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# HOW CLIMATE CHANGE COULD SPARK THE NEXT FINANCIAL CRISIS

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Sagatom Saha and Brody Viney

**Abstract:** Climate risk could potentially trigger another global financial crisis unless it is properly accounted for in global financial markets. U.S. policymakers should seek not only to reduce emissions but to also boost the climate resilience of physical infrastructure and mandate disclosure of climate-induced risk throughout the financial system.

## INTRODUCTION

Climate change is increasingly understood as one of the defining economic challenges facing the world in the 21st century. While the direct impacts of the climate crisis on economic activity are fairly clear, this paper explores a deeper, more indirect impact: the potential for climate change to trigger a financial crisis.

Scientists and economists already agree that global warming is and will be economically disastrous. The cumulative, manifold damage that climate change will bring—decreased labor productivity and the spread of communicable diseases from higher temperatures, diminishing agricultural yields amid drought and desertification, and physical losses from extreme weather events—will cost trillions.<sup>1</sup> Experts estimate that, without significant emissions mitigation, the damage will shave more than seven percent from global Gross Domestic Product (GDP) by the end of the century.<sup>2</sup>

Developing countries will inevitably bear the brunt of this damage, as they have little in place to shield them from what warming will bring. Low-lying atolls like the Marshall Islands and Kiribati will be underwater by the end of the century or sooner on current emissions trajectories.<sup>3</sup> In Bangladesh, rising sea levels are expected to submerge nearly 20 percent of the country while stronger, more frequent cyclones will permanently ruin arable lands farther inland.<sup>4</sup>

The United States will also face major costs with a loss of more than ten percent of its GDP under a business-as-usual scenario.<sup>5</sup> The Congressional Budget Office

(CBO) estimates that economic losses from hurricanes and storm-related flooding alone will cost \$54 billion annually under current climate and weather conditions – a figure that would only increase with more frequent and extreme events.<sup>6</sup> A New York Federal Reserve regulator put the direct damages from climate change at more than \$500 billion over the last five years.<sup>7</sup>

However, the United States has a key advantage: deep financial markets that can provide insurance against economic losses. When a flood or wildfire hits a home or business, insurance kicks in. Insurers help economies absorb shock: They profit when skies are calm and make payouts when disaster strikes. The system functions as long as insurers can reasonably determine how likely and costly certain risks are.

Yet climate change stands to ruin the arithmetic that insurers and financial markets use to assess these risks. Simply put, warming will make rare events today far more common in the future. As Mark Carney, the governor of the Bank of England, warned in 2015, “[t]he catastrophic norms of the future are in the tail risks of today.”<sup>8</sup>

As this paper describes, the unprecedented scale of these risks has the potential to spark a major financial crisis. If climate-related catastrophes trigger the insolvency of a major insurer, contagion through mortgage and other financial markets could be rapid, deepening the economic costs and slowing recovery. In short, climate change could strike twice, first through its direct impacts on the economy, and second through a major financial meltdown.

The global economy’s future could hinge on the United State’s ability to measure and mitigate this risk and the ensuing impact. The last global financial crisis proved that the United States is so central to the global financial system that its problems can bring down markets around the world. Further, all developed countries are facing the same task of mitigating the exposures of their financial markets to climate change.

Lawmakers would do well to heed this warning by investing in reducing emissions, boosting the resilience of physical infrastructure to climate change, and requiring the disclosure of climate-induced risk throughout the financial system. Failure to act would risk turning the global financial system from an asset to a liability, as the physical damage to local communities spreads throughout the economy, killing investments and business confidence; erasing stocks and pension value; and fueling a major economic downturn.

## THE FINANCIAL BOILING POINT

To understand the damage that climate change could unleash on the global financial system, look no further than the 2008 global financial crisis that commenced when the U.S. housing market bubble burst. While a housing bubble differs greatly

from a hurricane, their impacts on the financial system could be uncannily alike.

A financial crisis can take many forms, but generally involves a major failure in the system of financial intermediation, the web of transactions that matches depositors and investors with investment opportunities, and borrowers with sources of funding.<sup>9</sup> Often, this failure reflects concerns about the solvency or liquidity of the financial institutions such as banks that perform these matching functions, driven by unexpected falls in the value of the assets these institutions hold.

Leading up to 2007, U.S. banks and their subsidiaries sliced and diced subprime mortgage loans into securities that promised attractive rates of return but hid the risk of default inherent to homeowners with poor credit history. In theory, the risk was small as long as the housing market continued to appreciate, as the borrower could always refinance or sell the house for a higher price in the face of pending default.

When the U.S. housing bubble inevitably burst, the nation's largest financial institutions were left standing with worthless mortgage-backed securities. As economist Alan Blinder describes, this "high stakes game of musical chairs turned out to be remarkably short on seats, and large swathes of the financial industry fell rudely to the floor."<sup>10</sup> Everyone knew that prices could fall at some point, but nobody expected the fall to be so great, or so widespread. Risk models built on historical data turned out to be woefully wrong, and losses piled up well beyond what anyone had thought possible.<sup>11</sup>

Importantly, the interconnected nature of global financial markets – and the crucial role of U.S. institutions at the center of this web – meant that the crisis spread rapidly beyond U.S. borders, triggering financial market failures around the world.<sup>12</sup> These spillovers triggered a recession in global GDP, and more than a decade on, the effects continue to reverberate through the economies of many countries.<sup>13</sup>

Climate change has the potential to trigger a similarly large and unexpected collapse in asset values. The latest report from the United Nations' Intergovernmental Panel on Climate Change (IPCC) warns of increased flooding, more common wildfires, and stronger hurricane seasons that exceed historical expectations in the near future.<sup>14</sup> As these events take their toll on housing and other physical infrastructure, losses could once again exceed those predicted in financial models.

The financial institutions most directly exposed to this risk are insurance companies. The insurance business model relies on receiving many small premiums from a diverse customer base, across which individual risks are largely uncorrelated.<sup>15</sup> Over the long run, insurers should earn more than they pay out, as long as they can properly estimate the probability and dollar value of the risk they are underwriting, making them highly dependent on risk assessment and modeling, and highly exposed to climate risk.

Unexpected disasters can already wreak havoc for insurers. The Insurance Information Institute reports that insured losses from catastrophes in the United States have risen in recent years, reaching \$49.5 billion in 2018 and as high as to \$108.2 billion in 2017, in part driven by the combined impact of extreme weather events like the Camp Fire and Hurricanes Maria, Irma, and Harvey.<sup>16</sup> As the effects of climate change become more pronounced, damage from future disasters could be even greater.

In the worst-case scenario, hurricanes similar to the scale of Katrina, Harvey, Maria, and Sandy occur within the same year while unprecedented flooding hits the South and Midwest and wildfires in California also escalate.<sup>17</sup> Homeowners and businesses across the country, who previously had differing levels of exposure to these natural disasters, are all suddenly struck by catastrophe at the same time. As a result, insurers have to make payouts that their premiums cannot cover and their shareholders did not expect. Simultaneous demand for payouts from communities nationwide combined with tanking stock value could be enough to take an insurer under.

This scenario has played out before. In 1992, the destruction wrought by Hurricane Andrew in Florida led to the insolvency of nine insurance companies and large losses for many more.<sup>18</sup> More recently, American multinational finance and insurance corporation American International Group (AIG) nearly went bankrupt in 2008 as the mortgage meltdown led to almost \$100 billion in losses.<sup>19</sup> The systemic importance of AIG meant that U.S. taxpayers ultimately bailed out the firm with an \$85 billion loan.

Little effort has been put into shoring up the world's systemically important insurers since the global financial crisis. The Financial Stability Board, which coordinates financial regulation among G20 countries, maintained a list of nine insurance firms deemed too big to fail, but the board has not issued a new list since 2016.<sup>20</sup> While it is hard to know how risks have evolved, it is possible firms that would have been on the list are now avoiding capital requirements that would absorb higher risk amid an unexpected crisis.

What is clear is that insurers are increasingly feeling the pressure. Natural disasters contributed to 2017 being the largest global insurance loss year ever.<sup>21</sup> As recently as November 2019, AIG reported that catastrophe losses of \$497 million in the third quarter had again prevented it from achieving an underwriting profit, following successive years of losses.<sup>22</sup> Both insured and uninsured weather-related losses have skyrocketed over the last several decades.<sup>23</sup>

As Rostin Behnam, a Commissioner to the U.S. Commodity Futures Trading Commission, summarizes: "If climate change causes more volatile, frequent and extreme weather events, you're going to have a scenario where these large providers

of financial products—mortgages, home insurance, pensions—cannot shift risk away from their portfolios...It's abundantly clear that climate change poses financial risk to the stability of the financial system."<sup>24</sup>

#### CONTAGION: FROM COLLAPSE TO CRISIS

If the climate crisis does trigger the collapse of a major insurer, the shockwaves will be vast. The insurance industry made up more than 11 percent of U.S. GDP in 2017 and plays a vital role in the functioning of the economy.<sup>25</sup> A major failure would leave counterparties—the people and businesses it had insured—unprotected, risking widespread panic.

Worse still, the mortgage market may also feel the financial pain. A destroyed home doesn't lead to a mortgage default if the home is insured. Not so if the insurance company can't pay up. In a scenario where one or more insurers go under, the resulting rise in unexpected defaults could have even more severe ramifications for mortgage markets, again collapsing the value of mortgage-backed securities (MBS).

While MBS assets don't carry the same toxic asset risk as they did a decade ago, recent research suggests banks may increase securitization of mortgages exposed to flood and other climate risks, shifting risk onto MBS investors.<sup>26</sup> There are almost \$10 trillion in mortgage-related securities outstanding, owned by investors all around the world.<sup>27</sup> As in 2008, a collapse in this market would put at risk the global financial system as a whole.

Fannie Mae and Freddie Mac, the U.S. government-sponsored enterprises that almost collapsed themselves in 2008, guarantee much of this market, with \$4.8 trillion in enterprise guaranteed MBS outstanding in 2017.<sup>28</sup> In the event of widespread defaults, these giant, heavily leveraged enterprises will be on the hook to repay investors.

The possibility of climate change creating such a situation is front of mind for at least some of the institutions affected. In 2016, Freddie Mac's Economic & Housing Research group asserted that "rising sea levels and spreading flood plains nonetheless appear likely to destroy billions of dollars in property and to displace millions of people. The economic losses and social disruption may happen gradually, but they are likely to be greater in total than those experienced in the housing crisis and Great Recession."<sup>29</sup>

The Trump administration plans to privatize Fannie Mae and Freddie Mac, but they would remain insured by the government under the proposed privatization.<sup>30</sup> This means that, whether privatized or not, taxpayers could once again be left footing the bill for a bailout.

Another source of contagion risk could be the reinsurance system. Insurance

companies can turn to reinsurance, which provides insurance to insurers, to cover their losses from extreme events. However, even this safety net is at risk. UBS, one of the banks deemed systemically important in the aftermath of the last global financial crisis, predicted that an estimated \$70 billion of natural catastrophe losses in 2019 could have eroded all the excess capital that the reinsurance industry holds.<sup>31</sup> In fact, returns were barely expected to cover capital costs for the industry for 2018 and 2019.<sup>32</sup>

In short, if one insurer—or a few—go under, the localized climate-induced damage from hurricanes, floods, and wildfires could spread rapidly through the mortgage market and elsewhere in the global financial system.

## A WORLD WITHOUT INSURANCE

The crisis scenario outlined so far represents an extreme case. Crucially, whether it comes to pass will depend on how insurers and other market participants factor climate change into their risk modeling.

As the evidence on climate change and its disruptive effects grows, regulators and central bankers are increasingly sounding the alarm. In addition to Carney and Behnam, Glenn Rudebusch, the San Francisco Fed's executive vice president for research, warns, "Climate-related financial risks could affect the economy through elevated credit spreads, greater precautionary saving, and, in the extreme, a financial crisis."<sup>33</sup> Further, actuaries also recently ranked climate change over cybersecurity, terrorism, and financial stability as their chief concern.<sup>34</sup>

Still, there are significant knowledge gaps around the world in measuring financial exposure to climate change.<sup>35</sup> After all, the task is extremely difficult. Noticing that once-in-a-generation floods have become annual affairs is one thing but determining rates for flood insurance and assigning payouts is a completely different matter. Even though climate and weather have been the most frequently discussed topics among companies in the S&P 500, the ratings agency itself modeled that insurance companies are underestimating possible losses from extreme weather events by as much as 50 percent.<sup>36 37</sup>

"We understand that climate change causes a big systemic risk," says Stefano Giglio, a Yale professor of finance. "But right now, we don't have enough information, and we don't have the right financial products to insure this risk."<sup>38</sup>

If insurers are aware of climate risk but cannot formulate how to price it correctly, an abundance of caution could force insurers to drive up premiums in the future. Alternatively, it could be the case that insurance against flooding, wildfires, and other natural disasters will just be exorbitantly expensive even when correctly priced. Last year Ernst Rausch, chief climatologist for one of the world's largest reinsurance companies Munich Re, described such a scenario after his firm published a report

on climate change: “If the risk from wildfires, flooding, storms, or hail is increasing, then the only sustainable option we have is to adjust our risk prices accordingly... Affordability is so critical [because] some people on low and average incomes in some regions will no longer be able to buy insurance.”<sup>39</sup>

In the extreme, insurers, worried about their own bottom line, could refuse to extend coverage to millions of people in high-risk regions, and make premiums exorbitantly expensive for millions more. This would leave homeowners totally exposed to the impacts of climate change and would create the same risks of widespread mortgage default and financial contagion as the scenario in which an insurer collapses.

Such a future is not far off. Californians have already reported that their insurers have increased their rates several times over or dropped their homes from coverage altogether.<sup>40</sup> The number of new and renewed homeowners’ insurance policies dropped by 8,700 in the ten California counties most exposed to wildfire risk between 2015 and 2018.<sup>41</sup> At the same time, insurance losses following major fire events in the state reached \$13 billion in 2018.<sup>42</sup> All the while, wildfires in California are likely to become even more common, exacerbating the problem. This same danger applies to other extreme weather events as well: Flood insurance premiums jumped by 11 percent in 2018.<sup>43</sup>

#### CHARTING A CLEARER PATH

It is unclear which scenario will come to pass, but policymakers should not idly wait to find out how exactly climate change will disrupt the global financial system. Instead, they should take a three-pronged approach: working toward mitigating emissions as quickly as possible, hardening infrastructure to make communities resilient to climate-induced physical damage, and compelling firms to disclose their own exposure to global warming.

First, the most surefire way to mitigate the climate-induced risk hidden in the financial system would be to halt climate change itself by mitigating greenhouse gas emissions. In fact, there may not be another option. According to the former AXA insurance group chief executive, “A [two degrees Celsius] world might be insurable, a [four degrees Celsius] world certainly would not be.”<sup>44</sup>

Slashing global emissions to safe levels would require countries to significantly ratchet up the ambition of their climate plans under the Paris Agreement. The United States, a global powerhouse and world leader, should do its part by pledging to reduce emissions to zero as quickly as possible. Several candidates vying for the presidency in 2020 have drawn up realistic, albeit inexact plans for full decarbonization. Further, the United States and other developed countries will also need to be more generous with foreign aid as the climate plans of many countries



are contingent on external financing.

Pursuing this path would not only reduce financial risk but also generally safeguard economic growth.<sup>45</sup> Economists calculate that abiding by the Paris Agreement will limit climate-induced economic losses to only one percent erased from GDP compared to the more than ten percent currently expected.<sup>46</sup>

Second, governments should use the tools at their disposal to limit the damage that climate change can cause to homes, businesses, and critical infrastructure including power grids, dams, and communications equipment. A certain amount of damage from climate change is already baked in. For instance, sea levels will continue to rise as much as by 60 centimeters by mid-century even if emissions fall sharply and warming stays below two degrees Celsius.<sup>47</sup> While governments around the world should take aggressive steps to mitigate climate change, it will be important to take other measures to limit the economic and human consequences.

Increased spending on climate adaptation could go a long way toward affordably reducing risk. For example, governments could provide grants to homeowners to modify properties at risk of flood or wild fire damage. Insurers could also design contracts to better incentivize homeowners to invest in adaptation. Legislation requiring such modifications on new buildings would also reduce the cost of future natural disasters. Further, in the United States, the U.S. Federal Emergency Management Agency (FEMA) could refocus its resilience efforts to make sure newly vulnerable communities are prepared for pending climate-induced extreme weather events.

If homes are more resilient to the effects of climate change, the direct consequences of some extreme weather events may be reduced. Importantly, this would also reinforce the soundness of the financial system, reducing the likelihood of the kind of widespread defaults that could trigger a crisis in financial markets.


Third, there are many measures that lawmakers can impose to make transparent the climate risk hidden throughout the financial system. Congress can pass the Climate Risk Disclosure Act of 2019 bill, which would direct the U.S. Securities and Exchange Commission (SEC), in consultation with climate experts, to issue rules that require public companies to disclose their risk exposure to climate change at its current pace, as well as their strategies to manage this risk.<sup>48</sup> In 2010, the SEC released guidance urging public companies to disclose climate risk without describing how exactly such climate-related risks should be reported, leading to inconsistent reporting by public companies and a lack of transparency.<sup>49</sup> <sup>50</sup> This legislation could also extend to investment firms whose portfolios contain shares of companies exposed to climate change.

Last, major economic institutions such as the World Bank, International Monetary Fund (IMF), the U.S. Treasury, the Commerce Department, and Federal

Reserve System should make significant investments in improving models that describe how climate change will impact communities, markets, and the global economy. Investing in such data would incentivize companies to mitigate their own exposure once the impact of climate change on the economy is made clearer. It would also empower local communities to better understand the risks and choices they face.

Some organizations have already taken steps in the right direction. The Federal Reserve Bank of San Francisco proactively published outside research calculating the financial risks of climate change and potential solutions.<sup>51</sup> The World Bank has also stated a commitment to integrate climate considerations into its work, while many central banks and regulators have united to work on these issues through the Network for Greening the Financial System.<sup>52</sup> However, U.S. regulators have not joined this network, and Jerome Powell, chair of the Federal Reserve, has been hesitant to make climate change the business of central banks. Given the centrality of the United States to the global financial system, progress may be limited if the Fed and other U.S. institutions do not become more heavily involved.

To summarize, governments should combine strong global action on mitigating climate change with investments in adaptation, transparency, and better information about climate risks. While these measures may involve some costs, they pale in comparison to the potential benefits if they help to keep the financial system sound and prevent a global economic catastrophe.

As the world learned in 2008, the soundness of the global financial system depends on the management of financial and economic risks in the U.S. markets at its center. When it comes to climate change, these risks are enormous. It is in every business and community's interest that they are tackled head-on. 

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