm-investors-push-the-pace-on-climate-risk-financial-disclosures.pdf>.

<sup>27</sup> TCFD, 2019 Status Report, p. 5, (“Overall, the Task Force found signs of progress in implementing the recommendations among companies traditionally engaged on climate-related issues. These companies demonstrate that disclosing climate-related information consistent with the TCFD recommendations is possible and is a journey of continuing improvement.”).

<sup>28</sup> See, e.g., U.S. Climate Resilience Toolkit, Energy Data Gallery, <https://toolkit.climate.gov/topics/energy/energy-data-gallery> (last updated Sept. 24, 2019); Nat’l Aeronautics & Space Admin., NASA Earth Exchange (NEX) Downscaled Climate Projections (NEX-DCP30), <https://www.nccs.nasa.gov/services/data-collections/land-based-products/nex-dcp30> (last visited Apr. 14, 2021); U.S. Geological Survey, Regional Climate Change Viewer, <http://regclim.coas.oregonstate.edu/visualization/rcvv/index.html> (last visited Apr. 14, 2021); Bureau of Reclamation et al., Downscaled CMIP3 and CMIP5 Climate and Hydrology Projections, <https://gdo-dcp.ucllnl.org/downscaled-cmip-projections/#Welcome> (last visited Apr. 14, 2021); Conservation Biology Inst., Adapt West-A Climate Adaptation Conservation Planning Database for North America, <https://adaptwest.databasin.org/> (last visited Apr. 14, 2021).

risk, and facilitating availability and consistency of climate data.<sup>29</sup> Leading investors including BlackRock, the world's largest asset manager, have called for mandatory climate risk disclosure, noting that "consistent, high-quality and material public information will enable both asset owners and asset managers to make more informed decisions about how to achieve long-term returns."<sup>30</sup> Through regulatory action, corporate initiative, and technological innovation, investors can determine portfolio-wide climate risks with increasing accuracy.

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<sup>29</sup> CFTC, *Managing Climate Risk in the U.S. Financial System*; see particularly the Key Recommendations summarized on pages vi-ix.

<sup>30</sup> Larry Fink, "To Our Shareholders," (Jan, 26, 2021), <https://www.blackrock.com/corporate/investor-relations/larry-fink-chairmans-letter>.

**MANAGING CLIMATE RISK IN THE U.S. FINANCIAL SYSTEM**

## MANAGING CLIMATE RISK IN THE U.S. FINANCIAL SYSTEM

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Report of the Climate-Related Market Risk Subcommittee,  
Market Risk Advisory Committee of the  
U.S. Commodity Futures Trading Commission



Commissioner Rostin Behnam, Sponsor

Bob Litterman, Chairman

To view individual subcommittee members' concurring statements, if any, please see [cftc.gov](https://www.cftc.gov).

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## MANAGING CLIMATE RISK IN THE U.S. FINANCIAL SYSTEM

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Market Risk Advisory Committee of the  
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**Commissioner Rostin Behnam**, Sponsor

**David Gillers**, Chief of Staff, Office of Commissioner Behnam

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## Executive Summary

**Climate change poses a major risk to the stability of the U.S. financial system and to its ability to sustain the American economy.** Climate change is already impacting or is anticipated to impact nearly every facet of the economy, including infrastructure, agriculture, residential and commercial property, as well as human health and labor productivity. Over time, if significant action is not taken to check rising global average temperatures, climate change impacts could impair the productive capacity of the economy and undermine its ability to generate employment, income, and opportunity. Even under optimistic emissions-reduction scenarios, the United States, along with countries around the world, will have to continue to cope with some measure of climate change-related impacts.

**This reality poses complex risks for the U.S. financial system.** Risks include disorderly price adjustments in various asset classes, with possible spillovers into different parts of the financial system, as well as potential disruption of the proper functioning of financial markets. In addition, the process of combating climate change itself—which demands a large-scale transition to a net-zero emissions economy—will pose risks to the financial system if markets and market participants prove unable to adapt to rapid changes in policy, technology, and consumer preferences. Financial system stress, in turn, may further exacerbate disruptions in economic activity, for example, by limiting the availability of credit or reducing access to certain financial products, such as hedging instruments and insurance.

**A major concern for regulators is what we don't know.** While understanding about particular kinds of climate risk is advancing quickly, understanding about how different types of climate risk could interact remains in an incipient stage. Physical and transition risks may well unfold in parallel, compounding the challenge. Climate risks may also exacerbate financial system vulnerabilities that have little to do with climate change, such as historically high levels of corporate leverage. This is particularly concerning in the short- and medium-term, as the COVID 19 pandemic is likely to leave behind stressed balance sheets, strained government budgets, and depleted household wealth, which, taken together, undermine the resilience of the financial system to future shocks.

The central message of this report is that U.S. financial regulators must recognize that climate change poses serious emerging risks to the U.S. financial system, and they should move urgently and decisively to measure, understand, and address these risks. Achieving this goal calls for strengthening regulators' capabilities, expertise, and data and tools to better monitor, analyze, and quantify climate risks. It calls for working closely with the private sector to ensure that financial institutions and market participants do the same. And it calls for policy and regulatory choices that are flexible, open-ended, and adaptable to new information about climate change and its risks, based on close and iterative dialogue with the private sector.

At the same time, the financial community should not simply be reactive—it should provide solutions. Regulators should recognize that the financial system can itself be a catalyst for investments that accelerate economic resilience and the transition to a net-zero emissions economy. Financial innovations, in the form of new financial products, services, and technologies, can help the U.S. economy better manage climate risk and help channel more capital into technologies essential for the transition.

### Findings of the Report

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This report begins with a fundamental finding—financial markets will only be able to channel resources efficiently to activities that reduce greenhouse gas emissions if an economy-wide price on carbon is in place at a level that reflects the true social cost of those emissions. Addressing climate change will require policy frameworks that incentivize the fair and effective reduction of greenhouse gas emissions. In the absence of such a price, financial markets will operate suboptimally, and capital will continue to flow in the wrong direction, rather than toward accelerating the transition to a net-zero emissions economy. At the same time, policymakers must be sensitive to the distributional impacts of carbon pricing and other policies and ensure that the burden does not fall on low-to-moderate income households and on historically marginalized communities. This report recognizes that pricing carbon is beyond the remit of financial regulators; it is the job of Congress.

A central finding of this report is that climate change could pose systemic risks to the U.S. financial system. Climate change is expected to affect multiple sectors, geographies, and assets in the United States, sometimes simultaneously and within a relatively short timeframe. As mentioned earlier, transition and physical risks—as well as climate and non-climate-related risks—could interact with each other, amplifying shocks and stresses. This raises the prospect of spillovers that could disrupt multiple parts of the financial system simultaneously. In addition, systemic shocks are more likely in an environment in which financial assets do not fully reflect climate-related physical and transition risks. A sudden revision of market perceptions about climate risk could lead to a disorderly repricing of assets, which could in turn have cascading effects on portfolios and balance sheets and therefore systemic implications for financial stability.

**At the same time, this report finds that regulators should also be concerned about the risk of climate-related "sub-systemic" shocks.** Sub-systemic shocks are defined in this report as those that affect financial markets or institutions in a particular sector, asset class, or region of the country, but without threatening the stability of the financial system as a whole. This is especially relevant for the United States, given the country's size and its financial system, which includes thousands of financial institutions, many regulated at the state level. Sub-systemic shocks related to climate change can undermine the financial health of community banks, agricultural banks, or local insurance markets, leaving small businesses, farmers, and households without access to critical financial services. This is particularly damaging in areas that are already underserved by the financial system, which includes low-to-moderate income communities and historically marginalized communities.

**The report finds that, in general, existing legislation already provides U.S. financial regulators with wide-ranging and flexible authorities that could be used to start addressing financial climate-related risk now.** This is true across four areas—oversight of systemic financial risk, risk management of particular markets and financial institutions, disclosure and investor protection, and the safeguarding of financial sector utilities. Presently, however, these authorities and tools are not being fully utilized to effectively monitor and manage climate risk. Further rulemaking, and in some cases legislation, may be necessary to ensure a coordinated national response.

**While some early adopters have moved faster than others in recent years, regulators and market participants around the world are generally in the early stages of understanding and experimenting with how best to monitor and manage climate risk.** Given the considerable complexities and data challenges involved, this report points to the need for regulators and market participants to adopt pragmatic approaches that stress continual monitoring, experimentation, learning, and global coordination. Regulatory approaches in this area are evolving and should remain open to refinement, especially as understanding of climate risk continues to advance and new data and tools become available.

**Insufficient data and analytical tools to measure and manage climate-related financial risks remain a critical constraint.** To undertake climate risk analysis that can inform decision-making across the financial system, regulators and financial institutions need reliable, consistent, and comparable data and projections for climate risks, exposure, sensitivity, vulnerability, and adaptation and resilience. Demand will likely grow for public and open access to climate data, including for primary data collected by the government. Public data will enable market participants to, among other things, compare publicly available disclosure information and sustainability-benchmarked financial products. At the same time, proprietary data and analytical products can introduce innovations that improve climate risk management. A key challenge will be how best to balance the need for transparency through public data on one hand, with the need to foster private innovation through proprietary data, on the other.

**The lack of common definitions and standards for climate-related data and financial products is hindering the ability of market participants and regulators to monitor and manage climate risk.** While progress has been made in this area thanks to voluntary disclosure frameworks and work by foreign regulators, the lack of standards, and differences among standards, remains a barrier to effective climate risk management. The problem is compounded by a lack of international coordination on data and methodology standards. A common set of definitions for climate risk data, including modeling and calculation methodologies, is important for developing the consistent, comparable, and reliable data required for effective risk management. Also, taxonomies or classification systems can help foster greater transparency and comparability in markets for financial products labeled as “green” or “sustainable.”

**Climate-related scenario analysis can be a useful tool to enable regulators and market participants to understand and manage climate-related risks.** Scenarios illustrate the complex connections and dependencies across technologies, policies, geographies, societal behaviors, and economic outcomes as the world shifts toward a net-zero emissions future. Scenario analysis can help organizations integrate climate risks and opportunities into a broader risk management framework, as well as understand the potential short-term impact of specific triggering events. Scenario analysis is gaining traction in several contexts, both domestically and internationally, and regulators are increasingly using scenario analysis to foster greater risk awareness among financial market actors.

**Yet, the limitations of scenario analysis should be recognized.** While useful, climate scenarios and the models that analyze them have important limitations. Scenarios are sensitive to key assumptions and parameters, most have been developed for purposes other than financial risk analysis, and they cannot fully capture all the potential effects of climate- and policy-driven outcomes. Scenario analysis should have a valuable place in the risk management toolkit, but it should be used with full awareness of what it can and cannot do.

**The disclosure by corporations of information on material, climate-related financial risks is an essential building block to ensure that climate risks are measured and managed effectively.** Disclosure of such information enables financial regulators and market participants to better understand climate change impacts on financial markets and institutions. Issuers of securities can use disclosure to communicate risk and opportunity information to capital providers, investors, derivatives customers and counterparties, markets, and regulators. Issuers of securities can also use disclosures to learn from peers about climate-related strategy and best practices in risk management. Investors can use climate-related disclosures to assess risks to firms, margins, cash flows, and valuations, allowing markets to price risk more accurately and facilitating the risk-informed allocation of capital.

**Demand for disclosure of information on material, climate-relevant financial risks continues to grow, and reporting initiatives have led to important advances.** Investors and financial market actors have long called for *decision useful* climate risk disclosures, and in 2019, more than 630 investors managing more than \$37 trillion signed the

*Global Investor Statement to Governments on Climate Change*, which called on governments to improve climate-related financial reporting. Disclosure frameworks have been developed to enhance the quality and comparability of corporate disclosures, most notably, the Task Force on Climate-related Financial Disclosures (TCFD). Also, in 2010, the U.S. Securities and Exchange Commission (SEC) published *Commission Guidance Regarding Disclosure Related to Climate Change*, which provides public companies with interpretive guidance on existing SEC disclosure requirements as they apply to climate change.

**However, the existing disclosure regime has not resulted in disclosures of a scope, breadth, and quality to be sufficiently useful to market participants and regulators.** While disclosure rates are trending in a positive direction, an update published by the TCFD found that surveyed companies only provided, on average, 3.6 of the 11 total TCFD recommended disclosures. Large companies are increasingly disclosing some climate-related information, but significant variations remain in the information disclosed by each company, making it difficult for investors and others to understand exposure and manage climate risks. In addition, the 2010 SEC *Guidance* has not resulted in high-quality disclosure across U.S. publicly listed firms; it could be updated in light of global advancements in the past 10 years.

**In addition to the absence of an economy-wide carbon pricing regime in the United States, other barriers are holding back capital from flowing to sustainable, low-carbon activities.** One involves the misperception among mainstream investors that sustainable or ESG (environmental, social, and governance) investments necessarily involve trading off financial returns relative to traditional investment strategies. Another is that the market for products widely considered to be “green” or “sustainable” remains small relative to the needs of institutional investors. In addition, lack of trust in the market over concerns of potential “greenwashing” (misleading claims about the extent to which a financial product or service is truly climate-friendly or environmentally sustainable) may be holding back the market. And policy uncertainty also remains a barrier, including in areas such as regulation affecting the financial products that U.S. companies may offer their employees through their employer-provided retirement plans.

**These barriers can be addressed through a variety of initiatives.** For example, a wide range of government efforts—through credit guarantees and other means of attracting private capital by reducing the risks of low-carbon investments—catalyze capital flows toward innovation and deployment of net-zero emissions technologies. A new, unified federal umbrella could help coordinate and expand these government programs and leverage institutional capital to maximize impact and align the various federal programs. Climate finance labs, regulatory sandboxes, and other regulatory initiatives can also drive innovation by improving dialogue and learning for both regulators and market innovators, as well as via business accelerators, grants, and competitions providing awards in specific areas of need. In addition, clarifying existing regulations on fiduciary duty, including for example, those concerning retirement and pension plans, to confirm the appropriateness of making investment decisions using climate-related factors—and more broadly, ESG factors that impact risk-return—can help unlock the flow of capital to sustainable activities and investments.

**Derivatives markets can be part of the solution.** Refinements or modifications could be made to existing instruments to reduce derivatives market participants' risk exposure. For example, commodity derivatives exchanges could address climate and sustainability issues by incorporating sustainability elements into existing contracts and by developing new derivatives contracts to hedge climate-related risks. New products may include weather, ESG, and renewable generation and electricity derivatives. However, development of new derivatives will require that the relevant climate-related data is transparent, reliable, and trusted by market participants. This also applies to a wide range of asset classes that can direct capital to climate-related opportunities and help manage climate risk.

**U.S. regulators are not alone in confronting climate change as a financial system risk; international engagement by the United States could be significantly more robust.** Financial regulators and other actors have launched important initiatives to tackle the challenge. The United States already participates in the Basel Committee on Banking Supervision's climate task force, the International Organization of Securities Commissions (IOSCO) sustainable finance network, and relevant committees within the Financial Stability Board (FSB) to study climate-related financial risks. However, at the federal level the United States is not yet a member of the Central Banks and Supervisors Network for Greening the Financial System (NGFS), the Coalition of Finance Ministers for Climate Action, or the Sustainable Insurance Forum (SIF). The Group of Seven (G7) and Group of Twenty (G20), in which the United States plays a central role, could also address this challenge and promote international cooperation, but only if the United States is supportive.

## Key Recommendations

The full list of the report's recommendations can be found at the end of relevant chapters and compiled in an annex at the end of this report. Below, we highlight some of the most important.

We recommend that:

- The United States should establish a price on carbon. It must be fair, economy-wide, and effective in reducing emissions consistent with the Paris Agreement. This is the single most important step to manage climate risk and drive the appropriate allocation of capital. (Recommendation 1)
- All relevant federal financial regulatory agencies should incorporate climate-related risks into their mandates and develop a strategy for integrating these risks in their work, including into their existing monitoring and oversight functions. (Recommendation 4.1)
- The Financial Stability Oversight Council (FSOC)—of which the Commodity Futures Trading Commission (CFTC) is a voting member—as part of its mandate to monitor and identify emerging threats to financial stability, should incorporate climate-related financial risks into its existing oversight function, including its annual reports and other reporting to Congress. (Recommendation 4.2)

- Research arms of federal financial regulators should undertake research on the financial implications of climate-related risks. This research program should cover the potential for and implications of climate-related "sub-systemic" shocks to financial markets and institutions in particular sectors and regions of the United States, including, for example, agricultural and community banks and financial institutions serving low-to-moderate income or marginalized communities. (Recommendation 4.3)
- U.S. regulators should join, as full members, international groups convened to address climate risks, including the Central Banks and Supervisors Network for Greening the Financial System (NGFS), the Coalition of Finance Ministers for Climate Action, and the Sustainable Insurance Forum (SIF). The United States should also engage actively to ensure that climate risk is on the agenda of G7 and G20 meetings and bodies, including the FSB and related committees and working groups. (Recommendation 4.6)
- Financial supervisors should require bank and nonbank financial firms to address climate-related financial risks through their existing risk management frameworks in a way that is appropriately governed by corporate management. That includes embedding climate risk monitoring and management into the firms' governance frameworks, including by means of clearly defined oversight responsibilities in the board of directors. (Recommendation 4.7)
- Working closely with financial institutions, regulators should undertake—as well as assist financial institutions to undertake on their own—pilot climate risk stress testing as is being undertaken in other jurisdictions and as recommended by the NGFS. This climate risk stress testing pilot program should include institutions such as agricultural, community banks, and non-systemically important regional banks. (Recommendation 4.8) In this context, regulators should prescribe a consistent and common set of broad climate risk scenarios, guidelines, and assumptions and mandate assessment against these scenarios. (Recommendation 6.6)
- Financial authorities should consider integrating climate risk into their balance sheet management and asset purchases, particularly relating to corporate and municipal debt. (Recommendation 4.10)
- The CFTC should undertake a program of research aimed at understanding how climate-related risks are impacting and could impact markets and market participants under CFTC oversight, including central counterparties, futures commission merchants, and speculative traders and funds; the research program should also cover how the CFTC's capabilities and supervisory role may need to adapt to fulfill its mandate in light of climate change and identify relevant gaps in the CFTC's regulatory and supervisory framework. (Recommendation 4.11)

- State insurance regulators should require insurers to assess how their underwriting activity and investment portfolios may be impacted by climate-related risks and, based on that assessment, require them to address and disclose these risks. (Recommendation 4.12)
- Financial regulators, in coordination with the private sector, should support the availability of consistent, comparable, and reliable climate risk data and analysis to advance the effective measurement and management of climate risk. (Recommendation 5.1)
- Financial regulators, in coordination with the private sector, should support the development of U.S.-appropriate standardized and consistent classification systems or taxonomies for physical and transition risks, exposure, sensitivity, vulnerability, adaptation, and resilience, spanning asset classes and sectors, in order to define core terms supporting the comparison of climate risk data and associated financial products and services. To develop this guidance, the United States should study the establishment of a Standards Developing Organization (SDO) composed of public and private sector members. (Recommendation 5.2)
- Material climate risks must be disclosed under existing law, and climate risk disclosure should cover material risks for various time horizons. To address investor concerns around ambiguity on when climate change rises to the threshold of materiality, financial regulators should clarify the definition of materiality for disclosing medium- and long-term climate risks, including through quantitative and qualitative factors, as appropriate. (Recommendation 7.2)
- In light of global advancements in the past 10 years in understanding and disclosing climate risks, regulators should review and update the SEC's 2010 *Guidance* on climate risk disclosure to achieve greater consistency in disclosure to help inform the market. Regulators should also consider rulemaking, where relevant, and ensure implementation of the *Guidance*. (Recommendation 7.5)
- Regulators should require listed companies to disclose Scope 1 and 2 emissions. As reliable transition risk metrics and consistent methodologies for Scope 3 emissions are developed, financial regulators should require their disclosure, to the extent they are material. (Recommendation 7.6)
- The United States should consider integration of climate risk into fiscal policy, particularly for economic stimulus activities covering infrastructure, disaster relief, or other federal rebuilding. Current and ongoing fiscal policy decisions have implications for climate risk across the financial system. (Recommendation 8.1)

- The United States should consolidate and expand government efforts, including loan authorities and co-investment programs, that are focused on addressing market failures by catalyzing private sector climate-related investment. This effort could centralize existing clean energy and climate resilience loan authorities and co-investment programs into a coordinated federal umbrella. (Recommendation 8.2)
- Financial regulators should establish climate finance labs or regulatory sandboxes to enhance the development of innovative climate risk tools as well as financial products and services that directly integrate climate risk into new or existing instruments. (Recommendation 8.3)
- The United States and financial regulators should review relevant laws, regulations and codes and provide any necessary clarity to confirm the appropriateness of making investment decisions using climate-related factors in retirement and pension plans covered by the Employee Retirement Income Security Act (ERISA), as well as non-ERISA managed situations where there is fiduciary duty. This should clarify that climate-related factors—as well as ESG factors that impact risk-return more broadly—may be considered to the same extent as “traditional” financial factors, without creating additional burdens. (Recommendation 8.4)
- The CFTC should coordinate with other regulators to support the development of a robust ecosystem of climate-related risk management products. (Recommendation 8.5)

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## List of Acronyms and Abbreviations

<b>AASB</b>	Auditing and Assurance Standards Board	<b>CDP</b>	formerly, the Climate Disclosure Project
<b>ALM</b>	asset liability management	<b>CDS</b>	credit default swap
<b>AMS</b>	American Meteorological Society	<b>CDSB</b>	Carbon Disclosure Standards Board
<b>Amtrak</b>	National Railroad Passenger Corporation	<b>CFTC</b>	Commodity Futures Trading Commission
<b>ASCE</b>	American Society of Civil Engineers	<b>CMBS</b>	commercial mortgage-backed securities
<b>ARPA-E</b>	Advanced Research Projects Agency-Energy	<b>CME</b>	Chicago Mercantile Exchange
<b>AUASB</b>	Australian Accounting Standards Board	<b>CO<sub>2</sub></b>	carbon dioxide
<b>BES</b>	Biennial Exploratory Scenario, Bank of England	<b>COSO</b>	Committee of Sponsoring Organizations of the Treadway Commission
<b>BI</b>	BlackRock Investment Institute	<b>COVID-19</b>	Severe Acute Respiratory Syndrome Coronavirus 2
<b>BIS</b>	Bank of International Settlements	<b>CRD</b>	Corporate Reporting Dialogue
<b>CA100</b>	Climate Action 100+	<b>CRE</b>	commercial real estate
<b>CalPERS</b>	California Public Employees' Retirement System	<b>CSA</b>	Canadian Securities Administrators
<b>CalSTRS</b>	The California State Teachers' Retirement System	<b>DCM</b>	designated contract markets
<b>CCAR</b>	Comprehensive Capital Analysis and Review	<b>DCO</b>	designated clearing organizations
<b>CCS</b>	carbon capture and storage	<b>DFA</b>	The 2010 Dodd-Frank Wall Street Reform and Consumer Protection Act
<b>CCUS</b>	carbon capture, utilization, and storage	<b>DNB</b>	De Nederlandsche Bank
<b>CDI</b>	California Department of Insurance	<b>DOE</b>	U.S. Department of Energy
<b>CDO</b>	Climate Data Online	<b>DOL</b>	U.S. Department of Labor
		<b>DOT</b>	U.S. Department of Transportation

<b>DTCC</b>	Depository Trust and Clearing Corporation	<b>Freddie Mac</b>	Federal Home Loan Mortgage Corporation
<b>EC</b>	European Commission	<b>FSB</b>	Financial Stability Board
<b>ECB</b>	European Central Bank	<b>FSDA</b>	Future of Sustainable Data Alliance
<b>EIA</b>	U.S. Energy Information Agency	<b>FSOC</b>	Financial Stability Oversight Council
<b>EMMA</b>	Electronic Municipal Market Access	<b>G7</b>	Group of Seven
<b>EPA</b>	U.S. Environmental Protection Agency	<b>G20</b>	Group of Twenty
<b>ERISA</b>	The Employee Retirement Income Security Act of 1974	<b>GAO</b>	U.S. Government Accountability Office
<b>ERM</b>	enterprise risk management	<b>GDP</b>	Gross Domestic Product
<b>ESG</b>	environmental, social and governance	<b>GEM</b>	Global Energy Monitor
<b>ETF</b>	exchange-traded fund	<b>GFOA</b>	Government Finance Officers Association
<b>ETS</b>	Emissions Trading System	<b>GHG</b>	Greenhouse Gases
<b>EU</b>	European Union	<b>GHGRP</b>	Greenhouse Gas Reporting Program
<b>EU ETS</b>	European Union Emission Trading System	<b>GSE</b>	Government Sponsored Enterprises
<b>FAM</b>	Food and Agriculture Microdata Catalogue	<b>GRESB</b>	Global Real Estate Sustainability Benchmark
<b>Fannie Mae</b>	Federal National Mortgage Association	<b>GRI</b>	Global Reporting Initiative
<b>FAO</b>	Food and Agricultural Organization of the United Nations	<b>HMC</b>	Harvard Management Company, Inc.
<b>FASAB</b>	Federal Accounting Standards Advisory Board	<b>HSFO</b>	high-sulfur fuel oil
<b>FASB</b>	Financial Accounting Standards Board	<b>IAFP</b>	Investor Agenda Founding Partners
<b>FCM</b>	futures commission merchants	<b>IAIS</b>	International Association of Insurance Supervisors
<b>FDIC</b>	Federal Deposit Insurance Corporation	<b>IEA</b>	International Energy Agency
<b>FEMA</b>	Federal Emergency Management Agency	<b>IFRS</b>	International Financial Reporting Standards
<b>FINRA</b>	Financial Industry Regulatory Authority	<b>IIRC</b>	International Integrated Reporting Council
<b>Fintech</b>	financial technology	<b>ILS</b>	insurance linked securities
<b>FIO</b>	Federal Insurance Office, U.S. Department of the Treasury	<b>IMF</b>	International Monetary Fund
<b>FLIGHT</b>	Facility Level Information on GreenHouse Gases Tool	<b>IOSCO</b>	International Organization of Securities Commissions
<b>FMU</b>	Financial Market Utilities	<b>IPCC</b>	Intergovernmental Panel on Climate Change
		<b>IR</b>	Integrated Reporting

<b>IRENA</b>	International Renewable Energy Agency	<b>PRA</b>	Prudential Regulatory Authority (United Kingdom)
<b>ISDA</b>	International Swaps and Derivatives Association	<b>PRI</b>	Principles for Responsible Investment
<b>ISO</b>	International Organization of Standardization	<b>RCP</b>	Representative Concentration Pathways
<b>IWG</b>	Interagency Working Group on the Social Cost of Greenhouse Gases	<b>REIT</b>	Real Estate Investment Trust
<b>LMBA</b>	London Bullion Market Association	<b>RFS</b>	Renewable Fuel Standards
<b>LMI</b>	low-to-moderate income	<b>RGGI</b>	Regional Greenhouse Gas Initiative
<b>LPO</b>	Loan Programs Office	<b>RMBS</b>	residential mortgage-backed securities
<b>LSFO</b>	low-sulfur fuel oil	<b>RPS</b>	Renewable Portfolio Standard
<b>MBA</b>	Mortgage Bankers Association	<b>SASB</b>	Sustainability Accounting Standards Board
<b>MD&amp;A</b>	Management's Discussion and Analysis	<b>SCC</b>	social cost of carbon
<b>MSP</b>	major swap participants	<b>SDG</b>	Sustainable Development Goals
<b>MSRB</b>	Municipal Securities Rulemaking Board	<b>SDO</b>	Standards Developing Organization
<b>NAIC</b>	National Association of Insurance Commissioners	<b>SEC</b>	U.S. Securities and Exchange Commission
<b>NASEM</b>	National Academies of Sciences, Engineering, and Medicine	<b>SEF</b>	swap execution facilities
<b>NCA</b>	4th National Climate Assessment	<b>SIF</b>	Sustainable Insurance Forum
<b>NCD</b>	non-centrally cleared derivatives	<b>TCFD</b>	Task Force on Climate-related Financial Disclosures
<b>NFIP</b>	National Flood Insurance Program	<b>TEG</b>	technical expert group
<b>NFMA</b>	National Federation of Municipal Analysts	<b>UNEP FI</b>	United Nations Environment Programme Finance Initiative
<b>NGFS</b>	Central Banks and Supervisors Network for Greening the Financial System	<b>UNFCCC</b>	United Nations Framework Convention on Climate Change
<b>NOAA</b>	National Oceanic and Atmospheric Administration	<b>USCRT</b>	U.S. Climate Resilience Toolkit
<b>NYGB</b>	New York Green Bank	<b>USDA</b>	U.S. Department of Agriculture
<b>OFR</b>	Office of Financial Research, U.S. Department of the Treasury	<b>USGCRP</b>	U.S. Global Change Research Program
<b>ORSA</b>	Own Risk Solvency Assessments	<b>VaR</b>	Value at risk
<b>OTC</b>	over-the-counter derivatives or swaps	<b>WBCSD</b>	World Business Council for Sustainable Development
<b>P-ROCC</b>	Physical Risks of Climate Change	<b>WCI</b>	Western Climate Initiative
<b>PG&amp;E</b>	Pacific Gas & Electric Company		

## Foreword

*Bob Litterman, Chairman,  
Climate-Related Market Risk Subcommittee*

As this report is being finalized, the United States is in the midst of a worldwide pandemic, with deaths already exceeding 180,000 from COVID-19, and an associated economic collapse. Of course, there are many differences between the global pandemic, a sudden health crisis that is expected to have impacts of perhaps a few years, and climate change—a global threat that will play out over decades with potentially permanent consequences. But both are similar in one crucial dimension: Science clearly indicates that the cost of delay in responding to the risk can be devastating. A recent study suggests that, in the case of the virus, delaying social distancing by one week in the United States doubled the number of deaths (Pei, et al., 2020). Similarly, every year of delay in the policy response to climate change will lead to a higher mean global temperature increase and to greater probability of irreversible and catastrophic damages. I hope this obvious parallel will help move forward the inevitable global policy response, which in the case of climate change is the creation of incentives to reduce emissions.

The members of the Commodity Futures Trading Commission's Climate-Related Market Risk Subcommittee and I recognize that the financial community must prepare for climate-related risk management challenges. The smooth functioning of the financial markets is crucial to economic prosperity generally, and in particular to facilitating the flow of capital toward mitigating and adapting to climate change. We appreciate Commissioner Rostin Behnam's leadership and timely decision to convene this subcommittee and to request this report to guide the management of climate risk in the U.S. financial system. We also appreciate and thank the Market Risk Advisory Committee (MRAC) and the CFTC for their support. The MRAC's work to examine systemic issues that threaten the stability of the derivatives markets and other financial markets is critical. We hope our recommendations can play an important role in guiding the management of climate risk in the U.S. financial system.

This assignment as chairman of the subcommittee has entailed working with an incredibly talented and dedicated group of climate risk management and financial professionals. In convening the subcommittee, Commissioner Behnam asked many of the most important institutions that participate in the commodity and financial markets to pick a representative who would not only convey their interests, but who could also bring the expertise of the entire organization. These institutions included major banks, an insurance company, energy and agricultural market participants, investors, asset owners, universities, think tanks and non-governmental organizations. This report represents the collective wisdom of this group of professionals and their institutions.

My own background was well suited to lead this effort. I spent a 23-year career in risk management and investing roles at Goldman Sachs. I am well known in the financial community as the co-developer, along with Fischer Black, of the Black-Litterman global asset allocation model, which we created 30 years ago and which is still widely used in the investment industry to build portfolios that optimally balance risk and return. As a result of these experiences, I have a deep respect for the critical role that the financial markets have in facilitating the efficient allocation of capital in our market economy, and the importance of appropriate regulation, oversight, and risk management.

I have a broad background including economics, finance, and risk management, but also a long-term interest in biology, climate change, natural capital, and sustainable finance. As an undergraduate I majored in human biology at Stanford University. My first job was as a general assignment reporter for the San Diego Union. After a year, though, I decided to get a Ph.D. in economics, which I received from the University of Minnesota in 1979. I taught economics at the Massachusetts Institute of Technology for two years, followed by five years at the Federal Reserve Bank of Minneapolis working as a staff economist focused on economic forecasting. In 1986 I moved to Goldman Sachs and began a career on Wall Street as one of the early financial engineers. I started in fixed income research building financial models, followed by a promotion to partner in 1994 when I became the head of firm-wide risk management. In 1998, I moved to the asset management division and headed the quantitative group. In 2009, I left Goldman and helped to create Kepos Capital, a New York based investment management firm where I am currently a partner and chairman of the risk committee.

My focus on climate risk began when I left Goldman Sachs. Like many others, I was concerned that society is not adequately addressing the risks created by climate change. The root cause of climate change is the increase in greenhouse gas (GHG) emissions from humans. As an economist and risk professional, it has long been obvious to me that the risks created by climate change must be addressed by the creation of appropriate incentives to reduce carbon emissions. There is uncertainty about the precise policy levers and tools that will be used to mitigate climate risk, and the innovations that will be required to do so. However, at this moment, what is very clear is that the risks created from climate change are increasing rapidly, economic incentives are misdirected, and immediate action across the global financial system is required.

## The Heart of the Matter

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A fundamental flaw in the economic system lies at the heart of the climate change problem—the lack of appropriate incentives to reduce GHG emissions. No discussion of climate-related financial risk management can begin without focusing on this market failure. Financial markets do an amazing job of allocating capital in the direction of the incentives that they are given. Appropriate incentives arise in these markets primarily from the prices that balance supply and demand for capital, but that is not always the case.

When negative externalities exist, as is the case with the risks and costs imposed by GHG emissions, there is a role for government to ensure that those externalities are reflected in prices. Unfortunately, that is not happening: emissions remain mispriced and capital is flowing in the wrong direction. In fact, on average, global public policies strongly subsidize carbon emissions from fossil fuel consumption—the International Monetary Fund (IMF) estimated \$5.2 trillion (6.5 percent of gross domestic product) in 2017 alone (Coady, et al., 2019). Given the lack of appropriate incentives to reduce emissions, the inevitable responses in economic behavior are directly responsible for the current rapidly accelerating increase in climate risk.

The primary obstacle is political inertia. While there is an ongoing debate about the right price for emissions, what we do know is that inaction creates a large and growing liability. It is very possible that each ton of carbon dioxide put into the atmosphere today will have to be removed and sequestered at some future date to stabilize the world's climate, an expensive process that is not currently feasible and thus a substantial liability that this generation is creating for future generations. If we knew today what it would cost to pull carbon dioxide out of the atmosphere at industrial scale in the not too distant future, the present value of that cost would give us a good sense of an upper bound on where we should price carbon today.

But, because the future is very uncertain, society today should err on the side of caution. In the context of pricing climate risk, that implies imposing a higher price than what models used to calculate the social cost of carbon currently suggest. Prudent risk management calls for immediately implementing carbon pricing globally to quickly reduce GHG emissions and to try to get the planet to net-zero emissions as soon as possible while ensuring that the costs are shared equitably across society and that the distributional impacts are not regressive. Of course, policy should respond to new information over time, and it is very likely that circumstances will require that we need to go beyond net-zero and pull greenhouse gases out of the atmosphere.

## Managing Climate Risk

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How should financial markets and regulators respond in the face of this enormous market failure? Nearly everyone in the financial markets understands several fundamental principles of risk management. The first is that you must think about worst case scenarios. Of course, only rarely is there a well-defined “worst case.” In the financial community, we generally use

the expression “extreme, but plausible” to communicate a common-sense understanding of this type of risk scenario. In this report, we explore a variety of risks, including those that are extreme but plausible, which challenge the stability of the U.S. financial system.

Second, it is well understood that the purpose of risk management is to recognize risks and to warn when they are not being priced appropriately. Markets are in equilibrium when assets reflect not only the expected outcome, but when investors are paid an appropriate premium for the risks that they take. In the case of climate risk, neither the expected impacts—nor the potential for extremely bad outcomes—is being priced appropriately.

Third, time is of the essence. Given enough time, virtually any problem can be addressed. But in risk management, time is a scarce resource. When time runs out, risk can turn into catastrophe. With climate change, we do not know precisely when the planet’s climatic system will be pushed past catastrophic tipping points, beyond which financial (and other) consequences would become non-linear. Indeed, some scientists argue that there are thresholds which are very close or may have already been crossed. This uncertainty about thresholds is a powerful reason not to delay.

Finally, in financial markets we often distinguish between risk and uncertainty. Risk generally refers to a model-based statistical measure of a probabilistic distribution, such as volatility or Value-At-Risk (VaR). But we recognize that the real world does not behave according to a model. Our models give us measures of risk, but what we manage in the financial markets is the broader concept of uncertainty, the full potential of bad outcomes when our models are wrong. Similarly, with respect to climate change, the consequences are highly uncertain. After all, this is the first time we have performed this planetary experiment. This uncertainty means that in managing climate risk we must err on the side of caution if we are to maintain the relative stability and proper functioning of our market economies.

Unlike most financial risks, climate risk has unique characteristics, such as the extended time horizon over which damages are expected to occur, which make it more difficult to measure and manage. For the financial risk management of climate change to succeed, we need to be able to understand how physical climate impacts and the transition to a sustainable economy will affect the valuations of financial instruments. To understand this, regulators, investors, and financial institutions require meaningful data related to risk, as well as analytic tools that can interpret that data.

## About This Report

Commissioner Behnam asked me to lead a group of expert market participants to initiate the critical process of moving toward a climate-resilient U.S. financial system. The commissioner asked for a consensus document, and a process that facilitated meaningful conversations among relevant parties on complex issues that do not fit neatly into the current regulatory

structure. I think we accomplished that task, and we found plenty to agree on. Our toughest challenge was to keep the report to a manageable length.

What did we agree on? Let's start with the need for appropriate incentives. We all see that appropriate incentives are fundamental to the efficient allocation of capital. They are urgent, they are missing, and need to be addressed. Financial markets today are not pricing climate risk. The financial markets cannot do that on their own. Until this fundamental flaw is fixed, capital will flow in the wrong direction. That is the context for, but not the focus, of this report.

This report reflects agreement around a set of fundamental principles beyond pricing carbon, such as the need for collaboration with international efforts to address climate-related financial market risk. Ultimately, these principles coalesce around the need for leadership by the financial regulators to guide an iterative process forward while leaving room for American financial innovation. It also reflects a consensus about immediate next steps, such as the need to quickly improve the quality of the data, analytics, and understanding of the many dimensions of climate risk. We have also pointed out approaches to scenario analysis, stress testing, and standardization of definitions that will help move us forward on what will no doubt be a complex, iterative path toward the development of meaningful disclosure of material climate risk information—a goal toward which we all agree we must move more quickly.

Although we have not resolved all of the many difficult issues that need to be addressed, we hope that we have succeeded in developing a pragmatic platform for managing the risks and opportunities of climate change. This report makes recommendations to the CFTC but, recognizing that no one regulator can address climate risk in isolation, we also address this report to the wider financial community and Congress.

Investors and financial markets are poised to deliver the low-carbon capital and infrastructure that our global economy requires to address climate risk. We know what we need to do and how to do it. We are impatiently waiting for the appropriate incentives and other policies to reduce emissions to be instituted through legislation. Only then will the awesome power of the financial system be able to address at scale this existential threat.

Why am I so passionate about climate risk? The answer is easy. Like others, I see what is already happening—entire regions burned by increasing wildfires, larger storms, more frequent floods, ecosystems under mounting stress, major health impacts, and climate refugees. In addition, I worry about the future my four grandchildren will likely experience in the coming decades, along with the rest of their generation. Our decisions today will have a major impact on the quality of their lives. Those of us who see the danger, recognize the required path forward, and understand the urgency of taking action must muster the courage and clarity of vision to do what is required now to get us on that path.

## Chapter 1

# Introduction to Finance in the Face of Climate Change

While this report will be presented to the U.S. Commodity Futures Trading Commission (CFTC), its conclusions and recommendations will also be relevant to other federal and state financial regulators, federal and state lawmakers, leaders in finance and business, and the general public. Its objective is to analyze the existing and emerging risks that climate change poses to the soundness and stability of the U.S. financial system, and offer recommendations. The report considers the risk of climate change impacts, such as sea-level rise, extreme weather events, and rising temperatures, for economic activity and financial markets. It also takes into account the risks posed to the U.S. financial system by shifts in policy, technology, and consumer preferences—shifts that will be necessary to stabilize concentrations of greenhouse gases (GHGs) and reduce the risk of the most damaging impacts of climate change.

Importantly, since climate change will remain a matter of growing legislative interest, the report should help inform policy debates in the U.S. Congress and state legislatures. Finally, the report's recommendations should be of interest to the American people, who would ultimately benefit if our country can better manage one of the most significant threats it faces.

Over the past decade, financial regulators, business leaders, and legislators around the world have recognized the urgency of the challenge and embraced the need to better manage climate-related financial and market risks. Many countries have adopted legislation, guidance, and other initiatives to advance this goal. In addition, myriad international initiatives, working groups, task forces, coalitions, and other efforts have emerged to facilitate collaborative solutions and accelerate learning and information exchange. The United States has been involved in, and has even led, some of these international efforts; but it is noticeably absent in others. As the world's largest economy and second-largest emitter of GHGs, the United States must engage in—and lead—these initiatives. They are in the best interest of the nation, particularly since neither climate change nor financial crises respect national boundaries.

At the same time, managing climate-related financial risks requires close attention to the unique circumstances of the United States. They include the idiosyncrasies of our complex system of financial regulation, as well as existing and proposed legislation. It also must take into account the central role that the private sector plays in our financial system, and the importance of consultation and collaboration between the private and public sectors in the design of new policies.

Finally, it is worth noting two interrelated challenges. One is safeguarding the soundness and stability of the financial system in the face of climate change. The main goal here is to responsibly manage climate risk to protect the system's ability to serve the American public, support economic activity and entrepreneurship, and safeguard the assets of millions of savers, retirees, institutions, and businesses. The second challenge involves helping the financial system facilitate the transition to a low-carbon, climate-resilient economy. Central to this challenge is identifying ways financial markets and institutions can channel significantly more capital toward sustainable investments and net-zero-emission activities, including low-carbon and renewable energy, energy efficiency, other net-zero or low-carbon technologies for transportation, industry and agriculture, and resilience against climate impacts. "Net-zero" refers to activities or investments that seek a net neutral balance between GHG emissions produced and removed from the atmosphere.

This report focuses primarily on financial stability in the face of climate change. However, the report devotes a chapter to sustainable investment, recognizing its role in climate risk management and that, ultimately, a stable and well-functioning financial system is incompatible with unmitigated climate change. A world racked by frequent and devastating shocks from climate change cannot sustain the fundamental conditions supporting our financial system. Promoting the transition to a net-zero emissions economy and safeguarding financial stability are consistent, mutually reinforcing objectives.

## The State of Play

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As a starting point, this report acknowledges the U.S. government's official position on the scientific consensus on the causes, occurrence, and impacts of climate change. Departments and agencies of the U.S. government, as mandated by the Global Change Research Act of 1990 and operating through U.S. Global Change Research Program (USGCRP), must record and report on the scientific consensus on the causes and impacts of climate change. The most recent, officially promulgated report to Congress is known as the Fourth National Climate Assessment (NCA). As reflected in the NCA, the consensus of the U.S. government is that it is "extremely likely that human activities, especially emissions of greenhouse gases, are the dominant cause of the observed warming since the mid-20th century" (Wuebbles, et al., 2017, p. 1).

Limiting GHG concentrations to a level consistent with a warming of well below 2 degrees Celsius above pre-industrial levels—the core objective of the Paris Agreement on climate change—is therefore essential to achieve a reasonable probability of avoiding irreversible, catastrophic impacts. The best current science suggests that, to reach that goal, global emissions must peak during the current decade and then decline rapidly, reaching net-zero by mid-century. Limiting warming to 1.5 degrees Celsius would yield very significant additional benefits in the form of avoided damage to human populations as well as ecosystems (IPCC, 2018).

But, despite efforts by many countries, progress remains insufficient. Current policies put the world on a path toward a future well in excess of 2 degrees Celsius. Despite a short-term reduction in carbon dioxide (CO<sub>2</sub>), largely attributed to a transition away from coal, the United States is not on track to meet either its 2020 or 2025 goals under the Paris Accord (UNFCCC, 2015; EIA, 2020; EPA, 2020). While the COVID-19 pandemic and its attendant economic contraction will almost certainly significantly reduce emissions globally in 2020 and possibly beyond, those reductions are expected to be temporary in the absence of structural change. In any case, economic collapse is not a viable strategy for stabilizing the world's climate.

The United States' involvement is crucial in global efforts to combat climate change because of its size and economic weight. It is currently second only to China in emitting GHG. Cumulatively, the United States has put more GHGs into the atmosphere than any other country (including the European Union as a whole). It has contributed roughly one-quarter of all CO<sub>2</sub> emitted since the beginning of the Industrial Revolution (Ritchie and Roser, 2017). At the same time, the United States also remains the world's largest and most dynamic economy, as well as one of the largest producers and consumers of fossil fuels and energy generally. The scope and scale of U.S. industrial activity, long-term assets, and large population significantly expose the United States to climate change impacts (USGCRP, 2018).

While climate change is a global phenomenon, with the United States accounting for roughly one-sixth of annual global GHG emissions, U.S. leadership, historically, has been indispensable to global cooperation on climate change. For example, the United States played a key role in negotiating the United Nations Framework Convention on Climate Change, signed by President George H. W. Bush in 1992 and ratified by the U. S. Senate the same year. The United States also played an important role in negotiating the 1997 Kyoto Protocol, while its subsequent failure to ratify the agreement undermined its effectiveness. Ultimately, the United States was a driving force in the design and international adoption of the 2015 Paris Agreement, which has been ratified by 189 countries. That agreement is designed to achieve broad global participation, with all countries accepting responsibility to reduce emissions while balancing national autonomy with a clear expectation of continually increasing ambition. It also promotes transparency about countries' commitments and how well they are meeting those commitments.

While the United States has formally indicated its intention to withdraw from the Paris Agreement in November 2020, other countries are moving ahead. Most notably, the European Union has pledged to reduce emissions by 40 percent below 1990 levels by 2030 and is now moving forward with policies to increase that reduction target to 55 percent. Yet, no country or bloc can meet the global challenge by itself. Renewed U.S. engagement in international climate efforts, and its embrace of policies aimed at decarbonizing the economy, will be necessary to achieve significant, coordinated reductions in global emissions.

### The Centrality of Carbon Pricing

The British economist, Lord Nicholas Stern, in his influential *Review of the Economics of Climate Change*, famously called climate change “the greatest and widest-ranging market failure the world has ever seen” (Stern, 2007). From an economic perspective, greenhouse gas pollution is a powerful example of a negative externality. Emissions of CO<sub>2</sub> and other GHGs impose significant damages on society at large in the form of future climate impacts, but at least in the absence of government policy, these damages remain “external” to the calculus of individual economic agents (Stern). In effect, the environmental costs of burning fossil fuels, cutting down tropical forests, and other emitting activities have been treated as if they were “free.”

Without an effective price on carbon, financial markets lack the most efficient incentive mechanism to price climate risks. Therefore, all manner of financial instruments—stocks, bonds, futures, bank loans—do not incorporate those risks in their price. Risk that is not quantified is difficult to manage effectively. Instead, it can build up and eventually cause a disorderly adjustment of prices.

The global damage from an additional metric ton of CO<sub>2</sub> is uncertain but is captured in the concept of the “social cost of carbon” (SCC). The U.S. government’s central estimate for the 2020 SCC, calculated in 2016, amounts to \$52 per metric ton of CO<sub>2</sub> in current dollars (IWG, 2016). However, some scholars have argued that a more comprehensive consideration of damages or risk aversion would likely lead to a significantly higher SCC (Revesz et al., 2014; Daniel et al., 2019). Recent empirical evidence also finds that some measures of climate damages are much higher than previously understood (Hsiang et al., 2017).

The economist’s standard policy prescription in such cases is to correct the “missing price,” by either imposing a tax equal to the marginal social cost of pollution or by establishing an emissions trading system (ETS) that creates a market for emissions reductions (subject to a cap on total pollution across covered facilities) and thus a market price for pollution. Putting a price on GHG emissions, creates an economic incentive to allocate capital toward the development of new, lower-emitting technologies, promoting dynamic efficiency. In many ways, the two types of carbon pricing policies are broadly equivalent in practice.

Some jurisdictions have adopted carbon taxes or emissions trading systems. Eleven U.S. states and two Canadian provinces currently have an ETS. States in the Northeast established the Regional Greenhouse Gas Initiative (RGGI) in 2008. With the addition of Virginia in 2021, it will cover emissions from power generation in 11 states, capturing about 18 percent of total emissions in the region. Launched in 2013, the California Cap-and-Trade Program represents the broadest carbon pricing system in the world, covering 80 percent of the state's GHG emissions. The California program is directly linked to the Quebec system under the umbrella of the Western Climate Initiative (WCI), the first international mechanism linking different sub-national entities. As with RGGI, there are derivatives markets for California carbon allowances, including futures contracts.

The European Union Emission Trading System (EU ETS) remains the largest ETS worldwide, accounting for almost 90 percent of global emission trading volume. The EU ETS is supported by a large secondary market, in which allowances are traded bilaterally or on an exchange-cleared basis. In its next phase (2021 to 2030), the EU ETS will align its goals to the goals of the 2015 Paris agreement. Meanwhile, China is expected to launch a national ETS in 2020 that will initially cover the power sector before expanding to cover seven other industrial sectors by 2025. It has the potential to become the world's largest. Finally, carbon taxes are in place in jurisdictions, including Canada, Chile, Colombia, Mexico, South Africa, Sweden, and the United Kingdom.

Yet, despite these efforts, carbon remains underpriced worldwide. Today, various carbon pricing policies operate in 78 countries, states, provinces, and cities. Together, these initiatives cover about 22 percent of global GHG emissions. However, prices in many jurisdictions remain low, with half of the emissions covered by carbon pricing initiatives priced at \$10 per metric ton or less (World Bank, 2020). In 2017, the High-Level Commission on Carbon Prices concluded that a carbon price in 2020 in the range of \$40 to \$80/tCO<sub>2</sub> and rising to \$50 to \$100/tCO<sub>2</sub> by 2030 would be consistent with meeting the temperature target in the Paris Agreement (High-Level Commission on Carbon Prices, 2017). In the absence of effective, broadly applied carbon pricing, financial markets will continue to struggle to motivate economic agents to act in ways compatible with long-term temperature targets.

Various coalitions of governments, non-governmental organizations, and companies in different sectors have issued myriad statements in recent years affirming the importance of carbon pricing. Notable examples include: (i) the Carbon Pricing Statement signed by 73 countries and more than 1,000 companies and investors in 2014; (ii) the 2019 Global Investor Statement to Governments on Climate Change signed by 613 investors with more than \$37 trillion in assets; (iii) the Guiding Principles announced by the CEO Climate Dialogue made up of 21 companies and four non-governmental organizations (NGOs) in 2019; (iv) the *Economists' Statement on Carbon Dividends* signed in 2019 by more than 3,500 economists including all four former chairs of the Federal Reserve, 27 Nobel laureates, and 15 former chairs of the Council of Economic Advisers; and, (v) the Vatican Dialogues Participant Statement on Carbon Pricing signed by the CEOs of 10 major oil companies along with major asset managers and others in 2019.

These and other similar statements commonly cite principles for carbon pricing policy that include, (i) *fairness*, with respect to both the incidence of a carbon pricing policy (in other words, how the impacts are distributed among different income groups, as well as how revenue is allocated); (ii) *scope*, in particular whether the carbon pricing policy covers specific sectors or the entire economy; and, (iii) *effectiveness* in achieving emissions reductions and thus limiting warming—a function of the initial price level and how fast it rises, as well as whether the policy establishes an enforceable and stringent limit on emissions.

This report recognizes that all climate policy frameworks should be sensitive to the inequitable burdens of climate change, particularly current and future market failures impacting low- and moderate-income households and historically marginalized communities. To this end, this report highlights the extent to which business-as-usual represents significant risks for not only American financial institutions, but also for American households. However, where there are risks, there are also opportunities for broader advancement in achieving equitable and sustainable prosperity.

### U.S. and Global Action on Climate in the Financial Sector

Despite the absence so far of effective carbon pricing globally and in many key jurisdictions, financial regulators and market participants increasingly recognize the need to measure and manage climate risks. Central banks have been especially prominent in calling for efforts to advance that goal. The Central Banks and Supervisors Network for Greening the Financial System (NGFS), chartered in 2017, is a group of central banks and supervisors, “willing, on a voluntary basis, to share best practices and contribute to the development of environment and climate risk management in the financial sector and to mobilize mainstream finance to support the transition to a sustainable economy” (NGFS, 2019). As of June 2020, the group had 66 members and 13 observers, including members from most of the largest global economies and from the New York State Department of Financial Services—but no U.S. federal government entity (NGFS, 2020).

The views of central bankers are illustrative of growing concern about climate risk among financial regulators. U.S. Federal Reserve Board Governor Lael Brainard gave remarks titled *Why Climate Change Matters for Monetary Policy and Financial Stability*, stating, “Congress has assigned the Federal Reserve specific responsibilities in monetary policy, financial stability, financial regulation and supervision, community and consumer affairs, and payments. Climate risks may touch each of these” (Brainard, 2019). In 2018, Benoit Cœuré, then a member of the Executive Board of the European Central Bank (ECB), noted that climate change may warrant monetary policy action, if climate change impacts are so persistent that central banks can no longer “look through” climate change as a short-term shock (Cœuré, 2018). Guy Debelle, deputy governor of the Reserve Bank of Australia, echoed that statement in 2019, saying that central banks should view climate change as a “trend change” with an ongoing rather than temporary impact (Debelle, 2019).

Central banks are increasingly researching climate risk, including parts of the Federal Reserve System. The Federal Reserve Bank of San Francisco organized a conference in November 2019 on "The Economics of Climate Change." The Bank of England, the Bank of Canada and the ECB are all researching how climate change could affect macroeconomic forecasting, systemic risks, and monetary policymaking (Wilkins, 2019; Carney, 2019; Lagarde, 2020). The Basel Committee on Banking Supervision published a survey of its global membership of financial regulators in April 2020. Twenty-four of 27 responding members and observers have conducted research on climate-related financial risks (BIS, 2020).

Central banks and other financial regulators from major economies are focusing on greater disclosure of climate-related risks and opportunities by corporations. In 2015, the Group of Twenty (G20) asked the Financial Stability Board (FSB), composed of financial regulators from the world's largest economies, to consider climate risk. In response, the FSB established the industry-led Task Force on Climate-related Financial Disclosures (TCFD). The FSB initially focused on disclosure because, as noted in its 2015 response to G20 leaders, "[a]ppropriate disclosure is a prerequisite for both the private sector and authorities to understand and measure the potential effects on the financial sector of climate change, as markets evolve and as the wider economy transitions towards a low-carbon economy" (FSB, 2015, p. 2). The TCFD called for voluntary climate-related financial disclosures that are "consistent, comparable, reliable, clear, and efficient, and provide decision-useful information to lenders, insurers, and investors" (TCFD, 2020a). It also issued recommendations for implementing disclosures. As of February 2020, more than 1,000 companies and other organizations, including private sector organizations with a collective market capitalization of \$12 trillion and financial firms responsible for \$138.8 trillion of assets, have declared support for the recommendations (TCFD, 2020b).

Insurance regulators are also thinking about the management of climate risk. The Sustainable Insurance Forum (SIF), a network of 31 insurance supervisors and regulators from around the world, was created in 2016 to work on sustainability challenges. Membership includes the U.S. National Association of Insurance Commissioners, the California Department of Insurance, the New York Department of Financial Services, and the Washington State Office of the Insurance Commissioner (SIF, 2020). Its goals are to strengthen insurance supervisors' and regulators' understanding of, and responses to, both sustainability and climate-related challenges and opportunities for the insurance business. The SIF has focused on developing and sharing supervisory best practices to address risks posed by climate change to the insurance sector as a whole and to individual insurance firms as underwriters and investors (SIF/IAIS, 2018; SIF/IAIS, 2020).

Investors—through a variety of formal and informal bodies—also are increasingly focused on climate-related risks. For example, Climate Action 100+ is a group of 450 investors with more than \$40 trillion in assets. The group has encouraged "systemically important emitters" to reduce their GHG emissions, as well as to increase board oversight and disclosure (CA100, 2019). The Net-Zero Asset Owner Alliance, established in 2019, is

a group of major institutional investors, managing nearly \$4.7 trillion in assets, who have committed to shifting their investment portfolios to net-zero GHG emissions by 2050. Another example is the United Nations Principles for Responsible Investment (PRI) initiative, which requires strategy- and governance-focused climate risk reporting for all of its more than 3,000 signatories, which manage more than \$100 trillion in assets (PRI, 2020).

The leaders of some large asset owners and managers have made significant statements about the need to take climate risk seriously. The \$1 trillion Norwegian government pension fund, the world's largest sovereign wealth fund, has adopted a detailed set of climate-related expectations for all portfolio companies, covering strategy, risk management, disclosure, and policy (Norges Bank, 2019). The fund has also divested its holdings in certain coal-mining and coal-burning power companies. The California State Teachers' Retirement System (CalSTRS), one of the largest U.S. public pension funds, divested from U.S. thermal coal companies in 2016 and from non-U.S. thermal coal companies in 2017 (CalSTRS, 2016). Larry Fink, CEO of U.S. asset manager BlackRock, which managed nearly \$7 trillion in assets in late 2019, has publicly equated climate risk with investment risk and pledged that his company will be increasingly likely to vote against company managers and board directors when companies are not making sufficient progress in sustainable business practices (Fink, 2020).

While U.S. financial institutions have taken some significant steps, most financial sector leadership on climate action has, in recent years, come from outside the United States. European and British regulators, banks, asset owners, and insurers have been especially active. Authorities from China, Mexico, and Canada have also been very engaged. International organizations, including financial standard-setting bodies and the International Monetary Fund have devoted significant time and attention to climate risk management.

Yet, because of its financial system's size and scope, engagement by the United States is crucial if global financial markets are to effectively manage climate risk and facilitate the transition to more resilient, low-to-no-carbon economy. U.S. capital markets, both equities and fixed income, are the largest in the world and among the deepest and most liquid. The largest futures exchange in the world is based in the United States and offers the widest range of products across all asset classes. Four of the five largest asset managers in the world are based in the United States, and the United States represents the largest insurance market globally by premium volume. Without active leadership by U.S. regulators and financial institutions, the mission of prudent climate risk management will remain incomplete at best, and those gaps will remain a key weakness in the U.S. and global financial systems.

## Road Map of the Report

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The rest of this report focuses on the climate-related risks the U.S. financial system faces and on how regulators and financial institutions can address them. It is divided into eight chapters. This chapter has provided the policy and global context for this report. Chapters 2 and 3 explain the climate-related physical and transition risks that the U.S. economy and financial system face. Chapter 4 examines the challenge of climate risk management from the perspective of financial regulators. It reviews their existing authorities and recommends actions to address the risks outlined earlier in the report.

The remaining four chapters delve into topics of special interest to policymakers and the private sector. Chapter 5 focuses on how financial institutions and firms can manage climate risk, including by using consistent, comparable and reliable climate data and analytics. Chapter 6 looks more closely at climate scenarios and explains how they can provide useful insights that help regulators and companies plan. Chapter 7 looks at the disclosure of climate risk, outlining the evolution of the current disclosure regime and how it can be strengthened. Finally, Chapter 8 explores how the financial system can better facilitate capital flows toward activities and technologies that promote the transition to a resilient, net-zero emissions economy, including new and existing instruments that integrate and help effectively manage climate risk.

Collectively, these chapters provide recommendations that highlight a range of innovations in the public and private sectors that help advance the economic resilience of the U.S. financial system. More fundamentally, these innovations offer the opportunity to adapt the American economy to provide new financial products, services, and technologies to advance a broader global transition that removes or eliminates GHG emissions from the global economy. These innovations and opportunities provide a foundation for Americans to invest in a transition to a more environmentally sustainable and socially equitable future.

## Recommendation

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**Recommendation 1:** The United States should establish a price on carbon. It must be fair, economy-wide, and effective in reducing emissions consistent with the Paris Agreement. This is the single most important step to manage climate risk and drive the appropriate allocation of capital.

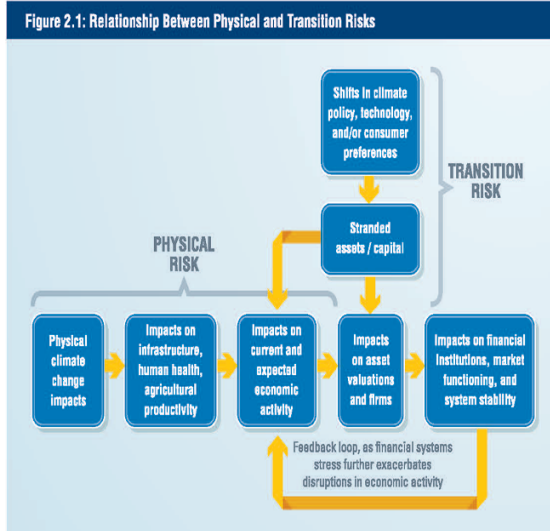
## Chapter 2

# Physical and Transition Risks in the Context of the United States

Climate-related physical and transition risks are already impacting, or are anticipated to impact, nearly every facet of the U.S. economy—a broad cross-section of markets, products, instruments, and services. How material these climate-related risks will be varies depending on time horizon, geographic region, and segment of the economy, as well as on climate mitigation and adaptation actions. If these risks are misunderstood and mismanaged, they could affect financial assets and financial markets, and in turn the ability of the financial system to serve the American economy. As summarized in this chapter, some climate change impacts already can be seen in various asset classes. These impacts ultimately undermine the economic welfare of American households and often disproportionately burden low-to-moderate income (LMI) and historically marginalized communities—further undermining environmental justice.

The risks associated with climate change are many and complex, but for simplicity, they are often divided into physical and transition risk. Physical risk is defined as risk that arises from the material, operational, or programmatic impairment of economic activity and the corresponding impact on asset performance from the shocks and stresses attributable to climate change. Transition risk, on the other hand, is defined as risk associated with the uncertain financial impacts that could result from a transition to a net-zero emissions economy. These risks could arise, for example, from changes in policy, technological breakthroughs, and shifts in consumer preferences and social norms (Bolton, et al., 2020).

Figure 2.1 summarizes the causal chains through which physical and transition risk could affect economic activity and the financial system. While both physical and transition risks can directly impact asset values, the distribution of indirect wealth effects may further impair assets. This chapter focuses on the causal chains ending with impacts on asset values. Chapter 3 focuses on the impacts on financial institutions and possible feedback loops.



### Physical Risks

The measurement and understanding of physical risk vary considerably from sector to sector and remains, overall, in an early stage of development. The impacts of physical risks may also vary significantly within a sector depending on the risk and firms' climate management practices and capacities. In general, physical risks may be either acute or chronic. Their severity depends on the physical exposure of assets, infrastructure, and populations. Advances in attribution science that help distinguish climate trends from natural variability (NASEM, 2016), together with advances in measurement technology, are improving the understanding of physical climate risk (Keenan, 2019). With further advances in technology and standardized disclosure practices, additional physical risks may be discovered, and existing risks will be measured and reported with increasing precision and sophistication. Through stress testing, scenario planning and other analytical measures, sectors and firms may be better prepared to mitigate and adapt to climate change.

Estimates of physical risks are based on a variety of assumptions, scenarios, and Representative Concentration Pathways (RCPs). RCPs are widely used, consensus-based models that estimate how climate systems may respond to specific concentrations of greenhouse gas in the atmosphere. Currently, no standardization exists within or across sectors on which parameters to use for evaluating physical risk, and so these estimates

remain first-order approximations. For instance, there is an ongoing debate concerning the assumptions in RCP 8.5 (the most severe of the RCPs) and whether it underestimates business as usual (Christensen, Gillingham, and Nordhaus, 2018) or overestimates physical and economic impacts by disregarding gradual shifts in the global energy economy (Ritchie and Dowlatabadi, 2017). However, these pathways and associated estimates nevertheless importantly help shape awareness among policymakers and the private sector on the magnitude and nature of the risk.

With those caveats, the latest research suggests that, by the end of this century, the negative impacts on the United States from climate change will amount to about 1.2 percent of annual gross domestic product (GDP) for every 1 degree Celsius increase (Hsiang, et al., 2017). This is roughly the equivalent of wiping out nearly half of average annual GDP growth rates in recent years. There is great uncertainty about how those losses may be distributed across the United States and within any given sector or asset class. But the research suggests that the South, Central and mid-Atlantic regions likely will be more heavily impacted than northern regions. This could affect how capital is distributed among regions (Hsiang, et al.; NGFS, 2019a). The relationship between climate change, warming temperatures, and economic output is not anticipated to be as linear as described in this chapter. Beyond certain ecological and economic thresholds, economic losses could be significantly greater.

### Agriculture and Ecosystem Services

Agriculture is an important part of the U.S. economy. In 2017, agriculture, food, and related industries contributed more than \$1 trillion, or 5.4 percent of GDP (USDA, 2020). Agricultural producers alone provided more than 3 million jobs in 2019 (USDA). Physical risks to agriculture include a wide range of shocks and stresses. They include, for example, localized heat stress impacting livestock (Rojas-Downing, et al., 2017) and farm workers (Lundgren, et al., 2013; Gubermot, et al., 2014), as well as potential annual productivity declines of 2 to 4 percent under moderate to severe emissions scenarios across the U.S. agricultural economy (Liang, et al., 2017). One study projects that each degree-Celsius increase in global mean temperature could, on average, reduce global yields of wheat by 6 percent; rice by 3.2 percent; maize by 7.4 percent; and, soybeans by 3.1 percent (Zhao, et al., 2017). These potential declines in crop yields undermine the domestic capacity to feed a global population that increases roughly 1.1 percent a year (World Bank, 2019). While the magnitudes of the estimates and the extent to which adaptation may mitigate future losses vary (Burke and Emerick, 2016), there is general agreement that climate change will reduce average yields and total production for most crops in most regions. (Porter et al., 2014). To this end, adaptation measures (for example, micro-irrigation) and resilience technologies (for example, drought-tolerant biotechnology) offer great promise for mitigating potential future declines in agricultural output.

Other risks include degradation in water and soil quality (Gowda, et al., 2018), quantity (Dai and Zhao, 2017), and increased uncertainty and variability in crop and fisheries yields (Walthall, et al., 2012), increased range and virulence of pests (Taylor, et al., 2018), and

more frequent disruptions of distribution and processing from extreme weather (Bakker, et al., 2018). More broadly, climate change is impacting, and is projected to impact, not only commercial agriculture in the United States, but also the ecological systems and biodiversity that agricultural systems rely on for everything from the provision of clean water to healthy forests (Lipton, et al., 2018). Logistical constraints that prevent or delay the shipment of crops, seeds and material, such as when the Mississippi River has too little or too much water to safely support barge traffic, also impact the agricultural economy (Attavanich, et al., 2013).

Financial market participants dealing in agricultural commodities must adapt to this wide range of physical risks by devising new ways to value, price, and manage climate risk. Another key challenge is the future capacity of the U.S. government to provide actuarially sound crop insurance, based on best available data, to support changes in underwriting and pricing attributable to climate change and natural variability (Antóni, et al., 2012; Rosa, 2018). Crop insurance for extreme events that can financially devastate American farmers is a crucial protection. In addition, future public and private investments in adaptation and resilience—water conservation, drought-tolerant crops, and logistics and storage infrastructure—are needed to manage physical risk in the sector.

### Infrastructure

Awareness is growing across infrastructure sectors, including energy, water, transportation, and communications, that physical risks do not just impact particular sites and locations (Bertolotti, et al., 2019), but also shorten the lifecycle of infrastructure and degrade its operational reliability (Maxwell, et al., 2018). Even slight degradations in lifecycle performance can compromise the long-term yields and creditworthiness of revenue-producing assets in both the public and private sectors. In addition, there is growing appreciation that disruptions in energy, transportation, and communications infrastructure can impose economic losses on communities, adding to the losses from damage to the infrastructure itself. Even in low-to-middle income countries with significantly less infrastructure than the United States, infrastructure disruptions already impose between \$391 billion and \$647 billion in annual costs to firms and households (Hallegatte, et al., 2019). It is reasonable to assume that under a business-as-usual scenario annual losses in the United States could far exceed these estimates.

In the context of longstanding deferred maintenance challenges, the U.S. power infrastructure faces significant vulnerabilities from more frequent extreme weather attributed to climate change (ASCE, 2017). Aging infrastructure and climate change will require significant capital investments to ensure compliance with existing reliability and engineering resilience standards for the delivery of electrical power and fuel (DOE, 2017). In addition, regulated utilities are facing increased legal liability from their inability to fully account for and mitigate physical risks (Gundlach, 2020). For example, the 2019 bankruptcy of the Pacific Gas and Electric Company (PG&E) marked the first-ever bankruptcy attributed, in

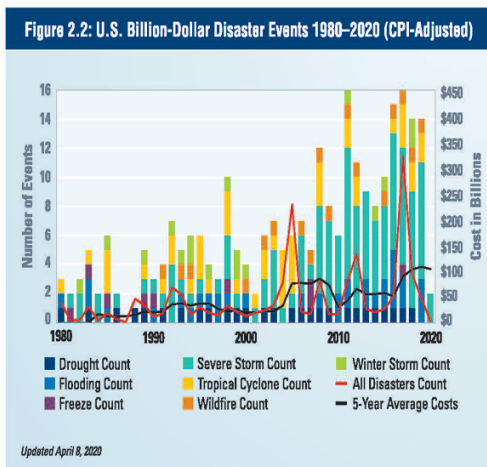
part, to liabilities arising from climate change-related impacts, namely, record wildfires. PG&E, with \$71 billion in assets and \$51 billion in debt, was confronted with \$30 billion in estimated wildfire liabilities (MacWilliams, et al., 2019).

In addition, the adaptation measures themselves—such as periodically cutting-off power in high-risk fire zones in California—may impose collateral economic costs (Ovaere, et al., 2019). Early-stage research suggests electrical transmission and distribution infrastructure costs from climate change could increase 25 percent by 2090 (Fant, et al., 2020). Similar costs associated with climate adaptation and direct losses likely will strain existing utility credit quality and bonding capacity, as well as increase customer costs—potentially limiting broader economic activity.

Transportation and water infrastructure share similar challenges from physical risk. For example, single-point and cascading failures in infrastructure systems can result from accelerated material degradation of concrete, steel, timber and earthen structures from extreme precipitation, extreme temperatures, and changes in relative humidity, salinization, and carbonization (Stewart and Deng, 2015; Bastidas-Arteaga, 2018). Location-specific exposure to extreme precipitation events, coastal flooding, inundation from rising sea levels, extreme heat, icing, subsidence and forest fires challenge nearly every element of transportation systems, from bridges and airports to pipelines and ports (Jacobs, et al., 2018).

The same can be said of infrastructure supporting the treatment, distribution and supply of water (Maxwell, et al., 2018). Even without climate change, significant resources will be required to safeguard water infrastructure. A survey of local governments by the U.S. Environmental Protection Agency estimated that state and local investments of \$472 billion (2018) will be required over the next two decades just to maintain drinking water infrastructure (EPA, 2018). One estimate puts future investments to maintain all domestic water infrastructure at \$123 billion per year (Ajami, et al., 2018). Climate change impacts likely will add to ongoing capital investment deficits in water infrastructure. Failure to adequately invest in water infrastructure could result in the loss by 2040 of nearly a million jobs that directly depend on water (EPA, 2018).

Growing demand for investments to protect infrastructure from climate-related physical risk are likely to increase fiscal pressure on state and local governments. Many of them are already straining under the weight of unfunded pension obligations and rising healthcare costs (Gilmore and St. Clair, 2018). The COVID-19 pandemic will add to pre-existing fiscal burdens. Some financial markets are beginning to price in the expected fiscal burdens of coping with physical risk. For example, municipal bond markets may already be pricing in exposure to sea level rise in some coastal jurisdictions (Goldsmith-Pinkham, et al., 2019). With greater discovery and reporting of physical risk, many public borrowers may face higher capital costs to compensate investors for higher perceived default risk. That, in turn, will increasingly limit governments' capacity to invest in critical infrastructure and in infrastructure that supports and protects their tax base. It may also result in higher local property and sales taxes.



Source: NOAA, National Centers for Environmental Information (2020)

As represented in Figure 2.2, the economic costs of disasters to the public and private sectors have been rising, as represented by the rising incidence of billion-dollar disasters. This is a function of greater exposure of cities, populations and assets, and the greater intensity and frequency of a variety of extreme weather events. Many of these extreme events are already attributable in varying degrees to climate change. For local governments, losses from such extreme events can have fiscal ramifications for many years. Even without climate change, the United States needs to make significant investments in building new infrastructure and maintaining existing infrastructure. Climate change and extreme weather events add additional barriers of cost, time, uncertainty, and risk to these investments.

### Commercial and Residential Real Estate

The real estate sector shares similar physical risks with the infrastructure sector. The real estate sector is not only dependent on infrastructure, it also generates local property tax revenue that supports most domestic infrastructure investment in the first place (Shi and Varuzzo, 2020). Since the value of real estate is closely linked to the value of the land it is built on, physical risks, such as wildfires and rising sea levels, can directly affect real estate prices.

Indeed, emerging research shows that exposure to climate-related risks already affects real estate values. For example, research has shown that increased perceptions of physical risk in a local housing market depress the prices of homes exposed to sea level rise

(Giglio, et al., 2015a; Giglio, et al., 2015b). Bernstein, et al. (2019) and Baldauf, et al. (2020) provide evidence that perceptions of flooding-related climate risk are currently priced into some real estate markets. Even in high-value markets, such as Miami, evidence suggests that the price appreciation of properties that have a high risk of climate-attributed flooding may slow relative to lower-risk properties (Keenan, et al., 2018). Similarly, early-stage research has demonstrated that the price of homes drops when they are designated to be in a wildfire risk zone (McCoy and Walsh, 2018; Gamache and Guilfoos, 2019). While climate risk already appears to affect real estate values, these effects likely will increase as physical risks become more frequent and severe. Commercial real estate is particularly vulnerable to the shocks and stresses of climate change that may lead to declines in local GDP, which drives demand for office, industrial, and retail space (BII, 2019).

A decline in real estate values can have larger implications for the U.S. economy and financial sector. For most U.S. households, housing constitutes the largest share of household wealth, and substantial evidence suggests that household spending varies with housing wealth (Mian, et al., 2013; Stroebel and Vavra, 2019). Declining real estate values—driven by climate-related impacts or the perception of such impacts in the future—could substantially depress economic activity. Some populations and local communities within the United States may ultimately be required to relocate, with potentially significant economic losses for households and investors.

Since most residential real estate in the United States is purchased with a mortgage, physical risk could also affect the underlying mortgages. Early-stage research suggests that wildfires and flooding cause increased residential mortgage default rates (Issler, et al., 2020). As Chapter 3 will discuss, declines in mortgage values could affect financial market participants, including banks that hold these mortgages on their balance sheets, investors in mortgage-backed securities, and government-sponsored enterprises (GSEs), primarily Fannie Mae and Freddie Mac, which guarantee the default risk of the mortgages they securitize (Ouazad and Kahn, 2019). Emerging evidence suggests that lenders are passing along riskier mortgages (Ouazad and Kahn) to the GSEs, in part, to remove risk from their own books (Keenan and Bradt, 2020). The federal guarantee of the GSEs suggests that U.S. taxpayers may ultimately be on the hook for prepayment and default risks associated with the impacts of physical risks on collateral values (Ouazad and Kahn, 2019; Keenan and Bradt, 2020).

### Human Health and Labor Output

Human health is significantly exposed to climate-related physical risks. Health impacts from climate change include extreme heat exposure; degraded air quality; infectious, water- and vector-borne diseases; food contamination and declining access to nutritious foods; chronic physical and mental stress; and, physical injuries and mental distress from extreme events (Ebi, et al., 2018). Many of these health impacts and corresponding financial costs have been shown to disproportionately burden low-wage workers and historically marginalized populations (Schmeltz, et al., 2016; Wondmagegn, et al., 2019). Thus, mitigating climate

change would reduce economic burdens that amplify economic inequality. For instance, a decline in the use of fossil fuels will improve air quality, which would have a disproportionately positive impact in certain marginalized communities (Bullock, et al., 2018).

These impacts could also reduce labor capacity and productivity, which in turn could reduce the capacity of workers and employers to pay for healthcare services. Most critically, extreme heat is anticipated to greatly impact human health and lead to greater rates of premature mortality. From extreme heat alone, annual damages from premature death in 2090 were projected to be between \$60 billion (2015) and \$140 billion (EPA, 2017). States in the Southeast and Great Plains could see declines in labor capacity approaching 3 percent (Dunne, et al., 2013; Houser, et al., 2015); some locations in Florida and Texas could see a total loss in annual labor hours of 6 percent or more (Gordon, 2014; EPA, 2017). Six percent is the equivalent of losing two weeks of income a year. By 2090, total impacts from extreme heat attributed to climate change could result in more than 2 billion lost labor hours, corresponding to \$160 billion (2015) in lost wages (Graff Zivin and Neidell, 2014; Hsiang, et al., 2017; EPA, 2017). Indeed, companies that rely on outdoor and manual labor may face physical risks from declining labor productivity and higher costs associated with workers' compensation, health insurance, and general liability insurance. They may also face pressure to increase wages to attract workers for such physically demanding employment (Day, et al., 2019). In cumulative terms, these emerging impacts are anticipated to disproportionately impact LMI and historical marginalized communities.

Finally, as the COVID-19 pandemic has made clear, healthcare and public health systems in the United States have limited excess capacity to treat patients during extreme events (Bein, et al., 2019). Such events could include, for example, events stemming from infectious diseases and tropical cyclones attributable, in part, to climate change (Wu, et al., 2016). Public health infrastructure in the United States and around the world has been affected by significant reductions of public investment in recent decades (Masters, et al., 2017). Unless this trend is reversed, the U.S. healthcare system may not be able to cope with the burdens from climate-related physical risk. For instance, healthcare facilities, networks and enterprises could face financial challenges associated with the exposure of highly vulnerable and aging populations subject to increasing climate-attributed stresses, such as extreme heat and infectious disease, and shocks, such as stronger hurricanes and wildfires (Desai, et al., 2019).

### Supply and Demand Shifts

Climate change likely will further affect both supply and demand in the economy. For instance, demand for electricity for space cooling and water for irrigation may significantly increase. However, direct and indirect measures of demand may also decrease. There is little empirical research on the extent to which output per worker may decline and the extent to which wage pressure and financial burdens may be redistributed demographically. However, climate change—within the context of broader trends such as the aging of society, and income inequality—likely will put additional and disproportionate pressure

on consumers and taxpayers (Hallegatte and Rozenberg, 2017). In theory, with lower wages and greater fiscal and financial burdens, American consumers could have relatively less spending power to support existing demand for the financial services, tourism, and retail sectors, with implications for manufacturing and wholesale trades. In some cases, local demand may be affected by climate-driven migration that may lead to depopulation in high-risk areas (Hauer, 2017). In these scenarios, historically marginalized populations and frontline communities likely would disproportionately bear the economic burdens (Kim, et al., 2018; Siders, 2019).

Beyond consumption and demand effects, many sectors of the economy face direct physical risks to their primary production and distribution, as well as to their supply chains (Goldstein, et al., 2019). Many sectors have benefited in recent years from firms within the sector coordinating their operations and supply chains to make them more resilient to increases in extreme weather that routinely directly impact 70 percent of all economic sectors (Brusset and Bertrand, 2018). The greater the complexity within a supply chain, the greater the system's resilience to climate shocks likely will be (Lim-Camacho, et al., 2017). However, increased redundancy in supply chains can come with the cost of reduced efficiency. The degree of supply chain re-optimization needed to respond to climate risks remains subject to a great deal of uncertainty. As climate change impacts increase, consumers, producers, and suppliers across all economic sectors will need to develop ongoing intelligence about direct and indirect physical risks in order to advance the economy's resilience and foster disciplined risk-taking in consumption and production (Keenan, 2019).

### Transition Risk

Transition risks arise from both uncertainties and substantive changes. They include market, credit, policy, legal, technological, and reputational risks. These transition risks range from the introduction of an explicit or implicit price on carbon to the economic obsolescence of entire asset classes because of changing consumer preferences. Transition risks may lead to economic losses for some, while at the same time yielding benefits for others. Transition risks may lead to both stranded capital, where asset-level capital is at-risk from devaluation, or stranded value, where the market-value of a project or firm is at-risk from devaluation or otherwise negatively discounted (NGFS, 2019a). In essence, transition risks arise when firms fail to prepare for or recognize broader market transitions.

In a speedy transition to a net-zero economy, fossil fuel industry assets might become stranded (Harvey, et al., 2018). To provide some context, 75 percent of total U.S. energy is derived from fossil fuels (EIA, 2020). In 2019, fossil fuels provided the energy for 62 percent of electricity generation and 95 percent of transportation (EIA). One estimate for stranded capital from fossil fuel assets suggests a potential global loss of wealth between \$1 trillion and \$4 trillion (Mercure, et al., 2018). In an alternative estimate, current stranded assets within fossil fuel companies range between \$250 billion and \$1.2 trillion—depending on how fossil fuel firms respond to global emissions reductions (IEA, 2020). Many of these

assets may or may not be fully depreciable given the significant uncertainty around public policies and consumer preferences concerning the timing, mode, depth, and cost-sharing of many energy transition scenarios (Kefford, et al., 2018).

In terms of stranded value, emerging evidence suggests that, in some cases, markets may already be pricing in transition risk. For example, a recent study suggests that uncertainty associated with policy risk is already penalizing oil companies that are investing in undeveloped fossil fuel reserves (Atanasova and Schwartz, 2019). Another study shows that, even with recent domestic policy support, market forces likely already have reduced domestic coal consumption past a point of no-return (Mendelevitch, et al., 2019). Between 2007 and 2017, total coal production in the United States declined by 32 percent, primarily because of persistently low natural gas prices (Morris, et al., 2020). Modeling of climate policy shows that risks to coal producers in the future will be even higher. One study suggests that a price of \$25 per ton of CO<sub>2</sub> rising at 5 percent a year more than inflation could by 2030 reduce U.S. coal production to 77 percent below 2016 levels (Morris, et al.). Declines in coal may also negatively impact state and local tax and royalty revenue. Concerns over stranded capital in coal assets are already impacting the financing of assets, even in high-growth countries that have strategically planned to expand coal generation capacity (Ha-Duong, 2020).

Financial market participants are already looking for ways to manage transition risk in their investment portfolios. For example, recent research suggests that portfolios that over-weight “greener” firms will outperform during periods with negative climate news (Engle, et al., 2020). Institutional investors already appear to be screening potential investments for direct carbon emissions and demanding compensation for associated transition risks (Bolton and Kacperczyk, 2019). This demand likely stems from the anticipated impacts of transition risks across the economy. Investors likely will increase their efforts to identify which assets are unduly exposed to a collapse in asset values that could threaten the economic viability of entire asset classes (Carney, 2018).

As a subset of transition risk, technological risks also represent a challenge for financial and fiscal stability. A wide variety of new technologies are needed to advance net-zero energy production, distribution, storage, and utilization. Firms and public policies will inevitably seek to pick winners and losers among these technologies and among the users of these technologies (Zurich, 2018). The risk is that investments will be made in inferior technologies that either fail to achieve their stated level of performance or are surpassed by superior technologies before their full economic utilization or depreciation. The extent of the technological risk often depends on the speed and diffusion of inferior technologies. Ultimately, consumers’ preferences for products and services of varying degrees of sustainability represents its own category of transition risks, whether it is meat consumption, gas powered vehicles, or even investment products.

By the same token, public policies that seek to advance specific technologies represent a policy risk if a technological beneficiary does not achieve the desired level of performance or economic return. Beyond misplaced technology preferences, policy risks may arise from a variety of legislative and administrative actions, or inactions, that fail to address the speed and depth of climate change. Risks for even the most well intended public policies, whether local sustainable investment protocols or federal tax policies, are defined by their distributional costs and benefits, timing, effectiveness, uncertainty, and continuity. Policy pathways could be classified along a continuum from smooth to disruptive. Disruptive policy pathways may be out of line with social momentum or technological capacity. A policy pathway may be disruptive because it is simply delayed too long or lacks the continuity to guide long-term capital investments. As Chapter 6 will discuss, poorly designed and poorly implemented policies can distort the allocation of capital across sectors and industries. In addition, a pathway may be disruptive because it leads to unmitigated sector-specific unemployment that is sensitive to the speed of energy transitions.

Current initiatives, such as the Inevitable Policy Response promulgated by the United Nations' Principles for Responsible Investment (PRI), have begun to provide a resource for financial markets to forecast short- to mid-term climate policies (PRI, 2019). Key policy domains include coal phase-outs; bans on internal combustion engine vehicles; carbon pricing; carbon capture and storage; net-zero power; energy efficiency; land use-based carbon management; and agricultural technologies and infrastructure policies. Each of these policies is evaluated based on institutional, political, and technological readiness, as well as metrics associated with social momentum and social equity (PRI). These are just a few of many metrics and models for evaluating policy risk that are discussed in more detail in Chapter 6.

Public and private sector actors also face a variety of climate-related legal risks, both physical and transition, from litigation and contract liability. As of the date of publication, more than 1,100 climate-related lawsuits have been filed in the United States (Sabin Center, 2020). The most high-profile litigation has centered on complaints advanced by state attorneys general for violations of state securities laws, among other allegations, against a fossil fuel legacy firm for its alleged failure to adequately disclose material climate-related risks to investors. In securities law, future legal risks likely will involve decisions about whether climate-related risk factors are material enough to require disclosure, as well as the adequacy of disclosures (Vizcarra, 2018; Vizcarra, 2020).

Finally, state and local governments have filed more than a dozen lawsuits under various tort theories, including state common law public nuisance claims, to recover climate-change related expenses from energy industry defendants. None of these lawsuits have ultimately satisfied the plaintiff's cause of action or theory of damages. However, a great deal of uncertainty is associated with an unbounded range of potential claimants and defendants. In such a mass tort scenario, federal legislation may be needed to organize claims and damage allocations, as with the tobacco litigation of the 1990s (Olszynski, et al., 2017).

Legal issues beyond tort and consumer protection claims may directly impact the financial economy. First, there are open questions about the extent to which officers, directors and other fiduciaries may be violating fiduciary duties by investing in, or failing to disinvest in, various carbon-intensive or otherwise highly exposed assets, companies, and industries (Gary, 2019). A second challenge arises from uncertain legal liability for public and private sector actors who fail to adequately disclose material physical risks on debt offerings and other contracts (Keenan, 2018). For public entities, a broader range of legal liabilities relate to limits on sovereign immunity arising from negligent mismanagement of physical risks (Klein, 2015). Finally, professionals such as, architects, engineers, and corporate directors face significant questions about the consideration of climate change risks and their duty of care (Hill and Martinez-Diaz, 2019).

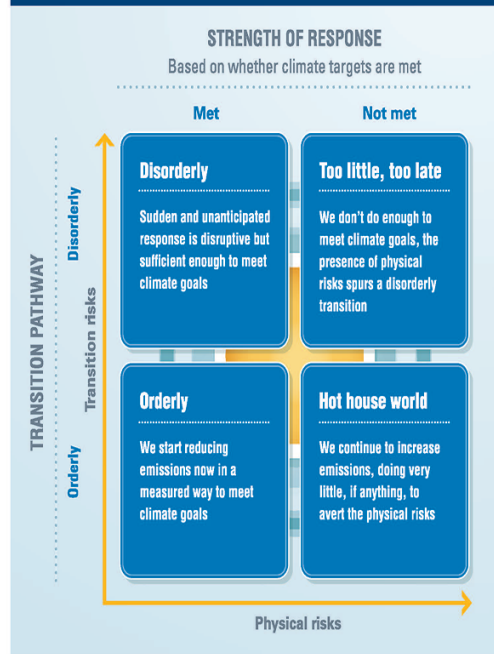
An additional technical challenge relates to the evidentiary application of attribution science to connect climate change with damage-specific events, as well as the causal relationships associated with demonstrating legal standing to bring claims (Marjanac and Patton, 2018). Overall, the accelerated pace of climate change is reorienting longstanding commercial relationships, memorialized in public and private law, faster than governing principles can be developed through appellate litigation. Additional legislation and regulation will ultimately be required to calibrate many facets of the law and the regulatory state—adding additional policy risk.

### Integrating Physical and Transition Risk

While usually discussed as distinct concepts, physical and transition risk will not remain in neatly separated boxes in the real world. The two are likely to interact in complex ways. For example, dedicating more resources to accelerate the transition to net-zero energy generation could create trade-offs, diverting resources from climate adaptation measures, thereby amplifying vulnerability to physical risks. Conversely, adaptation investments that mitigate the exposure and sensitivity of assets without regard for carbon management may ultimately amplify transition risks. Importantly, the longer governments wait to adequately cut emissions, the more rapidly physical and transition risks are likely to increase in parallel. The physical impacts of climate change will intensify while the magnitude of the response needed to arrest further warming grows. The public and private sectors must simultaneously advance both climate mitigation and adaptation to effectively manage both physical and transition risks.

In other areas, such as real estate, assets may be devalued simultaneously as a function of both absolute losses from physical risks and from the transition risk of consumer preferences shifting away from “non-green” assets that lack sustainability and resilience. Even within sectors with high measures of physical or transition risks, organizational resilience and risk management may dictate a wide variation in climate-related risk to any given firm (S&P Global, 2019).

**Figure 2.3: High-level Framework for the Scenario Analysis of Physical and Transition Risks**



Source: NGFS (2019b)

Figure 2.3 highlights four high-level scenarios that may be useful to frame assumptions and parameters for future analysis of the adequacy of measures to address physical and transition risks. The two primary factors represented in this framework are the total amount of emissions reduction and the orderliness and continuity of any transitions (NGFS, 2019b). Understood along a continuum, these factors likely will shape emerging strategies for managing market, credit, policy, legal, technological, and reputational risks. The goal is for the public and private sectors to manage an orderly transition that also recognizes and internalizes physical risks. As the following chapters will discuss, understanding the various modes of the transmission of these physical and transition risks into the various markets, instruments and assets classes of the financial system is critical for understanding the parameters shaping future investment analysis and prudential oversight.

## Chapter 3

# Implications of Climate Change for the U.S. Financial System

As described in Chapter 2, climate-related physical and transition risks, if not well-managed, likely will materially impact the value of a wide range of assets. This chapter explains how those impacts may manifest throughout the financial system, first considering general implications and then covering risks to financial markets and institutions.

### A Unique Challenge for Financial Stability

Our understanding of how climate change and societal responses to it will affect financial markets, institutions, and systems remains in its infancy. It is clear, however, that climate change presents a uniquely complex set of financial risks for three reasons. First, climate change will affect multiple sectors, geographies, and assets in the United States, sometimes simultaneously and within a short timeframe. This is no longer theoretical. For example, in a recent span of 24 months, the United States experienced several unprecedented extreme events. In 2017, for the first time in history, three Category 4 hurricanes made U.S. landfall in a single year, causing extensive damage to the Gulf Coast. In 2018, California experienced its deadliest and most destructive wildfire season in recorded history. And in the year through May 2019, the United States experienced its wettest 12 months on record, including devastating floods affecting 14 million people in the Midwest and South. In the future, such impacts could compound, magnifying economic and financial shocks.

Second, climate-related financial risks are large but remain uncertain because climate change is shifting fundamental environmental parameters, pushing planetary systems to new extremes. This is true for both acute and chronic physical risk. As a result, the climate in the future will fundamentally differ from today's climate. Traditional risk modeling techniques, which rely heavily on historical data, will become increasingly unhelpful guides to the future. That presents a significant challenge to financial market participants and regulators, whose decisions hinge on having good information and data on which to ground their views about future conditions. Thus, society's ability to understand climate risk will require forward-looking analysis, which is still being developed (Barnett, et al., 2020).

Third, the impact of climate change on a wide range of variables involves tipping points and what economists call “discontinuities”—situations in which conditions can remain stable for a long time but then deteriorate sharply and suddenly. Studies suggest that variables such as economic growth, crop yields, and labor productivity deteriorate more quickly and suddenly once a certain threshold temperature has been crossed (Burke, et al., 2015). If these variables deteriorate non-linearly in response to climate change impacts, sudden and disorderly price adjustments in financial markets become more likely (Hong, et al., 2020). Breakthroughs affecting low-to-zero carbon technologies can also lead to discontinuities, and consumer preferences and energy consumption patterns can change unexpectedly and rapidly (Kuran & Sunstein, 1998).

### Systemic Shocks

Because of their scale, breadth, and complexity, the impact of climate-related risks could be systemic. While no official definition of systemic financial risk exists under U.S. law, the most widely-accepted definitions contain several elements: (i) *shock amplification*, which refers to conditions in the financial system that allow a given shock to propagate widely, magnifying its disruptive effect; (ii) *disruption or impairment* of all or part of the financial system, meaning that portions of the system cease to effectively support economic activity; and (iii) *severe externalities*, meaning spillovers affect the real (non-financial) economy (Adrian, et al., 2014; IMF, BIS and FSB, 2009). Climate-change related risks can produce all three of the elements.

Systemic shocks are more likely when the prices of a wide variety of financial assets do not fully reflect climate-related physical and transition risks. Standard asset-pricing theory suggests that market participants will demand a premium to hold assets exposed to climate-related physical and transition risk. When those risks are not fully priced in, market participants will accumulate larger exposures to risky assets than would otherwise be desirable. A sudden revision of market participants’ perceptions about climate risk could trigger a disorderly repricing of assets, which could have cascading effects on portfolios and balance sheets and, therefore, systemic implications for financial stability.

Evidence is accumulating that markets are pricing in climate-related risks imperfectly, and sometimes not at all. As the previous chapter explained, the U.S. property market is beginning to price in risk of sea level rise and climate-attributed flood risk—but unevenly. For example, one study found that investors purchasing U.S. rental properties are demanding risk premiums well aligned with scientific projections for homes exposed to sea level rise but people purchasing homes for primary occupancy, on the other hand, are less likely to do so (Bernstein, et al., 2019). Another study examined stock prices across multiple countries, including the United States, and found no association between current stock prices and measures of predicted changes in climate-related physical hazards, even after controlling for fundamentals and for countries’ capacity to adapt to climate change (IMF, 2020).

An emerging body of research suggests that climate risk is currently underpriced in some markets, and that climate-exposed financial assets may be overvalued. Sudden and disruptive repricing is therefore possible should market participants revise their perceptions about

physical and transition risk. A variety of factors could trigger revised investor perceptions, including election outcomes, reports of technological breakthroughs that reduce the cost of zero-carbon technologies, new research findings about the speed and nature of physical climate impacts, and the occurrence of major catastrophes that raise awareness of new risks.

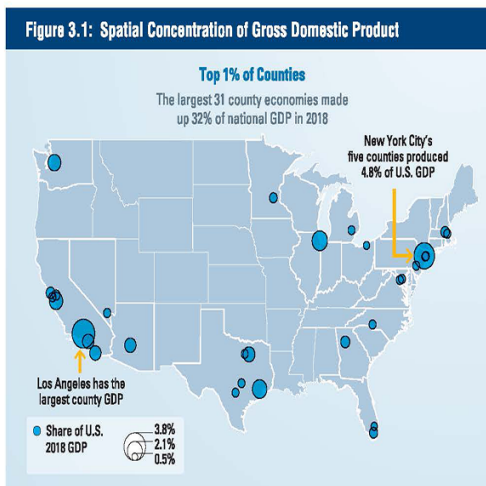
In addition, the fact that climate-related risks do not operate in isolation makes a systemic shock more likely. As Chapter 2 suggests, transition and physical risks could interact and compound the disruption either would exert on its own. In addition, climate-related risks could interact with existing, non-climate-related vulnerabilities in the financial system. For example, U.S. regulators have identified historically high levels of corporate leverage and the expansion of mortgage origination by nonbanks as existing risks to financial system stability (FSOC, 2019). Another, even more important, vulnerability is the likely legacy of the COVID-19 pandemic in the form of stressed financial-institution balance sheets, depleted household wealth, and growing business and government debt. Climate-related shocks could magnify any of these already serious vulnerabilities, increasing the probability of an overall shock with systemic implications.

### Sub-Systemic Shocks

Climate-related risks need not threaten the entire financial system to merit attention from financial regulators. Climate-related risks may well produce “sub-systemic” shocks, which are defined here as those that affect financial markets or institutions or a particular sector, asset class, or region, but without threatening the stability of the financial system as a whole. Such shocks are especially relevant for the United States, given its size and its financial system, which includes thousands of financial institutions, many regulated at the state level.

Sub-systemic shocks can result, for example, in businesses, farmers, and residents in particular communities losing access to hedging instruments, insurance, credit, and other critical financial services. In turn, that loss of access can result in business disruptions, lost income, and reduced household wealth. Over time, repeated sub-systemic shocks could lead to the gradual accumulation of stress in the U.S. financial system and to escalating economic and financial losses—a systemic crisis in slow motion.

The spatially-concentrated nature of economic activity in the United States compounds this risk. As shown in Figure 3.1, in 2018, just 31 counties—accounting for 1 percent of all counties—were responsible for generating one third of U.S. gross domestic product (GDP) (Tartar and Pickert, 2019). A majority of those counties are located along coastlines and are exposed to physical climate risk. Depending on how interrelated physical and transition risks become, economic activity in some of those counties could be adversely impacted both by transition and physical risk. Multiple shocks affecting several of those economic hubs over a short time horizon—a more intense version of what the country experienced in 2017-19, for instance—could cumulatively translate into an economic and financial shock with nationwide consequences.



Source: Adapted from Bloomberg (2019); Bureau of Economic Analysis (2020)

## Risks to Financial Market Operation

Climate-related risks may affect the functioning of markets essential for economic activity. This could happen through liquidity disruptions and through disruptions to financial market utilities.

### Liquidity Disruptions

To function properly, financial markets require adequate liquidity. However, liquidity can deteriorate very quickly during shocks, for example when concerns about counterparty risk spike, or when financial intermediaries are unable or unwilling to perform certain functions. For example, U.S. issuance of commercial paper maturing beyond one week seized up in March 2020 during the COVID-19 pandemic, as did primary- and secondary-market liquidity for financial and nonfinancial commercial paper. This occurred partly because prime money market funds, anticipating investor outflows, rushed to raise cash and build liquidity buffers by selling commercial paper. Also, dealer banks were reportedly less willing to intermediate, as they faced balance sheet and risk-limit constraints (IMF, 2020). Intermediation difficulties were also reported in the municipal bond market. Dealers, faced with large outflows from municipal bond funds, could not warehouse the surging supply of bonds. Conditions eased only after the Federal Reserve injected liquidity into these markets through large purchases of the relevant assets.

A confluence of physical and transition risks in a short time could plausibly cause liquidity problems in key markets. For example, a combination of highly destructive, climate-related extreme events affecting key economic hubs, in the context of already-stressed balance sheets and historically high levels of corporate and municipal debt, could trigger widespread concern about creditworthiness across multiple sectors and regions. In turn, that could lead to a sudden spike in risk aversion, pushing investors to scramble for cash by selling commercial paper and rushing out of certain bond funds—causing liquidity shortages and intermediation difficulties.

A similar scenario is plausible in futures markets. A combination of slow-onset and sudden extreme weather events in major agricultural states, for example, could lead to high volatility in certain agricultural commodity prices. Commodity prices can become especially volatile when storage facilities are damaged or storage capacity is otherwise constrained, forcing contracting parties supplying the physical commodity to incur additional costs. High volatility, in turn, could result in calls for variation-margin payments to clearinghouses and to greater pressure on short-term funding markets at the same time as other institutions, such as insurers and reinsurers, may be tapping the markets to fund large payouts related to the same extreme weather events. The result could be a liquidity crunch that temporarily interferes with the smooth functioning of the commodity futures market. Transition risk could plausibly cause similar disruptions, for example with challenges to liquidity or energy futures markets.

### Disruptions to Financial Market Utilities

Financial market utilities (FMUs) transfer, clear, or settle payments, securities, commodities, or other financial transactions among financial institutions.

The CFTC is primarily concerned with commodities and derivatives clearinghouses (otherwise known as designated clearing organizations, or DCOs), futures commission merchants, swap dealers, and major swap participants. Some DCOs are so critical that the Financial Stability Oversight Council has designated them as systemically important, which means that their failure “could create or increase the risk of significant liquidity or credit problems spreading among financial institutions or markets and thereby threaten the stability of the U.S. financial system” (Agnese, et al., 2017, p. 51).<sup>1</sup>

The CFTC has primary jurisdiction over two of the eight designated entities, the Chicago Mercantile Exchange (the CME Group) and ICE Clear Credit LLC. The CME Group, through its U.S. clearing division, is one of the largest central counterparty clearing services providers in the world. It clears all contracts traded on the designated contract markets owned by CME Group, Inc., which includes the largest and most liquid futures contracts

<sup>1</sup> Currently, eight clearing organizations have been designated as systemically important: (i) the Clearing House Payments Company L.L.C. on the basis of its role as operator of the Clearing House Interbank Payments System; (ii) CLS Bank International; (iii) Chicago Mercantile Exchange, Inc.; (iv) The Depository Trust Company; (v) Fixed Income Clearing Corporation; (vi) ICE Clear Credit LLC; (vii) National Securities Clearing Corporation; and, (viii) The Options Clearing Corporation.

based on the S&P 500 Index, Eurodollars, U.S. Treasuries, and energy products, as well as interest rate swaps. Significant disruption of its operations would cause liquidity to dry up in futures and options markets, which could threaten the stability of the U.S. financial system (Treasury, 2017). ICE Clear Credit clears a majority of the credit default swap (CDS) products in the United States that are eligible for clearing by a central counterparty. Its clearing members include global systemically important financial institutions. Disruption of its operations could lead to cascading defaults, which could create instability in U.S. CDS and securities markets (Treasury, 2017).

Climate-related disasters, such as storms, floods, or damaging winds, could disrupt the operations of FMUs, perhaps even systemically important ones, depending on the location and climate-vulnerability of the FMU's physical infrastructure. Prolonged disruptions could have severe consequences for the markets they serve, including paralysis. While markets have yet to experience major FMU disruptions, smaller episodes suggest this risk must be considered. In 2012, for example, Superstorm Sandy flooded a vault of the Depository Trust and Clearing Corporation (DTCC), an important clearing and settlement company with three subsidiaries designated by regulators as systemically important FMUs. The flood damaged or destroyed 1.7 million stock and bond certificates, as well as millions of other documents. It took the company weeks to recover, restore, and reconcile the documents. The company was unable to begin even a preliminary assessment of the damage for two weeks, until water had been pumped out of its vault (DTCC, 2014).

### Risks to Financial Institutions

In addition to affecting financial market functioning, climate-related risks may also affect financial institutions, potentially including systemically important ones. Three sets of questions are important here: Which combinations of assets could be affected by climate-related risks, by how much, and how quickly? Who holds those assets, and what is their ability to absorb the losses? And, to what extent are losses mitigated by public and private shock absorbers?

#### Which combinations of financial assets are affected, by how much, and how quickly?

As explained in Chapter 2, climate change will likely present a material risk to certain companies and asset classes. But the extent to which the value of those securities and assets is affected, and in what combination, also will have important implications for the holders of those securities and for financial markets more generally. As shown in Table 3.1, the financial assets most likely to be impacted fall in several categories—those tied to: (i) real property; (ii) infrastructure; (iii) companies whose business is affected by climate-related risks; (iv) coverage providers (namely insurers and reinsurers); and, (v) government revenue.

Key uncertainties include the size and frequency of the losses and the potential for simultaneous losses across different asset classes. In the case of physical risk, for example,

Table 3.1: Categories of Assets Exposed to Climate Change Impacts	
Categories	Examples
Financial assets directly tied to real property	<ul style="list-style-type: none"> <li>Commercial mortgage-backed securities (CMBS)</li> <li>Commercial real estate (CRE) bank loans</li> <li>Government-sponsored enterprise (GSE) Credit Risk Transfer securities</li> <li>Real Estate Investment Trusts (REITs)</li> <li>Residential mortgage-backed securities (RMBS)</li> <li>Residential mortgages</li> </ul>
Financial assets tied to infrastructure	<ul style="list-style-type: none"> <li>Debt and equities of power and water utilities and communications companies</li> <li>Debt and equities of public and private transportation infrastructure</li> </ul>
Financial assets tied to companies with businesses models or operations likely to be impacted by physical or transition risk	<p>Equities and debt of firms in the following sectors:</p> <ul style="list-style-type: none"> <li>Agriculture</li> <li>Airlines and the broader transportation sector</li> <li>Automobiles</li> <li>Cement, steel, chemicals, plastics</li> <li>Energy, including coal, oil, and gas production</li> <li>Hospitality</li> <li>Metals and mining</li> <li>Power generation</li> <li>Service and infrastructure providers to oil and gas</li> <li>Tourism</li> </ul>
Financial assets tied to insurance coverage providers	<ul style="list-style-type: none"> <li>Insurance and reinsurance company debt and equities</li> <li>Insurance linked securities (ILS)</li> </ul>
Financial assets tied to streams of government revenue	<ul style="list-style-type: none"> <li>Municipal bonds</li> <li>Sovereign bonds</li> </ul>

major flooding of residential and commercial property over a large region could result, in a short time, in rising mortgage delinquency and prepayment rates and falling values of residential mortgage-backed securities, securitized commercial real estate (CRE) loans, the bonds of affected municipalities, and the stock of insurance companies (if insurance companies must make large payouts for flooded commercial property). Importantly, the extent of the climate-related damage and the financial losses associated with them can be reduced through investments in resilience, business continuity planning, and effective climate risk management more generally.

In the case of transition risk, a sudden adoption of ambitious climate policy—or, more likely, a sudden shift in perceptions about the likelihood of a major policy change—aimed at limiting greenhouse gas emissions, even if the policy is phased in gradually, could impact the debt and equity values, investment, and payrolls of companies across several sectors, assuming that the costs of compliance are not fully passed through to consumers. Aside from companies in the oil, gas, and coal mining business, the shock could affect sectors including electric and gas utilities, motor vehicles and parts, and transportation and warehousing (Jorgenson, et al., 2018). On the other hand, investments that incorporate climate considerations, such as sustainable investments, can also provide financial upside and help hedge against climate-related losses.

### Who holds the assets, and what is their ability to absorb the losses?

How climate-related losses impact financial markets and institutions depends in part on which entities hold affected assets, the entities' risk management capability, and their loss-absorbing capacity. A nuanced understanding of different types of financial institutions is required. The degree to which climate risks become material for specific banks and other firms will depend in part on those institutions' capability of measuring and managing those risks. As Chapter 5 describes, financial institutions can integrate climate into their risk management framework in various ways. Subsequent chapters also describe how tools such as scenario planning and climate stress testing can help regulators and financial institutions understand whether and how climate risk may constitute material risk for particular firms.

**Credit-Providing Institutions.** Commercial banks and other credit-providing institutions lend to entities in locations and sectors that may experience climate-related impacts. Banks could both suffer losses from impaired loans and be left less able to provide credit to affected entities or even entire sectors.

In the case of transition risk, banks that lend to companies in carbon-intensive sectors may have some time to course-correct when facing policy or technological change that effectively increases the price of carbon and limits their clients' financial prospects. Average commercial and industrial loans in the United States typically have a maturity of one-to-three years. That gives banks frequent opportunities to modify loan terms and conditions and incorporate newly understood credit risks. In extreme circumstances, banks can refuse to roll over loans if they believe a company remains at high risk from sudden shifts in climate policy, technology, and changes in consumer demand.

Over the medium and long-run, however, the risk for banks would grow if they stopped lending to carbon-intensive companies and sectors but could not replace these loans with enough new credits to companies better able to adapt to higher carbon asset risk. If a bank, even a large one, was unable to adapt quickly enough, its financial soundness could be at risk. Certain policy paths—particularly major shifts in climate policy, or a shift in perceptions about the likelihood of such a policy change—could trigger an abrupt downturn in revenues and valuations for companies in carbon-intensive sectors, possibly

forcing banks to recognize credit losses on their loans and marked-to-market losses on their securities holdings. It is worth noting that several large U.S. banks have set sizeable “green” or “sustainable” finance goals, which suggests they are confident in their capacity to expand that side of their business.

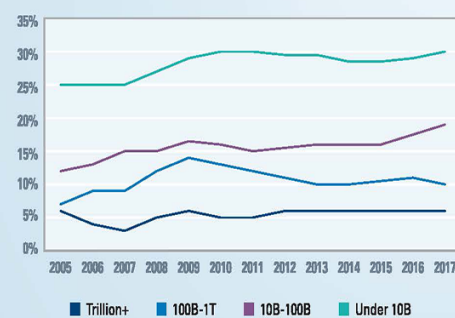
In the case of physical risk, it is worth distinguishing between large, well-diversified banks and smaller institutions that serve particular regions or communities. In general, the largest U.S. banks are relatively well positioned to cope with sudden climate-related extreme events, such as storms, floods, and wildfires. Large credit providers’ portfolios typically are geographically and sectorally diversified. Research suggests that bigger banks may be better able to offset temporary regional losses from natural disasters with earnings from other regions (Landon-Lane, et al., 2011). Large banks also are more resilient to particular climate-related extreme events than smaller banks because they have more diversified business models and are required by regulators to hold more capital relative to their assets.

However, large banks are not immune to chronic physical risks, such as prolonged drought and sea-level rise, which may materialize over multiple years or even multiple decades, and they are not immune to major disasters of increasing frequency and pervasiveness. Both these risks are more likely to simultaneously impact multiple sectors and regions, increasing credit risk across many borrowers. For example, in 2017, nine major international banks with combined assets of more than \$10 trillion, including one large U.S. bank, conducted a scenario analysis to assess how water stress might affect creditworthiness among a sample of their borrowers (UNEP FI, 2017). The banks undertook the exercise voluntarily to help them integrate and strengthen climate risk management.

The exercise showed that extreme droughts would increase loan default losses 10-fold for certain bank portfolios. Even under milder climate change scenarios, most companies in the analyzed portfolios experienced credit downgrades. The most affected sectors were water supply, agriculture, and in certain countries, power generation. In several cases, most of the financial losses came from slow-onset, chronic impacts such as drought, not from sudden extreme events. A key question for large banks remains not only how to manage these longer-term physical risks, but also how to manage them in a context of potentially growing transition risk.

Regional and community banks, in contrast, are more vulnerable to regionally concentrated physical risk, including to sudden extreme events. In 2019, community banks held 30 percent of all CRE loans, worth about \$700 billion (FDIC, 2019). These banks’ property loans tend to be more geographically concentrated than the loans of larger banks. In addition, CRE loans constitute a much larger share—nearly a third—of the loan books of small banks, as shown in Figure 3.2. In contrast, CRE loans represent only a small fraction (just over 5 percent) of the total loans of the largest banks. For this reason, climate-related shocks that affect commercial property in a particular region can take a much heavier toll on small institutions, which tend to be regional and community banks, than on banks with nationwide or global balance sheets. Figure 3.3 highlights the regional nature of depository banks’ exposure to commercial real estate lending.

**Figure 3.2: Commercial Real Estate Mortgages as a Percent (%) of Total Loans, by Bank Size Measured in Assets**



Source: Adapted from Yardi Matrix, based on data from BankRegData

**Figure 3.3: Regional Exposure to Commercial Real Estate Lending**



Source: Adapted from FDIC (2019)

Similarly, small banks in the Midwest, in particular, hold proportionately more of certain types of agricultural loans that could be affected by climate impacts. Flooding and extreme heat reduce crop yields and disrupt agricultural production. For example, following severe flooding

**Figure 3.4: Regional Exposure to Agricultural Lending**

Source: Adapted from FDIC (2019)

in the spring of 2019, bankers lending in the Midwest reported to the Federal Reserve Bank of Chicago that about 70 percent of their borrowers were at least moderately affected by extreme weather events in the first half of the year (Oppedahl, 2019). At the same time, the portion of the region's agricultural loan portfolios reported as having "major" or "severe" repayment problems hit its highest level in 20 years (Oppedahl).

Agricultural banks—those whose combined agricultural production and farmland loans account for at least a quarter of total loans—hold nearly half of all agricultural loans originated by U.S. commercial banks (Humston, 2019). Most of those banks are in the Midwest, as shown in Figure 3.4. Many agricultural banks are small and highly exposed to impacts that reduce farmers' ability to service their debts, including climate-exacerbated extreme weather events. Indeed, more than 70 percent of nonperforming agriculture loans in the Midwest sit on the balance sheets of banks with less than \$10 billion in assets (Tariq and Duren, 2019). Should agricultural banks become credit-stressed, farmers could lose access to affordable credit, making it more difficult for them to recover from climate-related shocks.

**Institutions Holding Climate-Impacted Assets.** This category includes a diverse range of financial institutions, including banks, pension funds, endowments, mutual funds, and insurance companies. These institutions operate along a wide spectrum of investment horizons and risk appetites, but prudent management of climate risk is essential for all. Most of them hold assets that may be affected—and in some cases are already being affected—by transition or physical risk. Ineffective management of these risks could lead to large financial losses, which in turn could trigger asset fire sales and elevated

counterparty risk. These events can channel financial contagion. Also, because climate risk is expected to increase over time, asset holders with longer asset-liability structures are more exposed to climate risk.

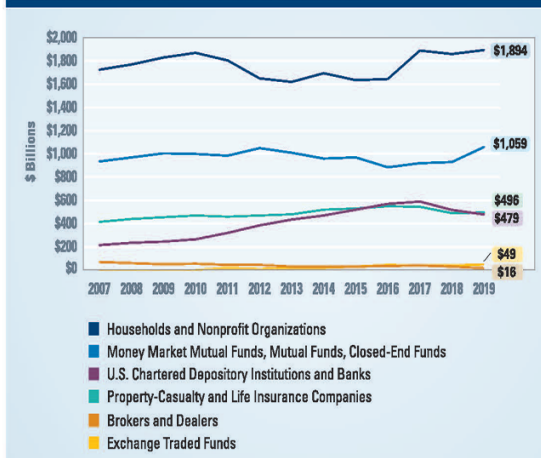
Commercial mortgage-backed securities (CMBS) offer one example. CMBS are made up of commercial mortgages pooled together and secured by commercial property, such as hotels, office and retail buildings, and warehouses. About half a trillion dollars of CMBS were outstanding as of 2019 (MBA, 2019), much of it held by institutional investors. Some of these loans, and the property that secures them, are at risk from flooding, wildfires, windstorms, storm surge, and sea level rise. As of March 2019, properties in New York, Houston, and Miami—cities that are highly vulnerable to climate change-exacerbated flooding because of sea-level rise and more intense storms—alone made up one-fifth of CMBS properties by market value in the Bloomberg Barclays Aggregate Index (BII, 2019).

The risk likely will rise. One analysis estimated that about 6 percent of the properties in the CMBS market lie in Federal Emergency Management Agency (FEMA) flood zones, which are at elevated risk of inundation (BII, 2019). Another recent study identified 2,000 CMBS loans, worth more than \$56 billion, that are exposed to climate change-exacerbated flooding along the East and West coasts (Morgan Stanley, 2019). Alarmingly, more than half of that exposure is estimated to lie outside FEMA flood zones. That means those properties are at higher risk of being underinsured, and therefore the loans attached to them are at higher risk of impairment, with increased risk for the value of the related CMBS.

Another example involves the \$3.8 trillion municipal bond market, made up of debt issued by U.S. municipalities. It provides crucial financing to local governments, including for infrastructure (MSRB, 2019). As shown in Figure 3.5, mutual funds, banks, and insurance companies hold a majority—about 55 percent—of municipal bonds, with households and non-profit organizations holding most of the rest.

Hurricanes, floods, and other disasters are already affecting the economies of issuing municipalities, and that risk is expected to grow. One analysis calculated that within a decade, if significant climate action is not taken, more than 15 percent of the current S&P National Municipal Bond Index by market value will be issued by cities suffering likely yearly economic losses of 0.5 percent to 1.0 percent of GDP. By the end of the century, close to 40 percent of the index would be issued by cities facing 3 percent or more of yearly GDP losses because of climate-related impacts (BII, 2019). Also, climate impacts could be even more devastating to municipalities in the aftermath of the COVID-19 pandemic, which likely will weaken the fiscal condition of many state and local governments. Climate-related losses could impair municipalities' ability to service their obligations and lead to downgrades and eventually defaults and losses for municipal debt holders.

Spillover effects that undermine local industries and economic activity could also affect municipal revenue. For example, a climate-related disaster could lead businesses, workers, and residents to relocate permanently out of a highly affected area, resulting in lower economic activity, falling property prices, and declining real estate taxes. Climate change

**Figure 3.5: Municipal Bond Holdings, by Type of Holder**

Source: Based on data from Federal Reserve Board Financial Accounts of the U.S. (2019)

can also damage the economic base in locations where, for example, fish have moved to other areas because of warming seas, or where waterfront tourism is ruined by algae growth. These impacts would affect the creditworthiness of municipalities, particularly where tax revenue sources are not sufficiently diversified.

Transition risk could affect the municipal bond market as well. Unless state and local governments in areas that mine coal and extract oil and gas succeed in rebasing their economies, shifts away from the use of fossil fuels could result in falling royalties and taxes. Some municipalities depend on energy revenues for up to half of their total tax revenue. Revenue losses could cause fiscal stress and, eventually, municipal bond downgrades (Morris, et al., 2019; Morris, 2016). Although regulations require disclosure of municipalities' fiscal risks, disclosure of climate-related risks by municipalities remains minimal, as discussed in Chapter 7, exacerbating risks to municipal bond holders (Morris, et al., 2019).

#### To what extent are losses mitigated by public and private shock absorbers?

Whether and how financial institutions incur destabilizing losses because of climate risks depends crucially on the presence of shock absorbers, namely private insurance and reinsurance. In addition, the federal government's assistance to people and businesses during extreme events plays a crucial role in directly mitigating risks for those who are impacted, and indirectly in terms of how risks are transmitted across the financial system.

Evidence on the aftermath of disasters in the United States illustrates the importance of these shock absorbers in reducing potential losses to financial institutions. After Hurricane Katrina devastated parts of the Gulf Coast in 2005, for example, household debt *declined* because homeowners used large government flood-insurance payouts to pay off mortgages (Gallagher and Hartley, 2015). Similarly, a study showed Hurricane Harvey did not hurt consumers' access to credit, thanks in large measure to public and private shock absorbers, including FEMA assistance, Small Business Administration disaster loans, auto and property and casualty insurance payouts, and aid from the National Flood Insurance Program (NFIP) (Hartley, et al., 2019). Also, the National Crop Insurance Program was an important source of support to farmers in the Midwest following the catastrophic floods of 2019 (USDA, 2019). As long as these mechanisms continue to cushion the losses, the financial system will be at least partially shielded from climate-related shocks.

However, these shock absorbers should not be taken for granted. As past disasters have repeatedly demonstrated, private insurers often raise premiums in the aftermath of major events to ensure that they have sufficient reserves to cover future losses. Insurers may also exclude coverage for risks that are too large to cover even at a higher price. In some cases, insurers may exit a state, regional, or national market altogether. For example, home insurers left the home flood insurance market decades ago.

State legislatures and state regulators, when they have the authority, may limit premium hikes or compel insurers to provide certain levels of coverage. This has been the case in states such as Florida and California. But insurers can decide to exit markets if the premium limits or the coverage requirements mean they would not be able to cover their losses. Fundamentally, if the risk is too high for private insurers, the risk may ultimately be left with the property owner, the government, or both.

Climate change can cause insurance companies to fail. After the catastrophic 2018 Camp Fire in California, for example, a medium-sized insurer that had written many of its policies to cover fire had to be taken over by the California Department of Insurance (Koren, 2018). This danger could be exacerbated if private insurers underestimate the probable maximum losses they are insuring because their models do not fully capture long-term climate trends (DNB, 2017). Insurers typically provide one-year policies, and their underwriting decisions tend to be made using retrospective models with short time horizons. Thus, they, their reinsurers, and their regulators could neglect to account for climate change-related shifts in the frequency or intensity of catastrophic events that unfold over multiple years or decades.

Another challenge is that shock absorbers may themselves exacerbate risk by creating moral hazard. For example, the NFIP, which is the principal mechanism for providing residential flood insurance in the United States, subsidizes the insurance premiums of some properties, typically those in the riskiest areas. This feature effectively promotes excessive risk-taking in areas most exposed to flooding, inundation from sea level rise, and extreme precipitation

events (Kousky, 2018). The implications of this moral hazard range widely from encouraging continuing development of residential property in risky areas to local governments' continued reliance on an unsustainable property tax base. Additionally, not enough attention is being paid to long-term solutions, such as relocation and investing in long-term resilience measures (Hill and Martinez-Diaz, 2019). This moral hazard is not unique to insurers—the demonstrated willingness of governments to bail out financial institutions could create an incentive for them to mismanage climate risk.

Finally, a critical question is whether federal insurance and other government backstops can in the longer-term sustain significantly higher claims than they were designed to meet. For example, a 2019 analysis by the U.S. Department of Agriculture's Economic Research Service found that under different emissions and agricultural adaptation scenarios, the cost of the Federal Crop Insurance Program could increase by 3.5 percent to as high as 37 percent by 2080 (Crane-Droesch, et al., 2019).

Another example of a government shock absorber is the government-sponsored entities (GSEs), the Federal National Mortgage Association (Fannie Mae) and the Federal Home Loan Mortgage Corporation (Freddie Mac). Congress created the GSEs to make mortgages more available by enhancing the liquidity and stability of the U.S. secondary mortgage market. The GSEs were endowed with certain competitive advantages which, taken together, conveyed an implicit government guarantee on their financial obligations. After the 2008 financial crisis, the GSEs began transferring a meaningful portion of this credit risk to the private market via Credit Risk Transfer securities, which are purchased by hedge funds, money managers, Real Estate Investment Trusts (REITs), insurance companies and pension funds, though the GSEs retain considerable risk on their own balance sheets.

As major holders of mortgages and originators of residential mortgage-backed securities, the GSEs are exposed to physical climate risk affecting property, particularly flood risk. Because Fannie Mae and Freddie Mac are limited by rules governing how they underwrite mortgages, they may have limited room to screen for and manage climate risk (Ouazad and Kahn, 2019). In addition, some of this opaque risk could be transferred to other parts of the financial system through the GSEs' sales of Credit Risk Transfer securities. Ensuring that the GSEs are effectively measuring, monitoring, and managing climate risk will be imperative for their continued ability to enhance the stability of the U.S. mortgage market.

The limitations of government shock absorbers will be an especially pressing issue in the face of the enormous fiscal burdens from the COVID-19 pandemic. Responding to the pandemic has already resulted in federal debt levels not seen since World War II. If, for any of the reasons cited above, investors lost confidence that public and private shock absorbers would continue absorbing climate-related losses to the extent that they have, fear in financial markets could trigger a disorderly adjustment of prices in one or more asset classes.

## Chapter 4

## Existing Authorities and Recommendations for Financial Regulators

In the face of climate change, U.S. financial regulators must ensure that emerging risks are identified, measured, and effectively managed before they result in systemic or sub-systemic financial shocks.<sup>2</sup> This chapter explains how financial regulators should undertake this task. It also provides a high-level review of the authorities available to them under existing legislation and assesses the extent to which these authorities are sufficient to start addressing climate risk immediately. Finally, the chapter provides recommended actions that financial regulators can take to better protect the U.S. financial system from climate risk.

### Five Functions of U.S. Financial Regulators

Regulators, in an ideal world, should be able to perform five important functions to address climate-related risks. These functions are consistent with how regulators manage more traditional risks to the financial system, such as credit, market, and operational risk. The five functions are:

**Identify and provide oversight of physical and transition risk at a systemic level.** Regulators should be able to monitor and assess how climate risk is affecting and could affect the financial system. That includes impacts on the functioning of financial markets and systemically important bank and nonbank financial institutions, impacts that cut across multiple asset classes and markets, and potential channels for financial contagion and shock magnification. Regulators should also be able to monitor “sub-systemic” shocks to parts of the financial system that serve particular sectors or regions of the country. This should

<sup>2</sup> As explained in Chapter 3, “sub-systemic” shocks are those that affect financial markets or institutions in a particular sector, asset class, or region of the country, but without threatening the stability of the financial system as a whole.

include institutions that fall under the threshold of “systemically important” but may be affected by sub-systemic shocks or more generally by the migration, motivated by climate risk, of financial activity from one part of the financial system to another.

**Ensure that financial institutions, dealers, and other key market actors can monitor and manage climate risks.** Financial regulators should have confidence that the entities they supervise have mechanisms and capabilities to manage climate risk effectively. These include, for example, effective governance arrangements, managerial incentives, risk identification protocols, and risk modeling and risk quantification tools and methods. Regulators should also encourage market participants to build capacity, develop data and tools, and share good practices.

**Ensure that financial institutions, dealers, and other key market actors have the capacity to absorb climate-related financial impacts without causing system-wide or regional disruptions.** Regulators should be confident that key market participants can cope with climate-related impacts such as credit, mark-to-market, and underwriting losses.

**Ensure that investors, customers, and counterparties have adequate information to understand material climate risk.** Publicly traded companies, entities registered with the CFTC and other regulators, and financial institutions should disclose information about material climate-related risks in an adequate and timely manner.

**Identify and address climate-related operational vulnerabilities in financial market utilities (FMUs) and critical service providers.** Financial regulators should have confidence that FMUs have adequately assessed their vulnerability to physical climate risk and have adequate contingency protocols, business continuity measures, and redundancies to ensure operational resilience in the face of a range of extreme climate events.

## Existing Authorities and Practices

To what extent are U.S. regulators able to fulfill the roles identified above? Existing legislation, in general, provides U.S. financial regulators with broad and flexible authorities to perform the key functions outlined above. However, regulators are not fully utilizing their authorities and tools to effectively monitor and manage climate risk. Further rulemaking, and in some cases legislation, may be necessary to ensure a coordinated national response.

## Systemic Risk Oversight

Regulators have significant, flexible authority to monitor and manage system-wide risk. The Financial Stability Oversight Council (FSOC)—created by the 2010 Dodd-Frank Wall Street Reform and Consumer Protection Act (DFA)—is charged with identifying risks and emerging threats to the financial stability of the United States, including those “that could arise outside the financial services marketplace” (DFA, 2010, Section 112). To that end, the FSOC is responsible for monitoring the financial services marketplace to identify

potential threats to financial stability; identifying gaps in regulation that could pose risks to financial stability; and facilitating information sharing and coordination among the FSOC member agencies and other federal and state agencies on rulemaking and examinations (DFA, 2010, Section 112), among other things. The CFTC is a voting member of the FSOC.

The FSOC is authorized to determine that a nonbank financial institution should be supervised by the Board of Governors of the Federal Reserve and subject to prudential standards (DFA, 2010, Section 113). It can make this determination if it judges that the institution, because of its nature, scope, size, scale, concentration, interconnectedness, mix of activities, or “any other risk-related factors that the Council deems appropriate” could pose a threat to financial stability (DFA, 2010, Section 113). (So far, FSOC has made four such determinations; all four designations have since been rescinded, three by the Council itself, and one by a federal court.) The FSOC can also recommend to the Board of Governors of the Federal Reserve—in the case of nonbank financial companies supervised by the Board of Governors and large, interconnected bank holding companies—that prudential standards and reporting and disclosure requirements be made “more stringent” than those applicable to other institutions that do not present similar risks to financial stability (DFA, 2010, Section 115).

The FSOC is supported by the Office of Financial Research (OFR) at the U.S. Department of the Treasury. The OFR is charged with performing long-term research and developing tools for risk measurement and monitoring (DFA, 2010, Section 153).

The Dodd-Frank Act also created the Federal Insurance Office (FIO) of the Department of Treasury, which is charged with monitoring “all aspects of the insurance industry, including identifying issues or gaps in the regulation of insurers that could contribute to a systemic crisis in the insurance industry or the U.S. financial system” (DFA, 2010, Section 502). The FIO can also recommend to the FSOC that it designate an insurer as an entity subject to regulation by the Board of Governors of the Federal Reserve.

### Risk Management

Under existing authorities, regulators have wide latitude to help ensure that financial institutions, dealers, and other key market participants are identifying and managing risk effectively, including in the context of the five functions mentioned above.

**Banks and nonbank financial companies.** Regulators enjoy broad authority to prudentially supervise and regulate banks and nonbank financial companies.

Under the Dodd-Frank Act, regulators can prescribe more stringent prudential standards based on the riskiness, complexity, size and “any other risk-related factors the Board of Governors deems appropriate” in the case of nonbank financial companies supervised by the Federal Reserve and for bank holding companies of a certain size (DFA, 2010, Section 165). Those prudential standards may include enhanced risk-based capital requirements and

leverage limits, liquidity requirements, overall risk management requirements, concentration limits, contingent capital requirements, and "such other prudential standards as the Board of Governors [of the Federal Reserve]...determines are appropriate" (DFA, 2010, Section 165). The Federal Reserve can supervise bank and nonbank financial firms' risk management frameworks, including requiring that firms establish risk committees to ensure that corporate managers appropriately govern risk, that firms use enterprise-wide risk management practices, and that firms clearly define oversight responsibilities in their boards of directors.

One important supervisory and regulatory tool is stress testing. Within its existing authorities, the Federal Reserve stress tests large bank holding companies periodically through its Comprehensive Capital Analysis and Review (CCAR). The CCAR's goal is to ensure that financial institutions have forward-looking capital planning processes that incorporate relevant risks, and that they hold sufficient capital to continue operations through adverse economic conditions. In the CCAR, regulators evaluate capital adequacy, internal capital adequacy assessment processes, and capital distribution plans. Once the financial institutions' boards have approved the capital plans, they are submitted to the Federal Reserve for review.

Also, banks with total consolidated assets of more than \$250 billion are required to conduct their own annual stress tests (DFA, 2010, Section 165, as amended by the Economic Growth, Regulatory Relief, and Consumer Protection Act of 2018). Regulators set definitions and rules that govern the stress tests, including the scope of application, scenarios, reporting, and disclosure. The company-run stress tests provide forward-looking information that enables regulators and the firms to better understand their risk profile. But the CCAR and company-run stress tests do not consider climate-related risks. In addition to stress testing, the Dodd-Frank Act authorizes to the Board of Governors of the Federal Reserve to "develop and apply such other analytic techniques as are necessary to identify, measure, and monitor risks to the financial stability of the United States" (DFA, 2010, Section 165).

Regulators in some jurisdictions are experimenting with climate risk stress testing. For example, the Bank of England in 2019 announced plans to conduct climate risk stress tests of major U.K. banks and insurers. That year, the Bank of England's Prudential Regulatory Authority (PRA) required insurers to conduct a climate risk stress test based on three scenarios and a prescribed methodology. Also, as part of the Bank's Biennial Exploratory Scenario (BES), scheduled to start in 2021, it will ask major U.K. banks and insurers to estimate the size of climate change risks in three scenarios over a 30-year time horizon and consider how they would adjust their business models under each scenario. To facilitate this analysis, the Bank will provide a set of climate scenarios alongside pathways for macro-financial variables. This will build on the work of the Central Banks and Supervisors Network for Greening the Financial System (NGFS), which has recently developed reference scenarios for central banks and supervisors.

Similarly, the Bank of France, the Australian Prudential Regulation Authority, and the Bank of the Netherlands have completed or are in the process of launching climate risk stress tests for banks and insurers. In March 2020, the European Central Bank (ECB) announced preparations for a macroprudential stress test aimed at understanding how climate risks could propagate across the non-financial economy and the financial system.

**Central bank asset purchases.** Under existing emergency authorities, the Federal Reserve can purchase financial assets to inject liquidity into stressed markets and to maintain firms' access to finance during adverse conditions. Asset purchase programs were crucial to the central bank's effort to address the financial crisis in 2008 and 2009, and have been revived and expanded to combat the financial impacts of the COVID-19 pandemic. As a result, the Federal Reserve has announced its intention to buy not only the agency mortgage-backed securities and federal government debt it purchases as part of its monetary policy operations to support the macroeconomy, but also municipal bonds and corporate debt in primary and secondary markets, including bonds of companies that fell below investment grade after March 22, 2020. These financial assets will sit on the central bank's balance sheet for an undefined period. If the value of these assets deteriorates, the public ultimately bears the risk. Currently, the Federal Reserve, in conducting asset purchases, does not systematically consider, measure, or disclose transition and physical climate risks.

**Commodities and derivatives markets.** The Commodity Exchange Act empowers the CFTC to regulate commodities and derivatives markets. That authority includes the regulation of market participants, such as futures commission merchants (FCMs), swap dealers and major swap participants (MSPs), and market infrastructure, including designated clearing organizations (DCOs), designated contract markets (DCMs), and swap execution facilities (SEFs) (CFTC, 2020). Following the financial crisis, the Dodd-Frank Act significantly extended the CFTC's jurisdiction to cover over-the-counter (OTC) derivatives or swaps.

Several CFTC authorities are especially relevant in the context of managing climate risk. The CFTC's regulations require swap dealers to maintain an effective risk management program that covers various risks. DCOs, DCMs and SEFs also must satisfy capital adequacy requirements and maintain a framework for monitoring and managing risk. Also, the CFTC requires swap dealers to "establish, document, maintain and enforce" a system of risk management policies and procedures designed to monitor and manage risks, including market, credit, liquidity, and foreign currency risks, as well as "any other applicable risks" (CFTC Rule 23.600). Other applicable risks presumably could include climate-related risks if they are deemed material. Swap dealers also are required to satisfy all capital and margin requirements established by the CFTC or any prudential regulator (CFTC Rule 23.600(c)(6)).

CFTC Rule 23.600(c)(2) requires swap dealers to make quarterly written reports to their senior managers and governing body, setting forth their market, credit, liquidity, foreign currency, legal, operational, settlement and any other applicable risk exposures, as well as any recommended or completed changes to their risk management program. These quarterly reports must be submitted to the CFTC within five business days of providing them to senior managers. The CFTC also conducts clearinghouse supervisory stress tests. Three have been conducted so far. The tests have included clearinghouse liquidity risks, though the tests have not covered operational risks, including risks from climate-related physical impacts.

**Insurance.** The U.S. system for regulating insurance markets vests authority with state insurance regulators. Under this system, unless a federal law explicitly preempts states from regulating some aspect of insurance, state insurance regulators' authority is governed by state laws and regulations. Because climate change-related impacts can pose risks to insurance companies as underwriters or investors, insurance regulators could use their authority under state laws and regulations to identify, monitor, and address climate-related physical and transition risks facing individual insurance companies and the insurance sector more broadly. If state insurance regulators need additional authority, states can enact laws granting it.

Insurance regulators can require stress testing to better understand insurers' risk profiles and capacity to absorb losses. For example, California's Insurance Commissioner conducted a climate risk scenario analysis of insurers' investment portfolios—the only state so far to do so (CDI and UC Berkeley CLEE, 2018). Unlike insurance regulators in other countries, including the Bank of England, the Bank of the Netherlands, and the Bank of France, no U.S. state insurance regulator has undertaken climate risk stress tests of insurance companies.

**Credit rating agencies.** Credit rating agencies provide information that is actively used by investors in the financial marketplace. The U.S. Securities and Exchange Commission (SEC) can prescribe rules requiring rating agencies to submit an annual internal controls report, which must contain, among other things, "an assessment of the effectiveness of the internal control structure" of the agencies (DFA, 2010, Section 932). The control structure governs the implementation of "policies, procedures, and methodologies" for determining credit ratings (DFA, 2010, Section 932).

In recent years, credit rating agencies have started to consider climate-related risks in their ratings. For example, one rating agency cited environmental, social, and governance (ESG) risks as material credit considerations in a third of the more than 7,600 private sector rating actions published in 2019 (Mutua, 2020). Progress has been notable in the incorporation of physical climate risk variables into sovereign and municipal bond ratings, as well as into ratings of some corporate debt.

### Disclosure and Investor Protection

Under existing authorities, financial regulators have broad authority to require disclosure of material information to regulators, investors, customers, and counterparties. Chapter 7 provides an additional discussion of disclosure-related authorities.

**Banks and nonbank financial companies.** Under the Dodd-Frank Act, the Board of Governors of the Federal Reserve can require periodic public disclosures by nonbank financial companies it supervises and by bank holding companies of a certain size “to support market evaluation of the risk profile, capital adequacy, and risk management capabilities” of those companies (DFA, 2010, Section 165). These disclosures are in addition to the disclosures required by the SEC for publicly listed banks and nonbank financial institutions.

**Securities issuers.** The SEC is charged with protecting investors and maintaining fair, orderly, and efficient capital markets. Firms issuing securities to the public must register with the SEC and disclose information about the company, its management, how the firm intends to use the funds raised through the sale of securities, and material risks to investors. Not only are publicly traded corporations required to register, but so are other securities-market participants, such as stock exchanges, securities brokerages, mutual funds, auditors, and investment advisers.

SEC Regulation S-K provides disclosure requirements for publicly traded companies. Under Regulation S-K, public companies are required to disclose material information—known trends, events, or uncertainties that are “reasonably likely to have a material effect” on the company’s financial condition or operating performance—through annual or other public filings (SEC, 1989). In 2010, the SEC issued guidance “to remind companies of their obligations under existing federal securities laws and regulations to consider climate change and its consequences as they prepare disclosure documents to be filed with us and provided to investors” (SEC, 2010). As discussed in more detail in Chapter 7, the guidance has not had a significant impact on actual climate risk disclosures by companies because of its lack of specificity and uneven application (Stevenson, 2019; Gelles, 2016).

**Commodities and derivatives markets.** Under the Commodity Exchange Act and CFTC regulations, the CFTC can require a range of upstream and downstream risk disclosures, including scenario analyses, in some circumstances. For example, certain market participants are required to make upstream financial disclosures to DCOs, DCMs and SEFs. Under the CFTC’s rules, risk disclosures primarily are made downstream, such as from swap dealers and FCMs to their counterparties and customers. In contrast to the broad company disclosures required by the SEC and other regulators, the CFTC-required disclosures are primarily product disclosures. However, they could be interpreted to specifically require addressing climate-related risks to certain commodity contracts.

For example, under the CFTC's business conduct rules, swap dealers must disclose to their counterparties, before entering into a swap, material information concerning it. This must be done in a manner reasonably designed to allow the counterparty to assess, among other things, the material risks of the swap (such as market, credit, liquidity, foreign currency, legal, and operational risk).<sup>3</sup> Before entering into a swap, the swap dealer also must notify the counterparty of its right to request and consult on the design of a scenario analysis. The purpose of the scenario analysis is to allow the counterparty to assess its potential exposure in connection with the swap over a range of assumptions, including severe downside stress that would result in significant losses (CFTC Rule 23.431(b)).

**Insurance.** State insurance regulators can require insurance companies to disclose a variety of risk-related information, including climate-related risks. Those disclosures can be made public by the regulators (NAIC, 2019; CDI, 2018). For example, since 2011, the National Association of Insurance Commissioners (NAIC) Climate Risk Disclosure Survey has been administered to insurance companies by regulators in California, New York, Washington, Oregon, and Connecticut. The California Department of Insurance (CDI) publishes the survey results on its website. The Climate Risk Carbon Initiative of the California Department of Insurance requires insurers above a certain annual premium threshold to report their investments in thermal coal, oil and gas enterprises, and utilities deriving 50 percent or more of their electricity from fossil fuels. The Department discloses the results on its website. In addition, state laws grant state regulators broad powers of financial examination as well as the authority to request information from insurers through mandatory "data calls."

State insurance regulators do not require insurers to make climate risk disclosures as recommended by the Task Force on Climate-related Financial Disclosures (TCFD). Six state insurance regulators require insurers with premiums in excess of \$100 million a year to answer the annual NAIC Climate Risk Disclosure Survey. The survey effectively covers about 1,000 insurers representing 70 percent of U.S. direct written premiums. However, the survey is outdated (it was designed in 2009 and not updated since), it does not collect quantitative information, and it falls far short of the disclosures recommended by the TCFD.

### Financial Market Utilities

Finally, U.S. regulators have broad authority to oversee the operational and financial resilience of financial market utilities and other critical service providers. For example, the FSOC can designate FMUs or payment, clearing, and settlement activities as systemically important based on, among other things, "the effect that the failure of or a disruption to the financial market utility or payments, clearing, or settlement activity would have on a critical markets, financial institutions, or the broader financial system" (DFA, 2010, Section 804).

<sup>3</sup> Note that swap dealers utilize standard disclosures prepared by International Swaps and Derivatives Association (ISDA), including the Physical Commodity Disclosures, which generally address risks regarding underlying physical commodities and markets.

Once designated an FMU or other financial institution is designated as systemically important, the Board of Governors of the Federal Reserve can prescribe risk management standards governing their operations related to the payment, clearing, and settlement activities. The CFTC and the SEC can do the same for the operations of critical service providers under their jurisdiction. Climate-related impacts are not incorporated into these risk management standards. Financial regulators are studying the potential impacts of cyberattacks aimed at disrupting FMUs (OFR, 2017). Lessons drawn from this exercise may be relevant and useful in the context of climate-related operational risks to FMUs.

## Recommendations

Market participants and the regulatory community, in the United States and abroad, are in the early stages of understanding and experimenting with how best to monitor and manage climate risk. Given the considerable complexities and data challenges involved, regulators and market participants should adopt pragmatic approaches that stress continuous monitoring, experimentation, and learning. Regulatory approaches in this area are evolving and should remain open to refinement, especially as the understanding of climate risk continues to advance and new data and tools become available.

At the same time, regulators should establish a clear framework with appropriate milestones. This is what financial regulators are already doing in some jurisdictions and is consistent with recommendations of financial regulatory bodies (Bank of England, 2019; Bank for International Settlements, 2020; NGFS, 2020). As explained above, in general, regulators have sufficient authority to start tackling climate risk immediately. The following recommendations provide, in our view, a good starting point.

## Systemic Risk Oversight

**Recommendation 4.1:** All relevant federal financial regulatory agencies should incorporate climate-related risks into their mandates and develop a strategy for integrating these risks in their work, including into their existing monitoring and oversight functions. Regulators should further develop internal capacity on climate-related risk measurement and management, including through their strategic planning, organizational structure, and additional resourcing.

**Recommendation 4.2:** The Financial Stability Oversight Council (FSOC), of which the CFTC is a voting member, should undertake the following:

- As part of its mandate to monitor and identify emerging threats to financial stability, incorporate climate-related financial risks into its existing oversight function, including its annual reports and other reporting to Congress;
- Encourage and coordinate, across the Council's member agencies, the sharing of best practices concerning the monitoring and management of climate-related risks, the building of relevant institutional capacity, the integration of climate-related risks into

the risk monitoring function of the agencies and into financial supervision and regulatory frameworks, and the potential for second-order impacts, such as the migration of financial activity from one part of the financial system to another; and

- Task the Office of Financial Research with developing a long-term program of research on climate-related risks to the financial system, paying close to the potential interconnectivity and spillovers of climate-related risks across the financial system; monitoring relevant developments; and developing tools that regulators can use for the monitoring and management of climate-related risks.

**Recommendation 4.3:** Research arms of federal financial regulators should undertake research on the financial implications of climate-related risks. This research program should cover the potential for and implications of climate-related “sub-systemic” shocks to financial markets and institutions in particular sectors and regions of the United States, including, for example, agricultural and community banks and financial institutions serving low-to-moderate income or marginalized communities. Research should also include the impact of climate risk on financial system assets and liabilities, including by sensitivity of specific sectors to climate change, geographic location, and tenor. In doing so, regulators should identify data gaps and approaches to address these shortcomings. Regulators should develop assessments of the magnitude of the impact of climate on these assets and liabilities, for example through scenario analysis.

**Recommendation 4.4:** Relevant federal regulators should assess the exposure and implications of climate-related risks for the portfolios and balance sheets of the government-sponsored enterprises (GSEs) and strongly encourage the GSEs to adopt and implement strategies to monitor and manage those risks.

**Recommendation 4.5:** The Federal Insurance Office, in collaboration with state insurance regulators, should undertake an assessment of the insurance sector’s systemic vulnerability to climate-related impacts and report the findings to the FSOC. FIO should also evaluate the adequacy of state insurance regulators’ oversight of climate-related risks.

**Recommendation 4.6:** Federal financial regulators should actively engage their international counterparts to exchange information and draw lessons on emerging good practice regarding the monitoring and management of climate-related financial risks. U.S. regulators should join, as full members, groups convened for this purpose, including the Central Banks and Supervisors Network for Greening the Financial System (NGFS), the Coalition of Finance Ministers for Climate Action, and the Sustainable Insurance Forum (SIF). The United States should also engage actively to ensure that climate risk is on the agenda of Group of Seven (G7) and Group of Twenty (G20) meetings and bodies, including the Financial Stability Board (FSB) and related committees and working groups. The Federal Reserve already participates in the Basel Committee on Banking Supervision’s climate task force, and the Securities and Exchange Commission participates in the International Organization of Securities Commissions’ (IOSCO) sustainable finance network.

## Risk Management

**Recommendation 4.7:** Financial supervisors should require bank and nonbank financial firms to address climate-related financial risks through their existing risk management frameworks in a way that is appropriately governed by corporate management. That includes embedding climate risk monitoring and management into the firms' governance frameworks, including by means of clearly defined oversight responsibilities in the board of directors.

**Recommendation 4.8:** Working closely with financial institutions, regulators should undertake—as well as assist financial institutions to undertake on their own—pilot climate risk stress testing as is being undertaken in other jurisdictions and as recommended by the NGFS. This will enable stakeholders to better understand institutions' exposure to climate-related physical and transition risks, as well as to explore climate-related opportunities. The pilot program should include the testing of balance sheets against a common set of scenarios (elaborated on in Chapter 6 and Recommendation 6.6), covering how financial institutions might respond to climate-related risks and opportunities over specified time horizons. This climate risk stress testing pilot program should include institutions such as agricultural, community banks, and non-systemically important regional banks.

**Recommendation 4.9:** Regulators should closely monitor international experience with climate risk stress testing of banks and insurers and apply relevant lessons to the U.S. context. U.S. regulators should engage in international forums, such as the NGFS, to ensure that climate risk stress testing conducted in the United States is comparable to similar exercises in other jurisdictions and avoid duplicative exercises for institutions with a multi-jurisdictional footprint.

**Recommendation 4.10:** Financial authorities should consider integrating climate risk into their balance sheet management and asset purchases, particularly relating to corporate and municipal debt.

**Recommendation 4.11:** The CFTC should:

- Undertake a program of research aimed at understanding how climate-related risks are impacting and could impact markets and market participants under CFTC oversight, including central counterparties, futures commission merchants, and speculative traders and funds; the research program should also cover how the CFTC's capabilities and supervisory role may need to adapt to fulfill its mandate in light of climate change and identify relevant gaps in the CFTC's regulatory and supervisory framework;
- Drawing on the conclusions of the research program above, review the extent to which existing CFTC rules are adequate to monitor and manage climate-related risks. For example, CFTC should review the extent to which rules for non-centrally cleared over-the-counter derivatives (NCD) are appropriate for monitoring and managing climate-related risks. It should also review rules related to capital and margin requirements of

futures commission merchants and swap dealers, as well as initial margin and default fund rules, risk management rules, and capital requirements pertaining to central counterparties;

- Expand its own central counterparty stress testing to cover the operational continuity and organizational resilience of central counterparties, including organizational resilience of operations, contingency planning, and engineering resilience for facilities exposed to climate-related physical risks. Where central counterparties and market infrastructure are not within the CFTC's direct supervisory remit, the supervision of physical risks should be addressed by the relevant FSOC member in a consistent fashion; and
- As better understanding emerges of the risk-transmission pathways and of where the material climate risks lie, consider expanding the CFTC's risk management rules and related quarterly risk exposure reports to cover material climate-related risks.

**Recommendation 4.12:** State insurance regulators and insurance regulators' supervisory colleges, which are convened by regulators where an insurer or its subsidiaries or affiliates operate in multiple jurisdictions, should:

- Require insurers to assess how their underwriting activity and investment portfolios may be impacted by climate-related risks and, based on that assessment, require them to address and disclose these risks; and
- To facilitate the risk assessment mentioned in the point above, insurance regulators should conduct, or require insurance companies to conduct, climate risk stress tests and scenario analyses to evaluate potential financial exposure to both the physical and transition impacts of climate change; state insurance regulators should provide the scenarios, assumptions, and parameters for the stress testing exercise.

**Recommendation 4.13:** Regulators should require insurers to integrate consideration of climate risks into insurers' Enterprise Risk Management (ERM) and Own Risk Solvency Assessments (ORSA) processes.

**Recommendation 4.14:** Regulators should require credit rating agencies to disclose the extent to which their ratings take into account climate risk, including for issuers of corporate, municipal, and sovereign debt. This should include a disclosure of applicable methodologies for those credit rating products that consider climate risk.

### Disclosure

See Chapter 7 for recommendations on disclosure.

### Financial Market Utilities

**Recommendation 4.15:** Federal regulators should ensure that risk management standards governing the operations related to the payment, clearing, and settlement activities of FMUs incorporate measures to monitor and manage physical climate risks. The CFTC, in its capacity as an FSOC member, should recommend that the Council oversee and coordinate this process as it pertains to FMUs designated as systemically important.

**Recommendation 4.16:** The CFTC should review the extent to which financial market infrastructure—including but not limited to systemically important FMUs for which it is the primary regulator—is resilient against losses that could arise through the physical impacts of climate change.

## Chapter 5

# A Closer Look at Climate Risk Management and Data

This chapter examines climate-related risk management by financial institutions. It reviews the components of physical and transition risk, building on the description of ongoing and potential climate impacts in Chapter 2. It then explores several important questions: How can more robust climate risk data and better analytics be developed, and how can financial institutions continue to build their capacity to utilize climate analytics to inform business decisions? What kind of analysis should be undertaken to complement existing risk management? How can climate-related risk analysis support and strengthen risk management across different parts of the financial system?

As referenced in Chapters 2 and 3, climate change has broad implications for macroeconomic performance, including inflation, interest rates, balance of payments, productivity, wealth, and gross domestic product (GDP) growth. Physical and transition risks could profoundly impact, among other things, valuation, credit risk analysis, and asset-liability matching. Climate change also has specific locational considerations and impacts on individual physical assets and the firms that own those assets. It can also affect complex supply chains, as well as public and private infrastructure that supports the economy. Understanding and developing tools to analyze and monitor qualitative uncertainties and quantitative risks, including location-specific risks, requires a variety of datasets, methodologies, and measurement technologies. Effectively managing climate risk requires understanding the vulnerability and resilience of economic actors and markets to climate risks because transition and physical risks from climate change do not uniformly impact companies, countries, sectors, or geographies.

While there is no one-size-fits-all methodology, tool, or scenario, many approaches may be appropriate for different cases. Integrated environmental and economic datasets and methods are relatively new and evolving so any climate risk management approach should be flexible and allow for ongoing learning and the incorporation of best available science and technology. Climate risk management should recognize that confidence intervals and the accommodation of uncertainty may vary considerably between scientific and financial stakeholders.

Required levels of confidence, spatial and temporal scales, and the range of potential climate-attributed shocks and stresses associated with physical and transition risks will govern the most suitable approaches for any given financial institution. In each instance, the inherent uncertainties, non-linearities and feedback sensitivities associated with climate change need to be considered; they increase the further into the future one attempts to look. Scenario analysis, covered in Chapter 6, seeks to inform and identify parameters and indicators to better manage deep uncertainties. This chapter focuses on how climate risk analysis can be applied to support and strengthen climate risk management, and the barriers to achieving this goal.

### The Demand for Climate Risk Management and Data

To undertake climate risk management, firms need reliable, consistent, and comparable data and methodologies. Climate risk management helps firms adapt to changes in markets arising from physical and transition risks and it helps them build resilience so they can continue to deliver products and services in the face of those risks. Drawn from several decades of international consensus building through the Intergovernmental Panel on Climate Change (IPCC) and the U.S. National Climate Assessments (NCA), these concepts have been widely applied and internalized into the governance and management of firms (Winston, 2014; Linnenluecke, 2017; McKnight and Linnenluecke, 2019). The following summarizes the key concepts framing current climate risk data and management practices. These concepts are consistent with the official definitions promulgated by the interagency U.S. Global Change Research Program (USGCRP), as ratified by the National Academies of Sciences, Engineering, and Medicine (NASEM).

### Adaptation and Resilience

Firms' two-pronged goal should be to adapt to climate change by addressing physical climate impacts and transitioning to a net-zero economy. *Adaptation* is defined as, "[a]djustment in natural or human systems to a new or changing environment that exploits beneficial opportunities or moderates negative effects" (USGCRP, 2020). In this sense, adaptation is not only about managing risk, it is also about taking advantage of opportunities that may arise in broader transformations of markets, including transformations shaping a more sustainable and equitable economy. For firms, the goal is to develop a robust *adaptive capacity*, which can be defined as, "[t]he potential of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, take advantage of opportunities, and cope with the consequences." (USGCRP). (A system could include, for example, a firm or a market.) Because of the many uncertainties of climate change, firms should strategically build a capacity to adapt to a variety of knowns and unknowns. To build the adaptive capacity of a firm, its executives may institute *adaptive management* processes that involve "iteratively planning, implementing, assessing and modifying strategies for managing resources in the face of uncertainty and change" (Keenan, 2018, p. 146). In 2019,

the International Organization of Standardization (ISO) published the first adaptation standard (ISO 1490:2019) aimed at supporting firms' adaptive management (ISO, 2019).

While adaptation and adaptive capacity frame the broader ambitions of firms and markets, in the near-term they must also build a capacity for *resilience*, which is defined as, "[a] capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, the economy, and the environment." (USGCRP, 2020). The resilience of a market or a financial system can be understood as its capacity to withstand various shocks and stresses and still maintain critical levels of performance. At the firm level, *organizational resilience* is the capacity to identify, diagnose, and manage external shocks and stresses to continue operations and regular business activities (Sahebjamnia, et al., 2015). Firms' organizational resilience activities may include everything from business continuity planning to contingent contracting for alternative supply chains. Other types of resilience, including *community resilience* and *ecological resilience*, are also central to supporting impact driven decision-making.

### Defining Climate Risk Management and Data

Firms should focus their risk management and long-term governance on building their capacity to adapt to new markets, products and services, while at the same time developing the organizational resilience to be able to actually deliver those products and services in the face of immediate shocks and stress, including both climatic and non-climatic events. Beyond preparing for physical risks, firms should adapt their businesses to facilitate and participate in a transition to a net-zero economy. Managing transition risks includes taking advantage of opportunities associated with new forms of sustainable production and consumption.

Climate risk is categorized as either transition or physical risk. But as Chapter 2 explains, sometimes these categories are not easily bifurcated. In other cases, certain types of physical risks are widely understood as known natural, technological, and human-caused hazards (FEMA, 2009). Both physical and transition risks, because they are novel, represent a challenge to the analytical parameters of conventional risk management, which often focus on specific plausible, but extreme events that have some basis in prior experience. Because risk is technically a probabilistic function of exposure, sensitivity and consequence, the novelty of climate change means that there is greater uncertainty and ignorance about the range of possible outcomes (USGCRP, 2020). Climate risk should properly be conceptualized as a combination of physical and transition risks—and uncertainties. To build their adaptive capacity and organizational resilience, businesses must develop near real-time intelligence that allows them to better understand a range of plausible events and scenarios. U.S. financial regulators, who are the stewards of the stability of the financial system, also must build these capacities for climate risk management. Together, the processes of adaptation and resilience within climate risk management define the demand for climate risk data.

Climate risk data is highly complex and relies on translating scientific and economic models into financial transmission pathways and then into decision-useful financial variables and metrics. In developing this data, time horizons should be considered, given that financial exposure can be somewhere between short-term, relative to certain climate risks, and long-term, for the duration of a durable asset class. Data should allow for both bottom-up and top-down analysis at the appropriate level of detail for the use case (the specific situation in which a product or service will be used). Ideally, available data would support a wide variety of estimates and projections, covering appropriate time horizons with levels of detail, geographical coverage, and confidence relevant to the particular use case. In this ideal situation, these models would produce decision-useful data that are comprehensive, consistent, and comparable and that would inform assessments of the underlying risk, uncertainty, and vulnerability of firms, counterparties, assets, and markets.

*Vulnerability* is a composite measure of exposure, sensitivity and, in this case, the adaptive capacity of a firm to manage the climate risks of a particular asset. *Exposure* reflects the presence of financial assets coinciding with climate impacts—namely acute extreme events or recognizable patterns of stress. Exposure is the prerequisite to the transmission of climate risks to financially relevant metrics. *Sensitivity* reflects a measure of the responsiveness of exposed assets to any given shock or stress. For instance, an asset with high exposure and low sensitivity may not be too adversely impacted. Table 3.1 provides examples of financial assets exposed to climate risks. While an ecosystem of climate data is emerging, much of the advances in measuring and evaluating asset exposure have not been accompanied by corresponding advances in evaluating the sensitivity of exposed assets or the adaptive capacity of firms to manage sensitivity and exposure. Physical risk data and projections need to be overlaid with exposure data at the asset level. Some financial institutions may have asset-level data to overlay with physical risk data, for example, a bank providing project finance loans. However, most finance use cases will not have direct access to asset-level data for counterparty analysis, let alone analysis of multiple counterparties in a portfolio (such as a listed equities portfolio). Understanding the vulnerability of exposed assets and counterparties to climate risk requires a wide variety of qualitative and quantitative metrics, and detailed data is largely unavailable across most use cases.

### Expanding Climate Risk Data

The increasing adoption of climate risk management practices should incentivize the development of more robust climate risk data. However, while physical risk data is more widely available than transition risk data, both are generally insufficient, and several barriers impede the development of robust decision-useful data. Effective risk management in general, including scenario analysis as described in Chapter 6, relies on the analysis of physical and transition risk data. The two primary barriers to expanding the quality and availability of climate risk data are (i) availability and (ii) standardized definitions.

### Availability

Climate data and supporting measurement technologies and analytical methodologies are rapidly advancing in what is now understood as an emergent climate services sector. However, the quality and interoperability of these services is at a relative early stage. Significant gaps in sectors and across asset classes are impeding not only climate risk management, but also aspects of operations and investment analysis that depend on data-informed processes.

The availability of climate data depends on a variety of public, private and civic sector sources. Historically, climate data was largely environmental and weather data produced by government agencies. Today, climate data serves to help market actors understand climate-related vulnerability in both qualitative and quantitative terms. It may reside: (i) in company disclosures to financial markets, regulators, and government agencies (in multiple jurisdictions and in different languages); (ii) in voluntary disclosures; (iii) in existing proprietary and non-proprietary databases; (iv) in public and private research institutions; and, (v) in academic research. However, the challenge is finding the relevant sources if they exist, and then validating, cleaning, and standardizing the data in an accessible form or format. Chapter 7 addresses corporate disclosure of climate risk information.

Ideally, relevant data would be available and structured to facilitate extraction for financial or sustainability reporting. However, many companies currently either do not report, or report only limited information. Further, calculation methodologies and reporting formats are not standardized. As a result, information is not comparable, causing measurement divergences. It is extremely difficult for individual institutions to secure all the data necessary for detailed datasets. Innovative technologies, such as “data mining” and remote sensing, could open new avenues for generating, at low cost, detailed climate risk data relating to both listed and non-listed companies.

Several organizations offer solutions to address these data and methodological challenges. Different providers collect carbon emissions data, largely based on company disclosures, while other providers use proprietary methods to estimate emissions data. For physical risk, several providers have developed models to assess the frequency and severity of physical perils based on future emissions pathways, predominantly IPCC scenarios. Coverage, including geography and level of detail, varies across these providers. This data and related services can be expensive, and licensing may restrict or otherwise impede integration into broader climate risk tools. It can often be too expensive for smaller firms, which instead rely on public data from government sources or academic institutions, which may specialize within local geographies. However, the value of this data is a key driver of related financial and risk management innovation. U.S. financial regulators or industry bodies may be able to develop common data platforms and technical standards to enable the flow of data in accessible formats. External organizations and public open access platforms also are seeking to address costs that may be incurred by parties that use and disclose climate risk data, including from internal specialists, technology systems, and consulting services.

At the heart of efforts to make climate-related data more accessible are two objectives, which can at times be in tension with each other: the expansion of public open access to climate data on one hand, and the development of proprietary intellectual property related to climate data and services, on the other. There is great demand for public open access to climate data, including primary data based on public and civil sector measurement infrastructure. The American Meteorological Society has taken steps to support principles that guide further development of open access environmental and climate data (AMS, 2019). These efforts are important for ensuring that a robust process can inform decision-making in both the public and private sectors. Market participants who want to compare publicly available disclosure information and sustainability-benchmarked financial products also would benefit from open access data. Open access data is important for consumer transparency, scientific integrity and market development.

At the same time, proprietary intellectual property that will drive innovation in technologies and climate-related data and services also is needed. These technologies and services are necessary to facilitate the data underlying climate risk management and disclosure. In recent years, increased investment in climate data technologies has been a positive sign for the commercialization of underlying intellectual property and the recognition in the private sector of its value. The challenge ahead will be to balance both the public and private objectives in the interests of both transparency and innovation. Appendix Table 1 includes a sample of public and civil society efforts to increase the availability of climate risk data. There are a wide range of private sector activities, not covered in the Appendix.

### Standardized Definitions

A common set of definitions for climate risk data—including modeling and calculation methodologies—is important for developing consistent, comparable, and reliable data. For data to be decision useful, it is necessary to know which climate-related variables materially impact the performance of markets, countries, sectors, asset classes, companies, projects, and securities, and how these variables interact. While these interactions often defy analysis, the ambition to better understand them remains. These fundamental research questions inform what data should be disclosed, including unit of measurement, frequency, and format.

Common definitions for climate risk data include reporting formats and calculation methodologies that can help mitigate limitations. However, lack of standards, and differences among standards, can create barriers to climate risk management. Voluntary disclosure frameworks, as described in Table 7.1, have helped significantly, but in the aggregate these frameworks identify more than 165 potentially “material” metrics, an overwhelmingly large number for many financial institutions. In some cases, different units of measure are stipulated for similar metrics across frameworks. Organizations are actively working to address some of these standards issues, but further work is needed.

An example of the challenges around climate risk data is the wide variation in available ESG (environmental, social, and governance) and climate scores. Massachusetts Institute of Technology research has found that ESG scores from the main five ESG data providers are uncorrelated for any given company (Berg, et al., 2019). Many practitioners are uncertain about which factors are best suited for particular use cases, a problem compounded by lack of transparency into underlying data and methodologies.

There is little international coordination on data and methodology standards, and existing efforts may conflict with the direction the United States may take. In 2018, The European Commission (EC) established a technical expert group (TEG) on sustainable finance to develop a European Union (EU) classification system—the EU taxonomy—to determine whether an economic activity is environmentally sustainable, as well as other related definitional standards for climate-related data and financial products. A goal of the EU taxonomy is addressing data inconsistencies by providing a single, methodologically transparent, and rigorous standard to judge the environmental attributes of financial products as sustainable and non-sustainable. However, explicitly setting thresholds poses challenges, particularly given the diversity of the U.S. economy and the context of the U.S. regulatory structure.

In general, taxonomies, standardized definitions and classification systems can help enable transparency and comparability. Consistency and reliability in climate risk data would then allow financial institutions to compare assets and companies, among other objectives. This could unleash competitive dynamics around managing climate risk that would increase resilience, including via “green” activities.

The United States should develop guidance supporting the comparison and reliability of climate risk data and financial products and services. The guidance should account for the nuances of the U.S. economy and regulatory system and build on the lessons learned in the EU and other jurisdictions, including China and Brazil. Development of this guidance could occur through the establishment a Standards Developing Organization (SDO) composed of public and private sector members. Given the potential downsides of standardization, the SDO should ensure it does not overly raise barriers to entry or restrict innovation. The SDO can work with international counterparts and the private sector to memorialize emerging best practices that advance climate risk management and the development of sustainable financial products and services. The NASEM can provide a foundation for the scope of SDO activities by convening public, private, civic, and international stakeholders to promulgate a consensus study report to Congress. Currently, market-based opinion and assurance bodies are serving this function for financial products, and these services are important for continued market development. For standards and guidance to be optimally effective, there will ultimately need to be multilateral global coordination in the development, maintenance, and benchmarking of relevant indicators, reinforced by robust disclosure practices.

### Scope 3 Emissions and Transition Risk

The Greenhouse Gas Protocol is a widely used global standardized framework for categorizing emissions as Scope 1, 2 or 3. Scope 1 emissions are direct emissions from owned or controlled sources, and Scope 2 emissions are indirect emissions from purchased energy (electricity, steam, heat and cooling) generated by external entities. Scope 3 emissions encompass all other indirect emissions across the value chain, including both upstream and downstream. Scope 1 and 2 data is much more available than Scope 3 data.

Scope 3 emissions are a proxy for and an important input to transition risk, particularly for bottom-up company-specific analysis, as they reflect transition exposure. For automakers, Scope 1 and 2 emissions include vehicle manufacturing, while Scope 3 emissions include the upstream supply chain as well as the downstream gasoline, diesel, or electricity that customers use to operate vehicles. The Scope 1 and 2 emissions from operating a building are dwarfed by the Scope 3 emissions from steel, cement, and other materials used during construction. However, Scope 3 emissions represent only a portion of transition risk, and complementary data is required to make Scope 3 emissions fully decision useful. Among other factors, emissions intensity, demand and supply elasticity, and the associated pass-through of production prices to consumers impact vulnerability in the short-term, while transition plans, evolving consumer preferences and technology innovation impact vulnerability in the longer-term. Effective risk management requires focus on the full spectrum of transition risk. For example, to assess oil and gas company transition risk from carbon pricing, key inputs include capital structure, marginal cost of production, emissions intensity of products, and duration of reserves.

Financed emissions are a special category of Scope 3 emissions, reflecting the indirect emissions underlying financial portfolios, products and services. Financed emissions can help highlight the point-in-time carbon exposure of a financial institution, portfolio or product, but need to be complemented with a range of other data (for example, use of proceeds from a financing and companies' emissions trajectories and financial capabilities) and specifics of the underlying portfolio or financial product (such as asset class, duration, diversification, geographic exposure, hedging, and risk mitigation) to be decision useful for transition risk management. Businesses are increasingly committing to net-zero emissions, and increased sustainable investments by an institution could cause its financed emissions to decline.

In addition, design issues specific to financed emissions raise challenges, particularly around allocating emissions to the wide range of financial activities. Financed emissions from owning 1 percent of a company might include 1 percent of that company's emissions; a portfolio can rapidly double count if aggregate financed emissions include each underlying company's own Scope 3 upstream and downstream emissions. The calculation becomes significantly more complex with other activities, such as when a financial institution serves as a counterparty or is one of multiple underwriters of a financing.

There is no agreed standard for financed emissions and little consistency or comparability to date, but a wide range of methodologies are being developed. Existing estimation methods present significant challenges and regulators should encourage the market to develop a more consistent way of measuring and reporting Scope 3 emissions across sectors where they are material and relevant.

## Climate Risk Analysis

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Effective traditional risk management includes identifying risks, defining risk categories, setting the company's risk appetite, quantifying the risks, and then monitoring and mitigating risks to stay within the determined risk appetite. Effective climate risk management needs to be integrated into this existing risk management process, including defining the risk categories impacted by climate risk—credit, market, strategic, insurance, liability, underwriting, operational, and reputational.

With reliable, consistent, and comparable data, analytical tools and methodologies can be developed to identify, assess, monitor, and manage climate risk within financial markets, as indicated by relevant risks, uncertainties, and vulnerabilities. Then firms may be able to develop an ongoing management capacity to adapt to physical and transition risks and to develop the resilience of their organizations, supply chains, and markets. Many financial institutions are already starting to do this, but climate risk analysis requires a different set of evolving methodologies, tools, and data sets to account for the many assumptions, inherent uncertainties, and long time horizons. These factors will be applied differently depending on roles, asset classes, relevant available climate risk data, and investment horizons. As an illustration, the following are steps that a financial institution can take in applying climate risk analysis.

### Risk Identification

The first step in identifying potential vulnerabilities to different types of climate risks is a qualitative or quantitative exercise that categorizes climate risks and then applies the categories to the relevant asset classes, sectors, and geographies. This can be done, for example, through a heat-mapping exercise. For transition risk, the identification exercise may use exposure and vulnerability data on the carbon intensities of different sectors and assumptions about a firm's elasticity and ability to pass-through costs. For physical risk, the exercise may use forward-looking climate data to discern the exposure and vulnerabilities of different sectors to specific climate impacts based on their geographic location, as well as their ability to improve resilience with hardening measures. Mapping out risks should include the transmission mechanisms of climate risk into financial products and services. For example, banks that have more concentrated long-dated loans are likely to face greater credit risk exposure through their lending than asset managers, which have greater market risk exposure.

### Risk Assessment and Measurement

Next, financial institutions need to quantify their risks. Climate risk is particularly difficult to assess and measure since it is highly uncertain, non-linear and can affect different types of assets, companies, sectors, and geographies differently. Financial institutions may use various approaches, including top-down or bottom-up, based on the type of risk, the structure of their business, and the balance between the efficiency of the analysis and its effectiveness

in informing risk management decisions. For example, to assess its liquidity position, a bank may consider a top-down climate stress test, applying a set of asset-based shocks to its tradable assets. Such a top-down approach may be relevant for a bank that has a diverse global portfolio of credit counterparties and a loan book that is more short-term and marked-to-market. Bottom-up approaches often require asset-level data, which is often limited.

A range of analytical methods may be necessary to manage credit risks and distinguish relative vulnerabilities within a portfolio. Examples could include portfolio review by sector or specific analysis of more material exposures, such as bottom-up analysis at the company-level. This may require enhanced due diligence of companies to gather the relevant climate risk data such as Scope 1, 2 and 3 emissions exposure, elasticity studies to understand vulnerability to price adjustments, and organizational resilience efforts, including insurance and business model transition plans. Physical risk assessment for material exposures in particular requires asset-level analysis since it is location specific. However, some transition risk assessments may also require geographic data (for example, for a power company, the electricity generation mix of coal, gas, renewables, and nuclear and whether it operates in jurisdictions with current or future carbon regulations). Resilience and the application of risk mitigation measures are critically important and may be evaluated by a firm's (i) utilization of risk transfer mechanisms; (ii) ability to pass through costs; and, (iii) financial wherewithal to manage risk, among other structural mitigants. While financial institutions may have different levels of capacity today, all should work to enhance their assessment protocols and frameworks.

### Scenario Analysis

As explored more broadly in Chapter 6, scenario analysis can help incorporate uncertainty into decision-making and is increasingly being used to analyze climate risk. Rather than trying to predict the future precisely, which is inherently unrealistic, scenario analysis attempts to put contours around the range of possible outcomes—from best case to extreme but plausible—by testing scenarios that are the most relevant to business planning and risk management. In doing so it can elucidate the risk of assets and portfolios in inherently hard to predict events. Scenario analysis can inform existing risk management processes, such as counterparty due diligence, concentration monitoring, and industry limit settings, and allow adjustment over time.

### Risk Monitoring and Management

Finally, as financial institutions conduct analyses to quantify climate risks and understand risk concentrations and material exposures, they should consider how to effectively size their risk appetite and monitor and manage their climate risk to stay within their risk appetite. For example, metrics such as climate-related value at risk<sup>4</sup> or exposure to high carbon intensity

<sup>4</sup> Value at risk (VaR) quantifies the size of loss on a portfolio of assets over a given time horizon, at given probability. Estimates of VaR from climate change can be seen as a measure of the potential for asset-price corrections due to climate change (Dietz, et al., 2016).

sectors could be monitored and managed against established industry limits defined by risk appetite. Monitoring would not only enable institutions to assess changes to climate risk exposure and sensitivity over time, but also to identify appropriate adjustments to mitigate the risk. Depending on the nature of their business, financial institutions could shift the allocation of capital in their portfolio from higher climate risk companies to lower climate risk companies, adjust their underwriting and investing exposures to different sectors or geographies, adjust the tenor or other structural aspects of their loans, or reduce insurance underwriting exposure to higher climate risk companies. Financial institutions also could manage climate risk by increasing their sustainable investments (as described in Chapter 8) and by encouraging companies to improve resilience through climate mitigation and adaptation activities.

### Building the Necessary Capacity and Skills

A key step in establishing and executing a climate risk framework, including incorporating any requirements by financial regulators as described in Chapter 4, is developing knowledge of the topic and a process for accountability. The assessment of climate risk requires novel capabilities for complex forecasting and data interpretation. Clearly defined governance structures, including at the senior management and board level as well as within existing risk owners, will help guide capacity building.

Firms currently are not investing sufficiently in employees with the analytical skills and experience necessary to understand the suitability of different datasets and methodologies for different use cases. Education and awareness training sessions at various levels of an organization can help, along with a growing number of external resources. For example, a significant body of research has been published, and industry groups and regulators have convened to pilot tools and share best practices. Climate risk management will improve—and regulators' expectations for it will grow—as companies embrace lessons learned from the ongoing development of effective datasets, analysis, and best practices. Overall, sufficient investments in human capital and market intelligence are critical for adaptive capacity and organizational resilience.

### Approaches to Climate Risk Analysis Across the Financial System

The financial system comprises a wide variety of financial institutions that play a range of roles. Most institutions will—at some point—likely need to undertake climate risk analysis. However, the specific methods of climate-related risk analysis, as well as its urgency, will vary widely. The following section illustrates how key participants in the financial system could accrue value from climate risk management, depending on the nature of their particular business. Chapter 8 further discusses climate risk management through sustainable investment.

### Fiduciary Duty

A wide variety of financial institutions owe various types of fiduciary duties to their beneficiaries and clients. The extent to which fiduciary duties allow or require the consideration of climate risk and other financial ESG factors is an evolving debate in American law (Gary, 2019; Schanzenbach and Sitkoff, 2020). In general, fiduciaries need to consider material risks in supporting the financial goals of their beneficiaries or clients. The duty of loyalty requires the adviser or asset owner to act in its clients' or beneficiaries' best interests, while the duty of care requires the fiduciary to maintain a reasonable standard of care when acting for its client or beneficiary. In many cases, fiduciary duty incorporates an investor's consideration of material risks and the appropriate integration of those risks in investment strategies to support beneficiaries' or clients' financial goals.

Fiduciary duty requires the assessment of material risks and the management of these risks on behalf of stakeholders in keeping with their stated long-term goals, and climate risk is increasingly being recognized as one such risk. As fiduciaries, many asset owners have a responsibility to manage assets on behalf of others and in many cases also match the timing of liabilities (such as, beneficiary payouts) with returns from investments (for example, asset liability management, (ALM)) and ensure that investments are managed for future generations. Climate risk is therefore a key consideration for long-term asset owners who are looking to meet ALM and intergenerational goals. Asset owners with a given mission, including the long-term support of an institution or beneficiary population, should consider the benefits climate-related investments could bring to their financial and mission-given goals. A fiduciary adviser or asset manager owes each of its clients a duty of loyalty and a duty of care and must act consistent with these obligations. As with the beneficiaries of asset owners, the clients of asset managers may have different risk appetites, time horizons and financial objectives. Fiduciary duty also applies to other aspects of the financial system, such as the duty of corporate managers to their shareholders.

### Asset Owners

Asset owners, whether they are individual investors or large institutional investors such as pension funds, take risks they deem appropriate to meet their individual or institutional goals. In most cases, and for pension funds in particular, their investment goals are generally focused on maximizing long-term return while minimizing risk. Climate risk impacts are likely to be material at these time horizons. Climate risk management can influence asset owner decisions and activities in many ways.

The impact of climate risk on asset values in different sectors, geographies, and asset classes can inform decisions about strategic asset allocations. Over a longer horizon (10-plus years), a significant portion of returns and risk are attributable to strategic asset allocation, in other words, the relative weighting of investments across different asset classes or different regions. An asset owner with a longer time horizon will want to factor in climate-related

risk when determining, for example, which regions or asset classes to focus on and which to avoid when deploying capital. Subject to normal financial considerations such as asset values, the asset owner might reduce capital allocations to more carbon intense sectors and to countries that are more vulnerable to climate change and increase allocations to transition-resilient asset classes such as clean energy. Asset allocation decisions can act as a hedge to climate risk. For example, allocations to climate-resilient asset classes can be added to hedge against unavoidable climate risk in other asset classes. In addition, for asset owners who invest based on market benchmarks, allocation considerations will need to consider the underlying benchmark.

In screening and constructing their portfolios, asset owners can invest through external asset managers or make direct investments. When investing through external managers, they can at times co-invest alongside these managers. For direct investments and co-investments, asset owners make investment decisions within chosen asset classes such as corporate equity, debt, or infrastructure and project level investments. Climate risk analysis can be incorporated directly into due diligence and screening of investments and can inform investment decisions, including whether to go long or short on, or overweight or underweight, particular opportunities. An investor who forecasts the manifestation of a transition risk, such as imminent climate policy action, may want to create a portfolio that underweights, excludes, or goes short on companies with significant transition risk. Asset owners also can incorporate climate risk analyses in screening and selecting external asset managers—for example, looking at whether a manager's processes appropriately account for and manage "non-traditional" risks, including climate risk, and whether a manager's strategies reflect strong investment processes and fall within risk tolerance guidelines. Asset owners may decide to use thematic asset managers such as those that have a clean energy or sustainable transport focus.

Through portfolio management and stewardship, asset owners monitor and engage with managers and companies to ensure performance over the lifetime of their investments. Knowledge of emerging climate risks, such as increased regional vulnerabilities to wildfires or impacts on assets or company value due to transition risks, can motivate asset owners to encourage asset managers or company managers to enhance their management of climate-related risks—for example, by encouraging resiliency planning and accelerating net-zero transition plans. Through this engagement, asset owners use their influence to drive changes that align with their investment objectives, including objectives for climate risk.

### Asset Managers

Asset managers work on behalf of asset owners to meet return objectives while minimizing risk. Asset managers are an extremely varied group, and therefore appropriate approaches to risk management may vary among types of firms, though firms' approaches also have much in common. Like asset owners, asset managers want to understand potential exposure and sensitivity to all types of risk, including climate risk. This is true for individual investment

decisions, portfolio construction, portfolio management and stewardship, and—in the case of certain asset managers that, for example, perform outsourced chief investment officer functions—strategic asset allocation. Asset managers generally have a fiduciary duty to the asset owners whose funds they are managing.

Asset managers generally focus first on meeting investment goals, and second on increasing assets under management. As described above, climate risk analysis is relevant for meeting investment goals through investment screening, portfolio construction, portfolio management and stewardship. In addition, asset managers attract new customers by demonstrating a strong track record and by aligning with the goals of asset owners. Asset managers that manage climate risk have the potential to generate better risk-adjusted returns than asset managers who do not. In addition, asset managers whose investment approaches align with asset owners' fiduciary and mission goals can benefit from increased interest and assets under management.

To enhance a variety of investment approaches that align with asset owners' goals, asset managers can use climate risk analysis. Asset managers can develop portfolios to meet the growing interest in investing in companies that are actively decarbonizing the economy and avoid investing in companies that are carbon intensive. Asset managers can actively encourage companies to meet their investment goals, including by reducing their climate impact. Climate risk analysis can also be used to create climate-friendly passive investment products, which provide a low-cost way for asset managers to meet client investment objectives.

### Commercial and Investment Banks

Banks have wide-ranging risk management frameworks for a variety of risks. Bank risk management frameworks are highly regulated, and Chapter 4 includes recommendations to address climate risk in existing risk management frameworks in a way that is consistent with banks' board-approved risk appetites. Within this risk appetite, banks provide a variety of financial services, each with its own potential use cases for climate risk analysis. These include lending, underwriting, asset management, direct investing, and liquidity and risk management.

In managing climate risk, banks are responding not only to the potential for increased climate risk from vulnerable assets, asset classes and sectors, but also to the wide range of opportunities from financial services and products that integrate physical and transition resilience. Banks are increasingly directing capital to the transition to a net-zero economy and communicating the positive impact of their activities, as are asset owners, asset managers and other types of financial institutions. Climate risk analysis can support the identification of opportunities to direct capital to sustainable investments and provide transparency about these efforts, as discussed in Chapter 8.

As lenders, banks need to understand the risks associated with their loans, including climate risk. For instance, a bank would be wary of lending to projects that faced significant physical risk as well as to companies that faced transition risk that was significant enough to potentially impair their ability to repay. Climate-related risk analysis is important both to individual lending decisions and to loan portfolios. For instance, how would a rapid transition away from fossil fuels change the probability of default of oil and gas borrowers? Scenario analyses and stress tests may increasingly factor into this type of consideration.

Investment banks underwrite securities, facilitating investors' purchase of equity or debt issued by corporations and governments. Securities underwriting depends on investor interest and sentiment, and integrating climate risk may reduce or increase demand for securities on a company and sectoral level. In addition, underwriters can be legally liable regarding appropriate disclosures in selling securities, and often use independent counsel to judge disclosures. Chapter 7 examines adequate disclosure of material climate risk.

Banks can have asset management divisions, with roles and climate risk use cases like those of asset managers. In addition, in certain cases, banks can invest directly, like asset owners. Banks also provide liquidity and risk management products by engaging in a wide variety of transactions with a wide variety of counterparties. As with other financial services, understanding the risk of doing business with these counterparties requires a holistic view of the risk that counterparties will default. Climate risk may be severe enough to jeopardize the counterparty's ability to meet its obligations. Chapter 8 discusses developments in reducing exposure to climate risk within existing derivative instruments and providing new derivative products to hedge against climate risks.

### Insurers

Climate-related risks have the potential to affect the performance of insurance companies' core lines of business and, perhaps, the viability of the companies themselves. Climate risk analysis should play a key role in the companies' risk management processes. For instance, insurance companies should consider climate-related physical risk when determining whether to insure consumer and corporate assets, such as homes and offices. To understand their own exposure and vulnerability to climate risk, they also should understand the aggregate risk in their portfolio of policies. Insurance companies should consider climate risk, including applicable measures of resilience, when determining which types of policies, which sectors, and which regions they want to focus on. Finally, insurers are also significant asset owners and therefore should incorporate climate risk analysis into their investment decisions.

## Recommendations

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**Recommendation 5.1:** Financial regulators, in coordination with the private sector, should support the availability of consistent, comparable, and reliable climate risk data and analysis to advance the effective measurement and management of climate risk.

- Regulators and financial institutions should support the range of platforms for climate data and analysis, including improving public access to governmental data and expertise that can enable climate risk management. They should also support new and existing open source platforms, as well as proprietary efforts to develop new climate risk datasets and tools that leverage innovative technologies.

**Recommendation 5.2:** Financial regulators, in coordination with the private sector, should support the development of U.S.-appropriate standardized and consistent classification systems or taxonomies for physical and transition risks, exposure, sensitivity, vulnerability, adaptation, and resilience, spanning asset classes and sectors, in order to define core terms supporting the comparison of climate risk data and associated financial products and services.

- To develop this guidance, the United States should study the establishment of a Standards Developing Organization (SDO) composed of public and private sector members.
- Recognizing that this guidance will be specific to the United States, this effort should include international engagement in order to ensure coordination across global definitions to the extent practicable.

**Recommendation 5.3:** Financial regulators should proactively encourage capacity building for climate risk management. This should be consistent with the education and training practices supported by agencies in implementing the Sarbanes-Oxley Act of 2002. It should align with and aid in meeting regulator expectations around embedding climate risk in governance frameworks.

## Chapter 6

# A Closer Look at Climate Scenarios

This chapter takes a closer look at the importance of climate scenarios in climate risk management. Scenario planning, also known as scenario analysis, is a systematic process for making strategic decisions in the face of uncertainty. It has a long history of use in military, political, and corporate planning. Climate scenarios, as advocated by the Task Force on Climate-related Financial Disclosures (TCFD) and others, are used by researchers, policymakers, and, increasingly, corporations to analyze potential climate-related futures, including the economic, social, and environmental implications of achieving different temperature and emissions goals.

Scenarios illustrate the complex connections and dependencies across technologies, policies, geographies, societal behaviors, and economic outcomes as the world strives toward a net-zero future. Climate scenarios can help policymakers and financial institutions identify effective and efficient policies for emissions mitigation and carbon sequestration and indicate what measures particular goals would require.

### Why Use Scenario Analysis?

Decision-makers can use scenario planning to consider the effectiveness of climate risk reduction and management measures, including both emissions mitigation and investment in adaptation and resilience. For example, cities facing increased heat stress could plant trees in high-traffic areas, increase the reflectivity of road and building surfaces, provide subsidies for low-income households to buy air conditioning, and provide more cooling centers for high-heat days. Areas facing projected increases in drought could select more drought-resistant crops, produce genetic innovation of seeds, evolve irrigation practices, and improve soil health practices. Together, adaptation interventions undertaken locally can stabilize the overall food production system.

Scenario analysis is an important tool for understanding and integrating climate risks and opportunities into a broader risk management framework. Scenario analysis is less about forecasting the most probable outcomes than it is a “what-if” analysis of different potential projections of the future. A common motto in the scenario planning world rings true—All climate scenarios are wrong, some are useful.

For example, practitioners can analyze scenarios that differ in their global trajectories of greenhouse gas emissions and atmospheric concentrations and thus pose different physical risks and damages from climatic disruption and ocean acidification. These scenarios can express the range of effects that different levels of radiative forcing would have on extreme weather events, sea level rise, agricultural productivity, public health, and other environmental and economic outcomes. Similarly, practitioners can analyze a low-carbon transition scenario in which the United States adopts an ambitious climate policy and compare it to a scenario—called a baseline, business-as-usual, or reference scenario—in which no new policies are adopted. In so doing, analysts gain insights into the potential outcomes (positive and negative) for individual assets, entities, or industries, as well as to the overall macroeconomy.<sup>5</sup>

Climate-related scenario analysis is gaining traction in several contexts, both domestically and internationally. Climate scenarios are being used within companies for internal decision-making; in analyses for disclosure of climate-related risks to investors and regulators; by banks and other financial institutions to assess individual investments and overall portfolios; and by financial regulators as discussed in Chapter 4. Each of these applications may require different scenarios that capture different risks. They may involve different modeling tools, underlying data, assumptions, and time scales. While useful, climate scenarios have limitations. The optimal design of climate scenarios will depend on the goals and methods of analysis. A wide variety of scenarios and of models to analyze the scenarios can be useful depending on the application.

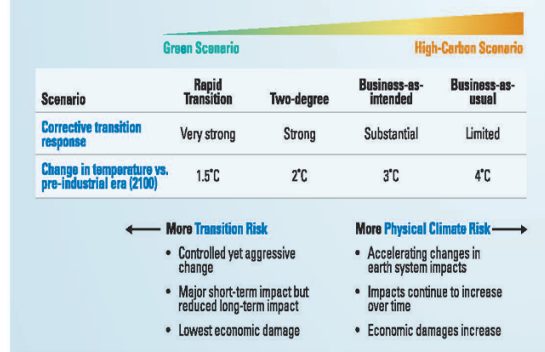
## What Are Climate Scenarios?

### Temperature Scenarios

One common scenario design posts a future in which atmospheric concentrations of greenhouse gases are stabilized at a level at which global mean temperatures do not rise by more than a certain amount, such as 2 degrees Celsius above pre-industrial levels. Lower temperature targets require that greenhouse gas concentrations stabilize at lower levels.

<sup>5</sup> One option for standardizing baseline projections would be to calibrate a model to a projection from the U.S. Energy Information Administration’s *Annual Energy Outlook*. These projections, however, apply only to fossil fuel-related CO<sub>2</sub> emissions and thus would not include projections of other gases and sources in the United States.

Figure 6.1: Relationships Between Transition Scenarios and Climate Risks



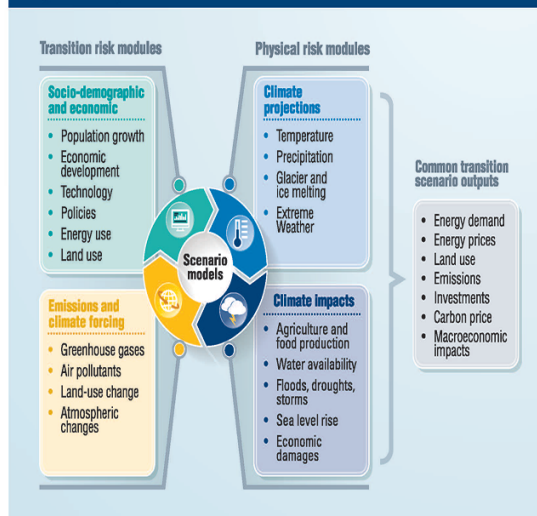
Note: "Business-as-intended" corresponds to Nationally Determined Contributions submitted under the Paris Agreement.

Source: Oliver Wyman (2019)

meaning that fewer net emissions can be emitted globally. Achieving a lower temperature target reduces the physical impacts of climate change but requires more aggressive and disruptive policies to achieve the necessary transition. As represented in Figure 6.1, a temperature scenario analysis can emphasize the physical climate outcomes, the policy outcomes, or both. Because temperature scenarios play out over at least several decades, they tend to involve longer-term projections of both physical and transition risks.

To study how the world can limit warming to a certain level, analysts specify a baseline policy, technology, and socioeconomic future. These scenarios generally include a set of assumptions that incorporate existing or planned global or regional policies, a business-as-usual sociodemographic projection, and projections for technological progress (including negative emissions and sequestration technologies), as highlighted by Figure 6.2. Scenarios can also incorporate disorderly or orderly transitions by specifying how gradually or sharply emissions fall. Policy scenarios specify government interventions that depart from the baseline—such as a carbon price trajectory or emissions limits—that then drive changes in the economy that reduce emissions. Depending on the kind of model and analysis, policy scenarios can apply economy-wide or to a subset of industries, for example just the power sector. In models of the global economy, scenarios can also apply internationally, allowing the investigation of spillovers across countries.

Figure 6.2: Representative Structure for Scenario Models



Source: Adapted from Potsdam Institute for Climate Impact Research (2018); Oliver Wyman.

In scenarios with no or limited emissions mitigation relative to business-as-usual, the likelihood and severity of major physical events will increase over time. These scenarios can encompass a broad range of impacts—including flooding, wind, heat, drought, and wildfire—or be restricted to physical risks of most concern to a given area.

Even under a 2 degrees Celsius scenario, the probability of major physical impacts will increase significantly over successive decades. If global mean temperature rises above 2 degrees Celsius, the probability of major physical impacts increases sharply, as does the probability that multiple perils impact a given region simultaneously. For example, without significant emissions abatement policies, the number of electric substations in Houston that would be exposed to acute flooding is forecasted to rise, significantly increasing risks for communities, chemicals plants, and oil and gas facilities (Jupiter Intelligence, 2020).

### Event-Based Analysis

Event-based scenarios focus on the potential short-term impact of one triggering event, such as the sudden implementation of a major emissions regulation, a technological breakthrough, or an extreme weather event. Triggers can also include sharp changes in preferences, such as increased consumer demand for carbon-neutral products or the refusal of market actors to insure coal mines.

Event-based scenarios could be particularly useful for stress testing by firms and regulators because abrupt or disorderly outcomes may pose special risks for companies and the financial sector because the risks may not be priced into asset values. Modeling shorter-term, disorderly scenarios can also highlight the importance of near-term decisions in managing risks. Event-based scenarios are particularly appropriate for financial institutions. For example, an event scenario that specifies sea-level rise 30 years from now is not necessarily relevant to a trading company whose average risk duration is one year, but it is relevant to a potential mortgage investor.

Event-based analysis is also useful for modeling agricultural production. It allows for the management of short-term weather events within a growing season or annual variance in growing conditions. Decision-makers can then model the point at which the geographic scale, severity, or frequency of localized events collectively drive structural changes or risks to the overall system, informing policies that bolster food security.

Another important component of event scenario design is the potential for multiple simultaneous (and potentially uncorrelated) events—such as this year’s sudden precipitous drop in oil prices as the COVID-19 growth shock was taking hold. Future examples could include a harvest shock in a breadbasket region of the world, which in turn could cause a spike in international food prices and trigger instability in food importing countries. In the face of multiple events, financial risks previously regarded as non-material could suddenly become material. In sum, plausible, relevant scenarios get risk managers’ attention. This achieves the desired outcome of the event-based analysis: informing near-term decisions around managing climate risk.

### Policy Pathways

To analyze the implications of achieving a given emission or concentration target, modelers run “solve-to-match” scenarios in which they estimate the carbon prices or other policy features that would be consistent with achieving a goal. For example, modelers may estimate the greenhouse gas (GHG) price trajectory that, when applied globally, stabilizes atmospheric concentrations of GHGs at a particular level. Alternatively, a climate policy scenario may reflect the actual policies countries are implementing or plausibly could implement. In that case, modelers would simulate different policies in different countries. For any given country, these scenarios may be much less stringent than those that achieve a temperature target of 2 degrees Celsius or less.

Policies can have both near-term and long-term impacts on the economy and the environment. Outcomes of interest to policymakers and stakeholders include policy impacts on prices, economic growth, structural changes in the energy system and other sectors, household welfare, trade, government revenue, and investment. Like any modeling, the further out the projection, the greater the uncertainties. Thus, modelers often caution policymakers to focus on comparisons across scenarios and the direction of change rather than point estimates within one scenario's results.

### Plausibility

Finally, climate scenarios should be both *plausible* and *relevant*, all the while informed by climate science. For physical risks, plausibility comes first and foremost from being based squarely on the latest climate science. Transition policies may vary considerably in their ambition. Because any number of changes in policies and market actor behavior are plausible, regulators should offer a range of climate scenarios. Relevance comes from ensuring that scenarios' time frames and impacts are material to an institution's business.

### Limitations of Scenario Analysis

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While useful, climate scenarios and the models that analyze them have limitations: they are sensitive to key assumptions, most have been developed for purposes other than financial risk analysis, and they cannot fully capture all of the potential effects of climate- and policy-driven outcomes. Like many modeling exercises, climate scenario outcomes are sensitive to key assumptions and parameters, such as the rate of technical change.

For example, the Intergovernmental Panel on Climate Change (IPCC) projects that substantial deployment of negative emissions technologies, such as biomass energy with carbon capture and storage (CCS), would be required to achieve a 1.5 degrees Celsius outcome, and many analyses draw similar conclusions about reaching 2 degrees Celsius. The cost and availability of such technologies has an enormous effect on the estimated price of carbon that would be required to deploy them. Models that assume the availability of low-cost CCS, battery storage, hydrogen fuel cells, or other as-yet-nascent technology will project that the requisite carbon taxes, cap and trade systems, or other policy measures to achieve stringent goals can be modest.

Likewise, models that assume limited availability of low-cost low- or negative-carbon technologies will project that the policies to achieve ambitious temperature targets will be quite costly. Understanding these sensitivities and considering multiple scenarios is useful not only to put the results in relative perspective, but also to motivate policies to promote technological development.

Most climate scenarios are intended for a purpose other than financial risk assessment. For example, the modeling studies assessed in IPCC reports typically involve energy-economy climate models used for policy analysis and research applications. They may report high-level results, such as shifts in fuel sources, but not critical outputs for financial analysis such as the number of electric vehicles on the road. Future enhancements could include more-detailed models, further calculations to generate new relevant variables, and models that better represent the direct and indirect transmission channels through which physical and transition risk could affect financial outcomes (NGFS, 2020a).

Finally, models cannot fully capture the range of how market actors will respond to climate change, how their responses will affect climate change, and how they will influence policies around climate change. As the climate continues to change, decision-makers will respond in ways that can both create and alleviate risks. Damages from climate change may be lower with appropriate adaptation and risk management—or substantially higher if potential low-probability but high-impact risks materialize. Market actor and policymaker responses are complex and should be considered qualitatively along with a quantitative scenario analysis. Some of these limitations are inherent to many models but are in this case further exacerbated by the often-multi-decade time horizon and the complexity and interdependencies of the effects modeled, from ice sheet melting to agricultural yields and migration. To mitigate the limitations of scenarios and modeling, practitioners should analyze multiple scenarios with various underlying assumptions and parameters.

## Practical Applications of Scenarios

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### Climate Scenarios and the Role of Regulators

Climate risk is in part a manifestation of the failure of the current economic system to price externalities and capture them in current accounting, performance measurement, and incentive systems. Scenarios help elucidate the nature of the externalities and translate climate risk into financial risk. Climate risk derives in part from a lack of policies, like a price on carbon, that would internalize the external costs of damaging emissions, but it also comes from traditional accounting practices that ignore these externalities and the prospect of their regulation. This mispricing naturally leads to the misallocation of capital, including the continuing distortions in energy systems that promote climate change.

Financial regulators around the world are aware of this misallocation and mispricing and some are adopting policies to address it. They do not have the authority to directly regulate emissions, but they can, through their financial stability objectives, promote climate risk management—which in turn can facilitate the orderly transition to a net-zero economy. Scenario analysis is an important tool that regulators can use to encourage climate risk management: Have you thought about these risks? Have you discussed them with your clients? What are you doing about it?

#### Climate Scenarios in the Context of Financial Stress-Testing (UNEP FI and Oliver Wyman, 2018)

Clear parallels exist between macro-economic stress testing and climate scenario analysis. Both use scenarios and are undertaken to estimate a firm's level of risk. Despite these high-level similarities, macro-economic risk and climate risk assessment have several significantly different features. The scope, time frame, and use of risk assessment exercises vary widely.

Since the 2008 global financial crisis, the term "stress testing" has generally been used to qualify a comprehensive, firm-wide scenario analysis. In such analyses, most elements of the profit and loss statement and balance sheet are estimated under a set of macro-economic scenarios designed to test the bank's resilience to a specific shock. Macro-economic stress testing is generally used in a regulatory context for the purpose of estimating capital needs and planning capital management for a period of two to five years.

In contrast, climate scenario analysis is not primarily a capital management exercise. Where macro-economic stresses are assumed over a period of only a few years, climate-related risk evolves over decades, though policymaker, consumer, and investor climate-related preferences could change much more abruptly.

In our view, the primary purpose of climate stress testing is to understand and evaluate the sensitivity of a bank's current portfolio to climate scenarios. Capturing projected impacts on the current business profile can facilitate strategic planning and portfolio construction. In other words, climate scenario analysis is more a "what-if" analysis under different transition and physical scenarios rather than holistic stress testing exercise as undertaken for modern capital management analyses.

For instance, the Bank of England's Prudential Regulation Authority (PRA) has imposed supervisory expectations on climate risk management. The expectations include incorporating risks related to climate change into the risk management framework, raising the issue to the board-level, and performing climate scenario analysis. By focusing on enhanced disclosure, the TCFD is also aiming to influence the allocators of capital by enabling the market to better price these risks (TCFD, 2017).

Central banks and regulators—including the Central Banks and Supervisors Network for Greening the Financial System (NGFS)—are also moving ahead on climate risk management and scenario development (Vaze, 2019; NGFS, 2020b). The NGFS provides practical advice on scenario analysis, along with eight high-level climate scenarios (NGFS, 2020c) and detailed technical documentation and modeling data (NGFS, 2020d). The scenarios reflect different projections of future temperature targets, policies, technology development, and climate damages with an eye to providing a foundation for decision-useful analysis by both governments and private sector actors.

### Should Institutions Use a Common Set of Climate Scenarios?

Both common and tailored scenarios are useful. From a practical perspective, it makes sense for practitioners and risk managers to converge on a common menu of scenarios. It would allow better comparability across results and encourage the development of universal scenario analysis capabilities. Policymakers and regulators, in consultation with experts and stakeholders, should develop and prescribe a consistent and common set of scenarios and assumptions, which will help align the collective action necessary to mitigate climate risk. Common scenarios render best practices transparent, minimize gaming, and serve to raise the collective bar. Internationally and domestically, alignment of scenarios across industry and regulatory bodies would also prove beneficial.

However, since policies and climate effects depend on location, it makes sense to customize the basic scenario frameworks with parameters that work for a particular context. For example, a common policy scenario design could specify an economy-wide carbon tax trajectory, but the pertinent initial values and the rate of change in the tax may differ from country to country.

While establishing a set of common standards would clearly be useful, over reliance on one model or scenario may generate systemic issues. It is therefore important that institutions go beyond running prescribed scenarios and use additional scenarios tailored to their exposures and vulnerabilities. By going beyond a pure compliance exercise, tailored scenarios will maximize the benefit for the institutions. Climate scenario analysis can inform adjustments to their risk management practices and improve their decision making more broadly.

Having common and tailored scenarios in place is not dissimilar to the stress testing exercises established during the financial crisis. Regulators deployed a set of scenarios to build investor confidence in the banking system and later also required institutions to run their own scenarios. Once armed with climate scenario modeling capabilities, institutions will naturally be able to run scenarios more tailored to their business needs.

## Recommendations

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### Scenarios and Scenario Analysis

Climate scenario analysis should focus on potential material impacts to the institution's financial portfolio, whether loans, derivatives, or investments. In this context, the following guidelines should be useful:

**Recommendation 6.1:** Analyze more than one warming path. Various long-term paths for climate change exist and can be used for scenario analysis. Three common scenarios are (i) Paris-aligned (for example, consistent with limiting temperatures well below 2 degrees Celsius above pre-industrial levels), (ii) current trajectory and (iii) in-between (for example, late policy adoption with a more abrupt and disruptive response). Each will produce different impacts on institutional portfolios and provide insights that will help to more effectively manage risk, particularly bookends of best- and worst-case scenarios. Scenarios should include both shorter- and longer-horizon paths as appropriate.

**Recommendation 6.2:** Analyze disruptive policy. It is particularly important to analyze a scenario involving a major policy disruption. Transition scenarios have wide implications across the economy, industries, and markets. Unanticipated policies can abruptly strand long-lived capital assets or induce rapid reallocation of capital across sectors and industries. Increasing physical impacts may increase the risks of a disorderly transition as fires, floods, and hurricanes, and the attendant shifts in public sentiment, force governments into unanticipated policy responses. Scenarios are therefore especially relevant for risk management.

**Recommendation 6.3:** Analyze both broad and specific impacts. Scenarios should capture the breadth of impacts but with a focus on materiality, covering a global perspective but enabling regional, country, and sectoral analysis appropriate to the firm's business.

**Recommendation 6.4:** Map macroeconomic and financial impacts. Scenarios should take into account macroeconomic and financial outcomes since these are likely to be most material to financial institutions. Coming up with additional temperature scenarios, for example, is less important than providing some common guidance on potential transmission mechanisms and implications for macroeconomic and financial factors.

**Recommendation 6.5:** Account for adaptation actions to the extent feasible. Tackling climate change necessarily involves myriad adjustments by a range of actors. Modeling the effects of such adaptation actions on portfolios is complex but may become more feasible with future technology and scenario modeling development.

### Policymakers and Regulators

**Recommendation 6.6:** Prescribe a consistent and common set of broad climate risk scenarios, guidelines, and assumptions and mandate assessment against these scenarios, as described in Chapter 4. Regulators, in consultation with industry participants, external experts, and other stakeholders, should develop and prescribe a consistent set of broadly applicable scenarios, guidelines, and assumptions and require institutions to assess their exposure to those scenarios. Climate scenarios should be both plausible and relevant, all the while informed by climate science. Regulators should require a range of climate scenarios, including scenarios covering severe but plausible outcomes. Key assumptions (including policy pathways) and limitations should be transparent. Scenarios, assumptions, and guidelines should be updated as relevant factors are better understood and as policy and technology evolve. There should be a recognition that climate risk will manifest differently across various parts of the financial system.

**Recommendation 6.7:** Provide analytical discretion, to the extent practicable, as long as regulatory needs for consistency and comparability are met. Given the many unknowns and complexities inherent in modeling the economy, climate change science, and policy, regulated entities will need some discretion in how they perform their analysis based on the prescribed scenario. On the other hand, regulators need consistent approaches across firms so they can ensure risks are responsibly analyzed and reported. Investors would benefit from better comparability across scenario-related disclosures. To achieve a balance across these needs, regulators, in consultation with the firms they regulate, should specify key assumptions, scope, and the outputs they expect. As long as regulators' prescribed expectations are satisfied, regulators should allow financial institutions to provide additional context and analysis informed by the nature and complexity of their business.

**Recommendation 6.8:** Encourage domestic and global coordination across regulators to provide a coherent approach. This is an overarching theme of this report and especially applicable to the use of scenarios for risk management. Requiring entirely different stress scenario exercises from institutions operating under different jurisdictions would be costly while generating uncertain value. Harmonizing requirements and prioritizing practical, actionable exercises where feasible would be useful. The high costs associated with multiple regulatory regimes is a lesson of post-financial crisis regulation that can be applied now to climate risk.

**Recommendation 6.9:** Focus on materiality and risk management. Climate risks can manifest in many different ways. Institutions should focus on what matters for them and what decisions need to be made given their specific exposures and vulnerabilities. Such an approach facilitates effective risk management by laying out plausible ways climate risk-related financial losses could occur.

**Recommendation 6.10:** Ensure a mechanism for ongoing refinement and improvement. As science, data, tools, conditions, and policy change, it is important for regulatory guidelines to evolve as well. Data in particular is evolving rapidly. Creating a mechanism for regular updating, rather than relying on ad hoc adjustments, would be beneficial to ensure effective and pragmatic oversight. As regulators better understand the material risks in the system and their spillover effects across industries and markets, a mechanism for ongoing learning and timely refinement from these lessons learned will ensure they are most effectively managing risk across the system.

### Capabilities and Applications

Given the uncertain nature of how the climate will evolve and the limited ability to rely on historical data and back-testing, robust scenario analysis calls for a new set of capabilities that combines statistical, financial, and environmental knowledge.

**Recommendation 6.11:** Tailor analysis to specific exposures. How an institution analyzes scenarios should be determined based on the unique nature of its portfolio. Not every scenario will be material to an institution's portfolio, depending on its largest asset concentrations, longest-dated assets, and highest potential sensitivities.

**Recommendation 6.12:** Use results to upgrade risk management capabilities. Regulators and risk managers can use insights coming from scenario analyses to strengthen and augment existing institutional risk management. Each institution should determine how to do so within its own framework but could include climate-related limits, adjustment to underwriting processes, client engagement, and climate risk appetite.

**Recommendation 6.13:** Beware of false precision. Scenario analysis can provide great value in understanding a range of potential outcomes (particularly between worst and best cases) and in identifying concentrations and relative sensitivities in a portfolio. But results, especially quantitative ones, will be illustrative, not precise, and so should be used accordingly in risk management decisions.

### Risk Managers

**Recommendation 6.14:** Risk managers should develop in-house capabilities, as relevant and in line with best practices, to analyze climate scenarios, understand the key underlying assumptions, and recognize the limitations.

**Recommendation 6.15:** Firms and institutions should consider additional climate scenarios, guidelines and assumptions tailored to their specific needs and vulnerabilities, in addition to those provided by policymakers and regulators, to enhance internal risk management and decision-making. This can focus on generating decision-useful information for identifying and managing climate risk given their specific exposures and vulnerabilities.

**Recommendation 6.16:** The scope, depth, and complexity of the analyses performed by institutions should be proportionate to the materiality of the impact measured.

## Chapter 7

## A Closer Look at Climate Risk Disclosure

As earlier chapters of this report have shown, the physical and transition risks of climate change are increasingly material to firms, investors, and the U.S. economy. When climate-related issues materially impact a firm's underlying operations and capital investments, the firm's financial statements should address them. When these issues pose material risks to firms, other sections of financial filings, such as Management's Discussion and Analysis, Risk Factors, and Description of Business (collectively, MD&A), should address them.

As the physical and transition risks of climate change have manifested with greater intensity and frequency, it has become increasingly clear that these risks affect capital markets writ large. The Sustainability Accounting Standards Board (SASB) finds that industries totaling 93 percent of U.S. market capitalization are materially exposed to climate risk (SASB, 2016). As firms, investors and other capital market actors seek to make informed decisions in the face of these risks, demand is growing among market stakeholders for comprehensive disclosure evaluating climate-related risks and uncertainties.

Climate risk disclosure offers a variety of potential benefits to issuers, investors, and society. For issuers, potential benefits include the improved ability: (i) to identify, assess, manage, and adapt to the effects of climate change on operations, supply chains and customer demand; (ii) to relay risk and opportunity information to capital providers, investors, derivatives customers and counterparties, markets, and regulators; and, (iii) to learn from competitors about climate-related strategy and risk management best practices. Peer group disclosures create an information platform where companies can learn from each other and, as a result, increase their organizational and network resilience.

For other market actors, the benefits of comprehensive climate disclosure are several. Investors can better assess a more refined measure of the long-term cost of capital, as well as risks to firms, margins, cash flow and valuations. In addition, investors and society can gain greater assurance that issuers take these risks seriously. In the absence of robust disclosure, market participants may presume that a company is unprepared for climate-related risks, especially at a time of heightened volatility, such as during an extreme climate-attributed event. Ultimately, a lack of disclosure could also affect market confidence in management, valuation multiples and the cost of capital.

By building on the firm-level disclosures provided by issuers, U.S. financial regulators would be better able to understand the impacts of climate change on financial markets. This greater understanding would allow them to issue relevant guidance or regulation needed to improve the resilience of financial markets in the face of this risk and uncertainty. By the same token, state and local governments—and community members themselves—would be better able to understand how companies in their localities are preparing for climate risks and opportunities that could impact the local economy, labor force, and tax base.

### The Current State of Climate-Related Disclosure

Disclosure frameworks have been developed to enhance the quality and comparability of corporate disclosures. Examples include CDP (formerly, the Climate Disclosure Project), the Climate Disclosure Standards Board (CDSB), the Global Reporting Initiative (GRI), the International Integrated Reporting Council (IIRC), the Sustainability Accounting Standards Board (SASB), and, most notably, the Task Force on Climate-related Financial Disclosures (TCFD). The TCFD recommendations have been integrated into several of the other frameworks. Many of these organizations, together with accounting and standardization groups, have formed the Corporate Reporting Dialogue to strengthen cooperation, coordination, and alignment among key standard setters and framework developers (CRD, 2019).

Investors and financial market actors have recognized this need and have long called for “decision useful” climate risk disclosures (CalPERS, et al., 2007). In 2019, 631 investors managing more than \$37 trillion signed the *Global Investor Statement to Governments on Climate Change*, which called on world governments to improve climate-related financial reporting. The statement specifically called on governments to “commit to implement the TCFD recommendations in their jurisdictions, no later than 2020” (AFP, 2019). As noted by the TCFD:

There is a growing demand for decision-useful, climate-related information by a range of participants in the financial markets. Creditors and investors are increasingly demanding access to risk information that is consistent, comparable, reliable, and clear. There has also been increased focus, especially since the financial crisis of 2007-2008, on the negative impact that weak corporate governance can have on shareholder value, resulting in increased demand for transparency from organizations on their risks and risk management practices, including those related to climate change (TCFD, 2017, p. 1).

In response to market participants’ informational needs, the number of entities disclosing climate-related information has increased, and the quality of the disclosed information has improved over the past several years (Ohm, et al., 2020). Yet, despite this progress, the information disclosed falls significantly short of what capital market actors need to adequately integrate climate risk into their decision-making (TCFD, 2019a).

**Table 7.1: Sample of Leading Voluntary Frameworks**

<b>CDP</b>	CDP issues an annual global questionnaire that collects information on climate change and other sustainability issues to help organizations measure and manage these risks and opportunities.
<b>Climate Disclosure Standards Board (CDSB)</b>	The CDSB Framework provides guidance on how and what to report on climate and other environmental issues in a mainstream annual report.
<b>Global Reporting Initiative (GRI)</b>	The GRI Standards outline how and what to report regarding the material economic, social, and environmental impacts, such as climate change of an organization on sustainable development. The GRI Standards can be used in sustainability reports, as well as in annual or integrated reports. It is oriented at a broad range of stakeholders.
<b>Integrated Reporting (IR)</b>	The International Integrated Reporting Council (IIRC) has developed a reporting framework that explains how an organization can report on the value it creates for itself and others. Reporting on the basis of the framework results in an integrated annual report or in a separate integrated report, and the main audience is providers of financial capital.
<b>Sustainability Accounting Standards Board (SASB)</b>	SASB's Standards guide reporting on financially material environmental, social and governance issues by means of indicators (called metrics) and disclosures for 77 industries. Its main use is intended to be in the communications to investors, such as the annual report, and it has the objective of informing financial stakeholders.
<b>Task Force on Climate-Related Financial Disclosures (TCFD)</b>	Established by the Financial Stability Board, the TCFD developed voluntary, consistent climate-related financial disclosures, building on existing disclosure regimes to develop a singular, accessible framework. The TCFD developed four widely adoptable core recommendations on climate-related financial disclosures of universal applicability to organizations across sectors and jurisdictions, divided into these topics: governance, strategy, risk management, and metrics and targets.

The widespread use of these frameworks underscores that collecting, assessing, and disclosing climate risk information is a practical process, in which most large companies are already engaged. Table 7.1 shows a range of active frameworks. In 2020, 515 investors with \$106 trillion in assets and 147-plus large purchasers with more than \$4 trillion in procurement spending have requested thousands of companies to voluntarily disclose their environmental data through the CDP. More than 7,000 companies globally use the CDP questionnaire (CDP, 2020). More than 10,000 reporting organizations across 90 countries use GRI instrumentation (GRI, 2019), including 74 percent of the largest 250 corporations (GRI, 2020). More than 100 companies have adopted SASB standards (SASB, 2020). Finally, 785 companies have committed to support the TCFD and many already disclose in accordance with at least some of the TCFD's recommendations (TCFD, 2019a).

### Task Force on Climate-Related Financial Disclosures

To accelerate global collaboration to improve climate disclosure, the TCFD was established by the Financial Stability Board at the request of Group of Twenty (G20) nations in 2015 to develop recommendations to help financial market participants understand their climate-related risks. Made up of 26 members representing investors and companies from a range of industries, the Task Force developed 11 recommended climate-related disclosures across four broad areas: governance, strategy, risk management, and metrics and targets. Central to the TCFD's recommendations is the application of forward-looking scenario analysis, which the TCFD states is critical for understanding the strategic implications of climate-related risks and opportunities.

The TCFD's recommendations apply to corporations in financial and non-financial industries, asset owners, and asset managers. The recommendations form a strong foundation for use by securities regulators as the basis for climate disclosure rules. They are based on existing regulatory reporting requirements related to material risk disclosure, including climate risks, as well as the work of CDP, CDSB, GRI, IIRC, SASB and others. Table 7.2 highlights the TCFD's principles for effective disclosure.

**Table 7.2: Principles for Effective Disclosures**

<b>1</b>	Disclosures should represent relevant information
<b>2</b>	Disclosures should be specific and complete
<b>3</b>	Disclosures should be clear, balanced, and understandable
<b>4</b>	Disclosures should be consistent over time
<b>5</b>	Disclosures should be comparable among companies within a sector, industry, or portfolio
<b>6</b>	Disclosures should be reliable, verifiable, and objective
<b>7</b>	Disclosures should be provided on a timely basis

Source: TCFD (2017)

At the same time, the slow rate of growth in the number of firms and other market participants disclosing under the current disclosure regime, which relies to a large extent on voluntary disclosures by companies and other market participants, is not sufficient to meet investor needs, given the urgency of mitigating and adapting to climate change. The TCFD's most recent status report included a review of reporting by more than 1,100 companies from 2016 to 2018, and found that, while disclosure rates were increasing, surveyed companies only made, on average, 3.6 of the 11 total TCFD recommended disclosures (TCFD, 2019b). An analysis of Russell 3000 companies found that 30 percent discussed climate change as a risk in their 10-K filings, but only 3 percent of companies discussed climate risks in the MD&A section of those filings (Rozin, 2019).

Large companies are increasingly disclosing some climate-related information, but vary significantly in the specific information they disclose, presenting a challenge for investors and others seeking to understand exposure to and management of climate risks. The TCFD found variations across its 11 recommended disclosures. For instance, climate disclosure rates varied from as low as 9 percent for one of its recommended disclosures to as high as 47 percent for another disclosure (TCFD, 2019b). In many industries, it is challenging to determine how a company is exposed to climate-related risks in its value chain (Bolton, et al., 2020). Progress has been made in classifying emissions impacts into Scope 1, 2 and 3 emissions, which allows for a risk assessment to evaluate potential weaknesses throughout the value chain (Bolton, et al.). Chapter 5 addresses Scope 3 emissions and transition risk in greater detail.

For all industries in which climate risk is material, the lack of comprehensive and comparable disclosure not only poses a challenge to investors seeking to assess, manage, and mitigate climate risk, but it also impedes the ability of disclosing organizations to inform their strategic responses to climate risk by benchmarking their performance against peer organizations.

To illustrate the point, a U.S. Government Accountability Office (GAO) report provides examples of two contrasting disclosures, with excerpts from U.S. Securities and Exchange Commission (SEC) filings (GAO, 2018). The GAO characterized the first example as containing boilerplate and unquantified information, and the second as containing some quantitative information and metrics.

The first example states, in part, that:

[C]limate change initiatives may result in significant operational changes and expenditures, reduced demand for our products and adversely affect our business ... We assess, monitor and take measures to reduce our carbon footprint at existing and planned operations. We are committed to complying with all Greenhouse Gas [GHG] emissions mandates and the responsible management of GHG emissions at our facilities (GAO, 2018, p. 35).

By contrast, the second example states:

Examples of legislation or precursors for possible regulation that do or could affect our operations include: European Emissions Trading Scheme (ETS), the program through which many of the European Union (EU) member states are implementing the Kyoto Protocol. Our cost of compliance with the EU ETS in 2015 was approximately \$0.4 million (net share pre-tax). ... Carbon taxes in certain jurisdictions. Our cost of compliance with Norwegian carbon tax legislation in 2015 was approximately \$31 million (net share pre-tax)(GAO, 2018, p. 36).

The disclosing firm goes on to highlight concrete actions in response to the risks:

The company has responded by putting in place a corporate Climate Change Action Plan, together with individual business unit climate change management plans in order to undertake actions in four major areas: ... Reducing GHG emissions—In 2014, the company reduced or avoided GHG emissions by approximately 900,000 metric tonnes by carrying out a range of programs across a number of business units.... The company uses an estimated market cost of GHG emissions in the range of \$8 to \$35 per tonne depending on the timing and country or region to evaluate future opportunities (GAO, 2018, p. 36).

These examples highlight the great disparity between intent and disclosure quality. Given the disparity in the quality and extent of disclosures under the existing regime, clearer and more consistent guidance as well as mandatory disclosure requirements may be needed for climate risk disclosure that covers materiality assessments.

## U.S. Legal Authorities and Practices Related to Climate Risk Disclosure

This section complements the discussion of authorities in Chapter 4. It provides additional detail of existing legislation, regulations, and practices in climate risk disclosure, as well as a discussion of the key barriers to more effective climate risk disclosure.

### Publicly Traded Corporations

In the United States, the SEC's Regulation S-K provides disclosure requirements for publicly traded firms. They are required to disclose, through annual or other public filings, known trends, events, or uncertainties that are "reasonably likely to have a material effect" on the firm's financial condition or operating performance. Information is material if there is a substantial likelihood that a reasonable investor would consider it important in making an investment decision.

In response to a petition from 22 institutional investors and other organizations managing more than \$1.5 trillion in assets, the SEC in January 2010 published, *Commission Guidance Regarding Disclosure Related to Climate Change* (the *SEC Guidance* or *Guidance*). It interprets SEC disclosure requirements, as they apply to business or legal developments relating to climate change (SEC, 2010). In addition to the review of the applicability of requirements under Regulation S-K to climate risks, the *Guidance* also discussed several topics that represent “some of the ways climate change may trigger disclosure required by these rules and regulations” and which “a registrant may need to consider” (SEC, 2010, p. 22). These include the impacts of legislation and regulation, international accords, indirect consequences of regulation or business trends, and the physical risk of climate change.

The SEC *Guidance* discussed disclosure requirements applicable to material climate risks: Description of Business, Legal Proceedings, Risk Factors, Management’s Discussion and Analysis, and Foreign Private Issuers. The *Guidance* also addressed disclosure in financial statements, where the SEC noted that “[i]n addition to the Regulation S-K items discussed in this section, registrants must also consider any financial statement implications of climate change issues in accordance with applicable accounting standards, including Financial Accounting Standards Board (FASB) Accounting Standards Codification Topic 450, Contingencies, and FASB Accounting Standards Codification Topic 275, Risks and Uncertainties” (SEC, 2010, p. 22).

The Sarbanes-Oxley Act of 2002 also set out requirements related to corporate disclosure that have resulted in rulemaking by the SEC. Section 302 of the law discusses disclosure controls, including the requirement to establish, maintain, and regularly evaluate the effectiveness of the issuer’s disclosure controls and to have corporate officers certify that such controls are in place (SEC, 2002). Building on this, Exchange Act Rules 13a-14 and 15d-14 require that the issuer’s principal executive officer and principal financial officer certify that the financial statements and other financial information included in the report do not omit a material fact. The purpose of the rules is to avoid misleading quarterly and annual reports and ensure the fair presentation in all material respects of the financial condition, results of operations and cash flows of the issuers.

To the extent climate risk is material to an issuer, Section 302 of Sarbanes-Oxley applies. The SEC’s 2010 climate disclosure guidance points this out and discusses management’s obligation, when determining materiality, to “consider all relevant information even if that information is not required to be disclosed” and “consider whether they have sufficient disclosure controls and procedures to process this information” (SEC, 2010, p. 19).

The impact of the 2010 *Guidance* has been limited. A report by the GAO found that “[c]limate-related disclosures vary in format because companies may report similar climate-related disclosures in different sections of the annual filings,” which may result in “SEC reviewers and investors [finding] it difficult to navigate through the filings to identify, compare, and analyze climate-related disclosures across filings...” (GAO, 2018, p. 19). The report

also found that “climate-related disclosures in some companies’ filings use boilerplate language, which is not specific to the company, and information is unquantified,” thereby limiting the utility of the information to investors (GAO, 2018). While the SEC has not updated the guidance since it was issued in 2010, global expectations for increasingly sophisticated and robust climate risk disclosure in financial filings have grown.

The quality of climate disclosure in the United States by issuers largely remains inadequate for the needs of investors (Mahoney and Gargiulo, 2019). Disclosure in SEC filings has been inadequate, in part, because materiality under U.S. law is often interpreted as limiting required disclosure to short- and medium-term risks, and firms may have assumed that climate risks are relevant only over longer time horizons. However, different firms and industries may have different time horizons over which climate risks are deemed material, taking into account factors like the economic life of assets, the percentage of valuation that can be attributed to future growth, the nature of climate-related risk exposure, and corporate strategy. Physical risk exposure of a company or industry may fall somewhere between near-term acute shocks and long-term chronic stresses. These factors should be evaluated when determining which climate risks—including medium- to long-term transition risks—are material and should be included in SEC filings.

Moreover, even in the case of long-term physical and transition risks, investors have asked the SEC to consider the perspective of shareholders investing for the long-term benefit of their beneficiaries. For example, the California Public Employees’ Retirement System (CalPERS), the second largest pension fund in the United States, “urge[d] the SEC” to consider improvements to its disclosure regime, including “clarify[ing] the definition of materiality to reflect long-term investor needs” (Hoffner, 2016). Guidance published by BlackRock (the largest asset management firm in the United States) and CalPERS for engaging the companies they own make clear their emphasis on long-term value creation and their need for climate risk disclosures to ensure that value is sustained (CalPERS, 2019; Fink, 2020).

### Municipal Securities

The Municipal Securities Rulemaking Board (MSRB) and the Financial Industry Regulatory Authority (FINRA) oversee the municipal securities market. Rules require that underwriters in most municipal securities offerings ensure that municipal issuers make information about themselves and their securities available both at the time of the offering and on an ongoing basis. Voluntary guidelines for primary and ongoing municipal bond disclosure, such as those promulgated by the Government Finance Officers Association (GFOA) and the National Federation of Municipal Analysts (NFMA), emphasize that issuers should provide information necessary to ensure a clear understanding of their condition (NFMA, 2019; GFOA, 2020).

Congress and the SEC oversee the MSRB, and its rules generally must be approved by the SEC before becoming effective. The MSRB is not responsible for enforcing its rules or conducting compliance examinations. The SEC, federal financial regulators, and FINRA

share responsibility for enforcement and compliance examinations in the municipal securities market. In 2010, Congress broadened the MSRB's mandate to include protection of state and local governments and other municipal entities, and extended the jurisdiction of the MSRB to include the regulation of municipal advisers. The MSRB's Electronic Municipal Market Access (EMMA) website aims to protect investors and municipal entities in the municipal market by increasing the transparency and availability of market information, including offering documents, official statements, and continuing disclosures.

To date, municipal regulators and the bodies that oversee them have not issued guidance or rules related to climate risk disclosure for municipal bonds. Two reports have examined applicable disclosure laws and examples of municipal securities disclosure and found climate risk disclosure to be inadequate (Rhodes and Magnini, 2019; Hamilton, 2010). However, the SEC's stance appears to be evolving. At a 2018 SEC municipal securities disclosure conference, the director of the SEC's Office of Municipal Securities asked attendees how market participants were grappling with climate risk. Several panels discussed disclosure of extreme weather events and climate risks, with speakers noting increased investor demand for climate-related information (Olsen, 2018; SEC, 2018).

### Federal Government Entities

The federal government also could strengthen disclosure practices for its own portfolio of assets. The Federal Accounting Standards Advisory Board (FASAB) issues federal financial accounting standards and guidance. FASAB guidance covers the annual Financial Report of the United States Government, as well as disclosure specific to federal departments, agencies and administrative units. In fiscal year 2019, the federal government collected \$3.6 trillion in taxes and other revenues, had a net cost of \$5.1 trillion, and had a balance sheet with \$4 trillion in assets and \$27 trillion in liabilities (Treasury, 2020). Thus, its disclosure of climate risk could be substantial. The federal government may be able to advance innovation in the measurement and disclosure of climate risks across the wide variety of asset classes that the federal government owns and manages. These innovations may reciprocally support disclosure practices and guidance among state and local governments, as well as the private sector.

### Global Climate Risk Disclosure Developments

Climate disclosure has become increasingly important to foreign financial regulators as recognition has grown that climate risks can have significant effects on financial systems. Foreign regulators increasingly recognize that they can do more to both ensure the stability of capital markets in the face of these risks and enable market actors to assess and mitigate the risks. This recognition is coming not only from securities regulators, but also from central banks, prudential supervisors, accounting and auditing overseers, and other regulators.

A consensus is growing among regulators that disclosure, as an important element of a climate risk management strategy, helps market participants better understand and act on the climate risks that they face, and provides comparable information that benefits investors, regulators, and other stakeholders. The International Organization of Securities Commissions (IOSCO), whose members represent 115 countries and more than 95 percent of the world's securities markets, has stated, "[s]ecurities market regulators have a key role to play in reminding issuers to consider such risks and to disclose material ESG [environmental, social and governance] information to investors" (IOSCO, 2019, p. 3). IOSCO has several workstreams to advance this disclosure.

Several foreign financial regulators have recently put forward or are exploring rules for climate risk disclosure, which could act as models to be adapted for the U.S. context. The European Commission (EC) adopted *Guidelines on Reporting Climate-related Information* in June 2019. The guidelines structure the proposed climate-related disclosure into five reporting areas: (i) business model; (ii) policies and due diligence; (iii) outcome of policies; (iv) principle risks and risk management; and, (v) key performance indicators (EC, 2019). Article 173 of France's Energy Transition Law lays out climate disclosure requirements for both listed companies and investors. The regulation uses a "comply or explain" approach that provides flexibility for how firms disclose their risks. Additionally, Article 173 calls for an assessment of reporting progress made during its first two years. This review may lead to more explicit guidance on reporting methodologies. Similar models are being explored by Spain and Sweden, among others.

The United Kingdom's *Green Finance Strategy* called on all listed companies and large asset owners to disclose in line with the TCFD recommendations by 2022 (HM Government, 2019). The strategy also announced that the U.K. government will form a task force to examine potentially effective disclosure approaches, including climate disclosure rules. In 2019, the final report of Canada's Expert Panel on Sustainable Finance proposed that Canada adopt the TCFD recommendations on a "comply or explain" basis (Canada, 2019). Additionally, in 2019, the Canadian Securities Administrators (CSA) issued guidance on how issuers could more effectively disclose their material risks, opportunities, financial impacts, and governance processes relating to climate change (CSA, 2019).

The International Financial Reporting Standards (IFRS) Foundation published a mapping exercise discussing when it would be appropriate for companies to disclose climate issues according to the following IFRS standards: (i) Presentation of Financial Statements; (ii) Impairment of Assets; (iii) Property Plant and Equipment; (iv) Intangible Assets; (v) Fair Value Measurement; (vi) Financial Instruments; and, (vii) Provisions, Contingent Liabilities and Contingent Assets (Anderson, 2019). The Australian Accounting Standards Board and Auditing and Assurance Standards Board discussed the potential financial implications of climate risks that issuers should consider, such as changes in the useful life of assets, changes in the fair valuation of assets, and changes in expected credit losses for loans and other financial assets (AASB and AUASB, 2019).

### The Case for Regulatory Action

Given the inadequacy of the current climate risk disclosures, U.S. regulators should build on their global counterparts' models and issue rules for climate risk disclosures. They should monitor the rules for effectiveness. Such action by regulators would be directly responsive to market demand for enhanced climate disclosure.

Investors are increasingly demanding more comprehensive and useful climate-related information. The Climate Action 100+ initiative—where more than 450 investors representing more than \$40 trillion in assets engage the largest carbon intensive companies—identifies TCFD-based climate risk disclosure as a foundational principle (CA100, 2019). Recent proxy seasons have continued to demonstrate strong investor interest in climate change. Investors and investor groups have called on companies to voluntarily adopt frameworks and standards, proffered by organizations such as the TCFD and SASB, to improve the quality of climate-related disclosure (Fink, 2020; Taraporevala, 2020). Additionally, they have called on the G20 financial regulators to incorporate TCFD into their standards (IAFP, 2019). The Investor-as-Owner Subcommittee of the SEC Investor Advisory Committee recommended in May 2020 that the reporting requirements of issuers be updated to cover material, decision-useful ESG factors (SEC, 2020).

Currently, although many large companies voluntarily disclose their climate-related risks, disclosure generally exhibits inconsistent quality, lacks comparability, and varies by industry (TCFD, 2019b). In its 2019 status report, the TCFD found that, on average, the banking industry was a relative leader in adhering to the TCFD's disclosure recommendations, whereas industries like transportation, agriculture, forestry, food, technology and media, and consumer goods tended to have the lowest rates of disclosure (TCFD, 2019b). This disclosure gap is particularly concerning because financial institutions require effective climate-related disclosures to adequately factor climate risks into their decisions. This imbalance between the climate-related disclosure provided and the information needed for analysis and decision-making underscores the importance of regulatory action to close the gap.

Disclosure of material climate risk is essential, but the existing disclosure regime cannot fill the reporting gaps discussed in this chapter. The primary barrier is the significant ambiguity about when climate change rises to the threshold of materiality, particularly for medium- and long-term risks. Without further clarity on what is material and therefore on what must be disclosed, companies concerned about being disadvantaged by moving sooner than their competitors are unlikely to proactively expand their disclosure. Comparable disclosure cannot develop without clear rules about what metrics companies should consider.

Investors need robust climate risk disclosure to fulfill their fiduciary obligations. Fiduciaries and investors, surveys show, consider ESG risks, including climate risk, as a part of their fiduciary duties (Comtois, 2019), and believe that ignoring ESG factors could lead to “material risk” (Idzelis, 2019). From a global perspective, the IOSCO recommended in 2019 that securities regulators ensure that institutional investors, consistent with their fiduciary duties, incorporate ESG issues into investment analysis, strategies and governance, and consider the material ESG risks of the companies in which they invest (IOSCO, 2019). As discussed in Chapter 8, that is not possible without comparable, reliable and decision useful information.

Credit rating agencies are starting to factor in climate risks in assessing the creditworthiness of public and private sector organizations and transactions because, among other things, climate change can impact cash flows and borrowers’ ability to meet their debt obligations. The continued absence of reliable, relevant, and comparable climate disclosures, both across and within sectors, will hamper credit rating agencies’ ability to fully account for the potential impacts of climate risk on creditworthiness.

U.S. regulators are well positioned to facilitate the process of enhancing the availability and quality of decision-useful climate-related information. Existing regulatory guidance largely applies to climate risk, where climate risks are material to a regulated security (SEC, 2010). However, the unique nature of climate risk means that clearer rules are needed to increase the level and improve the quality of disclosure. Absent this clarity, lack of information will continue to impede the efficiency of markets and their ability to accurately price climate risks and opportunities (Krueger, 2015).

## Recommendations

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In developing and implementing the recommendations below, financial regulators and the entities they oversee should consult with stakeholders, including investors, businesses, global peers, and other market intermediaries to create a U.S. climate disclosure regime. They also should closely coordinate with international bodies and foreign regulators to ensure the U.S. regime is aligned internationally. Because the understanding of climate risk remains at an early stage, any regulatory approach to climate-related disclosure should evolve in line with emerging best practices. Regulators should continually monitor the state of corporate climate disclosures, evolving clarity on the financial impacts of climate change and emerging best practices. This will allow regulators to continually monitor the quality of the information disclosed in a sophisticated manner, and issue supplemental guidance or begin rulemaking where needed to reflect emerging best practice and market needs. A mandatory, standardized disclosure framework for material climate risks, including guidance about what should be disclosed that is closely aligned with developing international consensus, would improve the utility and cost-effectiveness of disclosures.

### Financial Market Regulators

**Recommendation 7.1:** All financial regulators should consider the following principles for effective disclosure, which are mainly derived from principles developed by the Task Force on Climate-related Financial Disclosures, when developing rules on climate risk disclosure, implementing existing rules or guidance, or seeking public comment on actions they should take:

- Disclosures should represent relevant information.
- Disclosures should be specific and complete.
- Disclosures should be clear, balanced, and understandable.
- Disclosures should be consistent over time.
- Disclosures should be comparable among companies within a sector, industry, or portfolio.
- Disclosures should be reliable, verifiable, and objective.
- Disclosures should be based on current consensus science (and updated as the science evolves) and the best available projections regarding climate change impacts.
- Disclosures should be provided on a timely basis.

**Recommendation 7.2:** Material climate risks must be disclosed under existing law, and climate risk disclosure should cover material risks for various time horizons. To address investor concerns around ambiguity on when climate change rises to the threshold of materiality, financial regulators should clarify the definition of materiality for disclosing medium- and long-term climate risks, including through quantitative and qualitative factors, as appropriate. Financial filings should include disclosure of any material financial risks from climate change in a consistent but non-boilerplate manner, as well as a qualitative description of how firms assess and monitor for potential changes in climate risks that may become material.

**Recommendation 7.3:** Regulators should consider additional, appropriate avenues for firms to disclose other substantive climate risks that do not pass the materiality threshold over various time horizons outside of their filings. Regulators should consider that a growing number of companies are creating greenhouse gas reduction targets and strategies out to the year 2035 or 2050, and targeted disclosure related to these items may be appropriate to facilitate robust efforts toward this positive trend.

**Recommendation 7.4:** Recognizing the costs associated with collecting, assessing and disclosing climate risk information, financial regulators should consider whether smaller companies could be provided a longer period of time to provide their initial disclosures, and the specific disclosures required of those companies could be different and less burdensome than those required of larger issuers.

**Recommendation 7.5:** In light of global advancements in the past 10 years in understanding and disclosing climate risks, regulators should review and update the SEC's 2010 *Guidance* on climate risk disclosure to achieve greater consistency in disclosure to help inform the market. Regulators should also consider rulemaking, where relevant, and ensure implementation of the *Guidance*. Such an update could incorporate advice on:

- Information that is needed from all companies in order to enable financial regulators to assess the systemic risks posed by climate change. Federal financial market regulators should work closely with prudential regulators to develop these rules.
- Industry-specific climate risk information. Rules should build from existing standards that provide industry-specific climate disclosure recommendations, for example, those developed by the TCFD, SASB, CDSB, the Physical Risks of Climate Change (P-ROCC) framework, and the Global Real Estate Sustainability Benchmark (GRESB) standards for real estate and infrastructure. Because these standards are already sophisticated, regulators do not need to create their own standards or metrics from scratch. Regulators should encourage stakeholders to partner with these standard-setting bodies to further develop, standardize, implement, and validate these metrics over time. Regulators should also acknowledge, in any rulemaking, that climate disclosure standards continue to evolve, and it could provide issuers flexibility, where appropriate, to adopt these evolving standards.
- Governance, risk management and scenario planning information that demonstrates how well companies are situated for a clean energy transition. Federal financial market regulators should work closely with prudential regulators to develop these rules. Scenario planning disclosure is discussed in Chapter 6. Regarding governance and risk management disclosure, regulators should consider the TCFD's recommendations and the Committee of Sponsoring Organizations of the Treadway Commission/World Business Council for Sustainable Development (COSO/WBCSD) guidance, applying enterprise risk management to environmental, social and governance-related risks.

**Recommendation 7.6:** Regulators should require listed companies to disclose Scope 1 and 2 emissions. As reliable transition risk metrics and consistent methodologies for Scope 3 emissions are developed, financial regulators should require their disclosure, to the extent they are material.

**Recommendation 7.7:** Regarding derivatives, financial regulators should examine the extent to which climate impacts are addressed in disclosures required of the entities they regulate and consider guidance and rulemaking if disclosure improvements are needed. This could include, for example, swap dealers registered with the CFTC, risk management rules that govern risk identification approaches; Quarterly Risk Exposure Reports, and business conduct rules that govern disclosure of material information to counterparties prior to entering into a swap.

### Accounting Standards Regulators

**Recommendation 7.8:** Once climate risk disclosure standards are well advanced, accounting standards regulators should undertake a mapping exercise of the applicability of accounting standards to climate-related disclosure and subsequently issue guidance on disclosure, as appropriate. This would provide U.S. companies greater clarity about how climate risks may be integrated into financial statements.

**Recommendation 7.9:** The United States should direct the Federal Accounting Standards Advisory Board (FASAB) to study and pilot the development of climate-related federal accounting standards, disclosure procedures and practices for U.S. government departments, agencies and administrative units.

### Municipal Securities Regulators

**Recommendation 7.10:** Municipal securities regulators should provide improved tools on the EMMA website to search for climate-related disclosure in municipal bond filings, similar to that provided for publicly traded companies, to allow better assessments of potential climate risk exposure in such assets and how they are being addressed.

**Recommendation 7.11:** Municipal securities regulators and the federal financial market regulator overseeing them should examine the quality of climate-related disclosures in municipal bonds' official statements and continuing disclosures, and whether the disclosure provided is adequate for market participants to assess any underlying climate risk exposure. If disclosure is found to be deficient, they should issue a public statement calling on key stakeholders to improve disclosure, including municipalities, municipal advisers, and banks.

**Recommendation 7.12:** Municipal securities regulators and federal financial market and prudential regulators should study how risks facing municipalities differ from—and could in some cases be more impactful than—risks facing issuers and explore options to enhance disclosure on these issues. Some municipalities already disclose information, as part of their bond issuances, about floods, storms, dam safety, droughts, wildfires, sea level rise, and risk mitigation efforts, and further study could demonstrate that such disclosure should be enhanced.

## Chapter 8

## A Closer Look at Financing the Net-Zero Transition

This chapter examines how financial regulators can accelerate the transition to a net-zero, climate-resilient economy. It focuses on the structural changes and market innovations that can expand capital flows to sustainable finance solutions, which are a key component of managing physical and transition risk in the U.S. financial system. As Chapter 1 notes, it is essential that the United States establish a price on carbon. This is the single most important step to manage climate risk.

Financial products have a variety of risks, and this report has articulated the financial implications of climate risk in detail. Financial innovation is required to further develop the tools and resulting products that can efficiently manage climate risk and facilitate the allocation of capital to an economy-wide, net-zero transition. The transition to a resilient, net-zero emissions future is the linchpin in managing long-term climate risk to the U.S. economy and households. Doing so requires embedding climate risk within the risk management frameworks of financial institutions, expanding climate risk data, building expertise in managing climate risks, leveraging scenario analysis, and improving disclosure.

This chapter highlights a selection of the many measures that regulators, financial institutions, and market participants can adopt to catalyze climate-related investment. Once carbon pricing is adopted, these measures will be equally if not more important in facilitating orderly shifts in investment decisions. While some financial products are already available to assist market participants interested in investing in the transition, this chapter focuses on the scale of investment needed and the gaps where further institutional effort is necessary to facilitate the development of climate-related financial products and services.

### Estimating the Scale of Investment Needed

Reducing emissions and limiting warming and adapting to the changing climate will require significant public and private investment. Key objectives include deploying low or zero carbon technologies, accelerating innovation in carbon capture, utilization and storage technologies (CCUS), sequestering emissions through natural climate solutions, and developing infrastructure and technologies needed to adapt to physical risks.

Investment needs are broadly estimated to be in the trillions of dollars. One estimate comes from the International Renewable Energy Agency (IRENA), which charts an ambitious yet technically and economically feasible path for limiting warming to “well below” 2 degrees Celsius, in line with the Paris Agreement. IRENA estimates that \$110 trillion of cumulative worldwide investment in the energy sector will be needed leading up to 2050 (IRENA, 2019). That equates to roughly 2 percent of average global gross domestic product (GDP) per year over the period. Of the \$110 trillion, \$95 trillion is already required under the reference case scenario of current plans and policies but would need to be redirected from investments in high-carbon to low-carbon activities. An additional \$15 trillion is necessary to further reduce emissions. This transformation is estimated to boost total global GDP by 2.5 percent, or 5.3 percent when considering the avoided climate-related damages relative to the reference case (maintenance of current plans and policies). The transition would result in \$11.8 trillion in stranded assets by 2050, but delaying action would nearly double total stranded assets to \$19.5 trillion by 2050. However, the cumulative benefit in terms of avoided climate-related and air pollution damages ranges from \$50 trillion to \$142 trillion, and reducing fossil fuel subsidies would generate further savings of \$15 trillion by 2050, relative to the reference case.

Decarbonizing the U.S. power grid over the next 10 to 20 years has been estimated to cost upward of \$4.5 trillion (Wood MacKenzie, 2019). This and other estimates generally focus on the direct costs of transitioning domestic energy infrastructure, while there are additional costs to transition transportation, agriculture, and industry. However, these cost estimates reflect significant economic opportunity, and it is useful to consider them alongside the counterfactual costs of business-as-usual, as well as the co-benefits that arise from technological innovation, new categories of labor and expanded employment, and the avoided costs associated with the improved resilience of infrastructure.

Mobilizing the trillions of dollars necessary to finance the technologies and activities that support the net-zero transition will require tapping into vast pools of capital. In a financial environment characterized by ultra-low interest rates, institutional investors are seeking higher returns, as long as investments meet their preferred risk return profile and investment horizons. Despite inadequate incentives to reduce emissions and various structural barriers, U.S. investors are already starting to position themselves for the inevitable transition.

## Barriers to Sustainable Investing

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### Misperceptions about Risk-Return

Multiple barriers may be holding back U.S.-based institutional investors. One involves a common, long-held misperception among investors that sustainable or environmental, social and governance (ESG) investments necessarily have lower returns relative to traditional investment strategies. This is based on the historical view that ESG investing is a values-driven activity, and that ESG data and principles may be incongruent with a fiduciary duty to seek the highest returns. This perspective underlies historical practices like omitting certain companies or sectors via ESG screens. These misperceptions ignore the evolution of a wide range of financial ESG factors and strategies, as well as the proposition that impact investing may yield additional returns. This report in general, particularly Chapter 5, details the variety of ways climate risk management could drive improved risk-return.

The nature of financial markets perpetuates these misperceptions. Asset owners and managers set investment strategies and evaluate returns based on benchmarks and strategic asset-allocation targets. Managed funds often raise capital based on explicit terms including investment theses and lock-up periods ranging from months to years. Return targets tend to be based on historical returns or on capital market forecasts premised on economic growth and other factors. This practice drives a strong status quo bias that undermines a more complete evaluation of what the future may bring, including future opportunities associated with managing climate risk. Without a historical track record or clear empirical justification, it is often difficult for traditional investors to integrate sustainable investments into their portfolios. Ultimately, empirical evidence does not support these collective barriers characterizing sustainable investments as inferior. Studies analyzing financial performance across a large sample of ESG approaches show that making investment decisions using ESG factors does not hurt investment performance across the sample, and, in some cases, it enhances risk-adjusted returns (Friede et al., 2015; Morgan Stanley, 2015a; Morgan Stanley, 2015b; Clark et al., 2015; Khan, et al., 2016).

### Insufficient Investment Opportunities

A second barrier to sustainable investment is the shortage of climate-related investment opportunities relative to investor demand. Demand for sustainable investments is large and growing. Coalitions of asset owners, asset managers, and other financial institutions are expressing interest and support for sustainable investment. For example, the U.N. Principles for Responsible Investment (PRI) includes more than 3,000 investor signatories with more than \$100 trillion in assets under management. However, expressions of support have not translated into the necessary capital flows.

In addition, a growing number of asset owners, including endowments and pension funds, are committing to transitioning their investment portfolios to net-zero emissions by 2050—a goal consistent with a maximum temperature rise of 1.5 degrees Celsius above pre-industrial temperatures and in alignment with the Paris Agreement. The Paris Agreement has increasingly motivated U.S. and global companies and investors to voluntarily commit to reducing their carbon footprints, and some firms have pledged to achieve net-zero or net-negative emissions. Recently, Harvard University and Stanford University, which manage two of the five largest university endowments globally, committed to net-zero portfolios (HMC, 2020; Stanford, 2020).

The market for products widely considered to be “green” or “sustainable” is rapidly expanding but remains small relative to institutional investors’ needs. A growing number of opportunities are focused on integrating climate risk and investing in the transition, but many of the opportunities have been within private markets, including venture capital, private equity and infrastructure. Public equity and debt markets are significantly larger and more liquid but offer far fewer sustainable investment opportunities.

With respect to debt, even though global green bond issuance hit a record \$255 billion in 2019, it was not nearly enough to satisfy investor demand, particularly once emerging market risk and other constraints were considered (Chestney, 2020). Similarly, investors have few options for sustainable U.S. corporate debt exchange-traded funds (ETFs). Among the largest global asset management firms, only a few U.S.-domiciled ETFs with any measure of sustainability focus are currently available. A variety of factors are driving these limitations.

The lack of sufficient scale is even more clear in equity markets, as is the gulf between Europe and the United States. In Europe and elsewhere, investors are shifting increasing portions of their portfolios to “green” or “sustainable” assets. For example, as of March 2020, total sustainable European fund (open-end funds and ETFs) assets reached a record of more than \$680 billion (Morningstar, 2020). By comparison, sustainable U.S. fund (open-end funds and ETFs) assets totaled nearly \$120 billion (Morningstar, 2020). In the first quarter of 2020, \$45.6 billion globally flowed into ESG funds, with 72.4% of ESG inflows in Europe relative to 22.8% in the United States, and this occurred in the context of an outflow of \$384.7 billion for the overall fund universe (Morningstar). These trends suggest that U.S. demand for these products may be weaker relative to European demand for a variety of reasons, including the lack of proper incentives.

### Concerns About “Greenwashing”

A third barrier holding back sustainable investment may be concerns about potential “greenwashing.” Some investors lack confidence that “sustainable” or ESG-labeled products are as green as they claim to be. These concerns form the partial basis for a current SEC Request for Comment about the naming of funds and investment companies (SEC, 2020). The absence of widely accepted, consistent definitions and standards for climate risk data in

general, and sustainable investing in particular, may be hindering market development. It is difficult for investors to understand what labels such as “ESG,” “sustainable,” “green,” “low-carbon,” or “net-zero” actually mean and to compare products that carry the same label.

Today, financial products may be identified as sustainable or green, based on the proprietary research of the provider. Investors looking for consistency in labeling can rely on private certification entities, but with potential implications for cost and comparability. Private certifications are limited to a comparatively narrow range of sectors and asset classes. Their advantage is that they likely incorporate emerging intelligence and expertise on climate risks, uncertainties, and opportunities. Their disadvantage is that comparability may be difficult.

Credible data is the foundation of any financial product’s sustainability credentials. It can be attained from emerging public source and proprietary data providers, as well as from corporate disclosure and reporting. The goal is consistent and comparable information. A lack of available climate risk data is hindering the development of sustainable investment products, including derivatives based on ESG or sustainable assets. For example, certain carbon indices are designed to screen for companies based on their carbon intensities or environmental performance. But to build datasets like that, clearly demarcated methodologies and definitions are needed to ensure the integrity of financial products such as over-the-counter (OTC) and listed derivatives with ESG and, more specifically, carbon-related underliers. Clear definitions and methodologies are also necessary for central counterparties to adequately assess and manage risks associated with listed ESG contracts.

### Policy Uncertainty

One of the most critical factors holding back sustainable investment is policy uncertainty. The lack of carbon pricing and uncertainty about climate policy more generally create enormous financial risk and make long-term investments in energy, infrastructure and other sectors difficult to effectively value. This difficulty reduces the flow of capital to renewable energy and other existing low-carbon technologies, and to new technological innovations needed across nearly every sector. Technological innovation, from initial research through pre-pilot, pilot and initial commercialization, is an area of particular market failure, given the long time horizon to commercialization, the capital intensity of many sectors, and the risk aversion of market participants.

While the absence of climate policies impedes sustainable investment, so too do various existing policies. One example is regulation of financial products that U.S. companies may offer to their employees through retirement plans. The Employee Retirement Income Security Act of 1974 (ERISA) and the rules adopted under it by the U.S. Department of Labor (DOL) govern the management of retirement and pension plans. ERISA articulates fiduciary responsibilities that companies must follow in retirement plan offerings. Elements of this regulation may be chilling the offering of sustainable products in U.S. retirement plans.

Guidance issued by the DOL in 2018 and recently proposed amendments to ERISA rules limit how managers of ERISA assets may consider ESG benefits (DOL, 2018; DOL, 2020). Because of misperceptions about risk-return, ERISA plan sponsors and managers also may believe they could risk violating their fiduciary duties if they integrate sustainability factors into their investment approach.

### Catalyzing Structural Change and Market Innovation

Addressing barriers and building an ecosystem that supports sustainable finance will require structural shifts. The ultimate goal is that all investment products and services internalize climate risks and opportunities in a manner that drives dynamic competition and mitigates GHG emissions. Effectively pricing carbon is the best way to recognize the inherent risk-return profile of sustainable investments and would significantly expand the market for them. However, gaps remain, and policymakers have an important role to play in reducing barriers and harnessing the innovative capacity of markets.

### Fiscal Policy

Beyond carbon pricing, a wide range of complementary policies can mitigate climate risk and advance the transition to a net-zero emissions future. The U.S. government's fiscal authority—its capacity to spend, borrow, and structure the tax code—can significantly increase the scale of investment in sustainable projects. To be sure, trillions of dollars are needed for the transition, and there are limits to how much the government can do on its own. Additionally, constant changes in the direction of fiscal policy can sustain policy uncertainty. Fiscal policy nevertheless can advance the transition in many ways. Project standards can be designed to minimize “greenwashing,” for example. Fiscal policy can support the many co-benefits of the transition, including job creation and the promotion of equity for historically marginalized communities. Additionally, it can drive continued innovation by funding basic scientific research and the deployment of mature technologies.

Fiscal policy includes economic stimulus, disaster relief, and infrastructure, all of which have implications for climate risk. The direction of public investment could increase or decrease climate risk across the financial system. The ongoing response to the COVID-19 global economic crisis has included urgently needed economic stimulus. Future spending offers possibilities for reducing the structural barriers holding back the transition to a net-zero emissions future, while simultaneously supporting the economy. Policymakers’ ambition should be to enhance the economy’s long-term potential, including by managing climate risk, not to maintain the status quo.

### Catalyzing Private Capital

Government spending can be structured to more directly address market failures and structural barriers that impede private sector capital flows. These efforts can harness the power and innovation of the financial system to efficiently drive capital toward the net-zero transition. These programs can increase total investment by leveraging private sector dollars alongside public sector dollars. These efforts can help expand the scale of both investor demand and the supply of quality investment opportunities, improve risk-return by stimulating the integration and pricing of climate risk, and aid in definition standardization to alleviate “greenwashing” concerns.

Several successful government programs focus on de-risking certain investments and attracting private capital—effectively expanding the universe of investable green assets. The U.S. Department of Energy (DOE), U.S. Department of Agriculture (USDA), and U.S. Department of Transportation (DOT) have the authority to encourage clean energy and resilience through the loans and loan guarantees they deploy to a range of large-scale infrastructure projects. As of year-end 2019, the DOE Loan Programs Office (LPO) had \$44 billion in available loan and loan guarantee authority to support advanced vehicle manufacturing; advanced nuclear; advanced fossil energy (for example, CCUS); renewable energy and energy efficiency; and tribally-owned energy projects (DOE, 2020). Entities such as the Advanced Research Projects Agency-Energy (ARPA-E) provide capital and support to advance innovations that are still too nascent for private sector investment. ARPA-E funding typically averages \$500,000 to \$10 million. It has provided \$2.3 billion since 2009 to 850 projects, many of which led to patents, new companies, or partnerships with other government agencies; 20 percent of the projects went on to raise \$3.2 billion in private sector funding (ARPA-E, 2020). These credit enhancements and co-investments attract private sector funds.

Green banks at the state and municipal level have directly addressed a range of barriers and opportunities. Green banks can mitigate barriers of scale by aggregating small transactions and supporting the development of new products. They can foster investor trust by participating in classification guidance and leading the initial development of new markets. They can also help address concerns about financial returns by de-risking investments and familiarizing investors with new markets. Ultimately, many of these programs are focused on attracting private sector capital to increase total funding.

For example, the New York Green Bank (NYGB) is a state-sponsored specialized financial entity that collaborates with the private sector to accelerate and expand sustainable investment. NYGB invests with the goal of unlocking significantly more private capital. Examples include warehousing and aggregation facilities, term loans, credit enhancements, and construction finance. As of the first quarter of 2020, NYGB had invested nearly \$960 million in energy efficiency, solar, sustainable transportation, and fuel cell projects.

NYGB is targeting a ratio of total project investment to NYGB funds of 8-to-1. Its goal is to eventually generate \$8 billion in investment from its \$1 billion of capital. So far, the bank has mobilized \$2.6 billion (NYGB, 2020).

Existing authorities could be leveraged and expanded into a more unified program, perhaps under a federal umbrella, that could coordinate a wide range of government programs and provide an increase in institutional capital to maximize their impact. Potential tools could include those that are already actively used, such as lending and credit enhancements. The federal umbrella could also facilitate the initial capitalization of state and local green banks and other state climate initiatives.

### Supportive Regulatory Policy

Regulators have long supported innovation in the markets they oversee. They could do the same for sustainable investments. Regulation, for example around permitting and federal leasing, can stimulate capital flows. Financial regulators have sought to facilitate financial technology (fintech) innovation and at the same time tried to ensure their policies keep pace with the ever-changing financial services industry. By the same token, fintech innovators need a detailed understanding of regulation to pursue their work successfully.

Financial regulators support innovation through regulatory labs or sandboxes. A lab serves as a forum for firms to engage with regulators. They help regulators adapt their regulatory frameworks to innovation and help market participants navigate regulation. Sandboxes go further by creating a formal structure for innovators to develop and test new products and services, with regulatory oversight and support. Labs and sandboxes can also drive innovation via accelerators, grants and competitions providing awards in specific areas. Labs and sandboxes established by domestic and foreign regulators currently focus on fintech innovation in general. For example, the CFTC established LabCFTC with the aim of—“facilitating market-enhancing FinTech innovation, informing policy, and ensuring that the agency has the regulatory and technological tools and understanding to keep pace with changing markets” (CFTC, 2019).

A similar approach could be used to drive market innovation for climate-related financial products. Climate-related financial innovation, including climate data platforms and climate fintech solutions, is crucial for managing climate risk and driving the transition to a net-zero emissions future. A climate finance lab or sandbox could enhance emerging innovations relating to climate risk data and analysis and facilitate the development of innovative financial products.

In addition, labs and sandboxes, as well as catalytic funding programs, can facilitate access to data and expertise. By improving the availability and consistency of data, government programs can reduce private sector risk aversion to creating new or modified financial products and services (Keenan, 2019). Improved data integration and access would encourage the development of new climate-related technologies and products, particularly the emerging efforts to use nature-based solutions for physical climate resilience and

adaptation investments. Some programs to integrate and communicate data already exist, such as the U.S. Department of Energy's Energy Investment Center, which was established to share the technical expertise of the Department's National Laboratories with investors.

Finally, the clarification of existing rules could help unlock sustainable investment. As noted, regulatory concerns may discourage ERISA plan sponsors and managers from integrating climate-related factors into their investment approach. Similar concerns arise in other situations where there is fiduciary duty. They include the potential misperception of risk-return, worry about violating unclear standards (including those caused by conflicts or changes in regulatory guidance), and potential liability for the underperformance of investments being attributed to their sustainability features.

Clarification is necessary to confirm the appropriateness of making investment decisions using climate-related factors—and more broadly, ESG factors that impact risk return. Because climate-related factors may affect financial performance, they should be considered by fiduciaries to the same extent as “traditional” financial factors—such as valuation, profitability ratios, and management strength. Regulatory efforts must not discourage the consideration of these factors, and instead should encourage their consideration. Climate risk and opportunities, as well as broader sustainability and ESG factors, need to be considered as part of the analysis of financial fundamentals and the normal investment process.

### Innovation in Derivatives Markets

For more than 25 years, derivatives have been used to hedge climate-related risks. The need for new products likely will grow. Various OTC and exchange-traded climate-related derivatives currently are used by agricultural, energy and metals market participants, as well as financial entities. These instruments include traditional weather derivatives, electricity futures, and relatively new instruments, such as ESG futures and carbon derivatives based on equity indices. Broadly speaking, derivatives can address climate-related risk through adjusting existing instruments and by providing new instruments.

To advance the market for climate-related derivatives, regulators should consider appropriate and targeted exemptions from their rules when needed to facilitate coordination with other regulators and promote market development. For example, the CFTC classified environmental commodities as non-financial commodities, thus allowing them to be purchased and sold pursuant to excluded spot and forward contracts. This paved the way for primary regulation by the agencies designing the underlying market—the Environmental Protection Agency for Renewable Fuel Standards (RFS) markets and state agencies for existing Renewable Portfolio Standards (RPS) and carbon markets.

The CFTC provided guidance to these primary regulators based on its experience as a market regulator. For example, in its *Report on the Oversight of Existing and Prospective Carbon Markets*, the CFTC encouraged broad and open market participation and emphasized

that “rules and trading systems should be designed to encourage market liquidity, facilitate price discovery and allow those directly and indirectly impacted by the regulation of carbon emissions to efficiently hedge associated risks” (CFTC, 2011, p. 50). Appropriate oversight of primary and secondary markets could be revisited “if or when Congress considers Federal market-based options for reducing greenhouse gas (GHG) emissions” (CFTC, 2011, p. 52).

### Reducing Exposure to Climate-Related Risks within Existing Instruments

Businesses and consumers are increasingly focused on the environmental impact of the commodities they produce and consume. As a result, businesses often desire greater oversight and understanding of their supply chains to ensure that the commodities meet certain sustainability definitions and standards. This trend will likely impact not only commodity spot markets, but also the corresponding derivative markets.

As a result, commodity derivatives exchanges may seek to incorporate sustainability- and climate-related elements into existing contracts. As environmental standards evolve, futures contracts will need to be modified to replicate changes to the physical market. Consider, for example, the recent transition from high-sulfur fuel oil (HSFO) to low-sulfur fuel oil (LSFO) to comply with the terms of the United Nation’s International Maritime Organizations 2020 international agreement. Or the metals industry, where the London Bullion Market Association (LBMA) introduced a Responsible Sourcing program for precious metals that aims to protect the integrity of the global supply chain for the wholesale precious metals markets. In conjunction with these physical market changes, all COMEX physically delivered gold futures contracts were modified to ensure compliance with LBMA Responsible Gold Guidance, which formalizes and consolidates standards of due diligence among all LBMA Good Delivery Refiners. Agricultural suppliers are increasingly asked to deliver “greener” commodities with specified environmental traits, such as low-methane rice, the standards could become incorporated into existing product specifications.

However, there are various challenges to modifying these exchange-listed contracts. Some market participants may be reluctant to support sustainability specifications because of a lack of verifiable climate-related standards and concerns that sustainability specifications may reduce the liquidity of the product (World Federation of Exchanges, 2019). Commodity exchanges should work closely with the industry and the CFTC to anticipate future product changes influenced by climate risk so that contracts related to them can be traded effectively. Private sector players can also help establish trust and transparency for climate-related standards and guidelines as existing products are modified to incorporate sustainability elements. This is like the role price reporting agencies currently play in some commodity markets and can help advance price transparency in derivatives markets.

Modifications to existing products are not limited to derivatives traded on commodity derivative exchanges. More recently, some OTC swap contracts have been modified to embed new sustainability incentive mechanisms. Appearing first in an OTC interest

swap in August 2019, and then in October 2019 in a foreign exchange forward swaps, this mechanism consists of reducing one counterparty's payment in the event it achieves some pre-agreed sustainability performance target. If expanded across derivatives, this mechanism could provide market participants with a financial incentive for improved environmental performance.

### Providing New Derivatives Products to Hedge Climate-Related Risks

To serve the long-term need for price discovery and risk mitigation, the derivatives industry must provide new, innovative products focused on climate risk. However, there is no comprehensive and comparable set of metrics for climate-related risks, and the ability to accurately quantify climate risks is critically important for financial functions ranging from assessing lending risk, to pricing derivatives, and, ultimately, to constructing sustainable finance products. Derivatives products can only be developed if climate-related data is transparent, reliable and trusted by market participants. If that happens, new-product innovation would likely span multiple asset classes as data becomes more available.

Weather derivatives, or index insurance, have for decades provided customized solutions to address low risk, high probability weather-related events. To date, most exchange-listed weather futures and options are based on weather indexes that aggregate both catastrophic and non-catastrophic data. While these products can help manage localized exposure to weather-related risk, they do not address the broader impact of climate risk. It has been very challenging to develop liquidity in weather derivatives because liquidity providers have no associated risk layoff. Since exchange-traded weather derivatives do not meet reporting thresholds, commodity exchanges have not reported position data for weather derivatives or indexed weather derivatives products to the CFTC.

Extreme weather events, shifting demand patterns, and new technology for renewable power generation, will require the continued development of new products, data, and related technology to improve the ability of electricity market participants to measure and manage their risk. Electricity prices can be extremely volatile, posing challenges for smaller market participants, who often offer renewable energy. Volatility is greater in the intra-day, and short-dated markets where there are few instruments to mitigate risk. Greater volatility results in higher prices for end-use customers. Also, the inability to effectively hedge makes it more difficult for renewable generation to receive funding. Typically, renewable energy providers' sell long-term Purchase Power Agreements (approximately for 10 years), but do not often hedge their operational capacity even one day in advance. Hedging solutions currently available to smaller market participants are prohibitively expensive and lack the detail necessary to provide effective risk management. Lastly, as an increasingly large portion of power generation derives from renewable sources, new futures contracts could be developed to manage risks around wind and solar power generation, as well as transmission and storage, including via managing intermittent generation, congestion risk, and Renewable Energy Certificates markets.

In addition, as demand increases for financial products to manage climate risk, derivatives exchanges likely will seek to develop products where investor interest is high. In 2019, \$20.6 billion flowed into ESG funds, four times more than during the previous period (Hale, 2020). ESG ETF and Index futures have seen increased volumes and open interest. To attract a broader set of market participants, these new ESG-related futures contracts will need to develop deeper liquidity. The successful adoption of these derivatives products also depends on the continued growth of ESG funds and the decline of their costs.

The development of new derivative products focused on measurable climate-related events such as sea level rise, extreme rainfall events, and natural disasters should appeal to a broad set of market participants. Reliable and trustworthy data sources that help measure environmental attributes and characteristics throughout the physical commodity supply chain will be needed to underpin these new derivatives contracts. Private sector companies are finding new ways to collect, process, and transfer decision-useful lifecycle datasets to differentiate their products on the basis of their climate impacts and reveal the market value or risks associated with asset-level environmental attributes.

### Innovation in Other Financial Markets

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While derivatives are a risk-focused product, a wide range of other innovative financial products also can help isolate and manage risk, including climate risk, and thereby drive capital to sustainable investment opportunities. Broadly, these instruments can be grouped into two categories: (i) new instruments to direct capital to climate-related opportunities; and (ii) increased exposure to climate-related opportunities within existing instruments.

#### New Instruments to Direct Capital to Climate-Related Opportunities

A wide range of financial products directly provide funding to sustainable or transition projects. These instruments can expand capital flows by leveraging improved data and by increasing investor awareness of the return potential for ESG. These instruments provide capital at the corporate or project level.

Many innovative financial structures aim to increase demand from the deep pools of institutional capital. As we saw above, green bonds are widely used due to their relative simplicity. However, more green bonds are needed. While the green bond label can apply to a variety of debt instruments, most have been based on corporate credit and cash flows. In addition, the cost of issuance and the lack of market rewards for issuing remain barriers to the issuance of green bonds. The green bond market has spurred offshoots, including sustainability bonds and Sustainable Development Goal (SDG) bonds, which cover a wider range of eligible projects. More recently, transition bonds have been issued to fund projects that reduce carbon emissions, typically along a pathway compatible with the goals of the Paris Agreement.

Financial products can directly deploy investors' capital to green assets. This includes venture capital, private equity and infrastructure investments supporting the development and deployment of climate-related technologies. It also includes traditional insurance products for new technologies such as CCUS.

Securitization allows for tranches of risk, attracting new capital and recycling existing capital to continue private sector sustainable investment. In addition to securitization of green assets, innovation in securitization could help with difficult local stranded asset problems, including how to retire older highly polluting power plants without excessively burdening ratepayers. In a regulated utility securitization, utilities issue bonds that are paid back through a discrete customer charge. Customers benefit because the utility is refinancing the unrecovered value of the plant being retired at a lower cost than if the utility issued stock. Credit agencies generally view the mechanism positively because the utility recovers its investment and generates cash for other purposes. Securitization, by isolating and allocating climate risk to investors willing to accept it, may prove to be critically important for financing the transition.

### Increasing Exposure to Climate-Related Opportunities within Existing Instruments

A nascent but growing range of innovative products prices physical and transition risk within existing instruments. Insurance is an example of a sector with significant advances in integrating climate risk. As the availability of data increases, a range of new financial products, including insurance and insurance linked securities (ILS), are being developed to integrate the benefits of adaptation and resilience activities.

Catastrophe bonds are an innovative security that transfers the catastrophic risk of extreme events, including climate-attributed weather events, to the capital markets. Recently, catastrophe bonds have evolved to account for the changing nature of physical risk. In 2015, the quasi-public National Railroad Passenger Corporation (Amtrak) issued \$275 million of catastrophe bonds to cover storm surge, wind damage and earthquakes. It was one of several catastrophe bonds issued after Superstorm Sandy struck in 2012, causing \$1 billion of damage to Amtrak tunnels. In the future, the pricing of catastrophe bonds could potentially account for resilience and climate adaptation that might reduce physical risks.

Sustainability-linked loans, revolving credit facilities, letters of credit, and guarantees are emerging which adjust their interest rate to correlate with performance toward achieving sustainability targets. There are new insurance products whose pricing and underwriting reflect the potentially stronger cash flows and valuations of "green" buildings (CDI and UC Berkeley CLEE, 2018). Nature-based solutions can provide unique value. They include property insurance that can take into account the benefits of ecological forestry for reducing the risk of severe wildfires or the benefits of coral reefs, mangroves or salt marshes for reducing the risk of coastal flooding (The Nature Conservancy, 2019).

## Recommendations

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Effective and well-functioning markets should allocate capital efficiently to net-zero emissions investments, spur innovation, and create and preserve quality jobs in a growing net-zero economy. These recommendations seek to meet these goals by improving the functioning of markets by reducing structural barriers and catalyzing private sector innovation. In undertaking these efforts, consideration should be paid to the distributional and equity impacts on low-to-moderate income households and marginalized communities. In addition, efforts should aim to facilitate an orderly transition, where possible, avoiding adding financial strain on already stressed sectors, including agricultural producers and commercial and industrial companies, among others.

**Recommendation 8.1:** The United States should consider integration of climate risk into fiscal policy, particularly for economic stimulus activities covering infrastructure, disaster relief, or other federal rebuilding. Current and ongoing fiscal policy decisions have implications for climate risk across the financial system.

**Recommendation 8.2:** The United States should consolidate and expand government efforts, including loan authorities and co-investment programs, that are focused on addressing market failures by catalyzing private sector climate-related investment. This effort could centralize existing clean energy and climate resilience loan authorities and co-investment programs into a coordinated federal umbrella.

**Recommendation 8.3:** Financial regulators should establish climate finance labs or regulatory sandboxes to enhance the development of innovative climate risk tools as well as financial products and services that directly integrate climate risk into new or existing instruments.

**Recommendation 8.4:** The United States and financial regulators should review relevant laws, regulations and codes and provide any necessary clarity to confirm the appropriateness of making investment decisions using climate-related factors in retirement and pension plans covered by ERISA, as well as non-ERISA managed situations where there is fiduciary duty. This should clarify that climate-related factors—as well as ESG factors that impact risk-return more broadly—may be considered to the same extent as “traditional” financial factors, without creating additional burdens.

**Recommendation 8.5:** The CFTC should pursue the following activities to further catalyze climate finance market development:

- Survey market participants about their use of climate-related derivatives, the adequacy of product availability and market infrastructure, and the availability of data to incorporate climate impacts into existing and new instruments.
- Consider appropriate and targeted exemptions where needed to help facilitate coordination with other regulators and promote market development.
- Support the study and adoption of alternative execution methods, such as block trading, auction style markets, or incentive programs, to attract liquidity providers to make climate-related markets.
- Coordinate with other regulators to support the development of a robust ecosystem of climate-related risk management products.

## Conclusion

As this report was being finalized, governments around the world were working assiduously to contain the spread of COVID-19. Along with other major economies, the U.S. economy was suffering from simultaneous demand and supply shocks, the result of the synchronized shutdown of many parts of the economy. Unemployment had surged to post-Depression highs, and the economy was contracting at a record rate. Many households and businesses were suffering from falling income and wealth, as well as deteriorating creditworthiness. Stress in financial markets subsided only after the Federal Reserve launched interventions of unprecedented scale and scope, and Congress approved historically large fiscal measures to assist businesses and households. While the “great shutdown” to contain the virus led to a significant drop in global greenhouse gas emissions, the decline was temporary and not expected to fundamentally change the overall course of global emissions.

The pandemic is relevant to this report because its legacy will likely be prolonged fiscal deterioration, stressed business balance sheets, and depleted household wealth. In this context of heightened financial fragility, managing climate-related risk becomes even more important and urgent.

This report has argued that the physical impacts of climate change are already affecting the United States, and over time, will likely touch virtually every sector and region of the country. Depending on the evolution of policy, technology, and consumer preferences, the transition to net-zero emissions may also impact many segments of the economy. Both physical and transition risks could give rise to systemic and sub-systemic financial shocks, potentially causing unprecedented disruption in the proper functioning of financial markets and institutions. Sub-systemic shocks to particular sectors or regions could reduce access to financial services by marginalized communities and people already underserved by the financial system. Climate impacts may also magnify or exacerbate existing, non-climate-related vulnerabilities in the financial system, with potentially serious consequences for market stability.

A financial system that is better able to measure and manage these risks will be better positioned to absorb and recover from climate-related shocks, as well as to help investors and entrepreneurs seize opportunities that arise from the transition to net-zero emissions. That will be especially significant in the post-COVID period, when the weakened economy and financial system will be especially vulnerable to any additional disruption. Given the uncertain timing of physical and transition risks, it is imperative that this process begin now.

As this report has mentioned repeatedly, policies essential to decisively address climate change lie beyond the purview of financial regulators. Those policies include, first and foremost, effective mechanisms to price carbon appropriately. Financial regulators and other market participants can insistently point to the need to “get incentives right,” and they can warn about the consequences of failing to act. But, ultimately, these critical policies must come from Congress, coupled with an international framework that can facilitate synchronized reductions in greenhouse gas emissions across countries.

However, that does not mean financial regulators have little to do while an adequate carbon-pricing regime emerges. Quite the contrary. This report has argued that financial regulators should actively promote, and in some cases require, better understanding, quantification, disclosure, and management of climate-related risks by financial institutions, large dealers, investors, asset owners and managers, and other market participants. They should also work to preserve the proper functioning of markets in the face of low-probability but high-impact risks. As this report has noted, regulators already enjoy wide latitude, on the basis of existing authorities, to advance these objectives.

To be sure, the road ahead will not be straight. The evolution of climate change and its impacts is highly uncertain. Also, as these pages have described, climate-related data, models, and scenario planning, remain in an incipient stage. Therefore, the process of strengthening climate risk management will be inherently experimental and demand constant learning and innovation. Persistent evaluation, consultation, and course-correction will be par for the course.

While this report has been addressed to financial regulators, financial market participants also have a critical role. In this context, financial regulators can help by encouraging and facilitating innovation in financial firms’ risk management. This includes innovations in scenario planning, improvements in environmental, social, and governance (ESG) data, and better methodologies for measuring climate-related financial risk.

At the same time, regulators can help promote the role of financial markets as providers of solutions to climate-related problems. A good example is the derivatives market, which thanks in part to regulatory changes, has evolved from a magnifier of financial shockwaves during the 2008 Global Financial Crisis to a source of risk-management instruments that can help preserve financial stability. Innovations in the derivatives market may also help market participants manage climate-related risks and maximize climate-related opportunities in the future. Importantly, financial innovation will result not only in products for managing risk, but also for promoting the flow of capital toward net-zero-emission, climate-resilient technologies and investments.

A theme that has run through this report is that the United States is not alone in confronting this challenge. Financial regulators around the world, including from many of the leading economies; multilateral organizations; and groups of investors and major financial institutions have joined this mission. Together, they are generating a plethora of initiatives and tools to safeguard financial stability in the face of climate risk. However, the United States remains, at best, a reluctant participant in these efforts, and in some cases, it is absent. Without the full involvement of the largest economy and home to the world's largest capital markets, international efforts will surely fall short. As this report has argued, the United States should fully participate in these forums and help lead the way.

Finally, in a report such as this, it is important to recall the ultimate objective. Financial stability is not an end in itself—it is a means to protect the assets of millions of Americans and to ensure that the financial system continues to support their goals and aspirations through an efficient and sustainable allocation of capital. In a world confronting climate change, it is imperative that the financial system continue to serve this purpose and, where possible, to advance the solutions needed to meet the climate challenge.

## List of Recommendations

### Chapter 1

**Recommendation 1:** The United States should establish a price on carbon. It must be fair, economy-wide, and effective in reducing emissions consistent with the Paris Agreement. This is the single most important step to manage climate risk and drive the appropriate allocation of capital.

### Chapter 4

Market participants and the regulatory community, in the United States and abroad, are in the early stages of understanding and experimenting with how best to monitor and manage climate risk. Given the considerable complexities and data challenges involved, regulators and market participants should adopt pragmatic approaches that stress continuous monitoring, experimentation, and learning. Regulatory approaches in this area are evolving and should remain open to refinement, especially as the understanding of climate risk continues to advance and new data and tools become available.

At the same time, regulators should establish a clear framework with appropriate milestones. This is what financial regulators are already doing in some jurisdictions and is consistent with recommendations of financial regulatory bodies (Bank of England, 2019; Bank for International Settlements, 2020; NGFS, 2020). As explained above, in general, regulators have sufficient authority to start tackling climate risk immediately. The following recommendations provide, in our view, a good starting point.

### Systemic Risk Oversight

**Recommendation 4.1:** All relevant federal financial regulatory agencies should incorporate climate-related risks into their mandates and develop a strategy for integrating these risks in their work, including into their existing monitoring and oversight functions. Regulators should further develop internal capacity on climate-related risk measurement and management, including through their strategic planning, organizational structure, and additional resourcing.

**Recommendation 4.2:** The Financial Stability Oversight Council (FSOC), of which the Commodity Futures Trading Commission (CFTC) is a voting member, should undertake the following:

- As part of its mandate to monitor and identify emerging threats to financial stability, incorporate climate-related financial risks into its existing oversight function, including its annual reports and other reporting to Congress;
- Encourage and coordinate, across the Council's member agencies, the sharing of best practices concerning the monitoring and management of climate-related risks, the building of relevant institutional capacity, the integration of climate-related risks into the risk monitoring function of the agencies and into financial supervision and regulatory frameworks, and the potential for second-order impacts, such as the migration of financial activity from one part of the financial system to another; and
- Task the Office of Financial Research with developing a long-term program of research on climate-related risks to the financial system, paying close to the potential interconnectivity and spillovers of climate-related risks across the financial system; monitoring relevant developments; and developing tools that regulators can use for the monitoring and management of climate-related risks.

**Recommendation 4.3:** Research arms of federal financial regulators should undertake research on the financial implications of climate-related risks. This research program should cover the potential for and implications of climate-related "sub-systemic" shocks to financial markets and institutions in particular sectors and regions of the United States, including, for example, agricultural and community banks and financial institutions serving low-to-moderate income or marginalized communities. Research should also include the impact of climate risk on financial system assets and liabilities, including by sensitivity of specific sectors to climate change, geographic location, and tenor. In doing so, regulators should identify data gaps and approaches to address these shortcomings. Regulators should develop assessments of the magnitude of the impact of climate on these assets and liabilities, for example through scenario analysis.

**Recommendation 4.4:** Relevant federal regulators should assess the exposure and implications of climate-related risks for the portfolios and balance sheets of the government-sponsored enterprises (GSEs) and strongly encourage the GSEs to adopt and implement strategies to monitor and manage those risks.

**Recommendation 4.5:** The Federal Insurance Office, in collaboration with state insurance regulators, should undertake an assessment of the insurance sector's systemic vulnerability to climate-related impacts and report the findings to the FSOC. FIO should also evaluate the adequacy of state insurance regulators' oversight of climate-related risks.

**Recommendation 4.6:** Federal financial regulators should actively engage their international counterparts to exchange information and draw lessons on emerging good practice regarding the monitoring and management of climate-related financial risks. U.S. regulators should join, as full members, groups convened for this purpose, including the Central Banks and Supervisors Network for Greening the Financial System (NGFS), the Coalition of Finance Ministers for Climate Action, and the Sustainable Insurance Forum (SIF). The United States should also engage actively to ensure that climate risk is on the agenda of Group of Seven (G7) and Group of Twenty (G20) meetings and bodies, including the Financial Stability Board (FSB) and related committees and working groups. The Federal Reserve already participates in the Basel Committee on Banking Supervision's climate task force, and the Securities and Exchange Commission participates in the International Organization of Securities Commissions' (IOSCO) sustainable finance network.

### Risk Management

**Recommendation 4.7:** Financial supervisors should require bank and nonbank financial firms to address climate-related financial risks through their existing risk management frameworks in a way that is appropriately governed by corporate management. That includes embedding climate risk monitoring and management into the firms' governance frameworks, including by means of clearly defined oversight responsibilities in the board of directors.

**Recommendation 4.8:** Working closely with financial institutions, regulators should undertake—as well as assist financial institutions to undertake on their own—pilot climate risk stress testing as is being undertaken in other jurisdictions and as recommended by the NGFS. This will enable stakeholders to better understand institutions' exposure to climate-related physical and transition risks, as well as to explore climate-related opportunities. The pilot program should include the testing of balance sheets against a common set of scenarios (elaborated on in Chapter 6 and Recommendation 6.6), covering how financial institutions might respond to climate-related risks and opportunities over specified time horizons. This climate risk stress testing pilot program should include institutions such as agricultural, community banks, and non-systemically important regional banks.

**Recommendation 4.9:** Regulators should closely monitor international experience with climate risk stress testing of banks and insurers and apply relevant lessons to the U.S. context. U.S. regulators should engage in international forums, such as the NGFS, to ensure that climate risk stress testing conducted in the United States is comparable to similar exercises in other jurisdictions and avoid duplicative exercises for institutions with a multi-jurisdictional footprint.

**Recommendation 4.10:** Financial authorities should consider integrating climate risk into their balance sheet management and asset purchases, particularly relating to corporate and municipal debt.

**Recommendation 4.11:** The CFTC should:

- Undertake a program of research aimed at understanding how climate-related risks are impacting and could impact markets and market participants under CFTC oversight, including central counterparties, futures commission merchants, and speculative traders and funds; the research program should also cover how the CFTC's capabilities and supervisory role may need to adapt to fulfill its mandate in light of climate change and identify relevant gaps in the CFTC's regulatory and supervisory framework;
- Drawing on the conclusions of the research program above, review the extent to which existing CFTC rules are adequate to monitor and manage climate-related risks. For example, CFTC should review the extent to which rules for non-centrally cleared over-the-counter derivatives (NCD) are appropriate for monitoring and managing climate-related risks. It should also review rules related to capital and margin requirements of futures commission merchants and swap dealers, as well as initial margin and default fund rules, risk management rules, and capital requirements pertaining to central counterparties;
- Expand its own central counterparty stress testing to cover the operational continuity and organizational resilience of central counterparties, including organizational resilience of operations, contingency planning, and engineering resilience for facilities exposed to climate-related physical risks. Where central counterparties and market infrastructure are not within the CFTC's direct supervisory remit, the supervision of physical risks should be addressed by the relevant FSOC member in a consistent fashion; and
- As better understanding emerges of the risk-transmission pathways and of where the material climate risks lie, consider expanding the CFTC's risk management rules and related quarterly risk exposure reports to cover material climate-related risks.

**Recommendation 4.12:** State insurance regulators and insurance regulators' supervisory colleges, which are convened by regulators where an insurer or its subsidiaries or affiliates operate in multiple jurisdictions, should:

- Require insurers to assess how their underwriting activity and investment portfolios may be impacted by climate-related risks and, based on that assessment, require them to address and disclose these risks; and

- To facilitate the risk assessment mentioned in the point above, insurance regulators should conduct, or require insurance companies to conduct, climate risk stress tests and scenario analyses to evaluate potential financial exposure to both the physical and transition impacts of climate change; state insurance regulators should provide the scenarios, assumptions, and parameters for the stress testing exercise.

**Recommendation 4.13:** Regulators should require insurers to integrate consideration of climate risks into insurers' Enterprise Risk Management (ERM) and Own Risk Solvency Assessments (ORSA) processes.

**Recommendation 4.14:** Regulators should require credit rating agencies to disclose the extent to which their ratings take into account climate risk, including for issuers of corporate, municipal, and sovereign debt. This should include a disclosure of applicable methodologies for those credit rating products that consider climate risk.

### Financial Market Utilities

**Recommendation 4.15:** Federal regulators should ensure that risk management standards governing the operations related to the payment, clearing, and settlement activities of FMUs incorporate measures to monitor and manage physical climate risks. The CFTC, in its capacity as an FSOC member, should recommend that the Council oversee and coordinate this process as it pertains to FMUs designated as systemically important.

**Recommendation 4.16:** The CFTC should review the extent to which financial market infrastructure—including but not limited to systemically important FMUs for which it is the primary regulator—is resilient against losses that could arise through the physical impacts of climate change.

## Chapter 5

**Recommendation 5.1:** Financial regulators, in coordination with the private sector, should support the availability of consistent, comparable, and reliable climate risk data and analysis to advance the effective measurement and management of climate risk.

- Regulators and financial institutions should support the range of platforms for climate data and analysis, including improving public access to governmental data and expertise that can enable climate risk management. They should also support new and existing open source platforms, as well as proprietary efforts to develop new climate risk datasets and tools that leverage innovative technologies.

**Recommendation 5.2:** Financial regulators, in coordination with the private sector, should support the development of U.S.-appropriate standardized and consistent classification systems or taxonomies for physical and transition risks, exposure, sensitivity, vulnerability, adaptation, and resilience, spanning asset classes and sectors, in order to define core terms supporting the comparison of climate risk data and associated financial products and services.

- To develop this guidance, the United States should study the establishment of a Standards Developing Organization (SDO) composed of public and private sector members.
- Recognizing that this guidance will be specific to the United States, this effort should include international engagement in order to ensure coordination across global definitions to the extent practicable.

**Recommendation 5.3:** Financial regulators should proactively encourage capacity building for climate risk management. This should be consistent with the education and training practices supported by agencies in implementing the Sarbanes-Oxley Act of 2002. It should align with and aid in meeting regulator expectations around embedding climate risk in governance frameworks.

## Chapter 6

### Scenarios and Scenario Analysis

Climate scenario analysis should focus on potential material impacts to the institution's financial portfolio, whether loans, derivatives, or investments. In this context, the following guidelines should be useful:

**Recommendation 6.1:** Analyze more than one warming path. Various long-term paths for climate change exist and can be used for scenario analysis. Three common scenarios are (i) Paris-aligned (for example, consistent with limiting temperatures well below 2 degrees Celsius above pre-industrial levels), (ii) current trajectory and (iii) in-between (for example, late policy adoption with a more abrupt and disruptive response). Each will produce different impacts on institutional portfolios and provide insights that will help to more effectively manage risk, particularly bookends of best- and worst-case scenarios. Scenarios should include both shorter- and longer-horizon paths as appropriate.

**Recommendation 6.2:** Analyze disruptive policy. It is particularly important to analyze a scenario involving a major policy disruption. Transition scenarios have wide implications across the economy, industries, and markets. Unanticipated policies can abruptly strand long-lived capital assets or induce rapid reallocation of capital across sectors and industries. Increasing physical impacts may increase the risks of a disorderly transition as fires, floods, and

hurricanes, and the attendant shifts in public sentiment, force governments into unanticipated policy responses. Scenarios are therefore especially relevant for risk management.

**Recommendation 6.3:** Analyze both broad and specific impacts. Scenarios should capture the breadth of impacts but with a focus on materiality, covering a global perspective but enabling regional, country, and sectoral analysis appropriate to the firm's business.

**Recommendation 6.4:** Map macroeconomic and financial impacts. Scenarios should take into account macroeconomic and financial outcomes since these are likely to be most material to financial institutions. Coming up with additional temperature scenarios, for example, is less important than providing some common guidance on potential transmission mechanisms and implications for macroeconomic and financial factors.

**Recommendation 6.5:** Account for adaptation actions to the extent feasible. Tackling climate change necessarily involves myriad adjustments by a range of actors. Modeling the effects of such adaptation actions on portfolios is complex but may become more feasible with future technology and scenario modeling development.

### Policymakers and Regulators

**Recommendation 6.6:** Prescribe a consistent and common set of broad climate risk scenarios, guidelines, and assumptions and mandate assessment against these scenarios, as described in Chapter 4. Regulators, in consultation with industry participants, external experts, and other stakeholders, should develop and prescribe a consistent set of broadly applicable scenarios, guidelines, and assumptions and require institutions to assess their exposure to those scenarios. Climate scenarios should be both plausible and relevant, all the while informed by climate science. Regulators should require a range of climate scenarios, including scenarios covering severe but plausible outcomes. Key assumptions (including policy pathways) and limitations should be transparent. Scenarios, assumptions, and guidelines should be updated as relevant factors are better understood and as policy and technology evolve. There should be a recognition that climate risk will manifest differently across various parts of the financial system.

**Recommendation 6.7:** Provide analytical discretion, to the extent practicable, as long as regulatory needs for consistency and comparability are met. Given the many unknowns and complexities inherent in modeling the economy, climate change science, and policy, regulated entities will need some discretion in how they perform their analysis based on the prescribed scenario. On the other hand, regulators need consistent approaches across firms so they can ensure risks are responsibly analyzed and reported. Investors would benefit from better comparability across scenario-related disclosures. To achieve a balance across these needs, regulators, in consultation with the firms they regulate, should specify key assumptions, scope, and the outputs they expect. As long as regulators' prescribed expectations are satisfied, regulators should allow financial institutions to provide additional context and analysis informed by the nature and complexity of their business.

**Recommendation 6.8:** Encourage domestic and global coordination across regulators to provide a coherent approach. This is an overarching theme of this report and especially applicable to the use of scenarios for risk management. Requiring entirely different stress scenario exercises from institutions operating under different jurisdictions would be costly while generating uncertain value. Harmonizing requirements and prioritizing practical, actionable exercises where feasible would be useful. The high costs associated with multiple regulatory regimes is a lesson of post-financial crisis regulation that can be applied now to climate risk.

**Recommendation 6.9:** Focus on materiality and risk management. Climate risks can manifest in many different ways. Institutions should focus on what matters for them and what decisions need to be made given their specific exposures and vulnerabilities. Such an approach facilitates effective risk management by laying out plausible ways climate risk-related financial losses could occur.

**Recommendation 6.10:** Ensure a mechanism for ongoing refinement and improvement. As science, data, tools, conditions, and policy change, it is important for regulatory guidelines to evolve as well. Data in particular is evolving rapidly. Creating a mechanism for regular updating, rather than relying on ad hoc adjustments, would be beneficial to ensure effective and pragmatic oversight. As regulators better understand the material risks in the system and their spillover effects across industries and markets, a mechanism for ongoing learning and timely refinement from these lessons learned will ensure they are most effectively managing risk across the system.

## Capabilities and Applications

Given the uncertain nature of how the climate will evolve and the limited ability to rely on historical data and back-testing, robust scenario analysis calls for a new set of capabilities that combines statistical, financial, and environmental knowledge.

**Recommendation 6.11:** Tailor analysis to specific exposures. How an institution analyzes scenarios should be determined based on the unique nature of its portfolio. Not every scenario will be material to an institution's portfolio, depending on its largest asset concentrations, longest-dated assets, and highest potential sensitivities.

**Recommendation 6.12:** Use results to upgrade risk management capabilities. Regulators and risk managers can use insights coming from scenario analyses to strengthen and augment existing institutional risk management. Each institution should determine how to do so within its own framework but could include climate-related limits, adjustment to underwriting processes, client engagement, and climate risk appetite.

**Recommendation 6.13:** Beware of false precision. Scenario analysis can provide great value in understanding a range of potential outcomes (particularly between worst and best cases) and in identifying concentrations and relative sensitivities in a portfolio. But results, especially quantitative ones, will be illustrative, not precise, and so should be used accordingly in risk management decisions.

### Risk Managers

**Recommendation 6.14:** Risk managers should develop in-house capabilities, as relevant and in line with best practices, to analyze climate scenarios, understand the key underlying assumptions, and recognize the limitations.

**Recommendation 6.15:** Firms and institutions should consider additional climate scenarios, guidelines and assumptions tailored to their specific needs and vulnerabilities, in addition to those provided by policymakers and regulators, to enhance internal risk management and decision-making. This can focus on generating decision-useful information for identifying and managing climate risk given their specific exposures and vulnerabilities.

**Recommendation 6.16:** The scope, depth, and complexity of the analyses performed by institutions should be proportionate to the materiality of the impact measured.

## Chapter 7

In developing and implementing the recommendations below, financial regulators and the entities they oversee should consult with stakeholders, including investors, businesses, global peers, and other market intermediaries to create a U.S. climate disclosure regime. They also should closely coordinate with international bodies and foreign regulators to ensure the U.S. regime is aligned internationally. Because the understanding of climate risk remains at an early stage, any regulatory approach to climate-related disclosure should evolve in line with emerging best practices. Regulators should continually monitor the state of corporate climate disclosures, evolving clarity on the financial impacts of climate change and emerging best practices. This will allow regulators to continually monitor the quality of the information disclosed in a sophisticated manner, and issue supplemental guidance or begin rulemaking where needed to reflect emerging best practice and market needs. A mandatory, standardized disclosure framework for material climate risks, including guidance about what should be disclosed that is closely aligned with developing international consensus, would improve the utility and cost-effectiveness of disclosures.

### Financial Market Regulators

**Recommendation 7.1:** All financial regulators should consider the following principles for effective disclosure, which are mainly derived from principles developed by the Task Force on Climate-related Financial Disclosures, when developing rules on climate risk disclosure, implementing existing rules or guidance, or seeking public comment on actions they should take:

- Disclosures should represent relevant information.
- Disclosures should be specific and complete.
- Disclosures should be clear, balanced, and understandable.

- Disclosures should be consistent over time.
- Disclosures should be comparable among companies within a sector, industry, or portfolio.
- Disclosures should be reliable, verifiable, and objective.
- Disclosures should be based on current consensus science (and updated as the science evolves) and the best available projections regarding climate change impacts.
- Disclosures should be provided on a timely basis.

**Recommendation 7.2:** Material climate risks must be disclosed under existing law, and climate risk disclosure should cover material risks for various time horizons. To address investor concerns around ambiguity on when climate change rises to the threshold of materiality, financial regulators should clarify the definition of materiality for disclosing medium- and long-term climate risks, including through quantitative and qualitative factors, as appropriate. Financial filings should include disclosure of any material financial risks from climate change in a consistent but non-boilerplate manner, as well as a qualitative description of how firms assess and monitor for potential changes in climate risks that may become material.

**Recommendation 7.3:** Regulators should consider additional, appropriate avenues for firms to disclose other substantive climate risks that do not pass the materiality threshold over various time horizons outside of their filings. Regulators should consider that a growing number of companies are creating greenhouse gas reduction targets and strategies out to the year 2035 or 2050, and targeted disclosure related to these items may be appropriate to facilitate robust efforts toward this positive trend.

**Recommendation 7.4:** Recognizing the costs associated with collecting, assessing and disclosing climate risk information, financial regulators should consider whether smaller companies could be provided a longer period of time to provide their initial disclosures, and the specific disclosures required of those companies could be different and less burdensome than those required of larger issuers.

**Recommendation 7.5:** In light of global advancements in the past 10 years in understanding and disclosing climate risks, regulators should review and update the SEC's 2010 *Guidance* on climate risk disclosure to achieve greater consistency in disclosure to help inform the market. Regulators should also consider rulemaking, where relevant, and ensure implementation of the *Guidance*. Such an update could incorporate advice on:

- Information that is needed from all companies in order to enable financial regulators to assess the systemic risks posed by climate change. Federal financial market regulators should work closely with prudential regulators to develop these rules.

- Industry-specific climate risk information. Rules should build from existing standards that provide industry-specific climate disclosure recommendations, for example, those developed by the TCFD, SASB, CDSB, the Physical Risks of Climate Change (P-ROCC) framework, and the Global Real Estate Sustainability Benchmark (GRESB) standards for real estate and infrastructure. Because these standards are already sophisticated, regulators do not need to create their own standards or metrics from scratch. Regulators should encourage stakeholders to partner with these standard-setting bodies to further develop, standardize, implement, and validate these metrics over time. Regulators should also acknowledge, in any rulemaking, that climate disclosure standards continue to evolve, and it could provide issuers flexibility, where appropriate, to adopt these evolving standards.
- Governance, risk management and scenario planning information that demonstrates how well companies are situated for a clean energy transition. Federal financial market regulators should work closely with prudential regulators to develop these rules. Scenario planning disclosure is discussed in Chapter 6. Regarding governance and risk management disclosure, regulators should consider the TCFD's recommendations and the Committee of Sponsoring Organizations of the Treadway Commission/World Business Council for Sustainable Development (COSO/WBCSD) guidance, applying enterprise risk management to environmental, social and governance-related risks.

**Recommendation 7.6:** Regulators should require listed companies to disclose Scope 1 and 2 emissions. As reliable transition risk metrics and consistent methodologies for Scope 3 emissions are developed, financial regulators should require their disclosure, to the extent they are material.

**Recommendation 7.7:** Regarding derivatives, financial regulators should examine the extent to which climate impacts are addressed in disclosures required of the entities they regulate and consider guidance and rulemaking if disclosure improvements are needed. This could include, for example, swap dealers registered with the CFTC, risk management rules that govern risk identification approaches; Quarterly Risk Exposure Reports, and business conduct rules that govern disclosure of material information to counterparties prior to entering into a swap.

### Accounting Standards Regulators

**Recommendation 7.8:** Once climate risk disclosure standards are well advanced, accounting standards regulators should undertake a mapping exercise of the applicability of accounting standards to climate-related disclosure and subsequently issue guidance on disclosure, as appropriate. This would provide U.S. companies greater clarity about how climate risks may be integrated into financial statements.

**Recommendation 7.9:** The United States should direct the Federal Accounting Standards Advisory Board (FASAB) to study and pilot the development of climate-related federal accounting standards, disclosure procedures and practices for U.S. government departments, agencies and administrative units.

### Municipal Securities Regulators

**Recommendation 7.10:** Municipal securities regulators should provide improved tools on the EMMA website to search for climate-related disclosure in municipal bond filings, similar to that provided for publicly traded companies, to allow better assessments of potential climate risk exposure in such assets and how they are being addressed.

**Recommendation 7.11:** Municipal securities regulators and the federal financial market regulator overseeing them should examine the quality of climate-related disclosures in municipal bonds' official statements and continuing disclosures, and whether the disclosure provided is adequate for market participants to assess any underlying climate risk exposure. If disclosure is found to be deficient, they should issue a public statement calling on key stakeholders to improve disclosure, including municipalities, municipal advisers, and banks.

**Recommendation 7.12:** Municipal securities regulators and federal financial market and prudential regulators should study how risks facing municipalities differ from—and could in some cases be more impactful than—risks facing issuers and explore options to enhance disclosure on these issues. Some municipalities already disclose information, as part of their bond issuances, about floods, storms, dam safety, droughts, wildfires, sea level rise, and risk mitigation efforts, and further study could demonstrate that such disclosure should be enhanced.

## Chapter 8

Effective and well-functioning markets should allocate capital efficiently to net-zero emissions investments, spur innovation, and create and preserve quality jobs in a growing net-zero economy. These recommendations seek to meet these goals by improving the functioning of markets by reducing structural barriers and catalyzing private sector innovation. In undertaking these efforts, consideration should be paid to the distributional and equity impacts on low-to-moderate income households and marginalized communities. In addition, efforts should aim to facilitate an orderly transition, where possible, avoiding adding financial strain on already stressed sectors, including agricultural producers and commercial and industrial companies, among others.

**Recommendation 8.1:** The United States should consider integration of climate risk into fiscal policy, particularly for economic stimulus activities covering infrastructure, disaster relief, or other federal rebuilding. Current and ongoing fiscal policy decisions have implications for climate risk across the financial system.

**Recommendation 8.2:** The United States should consolidate and expand government efforts, including loan authorities and co-investment programs, that are focused on addressing market failures by catalyzing private sector climate-related investment. This effort could centralize existing clean energy and climate resilience loan authorities and co-investment programs into a coordinated federal umbrella.

**Recommendation 8.3:** Financial regulators should establish climate finance labs or regulatory sandboxes to enhance the development of innovative climate risk tools as well as financial products and services that directly integrate climate risk into new or existing instruments.

**Recommendation 8.4:** The United States and financial regulators should review relevant laws, regulations and codes and provide any necessary clarity to confirm the appropriateness of making investment decisions using climate-related factors in retirement and pension plans covered by the Employee Retirement Income Security Act (ERISA), as well as non-ERISA managed situations where there is fiduciary duty. This should clarify that climate-related factors—as well as ESG factors that impact risk-return more broadly—may be considered to the same extent as “traditional” financial factors, without creating additional burdens.

**Recommendation 8.5:** The CFTC should pursue the following activities to further catalyze climate finance market development:

- Survey market participants about their use of climate-related derivatives, the adequacy of product availability and market infrastructure, and the availability of data to incorporate climate impacts into existing and new instruments.
- Consider appropriate and targeted exemptions where needed to help facilitate coordination with other regulators and promote market development.
- Support the study and adoption of alternative execution methods, such as block trading, auction style markets, or incentive programs, to attract liquidity providers to make climate-related markets.
- Coordinate with other regulators to support the development of a robust ecosystem of climate-related risk management products.

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## Appendix

Appendix Table 1: Sample of Multi-Sector Efforts to Increase Climate Data Availability		
Initiative	Mission	Website
Aqueduct	Aqueduct maps water risks such as floods, droughts, and stress, using open-source, peer reviewed data.	<a href="https://www.wri.org/aqueduct">https://www.wri.org/aqueduct</a>
Climate Data Online (CDO)	Maintained by the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information, the CDO provides free access to NOAA's archive of weather and climate data.	<a href="https://www.ncdc.noaa.gov/cdo-web/">https://www.ncdc.noaa.gov/cdo-web/</a>
Climate Explorer	The Climate Explorer provides graphs and maps of historical and projected climate variables for counties across the United States.	<a href="https://crt-climate-explorer.nemac.org/">https://crt-climate-explorer.nemac.org/</a>
ClimateWatch	ClimateWatch provides open data sets, visualizations and customized analyses to support stakeholders.	<a href="https://www.climatewatchdata.org/">https://www.climatewatchdata.org/</a>
Food and Agriculture Organization of the United Nations (FAO)	FAO maintains a variety of data centers including FAOSTAT which provides food and agriculture statistics (including crop, livestock and forestry sub-sectors) for over 245 countries and territories and the Food and Agriculture Microdata Catalogue (FAM) which provides access to micro data sets collected through farm and household surveys.	<a href="http://www.fao.org/statistics/en/">http://www.fao.org/statistics/en/</a>

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Appendix Table 1: Sample of Multi-Sector Efforts to Increase Climate Data Availability (*continued*)

Initiative	Mission	Website
Future of Sustainable Data Alliance (FSDA)	FSDA works to identify and accelerate the reliable, actionable ESG data and related technology that is needed for improved investor decision-making.	<a href="http://solutions.refinitiv.com/futureofsustainabledata">http://solutions.refinitiv.com/futureofsustainabledata</a>
GeoAsset Project	GeoAsset is a public goods endeavor focused on making accurate, comparable, and comprehensive asset-level data tied to ownership publicly available across all major sectors and geographies.	<a href="https://spatialfinanceinitiative.com/geoasset-project/">https://spatialfinanceinitiative.com/geoasset-project/</a>
Global Energy Monitor (GEM)	GEM organizes the production of asset-level data sets for fossil fuel sectors.	<a href="https://globalenergymonitor.org">https://globalenergymonitor.org</a>
U.S. EPA Greenhouse Gas Reporting Program (GHGRP)	GHGRP requires reporting of emissions data from 8,000 facilities covering large GHG emissions sources, fuel and industrial gas supplies, and CO <sub>2</sub> injection sites in the United States. The Facility Level Information on GreenHouse gases Tool (FLIGHT) leverages the GHGRP data into a visual tool to quickly filter data in a variety of ways, including by facility, industry, location, or gas.	<a href="https://www.epa.gov/ghgreporting">https://www.epa.gov/ghgreporting</a>
Oasis Hub	Oasis Hub is an aggregator for catastrophe, extreme weather and environmental risk data, tools and services, as well as provider of data set enhancement, development and data aggregation services.	<a href="https://oasishub.co">https://oasishub.co</a>
OS-Climate	OS-Climate aims to aggregate the best available data, modeling, and computing and data science worldwide into an AI-enhanced physical-economic model that functions like an operating system, enabling powerful applications for climate-integrated investing.	<a href="https://www.os-climate.org">https://www.os-climate.org</a>

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Appendix Table 1: Sample of Multi-Sector Efforts to Increase Climate Data Availability (*continued*)

Initiative	Mission	Website
Power Explorer	Power Explorer aims to serve as the most comprehensive source for understanding the world's power systems and their impacts on development and environmental challenges.	<a href="http://powerexplorer.org">http://powerexplorer.org</a>
U.S. Climate Resilience Toolkit (USCRT)	USCRT serves as multi-sector platform for case studies, data sets, digital tools, and other resources for a variety of domestic stakeholders.	<a href="https://toolkit.climate.gov/">https://toolkit.climate.gov/</a>
World Bank Sovereign ESG Data Portal	Data platform that provides country-level sustainability performance information to increase transparency and support investment aligned with sustainable development.	<a href="https://databank.worldbank.org/source/environment-social-and-governance-(esg)-data">https://databank.worldbank.org/source/environment-social-and-governance-(esg)-data</a>

## Members of the Climate-Related Market Risk Subcommittee

The CFTC seeks to ensure that all of its advisory committee and subcommittee memberships are fairly balanced. To that end, the selection of the Climate-Related Market Risk Subcommittee members was consistent with the MRAC Federal Advisory Committee Act Charter and Membership Balance Plan. The Subcommittee members were selected to ensure that the subcommittee's membership consists of a wide range of perspectives and interests, including representation from industry, public interest groups, and academia.

Name	Entity Representing	Position Title
Robert 'Bob' Litterman (Chairman)	Kepos Capital	Chairman of the Risk Committee and Founding Partner
Clark E. Anderson	Morgan Stanley	Managing Director
Nathaniel Bullard	BloombergNEF	Chief Content Officer
Ben Caldecott	Special Government Employee	Director, Oxford Sustainable Finance Programme & Associate Professor Smith School of Enterprise and the Environment, University of Oxford
Martina L. Cheung	S&P Global	President, S&P Global Market Intelligence
John T. Colas	Marsh & McLennan Companies	Vice Chairman, Oliver Wyman Financial Services America
Robert Coviello	Bunge	Senior Vice President, Sustainability and Government Affairs
Peter W. Davidson	Aligned Climate Capital	Co-Founder and Chief Executive Officer

*Continued on next page*

Name	Entity Representing	Position Title
Jeffrey S. Dukes	Special Government Employee	Director, Purdue Climate Change Research Center; Professor of Forestry and Natural Resources; Professor of Biological Sciences; Belcher Chair for Environmental Sustainability
Hervé P. Duteil	BNP Paribas	Chief Sustainability Officer
Athena Eastwood	Dairy Farmers of America	Outside Counsel
Eliza H. Eubank	Citigroup	Managing Director and Global Head of Environmental and Social Risk Management
Naty Figueroa	BP	Global Environmental Products Commercial Manager
Christopher J. Goolgasian	Wellington Management	Managing Director; Director, Climate Research; and Portfolio Manager
John Hartmann	Cargill	Global Sustainability Lead, Cargill Agricultural Supply Chain and Global Edible Oils
Dave Jones	The Nature Conservancy	Senior Director of Environmental Risk
Jesse M. Keenan (Editor)	Special Government Employee	Associate Professor of Real Estate, School of Architecture, Tulane University
Nathaniel Keohane	Environmental Defense Fund	Senior Vice President for Climate
Mindy Lubber	Ceres	Chief Executive Officer and President
Divya Mankikar	CalPERS	Investment Manager
Leonardo Martinez-Diaz (Editor)	World Resources Institute	Global Director of the Sustainable Finance Center
Sara Menker	Gro Intelligence	Founder and Chief Executive Officer
Stephen Moch (Associate Editor)	Special Government Employee	Graduate Student, Harvard Business School & Harvard Kennedy School

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Name	Entity Representing	Position Title
Adrienne Monley	Vanguard	Head of Investment Stewardship, Americas
Adele Morris	Special Government Employee	Senior Fellow and Policy Director, Climate and Energy Economics Project, The Brookings Institution
David Parham	Sustainability Accounting Standards Board	Director of Research – Projects
Daniel R. Paul	ConocoPhillips	Commercial Manager of Risk, Regulatory Affairs, Market Analysis & Business Development
Rene Ramos	JPMorgan Chase	Executive Director, Climate Risk Executive, Global Environment and Social Risk Management
Armin Sandhoevel	Allianz Global Investors	Chief Investment Officer, Infrastructure Equity
Truman Semans	OS-Climate	Founder and Chief Executive Officer
Betty Simkins	Special Government Employee	Professor of Finance and Williams Chair; Head, Department of Finance, Spears School of Business, Oklahoma State University
Johannes Stroebel	Special Government Employee	David S. Loeb Professor of Finance and the Boxer Faculty Fellow at the New York University Stern School of Business
David S. Vogel	Voloridge Investment Management	Founder and Chief Executive Officer
Julie Winkler	CME Group	Chief Commercial Officer

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Commission, Market Risk Advisory Committee.

**GAO REPORT: PUBLIC COMPANIES—DISCLOSURE OF ENVIRONMENTAL, SOCIAL, AND GOVERNANCE FACTORS AND OPTIONS TO ENHANCE THEM**



United States Government Accountability Office

Report to the Honorable Mark Warner  
U.S. Senate

July 2020

## PUBLIC COMPANIES

# Disclosure of Environmental, Social, and Governance Factors and Options to Enhance Them

This Report Is Temporarily Restricted Pending Official Public Release.

## GAO Highlights

Highlights of [GAO-20-530](#), a report to the Honorable Mark Warner, U.S. Senate

### Why GAO Did This Study

Investors are increasingly asking public companies to disclose information on ESG factors to help them understand risks to the company's financial performance or other issues, such as the impact of the company's business on communities. The Securities and Exchange Commission requires public companies to disclose material information—which can include material ESG information—in their annual 10-K filings and other periodic filings.

GAO was asked to review issues related to public companies' disclosures of ESG information. This report examines, among other things, (1) why investors seek ESG disclosures, (2) public companies' disclosures of ESG factors, and (3) the advantages and disadvantages of ESG disclosure policy options.

GAO analyzed 32 large and mid-sized public companies' disclosures on 33 selected ESG topics. Among other criteria, GAO selected companies within eight industries that represented a range of sectors in the U.S. economy and selected ESG factors that were frequently cited as important to investors by market observers. GAO also reviewed reports and studies on ESG policy proposals and interviewed 14 large and mid-sized institutional investors (seven private-sector asset management firms and seven public pension funds), 18 public companies, 13 market observers (such as ESG standard-setting organizations, academics, and other groups), and international government, stock exchange, and industry association representatives.

View [GAO-20-530](#). For more information, contact Michael Clements at (202) 512-8678 or [ClementsM@gao.gov](mailto:ClementsM@gao.gov).

July 2020

## PUBLIC COMPANIES

### Disclosure of Environmental, Social, and Governance Factors and Options to Enhance Them

#### What GAO Found

Most institutional investors GAO interviewed (12 of 14) said they seek information on environmental, social, and governance (ESG) issues to better understand risks that could affect company financial performance over time. These investors added that they use ESG disclosures to monitor companies' management of ESG risks, inform their vote at shareholder meetings, or make stock purchasing decisions. Most of these institutional investors noted that they seek additional ESG disclosures to address gaps and inconsistencies in companies' disclosures that limit their usefulness.

GAO's review of annual reports, 10-K filings, proxy statements, and voluntary sustainability reports for 32 companies identified disclosures across many ESG topics but also found examples of limitations noted by investors. Twenty-three of 32 companies disclosed on more than half of the 33 topics GAO reviewed, with board accountability and workforce diversity among the most reported topics and human rights the least. Disclosure on an ESG topic may depend on its relevance to a company's business. As shown in the figure, most companies provided information related to ESG risks or opportunities that was specific to the company, though some did not include this type of company-specific information.

**The Four Environmental, Social, and Governance (ESG) Disclosure Topics GAO Reviewed with the Most and Least Company-Specific Disclosures, Generally Covering Data from 2018**



Source: GAO analysis of company disclosures. | GAO-20-530

Note: GAO reviewed 32 companies' 10-Ks, proxy statements, annual reports, and voluntary sustainability reports (generally with data from 2018, and some with data from 2017 and 2019).

Additionally, differences in methods and measures companies used to disclose quantitative information may make it difficult to compare across companies. For example, companies differed in their reporting of carbon dioxide emissions.

Policy options to improve the quality and usefulness of ESG disclosures range from legislative or regulatory action requiring or encouraging disclosures, to private-sector approaches, such as using industry-developed frameworks. These options pose important trade-offs. For example, while new regulatory requirements could improve comparability across companies, voluntary approaches can provide flexibility to companies and limit potential costs.

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**Abbreviations**

CDP	Carbon Disclosure Project
Corporation Finance	Division of Corporation Finance
ESG	environmental, social, and governance
ESMA	European Securities and Markets Authority
GRI	Global Reporting Initiative
IIRC	International Integrated Reporting Council
SASB	Sustainability Accounting Standards Board
SEC	Securities and Exchange Commission
TCFD	Task Force on Climate-Related Financial Disclosures

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U.S. GOVERNMENT ACCOUNTABILITY OFFICE

441 G St. N.W.  
Washington, DC 20548

July 2, 2020

The Honorable Mark Warner  
United States Senate

Dear Senator Warner:

Investors are increasingly asking public companies to disclose information on environmental, social, and governance (ESG) factors to help them understand risks to the company's financial performance or other issues, such as the impact of the company's business on communities. Examples of ESG factors include climate-related impacts, investments in human capital, and the strength of a company's data security program. Some of the largest institutional investors in the United States have announced that they take ESG factors into account to inform their investment decisions and manage investment risks. For example, in a recent letter to clients, executives of BlackRock, Inc., which manages more than \$6 trillion in investment assets, stated their view that ESG investment options can offer investors better outcomes.<sup>1</sup> This letter also outlined plans to increase their focus on managing ESG-related risks through how BlackRock constructs investment portfolios, designs investment products, and engages with companies.<sup>2</sup>

The Securities and Exchange Commission (SEC) requires public companies to disclose material information—which can include material

<sup>1</sup>As of June 2019, BlackRock managed a total of \$6.84 trillion in assets across equity, fixed income, cash management, alternative investment, real estate, and advisory strategies, according to BlackRock's website.

<sup>2</sup>In 2018, we reviewed 11 studies in peer-reviewed academic journals published from 2012 to 2017 that assessed the impact on financial performance of incorporating ESG factors. Nine of the 11 studies reported finding a neutral or positive relationship between financial returns and the use of ESG information to inform investment management decisions in comparison to otherwise similar investments that did not incorporate ESG information. See GAO, *Retirement Plan Investing: Clearer Information on Consideration of Environmental, Social, and Governance Factors Would Be Helpful*, GAO-18-398 (Washington, D.C.: May 22, 2018).

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ESG information—in their annual 10-K filings and other periodic filings.<sup>3</sup> SEC has issued interpretive releases to help explain to companies how current disclosure requirements apply to particular ESG topics, such as climate change. Third-party organizations have created voluntary frameworks for companies to consider to improve the quality and consistency of companies' ESG disclosures. However, some investors and market observers have continued to express dissatisfaction with the quality and consistency of public companies' ESG disclosures.

You asked us to review issues related to public companies' disclosures of ESG information.<sup>4</sup> This report examines (1) why and how investors have sought additional ESG disclosures; (2) how public companies' disclosures of selected ESG factors have compared within and across selected industries; (3) steps SEC staff have taken to assess the effectiveness of the agency's efforts to review the disclosure of material ESG factors; and (4) the advantages and disadvantages of policy options that investors and other market observers have proposed to improve ESG disclosures.<sup>5</sup>

To obtain information about how and why investors have sought additional ESG disclosures, we reviewed relevant reports and studies by academics, investment firms, and others. In addition, we conducted semi-structured interviews with a nongeneralizable sample of 14 institutional investors:

- four large private asset management firms (each with more than \$1 trillion in worldwide assets under management as of December 31, 2018);

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<sup>3</sup>Material information can include, among other things, known trends, events, and uncertainties that are reasonably likely to have an effect on the company's financial condition or operating performance, as well as potential risks to investing in the company. SEC considers information to be material if there is a substantial likelihood that a reasonable investor would consider it important in making an investment decision in the context of the total mix of available information.

<sup>4</sup>This review was conducted in response to a 2018 request from Senator Mark Warner—then Ranking Member, Senate Subcommittee on Securities, Insurance, and Investment.

<sup>5</sup>For other GAO work on ESG disclosures, see GAO, *Climate Related Risks: SEC Has Taken Steps to Clarify Disclosure Requirements*, GAO-18-188 (Washington, D.C.: Feb. 20, 2018); GAO-18-398; and *Corporate Boards: Strategies to Address Representation of Women Include Federal Disclosure Requirements*, GAO-16-30 (Washington, D.C.: Dec. 3, 2015).

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- three mid-sized private asset management firms (each with from \$500 billion to \$1 trillion in worldwide assets under management as of December 31, 2018);
  - three large public pension funds (each with more than \$100 billion in total assets as of September 30, 2018); and
  - four mid-sized public pension funds (each with from \$40 billion to \$100 billion in total assets as of September 30, 2018).<sup>6</sup>

To get a mix of regional perspectives, we incorporated geographic location into our selection when possible. For example, we selected at least one of the seven public pension funds from each of four U.S. census regions (Northeast, South, Midwest, and West). To understand trends in the use of shareholder proposals to promote improved ESG disclosure, we obtained and analyzed proposals for a generalizable, random sample of 100 public companies listed on the S&P Composite 1500 as of October 4, 2019.<sup>7</sup>

To compare public companies' ESG disclosures within and across industries, we analyzed disclosures from a nongeneralizable sample of 32 companies across eight industries on eight ESG factors. We selected ESG factors that were frequently cited as important to investors and companies by a range of market observers, including ESG standard-setting organizations and academics. We selected the eight industries because they represented a range of sectors of the U.S. economy (e.g., transportation, services, and manufacturing). By selecting four of the eight largest companies in each industry, we arrived at 32 companies. We reviewed companies' recent regulatory filings (10-K and definitive proxy statement), annual reports, and voluntary corporate social responsibility

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<sup>6</sup>In this report, we refer to asset management firms in the private sector as "private" to differentiate them from public pension funds. Our sample of these asset management firms includes firms that are publicly traded.

<sup>7</sup>The S&P Composite 1500 combines three indices—the S&P 500, the S&P MidCap 400, and the S&P SmallCap 600.

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reports to identify relevant disclosures on the selected ESG topics.<sup>8</sup> In addition, we conducted semi-structured interviews with representatives from 18 of the 32 companies to obtain their perspectives on their ESG disclosure practices.<sup>9</sup>

To review SEC staff's efforts related to ESG disclosures, we reviewed relevant Division of Corporation Finance (Corporation Finance) procedures. We also interviewed SEC officials and 15 review staff (six attorneys, six accountants, and three branch chiefs) involved in Corporation Finance's oversight of public companies' disclosures. To identify relevant policy proposals to improve ESG disclosures, we reviewed reports and public statements and comments from investors, ESG standard-setting organizations, and other groups. In addition, we reviewed reports and studies on international ESG disclosure requirements to identify and obtain information about relevant policy approaches implemented in other countries. We also interviewed government officials in the United Kingdom and Japan and stock exchange and industry association representatives from South Africa. Finally, we conducted interviews with 13 market observers, including ESG standard-setting organizations, academics, and representatives of industry and investor groups to obtain their perspectives on issues and

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<sup>8</sup>We reviewed companies' 2018 10-Ks, 2019 definitive proxy statements (which typically covered the same reporting period as the 2018 10-K), and 2018 annual reports (when different from the company's 10-K). Companies are required to send an annual report to their shareholders or post the report on their websites before an annual meeting to elect directors. Some companies choose to use their 10-K as their annual report and do not provide separate annual reports. We reviewed annual reports that were distinct from companies' 10-Ks. Of our selected companies, 21 published annual reports separate from their 10-Ks. We also reviewed companies' most recent sustainability reports available on their websites, accessed from July through December 2019. The reporting years for these sustainability reports were: 2017 (three companies), 2017–2018 (three companies), 2018 (16 companies), or 2018–2019 (three companies). Seven companies did not have sustainability reports available on their websites. Sustainability reports are sometimes called corporate responsibility reports or ESG reports. SEC's rules and regulations also generally require foreign companies with securities listed in the United States to file an annual form 20-F, which contains financial and nonfinancial information for investors. For the purposes of this report, we did not review form 20-F filings.

<sup>9</sup>We requested interviews with all 32 of our selected companies, but eight companies declined, and six companies did not respond to our request. For those that did not respond, we made at least three requests by email.

policy options related to ESG disclosures.<sup>10</sup> We selected these market observers through studies and reports of companies' ESG disclosures that identified leading observers with subject matter expertise and through referrals obtained during interviews for this study.

We conducted this performance audit from January 2019 to July 2020 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

## Background

The use of ESG factors has emerged as a way for investors to capture information on potential risks and opportunities that otherwise may not be taken into account in financial analysis. ESG factors like climate change impacts and workplace safety may affect a company's expected financial performance and thereby its value to shareholders. See table 1 for examples of ESG factors.

Table 1: Examples of Environmental, Social, and Governance Factors

Environmental	Social	Governance
Climate change impacts and greenhouse gas emissions	Labor standards	Board composition
Energy efficiency	Human rights	Executive compensation
Renewable energy	Employee engagement	Audit committee structure
Air, water, resource depletion, or pollution	Customer satisfaction	Bribery and corruption
Waste management	Community relations	Whistleblower programs
Biodiversity impacts	Gender and diversity	Accident and safety management

Source: GAO analysis of documentation from the CFA Institute, Sustainable Accounting Standards Board, and Principles for Responsible Investment. | GAO-20-530

ESG standard-setting organizations were created to improve transparency and consistency in companies' disclosure of ESG information. Several independent and nonprofit organizations have created voluntary frameworks companies may use to disclose on ESG

<sup>10</sup>To characterize investor, company, SEC review staff, and market observer views throughout the report, we consistently defined modifiers to quantify the views of each group as follows: "nearly all" represents 80–99 percent of the group, "most" represents 50–79 percent of the group, and "some" represents 20–49 percent of the group. The number of interviews each modifier represents differs based on the number of interviews in that grouping: 14 institutional investors, 18 public companies, 15 SEC review staff, and 13 market observers.

issues, as shown in table 2. Frameworks are generally comprised of single-issue categories that contain several specific disclosure topics related to that category.

**Table 2: Environmental, Social, and Governance (ESG) Standard-Setting Organizations and Voluntary Reporting Frameworks**

ESG standard-setting organization	Description of voluntary reporting framework
Global Reporting Initiative (GRI)	GRI is an international nonprofit organization that was established in 1997. GRI created the first international guidelines for sustainability reporting in 2000, then replaced these guidelines with sustainability reporting standards in 2016. According to GRI, 82 percent of the world's 250 largest companies report on ESG topics using the GRI standards. Companies determine which, if any, of their business operations may have a relevant impact and select GRI sustainability reporting standards accordingly.
United Nations Global Compact	The United Nations Global Compact was established in 2000. Participating companies are encouraged to incorporate the compact's 10 principles on human rights, labor, the environment, and anti-corruption into their operations. In 2017, the compact partnered with GRI to produce a guide that uses GRI's standards to help companies disclose how they act on the compact's 10 principles.
International Integrated Reporting Council (IIRC)	IIRC is an international nonprofit organization that was established in 2010, which encourages companies to merge their financial and sustainability disclosures using a process called integrated reporting. IIRC's integrated reporting framework provides companies with guidance on the principles and content of integrated reports, but it does not provide standards for ESG disclosures.
Sustainability Accounting Standards Board (SASB)	SASB is a U.S. nonprofit organization that was established in 2011. In 2018, SASB developed a voluntary reporting framework in consultation with companies, investors, and subject matter experts. The framework is comprised of industry-specific sustainability accounting standards for 77 industries intended to allow companies to communicate ESG information that could have a financial impact on the company.
<b>Additional climate change-related frameworks</b>	
CDP Global (previously the Carbon Disclosure Project)	CDP is an international nonprofit organization that was established in 2000. CDP scores organizations on environmental risks and opportunities related to climate change, water security, and deforestation. CDP gathers information to generate its scores and reports by sending questionnaires to participating investors and companies as well as public entities, including cities, states, and regions.
Task Force on Climate-Related Financial Disclosures (TCFD)	TCFD was established by the Financial Stability Board in 2015 to make recommendations for improving principles and practices for voluntary climate change disclosure. In 2017, TCFD released a climate-related risk disclosure framework. This framework is intended to help companies consider and report on risks associated with climate change, such as physical, liability, and transition risks that could have a financial impact on a company in the future.

Source: GAO analysis of standard-setting framework documents. | GAO-20-530

SEC rules and regulations generally require public companies to disclose, among other things, known trends, events, and uncertainties that are reasonably likely to have a material effect on the company's financial condition or operating performance, as well as potential risks to investing in the company. SEC considers information to be material if there is a substantial likelihood that a reasonable investor would consider it important in making an investment decision in the context of the total mix

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of available information.<sup>11</sup> Public companies disclose information on an ongoing basis through annual 10-K filings, quarterly 10-Q filings, and definitive proxy statements, among other disclosure requirements.<sup>12</sup> Regulation S-K contains SEC integrated disclosure requirements for 10-K filings and other periodic reports filed with SEC.<sup>13</sup> Staff in Corporation Finance are to selectively review 10-K filings for compliance with requirements outlined in Regulation S-K and other applicable accounting standards and form requirements. While federal securities laws generally do not specifically address the disclosure of ESG information, Regulation S-K's disclosure requirements for nonfinancial information apply to material ESG topics. Regulation S-K also includes prescriptive requirements for disclosure of certain topics considered to be ESG topics, such as board composition, executive compensation, and audit committee structure.<sup>14</sup>

Corporation Finance's legal and accounting staff review filings through seven offices organized by industry, and office managers assign different levels of reviews to 10-K filings, such as full reviews (which include financial and legal reviews) and financial-only reviews. The Sarbanes-Oxley Act of 2002 requires SEC to review the financial statements of each reporting company at least once every 3 years, which informs, among other factors, how Corporation Finance selects and determines

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<sup>11</sup>See 17 C.F.R. §§ 240.12b-2, 230.405; see also *Basic Inc. v. Levinson*, 485 U.S. 224, 231-32 (1988) (quoting *TSC Industries, Inc. v. Northway, Inc.*, 426 U.S. 438, 449 (1976)) ("[T]o fulfill the materiality requirement 'there must be a substantial likelihood that the omitted fact would have been viewed by the reasonable investor as having significantly altered the 'total mix' of information made available.'"). For the purposes of this report, we use "companies," to refer to public companies subject to the registration and reporting requirements of the Securities Act of 1933 and the Securities Exchange Act of 1934.

<sup>12</sup>Definitive proxy statements are the final version of proxy statements that public companies are required to file with SEC and provide to shareholders prior to certain shareholder meetings.

<sup>13</sup>See Regulation S-K, 17 C.F.R. Pt. 229.

<sup>14</sup>SEC also has proposed amendments to modernize Regulation S-K, including refocusing the disclosure of human capital resources to include any material information on human capital measures or objectives on which the company focuses in managing the business. See Modernization of Regulation S-K Items 101, 103, and 105, 84 Fed. Reg. 44,358 (proposed Aug. 23, 2019). Current human capital disclosure rules require companies to report on their number of employees, and these changes aim to provide investors with a better understanding of how companies manage human capital resources.

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the extent to which 10-K filings are reviewed.<sup>15</sup> In conducting these reviews, Corporation Finance staff may provide comments to a company to obtain additional information, clarification on the company's disclosure, or to significantly enhance its compliance with applicable reporting requirements. Comments depend on the issues that arise in a particular filing, and staff may request that a company provide additional information to help them better evaluate disclosures.

SEC occasionally issues interpretive releases on topics of general interest to the business and investment communities, which reflect the Commission's views and interpret federal securities laws and SEC regulations. For example, in 2010, SEC issued the Commission Guidance Regarding Disclosure Related to Climate Change, which described how existing disclosure requirements could apply to climate change-related information and how companies may consider climate disclosures in required filings.<sup>16</sup> In 2018, SEC also issued the Commission Statement and Guidance on Public Company Cybersecurity Disclosures, outlining how existing reporting requirements could apply to cybersecurity-related risks and incidents.<sup>17</sup> These interpretive releases do not establish new reporting requirements. Instead, they identify items in existing laws and regulations that may be most likely to require disclosure on these topics, such as description of the company's business and potential risk factors that may affect the company.

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<sup>15</sup>Sarbanes-Oxley Act of 2002, Pub. L. No. 107-204, §408, 116 Stat. 745, 790-91 (2002) (codified at 15 U.S.C. § 7286).

<sup>16</sup>Commission Guidance Regarding Disclosure Related to Climate Change, 75 Fed. Reg. 6290 (Feb. 8, 2010).

<sup>17</sup>Commission Statement and Guidance on Public Company Cybersecurity Disclosures, 83 Fed. Reg. 8166 (Feb. 26, 2018).

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### Most Large Investors Told Us They Sought Additional ESG Disclosures to Better Understand and Compare Companies' Risks

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#### Most Investors Said They Engage with Companies to Address Gaps or Inconsistencies in ESG Disclosures That Limit Their Usefulness

Institutional investors with whom we spoke generally agreed that ESG issues can have a substantial effect on a company's long-term financial performance.<sup>18</sup> All seven private asset managers and representatives at five of seven public pension funds said they seek ESG information to enhance their understanding of risks that could affect companies' value over time. Representatives at the other two pension funds said that they generally do not consider ESG information relevant to assessing companies' financial performance. While investors with whom we spoke primarily used ESG information to assess companies' long-term value, other investors also use ESG information to promote social goals. A 2018 US SIF survey found that private asset managers and other investors, representing over \$3.1 trillion (of the \$46.6 trillion in total U.S. assets under professional management), said they consider ESG issues as part of their mission or in order to produce benefits for society.<sup>19</sup>

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<sup>18</sup>Institutional investors include public and private entities that pool funds on behalf of others and invest the funds in securities and other investment assets. We interviewed 14 institutional investors: four large private-sector asset management firms (each with more than \$1 trillion in worldwide assets under management), three private-sector mid-sized asset management firms (each with from \$500 billion to \$1 trillion in worldwide assets under management), three large public pension funds (each with more than \$100 billion in total assets), and four mid-sized public pension funds (each with from \$40 billion to \$100 billion in total assets). Other types of institutional investors include private or nonprofit organizations such as labor organizations, foundations, and faith-based investors.

<sup>19</sup>US SIF: The Forum for Sustainable and Responsible Investment, *Report on US Sustainable, Responsible and Impact Investing Trends* (2018). US SIF is a nonprofit organization that promotes sustainable investment practices by encouraging members to focus on long-term investment and ensure that ESG impacts are meaningfully assessed in all investment decisions. US SIF members include private asset management firms, asset owners, and private and nonprofit investing organizations.

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Institutional investors we interviewed identified various ways they use ESG disclosures to inform their investment decisions and manage risks related to their investments.

- **Protecting long-term investments by monitoring companies' management of ESG risks.** Some investors with whom we spoke noted that they primarily make long-term investments in passively managed funds, which may prevent them from making investment decisions based on ESG information.<sup>20</sup> However, 10 of 14 investors said that their focus on long-term factors that drive value leads them to monitor or influence companies' management of ESG issues to protect their investments. Investors generally said they use ESG disclosures to determine which ESG issues companies monitor and to assess how companies manage these risks. Nearly all investors said ESG issues can be important to a company's operations and performance over time. For example, seven of 14 investors said they used ESG disclosures to identify companies that were less transparent than their peers or appeared to be outliers in their industries, such as having less board diversity than their peers. Investors then engaged with these companies to discuss their risk-management strategies, encourage disclosure on ESG issues, or provide information about what kind of disclosure they would find useful.
- **Informing shareholder votes.** Most investors with whom we spoke said they use ESG information to inform their votes as shareholders at annual shareholder meetings, either through a proxy advisory firm or independently.<sup>21</sup> Specifically, nine of 14 investors said that ESG information informs how they vote on directors' nominations to the board and other proposals at public companies' annual meetings. For example, representatives from two large public pension funds said

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<sup>20</sup>For example, an investment firm may employ a passive investment strategy by managing the selection and allocation of investments in a particular fund with the goal of matching the returns of a benchmark index, such as the S&P 500. In contrast, an active investment strategy involves choosing investments with the goal of generating returns that outperform a benchmark index.

<sup>21</sup>Shareholders of publicly traded companies generally vote annually on issues that could affect the companies' value, such as the election of directors, executive compensation packages, and proposed mergers and acquisitions. The shareholders receive advance notice of the votes through a definitive proxy statement and may vote in person or choose a third party (proxy) to cast their vote. Most proxy votes are cast by or on behalf of institutional investors, such as mutual funds and pension funds, because of the level of stocks they manage relative to other types of investors.

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they withhold votes for directors if they determine that a company's board had not effectively disclosed issues, such as climate risk or executive performance metrics.<sup>22</sup>

- **Creating ESG funds or portfolios.** Five of 14 investors we interviewed said they created ESG-focused investment funds or portfolios with goals such as promoting social responsibility and environmental sustainability. In creating these funds and portfolios, investors generally review companies' ESG disclosures to determine which companies to include or exclude from these funds or portfolios. For example, two private asset managers said they created ESG funds or portfolios to attract investors focused on social goals, such as faith-based investors, while representatives from one pension fund said they had worked with an asset manager to create a low-emissions index intended to support the Paris Agreement's goals.<sup>23</sup>
- **Divesting.** Some investors we interviewed said they typically would not divest based on a company's ESG disclosures, and three said that ESG information could lead them to divest. A mid-size asset manager noted that the firm works with companies to improve their disclosures rather than divest. Conversely, representatives from one mid-size pension fund said they found that buying or selling shares is a more efficient method for changing corporate behavior than the lengthier strategy of engaging companies in dialogue. Additionally, a large asset manager said that its portfolio managers sell shares if a company's ESG performance or response to engagement is poor.

Although some studies report that the quantity and quality of ESG disclosures generally improved in the last few years, 11 of 14 investors with whom we spoke said they seek additional ESG disclosures from

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<sup>22</sup>When directors run unopposed, shareholders have the option to withhold their vote in favor of the candidate. According to SEC's Office of Investor Education and Advocacy, while a substantial number of "withhold" votes will not prevent an unopposed candidate from being elected, it can indicate shareholder dissatisfaction with the candidate and sometimes influence future decisions on director nominees by the board of directors.

<sup>23</sup>The Paris Agreement is an agreement reached by parties to the United Nations Framework Convention on Climate Change to strengthen the global response to the threat of climate change that entered into force in 2016.

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companies to address gaps and inconsistencies, among other issues.<sup>24</sup> Investors described challenges with understanding and interpreting both quantitative and narrative disclosures.

- **Quantitative disclosures.** Investors cited examples of inconsistencies in companies' quantitative disclosures that limit comparability, including comparability among companies that disclose on the same ESG topics. Specifically, investors described challenges such as the variety of different metrics that companies used to report on the same topics, unclear calculations, or changing methods for calculating a metric. For example, five of 14 investors said that companies' disclosures on environmental or social issues use a variety of metrics to describe the same topic. A few studies have reported that the lack of consistent and comparable metric standards have hindered companies' ability to effectively report on ESG topics, because they are unsure what information investors want.<sup>25</sup> In addition, some investors said that companies may change which metrics they use to disclose on an ESG topic from one year to the next, making disclosures hard to compare within the same company over time.
- **Narrative disclosures.** Most investors noted gaps in narrative disclosures that limited their ability to understand companies' strategies for considering ESG risks and opportunities. For example, some investors noted that some narrative disclosures contained generic language, were not specific to how the company addressed ESG issues, or were not focused on material information. For example, two private asset managers said that companies may provide boilerplate narratives or insufficient context for their quantitative disclosures, and representatives from one pension fund said that the fund would like additional disclosures on cybersecurity

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<sup>24</sup>International Monetary Fund, *Global Financial Stability Report: Lower for Longer* (October 2019); Council of Institutional Investors Research and Education Fund, *Board Evaluation Disclosure* (January 2019); Investor Responsibility Research Center Institute and Sustainable Investments Institute, *State of Integrated and Sustainability Reporting 2018* (2018); Sustainable Accounting Standards Board, *The State of Disclosure 2017: An Analysis of the Effectiveness of Sustainability Disclosure in SEC Filings* (December 2017); and KPMG, *Survey of Corporate Responsibility Reporting 2017* (October 2017).

<sup>25</sup>World Economic Forum, *Toward Common Metrics and Consistent Reporting of Sustainable Value Creation* (January 2020); International Monetary Fund, *Global Financial Stability Report: Lower for Longer* (October 2019); and U. S. Chamber of Commerce Foundation and the Chamber's Center for Capital Markets Competitiveness, *Corporate Sustainability Reporting: Past, Present, Future* (November 2018).

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but has found that most disclosures on this topic are generic and not very helpful.

Additionally, most institutional investors said that there is fragmentation in the format or location of companies' ESG disclosures, which can make this information hard to compile and review. However, these investors generally said that it is more important for companies to focus on providing disclosures than on how or where the disclosures are presented. These investors said that they are able to purchase access to compiled data from third-party data providers to use in their analysis of companies' ESG disclosures.

Regarding how investors seek ESG disclosures, nearly all institutional investors with whom we spoke said they engage with companies to request additional ESG disclosures through meetings, telephone calls, or letters. Some investors said that companies' responsiveness, which can include producing ESG presentations for investors and discussing ESG information on earnings calls, varied by size because larger companies have more resources to respond to investor engagement. Engagement also can be complicated by conflicting investor demands, as well as the proliferation of standards and surveys. According to representatives from an industry group that we interviewed, the large number of demands for specific ESG information from investors and third parties can pose a challenge to companies as they prioritize how to respond. For example, one company said it receives diverse requests for information that indicate that those investors do not agree on what issues are most important.

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To a Limited Degree,  
Some Investors Seek ESG  
Disclosures through  
Shareholder Proposals

Some investors seek additional ESG disclosures by submitting shareholder proposals, which are requests from shareholders that the company take action on a specific issue or issues. These proposals are generally presented for a shareholder vote at public companies' annual

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meetings.<sup>26</sup> However, shareholder proposals can be withdrawn before coming to a vote when the company reaches an agreement with the shareholder who submitted the proposal prior to the annual meeting.

Our analysis of a generalizable sample of companies listed on the S&P 1500 found that in 2019, an estimated 10 percent of companies received one or more shareholder proposals and an estimated 5 percent of companies received one or more shareholder proposals related to increasing ESG disclosures.<sup>27</sup> For the ESG-related proposals in our sample, on average about 28 percent of shareholders voted in favor of these proposals and no proposals received more than 50 percent of the vote.<sup>28</sup> As shown in table 3, the companies in our sample received a total of six proposals requesting additional ESG disclosures on a variety of social and governance topics. Most of these proposals were submitted to large companies.<sup>29</sup> Investors that submitted proposals included one public

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<sup>26</sup>According to SEC, under state law shareholders generally have the right to appear in person at an annual or special meeting and put forth a resolution to be voted on by the shareholders. See Procedural Requirements and Resubmission Thresholds under Exchange Act Rule 14a-8, 84 Fed. Reg. 66,458, 66,474 (proposed Dec. 4, 2019). U.S. public companies generally hold their annual meetings to consider key management and shareholder proposals that may have an effect on a company's operations and value, such as executive compensation and director elections, or other more routine issues that may not affect value, such as changing a corporate name or approving an auditor. Under SEC rules, shareholders who have held at least \$2,000 or 1 percent of a company's stock for 1 year can submit proposals for a vote. SEC has proposed an update to this threshold and suggested that higher ownership requirements or longer holding periods would demonstrate a shareholder's economic stake or long-term investment interest in the company. See *id.*

<sup>27</sup>All estimates from our review of a sample of companies' shareholder proposals are subject to sampling error. These estimates have a 95 percent confidence interval that extends from 6 to 17 percent for companies receiving one or more shareholder proposals and from 2 to 11 percent for companies receiving one or more shareholder proposals related to increasing ESG disclosures. We only reviewed shareholder proposals that were included in companies' 2019 shareholder meeting materials.

<sup>28</sup>Voting requirements vary among U.S. public companies. Companies' bylaws generally determine how shareholder votes are counted and requirements differ based on the type of proposal being voted, the proportion of votes required for an item to pass, and which votes are factored into the voting outcome. For example, some U.S. public companies count abstentions as votes cast against certain nonbinding items, such as votes on executive compensation and shareholder proposals, while others count only votes cast for and against the item. Some companies require items to receive more than 50 percent of the vote to be considered as having passed.

<sup>29</sup>For our sample, we refer to companies appearing in the S&P 500 as large, companies in the S&P MidCap 400 as mid-sized, and companies in the S&P SmallCap 600 as small.

pension fund, one labor organization, three socially focused asset managers, and one higher education endowment.

Table 3: Shareholder Proposals Submitted to 100 Sampled Companies Requesting Additional Environmental, Social, and Governance (ESG) Disclosures, 2019

Company size	ESG topic and classification	Additional ESG disclosure requested	Type of investor	Percentage votes in favor <sup>a</sup>
Large	Political spending (Governance)	Report corporate spending on political activities	Pension fund	34.4
Large	Personnel management (Social)	Report on the potential impacts of mandatory arbitration for employees' sexual harassment claims	Labor union	34.0
Large	Human rights (Social)	Report on the risk of child exploitation occurring via the company's products and services	Faith-based asset manager	33.0
Large	Executive compensation (Governance)	Report on the feasibility of linking executive compensation to performance around cybersecurity and data privacy	ESG investment fund	12.2
Mid-sized	Board diversity (Governance)	Report on steps to enhance board diversity	ESG investment fund	26.6
Mid-sized	Supply chain management (Social)	Report on steps to increase supply chain transparency	Higher education endowment	No vote <sup>b</sup>
Average	—	—	—	28.0

Source: GAO review of shareholder proposals. | GAO-20-530

<sup>a</sup>The percentage of votes in favor was calculated using the number of votes shareholders cast in favor of the proposal divided by the sum of votes cast in favor, against, and abstain.

<sup>b</sup>The company's 8-K filing that included the Submission of Matters to a Vote of Security Holders did not record a vote on this shareholder proposal. There are several possible reasons for not voting on a proposal, such as the proponent did not present the proposal at the annual meeting or withdrew the proposal before the meeting.

Notes: In this table, we refer to companies appearing in the S&P 500 as large, companies in the S&P MidCap 400 as mid-sized, and companies in the S&P SmallCap 600 as small. Each of the proposals in the table (1) was submitted to a company in our generalizable sample, (2) contained a request for an additional ESG disclosure, and (3) was included in the company's 2019 annual shareholder meeting materials. No small companies in our sample received a shareholder proposal requesting additional ESG disclosure in 2019.

All of the private asset management firms and representatives from three of seven pension funds we interviewed said they do not use shareholder proposals as a means to influence companies' ESG disclosures. One of these pension funds said they have found filing shareholder proposals unnecessary after engaging in dialogue with companies. However, representatives from four of seven pension funds said they have filed shareholder proposals to seek additional ESG disclosures. Two large pension funds said they have found filing shareholder proposals an important engagement method for getting companies' attention on ESG

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issues, while the other two funds noted that it was rare for them to file a proposal.

Similarly, studies and reports we reviewed indicated that shareholder proposals are concentrated among a relatively small number of shareholders and that the number of proposals has been declining in the last 5 years.<sup>30</sup> For example, a law firm's analysis of shareholder proposals filed with companies listed on the S&P 1500 in 2019 reported that 10 investors submitted over half of all proposals.<sup>31</sup> This report also found that faith-based investors and socially focused asset managers, who seek to advance social causes in their investments, submitted the majority of environmental and social proposals in both 2018 and 2019. In addition, this analysis showed that the total number of shareholder proposals, including withdrawn proposals, submitted annually declined each year from 2015 to 2019. As the total number of proposals has declined, shareholder proposals related to environmental and social issues constituted over 45 percent of proposals each year from 2015 to 2019.<sup>32</sup> While studies found that during this same time period shareholder support increased for these environmental and social proposals that went to a vote, shareholder support for most of them remained below 30 percent.<sup>33</sup>

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<sup>30</sup>These studies include shareholder proposals that were included in the shareholder meeting materials and those that were withdrawn before being included. Some shareholder proposals are submitted by investors representing larger groups of investors, which submit proposals through individual members.

<sup>31</sup>Sullivan and Cromwell, LLP, *2019 Proxy Season Review, Part I: Rule 14a-8 Shareholder Proposals* (July 2019). The law firm Sullivan and Cromwell advises U.S. public companies on corporate governance issues, including the shareholder proposal process. The firm's analysis relied on data from Institutional Shareholder Services, Inc. that was current as of June 30, 2019. Sullivan and Cromwell estimates that 90 percent of U.S. public companies' annual shareholder meetings are held before June 30 each year.

<sup>32</sup>Sustainability Accounting Standards Board, *2015 Annual Report* (June 2016); Sullivan and Cromwell, LLP, *2018 Proxy Season Review* (July 2018); and Sullivan and Cromwell, LLP, *2019 Proxy Season Review, Part I: Rule 14a-8 Shareholder Proposals* (July 2019).

<sup>33</sup>US SIF: The Forum for Sustainable and Responsible Investment, *Report on US Sustainable, Responsible and Impact Investing Trends* (2018); Sullivan and Cromwell, LLP, *2018 Proxy Season Review* (July 2018); and Sullivan and Cromwell, LLP, *2019 Proxy Season Review, Part I: Rule 14a-8 Shareholder Proposals*, (July 2019).

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Selected Companies  
Generally Disclosed  
Many ESG Topics but  
Lack of Detail and  
Consistency May  
Reduce Usefulness to  
Investors

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Companies Considered  
Stakeholder Input and  
Regulatory Requirements  
in Disclosing on ESG  
Topics

Representatives from public companies with whom we spoke said they use several methods and consider multiple factors when deciding which ESG topics to report. Most companies (10 of 18) noted that legal and regulatory requirements were their primary consideration when determining which ESG factors to disclose.<sup>34</sup> In addition, nearly all companies (15 of 18) told us they conduct some form of stakeholder engagement when determining what ESG information beyond regulatory requirements to report. As part of the engagement process, companies generally said they reach out to investors, representatives of communities they operate in, and other interested stakeholders to solicit their opinions about which ESG factors are important to them. Some companies described their ESG stakeholder engagement process as part of their broader company-wide outreach efforts, while others told us they hired outside firms to conduct this engagement on their behalf.

In addition to stakeholder outreach, most companies (11 of 18) told us they perform assessments to determine which ESG topics to include in their regulatory filings or other reports. As part of these assessments, companies review a wide array of potential risks and identify the ones that would have the most impact on their business. In addition to requirements, outreach and assessments, most companies (nine of 18) told us they review ESG disclosure frameworks, such as GRI and SASB, to inform their consideration of which ESG factors to disclose.

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<sup>34</sup>As mentioned previously, SEC rules and regulations require public companies to disclose material information, including material ESG information, in their annual 10-K filings and other periodic reports filed with SEC. Similarly, SEC requires companies to provide certain governance information in their proxy statements in advance of shareholder meetings where shareholders elect members of the company's board of directors.

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Similar to deciding which ESG topics to disclose, most companies (10 of 18) told us they also rely on legal and regulatory requirements when determining where to disclose ESG information. Specifically, companies said they identify those ESG factors that should be included in the 10-K or proxy statement according to SEC requirements, and publish information on these factors in their regulatory filings. In addition, some companies (six of 18) told us that they view their voluntary sustainability report as complementary to their regulatory filings. Specifically, four companies said they view their sustainability reports as a place to publish relevant ESG information that may not necessarily be material under the SEC definition and is therefore not included in regulatory filings. Lastly, some companies also told us that their voluntary sustainability reports provide an opportunity to disclose information that is of interest to ESG-focused investors or non-investor stakeholders. For example, some companies (five of 18) told us they use these reports to reach a broader stakeholder audience beyond investors, including employees and customers, when writing their sustainability reports.

In addition to the regulatory and voluntary reporting that we reviewed, representatives from all 18 companies said they communicate ESG information in other ways. For example, most companies (13 of 18) said they also publish issue-specific ESG reports, most commonly on climate change.<sup>35</sup> Most companies (12 of 18) also said they include ESG information on their company websites, because information could be updated more frequently and include more dynamic content, such as videos. Finally, most companies (11 of 18) told us they have developed ESG-focused presentations for investors, and some companies (four of 18) said they have begun including ESG information in their traditional investor communications, such as quarterly earnings calls and stockholder bulletins.

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<sup>35</sup>Most companies said they submitted responses to an annual questionnaire from CDP, and other companies said they have issued their own stand-alone climate change reports. Other companies said they published issue-specific reports on ESG topics directly relevant to their industry. For example, a utility company told us it produces a report that details information related to its methane emissions, while a retailer that sells food said it has published reports with information on the use of palm oil in its supply chain.

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Most Companies  
Disclosed on Many ESG  
Topics, but Detail Varied  
on How ESG-Related  
Risks Are Managed

To assess the amount and characteristics of the ESG information companies report, we reviewed regulatory filings and voluntary reports issued by 32 large and mid-size public companies in eight industries.<sup>36</sup> For each company, we reviewed two types of regulatory filings (10-K and the definitive proxy statement), annual reports (when distinct from the 10-K), and voluntary sustainability reports (where available). Of our selected companies, 25 published voluntary sustainability reports and 21 published annual reports separate from their 10-Ks.<sup>37</sup> Using keyword search terms, we searched these documents to identify disclosures related to eight broad ESG factors and 33 more-specific disclosure topics under these factors (see fig. 1).<sup>38</sup> We selected ESG factors from among those that a range of market observers frequently cited as important to investors or potentially material and selected ESG topics by reviewing ESG disclosure frameworks. For more information about this methodology, see appendix I.




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<sup>36</sup>These industries were airlines, beverages, biotechnology and pharmaceuticals, commercial banks, consumer retail, electric utilities, internet media and services, and oil and gas production.

<sup>37</sup>We defined a sustainability report as a stand-alone comprehensive document that provided information on a range of environmental, social, and governance issues relevant to the company. We did not include single-issue documents or information included on websites that was not also part of the sustainability report. Sustainability reports are sometimes called corporate responsibility reports or ESG reports. We reviewed annual reports that were distinct from companies' 10-Ks. Companies report ESG information through means other than these four types of documents, such as through their website or issue-specific company reports.

<sup>38</sup>Of our 33 more-specific disclosure topics, 16 were narrative disclosures and 17 were quantitative metrics. We identified ESG disclosures by searching for keywords specific to each factor. The search terms we used were not intended to represent a comprehensive list of keywords that may relate to the ESG factors we selected for review. Therefore, the disclosures we identified are not intended to be a comprehensive list of companies' ESG disclosures on our selected topics.

Figure 1: Selected Environmental, Social, and Governance (ESG) Factors and Topics for Our Review of Public Companies' ESG Disclosures

ESG category	ESG factor	Narrative ESG topics	Quantitative ESG topics
	Climate change	<ul style="list-style-type: none"> <li>Climate-related risks and opportunities the company has identified</li> <li>How the company manages climate-related risks and opportunities</li> </ul>	<ul style="list-style-type: none"> <li>Direct greenhouse gas emissions (Scope 1)<sup>a</sup></li> <li>Indirect greenhouse gas emissions (Scope 2)<sup>a</sup></li> <li>Value chain greenhouse gas emissions (Scope 3)<sup>a</sup></li> <li>Reductions in greenhouse gas emissions</li> </ul>
	Resource management <sup>b</sup>	<ul style="list-style-type: none"> <li>Risks and opportunities the company has identified related to energy or water resource management</li> <li>How the company manages risks and opportunities related to energy or water resource management</li> </ul>	<ul style="list-style-type: none"> <li>Total energy consumption or water withdrawal</li> <li>Energy consumption reduced or water withdrawal from areas with water stress</li> </ul>
	Human rights	<ul style="list-style-type: none"> <li>Identification of company operations that might endanger human rights</li> <li>Company actions to protect human rights</li> </ul>	<ul style="list-style-type: none"> <li>Number of human rights infringements identified by the company</li> <li>Number of human rights reviews of operations performed by the company</li> </ul>
	Personnel management	<ul style="list-style-type: none"> <li>Obstacles that might limit the company's ability to hire the talent it needs</li> <li>How the company recruits and retains personnel</li> </ul>	<ul style="list-style-type: none"> <li>Percentage of employees leaving the company either voluntarily or involuntarily</li> <li>Breakdown of employees by full- and part-time</li> <li>Percentage of employees represented by a collective bargaining agreement</li> </ul>
	Workforce diversity	<ul style="list-style-type: none"> <li>Company actions to promote diversity and inclusion</li> <li>Company actions to prevent and address discrimination</li> </ul>	<ul style="list-style-type: none"> <li>Percentage of employees by gender</li> <li>Percentage of employees by race, ethnicity, or other demographic indicators</li> <li>Percentage of board members by race, ethnicity, or gender</li> </ul>
	Board accountability	<ul style="list-style-type: none"> <li>Company actions to incorporate shareholder preferences in board nominations</li> <li>Company actions to avoid conflicts of interest among board members</li> <li>Company actions to add new directors to the board</li> </ul>	<ul style="list-style-type: none"> <li>Number of independent board members<sup>c</sup></li> </ul>
	Data security	<ul style="list-style-type: none"> <li>How the company identifies and addresses data security risks</li> <li>How the company uses and protects consumer data</li> </ul>	<ul style="list-style-type: none"> <li>Number of data security incidents</li> </ul>
	Occupational health and safety	<ul style="list-style-type: none"> <li>How the company manages occupational health and safety risks</li> </ul>	<ul style="list-style-type: none"> <li>Hours of health and safety training for employees</li> </ul>

Source: GAO analysis. | GAO-20-530

<sup>a</sup>Scope 1 emissions are direct emissions from sources that are owned or controlled by the company, such as emissions from on-site fossil fuel combustion, company vehicles, and wastewater treatment. Scope 2 emissions are indirect emissions from purchased electricity. Scope 3 emissions are indirect emissions from sources not owned or directly controlled by the company but that are related to the company's activities, such as employee travel and commuting.

<sup>b</sup>Our review of resource management disclosure covered energy management topics for companies in the airline, commercial banking, consumer retail, and internet media and services industries, and

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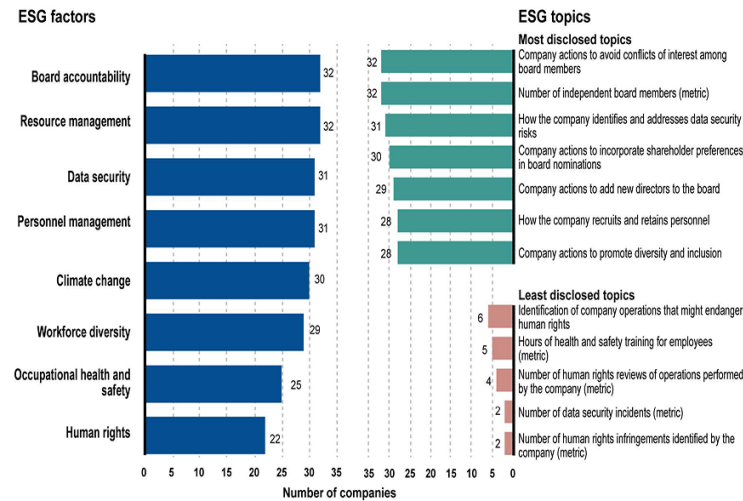
covered water management topics for companies in the beverage, biotechnology and pharmaceuticals, electric utilities, and oil and gas production industries.

<sup>1</sup>An independent board member is generally a person who is not an executive officer or other employee of the company. For the purposes of our analysis, we used the definition of independent board member provided in the filing or report we were reviewing.

As shown in figure 2, we identified disclosures on six or more of the eight ESG factors for 30 of the 32 companies in our sample and identified 19 companies that disclosed information on all eight factors. All selected companies disclosed at least some information on factors related to board accountability and resource management. In contrast, we identified the fewest companies disclosing on human rights and occupational health and safety factors.

With regard to the 33 more-specific ESG topic disclosures we examined, 23 of 32 companies disclosed on more than half of them. The topics companies disclosed most frequently were related to governance of the board of directors and addressing data security risks. Conversely, based on disclosures we identified, we found that companies less frequently reported information on topics related to the number of self-identified human rights violations and the number of data security incidents. In addition, we found that companies most frequently disclosed information on narrative topics and less frequently disclosed information on quantitative topics. There are several reasons why a company may not have disclosed information on a specific ESG topic, including that the topic is not relevant to its business operations or material.

Figure 2: Number of Companies for Which Our Review Identified Disclosure on Certain Environmental, Social, and Governance (ESG) Factors and Topics, Generally Covering Data from 2018



Source: GAO analysis of company disclosures. | GAO-20-530

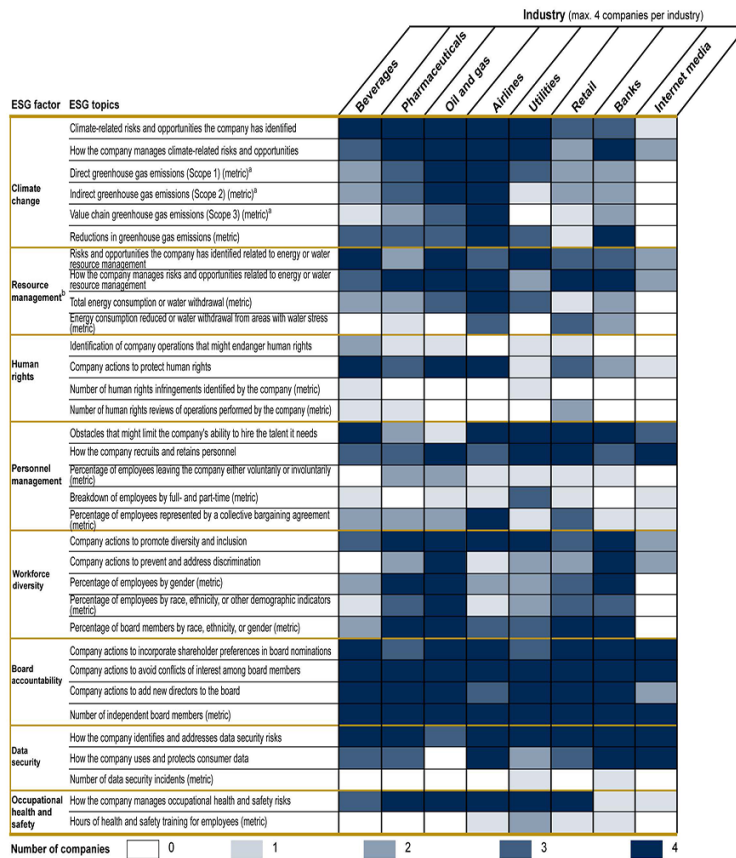
Notes: We reviewed 32 selected companies' 2018 10-Ks, 2019 definitive proxy statements (which typically covered the same reporting period as the 2018 10-K), and 2018 annual reports (when different from the 10-K). We also reviewed companies' most recent sustainability reports available on their websites, accessed from July through December 2019. These documents generally contained data from 2018, but some contained data from 2017 and 2019. Companies can report ESG information through means other than these four documents, such as through their websites or issue-specific company reports. There are several reasons why a company may not disclose information on a specific ESG topic, including that the topic is not relevant to its business operations or material.

Figure 3 compares the amount of disclosure on the 33 ESG topics within and across the selected industries. We identified the most disclosure on the group of topics related to board accountability, climate change, and workforce diversity and the least amount on topics related to human rights. SEC requires companies to report certain governance information in their proxy statements in advance of shareholder meetings where shareholders elect members of the company's board of directors, which may help explain why board accountability topics are the most reported across industries in our sample. Additionally, differences in disclosure can result, in part, from the relevance of an ESG topic to a particular industry.

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For example, more companies in the airline and oil and gas industries disclosed information on climate change, while more companies in the internet media and banking industries disclosed information on data security. We identified disclosures on fewer topics by companies in the internet media industry than the other industries we assessed. None of the four internet media companies in our sample issued a stand-alone sustainability report. As discussed below, most companies tended to include more extensive ESG disclosures in their sustainability reports than in their regulatory filings.

Figure 3: Number of Companies for Which Our Review Identified Disclosure on Certain Environmental, Social, and Governance (ESG) Topics by Industry, Generally Covering Data from 2018



Source: GAO analysis of company disclosures. | GAO-20-530

<sup>a</sup>Scope 1 emissions are direct emissions from sources that are owned or controlled by the company, such as emissions from on-site fossil fuel combustion, company vehicles, and wastewater treatment.

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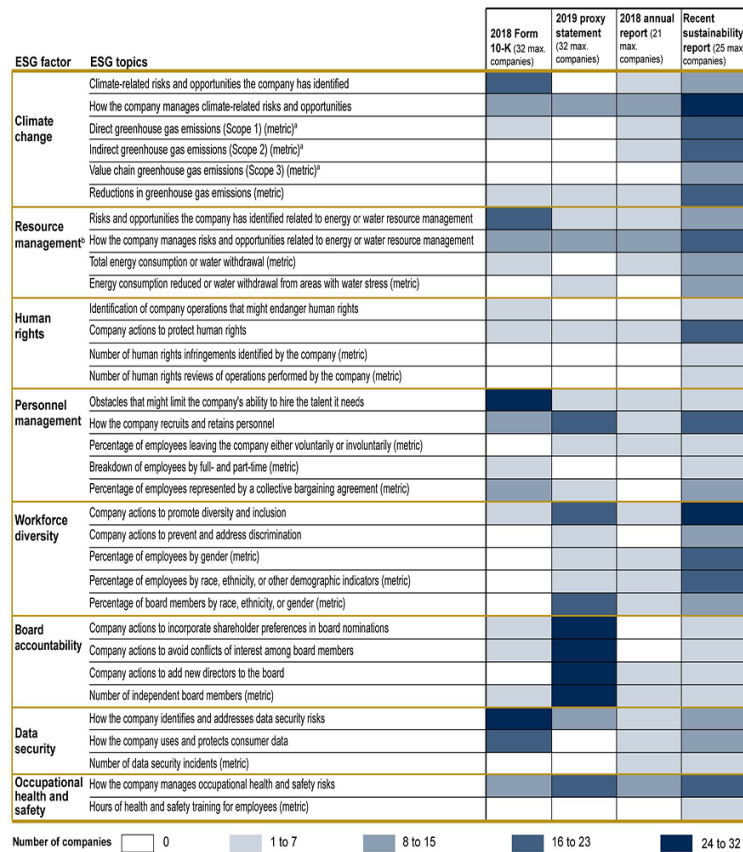
Scope 2 emissions are indirect emissions from purchased electricity. Scope 3 emissions are indirect emissions from sources not owned or directly controlled by the company but that are related to the company's activities, such as employee travel and commuting.

<sup>10</sup>Our review of resource management information covered energy management topics for companies in the airline, commercial banking, consumer retail, and internet media and services industries, and covered water management topics for companies in the beverage, biotechnology and pharmaceuticals, electric utilities, and oil and gas production industries.

Notes: We reviewed 32 selected companies' 2018 10-Ks, 2019 definitive proxy statements (which typically covered the same reporting period as the 2018 10-K), and 2018 annual reports (when different from the 10-K). We also reviewed companies' most recent sustainability reports available on their websites, accessed from July through December 2019. These documents generally contained data from 2018, but some contained data from 2017 and 2019. Companies can report ESG information through means other than these four types of documents, such as through their websites or issue-specific company reports. There are several reasons why a company may not disclose information on a specific ESG topic, including that the topic is not relevant to its business operations or material.

Figure 4 illustrates how the amount of disclosures on the 33 ESG topics compared across the four types of documents we reviewed. We found that companies generally reported information on a wider variety of ESG topics in their voluntary sustainability reports. Specifically, with the exception of a few topics, when companies disclosed information on an ESG topic, they most frequently did so in their sustainability reports. Certain ESG topics were reported more frequently in regulatory filings. For example, nearly all selected companies reported ESG information related to their board of directors in their proxy statements. Additionally, we found that companies disclosed on risks related to climate change, data security, hiring employees, and resource management in their 10-Ks, which includes a risk factors section where companies are required to discuss the most significant factors that make investment in the company speculative or risky.

Figure 4: Number of Companies for Which Our Review Identified Disclosure on Certain Environmental, Social, and Governance (ESG) Topics by Document, Generally Covering Data from 2018



Source: GAO analysis of company disclosures. | GAO-20-530

<sup>a</sup>Scope 1 emissions are direct emissions from sources that are owned or controlled by the company, such as emissions from on-site fossil fuel combustion, company vehicles, and wastewater treatment.

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Scope 2 emissions are indirect emissions from purchased electricity. Scope 3 emissions are indirect emissions from sources not owned or directly controlled by the company but that are related to the company's activities, such as employee travel and commuting.

<sup>39</sup>Our review of resource management information covered energy management topics for companies in the airline, commercial banking, consumer retail, and internet media and services industries, and covered water management topics for companies in the beverage, biotechnology and pharmaceuticals, electric utilities, and oil and gas production industries.

Notes: We reviewed 32 selected companies' 2018 10-Ks, 2019 definitive proxy statements (which typically covered the same reporting period as the 2018 10-K), and 2018 annual reports (when different from the 10-K). We also reviewed companies' most recent sustainability reports available on their websites, accessed from July through December 2019. These documents generally contained data from 2018, but some contained data from 2017 and 2019. Companies can report ESG information through means other than these four documents, such as through their websites or issue-specific company reports. There are several reasons why a company may not disclose information on a specific ESG topic, including that the topic is not relevant to its business operations or material.

As discussed earlier, some investors with whom we spoke said they seek additional narrative disclosures from companies whose disclosures contained generic language or did not provide specific details about how the company manages ESG-related risks or opportunities. Among the 33 ESG topics we reviewed, 16 were topics for which companies reported a narrative rather than quantitative disclosure. We categorized these narrative disclosures as either generic or company-specific (see fig. 5 for examples).<sup>39</sup> We defined company-specific disclosures as those that discussed specific ways that ESG-related risks and opportunities could affect the company's operations or specific steps the company takes to manage or respond to the ESG-related risks or opportunities. We defined disclosures that did not include such specific details as generic disclosures. As a result, such generic disclosures can be considered applicable to the reporting company as well as to many of its peers. According to two reports, companies may choose not to disclose more detailed information for a particular ESG topic for several reasons, including concerns that such disclosures would put the company at a competitive disadvantage or expose it to legal liability.<sup>40</sup>

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<sup>39</sup>We considered each disclosure as a whole and, if it provided some company-specific information, we categorized the disclosure as company-specific. We did not characterize quantitative disclosures as we considered them to be inherently company-specific.

<sup>40</sup>Fatima Maria Ahmad, *Beyond the Horizon: Corporate Reporting on Climate Change* (Center for Climate and Energy Solutions, September 2017); and Sullivan and Cromwell, LLP, *2019 Proxy Season Review, Part I: Rule 14a-8 Shareholder Proposals* (July 2019).

Figure 5: Examples of Generic and Company-Specific Disclosures

<b>Data Security</b> How the company uses and protects consumer data.	<b>Personnel Management</b> How the company recruits and retains personnel.
<p><b>Generic disclosure from 10-K</b></p> <p><i>Although we have developed systems and processes that are designed to protect our data and user data, to prevent data loss, to disable undesirable accounts and activities on our platform, and to prevent or detect security breaches, we cannot assure you that such measures will provide absolute security, and we may incur significant costs in protecting against or remediating cyber-attacks.</i></p> <p><b>Company-specific disclosure from annual report</b></p> <p><i>A new technique invented at [company] ... allows us to train AI models and make products smarter without raw data ever leaving your device. [Company-specific program] can learn new words after thousands of people start using them, without us ever knowing what you're typing. In the future, AI advancements will provide even more ways to make products more helpful with less data.</i></p>	<p><b>Generic disclosure from annual report</b></p> <p><i>By bringing together the beliefs, values and ideas that define an organization, a strong workplace culture creates a framework that attracts and retains the right kind of talent.</i></p> <p><b>Company-specific disclosure from sustainability report</b></p> <p><i>To continue to attract and retain the best and most diverse people, we're creating a new holistic strategy to reimagine and redesign the end-to-end employee experiences. Feedback on the hiring experience from hiring managers, Human Resource Partners, recruiters and applicants highlighted the need for greater visibility, improved speed, more relevant candidates and a simpler, more intuitive process. In response, we launched the [company-specific website] globally in 2018, providing data driven analytics and innovative tools as the basis for a faster, transparent, more agile process for managers to hire candidates.</i></p>

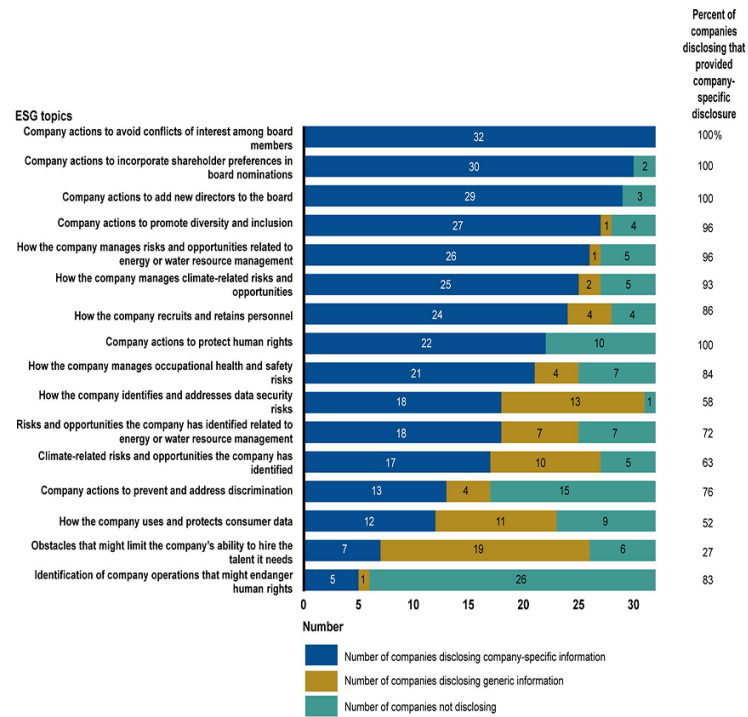
Source: GAO analysis of company disclosures. | GAO-20-530

Note: We removed direct references to company names and company programs from these excerpts.

For 11 of the 16 narrative topics, among companies for which we identified disclosures on these topics, at least 75 percent disclosed company-specific information (see fig. 6). For certain topics, such as those related to companies' actions to add new directors to the board and promote diversity and inclusion, most companies disclosed information and nearly all of those companies reported company-specific information. In contrast, for other narrative topics, such as addressing data security risks and describing climate-related risks and opportunities, we identified company-specific information for less than two-thirds of disclosing companies. In addition, for one narrative topic, describing obstacles that might limit the company's ability to hire the talent it needs, less than one-third of disclosing companies reported company-specific information. We also found that disclosures we identified in companies' 10-K filings were less likely to be company-specific than those in the other three types of documents we reviewed.<sup>41</sup>

<sup>41</sup>More companies disclosed company-specific information than generic for three of 16 narrative topics in the 10-K. For the proxy statement, annual report, and sustainability report, those numbers were 12, 10, and 16 of 16, respectively.

Figure 6: Category of Disclosure on Certain Environmental, Social, and Governance (ESG) Topics of Selected Companies, Generally Covering Data from 2018



Source: GAO analysis of company disclosures. | GAO-20-530

Notes: We reviewed 32 selected companies' 2018 10-Ks, 2019 definitive proxy statements (which typically covered the same reporting period as the 2018 10-K), and 2018 annual reports (when different from the 10-K). We also reviewed companies' most recent sustainability reports available on their websites, accessed from July through December 2019. These documents generally contained data from 2018, but some contained data from 2017 and 2019. We categorized disclosures we identified in these documents as either company-specific (narrative specific to that company's risks or management activities) or generic (narrative that could broadly apply to many companies) for 16 narrative ESG topics.

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Though most of the narrative ESG disclosures we reviewed contained company-specific details, these disclosures varied in the amount of detail they provided about how a company manages ESG-related risks and opportunities (see fig. 7). In particular, some companies' disclosures included details about specific steps the company was taking to manage an ESG-related risk or opportunity and details about the results of such efforts, while others did not. To the extent that some companies provided more detailed disclosures, those companies' disclosures could be of greater usefulness to investors trying to understand the ESG risks facing a company or the steps the company was taking to manage ESG risks.

Figure 7: Examples of the Range of Detail in Company-Specific Environmental, Social, and Governance (ESG) Disclosures

Board Accountability	Workforce Diversity
Company actions to add new directors to the board.	Company actions to promote diversity and inclusion.
Examples of company-specific disclosures that provided limited details about the specific steps the company took to address an ESG risk or opportunity.	
Disclosure from company's proxy statement	Disclosure from company's sustainability report
<p><i>Our Governance Committee believes that it is important to maintain a balance of tenure on the Board to benefit from the business, industry and governance experience of longer-serving directors; the fresh perspectives contributed by new directors; and the value of continuity as Board composition changes. Our Governance Committee approaches its task of recommending candidates for election or re-election with the goal of having a mix of directors with long, medium and short tenures on the Board. It therefore aims to have a measured rate of Board refreshment.</i></p>	<p><i>[The company's] Corporate Diversity Council sponsors the company's diversity and inclusion strategy by executing business-unit specific initiatives, which results in a diverse and inclusive culture where employees feel valued and motivated to do their best every day.</i></p>
Examples of company-specific disclosures that described the specific steps the company took to address an ESG risk or opportunity but that did not describe the results of these efforts.	
Disclosure from company's proxy statement	Disclosure from company's proxy statement
<p><i>Directors are elected each year, at the Annual Meeting of Shareowners, to hold office until the next Annual Meeting and until their successors are elected and qualified... Furthermore, pursuant to our Corporate Governance Guidelines, Directors whose job responsibilities change or who reach the age of 74 are asked to submit a letter of resignation to the Board. These letters are considered by the Board and, if applicable, annually thereafter.</i></p>	<p><i>We have since added many new internal programs, including: [Program 1] and [Program 2]. [Program 1] trains managers to understand the issues that affect underrepresented communities and to actively solicit input from people who may feel excluded. [Program 2] gives everyone at [the company] the common language, tools, and space to identify when someone may be experiencing bias and to stand up in support of them.</i></p>
Examples of company-specific disclosures that described the specific steps the company took to address an ESG risk or opportunity and that provided results of these efforts.	
Disclosure from company's proxy statement	Disclosure from company's sustainability report
<p><i>To promote thoughtful Board refreshment, we have: developed a comprehensive, ongoing Board succession planning process; implemented an annual Board and Committee assessment process; and adopted a policy in which no director may stand for election to the Board after reaching the age of 72. Eight of the 13 director nominees have joined since the beginning of 2014. The average age of our director nominees and our independent director nominees is 60.6 years and 61.1 years, respectively. The average tenure of all our director nominees and our independent director nominees is 6.1 years and 6.6 years, respectively.</i></p>	<p><i>We launched bias training to provide our team with tools to recognize and manage bias and to understand how our similarities and differences can enhance our team and our business. We are taking a thoughtful approach to how we roll it out to our full organization. We started with taking 7,000 of our headquarters team members through a three-hour bias training session that equated to 21,000 hours of training. In addition, we are embedding bias training for our team members into regular training that they have throughout the year, as well as for new team members joining [the company].</i></p>

Source: GAO analysis of company disclosures. | GAO-20-530

Note: We removed direct references to company names and company programs from these excerpts.

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Differences in How  
Companies Reported  
Some Quantitative ESG  
Topics Could Limit  
Comparisons across  
Companies

We identified inconsistencies in how companies disclosed on some of our selected quantitative ESG topics, which may limit investors' ability to compare these disclosures across companies.<sup>42</sup> Specifically, we found instances where companies defined terms differently or calculated similar information in different ways. We most frequently identified these inconsistencies in quantitative topics associated with climate change, personnel management, resource management, and workforce diversity. For quantitative topics related to data security, human rights, and occupational health and safety, five or fewer of the 32 companies in our sample disclosed information on these topics, limiting comparisons across companies.

As previously discussed, some investors told us that one of the reasons they seek additional ESG disclosures is because it is difficult to compare disclosures across companies. SEC also noted in a 2016 concept release that sought comment on modernizing certain disclosure requirements in Regulation S-K that consistent disclosure standards can increase the efficiency with which investors process the information.<sup>43</sup> Additionally, three of the most commonly used ESG disclosure frameworks—GRI, SASB, and TCFD—have a stated goal to help companies disclose information in a way that allows investors to compare information among companies.

Despite this focus on comparable reporting from investors, regulators, and standard-setters, we identified instances where companies reported certain quantitative metrics differently from one another for some ESG topics. For example, in workforce diversity disclosures, some companies reported their employee demographics using broad groupings, such as "minority" or "ethnically diverse," while others reported by specific racial or ethnic groups. Similarly, some companies defined greenhouse gas emissions differently. Most companies combined carbon dioxide and other greenhouse gases when reporting emission data, but a few reported carbon dioxide emissions alone.

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<sup>42</sup>Our review focused on disclosures for selected ESG topics. While inconsistencies also may exist in other disclosure areas that are not governed by commonly accepted standards, these areas were outside the scope of our study. We identified these inconsistencies through our review of public companies disclosures on ESG topics, which, as previously mentioned, is not intended to be a comprehensive list of companies' ESG disclosures on our selected topics.

<sup>43</sup>Business and Financial Disclosure Required by Regulation S-K, 81 Fed. Reg. 23,916, 23,919 (Concept Release, Apr. 22, 2016).

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We also identified instances of companies using different calculation methods or units of measure when reporting information related to climate change and resource management. For example, companies used different base years when calculating their reduction in greenhouse gas emissions, limiting their comparability. Some companies reported reductions year-over-year, while many reported reductions over multiple years with no consistency within or across industries. For example, airline companies we reviewed reported emission reductions with base years ranging from 1990 to 2017. Similarly, when disclosing total water withdrawal, eight companies used metric units of measure while two companies used imperial units of measure.

Companies that used the same ESG framework did not always disclose on ESG topics in a consistent manner. Specifically, we identified the types of inconsistencies discussed above in quantitative disclosures among those companies using the GRI framework.<sup>44</sup> For example, we identified four different methods for reporting workforce diversity among companies that reported using the GRI framework to develop their disclosures. The GRI framework does not specify the method for reporting diversity information, as it does for certain other topics.

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<sup>44</sup>We reviewed how those companies that reported using the GRI framework disclosed information on these topics because GRI was the disclosure framework companies reported using most frequently. Of the selected companies, 14 reported using the GRI framework and four companies reported using the SASB framework to disclose ESG information in their sustainability reports.

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SEC Primarily Uses a Principles-Based Approach for Overseeing ESG Information and Has Taken Some Steps to Assess ESG Disclosures

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SEC Provides Flexibility to Companies to Determine Whether ESG-Related Information Is Material and Should Be Disclosed

SEC staff generally use a principles-based approach to overseeing public companies' disclosures of nonfinancial information, including information on ESG topics.<sup>45</sup> Under this approach, SEC staff rely primarily on companies to determine what information is material and requires disclosure in their SEC filings, such as the 10-K filing.<sup>46</sup> SEC officials noted that companies are ultimately responsible for the disclosures they provide to investors, and they have liability for their disclosures under federal and state securities laws.<sup>47</sup> While federal securities laws generally do not specifically address the disclosure of ESG information, Regulation S-K's disclosure requirements for nonfinancial information apply to material ESG topics.

Corporation Finance officials noted that their reviews of public companies' 10-K filings are not a checklist review for compliance with securities regulations. Instead, these reviews are meant to identify and address

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<sup>45</sup>Regulation S-K contains disclosure requirements that are applicable to the nonfinancial portion of public companies' 10-K filings to SEC. Principles-based disclosure requirements state an objective and look to management to exercise judgment in satisfying that objective by evaluating the significance of information to determine whether disclosure is required. Regulation S-K also includes prescriptive disclosure requirements, such as costs of complying with environmental laws and regulations. As previously mentioned, certain ESG topics such as board composition, executive compensation, and audit committee structure are specifically addressed in SEC's rules and regulations.

<sup>46</sup>As previously discussed, companies' disclosure of material information can include known trends, events, and uncertainties that are reasonably likely to have a material effect on the company's financial condition or operating performance, as well as potential risks to investing in the company.

<sup>47</sup>Public companies can face liability under securities laws for disclosing false or misleading statements or for omitting a material fact when inclusion of that fact is necessary to prevent a statement from being misleading.

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potentially significant disclosure issues, such as nondisclosure of information that the Corporation Finance review team believes is material and therefore may influence an investor's investment decision. Some Corporation Finance review staff told us that in their reviews of public companies' 10-K filings they generally defer to companies' determinations about which ESG information is relevant to their business and should be disclosed. Review staff also generally said they perform company- and industry-specific research as part of their review, including company websites, web searches for news articles, and earnings calls that may identify material ESG information. In a January 2020 statement that addressed climate change and environmental disclosures, the SEC Chairman reiterated his view that SEC's approach to disclosure on these topics should continue to be rooted in materiality, including providing investors with insight regarding the company's assessments and plans for addressing material risks to its business operations. The Chairman's statement also noted that this approach is consistent with the Commission's ongoing commitment to ensure that current disclosures on these issues provide investors with a mix of information that facilitates well-informed capital-allocation decisions.<sup>48</sup>

Corporation Finance has provided its review staff with internal review guidance that highlights relevant issues to consider, while emphasizing the use of professional judgment when reviewing companies' 10-K and other filings. Staff use internal procedural guidance that provides steps for conducting and documenting reviews of filings. While this guidance does not include specific instructions for reviewing ESG disclosures, staff are instructed to conduct background research on companies and industries to determine if there is material information, such as potential risks, that may be relevant to a company's filing. As noted above, according to review staff, this company-specific research could include ESG information.

In addition, Corporation Finance has distributed internal review guidance on a few ESG-related topics. This guidance illustrates how existing disclosure requirements may apply to a given topic and offers information for staff to consider when conducting background research and performing filing reviews. In cases where the SEC review team identifies a potential disclosure deficiency related to an ESG or other topic, they may issue a comment letter to the company to request additional

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<sup>48</sup>Proposed Amendments to Modernize and Enhance Financial Disclosures; Other Ongoing Disclosure Modernization Initiatives; Impact of the Coronavirus; Environmental and Climate-Related Disclosure," Chairman Jay Clayton (Jan. 30, 2020).

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information or additional disclosures when necessary. Most review staff with whom we spoke said ESG-related information generally does not rise to the level of comment unless they identify material information during background research that may be relevant to the company's operations.

In April 2019, Corporation Finance reallocated responsibilities for reviewing nonfinancial information in 10-K filings, which also can include ESG information, from attorneys to accountants. Corporation Finance officials cited resource constraints, which reduced the number of attorneys within the Division, as a factor in this decision.<sup>49</sup> While review teams vary by industry group and company, attorneys previously held primary responsibility for reviewing nonfinancial disclosures, whereas accountants primarily reviewed financial statements and related disclosures in 10-K filings. SEC staff provided training to accountants on how to conduct these reviews, which outlined Regulation S-K reporting requirements for nonfinancial disclosures and highlighted areas for staff to consider in various sections of the 10-K. Two of six accounting review staff with whom we spoke noted that this training was thorough and said they refer to training materials when conducting 10-K filing reviews. Additionally, most accounting review staff told us they can consult legal staff within their industry offices during reviews as necessary. According to Corporation Finance officials, attorneys may still participate in reviews of 10-K filings.<sup>50</sup> Accounting staff also noted that they previously reviewed nonfinancial information within the context of financial disclosures as part of their financial reviews of 10-K filings.

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**SEC Took Steps to Assess Samples of Companies' ESG Disclosures and Identify Emerging Issues**

Corporation Finance has conducted assessments of samples of public companies' 10-K filings to examine the amount and type of disclosure on selected ESG topics. Overall, Corporation Finance staff found that most sampled companies included disclosure of selected ESG topics within 10-K filings and told us they did not issue additional guidance or interpretive releases on these topics following these assessments.

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<sup>49</sup>SEC implemented a hiring freeze from fiscal years 2017 to 2019, and, according to Corporation Finance officials, experienced a decrease of more than 350 positions during this time.

<sup>50</sup>According to Corporation Finance officials, the extent to which attorneys participate in 10-K filing reviews depends on the workload for each industry office. For example, because attorneys primarily focus on reviewing initial public offerings, attorneys may review fewer 10-Ks in industry offices with a large volume of initial public offerings, according to Corporation Finance officials.

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- **Climate change disclosures:** In 2012 and 2014, SEC staff issued mandated reports to the Senate Committee on Appropriations that assessed the compliance of climate change disclosures included in a sample of 60 companies' 10-K filings in selected industries. The Committee had required these reviews following SEC's issuance of its interpretive release on climate change disclosures in 2010. SEC staff found that most sampled companies included climate-related information within their 10-K filings with varying levels of detail. Since 2014, Corporation Finance has conducted additional internal assessments on these topics that have resulted in findings consistent with previous reviews.
  - **Additional ESG-related disclosures:** In recent years, Corporation Finance staff conducted additional assessments of disclosures related to some ESG topics. These assessments involved staff reviewing the disclosures of a sample of companies' filings and evaluating compliance with disclosure requirements. Corporation Finance found that while the level of detail among disclosures varied, nearly all companies included the relevant ESG topic within their filings. Additionally, Corporation Finance staff outlined action items for the Division, such as providing comments to companies as appropriate and monitoring press reports for information that may be material for companies to disclose.

In addition to internal assessments, SEC has taken steps to identify significant emerging disclosure issues through the creation of the Office of Risk and Strategy within Corporation Finance. According to Corporation Finance officials, this office was created in February 2018 and was allocated additional resources in October 2019 to support its risk surveillance function, in which it identifies emerging issues that may be material for public companies by reviewing press articles, speeches, and information from other sources such as industry experts. According to Corporation Finance officials, once the office identifies an issue that may present material disclosure risks, it may perform research and analysis that can determine whether further internal or external guidance may be necessary. Corporation Finance officials also noted these efforts may result in additional guidance to review staff based on topics identified.

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### Policy Options to Enhance ESG Disclosures Range from Regulatory Actions to Private-Sector Approaches

Investors and market observers have proposed a range of policy options to improve the quality and usefulness of ESG disclosures.<sup>51</sup> These options include legislative or regulatory action to require or encourage certain ESG disclosure practices, as well as private-sector approaches, such as industry-developed frameworks and stock-exchange listing requirements.

These policy options can pose important trade-offs in relation to the extent to which they impose specific new disclosure requirements or encourage companies to voluntarily adopt certain ESG disclosure practices. For example, while new ESG-related requirements may help achieve greater comparability in ESG disclosures across companies and reduce investor demands on public companies, voluntary approaches may provide more flexibility to companies while limiting potential costs associated with disclosing ESG information that may not be relevant for their business.

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#### Legislative or Regulatory Actions

Some institutional investors and market observers have proposed new legislative or regulatory requirements to enhance public companies' ESG disclosures. These actions could take the form of new requirements for specific ESG disclosures, a new SEC regulation that endorses the use of an ESG disclosure framework, or new SEC interpretive releases on ESG disclosure topics.

#### Issue-Specific Rulemaking

Some market observers have recommended that SEC issue new rules requiring issue-specific ESG disclosures, such as disclosures related to climate change.<sup>52</sup> For example, one investor association said that it has supported various petitions and requests for rulemaking at SEC on environmental and human capital issues. SEC has taken steps to consider these types of issue-specific ESG disclosures. For example, in August 2019, SEC proposed including disclosure topics related to human capital resources and management in the description of business section

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<sup>51</sup>As previously mentioned, we interviewed 14 institutional investors (seven private asset management firms and seven public pension funds) and 13 groups and organizations that we refer to as market observers in this report.

<sup>52</sup>We identified several bills recently introduced in the House and Senate that would require certain companies to disclose additional ESG information. These bills include disclosures on a variety of issues such as information regarding sexual harassment claims, financial and business risks associated with climate change, and the racial, ethnic, and gender composition of the board of directors and executives. As of May 2020, none of these bills had become law.

of Regulation S-K.<sup>53</sup> The rule has not been finalized, but in comment letters to SEC on the proposed rule, some organizations requested more line-item disclosures and metrics on this topic.<sup>54</sup>

**Gender Pay Gap Disclosure Requirements in the United Kingdom (UK)**

In 2017, the UK required issue-specific disclosure rules for large companies to report the difference in average pay for male and female employees, according to a report by the UK House of Commons' Business, Energy, and Industrial Strategy Committee. An intended benefit of gender pay gap disclosure is achieving greater equity in pay by gender and improved economic performance among UK companies, according to this committee report. However, the committee found in its 2018 review of this reporting that some companies were unsure how to account for alternative compensation, such as child care vouchers and bonuses, and that additional guidance was necessary to help companies standardize their disclosures. The committee's report also recommended that the government mandate narrative disclosures where companies explain their action plan for closing any gender pay gap they may have.

Source: UK House of Commons, Business, Energy and Industrial Strategy Committee, *Gender Pay Gap Reporting*, Thirteenth Report of Session 2017–2019 (July 2018). | GAO-20-530

As previously mentioned, most investors told us they seek comparable information across companies, which line-item disclosure requirements may facilitate. Increasing comparability across companies also may reduce investor demands on companies, which have been increasing the last 5 years, according to most companies with whom we spoke.<sup>55</sup> Additionally, requiring ESG disclosures in companies' regulatory filings—rather than across multiple locations—could reduce information disparities between large and small investors, because the information would be located in a single place that was readily available to everyone. For example, some third-party data providers, which compile ESG information from various sources, may be prohibitively expensive to individual investors and small advisors, according to a study commissioned by the Department of Labor.<sup>56</sup>

One impediment to improved ESG disclosures that some institutional investors, companies, and market observers with whom we spoke cited was the lack of consensus around what information companies should be disclosing. Focusing on issue-specific ESG disclosure rules could allow SEC to enhance disclosures on the most pressing issues that may have more consensus, according to two academics we interviewed. As previously discussed, our review found that several ESG factors were commonly disclosed by companies across industries, including board accountability, climate change, and workforce diversity.

On the other hand, regulatory requirements that necessitate new or additional disclosures may increase compliance costs for companies. None of the 18 companies with whom we spoke had quantified the costs associated with their ESG reporting. However, companies generally said that collecting and reporting ESG information required input from

<sup>53</sup>See 84 Fed. Reg. 44,358 (proposed Aug. 23, 2019).

<sup>54</sup>Other organizations commented, cautioning against line-item disclosures for several reasons, including those discussed later, such as costs to companies or lack of flexibility.

<sup>55</sup>As previously mentioned, we interviewed representatives from 18 of our nongeneralizable sample of 32 public companies.

<sup>56</sup>Summit Consulting, LLC, *Environmental, Social, and Governance (ESG) Investment Tools: A Review of the Current Field*, a report prepared at the request of the Chief Evaluation Office, Department of Labor, December 2017.

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employees across the company. Three companies said ESG reporting represented an increasing opportunity cost as employees spent more time on reporting and away from business activities. Data not used in regular business operations or data that required outside assurance were the most costly disclosures, according to some companies.

In addition, some market observers have noted that issue-specific rules can become outdated as issues evolve and that these types of disclosures would reduce flexibility for companies. Line-item or issue-specific disclosures also may not be relevant for all companies, possibly resulting in large volumes of immaterial information. According to one academic, compelling companies to disclose on issues that may not be relevant to them could distract companies from using resources on the relevant disclosures.

Endorse an ESG Framework in Regulation

Other market observers recommended that SEC issue a new rule endorsing one or more comprehensive ESG reporting frameworks, such as SASB or GRI, for companies' reporting of material ESG issues. SEC has required the use of frameworks in other rulemakings, such as rules related to companies' evaluation and disclosure of their internal controls. For that rule, SEC endorsed the Committee of Sponsoring Organizations of the Treadway Commission (COSO) Framework as satisfying regulatory requirements.<sup>57</sup> In its evaluation of several countries' reporting policies, the United Nations Environment Programme recommended regulators use existing international standards and guidelines when developing sustainability reporting policies.<sup>58</sup>

Regulations that endorse one or more frameworks could maintain flexibility for companies, because companies could choose which parts of the framework are relevant to their businesses. In addition, frameworks can be updated over time without necessitating new rulemaking in contrast to issue-specific requirements that could become outdated. Some institutional investors and companies with whom we spoke noted the importance of flexibility if there were to be any new regulation for ESG disclosures. Additionally, frameworks could encourage companies to

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<sup>57</sup>See Management's Report on Internal Control Over Financial Reporting and Certification of Disclosure in Exchange Act Periodic Reports, 68 Fed. Reg. 36,636, 36,642 (June 18, 2003).

<sup>58</sup>United Nations Environment Programme, *Evaluating National Policies on Corporate Sustainability Reporting* (2015).

#### European Union Directive Endorsement of ESG Frameworks

A 2014 European Union directive that endorsed companies' use of existing frameworks to report how they manage social and environmental challenges has needed several updates to improve comparability across companies, according to a report by the European Securities and Markets Authority (ESMA). In 2017 and 2019, the European Commission issued voluntary guidelines for the directive that encouraged companies to use an established disclosure framework to make nonfinancial information easier to report and compare, according to ESMA. However, respondents to a 2019 survey by ESMA said that among other obstacles, the lack of specificity in the directive's requirements and the use of various frameworks contributed to a lack of comparability among companies' environmental, social, and governance (ESG) disclosures. As a result, ESMA recommended the European Commission amend the directive to include both general principles for reporting ESG information as well as a set of specific, universal disclosures.

Source: European Securities and Markets Authority, *Report Underscore Short-Term Pressure on Corporations* (December 2019). | GAO-20-530

disclose on a wide range of ESG issues. Most investors told us they focused on a broad array of ESG issues in their analyses.

However, companies reporting based on different frameworks may limit comparability across companies, and there was not consensus on which framework companies should use. While some institutional investors told us they supported SASB's framework, investors also mentioned other frameworks such as GRI, TCFD, and CDP. In a 2019 survey of 46 global institutional investors, a consulting firm found that agreeing on ESG standards that are relevant to companies' performance was a challenge.<sup>59</sup> Additionally, the Chamber of Commerce noted that companies said in roundtable discussions that the lack of universally accepted ESG reporting standards was a major challenge to effective ESG reporting.<sup>60</sup> There have been initiatives recently to standardize ESG frameworks.<sup>61</sup> However, a project to improve comparability across frameworks found that there were already high levels of agreement between climate change disclosures standards and that standard-setting organizations needed to more clearly communicate how their standards were interconnected.<sup>62</sup>

Additionally, companies reporting under a framework may choose not to disclose certain ESG information, which could result in less comparability. As previously discussed, among the company disclosures we reviewed, we identified instances of calculation inconsistency among quantitative disclosures for companies that reported information according to GRI—the most prevalent reporting framework in our sample—because GRI does not always include prescriptive disclosure recommendations and sometimes allows for different calculation methods.

#### SEC Interpretative Releases

Some institutional investors and companies with which we spoke indicated that additional SEC interpretative releases addressing how ESG

<sup>59</sup>Morrow Sodali, *Institutional Investor Survey 2019*.

<sup>60</sup>U.S. Chamber of Commerce Foundation and the Chamber's Center for Capital Markets Competitiveness, *Corporate Sustainability Reporting: Past, Present, and Future* (November 2018).

<sup>61</sup>For example, in 2019, the World Economic Forum International Business Council—an organization of approximately 120 large multinational companies—launched a project to create a standard set of metrics for ESG reporting. The project partnered with four large accounting firms and published a proposed set of metrics in January 2020. World Economic Forum, *Toward Common Metrics and Consistent Reporting of Sustainable Value Creation* (January 2020).

<sup>62</sup>Corporate Reporting Dialogue, *Driving Alignment in Climate-Related Reporting, Year One of the Better Alignment Project* (September 2019).

topics fit within existing disclosure requirements could be helpful. These releases can highlight the importance of ESG disclosures without requiring a rule change, because they clarify without changing the existing disclosure requirements. Some investors and SEC review staff said that interpretive releases serve as a good reminder for companies to consider ESG issues in their disclosures. Interpretive releases also maintain flexibility for companies to disclose the information that is material for each company. However, two market observers noted that because these releases do not create new disclosure requirements, they may not have much impact on ESG disclosures on their own.

About half of the companies told us previous SEC releases had been helpful, but most investors said disclosures on these issues remain inconsistent. Eight of 18 companies said SEC's previous releases on climate change and cybersecurity had helped create an even playing field for companies or underscored the need for more transparency on these issues, among other things. However, two investors and one international organization noted that the release on climate change did not appear to expand disclosure of climate change risk among U.S. companies. As previously discussed, SEC staff reviewed samples of company's disclosures on climate change and found that most sampled companies included climate-related information within their 10-K filings with varying levels of detail. As a result, SEC staff decided against recommending that the Commission issue additional releases.

#### Private-Sector Approaches

Some institutional investors, companies, and market observers have cautioned against legislative and regulatory intervention in ESG disclosures and have recommended private-sector approaches to improve companies' ESG disclosures. One advantage of private-sector approaches is that because they are voluntary, they provide companies with flexibility. Some investors and companies said flexibility was important in ESG reporting because the relevance of ESG issues can vary by company and change over time. Conversely, because ESG disclosures remain voluntary under these approaches, companies may choose not to use them in their reporting. Private-sector approaches could include industry-developed frameworks and stock exchange listing requirements.

#### Industry-Developed Frameworks

Some market observers with whom we spoke recommended that industries develop their own industry-specific ESG framework. For example, Edison Electric Institute and the American Gas Association partnered to develop standards to guide electric and natural gas companies' ESG reporting. According to the American Gas Association,

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#### Stock Exchange Listing Requirements

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the framework was created to provide the financial sector with more uniform and consistent ESG data and information.<sup>63</sup> SASB's framework also provides industry-specific standards, covering 77 different industries.

Industry-specific standards focus on ESG issues that industry representatives believe are relevant to that industry. Some investors, companies, and market observers said that ESG issues vary by industry and therefore industry-specific standards are preferred. As previously discussed, we identified some differences in the amount of disclosures on specific ESG topics between industries. Agreed-upon industry-specific standards provide consensus across various stakeholders and provide comparability of ESG disclosures across companies, according to some market observers, which also may reduce investor demands on companies.

One disadvantage of relying on industries to create standards is that some industries may be diverse and unable to find consensus on standards. For example, two companies told us that their unique business model does not fit into one industry group. Company and trade association interests also may conflict with those of investors and other stakeholders. According to two academics with whom we spoke, individual companies do not have an incentive to work towards standardized ESG reporting standards and will not do so on their own.

In some countries, stock exchanges have used ESG disclosure listing requirements to try to improve companies' disclosures. The United States has several stock exchanges that list publicly traded companies, and none have extensive ESG disclosure listing requirements. NASDAQ produces a voluntary ESG reporting guide for companies and the New York Stock Exchange, as a subsidiary of the Intercontinental Exchange, has declared its support for ESG disclosures of its listed companies, but neither requires such ESG reporting to be listed on its exchange.

ESG reporting endorsements from stock exchanges has been shown to accelerate the adoption of integrated reporting in other countries,

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<sup>63</sup>PIECA, the American Petroleum Institute, and the International Association of Oil and Gas Producers also developed guidance for the oil and gas industry on voluntary ESG reporting.

#### Johannesburg and Tokyo Stock Exchange Listing Requirements

Stock exchanges in Japan and South Africa are examples where listing requirements have been implemented to improve public companies' environmental, social, and governance (ESG) reporting in those countries. According to officials from Japan's Financial Services Agency, listing requirements on the Tokyo Stock Exchange have helped change how Japanese companies disclose ESG-related information and engage in proactive risk management. Similarly, officials from the Johannesburg Stock Exchange said that its listing requirements have had a positive impact on companies' integrated reporting, which includes ESG information. However, these officials stated that other factors also have contributed to the increase in integrated reporting in South Africa. These include an understanding by local companies of how ESG factors affect their day-to-day operations and increased investor interest in ESG disclosures. According to research comparing integrated reporting in 10 countries, a number of factors contributed to South African companies' high-quality integrated reports, including a framework for integrated reporting developed by a local nonprofit organization to assist companies in meeting the listing requirements.

Source: GAO interviews with stock exchange and government officials and Robert G. Eccles, Michael P. Krzus, and Carlos Solano, *A Comparative Analysis of Integrated Reporting in Ten Countries* (March 2019). [GAO-20-530]

according to two industry studies.<sup>64</sup> One third-party data provider noted that listing requirements provide an incentive—listing on the exchange—for companies to report on ESG issues. However, competition between U.S. stock exchanges could give companies alternative listing opportunities if one stock exchange enacted ESG disclosure listing requirements. According to officials from the Johannesburg Stock Exchange, as commercial entities, stock exchanges may choose to avoid imposing mandatory listing requirements on companies because they would risk losing listings that generate revenue to other exchanges or discouraging companies from listing publicly.

Finally, some institutional investors, companies, and market observers noted that it was too early to prescribe standards for ESG disclosures, because there is not consensus among companies, investors, and market observers on which ESG issues should be disclosed. The marketplace should be given time to resolve these issues, according to these market participants and observers. Government officials in the United Kingdom and Japan and industry association representatives from South Africa noted that increased investor interest prompted more meaningful ESG disclosures from companies in their countries. However, they said that nonfinancial reporting requirements can be a catalyst for changing attitudes towards ESG disclosures.

### Agency Comments

We provided a draft of this report to SEC for review and comment. SEC provided written comments that are reprinted in appendix II. SEC also provided technical comments, which we incorporated as appropriate.

In its written comments, SEC generally concurred with our findings and stated that our report will contribute to the ongoing discussion around ESG disclosures among public companies, investors, and policy makers. SEC also highlighted some of its related activities, such as issuing interpretive releases on climate change and cybersecurity and soliciting public comments on disclosure requirements. In addition, SEC reiterated

<sup>64</sup>KPMG, *The Road Ahead: The KPMG Survey of Corporate Responsibility Reporting 2017* (October 2017); and Sustainable Stock Exchanges, *10 Years of Impact and Progress: Sustainable Stock Exchanges 2009–2019* (September 2019).

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its commitment to materiality as the foundational principle for public company disclosure requirements.

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As agreed with your office, unless you publicly announce the contents of this report earlier, we plan no further distribution until 4 days from the report date. At that time, we will send copies of this report to the appropriate congressional committees, the Chairman of the Securities and Exchange Commission, and other interested parties. In addition, the report will be available at no charge on the GAO website at <https://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (202) 512-8678 or [clementsm@gao.gov](mailto:clementsm@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix III.

Sincerely yours,



Michael Clements  
Director, Financial Markets and Community Investment

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## Appendix I: Objectives, Scope, and Methodology

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This report examines (1) why and how investors have sought additional environmental, social, and governance (ESG) disclosures; (2) how public companies' disclosures of selected ESG factors have compared within and across selected industries; (3) steps the Securities and Exchange Commission (SEC) staff have taken to assess the effectiveness of the agency's efforts to review the disclosure of material ESG factors; and (4) the advantages and disadvantages of policy options that investors and market observers have proposed to improve ESG disclosures.

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### Why and How Investors Have Sought Additional ESG Disclosures

To obtain information about why and how investors have sought additional ESG disclosures, we reviewed relevant reports and studies by academics, investment firms, and others published in the last 5 years. We identified these reports and studies through interviewing investors and market observers, reviewing sources cited in documents we obtained, and conducting internet searches. These reports and studies provided investor perspectives on issues related to ESG disclosures, including how investors use ESG disclosures, the types of ESG disclosures investors seek from companies, and investors' use of shareholder proposals to request ESG information.

In addition, we selected a nongeneralizable sample of 14 institutional investors and conducted semi-structured interviews with them to obtain information and perspectives on how and to what extent they incorporate ESG information into their investment decisions, why they do or do not incorporate ESG information, and why and how they engage with companies around these disclosures. Institutional investors include public and private entities that pool funds on behalf of others and invest the funds in securities and other investment assets. For our sample, we selected private-sector asset management firms and public pension funds of varying size:

- four large private asset management firms (each with more than \$1 trillion in worldwide assets under management as of December 31, 2018);
- three mid-sized private asset management firms (each with from \$500 billion to \$1 trillion in worldwide assets under management as of December 31, 2018);
- three large public pension funds (each with more than \$100 billion in total assets as of September 30, 2018); and

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Appendix I: Objectives, Scope, and  
Methodology

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- four mid-sized public pension funds (each with from \$40 billion to \$100 billion in total assets as of September 30, 2018).<sup>1</sup>

To get a mix of regional perspectives, we incorporated geographic location into our selection when possible. For example, we selected at least one of the seven public pension funds from each of four U.S. census regions (Northeast, South, Midwest, and West). The information collected from this sample of institutional investors cannot be generalized to the larger population of all institutional investors.

To obtain information about the extent to which investors have used shareholder proposals to promote improved ESG disclosures, we analyzed proposals submitted to a stratified random sample of 100 companies listed as of October 4, 2019, on the S&P Composite 1500, which combines three indices—the S&P 500, the S&P MidCap 400, and the S&P SmallCap 600 (see table 4). For our sample, we refer to companies appearing in the S&P 500 as large, companies in the S&P MidCap 400 as mid-sized, and companies in the S&P SmallCap 600 as small. With this probability sample, each company on the S&P Composite 1500 had a nonzero probability of being included, and that probability could be computed for any company. We stratified the population into three groups on the basis of company size, and each sample element was subsequently weighted in the analysis to account statistically for all the members of the population, including those that were not selected. All sample estimates in this report are presented along with their 95 percent confidence intervals.

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<sup>1</sup>In this report, we refer to asset management firms in the private sector as “private” to differentiate them from public pension funds. Our sample of these asset management firms includes firms that are publicly traded.

Appendix I: Objectives, Scope, and Methodology

Table 4: Stratified Random Sample of Companies for Review of Shareholder Proposals

Company size	S&P index (market capitalization range)	Number of companies in index	Number of companies selected for sample
Large	S&P 500 (\$8.2 billion or greater)	505	34
Mid-sized	S&P MidCap 400 (\$2.4 billion to \$8.2 billion)	401	27
Small	S&P SmallCap 600 (\$600 million to \$2.4 billion)	601	39
Total	S&P Composite 1500 (\$600 million or greater)	1,507	100

Source: GAO analysis. | GAO-20-530

Notes: Market capitalization is the total dollar market value of all of a company's outstanding shares. The market capitalization ranges and number of companies included in each S&P index are based on the value and membership of these indices as of October 4, 2019.

For each company in our sample, we obtained and reviewed its definitive proxy statement for the annual meeting that took place in calendar year 2019 to identify shareholder proposals.<sup>2</sup> Using a data collection instrument, we analyzed each shareholder proposal submitted to a company in our sample to determine if it was related to ESG disclosures, what type of ESG disclosure it was requesting (environmental, social, or governance), and what type of investor (such as individual, labor union, or pension fund) requested the proposal. For any company in our sample that disclosed one or more shareholder proposals in its definitive proxy statement, we obtained and reviewed the company's 8-K that included the number of votes each proposal received at the company's annual meeting.<sup>3</sup> We then calculated the percentage of votes in favor of the proposal, using the number of votes shareholders cast in favor of the proposal divided by the sum of votes cast in favor, against, and to abstain. We downloaded these SEC filings from its online Electronic Data Gathering, Analysis, and Retrieval (EDGAR) system.

<sup>2</sup>Definitive proxy statements are the final version of proxy statements that public companies are required to file with SEC and provide to shareholders prior to certain shareholder meetings.

<sup>3</sup>In addition to filing annual and quarterly filings with SEC, public companies must file an 8-K to announce major events that shareholders should know about, including the voting results for shareholder proposals presented at the annual meeting.

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How Selected Public Companies' ESG Disclosures Compared within and across Industries

To compare public companies' ESG disclosures within and across industries, we identified and analyzed disclosures related to eight ESG factors by 32 large and mid-sized public companies across eight industries. First, we judgmentally selected eight ESG factors by reviewing ESG factors frequently cited by a range of market observers (such as ESG standard-setting organizations, academics, nonprofits, and international organizations) as being important to investors or possibly material for companies in several industries and through discussions with market observers, including two ESG standard-setting organizations and one investor association. We selected eight factors that were among the most frequently cited, including at least two from each of the three categories of ESG (environmental, social, and governance). The eight ESG factors we selected were (1) climate change, (2) resource management (water and energy), (3) human rights, (4) occupational health and safety, (5) personnel management, (6) workforce diversity, (7) board accountability, and (8) data security.

We then judgmentally selected 33 specific topics to represent company disclosures on the eight ESG factors. Among these 33 specific topics, we selected 16 narrative disclosure topics that companies can address by providing a narrative discussion of ESG-related risks and opportunities and their management of them and 17 quantitative disclosure topics that companies can address by providing numbers and percentages. We selected these topics by reviewing four ESG disclosure frameworks and identifying commonly occurring disclosure topics associated with the selected ESG factors.<sup>4</sup> For a list of the ESG factors and topics we selected, see figure 1 in the body of the report.

We then selected a nongeneralizable sample of 32 large and mid-sized public companies to review their disclosures on the eight ESG factors and 33 ESG topics. First, we judgmentally selected eight industries from which to select public companies. We identified industries that were likely to disclose information on the selected ESG factors; had multiple companies included in the S&P 500; and, when taken together, represented a diverse range of industry sectors. The eight industries we

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<sup>4</sup>The four frameworks we reviewed were those published by the Global Reporting Initiative, Sustainability Accounting Standards Board, Task Force on Climate-Related Financial Disclosures, and Investor Stewardship Group. These four frameworks are composed of single-issue categories that contain several specific disclosure topics related to that issue. For example, the Global Reporting Initiative's energy category includes specific disclosure topics on energy consumption and energy reduction for a company.

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selected were (1) airlines, (2) beverages, (3) biotechnology and pharmaceuticals, (4) commercial banks, (5) consumer retail, (6) electric utilities, (7) internet media and services, and (8) oil and gas production. We used industry classifications from the Standard Industrial Classification system, which SEC's Division of Corporation Finance uses as a basis for assigning review responsibilities for industry groups.<sup>5</sup>

We then selected four public companies within each of these eight industries for a total of 32 companies. We selected four companies per industry that were among the eight largest in terms of market capitalization and that, when considered collectively within industries, provided representation across different U.S. regions. We limited our selection to U.S. public companies that were traded on either of the two largest American stock exchanges. The information collected from this sample of public companies cannot be generalized to the larger population of all public companies.

We reviewed recent regulatory filings for these companies and voluntary reports, such as corporate social responsibility reports, to identify relevant disclosures on the selected ESG topics. We reviewed companies' 2018 10-Ks, 2019 definitive proxy statements (which typically covered the same reporting period as the 2018 10-K), and 2018 annual reports (when different from the 10-K).<sup>6</sup> We also reviewed companies' most recent sustainability reports available on their websites, accessed from July through December 2019.<sup>7</sup> We defined a sustainability report as a voluntary, stand-alone document that provided information on sustainability and other issues related to environmental, social, and governance factors. Companies can use other means to report ESG information, such as their websites or issue-specific company reports. We

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<sup>5</sup>The Standard Industrial Classification was developed by the U.S. government in the 1930s to consolidate various government classification schemes and to facilitate the comparison of industrial data. This classification system is also used for company filings in SEC's EDGAR database.

<sup>6</sup>Companies are required to send an annual report to their shareholders or post the report on their websites before an annual meeting to elect directors. Some companies choose to use their 10-K as their annual report and do not provide separate annual reports. We reviewed annual reports that were distinct from companies' 10-Ks. Of our selected companies, 21 published annual reports separate from their 10-Ks.

<sup>7</sup>The reporting year for these sustainability reports were 2017 (three companies), 2017–2018 (three companies), 2018 (16 companies), or 2018–2019 (three companies). Seven companies did not have sustainability reports available on their websites.

did not include single-issue documents or information included on websites that was not also part of the sustainability report.<sup>8</sup> There are several reasons why a company may not disclose information on a specific ESG topic; for example, the topic may not be relevant to its business operations or the company may not consider it to have a significant enough impact on its financial performance to warrant disclosure.

To identify relevant disclosures, we searched each document for a list of keywords related to each of the eight ESG factors to help identify passages likely to contain ESG disclosures on the 33 specific ESG topics. We selected these keywords by reviewing the 33 topics we selected and identifying unique terms associated with them. We categorized each narrative disclosure as being generic or company-specific.<sup>9</sup> We categorized a narrative disclosure as company-specific if it included details about how ESG-related risks and opportunities affect the company's specific operations or how the company manages these risks or opportunities. Otherwise, we characterized the narrative disclosure as generic. Generic narrative disclosures are disclosures that could apply to the reporting company as well as to many of its peers. We considered each disclosure as a whole and, if it provided some company-specific information, we categorized the disclosure as company-specific.

In addition, we conducted semi-structured interviews with representatives of 18 of the 32 selected companies to obtain their perspectives on how they determine what ESG information to disclose, where to disclose it, and the benefits and challenges of ESG reporting. We requested interviews with all 32 of the selected companies, but eight companies declined and six companies did not respond to our request. For those that did not respond, we made at least three requests by email. We interviewed at least one company from each of the selected industries. Furthermore, through the semi-structured interviews with investors described above, we obtained investors' perspectives on characteristics of ESG disclosures that may limit their usefulness to investors.

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<sup>8</sup>An example of a single-issue report would be a document that focused solely on an electric utility's methane emissions and did not discuss other ESG factors.

<sup>9</sup>We considered quantitative disclosures to be inherently company-specific.

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Appendix I: Objectives, Scope, and Methodology

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SEC Staff Efforts Related to the Disclosure of Material ESG Factors

To understand SEC's current regulatory framework for overseeing public companies' disclosures, we reviewed relevant laws and regulations, such as Regulation S-K and the Sarbanes-Oxley Act of 2002.<sup>10</sup> To review SEC's efforts related to ESG disclosures, we reviewed relevant SEC policies and procedures, such as internal guidance and SEC's interpretive releases to public companies on climate change and cybersecurity disclosures. We also reviewed SEC's 2012 and 2014 reports on climate change disclosures to the U.S. Senate Committee on Appropriations.<sup>11</sup> We reviewed additional internal SEC assessments on selected ESG-related topics to obtain information on steps taken by SEC to review ESG disclosures. To obtain information on how staff conduct reviews of annual 10-K filings and ESG information, we interviewed SEC officials from the Division of Corporation Finance and a nongeneralizable sample of 15 review staff from the same division (six attorneys, six accountants, and three office chiefs). For our sample, we judgmentally selected staff in industry groups in accordance with those selected for our sample of public companies and with varying levels of tenure at SEC. The information collected from this sample of SEC review staff cannot be generalized to the larger population of all SEC review staff.

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Policy Options to Improve ESG Disclosures

To identify relevant policy proposals to improve ESG disclosures, we reviewed reports and public statements from investors, ESG standard-setting organizations, and other groups that provided their perspectives on the current state of ESG disclosures and potential policy proposals, including advantages and disadvantages of these proposals. For example, we reviewed letters submitted by various groups to SEC in response to its 2016 request for public comment on possible changes to regulation S-K, as well as press releases by large asset management firms. We conducted searches of government and academic literature for research on ESG disclosures from the previous 5 years. We searched the internet and various databases, such as ProQuest Newsstand Professional and Scopus. Using broad search terms, we identified articles related to our research objectives that provided useful context and discussion topics for interviews with market observers, investors, and

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<sup>10</sup>Regulation S-K, 17 C.F.R. Pt. 229; Sarbanes-Oxley Act of 2002, Pub. L. No. 107-204, 116 Stat. 745 (2002).

<sup>11</sup>Senate Committee on Appropriations reports accompanying Financial Services and General Government Appropriations bills for fiscal years 2012 and 2013 directed SEC to submit reports to the Committee on the quality of public company disclosures about climate change-related matters. See S. Rep. No. 112-79, at 111 (2011); S. Rep. No. 112-177, at 109 (2012). SEC submitted to the Committee reports on climate change disclosures in 2012 and 2014, within the 90 day time frames specified in the reports.

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Appendix I: Objectives, Scope, and Methodology

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companies. We also identified relevant reports and studies through investor and market observer interviews, by reviewing sources cited in documents we obtained, and through internet searches.

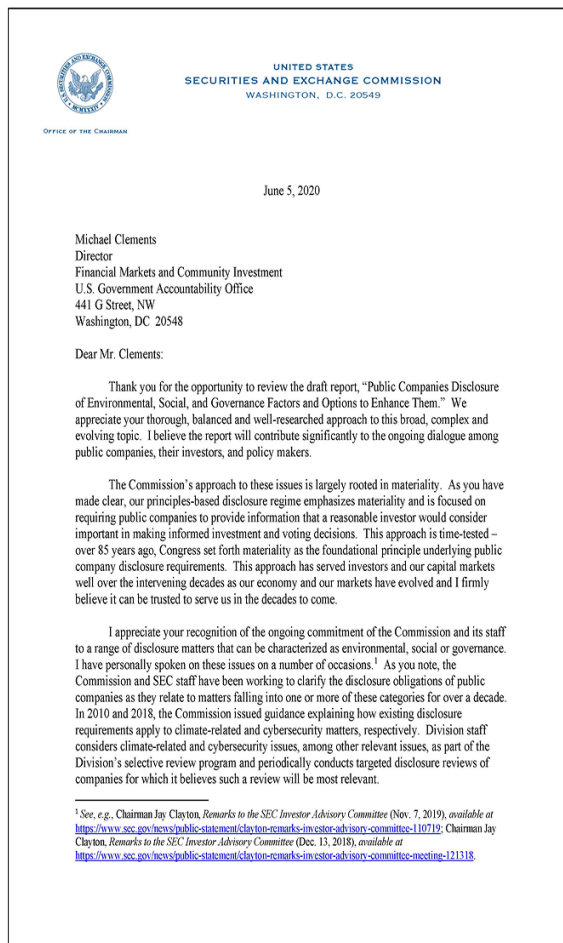
In addition, we reviewed reports and studies on international ESG disclosure requirements to identify and obtain information about relevant policy approaches implemented in other countries. We interviewed government officials in the United Kingdom and Japan and stock exchange and industry association representatives from South Africa to obtain their perspectives on the quality of ESG disclosures in their countries and the advantages and disadvantages of their current ESG disclosure laws and policies. We selected these countries for interviews because each had implemented one or more of the ESG policies that had been discussed as potential policy proposals by investors and market observers in the United States. Finally, we interviewed a nongeneralizable sample of 13 market observers selected to represent a range of stakeholders, including ESG standard-setting organizations, academics, and representatives of industry and investor groups, to obtain their perspectives on issues and policy options related to ESG disclosures.<sup>12</sup> We selected these market observers through studies and reports of companies ESG disclosures that identified leading observers with subject matter expertise and through referrals obtained during interviews for this study. We also used information obtained from our interviews with investors and companies to inform our analysis for this objective.

We conducted this performance audit from January 2019 to July 2020 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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<sup>12</sup>To characterize investor, company, SEC review staff, and market observer views throughout the report, we consistently defined modifiers to quantify the views of each group as follows: "nearly all" represents 80–99 percent of the group, "most" represents 50–79 percent of the group, and "some" represents 20–49 percent of the group. The number of interviews each modifier represents differs based on the number of interviews in that grouping: 14 institutional investors, 18 public companies, 15 SEC review staff, and 13 market observers.

## Appendix II: Comments from the Securities and Exchange Commission



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and Exchange Commission

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Mr. Michael Clements  
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The Commission has also solicited public comment on a number of our disclosure requirements as part of our disclosure effectiveness initiative. These solicitations of comment have had tangible impacts on a number of rulemaking initiatives, including the adoption of final rules relating to pay ratio in 2015 and the recent proposed changes to address disclosures about human capital in 2019. Equally important to these efforts is our ongoing consideration of the actions of other regulatory bodies and standard setters, as well as the recommendations of a range of public interest groups and advisory committees.

I am committed to continuing the ongoing engagement of the Commission and its staff with market participants on disclosure issues generally, including matters that can be characterized as environmental, social or governance matters. Thank you for the consideration your staff has shown during this engagement and for the opportunity to share my views.

Sincerely,



Jay Clayton  
Chairman

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## Appendix III: GAO Contact and Staff Acknowledgments

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### GAO Contact

Michael Clements at (202) 512-8678 or [clements@ga.gov](mailto:clements@ga.gov).

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### Staff Acknowledgments

In addition to the contact named above, John Fisher (Assistant Director), Katherine Carter (Analyst in Charge), Emily Bond, Rachel DeMarcus, David Dornisch, Justin Fisher, Christopher Lee, Elizabeth Leibinger, Efrain Magallan, Adam Martyn, Patricia Powell, Jena Sinkfield, Tyler Spunaugle, Winnie Tsen, and Jack Wang made key contributions to this report.

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