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Encouraging Adaptation to Climate Change: Long-Term Flood Insurance

Howard Kunreuther and Erwann Michel-Kerjan¹

As defined by the Intergovernmental Panel on Climate Change, adaptation includes a set of actions to moderate harm or exploit beneficial opportunities in response to climate change. To date, little research has addressed public policy options to frame the nation's approach to adapt to a changing climate. In light of scientific evidence of extreme and unpredictable climate change, prudent policy requires consideration of what to do if markets and people fail to anticipate these changes, or are constrained in their ability to react. This issue brief is one in a series that results from the second phase of a domestic adaptation research project conducted by Resources for the Future. The briefs are primarily intended for use by decisionmakers in confronting the complex and difficult task of effectively adapting the United States to climate change impacts, but may also offer insight and value to scholars and the general public. This research was supported by a grant from the Smith-Richardson Foundation.

Policy Recommendations

The severe hurricanes in Florida in 2004, Hurricanes Katrina, Rita and Wilma in 2005, and Hurricane Ike in 2008 clearly demonstrate that the United States is highly vulnerable to large-scale risks from storm surge and flooding. Given the possibility of sea level rise due to global warming, we are entering a new era of catastrophes unless the increasing number of property owners located in coastal areas invest more in risk-reduction measures (adaptation measures) than they do today. In this context, the current debate about how best to adapt to a changing climate raises an important policy question: how can the United States sustain itself against more devastating climate-related natural disasters in the future? Focusing on the flood risk, we

¹ Howard Kunreuther is the Cecilia Yen Koo Professor of Decision Sciences and Public Policy at the Wharton School, University of Pennsylvania. Erwann Michel-Kerjan is Managing Director, Risk Management and Decision Processes Center, Wharton School, University of Pennsylvania. The authors can be contacted by email at Kunreuther@wharton.upenn.edu and ErwannMK@wharton.upenn.edu.



recommend that Congress and the Administration revise the 1968-established National Flood Insurance Program (NFIP), which covers more than \$1.2 trillion of assets today, by moving from annual insurance contracts to long-term policies tied to property. Such a change will encourage people in high risk areas to think more about the long-term and invest in cost-effective adaptation measures that reduce losses from future floods and hurricanes.

What Losses Can We Expect?

Between 1970 and 2004, storms and floods were responsible for more than 90 percent of the total economic costs of extreme weather-related events worldwide. Hurricane Katrina, which hit Louisiana and Mississippi at the end of August 2005, killed 1,300 people and forced 1.5 million people to evacuate the affected area—a historic record for the country. Insured losses to the private sector from this hurricane have been estimated at \$48 billion in 2008 dollars (Kunreuther and Michel-Kerjan 2009) with an additional \$17 billion dollars paid by the federally run National Flood Insurance Program—another record (Michel-Kerjan and Kousky forthcoming).

A series of hurricanes in 2008 caused billions of dollars in direct economic losses along the Caribbean basin and in the United States. Hurricane Ike was the most expensive individual event in 2008, with an estimated privately insured loss of \$17.6 billion in addition to \$2.4 billion in claims paid by the U.S. National Flood Insurance Program (NFIP) for related storm-surge water damage (Swiss Re 2009).

Of the 25 most costly insured catastrophes worldwide between 1970 and 2008, 17 occurred in the United States. Fourteen have occurred since 2001, 12 in the United States. Given these events, it is hard to believe that 20 years ago, when Hurricane Hugo hit South Carolina, it was the first catastrophe to inflict more than \$1 billion of insured losses.

Several elements explain this increase in the costs of disasters in recent years. They include urbanization of the population, an increase in the value at risk and density of insurance coverage, and the possible impact of global warming on the frequency and severity of hurricanes.

For indications as to why losses from natural disasters have increased so rapidly, one need only look at Florida. The 1,200 miles of coastline that make the state an attractive destination for tourists and retirees also make it vulnerable to impacts by hurricanes from the Atlantic, Gulf of Mexico, and Caribbean. Although this threat has long been a part of life in the state, the economic impact of the storms was historically limited by the sparseness of the population. In 1950, the state was only the 20th largest in the country with a population of 2.8 million. The years since then have witnessed a migration boom, so that the state is now the country's fourth largest, with a projected 2010 population of 19.3 million (a 600 percent increase since 1950).



One consequence of this trend is clear: hurricanes, which in the past inflicted relatively little property damage, are now potential sources of catastrophe. It has been conjectured, for example, that if the intense hurricane that hit Miami in 1926 were to make landfall in the same area today, it would cause economic losses dwarfing those of Hurricane Katrina (Pielke et al. 2008). And this increased exposure is not unique to Florida. As of December 2007, Florida and New York each had nearly \$2.5 trillion of insured values located on the coast. The coastal insured value for the top 10 states combined accounts for more than \$8.3 trillion (Kunreuther and Michel-Kerjan 2009). Such huge concentrations of insured value in highly exposed areas almost guarantees that any major storm that hits these regions could inflict hundreds of billion dollars of economic losses, unless the residential construction and infrastructures are properly protected by effective adaptation measures.

Experts are debating whether the series of major hurricanes in 2004 and 2005 may have been intensified due to climate change (higher sea surface temperatures). One of the expected effects of global warming substantiated by empirical data is indeed an increase in hurricane intensity (for more information, see Emmanuel, Sundarajan, and Williams 2008; Emmanuel 2008). Higher ocean temperatures lead to an exponentially higher evaporation rate in the atmosphere, which increases the intensity of cyclones and precipitation. Other studies suggest that El Niño, rather than sea surface temperature, might be the primary driver of more intense hurricane activity (Mann et al. 2009). No matter what the cause, an increase in the number of major hurricanes for a given period is likely to translate into more storms hitting the coasts and more severe damage to residences and commercial buildings.

Homeowners' Reluctance to Invest in Adaptation

The combination of increasing urbanization, concentration of value in high-risk areas, and the potential impact of a change in weather patterns highlights the importance of investment in adaptation measures by those in harm's way. Yet the empirical evidence suggests that property owners are reluctant to incur these costs.

A 1974 survey of more than 1,000 California homeowners in earthquake-prone areas, for example, revealed that only 12 percent of the respondents had adopted any protective measure (Kunreuther et al. 1978). Fifteen years later, despite the increased public awareness of the earthquake hazard, the proportion had changed little. In a 1989 survey of 3,500 homeowners in four California counties at risk from earthquakes, only 5 to 9 percent reported adopting any loss reduction measures (Palm et al. 1990). Reluctance among residents of flood-prone areas to invest in adaptation measures has been similar (Burby et al. 1988; Laska 1991).

Even after hurricanes caused extensive damage to large parts of the Eastern seaboard and Gulf coastlines during the 2004 and 2005 hurricane seasons, a large number of residents had still not



invested in relatively inexpensive loss reduction measures with respect to their property, nor had they undertaken emergency preparedness measures. A May 2006 survey of 1,100 adults living along the Atlantic and Gulf coasts revealed—10 months after Hurricane Katrina—that 83 percent of the responders had taken no steps to fortify their home, 68 percent had no hurricane survival kit, and 60 percent had no family disaster plan (Goodnough 2006).

This lack of interest in loss reduction even after the most devastating hurricane in the country's history is puzzling, because we know that the expected benefits of many of these measures justify the investment costs. An analysis of the potential reduction in damage from future hurricanes in four states (Florida, New York, South Carolina, and Texas) reveals that if current building codes were applied to all residential property in coastal areas, loss reductions would range from 61 percent in Florida for a 100-year return-period loss to 31 percent in New York for a 500-year loss. In Florida alone, mitigation reduces losses by \$51 billion for a 100-year event and \$83 billion for a 500-year event (Kunreuther and Michel-Kerjan 2009).

Why do property owners not invest in these measures? Before a disaster, many individuals perceive the likelihood of a flood or hurricane to be low enough that they contend it will not happen to them. They thus see no need to protect their home through insurance or adaptation measures. Individuals also tend to be highly myopic and hence focus only on the expected benefits from an adaptation measure over the next couple of years even though the average life of their property is 30 to 50 years. By not incorporating the long-term rewards from investing in a loss-reduction measure, the up-front costs are likely to appear unattractive. In fact, if one plans to move within the next few years and the value of the property does not reflect the investment in adaptation measures, this behavior makes economic sense.

The Need for Long-Term Insurance

When searching for sustainable solutions to make the nation safer with respect to future large-scale disasters, one needs to carefully consider these behavioral elements to create effective policies. As a solution to overcoming the “it cannot happen to me” and myopia problems that make insurance appear unattractive and discourage investment in adaptation measures, we propose multi-year insurance tied to the property rather than the currently-standard one-year policy tied to the property owner. An appropriate starting point for this new initiative is flood insurance – a national program with a single insurer (the federal government) designed to reduce future damage while providing financial protection to disaster victims.

The National Flood Insurance Program (NFIP) was created in 1968 because private insurers viewed flood risk as uninsurable and refused to provide coverage against water damage from disasters. The NFIP has expanded over the years and in November 2009 covered more than 5.5



million flood policies nationwide with a total exposure of \$1.2 trillion. Flood insurance is currently sold on an annual basis and is required as a condition for a federally insured mortgage.

One-year flood policies are problematic because many people buy the insurance when they get a mortgage or immediately after a flood, but do not keep the coverage for the long term. For instance, a recent study that tracked the nearly 1 million NFIP flood insurance policies-in-force to cover single-family homes in Florida in 2000 revealed that one-third had been canceled by 2002, and about two-thirds had been cancelled by 2005 (Michel-Kerjan and Kousky forthcoming).

As a result of these cancellations, there are likely to be a large number of uninsured victims after the next flooding disaster. Consider the flood in August 1998 that damaged property in northern Vermont. Of the 1,549 victims of this disaster, the Federal Emergency Management Agency (FEMA) found 84 percent of the homeowners in Special Flood Hazard Areas (SFHAs) did not have insurance, even though 45 percent of them were required to have such coverage (Tobin and Calfee 2005). These individuals considered insurance a poor investment, failing to realize that the best return on a policy is no return (when you have not suffered any loss).

With the NFIP up for renewal in Congress, we propose that consideration be given to long-term flood insurance (LTFI). By tying policies to the length of the mortgage (10, 20, 30 years), insurance will be directly linked to the property. A further step would be to require that all properties in flood-prone areas have coverage, just as auto insurance is required on all vehicles. When a resident moves to another location, the flood insurance policy would remain with the property.

A long-term flood insurance program would offer homeowners in flood-prone areas a fixed annual premium for coverage over a specified period (e.g., 5, 10, or 20 years). If the homeowner moved before the end of the policy period, the insurance contract would automatically be transferred to the new owner at the same cost. Private insurers currently participating in the write-your-own-program would offer a menu of long-term flood insurance contracts on behalf of the NFIP, as they do now for one-year contracts.

ADVANTAGES

A long-term flood insurance policy would be a significant improvement over the current annual policies from the perspective of all the relevant stakeholders: homeowners, banks, FEMA, and general taxpayers. Furthermore, it does not require a radical modification of the National Flood Insurance Program nor specific appropriations from Congress. Some of the features that a long-term policy provides follow.



Financial stability for homeowner. Fixed insurance rates for a multi-year period would provide homeowners with financial stability.² Residents in coastal area would know, also, that they are protected against water damage from floods and hurricanes (storm surge).

Avoiding cancellation of policies. A long-term flood policy would ensure that people do not cancel their coverage after two or three years, as many do today when they have not suffered losses. Homeowners would also be more likely to make a claim during the life of the policy given that the chances of a flood over any 20-year period is much higher than the annual probability. For example, if a homeowner lives in a high hazard area where the likelihood of flooding next year is 1 in 100, the chances that the property will experience at least one flood during a 25-year period are greater than 1 in 5.

Time and geographical spread of risk. If insurance were required of all homeowners in flood-prone areas, the risk would be spread over time and space. Additionally, expanding the policyholder base over what it is today by having all such properties covered would provide much needed financial revenue for the NFIP.

Encouraging investment in adaptation measures. Today, many residents do not invest in risk reduction measures (such as elevating the house) because the up-front cost is too high compared with the annual premium reduction they could expect from the NFIP. To complement a long-term flood insurance policy, we recommend that long-term home improvement loans be made available to spread the cost of the adaptation measure over time. For example, a homeowner with a 20-year mortgage and a 20-year flood insurance policy should be able to obtain a 20-year home improvement loan. For cost-effective adaptation measures and risk-based premiums, the financial arrangement would be such that the annual loan payments would be less than the rebate the property owner could obtain from the NFIP in the form of an annual premium reduction because the house is less exposed to flood damage. These risk reduction measures would likely have the added benefit of increasing property values.

Reducing costs to all interested parties. Long-term flood insurance coupled with long-term loans should provide benefits to all interested parties. Homeowners are better protected and pay less by investing in risk reduction measures, the NFIP would be less exposed to damage, the bank has safer mortgages, and the general public will have less of its taxes going to disaster relief.

GUIDING PRINCIPLES

If Congress and the Administration decide to move forward on this concept, two principles should guide the development of long-term flood insurance.

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² An alternative would be to revise the price every 10 years, for instance, based on new scientific knowledge regarding the exposure. This would particularly make sense if one expects changes in climate patterns.



Principle 1: Premiums should reflect risk. Insurance premiums should be based on risk to provide signals to individuals about the hazards they face and to encourage them to engage in cost-effective mitigation measures that reduce their vulnerability to catastrophes.

The application of principle 1 provides a clear signal of likely damage to those living in flood-prone areas as well as those considering relocating there. Risk-based premiums would legitimize providing discounts to policyholders investing in cost-effective adaptation measures.

Principle 2: Equity and affordability issues should be addressed. Any special treatment given to homeowners currently residing in hazard-prone areas (such as low-income uninsured or inadequately insured homeowners) should be funded through general public funding and not through artificial insurance premium subsidies. This principle reflects a concern for some residents in high-hazard areas who will face large premium increases if the NFIP adheres to principle 1.

Note that principle 2 applies only to individuals currently living in a flood-prone area. Those being charged subsidized premiums today (for instance because they moved to the house before their community entered the NFIP) would thus pay the full annual premium reflecting risk, however, this cost to the homeowner could be offset by an insurance voucher those residents would receive (similar in concept to food stamps for groceries) reflecting the difference between the risk-based premium and their subsidized premium. Those who decide to move to the area in the future would be charged full premiums that reflect the risk.

PRICING

Pricing a long-term flood insurance policy so that premiums reflect risk means taking into account the impacts of global warming (intensity of future hurricanes and sea level rise). There is considerable uncertainty surrounding the estimates of what the risks associated with losses from hurricanes and flooding may be 10, 20, or 30 years from now. There is thus a need for accurate flood maps and for FEMA to update these maps regularly to reflect these long-term changes and define a pricing formula that evolves over time as maps are revised (GAO 2008).

To understand more fully how climate change is likely to affect flood risk in the United States in the coming years and decades, it will be necessary to have a set of realistic scenarios with respect to losses from inland flooding and storm surge from hurricanes that reflect scientists' best estimates regarding climate change. To be of most use to insurers and federal, state, and local governments, these estimates must be informed by answers from experts to the following questions.

- How many major hurricanes (Category 3 or greater) are estimated to form in the Atlantic Ocean in the next six to 18 months (short term) versus in the next 10 to 30 years (long term)?



- Of those hurricanes, how many are estimated to make landfall?
- How far inland is damage likely to extend, and how closely can the storm tracks be predicted?
- Will climate change alter the number and types of storms that strike land? Do today's topological maps accurately reflect risk of inundation?
- How much will sea level rise and how will natural environmental protection (such as wetlands) change over the next half-century in five-year intervals in specific parts of our coasts? What effect will these changes have on flooding and storm surges from hurricanes?

Recent analyses by insurers and modeling firms using the latest estimates by scientists studying climate change enable one to undertake simulations as to how alternative scenarios with respect to global warming impact on the price of flood insurance for long-term policies (Heweijer et al. 2009). A recent study by Lloyd's of London (2008) in conjunction with Risk Management Solutions indicated that risk from sea level rise could double the average annual losses from storm surge by 2030. A 2005 study by the Association of British Insurers (ABI) concluded that with a 6 percent increase in wind speeds, average annual losses from hurricane damage in the United States would increase from \$5.5 billion to \$9.5 billion and losses from hurricanes with a 1 in 200 chance of occurring would increase from \$85 billion to \$150 billion based on existing properties.

One of the principal findings from these studies is that adaptation measures can reduce the losses from future disasters significantly. For example, the Lloyd's study showed that adaptation could reduce annual losses from storm surge for properties in high-risk coastal communities in the 2030s to below today's levels. This suggests that long-term flood insurance coupled with long-term home improvement loans that give homeowners the incentive to invest in loss reduction measures will make a significant difference in reducing the damage from future floods and hurricanes.

Conclusion: Moving from the Status Quo

The evidence on increasing losses from disasters, notably floods and hurricanes, indicates that the current structure of the National Flood Insurance Program is not adequate to cover truly catastrophic floods. It is also somewhat limited in achieving its twin objectives of reducing property losses from future disasters and providing protection to those who suffer severe water damage for a simple reason: many of these residents do not invest in risk-reduction measures voluntarily and cancel their flood insurance coverage if they haven't suffered a loss for several years.

On a complementary note, we need bold, innovative, and transparent programs so that people can understand the nature of the contract. Those who purchase insurance policies often have a



difficult time understanding what risks are covered, what risks are not, and the basis for being charged a specific rate. The problem is likely to be compounded for a long-term contract. The opportunity to educate consumers as to the basis for the premiums being charged lies in providing more detail on the nature of the risk covered and the amount charged for different levels of protection. It would be very useful for the NFIP to reveal this information much more clearly so that homeowners will be able to make trade-offs between costs and expected benefits, which is impossible for them to do today. Thaler and Sunstein (2008) argue for this type of disclosure by proposing a form of government regulation termed RECAP (Record, Evaluate, and Compare Alternative Prices). They recommend that the government require disclosure practices, not in a long, unintelligible document, but in a spreadsheet-like format that includes all relevant formulas.

The flood insurance program should combine the strengths of the public and private sectors and take into account how people make decisions so that proposed solutions will be considered as win-win propositions by the key interested parties.. In designing these programs, one needs to understand how a long-term insurance policy with rates reflecting risk can lead property owners to invest in loss reduction measures when the insurance is coupled with long-term home improvement loans and building codes. Real estate developers, the construction industry, and financial institutions play an important role in promoting this concept. Third-party inspectors will be needed to certify that the adaptation measures are in place and building codes are enforced.

Whether decision makers view long-term flood insurance as an attractive alternative depends on how the program is designed and presented to key interested parties in relation to the current structure of the NFIP. If the stakeholders have a common understanding of the goals and objectives of an innovative and comprehensive disaster management program, we may be able to move away from a status quo that encourages myopic thinking to a long-term strategy for reducing losses in this new era of catastrophes.



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