

Designing Insurance for Climate Change

Katherine R. H. Wagner
University of British Columbia

katherine.wagner@ubc.ca

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Abstract

Many natural disaster insurance markets were designed under historical distributions of climate risk that differ from those prevailing today. These differences create challenges for natural disaster insurance markets to mitigate the effects of climate change and also increase demand for innovative policy solutions.

Increasingly severe and costly extreme weather events have brought natural disaster insurance market reform to the forefront of political debates. In the U.S., for example, federal and state governments have enacted over 200 bills related to natural disaster management since 2018, and continue to consider others.¹ At the heart of many of these outstanding debates is a tension between maintaining affordability of natural disaster insurance for homeowners while allowing insurers to remain solvent. While policymakers deliberate, some homeowners cease to renew contracts that they consider too expensive and insurers pull out of markets where they consider risk uninsurable.^{2,3}

The scope of this policy debate about natural disaster insurance market reform is dwarfed by the scale of natural disasters themselves, however. In 2021, natural disasters caused over 300 billion dollars of economic damage around the world, the third costliest year ever recorded.⁴ These recent wildfires, floods, and extreme temperatures have shattered long-standing records in the U.S. and abroad.⁵ Climate change seems likely to continue to exacerbate the intensity and cost of these natural disasters in the future, contributing to drier droughts, stronger storms, and hotter heat waves.⁶

While climate change policy in the past focused on preventing future climate change from occurring through, for example, pricing carbon, the escalating cost of natural disasters has highlighted the importance of complementary, reactive policy that helps us adapt to climate change effects. This article explores the perfect storm of climate science and policy that has made natural disaster insurance market reform necessary and discusses promising policy directions for the future.

Historical Policy Inertia

Ongoing discussions on reforming natural disaster insurance markets are more widespread than in the past. A key part of the explanation for this new urgency may be that the costs to natural disaster insurers have become more salient in recent years, after catastrophic events such as Hurricane Harvey in Texas in 2017 and the Camp Fire in California in 2018. However, the increasing financial pressure on insurers is a symptom of a much longer divergence in the trends between underlying natural disaster risk and insurance premiums.

The distribution of global climate risk has changed much faster than the distribution of premiums in insurance markets around the world. For example, flood insurance payouts through the public U.S. National Flood Insurance Program (NFIP) have increased twentyfold in the last twenty years—more than seven times the increase in federal spending on Medicaid over this period.⁷ In Canada, nine of the ten most costly natural disasters have occurred over this same time period.⁸ These losses reflect a general trend in increasing natural disaster costs worldwide (Figure 1).⁹

By contrast, natural disaster insurance premium increases over the same time period have been limited. U.S. NFIP flood insurance premiums have been largely unchanged in real terms since the program's inception in 1968, which coupled with rising hurricane losses has resulted in a public debt burden in the tens of billions of dollars.¹⁰ Previous attempts at mandating flood insurance rate increases in this market were so unpopular that they were ultimately rescinded.⁷ Insurers from California to Germany are reducing coverage for homeowners they perceive as uninsurable at current prices.^{2,11} The slow updating of contract pricing is partially due to statutory price caps in some markets: Californian wildfire premium increases in excess of 6.9% trigger extensive regulatory reviews. Many insurance models underestimated the rapid escalation of climate change impacts, and the lag in updating premiums to reflect new information has created solvency difficulties for some insurers as costs have soared.⁶

In addition to the mismatch between the rates of change of risk and price, premium levels also typically weren't set with climate change in-mind. Many natural disaster insurance markets set rates using backward-looking formulas that exclude future changes in risk. Private wildfire insurers in California must set rates based on their own losses over the past twenty years; using model-based predictions of future risk is actually illegal.¹² The NFIP has also traditionally used historical losses to determine premiums, and program administrators are working now to phase out additional, explicit subsidies that were written into the rate schedule at the program's inception fifty years ago.¹³ This original mismatch has subsequently been exacerbated by the divergence between risk and premiums, which seems likely to continue given anticipated future effects of climate change.⁶

Current Unique Challenges

Distinguishing features of natural disaster insurance markets compound the increasing disconnect between risk and premiums created by historical policy. Natural disaster insurance markets differ from more

commonly studied insurance markets, such as health and unemployment, and regulatory reform that has been successful in these other markets may not carryover to managing climate risk.¹⁴

First, natural disasters create spatially correlated losses for insurers. Disasters that affect a large part of an insurer's geographic market are difficult to cross-subsidize with contracts without claims since a substantial share of the state or country where the insurer operates may experience damage. This is different from health insurance where in any one year a fairly predictable share of the market may suffer from a certain disease, the costs of which are offset by healthier individuals. By contrast, many claims may be made at the same time in natural disaster insurance markets. It is therefore more difficult for insurers to remain solvent without building up substantial reserves or purchasing insurance themselves.

In addition, realizations of natural disasters are relatively rare. Infrequently observed events create challenges for homeowners to understand the benefits of insurance and for insurers to model the costs of insuring them, leading to a potential divergence between willingness to pay and premiums. Surveys of homeowners at high risk of flooding in the U.S. and Europe suggest that a majority underestimate their risk relative to both true flood risk probabilities and models used for pricing.^{15,16,17} This misperception of risk appears to play an important role in contributing to low uptake of flood insurance because homeowners then underestimate the benefits of insurance.³ In the presence of such behavioral biases, it can actually take experiencing a natural disaster for individuals to learn that the expected benefits of purchasing insurance exceed the premiums.¹⁸

Natural disasters are also typically more catastrophic than losses in other insurance markets. One disaster can erase years of profitability, as Hurricane Katrina did with a then relatively balanced-budget NFIP.¹⁹ The underlying distribution of risk in these markets makes it difficult to credibly model insurers as risk-neutral companies seeking to break even in any given year, as is more typical of other markets with less variance in realized risk.²⁰

Combined, these features suggest that regulation of natural disaster insurance markets may need to be approached differently than other insurance markets. For example, policies that mimic other markets by implementing actuarially fair premiums may not achieve their objectives here since such premiums may not allow insurers to accumulate reserves for catastrophic loss years or may not be viewed as worthwhile by homeowners who misperceive their risk.

Future Directions

Despite these current challenges, promising recent developments in natural disaster insurance markets suggest that policy reform may be successful in the future.

First, reinsurance markets are becoming more developed. Reinsurance is “insurance for insurers”, allowing them to spread losses to other companies who have also purchased a reinsurance contract. Markets for reinsurance reduce the impacts of spatially correlated losses in one geographic area by smoothing risk across larger areas or countries. Risk of catastrophic hurricanes in the U.S. Gulf Coast can cross-subsidize risk of wildfires in Australia, for example. As a result, insurers who would otherwise be bankrupted by

a large hurricane can continue to operate in the event of such a disaster.

Second, new climate models are more precisely quantifying climate risk, which will allow more accurate risk-based pricing in the future. These models are already starting to be used to reset prices in some natural disaster insurance markets, with risk-based premiums currently being phased in as part of the NFIP Risk Rating 2.0 reform in the U.S., for example.¹³ Incorporating information from these new models means that future premiums need not rely on backward-looking formulas and infrequently observed realizations of natural disasters. Communicating this information to homeowners could also help address misperception of risk by signalling the expected benefits of insurance.

Third, financial market reforms are being implemented to address the possibility of catastrophic losses. Many countries in Europe permit insurers to make tax-deductible contributions to catastrophe reserve funds to save for rainy days. In the U.S., financial market regulations designed under previous climate regimes don't currently incentivize insurers to build up catastrophe reserves, but costly natural disasters are triggering renewed interest in such standards.²¹ In the meantime, issuance of catastrophe bonds that pay out after the occurrence of a specific type of natural disaster are growing in popularity and availability around the world.²²

Finally, and perhaps most importantly, people are gradually realizing that climate change is occurring and that we need to adapt. Natural disasters impacted one in ten U.S. homes in 2021, and more than half of Americans were under an extreme heat advisory in the summer of the same year.^{23,24} Experiencing increasingly extreme weather events may convey to homeowners and policymakers that insurance could play an important role in adapting to climate change.¹⁸

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Figures and Tables

Figure 1: Trend in Insured Losses from Natural Disasters Around the World

