

## 2018 RESEARCH PLAN

### ***Managing and Financing Extreme Events*** **Risk Management and Decision Processes Center** **The Wharton School, University of Pennsylvania**

- **New directions in flood insurance: understanding the emerging private flood market and investigating the role of flood insurance in the housing market**

As Congress considers reforms to the National Flood Insurance Program (NFIP) in advance of its reauthorization, actions targeted at growing the private flood market have consistently been included in legislative proposals. The Wharton Risk Center is undertaking research in partnership with the Department of Homeland Security's Flood Apex Program that is generating findings on the current status of private flood insurance, identifying the key levers to increasing private writing of flood policies, and investigating the role of the private sector in helping FEMA meet its goal of doubling flood coverage by 2023. As part of this research, the Risk Center is examining gaps in the supply of flood insurance and demand for coverage and developing proposals for closing this gap.

A related and important component associated with increased flood insurance market penetration is a better understanding of flood risk impact on the U.S. housing market. Working in conjunction with Penn's Institute for Urban Research, we will present a detailed overview of flood risk in relation to the U.S. housing market as well as potential policy recommendations to reduce flood risk to lenders that simultaneously promote homeowner and community flood resiliency.

- **The importance of flood mitigation now and in a changing climate**

Along with expanding flood insurance market penetration, pre-event flood risk mitigation by homeowners is critical to enhance flood resiliency. In fact, these two forms of protection can work in tandem since investment in loss reduction measures should reduce future claims payments and hence lower flood insurance premiums. Prior research has determined that although elevating a home may reduce future flood-related damage, it is very expensive to do and hence not cost-effective for some properties (notably, those on a slab foundation). This research will compare the expected benefits with the costs of other retrofitting measures for shallow flooding. As the flood hazard is not static but likely increasing in a warming climate marked by increased precipitation, rising sea levels, and changing storm patterns, we will incorporate the benefits to mitigation under these future flood hazard scenarios through our ongoing joint research with academic collaborators at Princeton University and other institutions.

- **Communicating natural hazard risk to enact action**

Hurricanes Harvey, Irma and Maria have highlighted the lack of disaster preparedness in communities subject to hurricanes and heavy rainfall, with most victims lacking flood insurance or adequate loss reduction measures. Such lack of preparedness can be due to a variety of reasons: (a) possibly, homeowners were unaware of or misunderstood their flood risk, (b) they incorrectly believed their homeowners' insurance covers flood damage, (c) they do not perceive actions are most effective to protect their property, and/or (d) they do not consider the long-term benefits of investing in loss reduction measures now given the high upfront costs.

Through a series of experiments across a variety of hazards, the Risk Center is investigating different ways of communicating the risks associated with natural disasters to identify risk communication strategies that can moderate these behavioral biases. We are currently examining the impact of stretching the time horizon for characterizing the likelihood of a disaster to see whether this framing promotes an increased take-up of insurance. For example, what are the outcomes if a property owner facing a flood with a 1-in-100 chance of occurring next year is presented as having a greater than 1-in-4 chance of having at least one flood over a 30 year period? While the question of framing time horizons has been posed in the literature, the Risk Center is the first to undertake an empirical investigation of the impact of this risk communication technique on homeowner behavior.

- **Building resiliency to new and emerging risks via metrics**

There is a growing recognition that public sector outlays to cover uninsured private and public losses associated with large-scale disasters are becoming financially unsustainable. There is thus a need to enhance the resiliency of communities and critical infrastructure and to measure progress over time. In this regard we will continue our multi-year research partnership with the Zurich Flood Resilience Alliance that is empirically validating findings on the 88 sources of flood resilience in over 100 communities across the globe with data collected using a web-based tool implemented with the alliance.

A related stream of research builds on our collaboration with the Department of Homeland Security's Critical Infrastructure Resilience Institute (CIRI) to develop resiliency metrics and assessment criteria for transportation critical infrastructure. Through case studies with a primary focus on a financial/insurance perspective, we will determine quantitative and qualitative criteria that can aid infrastructure managers in understanding their insurance needs and other financial concerns to facilitate recovery of utilities following a major disaster. These metrics will be geared not only to enhance resiliency toward natural disaster risks, but also to identify emerging risks, including cyber and terrorism, that managers of critical infrastructure face.

- **Using social media data to better understand protective decision making in response to disasters**

The advent of social media and smartphones has had a transformative effect on how we communicate. While traditional media channels such as television and word-of-mouth continue to play an important role in how consumers learn about hazards and make preparedness decisions, smartphones and social media are increasingly becoming a major source of news and advice. These channels have also opened up major new research opportunities to study the dynamics of hazard response by investigating changes in the linguistic content of social media conversations and postings (e.g., on Twitter) over the course of extreme events. In this research we will be using a suite of natural language processing tools to study how sentiment and conversation changes over the course of an evolving hazard event. The work will help inform not only basic questions about the dynamics of risk response, but also how warning messages might be improved in the face of new threats.

**For information, please contact:**

Dr. Howard Kunreuther Co-Director 215-898-4589 <a href="mailto:kunreuther@wharton.upenn.edu">kunreuther@wharton.upenn.edu</a>	Dr. Robert Meyer Co-Director 215-898-1826 <a href="mailto:meyerr@wharton.upenn.edu">meyerr@wharton.upenn.edu</a>	Dr. Jeffrey Czajkowski Managing Director 215-898-8047 <a href="mailto:jczaj@wharton.upenn.edu">jczaj@wharton.upenn.edu</a>
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**About the Wharton Risk Center**

Established in 1985, the Wharton Risk Management and Decision Processes Center develops and promotes effective corporate and public policies for low-probability events with potentially catastrophic consequences through the integration of risk assessment, and risk perception with risk management and risk financing strategies. Natural disasters (floods, hurricanes, earthquakes), technological hazards, and national and international security issues (e.g., terrorism risk insurance markets, protection of critical infrastructure, global security) are among the extreme events that are the focus of the Center's research. The Risk Center has become today one of the largest nexus of expertise on these issues worldwide and its neutrality allows it to undertake large-scale projects in conjunction with other researchers, organizations in the public and private sectors as well as international institutions. For instance, the Risk Center has been the academic partner of the World Economic Forum on its *Global Risks Report* since its inception in 2005.

Building on the disciplines of economics, decision sciences, finance, insurance, marketing and psychology, the Center supports and undertakes applied research on catastrophe risk markets to better understand how individuals and organizations make choices under conditions of risk and uncertainty. Risk Center research also investigates the effectiveness of strategies such as risk communication, information sharing, incentive systems, insurance, regulation and public-private collaborations at a national and international scale. From these findings, the Risk Center's research team is able to design new approaches to enable individuals, organizations and countries to make better decisions regarding risk under various regulatory and market conditions.

The Center is also concerned with training leading decision makers; its faculty take part in Wharton executive education programs. The Center actively engages multiple viewpoints, including top-level representatives from industry, government, international organizations, interest groups and academics through its research and policy publications, and through sponsored seminars, roundtables and forums.

More information is available at <http://riskcenter.wharton.upenn.edu/>.