Climate Change and the Insurance Industry

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Introduction

In 2018, natural catastrophes wreaked havoc around the world. Windstorms caused massive losses in the United States, Japan and the Philippines. Droughts hit the United States and Europe, and unusually large wildfires caused devastation in California. Experts have suggested that at least a portion of the world's global catastrophes in 2018 can be attributed to climate change.

Japan suffered seven typhoons, flooding and two earthquakes in 2018, while the Philippines suffered a super typhoon and Indonesia endured a deadly tsunami. The United States saw $160 billion in catastrophe losses, which is higher than the 30-year average of $140 billion, but lower than 2017's $350 billion in losses. Hurricane Michael, which hit Florida's coast in October, accounted for $16 billion in losses, approximately $10 billion of which were insured. But the most extraordinary U.S. catastrophe losses in 2018 came from wildfire: California suffered its worst wildfire season in history, with extensive loss of life and monetary losses of $24 billion. [i]

While experts cannot tell us which disasters are attributable entirely to climate change, they have gone on record saying that the increasing frequency and severity of catastrophes like those experienced in 2018 can, in fact, be linked to climate change. "Losses from wildfires in California have risen dramatically in recent years," said Ernst Rauch, Munich Re's head of climate and geosciences, noting that "many scientists see a link between these developments and advancing climate change." [i]

Yet, while exposure for the reinsurers who cover these catastrophes has increased over the last five years due to climate change, their rates have not. The phenomenon of reinsurance rates stagnating following a high catastrophe year is not new to the industry. The reinsurance industry starts each year with a certain amount of capacity that enables it to cover a certain amount of risk. When catastrophes occur, reinsurance capital is diminished, but can be replaced by underwriting profits on other lines of business, investment profits or the inflow of

new capital. If the capital is fully replaced, there will be competition to deploy capital in the following year, leading to only modest or potentially no rate increases, despite a recent catastrophe.

In addition to reinsurance capital, there is also competing capital from the securities markets. Insurance-linked securities (ILS) are a popular way to invest in the reinsurance market because the securities have little or no systematic risk. To the extent the ILS market remains robust and reinsurance capital is flat or increasing, rate increases will be more difficult to implement.

Climate change

Climate change refers to a broad range of global phenomena created predominantly by burning fossil fuels, which add heat-trapping gases to Earth's atmosphere. These phenomena include the increased temperature trends described by global warming, but also encompass changes such as sea level rise; ice mass loss in Greenland, Antarctica, the Arctic and mountain glaciers worldwide; shifts in flower/plant blooming; and extreme weather events.[ii]

Insurance is one of the main mechanisms used by individuals and business to manage the financial consequences of risk, including the threat posed by natural hazards such as windstorms and floods. Climate change consequences are insured through the coverage of the risks that insurance industry accepts from clients, since climate experts predict changes in the intensity and distribution of extreme weather events, and because of the resulting risk of catastrophic property claims. In this sense insurers are influenced by climate change because weather patterns increase their clients' exposure and they are asked to adapt their risk assessment and review their underwriting with a view to their specific risk exposure. This kind of products constitutes the core business of the insurance industry. But specifically, in the case of climate change many problems arise.

Climate change's relationship to global weather patterns increases the potential for losses so large that they threaten the solvency of insurers as more severe weather becomes more common and overall variability of conditions increases. Uncertainties in assessing climate change's impacts are high, affecting property and casualty, business interruption, health, and

liability insurance, among others. As a result, where a risk has significant ambiguous components, insurers are both more likely to charge a significantly higher premium and more likely to avoid insuring the risk entirely than where a risk is more well-defined. It is likely that many climate change-related risks are correlated, creating a skewed risk pool and exacerbating the risk of extremely large losses, and that some of these risks are not well-distributed across existing insureds. As a result of insurers' uncertainty aversion and need to protect against extremely large losses from single or related events, it is not clear that insurers will be willing to insure against some climate change-related risks at a price that policyholders are willing to pay.[iii]

Climate change is already modifying the frequency, intensity and regularity of hazards such as flood, cyclonic wind and storm surge and droughts. Long-term trends, however, can often only be inferred with a low level of confidence at this stage. Changing hazard patterns can also lead to increasing exposure in some areas as well as increases in vulnerability, all of which generate new risk. While it is impossible to predict exactly how climate change will modify disaster risk in the future, it is possible to calculate risk scenarios on the basis of climate models for specific regions. In other words, instead of calculating risk with today's hazards, a future scenario is calculated with new hazard parameters derived from a climate change model. By maintaining the exposure and vulnerability constant in the risk model, it is therefore possible to identify by how much climate change could increase risk levels under a given scenario. [iv]

Wildfires

Events such as the frequency and the extent of wildfires are affected by climate change. This follows as the paths of low and high pressures and of precipitation change with new weather patterns. The previous and the current California wildfire seasons, in combination with many wildfires in Europe, has contributed to an increasing awareness of the threat from wildfires. Available studies indicate increasing risk of wildfires in many areas of the Northern Hemisphere, including western United States, northern Africa and northeast Russia.

Wildfires are complicated because they can be affected by a variety of climate-related factors — drier vegetation, more lightning, earlier springs with longer fire season, and an

increased prevalence strong, dry winds — as well as by non-weather factors, such as zoning and other land use regulations (e.g., allowing building of homes in fire-prone areas). All these factors can affect the frequency and intensity of fires. Yet it can be said with confidence that some places will be affected more than others. For example, California is subject to strong, dry winds like the Diablo winds in northern California and the Santa Ana winds in southern California. Climate change research indicates that these winds will be more intense with global warming, and as a result California will be subjected to more frequent and more intense wildfires.

Hurricanes

The number of hurricanes may not necessarily have to increase, but since there is more heat energy trapped in oceans, the frequency of strong hurricanes (categories four and five on the Saffir Simpson scale) is likely to increase. Those hurricanes are also likely to last longer at maximum intensity and to cover a larger area.

The assessment is based on modelling and simulation, as the relatively low frequency of the events entail a small dataset. Also, natural annual variation is a far larger than the short-term impact of climate change.

Climate change is already seen in an increased likelihood of warm weather. In combination with urbanization and increasing housing values in vulnerable areas (as many people prefer to live near the coastline), climate change could lead to more infrequent, but more costly hurricane events.[v]

Flooding

Both the frequency and the severity of heavy precipitation causing inland and coastal flooding are clearly increasing. Rain-induced flooding, effects are not, however, uniformly distributed. Many regions already see more frequent and more severe flooding following precipitation, while others experience prolonged periods of drought. The sea level is expected to increase following ocean warming (thermal expansion) and melting land glaciers

All flood types are affected by climate-related factors, some more than others. Flash floods occur in small and steep watersheds and waterways and can be caused by short-duration intense precipitation, dam or levee failure, or collapse of debris and ice jams.

Urban flooding can be caused by short-duration, heavy precipitation. Urbanization creates large areas of impervious surfaces (such as roads, pavement, parking lots, and buildings) that increases immediate runoff, and heavy downpours can exceed the capacity of storm drains and cause urban flooding. Flash floods and urban flooding are directly linked to heavy precipitation and are expected to increase as a result of increases in heavy precipitation events.

River flooding occurs when surface water drained from a watershed into a stream or a river exceeds channel capacity, overflows the banks, and inundates adjacent low-lying areas. River flooding depends on precipitation as well as many other factors, such as existing soil moisture conditions and snowmelt. Coastal flooding is predominantly caused by storm surges that accompany hurricanes and other storms that push large seawater domes toward the shore. Storm surge can cause deaths, widespread infrastructure damage, and severe beach erosion. Storm-related rainfall can also cause inland flooding and is responsible for more than half of the deaths associated with tropical storms. Climate change affects coastal flooding through sea level rise and storm surge and increases in heavy rainfall during storms.[vi] Along rivers and sea coasts, some homes that were once considered at low risk are now endangered due to water that is climbing higher and surging farther inland than historic patterns predicted.

Insurance-Linked Securities and CAT bonds

Insurance-linked securities (ILS) are broadly defined as financial instruments whose values are driven by insurance loss events. Those instruments that are linked to property losses due to natural catastrophes represent a unique asset class, the return from which is uncorrelated with that of the general financial market.

The market for ILS has been very attractive for investors and insurers. One portion of ILS is the reinsurance of high-severity, low-probability events known as CAT bonds, or catastrophe

bonds. These include cover for natural disasters and other uncontrollable events. These policies are grouped by their assessed risk, and then re-insured by other insurers.

CAT bonds are very risky in general. Therefore, an insurer will try to minimize risk by writing many such policies. If an insurer charges a premium equal to the expected annual loss, it can stand to profit by those premiums by the law of large numbers. Another way insurance companies can spread their risk from CAT bonds is to transfer risk to another insurer, thereby reinsuring the original insurer's portfolio and minimizing liability.

Investors are attracted to these CAT bonds because they are unrelated to financial markets. That is where the capital markets and insurance-linked securities meet, through derivative or securities markets. CAT bonds are grouped by their level of risk and sold in portfolios in security markets. This makes reinsuring these contracts more attractive because it opens a whole market for them to be sold and for risk to be spread among many investors. It is much more attractive to write expensive, risky policies and share the risk with thousands of others than it is for one firm to assume total liability.[vii]

Forecasts for the precise effects of climate change are still surrounded by uncertainty. Nevertheless, global warming will have an effect on the frequency and severity of weather-related natural catastrophes. Individual insurance-linked instruments will only be marginally impacted by climate change. These securities have certain features which mitigate the impact that climate change could have on their risk level or overall attractiveness. Firstly, most CAT bonds have a three-year maturity and most private deals covering natural catastrophe risks have a one-year maturity. Over these timeframes, climate change will not have an effect that cannot be foreseen and priced in at inception. Other regular weather patterns are more likely to influence the risk levels of ILS during their tenure. Secondly, the catastrophe risk models that are used to assess the risk of ILS can incorporate shorter-term trends and prevailing – or forecast – climate conditions.

In the long run, the impact of climate change may lead to a higher reinsurance demand, both in regions that are already exposed and in new geographical areas. This could result in a broader and deeper ILS market due to new investible risks becoming available.[viii]

Conclusion

There is widespread consensus that climate change will lead to more extreme weather events globally and that we can expect more severe catastrophes. The climate is changing, and the direction of change is an established fact.

The dominant risks on the CAT bond market today are US East Coast hurricanes and California earthquakes. Of these, primarily hurricanes are affected by a changing climate. Wildfire perils currently make up a small portion of the total risk on the market and are all remote. Not even the 2017 season, the costliest season on record with losses exceeding $10 billion, would have been sufficient to trigger bonds in the liquid CAT bond segment by itself. The bonds that triggered in 2017 due to wildfire was multi-peril bonds following a severe hurricane season in combination with an extreme wildfire season. As wildfire risks increase, it reasonable to expect that more of this risk will be transferred to the capital markets and contribute to overall growth of the ILS market volume.

Currently, only a few CAT bonds cover flooding. Particularly, bonds covering hurricane risks typically do not include flooding following the event. Last summer, the Federal Emergency Management Agency (FEMA) issued its first CAT bond covering flood events to strengthen its flood insurance program.

With the large values at stake, where most of the losses from recent hurricanes were induced by flooding, we can reasonably expect an increasing number of bonds to cover flooding and contributing to ILS market growth.

While climate change and weather risk are a substantial threat to society, on many levels, the short-term impact on ILS is limited. The maturity-time of an ILS is typically between three and five years. In this time span, annual variations, for example ocean heat content and ocean currents, are the major risk factors. The liquidity of CAT bonds and many ILS instruments entail that new knowledge and changing risks will be reflected by pricing mechanisms.

As risks are continuously reassessed, prices of bonds are adjusted accordingly. In fact, ILS solutions bring a market valuation of climate/weather related risks, which can also facilitate a discussion on climate investments in mitigation efforts.

Climate change, along with increasing wealth in many countries and urbanization in vulnerable areas, will likely be important drivers for increasing demand for insurance, both for existing perils and for new ones. In the longer term, increasing risks will inevitably entail increasing insurance premiums, and even higher if mitigation investments are not in place to compensate for climate change.

In a growing market it is very likely that we will see an increased use of alternative capital, both to ensure access to capital and to decrease capital costs. If anything, the ILS market is set to grow following climate change. [iv]

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[vi] NOAA, 2013: United States Flood Loss Report - Water Year 2011. 10 pp., National Oceanic and Atmospheric Administration, National Weather Service.

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