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RISK MANAGEMENT AND DECISION PROCESSES CENTER
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Risk Management REVIEW

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Z Zurich Foundation Establishes $1.6m Fund for Flood Resilience Research at Wharton

Catastrophic floods — from hurricanes, tsunamis and inland storms — have displaced more individuals and have accounted for more economic losses in recent history than any other type of disaster. Around the world, recent floods have had major impacts in industrialized countries including Australia, Austria, China, Germany and the U.S., and in low-income countries including Bangladesh, Pakistan and Thailand. Strengthening communities' flood resilience is thus a topic of critical global importance.

In the United States, floods have been responsible for the largest number of lives lost and the most damage over the last century when compared with other natural disasters. Over the period 1960–2010, they accounted for nearly two-thirds of presidential disaster declarations. Given the projections of sea level rise from climate change and growing concentration of assets in coastal areas, one can expect a pronounced increase in flood losses in the coming years, unless steps are taken now to adapt to this changing environment. It is also important to better understand why risk reduction measures are not more widely adopted.

New Research Collaboration

To meet growing demand for research and knowledge development in this area, long-time Risk Center corporate partner, **Zurich Insurance Group** and the **Z Zurich Foundation** based in Switzerland have made a multi-year commitment of $1.6 million to create the ***Z Zurich Foundation Fund on Flood Resilience Research at Wharton.***

This initiative will broaden the scope of current flood resilience research, providing opportunities to advance global understanding of flood impacts, risk reduction, financial protection and community resilience.

Through this collaboration, the Risk Center will work closely with the Zurich Insurance Group and the Z Zurich Foundation's Community Flood Resilience Program, the **International Institute for Applied Systems Analysis (IIASA)** in Austria and the **International Federation of Red Cross and Red Crescent Societies (IFRC).**

Led by Wharton's Erwann Michel-Kerjan, the project brings together experts in catastrophic flood risk management to build and share knowledge that will enhance community flood resilience, business innovation and inform public policy debates with the goal of developing practical solutions that can be applied at the community, national and global levels.

The project will address research gaps on flood resilience, determine ways to remove obstacles to catastrophe risk reduction, develop and provide a perspective on appropriate risk transfer solutions and recovery measures in flood-prone areas and improve public dialogue on these issues.

The project will also create case studies on different approaches in flood risk management from which lessons can be drawn to establish a resilient flood risk management strategy for use in other communities and countries.

Addressing Affordability in the National Flood Insurance Program

Following claims payments from Hurricanes Katrina (2005) and Sandy (2012), the National Flood Insurance Program (NFIP) is $24 billion in debt to the U.S. Treasury as of July 2013. One reason for the NFIP's financial imbalance is that many homeowners historically received premium discounts below risk-based rates. FEMA estimates that about 20 percent of flood insurance policies receive premium discounts of about 40–45 percent.

Risk-based premiums are needed for the NFIP to be financially self-sustaining. Risk-based pricing is also important to emphasize to policyholders the magnitude of the risk that they face, as well as to encourage them to invest in mitigation measures in return for premium reductions

In July 2012, the President signed the Biggert–Waters Flood Insurance Reform Act with overwhelming bipartisan support from Congress. This bill included new provisions designed to improve the program's financial basis, including phasing out many of the premium discounts. Roughly 438,000 policies nationwide will see higher rates immediately as a result of Biggert–Waters. Starting October 2014, routine rate revisions also include a 5 percent assessment to help the program build a catastrophic reserve fund.

Some legislators are now wavering on their commitment to risk-based pricing for flood insurance because of concerns that their constituents will not be able to afford flood insurance. Indeed, affordability is an issue for many low- and moderate-income coastal residents.

However, a delay in implementing the flood reform legislation could further impede the financial soundness of the NFIP and discourage policyholders from investing in cost-effective risk mitigation. The NFIP must address affordability, but this should not be done through discounted premiums.

We propose a program of means-tested vouchers coupled with low-cost loans for investments in loss reduction measures, made affordable by reductions in the NFIP risk-based premiums. A combination voucher and loan program can save homeowners money by lowering their insurance premiums. Homeowners would receive a loan to make their property more resistant to flood damage, which in turn would lower the cost of their flood insurance. This program will also reduce the NFIP's exposure and improve its financial soundness through risk-based pricing.

The proposed voucher program has three key features. First, it is based on risk-based insurance premiums which are essential for communicating information about flood risk. Second, the vouchers would not only cover a portion of the insurance premium, but also would cover the costs of the loan to reduce future damage to the residence. Third, as a condition for receiving a voucher, a homeowner would have to undertake loss reduction measures that meet current standards.

Illustrative Example

Raising a house so it is above base flood elevation (BFE) could save thousands, if not tens of thousands, of dollars on annual flood insurance costs. To qualify for the insurance voucher, the homeowner would be required to elevate his house to one foot above BFE and would be given a loan for this purpose. The voucher would cover the combined costs of the annual loan payment and the insurance premium in excess of $2,500.

Consider two property owners — one in an A zone and one in a V zone — (see Figure 1) that want to reduce future damage from flooding and storm surge caused by hurricanes by elevating their homes. Both purchase an NFIP policy for $250,000 coverage. Assume that each property is three feet below BFE, and that the annual premium for the A zone resident is $4,000, and the annual premium for the V zone resident is $18,550. Further assume that each homeowner is eligible for a flood insurance voucher and has an income of $50,000 a year. Using 5 percent of gross income as our measure, these individuals would be expected to pay $2,500 toward flood insurance. If no loss reduction measures were undertaken, the A zone resident would receive a flood insurance voucher for $1,500, and the V zone resident would receive a voucher for $16,050.

The costs to elevate the houses in our example are estimated to be $25,000 for the A zone property and $55,000 for the V zone property. Both residents receive a 20-year loan at a 3 percent rate to cover these costs. The resulting annual loan payments are $1,680 and $3,660, respectively. Once the homes are elevated, the annual NFIP premiums drop to $520 for the A zone resident and $6,700 for the V zone resident.

After the homes are elevated, no voucher is required for the A zone resident because the coupled loan payment and premium, at $2,200, is less than the $2,500 that the homeowner is required to pay (based on income) for insurance. The annual cost to the homeowner of elevating the house is less than the cost of insurance ($2,500) without mitigation. For the V zone resident, after mitigation, the combined payment for the loan and premium is $10,360; the homeowner pays $2,500 and the federal government pays $7,860.

The savings from coupling mitigation with the insurance voucher are quite substantial, as shown in Figure 1. During the life of the loan, the total annual savings (the difference between the premium with no mitigation and the combined loan and premium after mitigation) are $1,800 for the A zone property and $8,190 for the V zone property.

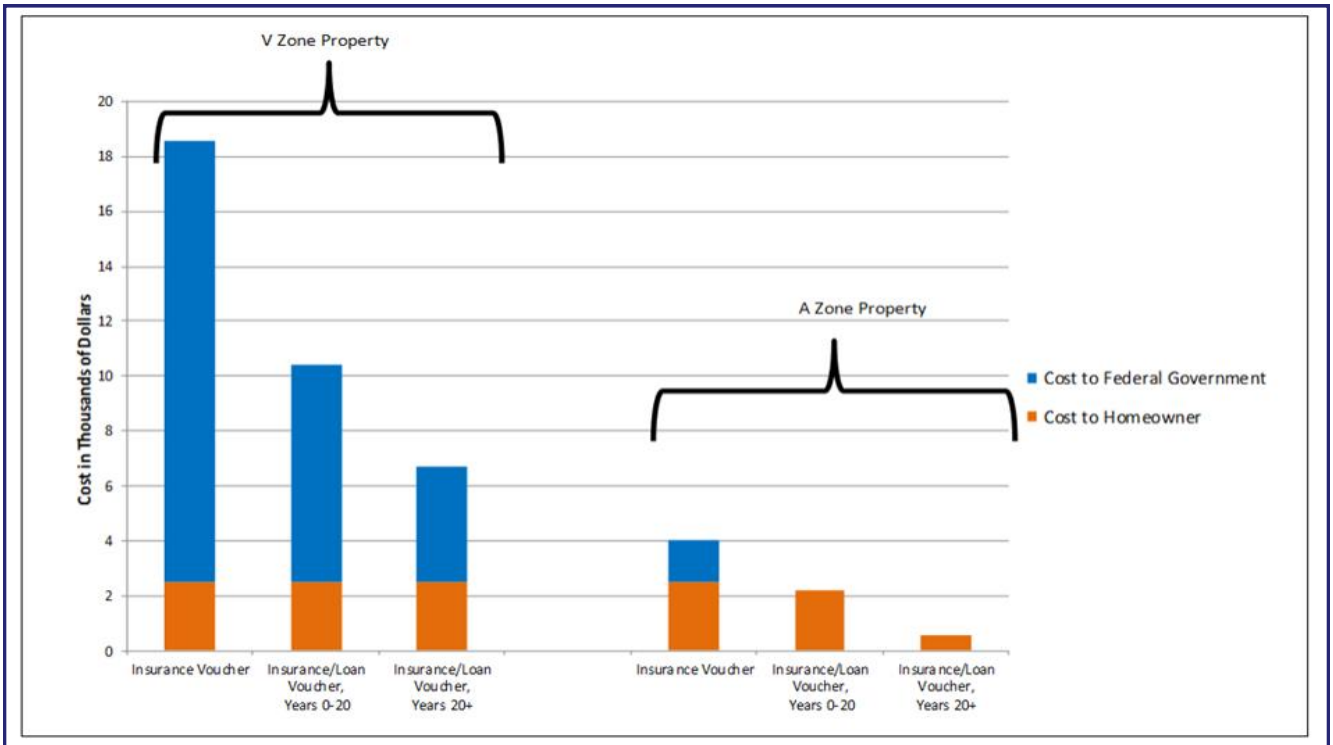

Figure 1. Cost to the Federal Government and Homeowner (Example)

Currently, single-family residences can purchase up to $250,000 of building coverage and up to $100,000 of contents coverage. Prices for these policies vary by flood risk zone based on Flood Insurance Rate Maps issued by FEMA. Areas where the annual risk of a flood is 1 in 100 or greater are divided into two broad groups: A zones and V zones. V zones are subject to wave action, or storm surge, and have higher rates reflecting this higher risk of damage.

For any pre-mitigation premium in the A zone greater than $2,200 and in the V zone greater than $10,360, it is less expensive to elevate the property and obtain the lower NFIP premium. The insurance and loan voucher program is also financially attractive for higher costs of elevation and for a range of loan terms.

Who Should Pay for Catastrophes?

A challenge at the heart of NFIP pricing is who should pay for catastrophes. Part of the motivation for the July 2012 reform legislation was the notion that individuals choosing to locate in risky locations should bear those costs. On the other hand, there is a public interest in helping low- and moderate-income residents afford insurance. Insurance guarantees that households will have money to rebuild after a disaster and is important financial protection for those in hazardous locations. Further, financing rebuilding ex ante with insurance — instead of ex post and off-budget through disaster aid — could lead to more prudent fiscal decisions. Linking such assistance to required mitigation measures will increase safety, reduce losses, and lower the financial cost of insurance. It will also reduce the financial burden on the general taxpayer.

More details on the proposed insurance loan/voucher program with illustrative data from Ocean County, NJ can be found in: "*Addressing Affordability in the National Flood Insurance Program*" by Resources for the Future and the Wharton Risk Center (August 2013, RFF#13-02) http://www.rff.org/rff/documents/RFF-IB-13-02.pdf.

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Managing Extreme Climate Change Risks through Insurance

The severe economic impacts of recent natural disasters highlight the challenges involved in providing adequate insurance coverage for such risks. For instance, the extreme floods in Germany and neighboring states in May and June 2013 gave rise to overall losses of more than $16 billion, of which only about one-quarter was insured. Other examples in 2013 are severe tornadoes in the United States in May, and flooding in Alberta, Canada in June. These events are part of a general trend of increasing worldwide economic losses from natural disasters.

This trend is likely to accelerate in the future because of climate change. Anthropogenic global warming has been projected to increase the frequency and/or severity of a variety of extreme weather events in regions around the globe. An important question that arises is how to design effective policies that limit the expected increase in these risks and reduce the impacts of natural disasters on society.

In my recent book, *Managing Extreme Climate Change Risks through Insurance* (see p. 23), I examine the role that insurance arrangements can play in increasing economic resilience to natural disasters. This is done by combining theory with empirical case studies from the Netherlands together with perspectives, studies and examples from around the world.

In order to design effective risk management policies for the future, it is important to understand the underlying drivers of past trends in natural disaster losses. A review of twenty-three studies on the causes of this development shows that increases in natural disaster risks in the past have been mainly attributed to socio-economic change, such as higher economic exposure in disaster-prone areas. Nevertheless, eight of these studies find that socio-economic change cannot completely explain observed trends in natural disaster damage, which suggests that climate change may have been partly responsible for these losses.

Regional projections of how natural disaster risks are expected to develop in the future are a key input for designing adequate local risk management strategies. I present a review of twenty-seven representative studies that project the potential impacts of climate change on future natural disaster risks in a variety of countries. This analysis shows that climate change can have profound effects on the risks from extreme weather events, such as more storms and floods. Although estimates of future risks from natural hazards are associated with large uncertainties, the majority of studies predict significant increases in risks. It is therefore imperative to design and implement policies now to adapt to projected future risk increases.

The insurance industry has a key role to play in enhancing societies' ability to adapt to climate change. First of all, providing sufficient coverage against natural disaster losses reduces the financial impacts of extreme weather events for individuals and businesses. This function of insurance to help people 'get back on their feet' after a disaster becomes more important if severe floods and hurricanes will occur more frequently. In this respect, climate change can provide opportunities for insurers to offer new products that meet demand for more natural disaster insurance coverage. An example is the development of flood insurance in the Netherlands, where flood coverage has not been generally available since a catastrophic North Sea flood 60 years ago. As a result of projected increases in flood risk due to climate change, the introduction of flood insurance is again heavily debated among insurers and policy makers in the Netherlands. A survey of 1,200 Dutch homeowners exposed to river flooding shows that opportunities exist for marketing of flood insurance. In particular, about half of the respondents are willing to insure against flooding if premiums are close to annual average flood losses. Interestingly, adverse selection, meaning that mainly individuals who face high flood risk will demand insurance, does not seem to pose a major problem, because flood insurance demand is largely driven by individual flood risk perceptions, which only to a limited degree relate to actual levels of risks.

Insurance companies can stimulate policyholders' investments in mitigation by differentiating premiums according to actual risk.

However, the extreme and uncertain characteristics of flood risks in the Netherlands do pose a problem for the development of broad private flood insurance coverage at affordable premiums. Flood risk may become even more extreme and challenging to insure because of sea level rise. This challenge applies more broadly to natural catastrophe insurance in other countries that are exposed to storm surge flooding from the sea, such as the UK, where the current flood insurance arrangement is under discussion.

One solution is to develop innovative public-private partnerships for insuring natural catastrophe risks. In such a partnership, insurers cover disaster losses up to a certain capped

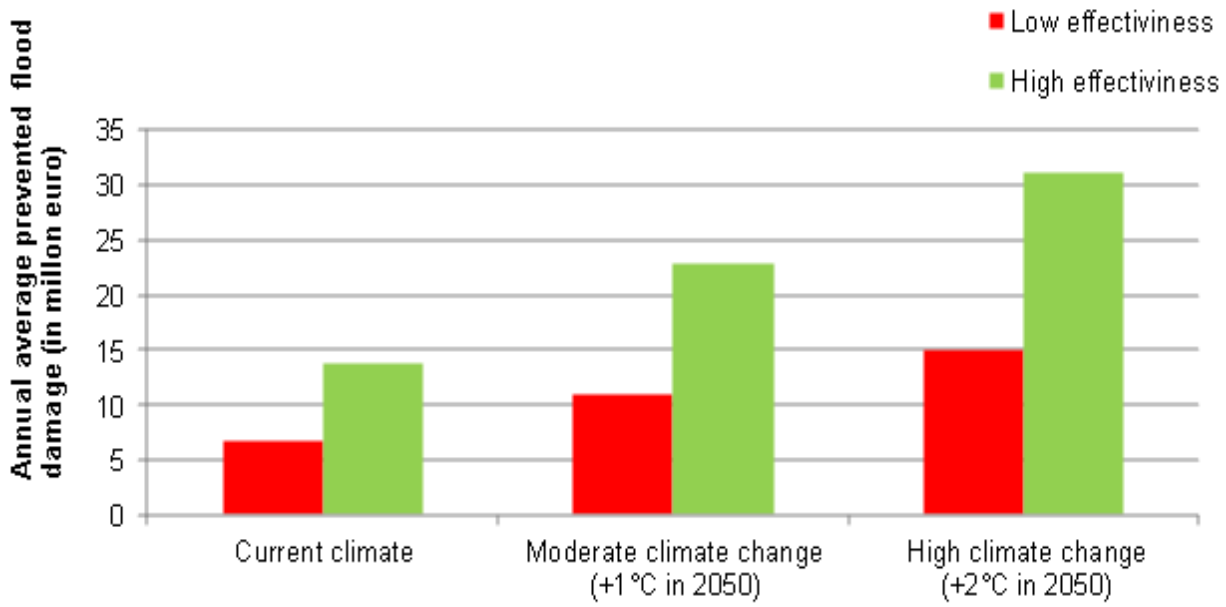

Figure 1. Potential average annual flood damage saved (in million euro) if homeowners in the Dutch river delta received insurance premium discounts for flood-proofing their home, under current climate conditions and two climate change scenarios.
Source: Botzen, W.J.W. (2013). *Managing Extreme Climate Change Risks through Insurance*. New York: Cambridge University Press, pp. 432.

amount. The government acts as an insurer of last resort for extreme, but rare, losses that exceed this cap. Alternatively, the government can provide reinsurance against extreme losses, which can result in more affordable coverage than private insurance.

Although the risk spreading function of insurance is important, it does not necessarily reduce the aggregate natural disaster risk faced by society. Limiting the projected increase in risks from extreme weather events requires investments in disaster prevention, such as flood protection infrastructure, which is often a task for governments. An additional strategy reduces the exposure and vulnerability of property to natural hazards, such as making buildings more resistant to floods and storms. A challenge with the latter strategy is that practical experience shows that individuals often do not invest in measures that reduce the vulnerability of their property to infrequent disasters such as floods. Low perceptions of disaster risks as well as short planning horizons by individuals can explain such behavior. For example, a study of flood risk perceptions of 1,000 Dutch households in 2008 showed that individuals often misperceive and underestimate the flood risks that they face, even if they live in relatively flood-prone areas that are unprotected by levees.

Insurance companies can overcome such behavioral biases and stimulate policyholders' investments in risk mitigation measures by differentiating premiums of natural disaster insurance according to actual risk. For instance, a survey conducted in the Netherlands a few years ago shows that many households would be willing to take measures that flood-proof their house in exchange for insurance premium discounts. Relatively simple measures, such as having flood shields available that can prevent water from entering homes could save billions of dollars in flood damage. Based on the number of Dutch homeowners who would be willing to undertake such flood-proofing measures in exchange for premium discounts, the average prevented flood losses would be on the order of several million euros per year, depending on the effectiveness of the measure (see Figure 1). These estimates of annual average prevented flood damage increase if floods were to occur more often in the future because of climate change, as shown by the prevented damage under a moderate and a high climate change scenario. These results illustrate the importance of insurers engaging proactively in encouraging risk reduction ex ante, with the objective to limit the costs of future extreme weather events. Otherwise, the already huge economic costs of natural disasters around the world will just keep rising.

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Tropical Cyclone Flooding: Not Just a Coastal Storm-Surge Phenomenon

Inland riverine flooding from tropical cyclones (TCs) is responsible for significant economic losses in the United States. Yet, most hurricane loss assessment efforts are focused on coastal areas. Hurricane Irene, which struck the U.S. east coast in 2011, provides a recent and poignant example: while intense media coverage and preparation and evacuation activities focused on the projected coastal landfall locations in North Carolina and New York, ultimately, most of the losses were due to heavy rainfall and associated inland riverine flooding, not storm surge.

Working with flood modelers at the **University of Iowa** and at **Princeton University (Willis Research Network** colleagues), we developed a methodological approach to better understand the relationship between TC-related flood magnitudes and inland flood damage. We empirically demonstrate that our data-driven methodology to quantify inland flood magnitude produces a very good representation of the number of non-storm-surge flood insurance claims experienced for each impacted geographic area.

First, we apply new quantification methods of the spatial structure of TC-related flood magnitudes (flood peak data) at a regional scale. Analyzing flood impacts associated with a geographically expansive individual TC event (i.e., across an entire state or even multiple states) requires characterization of the spatial extent of flooding. We propose and implement a data-driven approach to flood hazard characterization based on discharge observations from a network of stream gaging stations. By normalizing with respect to a reference site-specific discharge value (e.g., 10-year flood peak), we can account for the drainage area dependence of flood peak measurements from different sites and develop spatially varying information about the intensity of the flood event associated with TCs. A ratio with a value of 1 indicates that Ivan caused a flood peak equal to the 10-year flood peak. Values larger (smaller) than 1 indicate flood peaks caused by Hurricane Ivan that are larger (smaller) than the 10-year flood peak. Across Ivan's 23 impacted states there are a total of 27,790 census tracts with a quantified flood ratio. Nearly 2,000 census tracts (7%) had a flood ratio value greater than 1.

We then compare this data to claims data from the federally-run National Flood Insurance Program (NFIP) that underwrites the vast majority of residential flood insurance policies throughout the U.S., to which we have unique access. This combination of data allows us to produce a detailed characterization of homeowners' flood claims at a given inland location and flood magnitudes that led to those claims.

For example, our analysis of the NFIP database reveals that inland riverine flooding from Hurricane Ivan — a devastating and costly hurricane that impacted 23 U.S. states — led to 19,273 claims with $800.9 million in flood damages. This represents 67% of the total residential NFIP flood insurance claims and 54% of the total residential NFIP flood damages from Hurricane Ivan.

As illustrated in Figure 1, the inland riverine flood claims from Hurricane Ivan are primarily concentrated in three main geographic areas: Pennsylvania and southeastern Ohio; along the Appalachian Mountains in western North Carolina and northern Georgia; and along the coast near the landfall location in Alabama and Florida. Thus, the most severe flooding magnitudes from Hurricane Ivan were not limited to the coastal landfall location or to areas in the proximity of the center of circulation. Specifically, there are 1,241 census tracts that incurred at least one inland flood insurance claim. There is a clear relationship between the occurrence of large flood ratios and inland flood claims: in fact, 98.5% of total claims are associated with states that have a maximum flood ratio value occurrence of 1.4 or greater in at least one census tract (Figure 1a).

However, there are also geographic areas with flood peaks associated with Hurricane Ivan that are larger than the corresponding 10-year flood, but have no NFIP claims identified, perhaps because these communities do not participate in the NFIP. We find that of the total 27,790 unique census tracts with a quantified flood magnitude in the analysis, 6,940 tracts (25%) do not have any active NFIP flood insurance policies. Of these 6,940 census tracts, 498 have a flood ratio greater than 1 (Figure 1b).

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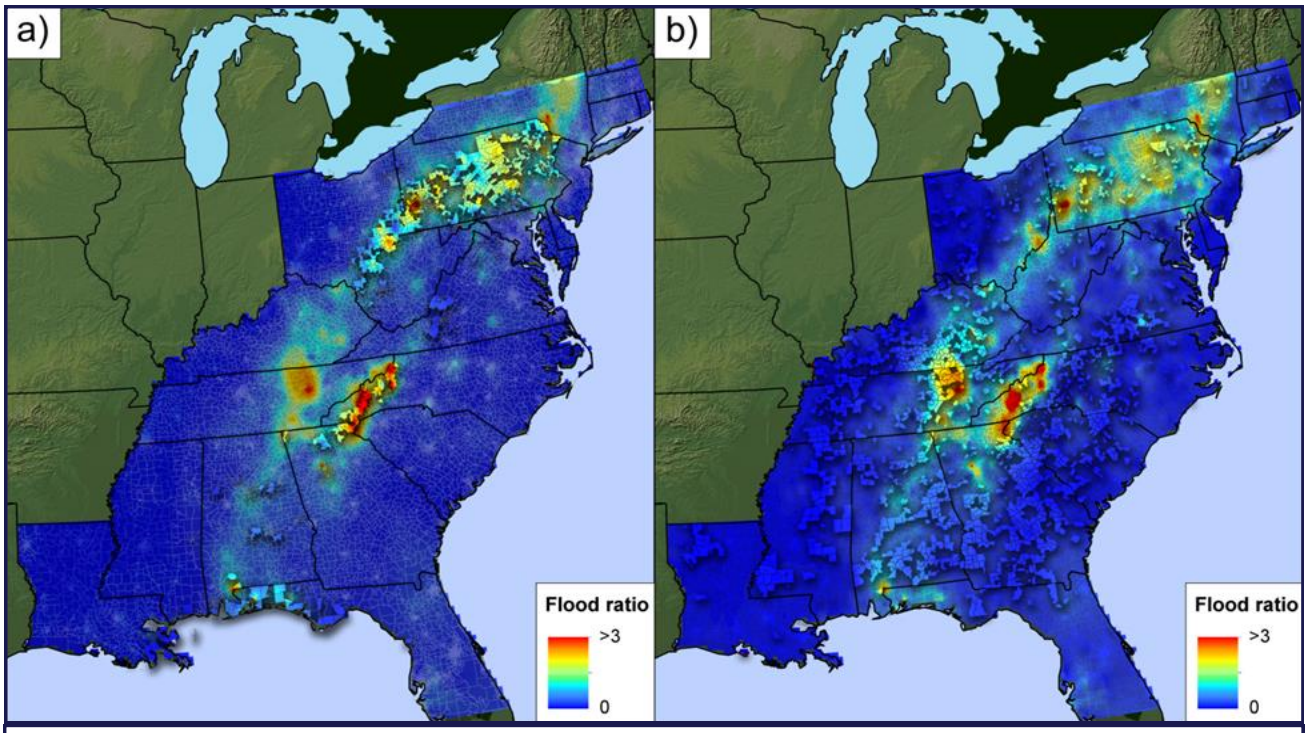

Figure 1. Inland riverine flood ratios from Hurricane Ivan.
Panel a): Locations of the 1,241 census tracts with at least one inland riverine flood insurance claim due to Hurricane Ivan are highlighted. Panel b): Locations of the 6,940 census tracts with zero NFIP market penetration are highlighted.

Finally, to explicitly determine the relationship between our NFIP inland flood insurance losses and inland flood intensities, we conducted an empirical analysis at the census tract level on the number of claims as a function of the quantified flood magnitude ratio and other relevant exposure factors. The coefficient values on the flood ratios from the estimation do in fact indicate whether a census tract has a higher probability of incurring any positive amount of claims, as well as an increasing number of claims as flood ratio values increase.

Guidance to federal, state and local authorities

In July 2012, President Obama signed the Flood Insurance Reform Act, which calls for better assessment of flood hazard. Our proposed methodology provides a foundation for TC flood risk assessment across all impacted areas, not just coastal landfall locations. For example, our inland flood risk assessment results could provide guidance to federal, state and local authorities in order to better sensitize inland residents who think that storms affect only coastal areas.

Notably, it is this type of inland risk assessment that is a priority for the National Weather Service (NWS) as evidenced by a U.S. Department of Commerce service assessment of Hurricane Irene where improvement on how the NWS "communicates the risk of inland flooding and educate[s] the public, media, and emergency managers on that risk" was the number one overarching recommendation.

Or, in the words of FEMA, "The next time you hear hurricane — think inland flooding!" (http://www.nws.noaa.gov/oh/hurricane/inland_flooding.html).

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Risk through the Eyes of the Beholder: Using Eye-Tracking & Facial Emotion Recognition to Study Responses to Natural Hazards

One of the most consistent findings that has emerged over years of research on risky decision making is that such decisions are often driven by automatic, emotional responses, far from the orderly, rational, logical decision making envisioned by economists. This is especially the case for low-probability, high-consequence events where emotions are more salient than data, and people have limited opportunities to learn from their mistakes. For example, people fail to purchase or maintain flood insurance or adequately prepare for hurricanes. A challenge facing research on decision-making under risk is that emotions are difficult to track and measure.

The Wharton Risk Center in collaboration with the Wharton Behavioral Lab recently initiated a program of research exploring the potential of two research tools — eye tracking and facial emotion recognition — to help further our understanding of emotional reactions to risk and decision making under uncertainty. We undertook pilot studies to explore the ability of these technologies to provide insights into decision makers' emotional responses in two natural hazards applications: comprehension and response to hurricane forecast maps, and decisions to buy flood insurance.

Hurricane Forecast Maps

Most people who live in areas that are occasionally affected by hurricanes are familiar with hurricane forecast maps issued by the National Hurricane Center (NHC). These maps show the current location of the eye of the storm, and the storm's forecast location over the next three to five days. The uncertainty about the storm's future path is depicted by a cone. Despite the ubiquity of such maps, little is known about people's ability to comprehend them or what kinds of emotional reactions (which induce preparatory responses) are triggered when subsequent forecast maps display the intensifying or easing of a threat. One concern of the NHC is that when people view such maps they may focus on the center of the cone and ignore the uncertainty in the forecast that surrounds it. The opposite possibility may also exist: people might focus on just the edge of the cone, as if it were a discrete indicator of whether they were in danger or not.

In our first study, participants viewed one of two sequences of hurricane forecast maps depicting a hypothetical hurricane that posed a potential threat to the subject's home in the northeastern United States. In one scenario, the storm was initially forecast to head out to sea but then turned westwards toward the coast (in a manner similar to Hurricane Sandy). The other was a "false alarm" where the opposite held: the storm was forecast to head toward the coast, but then turned out to sea. Our interests were in what features of the forecast map participants looked at (duration and sequence), and their emotional reactions as they viewed this information.

For most of the task, our participants ignored the cone, focusing instead on their home location and the area ahead of the current forecast.

The data produced a surprising answer to the question of whether people attend more to the center or edges of the uncertainty cone: for most of the task, our participants ignored the cone altogether, focusing instead on (1) their home location on the map; (2) the area ***ahead*** of the current forecast (as though they were extrapolating where the storm might go if it continued on its current path), and (3) the time information on the map. Eye-tracking and emotion data for one participant is given in Figure 1.

Flood Insurance Purchasing

We also explored the ability of the technology to provide fine-grained insights into the mechanism by which individuals make choices from a menu of insurance policies. After viewing a commercial for flood insurance, participants were given an information sheet about flood insurance and asked to rate their likelihood to purchase and willingness to pay for a flood policy. They were then asked to choose from among six different flood insurance policies that varied by issuer (the NFIP or a private insurer), deductible ($500-$1,500), maximum coverage ($200,000-$250,000), contract length (1 or 5 years), first-year premium ($400-$525), and maximum annual increase for multi-year contracts (5% or 10%).

By examining the scan paths, we were immediately able to determine that (perhaps not surprisingly) the premium was the largest single driver of the selection decision, as it received the most visual attention. But more interesting was that the scan paths gave us insight into how the decision was made; rather than immediately focusing on the size of the premium, participants postponed consideration of this factor to the end of the choice process. In essence, participants seemed to make choices using an attribute elimination rule where they first examined what they suspected would be less important attributes (like issuer) to see if they could be safely ignored as a basis of choice.

These pilot studies provide examples of the potential offered by these technologies for studying automatic decision processes in contexts of risk and uncertainty. Over the coming year we plan to broaden the range of applications, and explore the possibility of further augmenting eye-tracking and facial emotion recognition measures with physiological measures such as heart-rate monitoring.

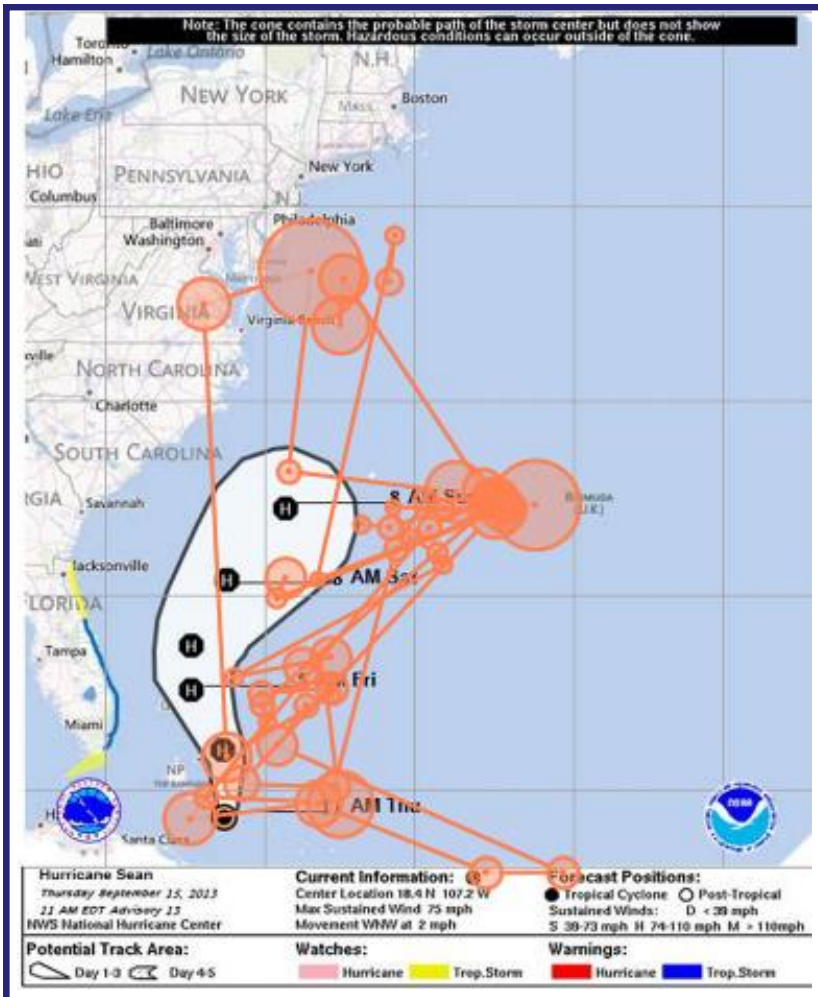
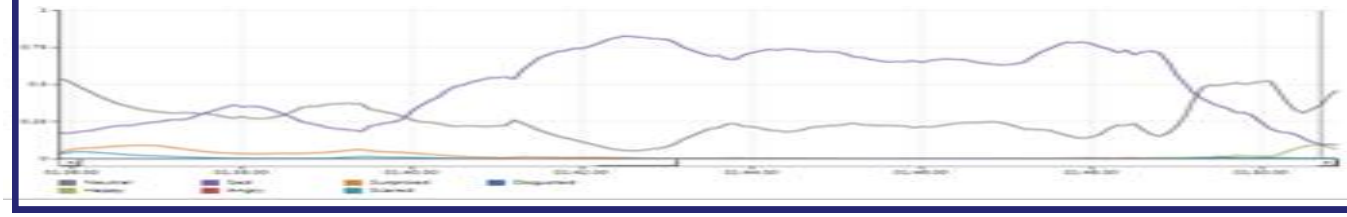


Figure 1: The top image shows the eye-tracking data for one participant while viewing a hurricane forecast map. The scan path is the sequence of eye movements marked by fixations and saccades as the image is viewed. Each circle represents a fixation (time when focus area does not change); each line represents a saccade (very brief moments when no area of image is clearly focused upon). The subject's dwell time (the amount of time the subject focused on the fixation) is represented by the size of the circle, with the larger circles representing longer dwell times. Note that very little time was spent on the cone itself, with attention focused instead on the surrounding text information and the participant's home location.

The emotion graph below plots changes in the valance of each emotion while the subject viewed the map. The graph shows an increase in sadness over time (purple line), triggered the moment the subject noticed the distance between the leading edge of the cone and her location. The data also showed counter-intuitive evidence on emotional reactions to unexpected changes in the forecast path. Perhaps because our subjects realized that they would not actually be experiencing these storms, they responded to changes in a manner akin to what one might expect to see from someone on a thrill ride: participants displayed happiness when the storm was suddenly forecast to impact their location and sadness when it was forecast to turn away.



Eye tracking develops millisecond-by-millisecond measures of exactly what the human eye is focusing on, hence information the brain is processing when viewing any visual field. Although eye-tracking has a history of application, its use was inhibited by the need for specialized goggles. Modern eye tracking devices, however, can be attached to the bottom of any computer monitor to record participants' eye movements as they look at the screen as they normally would.

Facial emotion recognition, a new technology, is also non-intrusive. As participants' eye movements are being recorded, a webcam records their facial movements. Emotion recognition software maps the face at over 500 points, The software can determine a baseline neutral expression and the relative intensity of six emotions — happiness, surprise, anger, sadness, disgust and fear.



From left: **Robert Meyer** is co-director of the Wharton Risk Management Center and Professor of Marketing.
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Tim Meyer and **Scott Monsky** were 2013 summer research associates at the Wharton Risk Center. Tim earned his B.A. in Marketing from the University of Miami in 2012. He currently is a Planning Associate at Haddad Brands. Scott earned his B.S. in Policy Analysis and Management from Cornell University in 2012. He currently teaches mathematics in Miami inner-city public schools through the Teach For America program.
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The South Florida Water, Sustainability, and Climate Project

Researchers from the Wharton Risk Management Center in conjunction with scientists from nine other universities, including **Florida International University, University of Miami, University of Florida, Florida State University, University of Hawaii, Michigan Technological University, Pennsylvania State University**, and **Geodesign Technologies** have been awarded a $5 million grant over five years to develop new strategies for managing south Florida's current and future water resources.

The grant is part of the **National Science Foundation's Water, Sustainability and Climate program**, dedicated to enhancing the understanding of and predicting the interactions between water systems, the built environment, ecosystem function and services, and climate change/climate variability through place-based research and integrative models.

In south Florida, water managers are confronted with increasing water demands from urban and agricultural users, as well as continued pressure to deliver fresh water to ecologically sensitive areas. Extreme rainfall variability causes alternating flood and drought conditions, sometimes leading to residential water use restrictions and agricultural losses. Climate change also poses complex challenges. Sea level rise and saltwater intrusion already impact urban drinking water supplies and the integrity of low-lying and highly valued natural environments such as the Everglades.

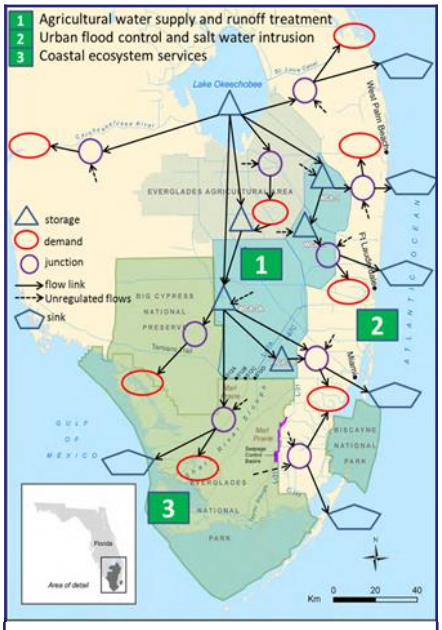
While new reservoir and storm water treatment zones are under construction, long-term adaptive strategies are needed to ensure sustainable water resources for both the expanding populations and threatened wetland ecosystems. The Comprehensive Everglades Restoration Plan, approved in 2000, was to address these issues, but it has stalled due to significant technical, economic and political challenges, as well as the retraction of the public sector. New approaches to managing this region's water resources are needed.

The South Florida Water, Sustainability, and Climate Project builds on the results of a two-year pilot study funded by the NSF in 2010, the Florida Coastal Everglades Long-Term Ecological Research (FCE-LTER) program. New optimization modeling approaches will be employed to develop management strategies that seek to ensure the resilience of water supplies for the built and natural systems, while also accounting for the broad-sector value of water use.

A multidisciplinary team of researchers is conducting studies on the linkages between freshwater supplies to the Everglades, ecosystem functioning and the socio-economic values of ecosystem services, such as recreational fishing provided by south Florida's estuaries. These results will be combined with economic benefit-cost analyses of water use in traditional sectors such as agriculture, manufacturing and utilities within a regional hydro-economic model. With input from stakeholders and experts, the model will be used to explore the economic and ecological implications of applying different types of criteria in decisions on how to optimize water use across the region. Minimizing costs is an example of the decision criteria whose implications will be evaluated under a range of population, economic and climate change scenarios modeled over the next 50–100 years.

The hydro-economic modeling effort is envisioned as a first step towards the development of more comprehensive strategies needed to enhance the sustainability of south Florida's water supplies. A second, fundamental step recognizes the importance of the human element in these scenario evaluations. Wharton Risk Center researchers Robert Meyer, Jeffrey Czajkowski, and Jessica Bolson are investigating how individuals' perceptions of risks to the water supply may differ, and how these differences may influence their decisions when faced with an uncertain future, such as the one faced by many south Floridians due to sea level rise.

The findings of these experiments will be used to help construct effective decision-making forums for regional water management plans. Finally, with agency and stakeholder involvement, project researchers will collaboratively develop recommendations for water management plans that foster long-term support. More information is on the project website: http://sfwsc.fiu.edu/



Based on: Watkins, D., Kirby, K., and Punnett, R. (2004). "Water for the Everglades: Application of the South Florida Systems Analysis Model." J. Water Resour. Plann. Manage., 130(5), 359–366.

Figure 1. The south Florida water supply system is represented as a series of linked reservoirs and demand nodes. Our investigations focus on the interrelatedness of three major issues (labeled 1, 2, 3) that south Floridians must take into account when developing water management strategies under current and future conditions.

Jessica Bolson is a post-doctoral fellow of the Wharton Risk Center and coordinator and researcher for the South Florida Water Sustainability and Climate Project (see page 18). Email: jbolson@rsmas.miami.edu

Wharton Risk Center's Involvement in U.S. Policy Decision Making

Helping Small Businesses Weather Economic Challenges and Natural Disasters

The U.S. Senate Committee on Small Business and Entrepreneurship held a roundtable on March 14, 2013 to focus on legislative proposals that address small businesses' access to capital, particularly legislation concerning the SBA's disaster assistance program. The session, "Helping Small Businesses Weather Economic Challenges and Natural Disasters: Review of Legislative Proposals on Access to Capital and Disaster Recovery," was led by the Committee Chair, Senator Landrieu of New Orleans, and Ranking Member, Senator James Risch. **Howard Kunreuther** and **Erwann Michel-Kerjan** were among those invited to participate in the roundtable, joining other experts, business owners and legislators to discuss the roles of loans, disaster relief financing and flood insurance.

Video of the hearing and written testimony are online at: http://www.senate.gov/isvp/?type=live&comm=smbiz&filename=smbiz031413.

Reauthorizing TRIA: The State of the Terrorism Risk Insurance Market

On September 25, 2013, the U.S. Senate Committee on Banking, Housing, and Urban Affairs met in open session to conduct a hearing on "Reauthorizing TRIA: The State of the Terrorism Risk Insurance Market." **Erwann Michel-Kerjan** from the Wharton Risk Center was one of the three witnesses to testify (along with **Peter Beshar** from Marsh & McLennan, and **Robert P. Hartwig** from the Insurance Information Institute).

Michel-Kerjan's testimony noted that reauthorization for modifying TRIA could be accomplished without disrupting the market, and that allowing TRIA to expire would increase taxpayers' financial exposure in the event of a terrorist attack. (See page 12.)

Video of the hearing and written testimony are online at: http://www.banking.senate.gov/public/index.cfm?FuseAction=Hearings.Hearing&Hearing_id=b9077dbb-2ae2-425a-89dd-793fcb049190.

Cybersecurity in Your Neighborhood: Why Public-Private Partnerships Matter

The nation's critical infrastructure is at risk. Communications systems, electrical power, transportation, even water supplies, face both physical and digital threats. President Barack Obama has signed a Presidential Policy Directive and an Executive Order to establish a national policy to protect these systems. But government can't act alone: the bulk of critical infrastructure is owned and operated by the private sector. Government and the private sector must work together to make safeguards for essential systems more effective.

Stephen Flynn, a senior fellow of the Wharton Risk Center and Founding Co-director of the George J. Kostas Research Institute for Homeland Security, Northeastern University (right), joined a panel discussion with (from right to left) **Francis X. Taylor**, General Electric Company and **Michael Chertoff**, former U.S. Secretary of Homeland Security. The panel was moderated by **Tom Gjelten**, National Public Radio. Speakers at the event included **Jane Harman**, President and CEO of the Wilson Center, and **Janet Napolitano**, U.S. Secretary of Homeland Security. The dialogue, hosted by the Wilson Center on June 20, 2013, was aired on C-SPAN. Video and transcript are online at: http://www.wilsoncenter.org/event/cybersecurity-your-neighborhood-why-public-private-partnerships-matter.

The Case for a *Modified* Government-Backed Terrorism Insurance Program

Given the series of unprecedented disasters and crises that has occurred since 2001, finding solutions to better manage and finance catastrophes is high on the agenda of top decision-makers around the world. That the G20, the World Economic Forum, the OECD and the World Bank all consider the topic a key priority is telling.

In the United States, recent extreme events — natural, environmental, technological, corporate and financial — have cost not billions but trillions of dollars. That's more than in any other country — a sobering record. America has proven to be a resilient nation. But if these events are predictive of what the near future will look like, we as a country must strengthen our ability to better prepare for and recover from future catastrophes, physically and financially.

On the terrorism front, which the bombing at the 2013 Boston Marathon shows is always with us, the debate about the Terrorism Risk Insurance Act (TRIA) is about to intensify.

In June 2013, the New York City Council Committee on State and Federal Legislation held a hearing to discuss proposed NYC Council resolution 1806-2013, which calls on the federal government to enact a long-term extension of TRIA. So far, there is no national consensus that this program should be extended.

TRIA was passed by President Bush in 2002 when insurers in many states decided to stop covering businesses against terrorism after suffering what was then the most costly disaster in the history of insurance. After 9/11, reinsurers (which paid most of the losses) exited this market, leaving insurers unprotected. Under TRIA, insurers are obligated to offer terrorism risk insurance to all their clients. The insurers benefit from free up-front reinsurance from the federal government above an industry threshold of $27.5 billion and up to $100 billion. Extended in 2007 for seven years, the program is scheduled to expire after December 2014. The debate as to whether there should be another renewal for TRIA has been growing more intense as the 2014 deadline approaches.

At the center of the debate against TRIA is the notion that if the federal government continues its pattern of renewing TRIA, it will continue to distort the insurance market by displacing long-term private market activity that would have otherwise emerged. It is, of course, impossible to verify this logic unless one lets TRIA expire and observes what happens over time, which could be a risky proposition.

Three complementary changes might help those in favor of renewing TRIA win the argument over those who think it should be allowed to expire.

I typically favor market-based solutions over any federal intervention. But my experience with terrorism risk and financial protection against terrorism risk in many developed countries tells me that the real challenge of having no TRIA-like protection post 2014 does not lie in the immediate disruption this could have on several industry sectors, but rather, the longer-term economic consequences of a future attack on U.S. soil and the question of who would ultimately pay for the recovery.

A paradox that has been somewhat overlooked in discussions about terrorism insurance in the United States is that a world without TRIA does not necessarily mean less financial exposure of the federal government to the economic consequences of terrorism. It might very well mean, de facto, increased financial liability for all of us as American taxpayers.

A world without TRIA might very well mean increased financial liability for all of us as American taxpayers.

If TRIA were to expire, and unless reinsurers re-entered the U.S. market with much more capacity than they provide today (which is unlikely given their choice to severely limit their exposure to terrorism risk in Europe and in the U.S.), most primary carriers are likely to exclude this risk from their portfolio everywhere they can.

Those that do not exclude it will charge much higher premiums than they currently do to take into account expensive capital they need to set aside to meet regulatory and/or rating agency requirements to cover extreme events. This is not necessarily a bad thing — it means market-based prices. And if there are no future attacks, that looks good — as would any mechanism absent of claims. But the day after a large attack, we would realize that many firms are uninsured or poorly insured.

One might argue from a conceptual view that these firms should be diversified enough to withstand these losses, especially if they are publically traded. But there is the political reality: Under extreme pressure from media and interest groups, I predict that the federal government will be asked to step back in. And as recent experience from corporate bailouts and disaster relief shows, it absolutely will.

(Continued on page 13)

(Continued from page 12)

Is that really the best we can do to prepare our nation? I don't think so.

TRIA is not perfect, of course. It provides federal reinsurance at no up-front cost to insurers, who keep 100% of the premiums they collect. That is unique worldwide. In one of the 20 studies on terrorism insurance our team at the Wharton Risk Center has published, we show that this free up-front reinsurance had led to much more capacity being deployed in the market — a good thing for businesses, but also with a higher concentration of exposure in insurers' portfolios than they would have assumed otherwise.

One option I have been asked to brief key stakeholders in the public and private sectors on is expected outcomes if the federal government were to start charging insurers to compensate for its de facto financial liability under TRIA.

Judging by my recent conversations with engaged parties, a combination of three complementary changes might actually help those in favor of renewing TRIA win the argument over those who think it should simply be left to expire. Ranked in order of highest political feasibility, these are (a) Continue to increase the industry-wide retention from the current $27.5 billion (it was $15 billion in 2005); (b) Reduce the 85% federal reinsurance above insurers' deductible to a lower level; (c) Require the U.S. Treasury to collect some funding to provide this reinsurance; this is done in different forms in countries as diverse as France, Germany, the UK and Israel.

This article is adapted from Erwann Michel-Kerjan's testimonies on terrorism insurance before the House of Representatives (September 11, 2012) and before the Senate (September 25, 2013).

Erwann Michel-Kerjan is managing director of the Wharton Risk Center and Chairman, and OECD Secretary-General Board on Financial Management of Catastrophes. Email: ErwannMK@wharton.upenn.edu

Second OECD International Meeting on Terrorism Risk Insurance

How is the terrorism threat evolving today? Are organizations anticipating this risk? Do current insurance solutions adequately answer the needs of market players in an ever changing risk context? What is the future of temporary national programs?

The second international meeting on terrorism risk insurance co-organized at the OECD Headquarters in Paris, France in December 2012 looked at these questions, reviewed the current status of terrorism risk insurance programs and markets in different countries, and provided a forum for policy dialogue for heads of terrorism insurance programs worldwide and renowned experts from the public sector, industry (insurers, reinsurers, brokers, risk modeling firms, risk managers) and leading research institutions.

Attendance by nearly 100 government and industry decision makers from over 20 countries — including the heads of national terrorism insurance programs established in OECD member countries — made this one of the most important gatherings ever on the issue of terrorism insurance.

Following the events of September 2001, the OECD developed a large portfolio of activities on the financial management of terrorism risk. Today, two-thirds of the 34 OECD countries rely on the insurance market to manage terrorism risk (as do nearly all non-OECD countries). One-third of OECD countries have established a national program of terrorism insurance to financially cover the risk of terrorism. Some of these schemes are very recent, such as the Danish terrorism insurance scheme. Some are up for renewal and will thus be assessed. Meanwhile, recent geopolitical events impact the terrorism threat at local and global levels.

This invitation-only meeting, organized under the auspices of the **OECD Secretary-General Board on Financial Management of Catastrophes** chaired by Wharton's Erwann Michel-Kerjan, provided the opportunity for a review.

More information is available at the OECD website at http://www.oecd.org/daf/fin/insurance/2ndMeetingOnTerrorismRisk%20Insurance,5_Dec_2012,Paris-Agenda.pdf

INTERNATIONAL NETWORK ON THE FINANCIAL MANAGEMENT OF LARGE-SCALE CATASTROPHES

What Affects Tenant Demand for Energy Efficient Buildings?

The Wharton Risk Center, as part of the **Greater Philadelphia Energy Efficient Buildings Hub (EEB Hub)** funded by the **U.S. Department of Energy**, has conducted research to better understand the factors that affect demand for energy efficient buildings amongst residential decision-makers.

Understanding the factors that influence demand are crucial to the adoption of energy efficiency measures in buildings, as these measures cannot be adopted without (1) building owners deciding to invest in energy efficient upgrades, and (2) tenants deciding to reside in energy efficient buildings.

For both owners and tenants, making the energy efficiency choice comes at a cost: owners have to invest in the energy efficiency upgrade — a cost which they then pass onto their tenants in the form of higher rent. It is important for building owners to anticipate demand for energy efficiency amongst tenants at this higher rent rate; if no demand exists, owners have no financial incentive to invest in energy efficient upgrades (as tenants are the ones who receive the benefits of lower energy costs). Therefore, insights into how to increase demand for energy efficiency amongst residential tenants can provide the impetus for owners to invest in energy efficiency.

Although much attention has been given to how economic considerations affect energy efficiency adoption, there has been less focus on how psychological factors can influence residents' willingness to pay a higher cost to occupy energy efficient buildings.

The Risk Center has investigated how both of these considerations together can affect demand for energy efficient buildings. Previous research has demonstrated the importance of people's psychological values to their economic choices, and shown that one important determinant of what individuals value is how they identify politically. For energy efficiency decisions, people's political leanings are particularly important to their attitudes and choices. Recent research conducted by the Risk Center (published in the *Proceedings of the National Academy of Sciences*) demonstrated that promoting environmental values polarized energy-efficient choices, as political conservatives rejected energy-saving options labeled as pro-environment (which they selected when no environmental label was provided).

How individuals identify politically plays an important role in determining their choice to occupy an energy efficient building.

While considerations on the reduction of carbon dioxide emissions may be politically polarizing, there is agreement across the political spectrum about the importance of other aspects of energy efficiency, namely reducing the cost of energy use and promoting energy independence. These findings demonstrate the importance of non-economic sources of value on people's choices in the domain of energy efficiency.

The Risk Center examined whether individuals' decisions to occupy an energy efficient building is affected by both economic and psychological considerations. Across three experimental studies, we investigated the causal relationship between these factors and willingness to pay to occupy energy efficient buildings. All studies shared a similar methodology: Participants made a hypothetical choice about whether to reside in one of two buildings which were similar in every respect expect that one building was an energy-efficient, LEED-certified building. The units in the energy efficient building had lower anticipated monthly utility costs, but a higher monthly rent (or mortgage payment). Expected energy costs and the differences in rent varied across the studies. Each study included a manipulation of the messaging used for energy efficiency, which compared a baseline condition (no message) to conditions in which environmental messaging and energy independence messaging were used. In these instances, the energy-efficient building featured an exterior plaque that promoted the environmental or energy independence benefits of its energy efficiency. Participants indicated in which building they would choose to reside, and evaluated the buildings and the decision itself, and indicated their own personal values related to the environment, saving money on energy use, and energy independence.

The results from these three studies clearly demonstrate that how individuals identify politically plays an important role in determining their choice to occupy an energy efficient building. Overall, political liberals were more likely to pay a higher price to reside in an energy efficient building than conservatives were (Studies 1-3). This ideological difference is reflective of the diverging valuation surrounding the environmental benefits of energy efficiency, with liberals valuing this aspect more than conservatives do (Studies 1-3). The use of environmental messaging to promote energy efficiency was shown to positively affect demand amongst liberals, while negatively affecting it amongst political moderates, and being unable to move political conservatives (Study 2). Together, these results suggest that environmental messaging is ideologically polarizing in its appeal. Finally, the results indicate that this ideological gap can best be bridged when there is both a clear financial incentive to choose the energy efficient building, and this choice is associated with a universally-appealing value (in this case, energy independence, Study 3).

Either facet on its own is insufficient to bridge the ideological gap. These findings highlight the importance of considering how both financial and value-based considerations, and their interaction, will influence people's decisions to invest in energy efficient buildings.

The Wharton Risk Center, with **Wharton's Initiative for Environmental Leadership (IGEL), Penn Institute for Urban Research (Penn IUR), Wharton Geospatial Initiative and Laboratory, and the Wharton Small Business Development Center (SBDC)** and in partnership with **Energy Efficient Buildings Hub (EEB Hub),** organized a conference in May 2013 (entitled *Building Energy Efficiency—Seeking Strategies that Work*), where findings were presented to top researchers and practitioners working in the energy efficiency area.

We are continuing our work with the EEB HUB on the factors that affect decision-makers' choices to occupy energy efficient buildings, with a focus on commercial properties. With the recently passed energy benchmarking and disclosure ordinance in Philadelphia that requires many commercial buildings to provide information about their energy performance that is then made publicly available, commercial tenants will soon have information on building energy performance and environmental impact.

Although the availability of this information is expected to increase demand for energy efficiency, there is no research to date on this question. Our research will examine how this information affects the decision to occupy energy efficient buildings (as compared to less energy efficient options), and identify how different ways of presenting this information influences the choice process. Taken together, this research can provide insight into factors that affect demand for energy efficient buildings at the individual level, which can then be harnessed by policy makers and market actors to create the best possible environment for demand for, and investment in, energy efficiency to flourish.

Dena Gromet is a research fellow of the Wharton Risk Center investigating how people's personal values affect their choices across a range of policy-relevant domains.
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Incentivizing Solar Technology Diffusion

The Wharton Risk Management Center and partners at **Sandia National Laboratories** (the lead institution), **California Center for Sustainable Energy**, the **National Renewable Energy Laboratory**, and **Vanderbilt University**, received a grant from the **Department of Energy Solar Energy Evolution and Diffusion Studies (SEEDS)** program. The project is investigating how social and economic incentives affect the residential adoption of solar technology.

The team is using a multi-faceted methodological approach to provide a single comprehensive framework that can forecast how solar adoption patterns will change under different business and policy scenarios. This methodological approach includes surveys and experimental studies to understand consumer decision making, the use of agent-based models to predict how social and economic factors will interact in the solar market, and field studies that will test these insights on the ground.

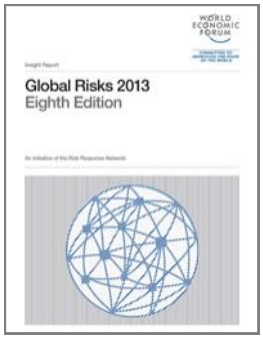
The SEEDS team met at Wharton in June. From left: Ruben Lobel (Wharton), Georgina Arreola (Energy Center), Kiran Lakkaraju (Sandia), Karen Campbell (Wharton), Arthur van Benthem (Wharton), Eugene Vorobeychik (Sandia), Timothy Treadwell (Energy Center), Howard Kunreuther (Wharton), Easan Drury (National Renewable Energy Lab), Erwann Michel-Kerjan (Wharton), Dena Gromet (Wharton).

Crafting Energy Efficiency Messages

The Risk Center is partnering with **Oliver Wyman** and a large U.S. electric utility to test the effectiveness of different messages at generating interest and purchasing of energy efficient products.

This project takes behavioral insights from laboratory research conducted by the Risk Center (and others), and applies them to real consumer decision-making. The results from this study will help illuminate how the way information is presented to consumers can affect their decision-making in the energy domain.

Risk Center Partnership with World Economic Forum on *Global Risks 2013*



Global Risks 2013, published by the **World Economic Forum** has identified severe income disparity and chronic fiscal imbalances as the two most prevalent global risks, reflecting on-going concerns about government debt. Rising greenhouse gas emissions was ranked as the third most likely global risk. The report describes 50 risks categorized as economic, environmental, geopolitical, societal or technological.

Findings were drawn from survey results from over 1,000 expert respondents to the Forum's Global Risks Survey, measuring their perceptions of risk likelihood, impact and interconnections over a 10-year time horizon. *Global Risks 2013* also includes a special report on national resilience, laying the groundwork for a new country resilience rating which would allow leaders to benchmark their progress.

"Eight years of tracking a large number of global risks and how they interact with each other has taught us three things," notes Erwann Michel-Kerjan. "One, it is possible to see risks coming from afar and prepare your organization/country in a timely fashion; two, risk management has become too important to be left to risk managers alone and is now being elevated to board and cabinet discussions as a core strategy; and three, there are winners and losers in this more volatile world, and the gap is widening. Decision makers need to take informed actions."

Karen Campbell, Wharton Risk Center fellow and former senior economist for the Forum notes, "The high correlation between perceptions of a nation's global competitiveness and its government's effectiveness at managing global risks suggests that leaders should consider incorporating risk management processes at all levels in order to achieve and sustain their nation's growth and development goals."

The report highlights the importance of fostering a culture of resiliency to cope with the increased frequency and intensity of risks that we face today. Howard Kunreuther notes, "There is a need to develop long-term strategies with short-term incentives that enable us to take steps now to reduce future losses."

The report was developed with contributions from **Marsh & McLennan, Swiss Re, Zurich Insurance Group, the University of Oxford, the National University of Singapore** and the **Wharton Risk Management Center of the University of Pennsylvania.** It was launched in January 2013 for the World Economic Forum's Annual Meeting in Davos, Switzerland.

Wharton's Role at the World Economic Forum's Annual Meeting in Davos

Wharton shared innovative ideas on confronting global challenges at the 2013 World Economic Forum meeting.

- Wharton organized a session on "Building Resilience to Global Risks," which explored strategies for managing catastrophic events. **Katherine Klein**, **Howard Kunreuther**, **Erwann Michel-Kerjan** and **Michael Useem** delivered presentations on *Financial mechanisms for post-disaster recovery*; *Long-term strategies for managing global risks*; *Building leadership and resilience to manage catastrophic events*; and *Leadership lessons from the psychology of resilience*. The session was introduced by **Wharton Dean Tom Robertson**.
- Michael Useem moderated a panel session, "Catastrophic Risks in the 21st Century," highlighting the importance of resilience in confronting disasters.
- Howard Kunreuther and Michael Useem took part in a panel session, "Improving Decision-Making," that identified methods and strategies to enable better decision making and evaluation processes.
- In a blog post, **Karen Campbell** explains how entrepreneurship can inform risk management strategies.

Top Five Global Risks (Likelihood) 2007-2013

	2007	2008	2009	2010	2011	2012	2013
1st	Breakdown of critical information Infrastructure	Asset price collapse	Asset price collapse	Asset price collapse	Meteorological catastrophes	Severe income disparity	Severe income disparity
2nd	Chronic disease in developed countries	Middle East instability	Slowing Chinese economy (<6%)	Slowing Chinese economy (<6%)	Hydrological catastrophes	Chronic fiscal imbalances	Chronic fiscal imbalances
3rd	Oil price shock	Failed and failing states	Chronic disease	Chronic disease	Corruption	Rising greenhouse gas emissions	Rising greenhouse gas emissions
4th	China economic hard landing	Oil and gas price spike	Global governance gaps	Fiscal crises	Biodiversity loss	Cyber attacks	Water supply crises
5th	Asset price collapse	Chronic disease in developed world	Retrenchment from globalization (emerging)	Global governance gaps	Climatological catastrophes	Water supply crises	Mismanagement of population ageing

Economic Environmental Geopolitical Societal Technological

Source: World Economic Forum
http://www3.weforum.org/docs/WEF_GlobalRisks_Report_2013.pdf

Effective Corporate Leadership in Catastrophic Risk Management

The Wharton Risk Management Center and the Wharton Center for Leadership's joint collaboration with the **Travelers Companies** is conducting a groundbreaking investigation in risk management leadership and policy. The project, ***Effective Corporate Leadership and Governance Practices in Catastrophic Risk Management***, funded by the Travelers/Wharton Partnership for Risk Management and Leadership Fund, is examining the catastrophe risk management practices of large, publicly-traded companies to identify effective strategies for detecting, preparing for and coping with catastrophic events.

An important outcome of this research will be business and policy guidelines and related leadership strategies to manage catastrophic risk in large companies. The research encompasses a range of qualitative and quantitative measures, including ***interviews with more than one hundred S&P 500 senior executives*** on major adverse events impacting their firm and what they learned from those events; ***analysis of S&P 500 stock price events*** to assess significant price drops/gains that can be correlated to catastrophic events; and ***analysis of SEC Form 10-K filings*** with an interest in the specific risks that firms report in their 10-Ks.

Interviews with S&P 500 Senior Executives

Corporate leaders in S&P 500 companies provided information on catastrophic risk management in their companies, such as how risk management is formally structured in the organization and the activities and strategies the company uses to mitigate risks. We will use this analysis to determine the characteristics of the most successful firms at managing catastrophic risks. This research has yielded several key insights, including the need for improved risk assessment, the advantages of experience, and benefits of proactive boards.

Analysis of S&P 500 Stock Price Events

We are analyzing data on stock price to learn what steps companies can take to increase financial resiliency based on historically successful strategies that they and their competitors have implemented over time. This research will quantify (1) how stock prices of S&P 500 companies reacted to specific catastrophic events from 2000 to 2011; (2) categories of risk to which S&P 500 firms appear most vulnerable; (3) how long it takes firms to recover after suffering a major drop (and how this varies over type of risk, industry, etc.); and (4) how firms' 10-K reports correlate with large shifts in their stock prices.

Analysis of SEC 10-K Filings

Using the risk factors section of the SEC 10-K filings (Item 1A) for 2007 and 2011, we have identified the twenty-one most frequently mentioned risks for the 100 firms in our interview sample. We will use this data to find variations in risk focus within and across industries, examine changes in risk emphasis over time, and compare the risks listed in firms' 10-Ks with the actual risk factors mentioned in the interviews with those that have impacted the firms' stock prices historically. The next step in the research will be to analyze the quality of the disclosures, the similarity and differences of disclosures within and across industries, and how firms quantify and manage risk differently from their counterparts.

Leadership Lessons from the Chilean Earthquake of 2010

Chilean Presidency appoints Kunreuther, Michel-Kerjan and Useem as advisors

In the early hours of February 27, 2010, a powerful earthquake rocked Chile for nearly two minutes. At Mw 8.8, it was the eighth largest seismic event of the modern era, five hundred times more powerful than the quake just six weeks earlier that had killed more than a quarter million in Haiti. The F27 event in Chile devastated homes, schools, hospitals, roads and telecommunications, paralyzing the country for days. The damage was equal to 18 percent of Chile's GDP, the equivalent of a $1.2 trillion loss in the U.S., more than a dozen times greater than that caused by Hurricane Katrina in 2005 or Sandy in 2012.

Yet Chile's death toll was 600 times less than Haiti's, and the economy was fully back on track with six percent annual GDP growth the following year. How? From the outset, the national leadership insisted that the country think strategically and act deliberatively, that it go beyond what they had already done to reduce losses from future earthquakes. The decisions and actions taken by the nation's leaders in the days that followed the quake and the nation's traditions and culture facilitated the implementation of policies that dealt with both the immediate recovery needs and long-term planning.

Howard Kunreuther and **Erwann Michel-Kerjan** of the Wharton Risk Management Center and **Michael Useem** of the Wharton Center for Leadership serve as advisers to **Chilean President Sebastián Piñera** and his Ministers on matters of catastrophic risk management. They, with Aldo Boitano, Eugenio Guzmán, Rodrigo Jordán, and Matko Koljatic of **Vertical S.A.** and **Catholic University, Santiago, Chile**, in collaboration with the **World Economic Forum**, are writing a book on lessons learned from the management of the February 2010 earthquake and the recovery. With the active cooperation of the Government of Chile, the book is nearing completion, with publication expected in 2014.

New Post-Doctoral Fellows

The Risk Center welcomes new our post-doctoral fellows. They are among the nexus of people — over 70 faculty, fellows, visiting scholars, doctoral students and research assistants — devoted to furthering the practical understanding of how to manage situations of risk.

Ajita Atreya is a postdoctoral research fellow at the Wharton Risk Center. Her research interests include the areas of environmental and natural resource economics, natural disaster management, and risk and insurance. Her Ph.D. dissertation analyzed the perception of flood risk as captured in property prices and in decisions to purchase of flood insurance. At the Risk Center, Ajita is involved in the Zurich Flood Resilience Project (see page 1) to develop key initiatives and research focused on flood resilience in advancing a global understanding of flood impact.

Before joining the Risk Center, Ajita was a research intern at Resources for the Future in Washington, DC. She earned her Doctorate in Applied Economics from the University of Georgia in 2013. She holds a Master's degree in Agricultural Economics from Oklahoma State University and a Bachelor's degree from Tribhuvan University, Nepal. She has received several awards including a USGS/Georgia Water Institute research grant and a national award from the Ministry of Education, Nepal.

Benjamin Collier is a postdoctoral research fellow with the Wharton Risk Center. His research and field work pertain to addressing the constraints in investment in developing and emerging economies created by natural disasters and climate risk.

He has worked most extensively in Peru where he has built capacity in a variety of financial institutions through direct collaboration regarding natural disaster risk assessments and stress test modeling. As a result of this work, one of the most highly respected microfinance institutions in Latin America is now insuring against extreme El Niño events, allowing it to expand financial access sustainably in vulnerable regions of Peru.

At the Wharton Risk Center, Ben studies community flood resilience with a specific focus on the strength of local financial markets and small and medium enterprise vulnerability. He received his Ph.D. in Agricultural Economics from the University of Kentucky. He also holds Master's degrees in Economics and Psychology.

Jessica Bolson is a post-doctoral fellow for the Risk Center and project coordinator and researcher for the Risk Center's South Florida Water Sustainability and Climate Project, funded by the National Science Foundation. The project aims to collaboratively develop a hydro-economic model that optimizes water management operations with emphasis on water resource decision-making under uncertain conditions. In her role, Jessica works with stakeholders, climate scientists and government agencies in south Florida to improve understanding of the roles of cognitive and perceptual biases in risk assessment and decision-making.

In 2008, Jessica was selected as a Florida State Gubernatorial Fellow and worked at the Florida Department of Environmental Protection in the Office of Water Policy crafting a statewide water and climate change policy. She also has a research role with the Southeast Climate Consortium, one of the National Oceanic and Atmospheric Administration Regional Integrated Sciences and Assessment programs. Jessica received her Ph.D. in Ecosystem Science and Policy from the University of Miami's Abess Center. She holds Master's degrees in Climate and Society from Columbia University, and in Education from NYU.

Daniel Schwartz is a postdoctoral research fellow with the Risk Center. His primary research interest is in behavioral economics as applied to public policy. His recent research has focused on issues related to energy and the environment. Employing a mix of methodologies, including lab experiments, online experiments, surveys, field experiments, and secondary data analysis, he has examined (1) how the Hawthorne Effect — behavioral change due to study participation or novel treatment — can be used both to reveal the determinants of consumer behavior and to improve the design of field experiments; (2) how intrinsic and extrinsic motivations interact in shaping environmental behavior; and (3) why emotional messages often fail to produce sustained behavior change. This is part of a larger research agenda examining the design of public policies based on decision making process.

Daniel received his Ph.D. and M.S. in Behavioral Decision Research from Carnegie Mellon University in 2013 and 2010, respectively, and his B.S. in Industrial Engineering from the Universidad de Chile in 2004. Prior to graduate school, he worked as consultant in the application of data analysis techniques to consumers' behavior with projects in Chile, Brazil, Mexico, Peru and the United States.

In Memoriam: Isadore "Irv" Rosenthal

Dr. Isadore "Irv" Rosenthal, a retired senior fellow of the Risk Center, passed away in February 2013 at age 87.

Irv came to the Center in 1984 when it was being established. He was at that time the head of corporate health and safety at Rohm and Haas. Don Felley, then president of Rohm and Haas, was chairperson of the Risk Center's newly formed Advisory Committee, and he recommend Irv for his keen insights into the health and safety issues facing the chemical industry.

Irv became well-versed in the language of economics, psychology and decision sciences by rubbing elbows with students and faculty associated with the Risk Center. He understood the importance of involving the relevant stakeholders, bringing together experts from industry, government, public interest groups and the research community to discuss topics ranging from the epidemiology of health and safety risks to the role of insurance and third-party inspections in dealing with catastrophic accidents. Without his efforts, Congressional legislation and regulations associated with the Clean Air Act Amendments would not have had such a high profile within the chemical industry, the Environmental Protection Agency (EPA) and public interest groups.

Irv became a senior fellow at the Risk Center in 1990 upon his retirement from Rohm and Haas. He temporarily left the Center in 1999 to join the National Chemical Safety and Hazards Investigation Board, a five-year appointment made by President Clinton. He returned in 2004 to continue his research on approaches for managing environmental, health and safety risks.

Irv was instrumental in highlighting ways to make research on low-probability, high-consequence events relevant to the public and private sectors. His interactions with the Occupational Safety and Health Administration (OSHA) and EPA on how third party inspections and insurance could help enforce regulations on process safety risks led him to co-organize a workshop on this topic for the Risk Center and Penn Program on Regulation in 2010.

Paul R. Kleindorfer Memorial Fund

Paul Kleindorfer, Emeritus Professor of the Wharton School, passed away in August 2012 after a struggle with ALS. As the Anheuser-Busch Professor of Management Science, Paul served Wharton in a number of roles, including two terms as chair of the Operations and Information Management Department (OPIM), Vice Dean of the Doctoral Programs, and Co-Director of the Risk Center with Howard Kunreuther, a role in which he served until his retirement in 2006.

The OPIM department at the Wharton School established the *Paul R. Kleindorfer Memorial Fund* and the *Paul R. Kleindorfer Scholar Award* to honor Paul's memory and recognize the OPIM first-, second- or third-year doctoral student who is making the most outstanding progress towards the completion of his or her dissertation. The award provides $4,000 of research support.

The inaugural *Paul R. Kleindorfer Scholar Award* was presented this year to **Shiliang (John) Cui,** for his dissertation research modeling consumer decision making behaviors in queuing settings.

Contributions to the Paul R. Kleindorfer Memorial Fund may be sent to Alison Matejczyk at the Wharton School, University of Pennsylvania, 344 Vance Hall, 3733 Spruce Street, Philadelphia PA 19104.

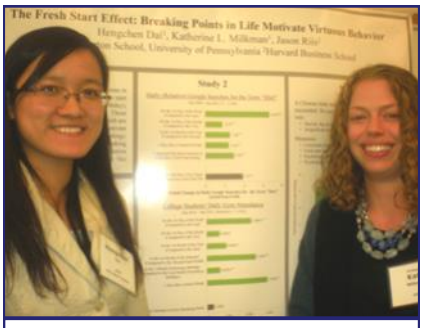
Please make checks payable to the Trustees of the University of Pennsylvania, with "Kleindorfer Fund" written in the memo field.

Russell Ackoff Doctoral Student Fellowship Awards, 2013

The Wharton Risk Center is pleased to announce the recipients of its 2013 Russell Ackoff Doctoral Student Fellowships. The grants fund data collection, conference fees and other research expenses for studies in human decision making by doctoral students in the Wharton School and other departments at the University of Pennsylvania. This year, fellowships were awarded to 22 doctoral students at Penn. The Russell Ackoff Fellowships are funded by an endowment provided to the Wharton School by the Anheuser-Busch Charitable Trust. Prof. Emeritus Russell Ackoff's (1919-2009) work was dedicated to furthering our understanding of human behavior in organizations. More information can be found at http://opim.wharton.upenn.edu/risk/ackoff.html.

RECIPIENT	DEPARTMENT	PROPOSAL TITLE
Naoki Aizawa and You S. Kim	Economics	Risk Selection & Advertisement in the Medicare Advantage Market
Luis Ballesteros	Management	The Drivers of Corporate Philanthropic Catastrophe Response: The Firm-Community-Event Triad
Alixandra Barasch	Marketing	Emotion Signals in Prosocial Behavior
Jonathan Z. Berman	Marketing	Expense Neglect in Forecasting Personal Finances
Cexun Jeffrey Cai	Marketing	Social Comparison in Contests
Cindy Chan	Marketing	Moral Violations Reduce Oral Consumption
Shiliang Cui	OPIM	Modeling Consumer Decision-Making in Blind Queues & Retrial Queues
Hengchen Dai	OPIM	The Effects of Individual Monitoring and Mental Depletion on Compliance with Standards: Field Evidence from the Hand Hygiene Practices of Health Care Professionals
Kaitlin Daniels	OPIM	Demand Response in Energy Markets: Voluntary & Involuntary Contracts
Sunita Desai	Health Care Management & Economics	Patient Learning of Preferences for Health Providers
Christine Dobridge	Finance	How Does Regulatory Risk Affect Firms? Evidence from a Natural Experiment
Katrina Fincher	Psychology	Sacralization & Entification: Conscience, Cohesion, and Group Competence
Ari Friedman	Health Care Management & Economics	Cost-shifting between Public and Private Insurers
Arun Gopalakrishnan	Marketing	Consumer Dynamic Usage Allocation and Learning: Theory and Empirical Evidence
Yeonjin Jung	Marketing	Public Attitudes towards Paternalistic Policies
Dokyun Lee	OPIM	Friending Consumers: The Effect of Advertising Content on Consumer Engagement in Social Media
Emma Edelman Levine	OPIM	When Dishonesty Breeds Trust
Melanie Thomas	Marketing	The Influence of Emotional Certainty on Attitude Certainty
Bradford Tuckfield	OPIM	Why Do People Quit? Speedy Exits in Timed Chicken Games
Boris Vabson	Business Economics & Public Policy	What Managed Care Does and How It Does It: Evidence from New York and Texas
Evan Weingarten	Marketing	Examining When People Talk About and Why: How Uncertainty, Accessibility, and Arousal Affect Whether People Talk About the Past, Present, or Future

Ackoff Doctoral Student Fellowship recipients of 2012 presented their research findings at the Risk Center's annual Ackoff luncheon. The event was held in April, coinciding with the announcement of the 2013 Ackoff award recipients.



Hengchen Dai (OPIM) and Prof. Katy Milkman

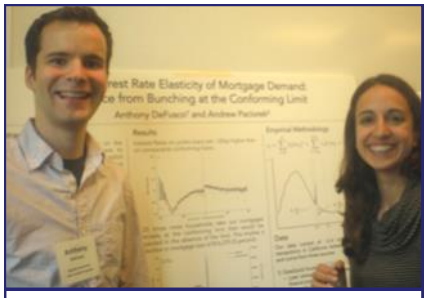
Jonathan Z. Berman (Marketing), Vivek Shah (Applied Economics) and Risk Center fellow, Dr. Dena Gromet

Kaitlin Daniels (OPIM) and Emma Levine (OPIM)

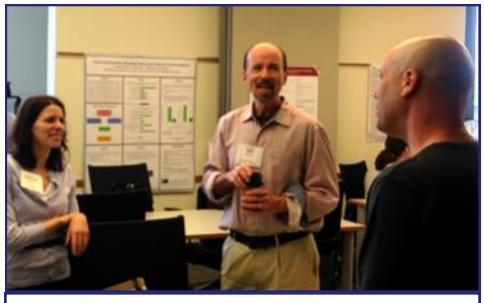
Pavel Atanasov (Psychology), Arun Gopalakrishnan (Marketing) and Prof. Howard Kunreuther (Risk Center co-director)

Boris Vabson (Business Economics & Public Policy) and Dina Shapiro (Annenberg School)

Theresa Kelly (OPIM) and Berkeley Dietvorst (OPIM)



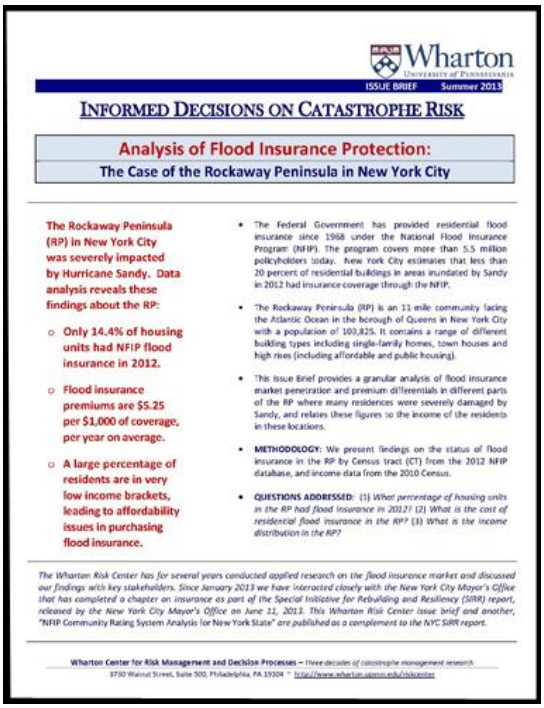
Anthony DeFusco (Applied Economics) and Barbara Elias (Political Science)



Prof. Deb Small, Prof. Bob Meyer (Risk Center co-director) and Prof. Gal Zauberman

Cindy Chan (Marketing) and Melanie Thomas (Marketing)

Wharton Risk Center Issue Briefs



Wharton
UNIVERSITY of PENNSYLVANIA

ISSUE BRIEF Summer 2013

INFORMED DECISIONS ON CATASTROPHE RISK

Analysis of Flood Insurance Protection:
The Case of the Rockaway Peninsula in New York City

The Rockaway Peninsula (RP) in New York City was severely impacted by Hurricane Sandy. Data analysis reveals these findings about the RP:

- Only 14.4% of housing units had NFIP flood insurance in 2012.
- Flood insurance premiums are $5.25 per $1,000 of coverage, per year on average.
- A large percentage of residents are in very low income brackets, leading to affordability issues in purchasing flood insurance.

- The Federal Government has provided residential flood insurance since 1968 under the National Flood Insurance Program (NFIP). The program covers more than 5.5 million policyholders today. New York City estimates that less than 20 percent of residential buildings in areas inundated by Sandy in 2012 had insurance coverage through the NFIP.
- The Rockaway Peninsula (RP) is an 11-mile community facing the Atlantic Ocean in the borough of Queens in New York City with a population of 103,825. It contains a range of different building types including single-family homes, town houses and high rises (including affordable and public housing).
- This Issue Brief provides a granular analysis of flood insurance market penetration and premium differentials in different parts of the RP where many residences were severely damaged by Sandy, and relates these figures to the income of the residents in these locations.
- **METHODOLOGY**: We present findings on the status of flood insurance in the RP by Census tract (CT) from the 2012 NFIP database, and income data from the 2010 Census.
- **QUESTIONS ADDRESSED**: (1) *What percentage of housing units in the RP had flood insurance in 2012?* (2) *What is the cost of residential flood insurance in the RP?* (3) *What is the income distribution in the RP?*

The Wharton Risk Center has for several years conducted applied research on the flood insurance market and discussed our findings with key stakeholders. Since January 2013 we have interacted closely with the New York City Mayor's Office that has completed a chapter on insurance as part of the Special Initiative for Rebuilding and Resiliency (SIRR) report, released by the New York City Mayor's Office on June 11, 2013. This Wharton Risk Center issue brief and another, "NFIP Community Rating System Analysis for New York State" are published as a complement to the NYC SIRR report.

Wharton Center for Risk Management and Decision Processes – *Three decades of catastrophe management research*
3730 Walnut Street, Suite 500, Philadelphia, PA 19104 ~ http://www.wharton.upenn.edu/riskcenter

The Wharton Risk Center's issue briefs, **INFORMED DECISIONS ON CATASTROPHE RISK** are non-technical three-page publications that present research findings together with the Risk Center research team's best thinking on how the findings and concepts can be applied to the management of catastrophe risk.

The 2012-2013 series' topics include improving insurance decisions; research on why people fail to learn from experience about protecting themselves against catastrophes; and studies of the National Flood Insurance Program's coverage and community protection in areas hit hardest by Hurricane Sandy.

The briefs can be accessed on the Center's website at http://opim.wharton.upenn.edu/risk/issuebriefs.php. To request hard copies, please contact Carol Heller, hellerc@wharton.upenn.edu.

Addressing Affordability: The National Flood Insurance Program

The Flood Insurance Reform Act of 2012 includes provisions for risk-based pricing to improve the NFIP's finances and encourage homeowners to reduce their risk. However, legislators are now wavering on their commitment to risk-based pricing because their constituents may not be able to afford risk-based premiums. We propose a voucher/loan program to assist with the cost of insurance and also reduce risk, made affordable by reductions in the NFIP risk-based premiums.

NFIP Community Rating System Analysis

The NFIP's Community Rating System (CRS) is a voluntary incentive program that encourages community floodplain management activities that exceed the minimum NFIP requirements. As of 2013, only 28 of the 1,466 NFIP communities in New York State participate in the CRS. This 1.9% participation rate is three times lower than the national average.

Analysis of Flood Insurance Protection: Rockaway Peninsula in New York City

The Rockaway Peninsula (RP) is an 11-mile community in New York City with a population of 103,825 that was severely impacted by Hurricane Sandy. Data analysis shows that only 14.4 percent of the housing units in the RP had flood insurance in 2012.

Hurricane Sandy's Storm Surge and the NFIP

Following the devastating storm surge and flooding from Hurricane Sandy, concerns have been raised about the status of flood insurance in the United States. Our analysis shows that many homeowners who sustained flood damage from Sandy did not have a flood insurance policy.

Failing to Learn from Experience: The Case of Hurricane Preparedness

The more effective an investment is in preventing harm, the more difficult it is for decision makers to remember the need for the investments. It is the experience of real — not imagined — losses that seemed essential for convincing decision makers of the value of protective investments.

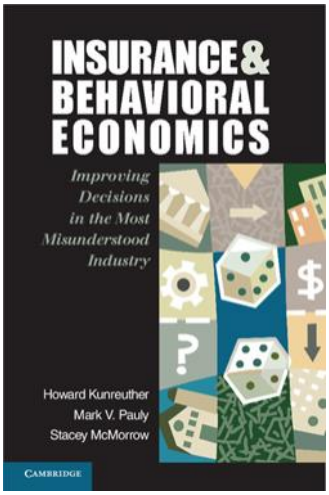
Insurance and Behavioral Economics: Improving Decisions in the Most Misunderstood Industry

We propose three guiding principles to make insurance more transparent and equitable, and to encourage investment in protective measures: (1): Premiums reflecting risk; (2): Dealing with equity and affordability issues; (3): Multi-year insurance.

New Books

Insurance and Behavioral Economics: Improving Decisions in the Most Misunderstood Industry

Howard Kunreuther, Mark V. Pauly and **Stacey McMorrow**



Cambridge University Press
January 2013
Paperback
isbn: 9780521608268
338 pages

Insurance is an extraordinarily useful tool to manage risk. When it works as intended, it provides financial protection to individuals and a profitable business model for insurance firms and their investors. But insurance is broadly misunderstood by consumers, insurance executives and regulators who often make incorrect choices regarding insurance based on emotions, biases and simplified decision rules. The authors consider if and how such choices could be modified to improve individual and social welfare, and offer recommendations for rules and incentives that may help decision makers avoid irrational behavior when it comes to insurance.

http://www.cambridge.org/us/knowledge/isbn/item6812077/?site_locale=en_US

About the Authors:

Howard Kunreuther is the James G. Dinan Professor of Decision Sciences and Business and Public Policy at the Wharton School, University of Pennsylvania.

Mark V. Pauly is the Bendheim Professor in the Department of Health Care Management at the Wharton School, University of Pennsylvania.

Stacey McMorrow is a research associate in the Health Policy Center at the Urban Institute, Washington, DC.

Managing Extreme Climate Change Risks through Insurance

W. J. Wouter Botzen

Cambridge University Press
May 2013
Hardback
isbn: 9781107033276
451 pages

In recent years, the damage caused by natural disasters has increased worldwide; this trend will only continue with the impact of climate change. This book considers the contribution that insurance arrangements can make to society's management of the risks of natural hazards in a changing climate. It also looks at the potential impacts of climate change on the insurance sector, insurers' responses to climate change, the role of the individual in preparing for disasters, as well as the difficulties individuals have in understanding and dealing with infrequent risks. The author combines theory with evidence from the rich experiences of the Netherlands and examples from around the world. Written in plain language, this book will appeal to researchers and policy-makers alike.

http://www.cambridge.org/us/academic/subjects/economics/natural-resource-and-environmental-economics/managing-extreme-climate-change-risks-through-insurance

About the Author:

W. J. Wouter Botzen is Assistant Professor in the Department of Environmental Economics at the Institute for Environmental Studies, VU University Amsterdam, and a visiting scholar at the Wharton Risk Management Center.

RECENT PUBLICATIONS more at http://opim.wharton.upenn.edu/risk/papers.php

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Gromet, Dena M., Howard Kunreuther & Richard P. Larrick. **Political Ideology Affects Energy-Efficient Attitudes and Choices**. *Proceedings of the National Academy of Sciences*. doi: 10.1073/pnas.1218453110. April 29, 2013.

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Kunreuther, Howard, Erwann Michel-Kerjan & Mark Pauly. **Making America More Resilient toward Natural Disasters: A Call for Action**. *Environment Magazine*. July-August 2013.

Kunreuther, Howard, Erwann Michel-Kerjan & Nicola Ranger. **Insuring Future Climate Catastrophes**. *Climatic Change*. 118(2): 339-354. May 2013.

Kunreuther, Howard & Mark Pauly. **Addressing the Disconnect**. *Best's Review*. January 2013.

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Michel-Kerjan, Erwann. **How Resilient is Your Country?** *Nature*. 491(7425): 497, doi:10.1038/491497a. November 22, 2012.

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RISK CENTER IN THE NEWS more at http://opim.wharton.upenn.edu/risk/facultynews.php

August 19, 2013, *WNYC Online,* Betting on the Next Catastrophe
Interview with Howard Kunreuther on use of catastrophe bonds to cover against financial losses from natural disasters.

July 9, 2013, *TIME*, The Case for Government-Backed Terrorism Insurance
Op-ed by Erwann Michel-Kerjan, adapted from his testimony before the U.S. Congress, House Subcommittee on Insurance, Housing and Community Opportunity, Committee on Financial Services in 2012.

July 1, 2013, *Science Nation*, Understanding Human Nature When Mother Nature Wreaks Havoc
Robert Meyer is interviewed about StormView™ research that gauges how residents of hurricane-prone regions might react in the event of an imminent storm.

July 1, 2013, *National Journal*, The health care industry has been a bright spot of the recovery, but it could reflect an unwelcome trend. Mark Pauly discusses the link between growth in health care jobs and costs.

June 3, 2013, *National Underwriter,* NYSE Roundtable: Officials Talk Lessons Learned from Sandy
Howard Kunreuther on hurricane preparedness: Educate people about the value of having insurance and risk mitigation.

May 24, 2013, *Marketplace*, Why don't we fix our crumbling bridges?
Interview with Robert Meyer: "There's a tendency to think that the legislators are somehow different from you and me making our day-to-day decisions, but a lot of the people who postpone funding for bridge repair are the same people who drive around with under-inflated tires or don't repair their roofs."

April 30, 2013, *Mother Jones, NBCNews.com*, *National Geographic*
Research by the Wharton Risk Center's Dena Gromet and Howard Kunreuther, and Duke University's Rick Larrick, shows that political conservatives are less likely to buy light bulbs that are labeled with a sticker that says "Protect the Environment."

April 23, 2013, *USA Today*, Boston bombings show need for terrorism insurance
Howard Kunreuther and Erwann Michel-Kerjan discuss terrorism insurance following the bombings at the Boston Marathon.

April 22, 2013, *CNN*, Four things Boston teaches us about terror
Op-ed by Stephen E. Flynn, Wharton Risk Center senior fellow and founding co-director of the George J. Kostas Research Institute for Homeland Security.

March 14, 2013, *USA Today*, Lawmakers: Small businesses vital to disaster recovery
Howard Kunreuther and Erwann Michel-Kerjan gave testimony at the Roundtable for the U.S. Senate Committee on Small Business and Entrepreneurship, "Helping Small Businesses Weather Economic Challenges and Natural Disasters."

March 6, 2013, *Fox News,* Why you're in denial about disasters.
Robert Meyer: "Even though people think there will be fire, hurricanes and earthquakes, they think the impact to them will not be severe."

February 26, 2013, *"Radio Times"* *National Public Radio,* "Moral hazard" & Sandy relief: Do federal funds invite disaster?
Interview with Howard Kunreuther (Wharton School) and Scott Gabriel Knowles, (Drexel University) by Marty Moss-Coane.

February 12, 2013, Forbes.com, Improving Insurance Decision Making
Op-ed by Howard Kunreuther and Mark Pauly on *Insurance and Behavioral Economics: Improving Decisions in the Most Misunderstood Industry.*

January 25, 2013, *The Weather Channel,* Climate and Risk Management
Jim Cantore of The Weather Channel interviews Howard Kunreuther at the World Economic Forum in Davos (video).

January 6, 2013, *CNN*, America isn't ready for superstorms
Op-ed by Risk Center senior fellow Stephen E. Flynn: Five important lessons to be learned In the aftermath of Hurricane Sandy.

November 24, 2012, *The New York Times*, Paying for Future Catastrophes
Op-ed by Erwann Michel-Kerjan and Howard Kunreuther.:Many people, including those in high-risk areas, don't have coverage, either put off by its cost or by the belief that the next disaster "will not happen to me."

November 21, 2012, *Nature*, How resilient is your country?
Op-ed by Erwann Michel-Kerjan: Extreme events are on the rise. Governments must implement national and integrated risk-management strategies.

November 17, 2012, *Newsday*, Sandy flood claims a drain on fed program
Erwann Michel-Kerjan discusses the operation of the National Flood Insurance Program, noting that if was a private company, "it would have gone bankrupt back in 2005."

October 30, 2012, *New York Times,* For Flood Victims, Another Blow Is Possible
Erwann Michel-Kerjan notes that flood insurance "is mandatory if you have a federally backed mortgage and you're living in a flood-risk area, but many people who were supposed to have that coverage were not covered."

October 30, 2012, *CNN Money*, Sandy Stimulus? Don't bet on it.
Research by Erwann Michel-Kerjan shows that disasters before an election draw more government relief than disasters after an election.

Risk Regulation Seminar Series

The Risk Regulation Seminar Series brings distinguished speakers to address topics of importance to academia, industry and public policy makers. The Seminar Series is jointly sponsored by the Penn Program on Regulation, the Wharton Risk Management & Decision Processes Center, and the University of Pennsylvania's Initiative for Global Environmental Leadership. Seminars are free and open to the public. More information is online at https://www.law.upenn.edu/academics/institutes/regulation/seminars.html.

October 23, 2012
Governing Inside the Organization: Interpreting Regulation and Compliance
Susan S. Silbey, Leon and Anne Goldberg Professor of Sociology and Anthropology, Massachusetts Institute of Technology

November 27, 2012
The Politics of Precaution: Regulating Health, Safety and Environmental Risks in Europe and the United States
David Vogel, Solomon P. Lee Chair in Business Ethics, University of California, Berkeley

January 16, 2013
Deciding By Default: Some Lessons from Behavioral Economics
Cass R. Sunstein, Felix Frankfurter Professor of Law, Harvard Law School

February 26, 2013
Climate Change, the IPCC, and International Policy Architecture
Robert Stavins, Albert Pratt Professor of Business and Government, Kennedy School of Government, Harvard University

April 9, 2013
Hackers' Market: Cybersecurity in the Digital Age
Richard Falkenrath, Principal, The Chertoff Group

Cass Sunstein considers the challenges – including concerns about individual privacy – and opportunities created by an increasingly feasible world of personalized default rules.

From 2009 to 2012, he served as the administrator of the White House Office of Information and Regulatory Affairs. He is co-author of Nudge: Improving Decisions about Health, Wealth, and Happiness (with Richard Thaler).

New Corporate Sponsors:

The Wharton Risk Center is pleased to welcome new partners, **CRAWFORD & COMPANY** and **LLOYDS.**

- Based in Atlanta, Ga., **Crawford & Company** is the world's largest independent provider of claims management solutions to the risk management and insurance industry as well as self-insured entities, with an expansive global network serving clients in more than 70 countries. The Crawford System of Claims Solutions® offers comprehensive, integrated claims services, business process outsourcing and consulting services for major product lines including property and casualty claims management, workers compensation claims and medical management, and legal settlement administration.

- As the world's leading insurance market, **Lloyd's** is home to 88 syndicates underwriting (re)insurance across all classes of business in 200 countries and territories worldwide. Lloyd's is a dynamic marketplace that combines underwriting expertise and diverse sources of capital with a powerful global distribution network. This year, Lloyd's celebrates its 325 anniversary from an award-winning modern building on Lime Street in the City of London, a world away from the modest surroundings of Edward Lloyd's 17th century coffee house.

Center for Risk and Economic Analysis of Terrorism Events (CREATE) Partners with the Wharton Risk Center

Under a grant from the **U.S. Department of Homeland Security,** the **Center for Risk and Economic Analysis of Terrorism Events (CREATE) at the University of Southern California** and its project partners are undertaking research to enhance the security of the United States.

Funding from CREATE is helping to support the Wharton Risk Center's research on affordability of flood insurance through the National Flood Insurance Program (see page 2); surveys on New York City residents' flood preparedness, and research on corporate demand for terrorism insurance that is informing U.S. policy on the Terrorism Risk Insurance Act (TRIA), up for renewal in December 2014 (see pp. 11 and 12).

Research Sponsors and Corporate Associates are a vital part of the Wharton Risk Center's operations.

In addition to providing crucial support for the Risk Center's operations, ***Corporate Associates*** participate in roundtable discussions and offer insight into the value, direction and timing of research projects. ***Research Sponsors*** provide funding for specific research initiatives of mutual interest and regularly interact with Risk Center directors, faculty and fellows to discuss these initiatives. Associates and Sponsors attend our workshops and conferences at no cost. These meetings offer an opportunity to consult with experts and policy makers from research institutions, industry and government agencies from the U.S. and abroad.

The Risk Center is inviting interested organizations to become ***Strategic Partners***. With a multi-year commitment, Strategic Partners play a key role in the Center's future research, which can enable these companies to impact the future of their industry. Strategic Partners will also benefit from greater visibility and customized relationships across the Wharton School through membership in the Wharton Partnership, Wharton's primary vehicle for fostering industry-academic collaboration.

Corporate Associate, Research Sponsorship, and Strategic Partnership contributions to the Risk Management and Decision Processes Center of the Wharton School are tax-deductible.

We thank our Corporate Associates, Research Sponsors and Strategic Partners in 2013 for their support and involvement.

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Over the past three decades, the Risk Management and Decision Processes Center at the Wharton School has been at the forefront of basic and applied research to promote effective corporate and public policies for low-probability events with potentially catastrophic consequences. The Wharton Risk Center has focused on natural and technological hazards through the integration of risk assessment and risk perception with risk management strategies. After the attacks of September 11, 2001, research activities were extended to include national security issues (e.g., terrorism risk insurance, protection of critical infrastructure).

Building on the disciplines of economics, finance, insurance, marketing, psychology and decision sciences, the Center's research program is oriented around descriptive and prescriptive analyses. Descriptive research focuses on how individuals and organizations interact and make decisions regarding the management of risk under existing institutional arrangements. Prescriptive analyses propose ways that individuals and organizations, both private and governmental, can make better decisions regarding risk. The Center supports and undertakes field and experimental studies of risk and uncertainty to better understand the linkage between descriptive and prescriptive approaches under various regulatory and market conditions.

In the past several years, the Center has significantly increased its size to now include 70 faculty, research fellows, students and visiting scholars to undertake large-scale initiatives.

Providing expertise and a neutral environment for discussion, the Center is also concerned with training decision makers and promoting a dialogue among industry, government, interest groups and academics through its research and policy publications and through sponsored seminars, roundtables and forums. Our newsletter and issue briefs provide updates of Center activities and publications.

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