

CLIMATE CHANGE IMPACTS, INSURANCE, AND THE NEXT ECONOMIC CRISIS

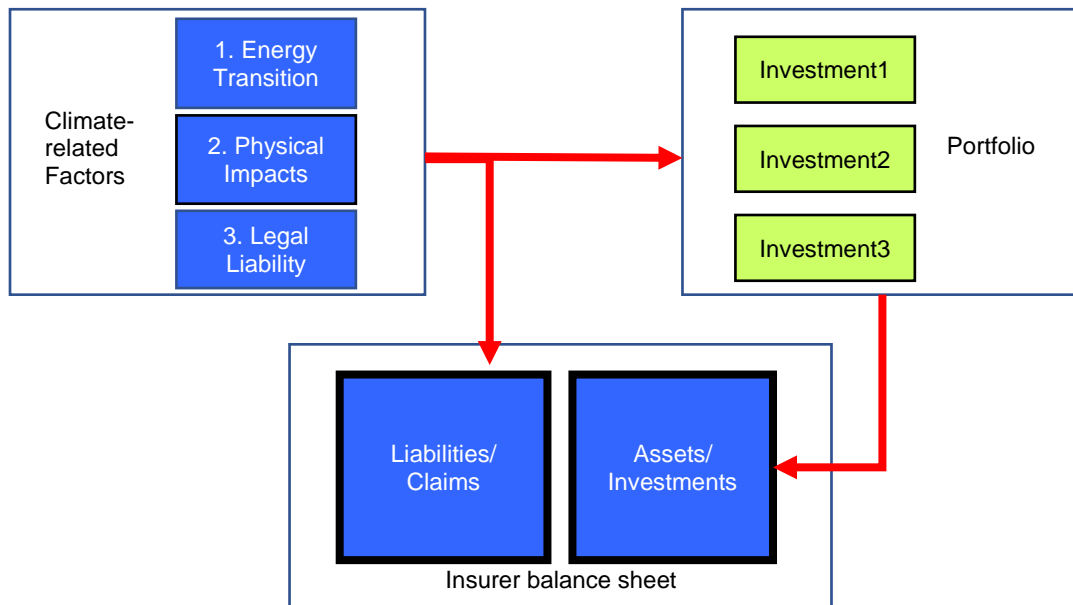
by Cynthia McHale, Ceres Senior Director

INTRODUCTION

The US insurance industry, which invests \$7 trillion and collects premiums of over \$1.3 trillion annually, plays a central role in the financial stability and economic vitality of our country.¹ US insurers (approximately 4,500) span three main sectors - **property/casualty** insurers consisting mainly of auto, home and commercial insurance, **life/annuity** insurers and **health** insurers. The sector is a large employer, providing some 2.7 million jobs (over 2% of US employment in 2017.) Insurance companies fund much of our critical infrastructure including roads, schools and other public projects – investing \$780 billion in state and local municipal bonds and loans in 2017. Insurers are also major investors in all business sectors, and contributed \$603b to the GDP in 2017 (3.1% vs. 2.9 percent for the banking industry).²

Insurers are exposed to investment as well as underwriting risks that are linked to climate. There are three broad channels through which climate change can drive financial losses for insurers:

- **Energy transition risks.** Transition risks can be defined as the risks of economic dislocation and financial losses associated with the transition to a lower-carbon economy.
- **Physical risk.** Impacts on insurance claims and the value of investments that arise from climate- and weather-related events, such as floods and storms that damage property or disrupt businesses.
- **Liability and legal risks.** Parties that suffer loss and damage arising from physical or transition risk from climate change could seek to recover losses from others who they believe are responsible.



¹ NAIC Capital Markets Bureau.

² All statistics from the 2019 Insurance Fact Book.

Understanding the connections between climate change, US insurer financial stability, and our nation's broader economy are critical to preventing a future economic crisis. We learned from the 2007- 2008 global financial crisis, triggered largely by a collapse in the sub-prime mortgage market, that financial markets around the world are highly correlated. The financial meltdown led to a \$700 billion financial-sector bailout by the US federal government, and drove the U.S. into a deep recession, with nearly 9 million jobs lost during 2008 and 2009 alone, or roughly 6% of the workforce.³ Today, despite surging stock markets and low unemployment figures, dark clouds are again forming on the horizon and there are fears of a mounting global recession. While no one knows what will cause the next downturn, it will come eventually.

Climate change heightens the risks along the three key vectors outlined above. This paper examines the risks related to one of these in particular - the physical impacts of climate change and extreme weather. As noted, insurers are also exposed to transition risk particularly in their investment portfolios, and climate liability/litigation as underwriters of Directors & Officers, Errors & Emissions, and General Liability insurance contracts. While certainly deserving of in-depth analysis, these topics are beyond the scope of this paper.

INCREASING FREQUENCY/SEVERITY OF FLOODING AND SEVERE HURRICANE EVENTS

An increase in the frequency and severity of extreme weather events could drive massive direct and indirect loss of property values in many parts of the US. Multiple catastrophic events which take place in a short period of time could fuel huge US insurer financial losses on both sides of company balance sheets, and would also trigger massive losses for banks and pension funds. Two types of climate change fueled extreme weather events are a particular concern:

- 1. Extreme inland and/or coastal flooding events causing massive property losses and business interruptions, and property devaluations.**
- 2. Category 4, 5 or higher hurricanes that destroy one or more major cities and disrupt businesses along the US Gulf/ Atlantic coasts.**

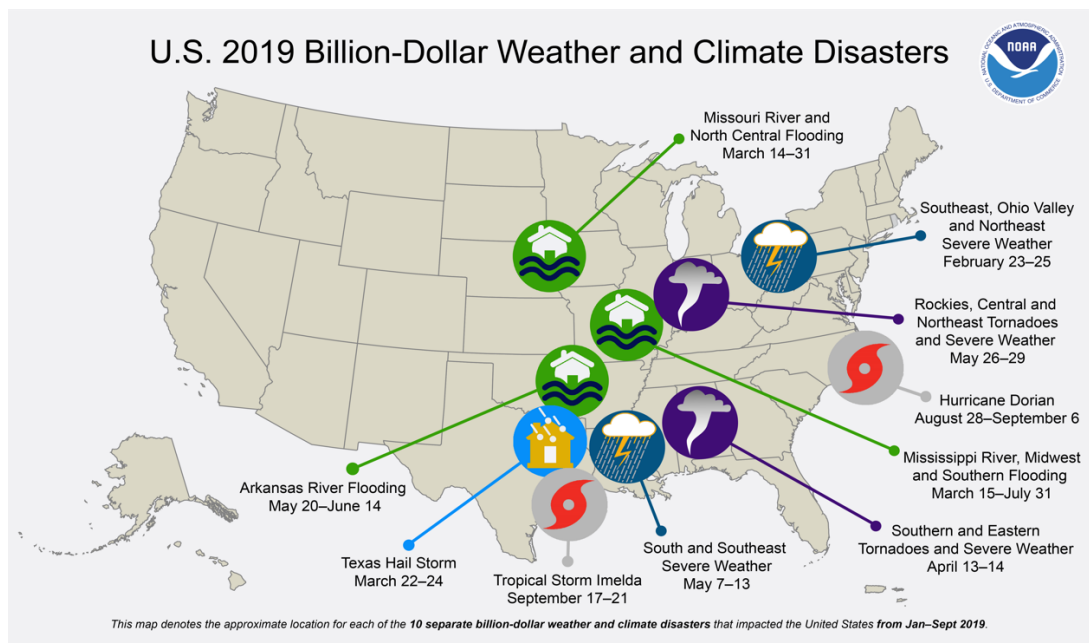
It is important to note that other types of climate change-related extreme weather such as more intense and frequent droughts, wildfires and extreme heat will also cause significant loss and negative economic impacts in the US.

³ The financial crisis had severe, long-lasting consequences for the U.S. and European economies. The number of jobs did not return to the December 2007 pre-crisis peak until May 2014. U.S. household net worth declined by nearly \$13 trillion (20%) from its Q2 2007 pre-crisis peak, recovering by Q4 2012. U.S. housing prices fell nearly 30% on average and the U.S. stock market fell approximately 50% by early 2009, with stocks regaining their December 2007 level during September 2012.

More Frequent and Severe Extreme Flooding Events—Coastal and Inland

The U.S. has sustained 254 weather and climate disasters since 1980 in which overall damages/costs reached or exceeded \$1 billion. The total cost of these 254 events exceeds \$1.7 trillion. Flooding is the costliest and most frequent type of natural disaster.⁴ From 2000 to 2018, flooding in the U.S. caused more than 6,200 deaths and \$830 billion in economic losses, according to the report by the nonprofit American Geophysical Union (AGU).⁵ Furthermore, the AGU report examined insurance claims data from Cook County (encompassing Chicago and its environs) and found that just as many claims came from outside of areas identified as a flood plain compared to locations within flood plains. This finding means that the current approach of managing the flood plain to manage flooding does not address the issue adequately.

Hurricane Harvey presents a very clear illustration of this issue. In 2017, flooding in and around Houston from Hurricane Harvey forced 39,000 people out of their homes – three fourths of which were outside the 100-year flood plain. Hurricane Harvey's damage was \$125 billion⁶, yet the US National Flood Insurance Program (NFIP) paid only between \$6 and \$9 billion, and private flood paid less than \$0.5 billion. In the case of Houston, and in many other recent extreme flooding events in the US caused by hurricanes, extreme precipitation events, and coastal flooding from sea-level rise most of the flood-related damages are uninsured.



⁴ <https://www.ncdc.noaa.gov/billions/events.pdf>

⁵ <https://news.wttw.com/2019/09/26/report-details-human-and-economic-costs-flooding-illinois-us>

⁶ <https://www.texastribune.org/2018/01/08/hurricane-harvey-was-years-costliest-us-disaster-125-billion-damages/>

Climate change fueled extreme flooding carry particularly relevant social and economic considerations. As noted above, most US homeowners do not carry insurance to protect their properties against the risk of flooding as the purchase of coverage is mandatory only in certain-high-risk areas. As the frequency, severity and variety of flood disasters increases, some areas historically considered to have low flood risk may see materially greater risk of damages from future catastrophes. In addition to the direct damages to property and communities, downstream impacts of the flood insurance issue include uninsured losses resulting in mortgage delinquencies, federal disaster relief to mitigate those shortfalls, and increased losses to bearers of mortgage risk including mortgagees, insurers, federal underwriting agencies and bondholders.

A recent article in the New York Times reported that climate risk embedded in residential mortgages has echoes of the sub-prime crisis.⁷ The article points out that retail banks, i.e., mortgage originators, sell new mortgage loans into the secondary market so the potential flood risks associated with these properties are transferred to investors such as **Freddie Mac** and **Fannie Mae** along with institutional investors such as pension funds and insurers that purchase mortgage-backed securities (an asset backed security secured by a mortgage or collection of mortgages). During the 2007 – 2008 financial the delinquency and loss performance of mortgage-backed securities rapidly deteriorated to a degree that far exceeded the level of default expectations of credit rating agencies.

Insurance companies are big investors in mortgage-backed securities. According to the National Association of Insurance Commissioners (NAIC), as of year-end 2017, US insurers held \$386b of residential mortgage backed securities and \$223b in commercial mortgage loans. The bottom line: retail banks are off-loading flood risks embedded in mortgages to Freddie Mac, Fannie Mae along with insurance companies and other types of institutional investors that buy these bonds. Insurers and other investors assume the investment risk based on the premise that the property will act as collateral should the borrower default on the loan. But if flooding destroys the property, many homeowners and businesses without flood insurance could default, leaving many properties almost worthless.

When accurate flood risks are assessed, real estate markets and property values are significantly affected. This has happened recently to properties located in designated FEMA flood zones, where banks require buyers/owners to purchase flood insurance sold through the NFIP. Recent reforms were implemented to the NFIP (which was \$21bn in debt as of March 2019) to make it more financially stable. Insurance rates were raised to reflect true flood risks and subsidies were scaled back for properties experiencing multiple and extremely severe flood events. As a result, some property owners saw their flood insurance rates rise dramatically thereby making the property significantly less valuable to future prospective buyers.⁸

What could quickly change banks' mortgage lending practices is a lack of available property (flood) insurance. The affordability of flood insurance is already becoming a major issue in some coastal areas, e.g., in places such as Atlantic City New Jersey, Norfolk Virginia and certainly St. Petersburg Florida. Furthermore,

⁷ <https://www.nytimes.com/2019/09/27/climate/mortgage-climate-risk.html>

⁸ <https://www.iii.org/article/spotlight-on-flood-insurance>

as sea levels rise, insurance costs will be a huge issue for both current and prospective property owners and developers who may become unable to acquire or transfer property without the necessary insurance in place. As a result, coastal property values could be significantly depressed, which would leave investors, including **Freddie Mac** and **Fannie Mae**, to realize major losses. In April 2016, Freddie Mac issued a report that warned of sea levels and flooding reaching a point where properties become uninsurable and unmarketable. The report concluded that this could cause homeowners to default on their mortgages and prompt another housing crisis.⁹

More Frequent Category 5 (or Higher) Hurricanes Impacting US Coastal Cities

According to a 2017 research report by MIT's Kerry Emanuel, the most dangerous storms — tropical cyclones that intensify rapidly just before landfall, catching forecasters and populations off guard, thereby risking large casualties — are likely to become increasingly frequent and severe as the globe warms, **increasing from one such storm every 100 years to one every 5 to 10 years.**¹⁰

In recent years, better tropical cyclone forecasts have resulted in reduced death tolls and lower damages than would otherwise have occurred. However, huge growth in coastal populations has resulted in an almost three-fold increase in the global population exposed to tropical cyclone hazards between 1970 and 2010. Kerry reports that in the US, the major metropolitan areas most at risk for surprise hurricane intensification just before landfall include **Houston, Texas; New Orleans, Louisiana; and Tampa/St. Petersburg and Miami, Florida.** The MIT models also foresee more hurricanes developing from climate change by 2035. Of those, 11% are expected to be Category 3, 4, or 5 in strength. The models estimate that 32 extreme storms with winds above 190 miles per hour are likely to form. That's more powerful than a Category 5, leading many meteorologists to call for a Category 6 designation.¹¹

In addition to more intense hurricanes, a warmer, wetter world also causes storms to remain in place longer. A 2018 study found that hurricanes have slowed.¹² The jet stream, driven by temperature contrasts between the Arctic and temperate zones, which pushes storms is becoming weaker. This is in large part due to the fact that the Arctic is warming faster than the rest of the globe. The net effect is that a weaker jet stream allows hurricanes to hover over one area thereby causing more damage from both wind and rainfall. Plus, as noted above, rising sea levels are significantly increasing the threat of storm surge flooding from storms, especially hurricanes.¹³ Several hurricanes over the last 15 years illustrate the risks.

⁹ <https://www.browardpalmbeach.com/news/freddie-mac-economist-warns-of-housing-crisis-caused-by-sea-level-rise-7777522>

¹⁰ <https://journals.ametsoc.org/doi/pdf/10.1175/BAMS-D-16-0134.1>

¹¹ <https://www.theguardian.com/us-news/2018/sep/15/hurricane-category-6-this-is-how-world-ends-book-climate-change>

¹² <https://insideclimatenews.org/news/02022018/cold-weather-polar-vortex-jet-stream-explained-global-warming-arctic-ice-climate-change>

¹³ <https://www.climate.gov/news-features/climate-qa/could-climate-change-make-atlantic-hurricanes-worse>

The most destructive US hurricane was **Hurricane Katrina** which cost \$160 billion when adjusted for inflation. It was a Category 5 hurricane that flooded New Orleans in 2005.¹⁴ Most of the damage was caused by storm surges that overwhelmed the levee system. In 2017 a few weeks after Hurricane Harvey, **Hurricane Irma** began heading toward Miami, Florida. It was a Category 5 storm, and the largest Atlantic storm ever. Its 185 mph winds lasted for 37 hours, a new record fed by 86-degree waters. If Irma had hit Miami, the damage could have reached \$300B, according to insurance firm, Swiss Re.¹⁵ That figure includes damage to buildings and their contents, and the economic cost of interruptions to business and individuals.

In September 2019, **Hurricane Dorian** was the most powerful storm to make landfall on the Atlantic coast since the 1935 Labor Day hurricane. Dorian struck the Bahamas on September 1 with maximum sustained winds of 185, stalling just north of the territory with unrelenting winds for at least 24 hours. The resultant damage to these islands was catastrophic; most structures were flattened or swept to sea, and at least 70,000 people were left homeless. After it ravaged the Bahamas, Dorian proceeded along the coasts of the Southeastern US and Atlantic Canada leaving behind considerable damage and economic losses in those regions. CoreLogic had forecasted that over 668,000 homes with a combined \$145B reconstruction cost value had been exposed in Florida to storm surge before Dorian altered its course

Following catastrophic hurricane events, such as these and when **Hurricane Sandy** came ashore in New York in 2012 (resulting in about \$26B insured loss) property insurers react very quickly by raising rates, limiting coverage or exiting the market entirely. Insurers' rapid adjustments in their risk-based underwriting create problems for both banks and prospective property buyers/sellers. When a homeowner or business can't obtain property insurance, banks won't sell mortgages. Or when property insurance becomes prohibitively expensive, buyers are driven away. Both of these situations reduce property values and limit prospective property sales to cash-only buyers, if there are buyers at all.

SUMMARY OF THE IMPACT OF WEATHER DISASTERS ON INSURERS, BANKS AND THE REAL ECONOMY

1. Impact of Insured Losses on the Balance Sheets of Insurers

If insured losses resulting from floods or a hurricane or a series of events are sufficiently large and concentrated, they could lead to distress or failure of insurance companies. For example, Hurricane Andrew in 1992 resulted in the insolvency of several insurance companies. The failure and distress of insurance companies in turn could affect financial stability if they were to lead to disruptions to critical insurance services and systemically important financial markets, such as securities lending and funding transactions. Large-scale fire sales of assets by distressed insurers could reduce asset prices which could adversely affect the balance sheets of other financial institutions, such as banks.

¹⁴ <https://www.thebalance.com/hurricane-damage-economic-costs-4150369>

¹⁵ <https://www.thebalance.com/hurricane-harvey-facts-damage-costs-4150087>

Natural disasters are more likely to lead to financial distress or insolvencies of insurance companies if they underestimate the risks posed by a changing climate, and hold insufficient capital as a result. Because insurers base their premiums on historical loss patterns, industry experts and analyses suggest that the insurance industry may indeed be underestimating the impact of climate change on catastrophe risks. Standard and Poor's argues that some reinsurers might be underestimating their exposure to one-in-10 year and one-in-250-year catastrophe losses by an average of about 50%, using an illustrative scenario analysis to test the potential impact of climate change.¹⁶

2. Impact of Uninsured Losses on the Balance Sheets of Insurers and Banks

To date, weather-related catastrophes have not led to large-scale failures of insurers or system-wide financial instability in advanced economies. What has been more common, however, is collective withdrawal of insurers from markets/risks that they consider to have become uninsurable. In addition, insurers have responded by raising premiums and deductibles, and limiting coverages. The higher premiums and lack of insurance availability could in turn reduce property values in affected areas (and potentially, also unaffected areas that face similar risks), which could tighten the borrowing constraints of households and corporates. Thus, even if losses are at least partially insured and some financing for reconstruction is available, a severe weather-related catastrophe could affect the banking sector and the real economy in the near-term.

Insurance is a key mechanism via which losses arising from natural disasters are spread across time and society. Thus, while withdrawal of insurers from covering weather-related risks would help protect the insurance industry from losses, this does not necessarily represent an efficient outcome for the broader financial system or the economy as a whole. An excessively high price for catastrophe insurance, or the lack of insurance, could lead to even lower levels of insurance penetration, which in turn could reduce property values. The reduction in property values could in turn reduce lending to inefficiently low levels in the presence of borrowing constraints. According to one study, a poorly functioning catastrophe market leads to about 20% less bank-financing of catastrophe-susceptible commercial real estate.¹⁷

Households and corporates balance sheets could be further weakened if output and employment fall in affected areas due to a slow reconstruction, which is more likely when the affected parties suffer large uninsured losses and fiscally-funded aid is limited. A reduction in collateral values and a weakening of household and corporate balance sheets in turn could increase the probability of default of loans, thus could adversely affect the banking system.

¹⁶ <https://www.spratings.com/documents/20184/544129/Global+Reinsurance+Highlights+2014/8d0a7dcb-3b36-48fe-ac57-a3486723286e>

¹⁷ <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1540-6261.2009.01446.x>

If banks suffer losses on their capital as a result of a natural disasters – especially flooding and hurricanes – and cannot raise new capital immediately, then they could reduce lending to both affected and unaffected areas in order to improve their regulatory capital ratios. The resulting reduction in credit supply could in turn exacerbate the fall in the property values and further damage the balance sheets of households and corporates, potentially deepening the post-disaster downturn. A natural disaster could potentially also ‘crowd out’ bank lending in unaffected areas, as credit demand increases in affected areas when households and corporates seek to fund the reconstruction of damaged homes and buildings by supplementing insurance payments through bank credit.

Figure 2: A transmission map from a natural disaster to financial sector losses and the macroeconomy

¹⁸ <https://pdfs.semanticscholar.org/e48c/93172c93a98b0ef0434e0a9331bd82b2147e.pdf>