Risk Management REVIEW

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RISK MANAGEMENT AND DECISION PROCESSES CENTER
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INSIDE THIS ISSUE:

Travelers/Wharton Partnership for Risk Management and Leadership

The Wharton Risk Center, the Wharton Center for Leadership and Change Management, and Travelers have renewed their strategic partnership with funding of $1.25m over five years from the Travelers Companies.

Catastrophe risks impose a significant financial burden on society, particularly when they are not managed effectively.

With the renewal of our five-year strategic partnership with the **Travelers Companies**, the Risk Center is exploring roles for government agencies and the private sector — builders, developers, banks, financial institutions and insurers — in incentivizing individuals, firms, infrastructure owners and operators, and communities to increase their resiliency.

No systematic, rigorous analysis has yet been conducted as to the roles that government can and should play in this context. The new research funded by the **Travelers/Wharton Partnership for Risk Management and Leadership** will address these issues.

Specifically, the Center will review pre- and post-disaster interventions currently undertaken by the private and public sectors regarding catastrophe risk management with a special focus on ways to incentivize those at risk to undertake loss reduction measures. It is imperative to improve communication about disaster risk and to encourage individuals, firms and communities to invest in loss reduction prior to a disaster.

Our research will examine ways to improve communication about disaster risk that can reduce the insurance protection gap; develop knowledge about the effectiveness and adoption of building codes; evaluate the effectiveness of the National Flood Insurance Program's community rating system; evaluate the effectiveness of premium incentives for loss mitigation; and understand how uncertainty about government regulations and standards can hinder firms. The Travelers/Wharton partnership is also funding research on how governmental disaster relief discourages investment in mitigation measures and insurance purchase.

Government must be an integral part of a national strategy to improve catastrophe risk management and resilience. For example, a state's well-enforced building codes and land use regulations can significantly reduce losses from future natural disasters. Additionally, the federal government provides financial protection against truly devastating events (e.g., a large-scale terrorist attack), thus enabling private insurers and reinsurers to offer coverage so that firms can invest in measures that foster economic growth and resiliency. Additionally, government can assist by incentivizing prudent behavior and encouraging communities to financially protect themselves against damage to public infrastructure.

At the same time, government actions, particularly regulations newly enacted in response to catastrophic events, can adversely affect firms' operations. Moreover, regulations currently favor short-term investments rather than fostering a long-term vision that would unlock significant capital to support resilience-enhancing investment in infrastructure.

The indirect impacts of such regulation need to be better understood since the insurance industry has more than $30 trillion of assets under management, some of which could be allocated to long-term investments in resilience.

(Continued on page 6)

The Future of Risk Management:
The Wharton Risk Center celebrates its 30th anniversary

The Risk Management and Decision Processes Center was established by Howard Kunreuther in 1985 following the chemical spill in Bhopal, India on December 3, 1984, the impetus for research on catastrophic risk management. In October 2015, the 30th anniversary of the Center offered an opportunity to consider the future of risk management.

The Wharton Risk Center marked its 30th anniversary with a symposium on The Future of Risk Management. Accomplished friends of the Center — nearly 100 scholars, scientists, practitioners, industry leaders, and policy makers in the areas of risk assessment, risk perception and risk management — shared their perspectives and participated in lively discussions on the challenges and opportunities in developing strategies to deal with extreme events — themes of the Risk Center since its inception.

Essays from the symposium, reflections with an emphasis on lessons learned, will be published by the University of Pennsylvania Press as a book entitled, "*The Future of Risk Management.*"

The field of risk management has undergone significant changes in the past 30 years to a large extent due to the increasing frequency and size of catastrophic events. Celebrating 30 years gives us a unique opportunity to reflect on questions still unanswered: ways to address behavioral biases and misperceptions of risk and to encourage deliberative thinking, the roles of risk communication, science and technology, economic incentives, well-enforced standards and regulations, new risk transfer instruments, public-private partnerships and long-term strategies for managing natural and man-made disasters.

We thank our corporate sponsors, research partners and our colleagues in the public sector and private sectors. The research undertaken by the Center could not have been accomplished without your active involvement and guidance. We look forward to working with you and others over the next 30 years.

For more information, see:

Symposium website
http://riskcenter.wharton.upenn.edu/30th-anniversary/

What Have the Past 30 Years Taught Us About Managing Risk? (podcast)
http://knowledge.wharton.upenn.edu/article/past-30-years-taught-us-managing-risk/ (interview with Risk Center directors Howard Kunreuther, Bob Meyer and Erwann Michel-Kerjan)

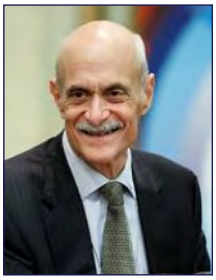
How Risk Management Can Adapt to an Era of 'Truly Remarkable' Change (article)
http://knowledge.wharton.upenn.edu/article/how-risk-management-can-adapt-to-an-era-of-truly-remarkable-change/

Howard Kunreuther (Wharton, Univ. of Pennsylvania); **Daniel Kahneman** (Princeton University); **Paul Slovic** (University of Oregon); **Elke Weber** (Columbia University); **Baruch Fischhoff** (Carnegie Mellon University)

James Whittle, Assistant General Counsel & Chief Claims Counsel, **American Insurance Association** (seated) and **Don Griffin**, Vice President, Personal Lines, **Property Casualty Insurers Association of America**

University of Pennsylvania Provost Vincent Price opened the symposium: "1985 was pre-Hurricane Andrew, pre-9/11 and pre-Fukushima… and before we understood the existential danger of climate change."

The Risk Center recognizes the important contributions to risk management made by those whom we have been fortunate to work with and learn from. At a celebratory dinner for our 30th anniversary, we honored these individuals and organizations:



Michael Chertoff served as **Secretary of the U.S. Department of Homeland Security (DHS)** from 2005 to 2009, transforming the Federal Emergency Management Agency (FEMA) into an effective organization following Hurricane Katrina. The Risk Center has had considerable interaction with DHS during and since Secretary Chertoff's tenure. Secretary Chertoff and his colleagues at DHS have provided us with insights into the challenges in dealing with catastrophic risks and the importance of public-private partnerships.

Professor Klaus Schwab (right) is **Founder and Executive Chairman** of the **World Economic Forum.** He has played a key role in bringing together key stakeholders from the private and public sectors to interact on problems of social importance. Professor Schwab also established the Global Agenda Councils (Risk Center faculty were among the founding members of the Forum's Global Agenda Council on Mitigation of Natural Disasters) and the annual *Global Risks Report* (see page 21) on which the Risk Center has partnered since the *Report's* inception in 2004. **Jean-Pierre Rosso**, (left) Vice-Chair of the World Economic Forum USA accepted the award.

The Travelers Companies have been involved with the Risk Center for over 10 years, beginning with long-time CEO, **Jay Fishman (1952-2016)** (see page 6).

We have greatly appreciated Travelers' insights on a variety of projects related to managing natural hazards and their important role in the Wharton Risk Center/Leadership Center study — funded by the Travelers/Wharton Partnership for Risk Management and Leadership — on how S&P 500 companies are dealing with catastrophe risk (see page 6). **Alan Schnitzer**, now CEO of Travelers, Inc. accepted the award.

The Behavioral Audit: A New Approach to Catastrophic Risk Management

Our forthcoming book, *The Ostrich Paradox: Why We Underprepare for Disasters,* explores the psychological and economic reasons why individuals and communities often underinvest in protection against low-probability, high-consequence events and the steps that we might take to improve decisions. The title, of course, is a metaphor: while ostriches are often characterized as hapless birds that bury their heads in the sand whenever danger approaches, they are, in fact, highly astute escape artists, birds who use their great speed to overcome their inability to fly. We propose a path by which humans might similarly adapt to their cognitive limitations when making protective decisions, such as difficulties in contemplating and dealing with long-term consequences, tendencies toward excessive optimism, and instincts to follow the herd.

The core thesis of the book is that, much in the same way that ostriches are limited in their defensive actions because they cannot fly, we need to recognize that when making decisions, biases are part of our cognitive DNA. But we might be able to design and structure a suite of choice environments, incentives, and communication methods that allow human decision makers to overcome these biases when faced with future hazards. We term this tool the behavioral risk audit. Like a financial audit, it is designed to provide communities and individuals with a systematic framework for characterizing their state of preparedness for different potential disasters, identify weak links, and suggest remedial solutions.

The behavioral audit departs from existing practice in that it focuses on those who will be preparing or responding to the hazard rather than on the hazard itself. Standard approaches first analyze the nature of the risk faced by individuals or communities and the vulnerability of buildings and infrastructure. They then consider protective measures that can be taken by individuals and communities to mitigate that specific risk. The behavioral audit, in contrast, encourages planners to reflect on how individuals in hazard-prone areas think about the risks they face and the flaws in their mental models as to the likelihood and consequences of a disaster to themselves, their property and to the community. It then suggests ways to improve their decisions in undertaking protective measures by recognizing these biases and simplified decision rules.

A behavioral risk audit involves four sequential steps:

- **Biases**: An initial list of six psychological limitations that lie at the root of why people often under-prepare for hazards: Myopia, Amnesia, Optimism, Inertia, Simplification, and Herding
- **Impact**: A description of how each of these flaws will impact beliefs about the likelihood and severity of the risks posed by the hazard
- **Manifestation**: Analysis of how these beliefs will be manifested in protection errors
- **Remedies**: The design of possible remedies for overcoming each bias and simplified decision rule

These analyses are reflected in a problem/solution matrix that would provide decision makers with an holistic view of the psychological barriers that preclude people from properly investing in protection, and a roadmap for overcoming them.

Example: Using the Behavioral Risk Audit to encourage protection against flood damage

To illustrate how a behavioral risk audit would proceed, consider how one might design a suite of tactics for overcoming the tendency for homeowners to under-protect against flood risk. The audit starts with a systematic analysis of the cognitive barriers to buying insurance and/or undertaking mitigation and articulates their consequences. It then invites possible solutions. For example, an audit of the flood-risk problem might yield a matrix such as in Table 1.

The process of developing such a matrix is not a one-time exercise. In the early stages of planning it provides a tool for envisioning hazards and existing preparedness measures through the eyes of stakeholders, each of whom has values, goals and agendas. Some have limited scientific knowledge about the hazard and the risks it poses, and for whom disaster preparedness is barely on their radar screen given their day-to-day concerns. Others may be very concerned with the hazard. Once the matrix is developed, it provides a template for the behavioral features that characterize a successful preparedness plan by offering an integrated set of remedies that recognize and overcome specific biases and simplified decision rules. Over time, the template would be revisited as experience is gained on the manifestation of different biases in specific situations and the success of remedies.

For more information, please contact the authors or visit Wharton Digital Press at: wdp.wharton.upenn.edu/book/ostrich-paradox.

Table 1. Behavioral Risk Audit for Protecting Against Flood Damages

Bias	Impact	Manifestation	Remedies
Myopia	Focus on short-term horizons in evaluating loss mitigation options	Failure to invest in cost-effective measures due to high upfront costs	Long-term loans coupled with insurance premium reductions to spread the upfront cost over time
Amnesia	Fading memory of past floods and resulting damage	Failure to renew an annual flood insurance policy	Multi-year policies renewed automatically with the same annual premium
Optimism	Underestimation of the probability of a flood	Tendency to see flood insurance and mitigation as overly expensive relative to benefits	Stretching the time horizon so individuals' perception of the probability of a disaster is closer to the scientific estimate
Inertia	A preference for the status-quo in protective investments	Reluctance to purchase insurance or invest in loss reduction measures, procrastination in decisions	Make protection the default; make insurance a condition for a mortgage, or part of a bundled policy that the consumer can opt out of
Simplification	Limited consideration of information available about flood risk	Ignorance of the flood risk of a location, lack of knowledge of possible remedies	Communication programs that make it easier for residents to be aware of their flood risk; examples of the consequences of flood that dramatize impact
Herding	Tendency to base insurance purchase decisions on whether friends and neighbors have policies	Low rates of insurance take-up at the community level	Communication programs that emphasize social norms of safety; seals of approval that enhance the social status of protective investments

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Robert Meyer and Howard Kunreuther are co-authors of *The Ostrich Paradox* (Wharton Digital Press, forthcoming).

(Continued from page 1)

The renewed five-year Travelers/ Wharton Partnership for Risk Management and Leadership Fund furthers the 2010-2015 research program "Effective Leadership Practices in Catastrophe Risk Management in the S&P 500," conducted by the Wharton Risk Center and Wharton Leadership Center with the support of Travelers.

Over the past several years, executives in one hundred S&P 500 firms have shared how the senior management and boards in their enterprises are coping with and learning from a range of disruptions and crises — their own and others' — and how their operations are preparing for future calamities in the U.S. and abroad. We examine how their stock prices responded to shocks, and observed concerns about government as a source of friction as regulator or crisis manager. We have identified good practices that will benefit firms and community leaders worldwide. The book ***Rethinking Catastrophic Risks: How Corporate America Copes with Disruption***, by H. Kunreuther, E. Michel-Kerjan and M. Useem (Oxford University Press) is forthcoming in 2017.

The Wharton Risk Center notes with sorrow the passing of **Jay Fishman** (1952-2016), CEO of Travelers, pioneer in risk management and graduate and long-time friend of the Penn/Wharton community. His final public interview aired 18 August 2016 on *Sirius XM Channel 111, Business Radio Powered by The Wharton School*. The podcast, hosted by Prof. Michael Useem, director of the Wharton School's Center for Leadership, can be accessed on the Risk Center's website.

The Transformation of Insurance

Most people rarely think about insurance. They don't interact much with their insurer unless they have a claim; the industry has one of fewest annual customer interactions.

Yet, insurance is one of the largest industries in the world, with global annual revenues north of $4.75 trillion, including more than $1 trillion here in the United States. And since most of the world is still uninsured, opportunities for growth are significant.

Over the past several years, the industry has been undergoing a necessary transformation. More on that in a moment, but first let us review some of the basics of insurance.

The underwriting/asset management equation

The traditional insurance business model is to select risks and charge adequate premiums — a process called underwriting — that will provide a reasonable net profit. Careful liability management led property/casualty (P&C) insurance underwriting to be generally profitable in the U.S. from 1920 to the 1980s.

But in the years since, competition and regulatory pressure, as well as too much unmanaged risk-taking focused on short-term volume growth rather than value, changed the landscape: not a single underwriting profitable year was recorded from 1979 through 2003 in the United States. This is not to say that every insurer or business line had underwriting losses year after year, but taken together, the underwriting part of the P&C insurance model has been losing money for the decades that followed the '80s.

You might wonder how this model can be sustainable. The answer lies in assets under management. When an insurer collects a premium, some of it is invested. If investment returns are good enough, they exceed underwriting losses, leading to overall profits. In other words, underwriting losses had been manageable thanks to high investment revenues. But this model has been challenged in the 21st Century.

The increasing role of technology is helping insurance companies make smarter assessments of risk, and helping their clients be safer, too.

Two drivers of change

First came a series of catastrophes that impacted underwriting results — think 9/11 terrorist attacks, Hurricane Katrina in 2005, the Japanese tsunami in 2010, Thailand floods in 2011, Superstorm Sandy in 2012, pandemics, technological disasters, geopolitical risks, and the increasing number and scale of cyber-attacks, to name just a few.

This series of costly extreme events triggered a renewed interest in better selecting what risks to insure, under what conditions, and at what price. Moreover, in a fast-changing and highly interdependent environment, risks are becoming more interdependent, too. New risks are emerging, making assessment by traditional actuarial approaches more challenging, if not inappropriate. The past alone cannot predict the future anymore.

The other game changer for many insurers came, more abruptly,

with the 2008 financial crisis. It significantly destroyed asset value and led to numerous regulations. Combined with a stagnant low interest rate environment, many asset managers, including insurers, have been unable to achieve the investment returns they once enjoyed.

The underwriting/asset management equation, so central to the insurance model, has to be rethought. In other words, insurers need to design and implement strategies that will help them measurably improve underwriting performance again, meet evolving demand, and create value.

New strategic thinking towards better risk selection

This new reality has triggered fresh thinking and innovations at a pace that the industry has probably not seen for a long time. Large insurers, typically the incumbents, are challenged by newcomers who want to disrupt the market with new technologies. The word "InsureTech," recently coined, refers to technologies and platforms that optimize insurance operations developed by start-ups. In 2015 alone, investment in insurance tech reached $2.65 billion, compared to $740 million the previous year.

Large insurers have engaged in this important transformation, signifying a sweeping change in the industry. For instance, American International Group (AIG)'s new chief underwriting officer for its commercial-insurance unit is a data scientist, not an underwriter. And the new CEO of the large European insurer AXA has publicly stated that improving usage of data and developing predictive analytics will be key to improving risk management practices, strategic decision making and competitiveness.

We are now seeing more companies investing time and resources to upgrade their risk selection processes, from improving their understanding of their maximum exposure around the world (direct business interruption, contingent business interruption), to extracting information from decades of claims data and combining those with other sources of knowledge.

More granular, just-in-time and agile risk knowledge

The increasing role of technology is helping insurance companies make smarter assessments of risk and helping their clients be safer, too. More firms are directly empowering consumers, rather than relying solely on agents and brokers and on a single annual renewal-time interaction.

New technology is able to aggregate and combine data in a way that is accessible 24/7, easily visualized and understood by busy decision makers. Digitization makes complex analyses and stress-tests of insurance portfolios much easier to administer, reduces operational costs and human biases, helps tailor investment in risk management activities, prices the risk more granularly and transparently, and improves product design, all positively impacting delivery and performance.

For instance, new high-performing geographic information systems (GIS) have recently been developed allowing the collection and analysis of a vast amount of data in a user-friendly, mobile compatible platform. One can now geo-locate and calculate exposure to different types of risks for more than one million physical assets on the planet. Ten years ago, it may have taken a week or more for a team to generate that information. Today, this is done in less than five seconds.

The ongoing rejuvenation of insurance based on a renewed emphasis on liability management and knowledge-driven decisions has started to show results: 2013, 2014 and 2015 were three consecutive years of P&C underwriting profits in the United States for the first time since the early 1970s. We will have to see if these results hold in the face of future catastrophes. Meanwhile, the gap between the top performers who have embraced change and executed on it, and those who have not, is widening.

Risk management and resilience are now in the boardroom

The new normal — more frequent extreme events of all sorts, growing uncertainty, intensifying regulation, low rate of return on financial investments, changing consumer expectations, use of new technologies and the quest for resilience — obviously has a much wider impact than just on the insurance industry. As one good barometer, the World Economic Forum's annual meeting in Davos earlier this year devoted a large number of sessions to these very issues and it will again in 2017.

The risk management and resilience landscape is fundamentally changing, and is increasing in importance in C-suites and boards.[1] Once seen as fairly technical and dry, it has now become strategic, and more fun to work on.

A version of this article was published in August 2016 by the World Economic Forum.

References

[1] Kunreuther, H., Michel-Kerjan, E., & Useem, M. *Rethinking Catastrophic Risks: How Corporate America Deals with Disruption.* Oxford University Press (forthcoming, 2017).

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The Importance of Accurate Flood Maps

When Congress considers renewal of the National Flood Insurance Program (NFIP) in 2017, it will be important for them to provide adequate funding to develop accurate flood maps for determining risk-based insurance rates.

The need for better maps in the United States has long been recognized; legislation by Congress in 2012 established a second **Technical Mapping Advisory Council (TMAC)** to address stakeholder experience with flood maps, the mapping program's credibility and its efficiency. In its December 2015 annual report, the TMAC recommended that "FEMA should transition from identifying the 1-percent-annual-chance floodplain and associated base flood elevation as the basis for insurance rating purposes to a structure-specific flood frequency determination."[1]

This recommendation aligns with a 2015 report by the **National Research Council** on pricing negatively elevated structures where it concluded that "current NFIP methods for setting risk-based rates do not accurately and precisely describe critical hazard and vulnerability conditions that affect flood risk for negatively elevated structures."[2]

Today, building owners are not required to purchase flood insurance if their buildings are located in areas that FEMA has designated as having an annual flood probability of less than 1-in-100. Thus, flood maps, regulations and mandatory insurance purchase all focus on the areas that have a risk of flooding greater than 1-in-100, the Special Flood Hazard Areas (SFHAs). The risk of inundation in areas with a lower risk is not communicated effectively. It is therefore not surprising that most homeowners and renters outside the SFHA believe they are safe from future flood losses. In reality, their homes may be at risk for severe damage, as residents of Baton Rouge, Louisiana, discovered in August 2016 when they experienced devastating inland flooding; FEMA estimates that only 30 percent of the affected homeowners had flood insurance.

Residents of Pensacola, FL had a similar experience in 2014 when twenty inches of rain fell in the city in 26 hours, flooding homes and businesses, many which did not have flood insurance. The Risk Center is involved in a study of the flood risk in Pensacola and other areas of Escambia County. On a recent visit, we interviewed a number of flood victims, among whom was an elderly woman who had purchased her house several years ago. The flood risk had never been explained to her, so she did not purchase flood insurance; her property was inundated by the 2014 storm.

Accurate flood maps are thus needed not only for the highest-risk areas, but also for areas outside those normally considered flood-prone. Such maps, coupled with elevation data on individual structures, would provide information on the likelihood of floods of different depths that could damage the structure, contents and critical systems like air conditioning and heating units. State-of-the-art technologies such as LiDAR (Light Detection and Ranging) could determine the likely damage to structures from each of the potential floods.

Accurate knowledge about flood risk is a first step in encouraging homeowners to invest in cost-effective loss reduction measures that would reduce their premiums.

With estimates of the resulting damage to the property from floods of different magnitudes, actuaries can determine flood insurance premiums that reflect risk. Premiums based on risk, in turn, would enable FEMA, private insurers and other interested parties to communicate the flood risk to property owners. Real estate agents and mortgage institutions should have a responsibility and interest in ensuring that buyers and homeowners are aware of the risk, and in providing them with information on ways to reduce damage from future disasters. Providing accurate knowledge about flood risk is a first step in encouraging homeowners to invest in cost-effective loss reduction measures that would reduce their premiums.

Accurate flood maps also highlight the challenges faced by low- and moderate-income families in paying for insurance coverage that reflects their actual flood risk. With the passage of the Biggert-Waters Flood Insurance Reform Act of 2012 and the Homeowner Flood Insurance Affordability Act of 2014, flood insurance subsidies are being phased out and premiums will increase to levels that eventually

The Technical Mapping Advisory Council (TMAC) is a federal advisory committee established to review and make recommendations to FEMA on matters related to the national flood mapping program authorized under the Biggert-Waters Flood Insurance Reform Act of 2012. The TMAC will also produce a report on the impacts of climate sciences and future conditions and how they may be incorporated into the mapping program.

The TMAC is comprised of representatives from federal, state, local and private sector organizations and governed by the Federal Advisory Committee Act (FACA) requirements. See: https://www.fema.gov/technical-mapping-advisory-council

the expected annual risk of flooding. Premium increases are likely to be substantial for many of the non-compliant buildings in the 1-in-100 year flood zones that are currently subsidized under the NFIP. It is also possible that insurance premiums for some of these residents will decrease from their current prices.

It will be important for FEMA to develop programs to address affordability for low- and middle-income families who are required to purchase flood insurance and those who are currently uninsured but need this protection. The federal government may benefit from assisting residents by providing a means-tested voucher or tax credit to offset the cost of insurance with the condition that they invest in available cost-effective mitigation measures that would be supported by a low interest loan or grant.

Data from Ocean County, NJ[3] and Charleston, SC[4] detail how such a program would benefit the property owner, the community and the federal government. In situations where the costs of mitigation are too high relative to the expected benefits, the households could be given a buyout option to move to a safer location, as residents of Oakwood Beach, Staten Island, NY were after Hurricane Sandy.[5]

Cost estimates by the **Association of State Floodplain Managers** for developing accurate flood maps for the entire country are in the range of $4.5 to $7.5 billion. It is vital that Congress authorizes sufficient funds for constructing accurate flood maps so that flood risk can be communicated risk to all residents whose property is subject to inundation.

By continuing to move toward accurate risk-based insurance premiums, encouraging property owners to invest in cost-effective loss reduction measures and addressing the affordability issue, we will have taken a giant step in reducing flood damage in an efficient and equitable manner.

With funding from the **Florida Department of Emergency Management (FDEM),** the Wharton Risk Center is studying the challenges and opportunities for more effective flood risk management in Escambia County and the city of Pensacola, FL. This research project has three primary components: (1) developing more accurate flood risk assessments and maps; (2) using these better flood risk maps to calculate flood insurance premiums that accurately reflect risk; and (3) implementing affordability studies for low-income households to examine risk-based premiums coupled with means-tested vouchers and low interest loans to encourage investment in cost-effective mitigation measures.

Flood risk maps are being updated by the **Federal Emergency Management Agency (FEMA)**, the **Northwest Florida Water Management District**, and their contractors. The updated flood risk maps will be geospatially analyzed in conjunction with buildings' structural characteristics such as foundation type and elevation above the ground to calculate risk-based insurance premiums.

Howard Kunreuther and Marilyn Montgomery (Wharton) and Elizabeth Rush (Bates College) visited Pensacola in August 2016 to conduct a preliminary inquiry into the intersection of flood risk, flood insurance reform and affordability in Pensacola. They met with local public officials to gain a better understanding of how the city is preparing for increased flood risk, and conducted field interviews in neighborhoods where flooding and the cost of flood insurance present challenges for residents.

References:

[1] The annual TMAC report for 2015 can be found at https://www.fema.gov/media-library/assets/documents/111853.

[2] National Research Council (2015). Tying Flood Insurance to Flood Risk for Low Lying Structures in the Flood Plain. Washington, DC: National Academies Press.

[3] Kousky, C., & Kunreuther, H. (2014). Addressing Affordability in the National Flood Insurance Program. *Journal of Extreme Events 1(*1):1-28.

[4] Zhao, W., Kunreuther, H., & Czajkowski, J. (2016). Affordability of the National Flood Insurance Program: Application to Charleston County, South Carolina. *Nat. Hazards Rev.17*(1).

[5] For more details on how the Oakwood Beach residents arranged the buyout options after Hurricane Sandy, see Rush, Elizabeth (2015). As the Seas Rise. *New Republic*, October 25.

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Social Equity and Affordability Concerns of the "Newly-Mapped" Procedure of the National Flood Insurance Program

The National Flood Insurance Program (NFIP) was designed to provide affordable flood insurance to homeowners in participating communities, and historically has not charged premiums that accurately reflect flood risk. But after claims payments from recent hurricanes increased the NFIP's debt, Congress passed legislation to address the program's financial balance. A key provision of the Homeowner Flood Insurance Affordability Act of 2014 is the "newly-mapped" procedure.

Effective in April 2015, the newly-mapped procedure applies when the NFIP changes a participating community's flood risk zone in the flood insurance rate maps. A new NFIP flood insurance rate map is called a preliminary map until the community being mapped officially adopts it; at that point it becomes the effective map used to determine flood insurance premiums.

Flood insurance coverage is mandatory for homeowners with a federally-backed mortgage within Special Flood Hazard Areas (SFHAs). Prior to the newly-mapped procedure, houses that were built in compliance with the effective flood maps at the date of construction and that continuously had flood insurance were charged flood insurance rates that were effective at the date of construction, regardless of whether the home was later mapped into a higher risk flood zone. As of April 2015, though, homeowners newly mapped into SFHAs have to pay flood insurance premiums that increase up to 18 percent annually until they reach full-risk rates.

To assess the potential social equity and affordability concerns of the newly-mapped procedure, we examined household income and median home values from the U.S. Census Bureau in a case study of how new flood maps might impact NFIP policyholders in Jefferson and Orleans Parishes in southeast Louisiana. Orleans Parish adopted a new flood map in March 2016, and Jefferson Parish is scheduled to adopt their new map in spring of 2017. Figure 1 shows the areas of flood zone changes in Orleans and Jefferson Parishes.

Most of the neighborhoods in the study area are being mapped out of SFHAs due to levee upgrades since Hurricane Katrina; these neighborhoods have higher median home values and significantly lower percentages of households with less than $35,000 annual income. Conversely, we find that neighborhoods that are newly mapped *into* SFHAs have significantly lower median home values.

In other words, areas of higher income households are more likely to be newly mapped out of SFHAs and can thus drop their flood insurance or enjoy substantially lower premiums, while areas of homeowners with lower value homes being newly mapped into SFHAs will have to pay flood insurance premiums that increase 18 percent annually.

Research is currently underway to analyze the sociodemographic traits of those who may be impacted by the newly-mapped procedure in additional NFIP communities in Louisiana, Florida, and North Carolina. Preliminary findings in Florida and North Carolina show that higher-income households with higher-valued ocean-front homes are being mapped out of coastal SFHAs. These coastal homeowners will have substantially lower premiums if the preliminary flood maps are adopted.

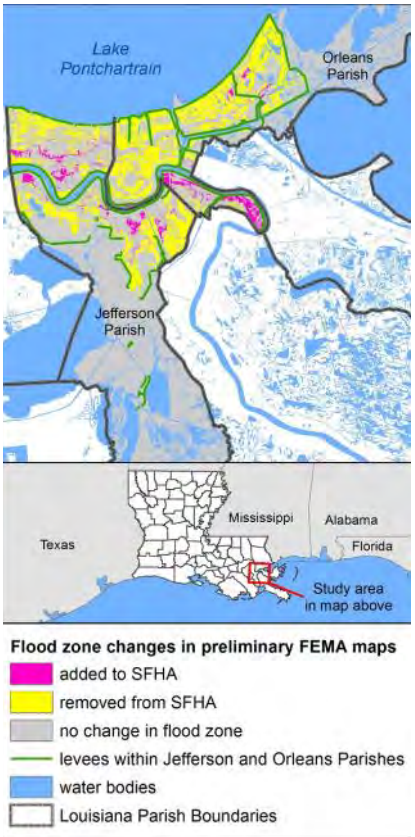

Figure 1. Changes in SFHAs based on the effective and preliminary flood hazard maps for Orleans and Jefferson Parishes. *Note*: This map was created by intersecting the effective flood maps with the preliminary maps in a GIS (geographic information system).

Further studies are necessary to substantiate claims of affordability issues related to the newly-mapped procedure, but it is a social equity concern that higher-income homeowners who are most able to pay flood insurance can drop it, while homeowners with lower valued homes will be required to pay new NFIP premiums.

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Flood Risk and Property Prices in Galveston County, TX

The Biggert-Waters Flood Insurance Reform Act of 2012 included a provision that would increase discounted (subsidized) National Flood Insurance Program premiums to full-risk levels on some homes. Realtors, homebuilders, and lenders decried the legislation, saying that risk-based premiums caused "property values to steeply decline and made many homes unsellable, hurting the real estate market"[1]

Although a number of studies indicate that properties within a designated high risk flood zone sell for a lower price than an equivalent property outside of it — typically on the order of 4 to 12 percent[2,3] attributed to higher flood insurance rates — such price discounting for homes in a higher risk zones is not always the case, because the homes most at risk for flood are also the most desirable due to their proximity to the water.

With support from the National Science Foundation and using flood insurance rate maps from FEMA and proprietary flood risk data from CoreLogic®, we determine the countervailing impacts of flood risk and water-related amenities in Galveston County, TX. Our study area included more than 35,000 homes in Galveston County. For each property in the analysis we calculate its distance to the nearest coastline, judged as a positive amenity. About 7,000 properties in our sample were located in either V or A zones (high risk, 100-year return period). The data from CoreLogic allowed us to identify flood return periods of less than or equal to 10 years, 10-25 years, 25-50 years, and 50-100 years. Figure 1 shows the average home price and average distance to the coast for homes in different flood return periods. For example, in our sample, the average distance to the coast of properties in the return period of less than or equal to 10 years was approximately 1,260 feet. These houses sold for an average price of about $287,540.

Our results show that properties in the V zone which are at the most risk command a high price compared to properties outside the flood risk zone; oceanfront properties in the V zone are valued 146 percent higher, equivalent to approximately $266,537 for an average-priced home in our study area.

House prices diminish as the distance to the coast increases. For example, when the distance to the coast increased by 100 feet, the price decreased from 146 percent to about 72 percent higher compared to properties outside the flood risk zones, but still higher-priced than houses farther from the coast. Compared to properties outside the flood risk zones, the A zone properties are valued 28 percent higher in our study.

Analysis of the CoreLogic data produced a similar result: properties in the flood return period of less than or equal to 10 years are the highest priced by a significant percentage, as depicted in Figure 1. Again, house prices decrease as the distance to the coast increases. We find that the price increase disappears around 1000 feet from the coast for properties in areas where the flood return period was 10 years.

Data issued by Zillow[4] on home values in coastal regions of Florida and the Carolinas reinforces our findings: their data shows that coastal properties maintain their premium over non-coastal properties even after hurricanes and in the aftermath of the housing bubble. Evidently, homeowners have a strong desire to live near water and have been willing to pay more for waterfront properties.

For more details, see: Atreya, A., & Czajkowski, J. (2016). Graduated Flood Risks and Property Prices in Galveston County. *Real Estate Economics*. http://onlinelibrary.wiley.com/doi/10.1111/1540-6229.12163/abstract.

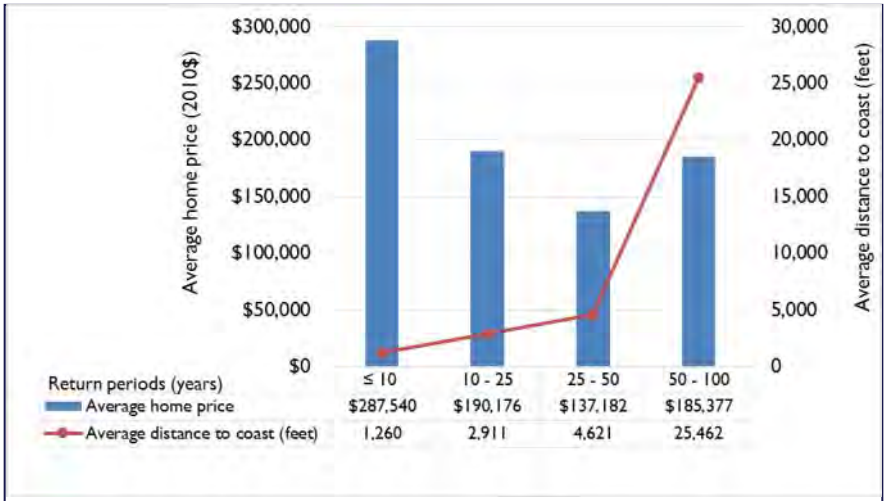

Figure 1. Average home prices and associated distance to coast in Galveston County, TX.

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[2] Atreya, A., Ferreira, S., & Kriesel, W. (2013). Forgetting the flood? An analysis of the flood risk discount over time. *Land Economics*, *89*(4), 577-596.

[3] Bin, O., & Landry, C.E. (2013). Changes in implicit flood risk premiums: Empirical evidence from the housing market. *Journal of Environmental Economics and management*, *65*(3), 361-376.

[4] Olsen, S. (2013). Time Heals All Wounds: Our Love of the Ocean. http://www.zillow.com/research/time-heals-all-wounds-our-love-of-the-ocean-3904/

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Homeowner Tornado Mitigation and the Role of Economic Incentives

On average, the U.S. experiences 1,000 tornadoes per year that produce more than $3 billion in property loss. A substantial amount of this tornado property loss has been caused by relatively less intense tornadoes, EF2 or lower on the Enhanced Fujita Scale for Tornado Damage, with wind speeds that range from 65 to 135 mph. Engineers have identified a set of comparatively inexpensive retrofit measures that homeowners could undertake to protect their home from much of the damage caused by these tornadoes, similar to those recommended in hurricane-prone regions of the United States.

Nevertheless, little has been done by homeowners to mitigate this tornado damage, even in high tornadic risk areas. It is possible that behavioral and/or economic rationales may be driving this inactivity: although the mitigation is relatively inexpensive in comparison to the value of the property, it may involve fairly significant upfront costs that have not been clearly demonstrated as being cost effective over time, or that are simply unaffordable for homeowners of certain income levels. In the face of rising impacts from natural disasters such as those from tornadoes, a white paper released by the National Institute of Building Sciences laid out an "incentivization" approach to facilitate cost-effective pre-disaster resiliency throughout the United States. For single family homeowners in particular, the value of protecting their property through resilience-enhancing activities can be driven through four incentive approaches: insurance premium reductions, grants, tax incentives, and mortgage programs (loans).[1]

With colleagues from the University of Oklahoma and Austin College, we conducted surveys to assess whether homeowners in Oklahoma (OK) are willing to pay (WTP) today to protect their home from EF0, EF1, and EF2 tornadoes that may occur in the future. Additionally, the survey allows us to investigate how three specific economic incentives — insurance premium reductions, low-interest loans, and a combination of the two — impact homeowner WTP.

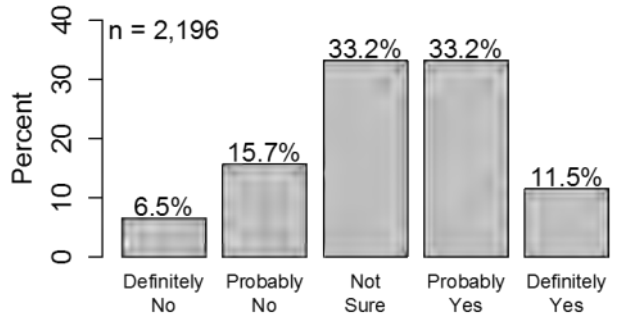

Figure 1. Percentage of 2,196 Oklahoma homeowners stating their willingness to pay to protect their home from tornado wind events across all one-time cost amounts presented in the survey.

In the survey, OK homeowners were presented with a scenario where an engineer has inspected their home and told them that by installing a set of components for a randomized one-time cost of either $8000, $5000, or $2000, their home would be protected from the majority of high-wind events that occur in Oklahoma, including most EF0, EF1, and EF2 tornadoes. They were then asked whether they would install this set of components to protect their home from high-wind events. As illustrated by the distribution of survey responses of 2,196 OK homeowners across all one-time cost amounts, while roughly one-third of the homeowners in the sample said that they were "not sure" if they would pay the randomly specified amount to install the mitigation components; nearly 45 percent said "probably yes" or "definitely yes." (See Figure 1.)

WTP for tornado mitigation can be influenced by a host of relevant factors, such as previous tornado experience, perceptions and knowledge of tornadic risk, homeowner income, and the cost of mitigation. In regard to the cost of mitigation specifically we find that as the cost of mitigation decreases, the percentage of respondents stating WTP "probably yes" or "definitely yes" increases, from 32.7 percent to 45.3 percent up to 56.6 percent for the one-time cost amounts of $8000, $5000 or $2000, respectively.

Importantly, WTP may also be influenced by an economic incentive such as receiving an insurance premium reduction which would offset the upfront cost of the mitigation measure. In a series of statistical analyses, we determine the effect on WTP of economic incentives. Our findings indicate that the negative impact of costs of tornado risk mitigation can be (partially) offset by the positive influence of the incentives offered. However, we find that this effect is not equal for all incentives; insurance premium reductions produce the largest increase to WTP. Furthermore, the influence of incentives is not necessarily additive: offering a low-interest loan option in conjunction with the premium reduction may diminish the appeal of reduced insurance premiums.

These findings provide a promising first look at demand for tornado risk mitigation in the United States and the effectiveness of the "incentivization" approach to resiliency.

[1] Developing Pre-Disaster Resilience Based on Public and Private Incentivization. National Institute of Building Sciences (NIBS) Multihazard Mitigation Council (MMC) with the Council on Finance, Insurance, and Real Estate (CFRIRE). October 2015. Available at https://c.ymcdn.com/sites/www.nibs.org/resource/resmgr/MMC/MMC_ResilienceIncentivesWP.pdf.

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An Integrated Approach for Responding to Hazards from Tropical Cyclones

Research partners from the Wharton Risk Center, **Princeton University, MIT**, and the **NOAA Geophysical Fluid Dynamic Laboratory** are undertaking a multi-year collaborative **National Science Foundation** project (NSF Hazard SEES Project EAR-1520683) on hurricane risk assessment and management.

Two important components of the project are better estimates of the coastal flood risk and the design of the National Flood Insurance Program (NFIP) to better address coastal flood risk.

A well-designed insurance program can play an important role in linking investment in loss reduction measures and financial protection should a disaster occur. Insurance premiums should reflect risk to communicate to floodplain residents the degree of the hazard they face. Risk-based premiums would also encourage investment in cost-effective loss reduction measures through a reduction in the cost of insurance. In contrast, under the NFIP today, many coastal houses are given subsidized premiums due to affordability considerations. Additionally, FEMA flood maps on which premiums are based may not accurately reflect the current risk and do not account for future climate change and sea level rise.

A workshop related to the project was held at the Wharton Risk Center in June 2016, with presentations and panel discussions by leading environmental scientists, economists, key representatives from **FEMA**, members of the **FEMA Technical Mapping Advisory Council,** and federal advisors from the **National Research Council** and **White House Office of Management and Budget** among others, to discuss risk analysis for hurricanes in a changing climate, mitigation and adaptation, and potential improvements to flood insurance policy and design.

The workshop concluded with an open discussion that developed a set of recommendations to improve resilience to floods. Among the goals for the public sector, private sector and researchers:

- Improve accuracy of flood maps; maps should indicate susceptibility to flood for at-risk structures based on their elevation and other factors; provide elevation certification for at-risk structures
- Improve flood risk communication, including the cost of potential damages and how sea level rise could lead to an increase in the price of flood insurance premiums
- Inform homeowners that FEMA disaster aid is mainly designated for repairing infrastructure and public facilities, not homeowners' property
- Fund vouchers and/or other financial aid to assist homeowners to purchase flood insurance and invest in loss-reduction measures that will also address affordability issues
- Create economic incentives for state and local governments to prevent further coastal development
- Create guidelines for community planners to determine circumstances when retreat instead of rebuilding is the preferred option
- Expand government acquisition of at-risk properties for open space and flood buffer zones
- Provide researchers with access to anonymized census data on household income and other factors such as percentage of income spent on mortgage, to help inform criteria for determining circumstances and methods on how financial assistance could be provided to address affordability issues

For more information, see the Wharton Risk Center issue brief at http://opim.wharton.upenn.edu/risk/library/WRCib2016c_FloodIns-Potential-Improvements.pdf.

This NSF project will develop a new framework for assessing hurricane hazards, estimate how these hazards may evolve in the future, and develop engineering and policy strategies for coping with these hazards. Project scientists will compare the hazards, vulnerability, and risk, as well as existing and potential risk management strategies for coastal cities in NY, NJ, NC, and FL in the U.S., and Shanghai in China, and will use these case studies to propose engineering and policy strategies to build resilient and sustainable coastal communities.

To contribute to sustainability — defined in the Hazards SEES program as human needs being met equitably and without sacrificing the ability of the future generations to meet their needs — the study team is applying these quantifications of climate change impact on tropical cyclone hazards and damage to coastal mega-cities around the world in order to inform decision makers about the likely consequences of continued greenhouse gas emissions on the global scale.

Involvement in U.S. Policy Decision Making


Scott Harrington, PhD
University of Pennsylvania

Wharton School Professor and Risk Center senior fellow **Scott Harrington**, an expert on the Affordable Care Act's Consumer Operated and Oriented Plans (CO-OPs) testified before the U.S. Senate Permanent Subcommittee on Investigations Committee on Homeland Security and Government Affairs on March 10, 2016.

Harrington described a fiscally lethal paradox he called the "winner's curse": CO-OP insurance programs succeeded in selling low-priced policies to so many customers that they quickly exceeded the amount of capital needed to pay those customers' claims. As a result, many CO-OPs failed, resulting in thousands of people losing their health coverage. The potential consequences of rapid enrollment growth of CO-OPs should have been a focus of the federal government and state regulators from their inception, Harrington said.

For more details, see http://ldi.upenn.edu/news/how-winners-curse-killed-aca-insurance-co-ops. Video at https://youtu.be/_qmZipLmXAg.

Stephen E. Flynn, Co-Director, George J. Kostas Research Institute for Homeland Security, Northeastern University, and a senior fellow of the Wharton Risk Center testified on October 27, 2015 before the Coast Guard and Maritime Transportation Subcommittee, Committee on Transportation and Infrastructure, U.S. House of Representatives on "Prevention of and Response to the Arrival of a Dirty Bomb at a U.S. Port." His testimony, "A Roadmap for Overcoming the Flaws in the U.S. Government Efforts to Improve Global Supply System Security" is online at http://transportation.house.gov/uploadedfiles/2015-10-27-flynn.pdf.

Video at http://transportation.house.gov/calendar/eventsingle.aspx?EventID=399348.

Howard Kunreuther addressed an open meeting of the **Federal Advisory Committee on Insurance (FACI)** on May 26, 2016 at the **Treasury Department** in Washington, DC in an examination of issues related to the affordability of flood insurance in the context of behavioral economics and its impact on the National Flood Insurance Program. **Tom Baker** of the **University of Pennsylvania Law School**, a Risk Center senior fellow, also presented on the role of behavioral economics in the insurance industry.

Kunreuther and colleagues **Carolyn Kousky (Resources for the Future),** and **Allen Schirm (Mathematica Policy Research)** who served together on the **National Research Council's Committee on the *Affordability of National Flood Insurance Premiums*** then engaged in a discussion with FACI members on the key recommendations from two published reports from the **National Academy of Science** on *"Analysis of Costs and Benefits of Reforms to the National Flood Insurance Program"* (see page 15).

The Federal Advisory Committee on Insurance (FACI) provides advice and recommendations to assist the Treasury's **Federal Insurance Office (FIO)** in carrying out its statutory authority. The FIO was established by the Dodd-Frank Wall Street Reform and Consumer Protection Act. The FACI was established to provide a source for consumers and representatives from the insurance and reinsurance industry, academics, and state regulators to offer advice and recommendations directly to the FIO on a periodic basis. More information at https://www.treasury.gov/initiatives/fio/Pages/faci.aspx.

Video of the May 26, 2016 meeting can be accessed at http://www.yorkcast.com/treasury/events/2016/05/26/faci/.

The National Academy of Sciences' Committee releases its reports on *Affordability of National Flood Insurance Premiums*

The National Flood Insurance Program (NFIP) was created by Congress in 1968. Over the years, a number of studies and reports have reviewed the program's structure and operations, often making recommendations for reform. Many, but not all, of these reports were made at the request of Congress. The reports of this committee were prepared in response to a congressional request in the Biggert-Waters Flood Insurance Reform Act of 2012 (BW-12).

BW-12, Section 100236, mandated that the **Federal Emergency Management Agency (FEMA**) conduct a study in cooperation with the **National Academy of Sciences (NAS)** that would "compare the costs of a program of risk-based rates and means-tested assistance to the current system of subsidized flood insurance rates and federally funded disaster relief for people without coverage." This came to be known as the "affordability study."

In response, the Water Science and Technology Board in the Division on Earth and Life Studies at NAS, in collaboration with the Board on Mathematical Sciences and their Applications, and the Committee on National Statistics, convened the committee on *Affordability of National Flood Insurance Program Premiums*. The committee members for both reports included persons who collectively brought expertise in insurance, economics, floodplain management, national flood and disaster science and policy, mapping and spatial statistics, and risk perception and communication to the work of the committee.

To fulfill the mandate of BW-12, FEMA and NAS agreed to a plan of work to produce two reports. The first report, released in March 2015, Affordability of National Flood Insurance Program Premiums: Report 1, described policy options and decisions to be made for FEMA's consideration as it formulates affordability policy alternatives for consideration by Congress.

The second report, released January 2016 focuses on how FEMA might develop analytical capacity and databases needed to evaluate affordability policy alternatives. Affordability of National Flood Insurance Program Premiums: Report 2 explains the decisions that must be made when designing an assistance program, and describes alternative ways premiums might be made more affordable. The report proposes an analytical approach FEMA might use to evaluate affordability policy options.

The affordability framework in Report 1 considers the following criteria:

(1) Accurate communication to consumers of the flood risk associated with their properties

(2) Targeted assistance to flood insurance policy holders based on their financial ability to continue to participate in the National Flood Insurance Program

(3) Individual or community actions to mitigate the risk of flood or lower the cost of flood insurance

(4) The impact of increases in risk premium rates on participation in the National Flood Insurance Program

(5) The impact that flood insurance rate map updates have on the affordability of flood insurance

Some key findings:

Informing policyholders of the NFIP risk-based rate may help provide accurate information on risk, but simulating premium increases if risk-based rates were to be charged requires elevation data for each insured property. Such data are now being requested for properties that were previously paying subsidized rates. Because flood insurance premiums for policies on properties outside the SFHA are not elevation rated, elevation data for those properties are missing and are not currently being collected.

The committee finds that continuing the practice of subsidizing flood insurance rates is increasingly unsustainable. Aid may need to be extended to property owners to purchase flood insurance. Providing targeted assistance requires policy judgments involving tradeoffs, however. Ideally, FEMA would formulate affordability policy alternatives for consideration, conduct an evaluation of the alternatives and propose a preferred affordability strategy. Policymakers will have to determine how to define affordability and assess whether premiums are cost burdensome.

Affordability of National Flood Insurance Program Premiums: Report 2

http://www.nap.edu/catalog/21848/affordability-of-national-flood-insurance-program-premiums-report-2

Removing the Pressure to Appear Certain: New Insights from Behavioral Science on the Sincerity of Expert Advice

Organizations in the public and private sectors alike frequently make complex decisions on the basis of assumptions derived from forecasts. Savvy decision makers within these organizations understand that there is an element of uncertainty underlying these assumptions and may rely on experts to help them understand these uncertainties.

Unfortunately, experts often exhibit excessive certainty in the accuracy of their own judgment. One reason for this may be that they are concerned that in failing to convey certainty, they will fail to project competence. This is a reasonable assumption given that those who convey the most certainty are perceived as being the most qualified advisors.[1]

How can organizational decision makers alleviate these concerns to get the most accurate and honest estimates of experts' uncertainty? One way is to consider how the questions they ask influence the extent to which expert advisors are threatened by uncertainty.

Internal and external sources of uncertainty

Individuals' attribution of uncertainty is partly dependent on how uncertainty is framed.[2] Experts feel most threatened by situations where they perceive their uncertainty to be diagnostic of internal causes such as inadequate expertise. Research at the Wharton Risk Center is showing that this has important implications on whether experts feel pressure to convey certainty.

When people are asked how "confident" they are about something, they focus on internal sources of uncertainty such as their level of expertise. Although intended as a straightforward attempt to understand the amount of uncertainty involved in the problem at hand, advisors may perceive questions framed around their confidence as a challenge to their authority on the subject.

Now, consider the following question one might ask the advisor, instead: "How likely is this event to occur?" Unlike the former question, this question focuses advisors away from internal sources of uncertainty and more on external ones, such as statistical randomness. Thus, this type of question is less likely to pressure experts into projecting certainty to establish authority.

In one experiment, research participants were placed in the role of a financial advisor and incentivized to be hired as advisors by others who had less information than they did about a series of stocks. To help advisees decide whether to hire a given advisor, advisors were prompted to express their degree of certainty in predictions they previously made about each stock's future value. Some advisors were prompted to indicate how "confident" they were in their ability to predict the stock's future value (thus priming them to think about internal sources of uncertainty). Other advisors were asked to indicate "how likely" they perceived specific outcomes to be (priming them to think about external sources of uncertainty).

Relative to their genuine beliefs assessed in private, advisors who were asked to indicate their "confidence" publicly conveyed more certainty to advisees. However, those who were asked to indicate the "likelihood" of outcomes they had predicted conveyed a similar amount of certainty to advisees as they did when making private judgments. In other words, advisors were strategically overconfident when they were asked about their "confidence," but better calibrated when they were asked about the "likelihood" of outcomes.

Advisors were strategically overconfident when asked about their "confidence," but better calibrated when asked about the likelihood" of outcomes.

Asking questions wisely

The evidence suggests that the way experts are prompted to reveal their uncertainty plays an important role in how they think about uncertainty. Thus, organizational decision makers would be wise to frame questions about experts' uncertainty around the likelihood of outcomes versus the advisor's own confidence.

For more information, see Van Zant, A.B. (2016). *Certainty Posturing: Evidence of Inauthentic Certainty in Advice.* Retrieved from https://alexvanzant.files.wordpress.com/2016/08/certainty-posturing.pdf

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[2] Ülkümen, G., Fox, C. R., & Malle, B. (2016). Two dimensions of subjective uncertainty: Clues from natural language. *Journal of Experimental Psychology: General.*

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How Should We Measure Terrorism Risk?

Tanya Xu | PPR News. Penn Program on Regulation, http://www.pennreg.org/ppr-news/

Since the terrorist attacks of 9/11, the U.S. government has spent over $650 billion on domestic security. But critical to keeping Americans safe is the government's ability to predict and reduce the chance of future attacks.

At a Risk Regulation seminar (see page 23), **Detlof von Winterfeldt**, a professor at the University of Southern California and co-founder and director of the **Center for Risk and Economic Analysis of Terrorism Events (CREATE)**, the first university-based **Center of Excellence** funded by the **U.S. Department of Homeland Security (DHS)**, discussed methods used by DHS to assess terrorism risks.

In the aftermath of 9/11, according to von Winterfeldt, the Department of Homeland Security considered several approaches to assess the threat posed by terrorism, including probabilistic risk analysis, game theory, possibility theory, and soft risk scoring methods. In recent years, probabilistic risk analysis has emerged as the predominant approach. Probabilistic risk analysis, or risk analysis, refers to a group of techniques that uses event trees to model possible outcomes that could occur from one initiating event. A number of agencies have used risk analysis to determine the most cost-effective responses to various catastrophes. For example, the Environmental Protection Agency has used risk analysis to model the potential health impacts of exposure to varying levels of carcinogens. FEMA has also used risk analysis to model consequences from natural disasters.

Detlof von Winterfeldt, founder and director of CREATE at the University of Southern California, delivers remarks at a Risk Regulation Seminar. The series is jointly sponsored by the Penn Program on Regulation and the Wharton Risk Management & Decision Processes Center.

Although other agencies have used risk analysis, von Winterfeldt described the Department of Homeland Security's adoption of risk analysis as controversial. Before 9/11, the government had not used risk analysis to assess terrorism threats, and it was unclear whether risk analysis could model terrorism threats effectively. A major challenge in applying risk analysis to assessing terrorism risk is that it requires researchers to model human actions. Some critics of risk analysis argue that it is impossible to assign probabilities to terrorist events because probabilities can be assigned only to natural events and not to intentional acts. Critics also argue that adversaries may observe and adapt their behavior to the approach, so that the insights gleaned from the analysis will be ineffective.

Despite these challenges, security agencies and experts now use risk analysis to solve a variety of problems. For example, CREATE has used risk analysis in order to determine the best way to respond to attempts by terrorists to shoot down commercial planes with surface-to-air missiles. Equipping planes with anti-missile technology would not actually increase overall public safety, because terrorists would simply shift their strategy to attacking commercial planes unequipped with the technology.

Von Winterfeldt offered several lessons on evaluating counter-terrorism measures. First, measures that prevent only a specific event from occurring may simply cause terrorists to shift their tactics from more resistant targets to more vulnerable ones. Regulators must consider the broader consequences of their actions in adopting countermeasures. Implementing two different countermeasures simultaneously is more cost-effective.

Von Winterfeldt also suggested that the media and public should respond in proportion to the magnitude of the crisis, as public fear of terrorist events can create large indirect economic impacts which can perpetuate and aggravate the consequences of the attack. An example is the 2001 anthrax attacks, for which the public's fear likely amplified the actual damage caused by the attack. Lastly, efforts to improve risk analysis should continue, using the right experts, including social scientists, journalists, and intelligence analysts.

See the full article at Regblog:
http://www.regblog.org/2016/08/25/xu-how-should-we-measure-terrorism-risk/

SEMINAR RECORDING:
http://whr.tn/29mVmrZ

Improving Homeland Security Decisions, A. Abbas, M. Tambe, D. von Winterfeldt, eds. (Cambridge University Press, forthcoming).

The Risk Center thanks CREATE for a decade of research collaboration on improving the nation's preparedness to natural disasters.

Ongoing Alliance with Zurich Insurance Foundation

The Wharton Risk Center enters its fourth year of strategic partnership with the Zurich Insurance Foundation on a multi-stakeholder project aimed at measurably enhancing community flood resilience around the world. Our focus is on the development and testing of a comprehensive web-based application to measure resilience, better understanding behavioral barriers that impede adoption of risk reduction and preparedness actions, and reducing the flood insurance protection gap. For more information visit https://riskcenter.wharton.upenn.edu/flood-resilience-research-collaboration-zurich-insurance/ or contact Erwann Michel-Kerjan at erwannmk@wharton.upenn.edu.

Update: Global Deployment of the Flood Resilience Measurement Tool

The ability to measure flood resilience is an important first step in demonstrating the impact of flood resilience enhancing initiatives. The United Nations recently determined that "no general measurement framework for disaster resilience has been empirically verified yet."[1]

To fill this gap, our Alliance has developed a framework for measuring flood resilience, as well as a quantitative methodology to empirically validate that it does in fact measure community flood resilience, and a web and mobile-based application that guides users through the measurement tool for gathering and evaluating community level data.

In early 2016, Alliance partners IFRC and Practical Action and four other NGOs (Mercy Corp, Plan, Concern International and the U.S. National Academy of Sciences) began collecting data in eight countries around the world (first in Indonesia, Mexico, Nepal and Peru, then in Afghanistan, East Timor, Haiti and the Unites States).

More than 100 mostly poor rural communities in these countries have been chosen for measuring and monitoring flood resilience and assessing the impact of flood resilience building projects or programs. As of October 2016, baseline resiliency measurements have been completed in about 65 of the communities.

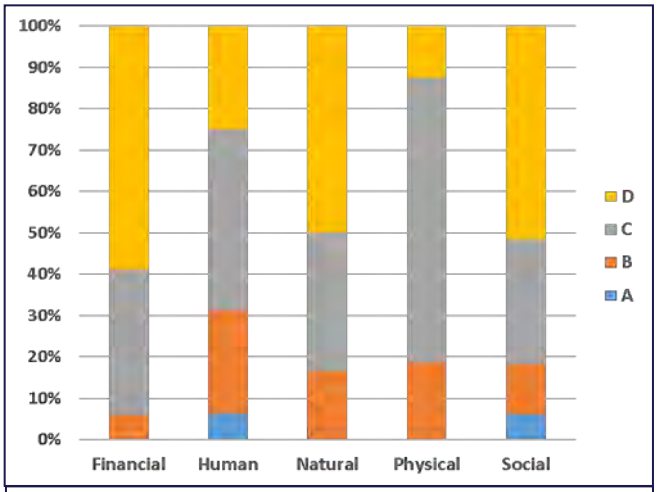

Figure 1. Assessment of sources of resilience in Tabasco, Mexico

The tool assesses 88 sources of resilience across the five capitals (human, social, physical, natural and financial) often referred to as the Sustainable Livelihoods Framework. Data is collected via a mixed-methods approach including household surveys, community focus groups, interviews of key informants, input from interest groups, and publicly available data. Evaluation of the community's sources of resilience takes a risk engineering technical standard approach where every source is awarded a letter grade of A to D. An example from a community in Tabasco, Mexico is presented in Figure 1. The graph shows the percent of each capital's sources receiving an A, B, C or D. For example, there are 17 sources of financial capital resiliency; in this community, 59% were scored as D, 46% were scored as C, and 5% were scored as B.

If a flood occurs in a community, actual resilience in terms of losses and recovery time will also be measured; this two-timeframe approach will help us ascertain whether our approach does, in fact, measure actual resilience. While the measurement tool helps to identify potential areas for intervention, choosing interventions is a complex process which must consider multiple factors and perspectives.

The research teams at Wharton and IIASA have begun gathering qualitative feedback from the teams using the tool in the communities. NGO partners report that beyond its potential value for measuring resilience, the tool gives them a structure to perform a deeper analysis of communities. Ultimately, this will contribute to a better understanding of how to build sources of resilience holistically so that communities at risk for floods in developed and developing countries not just survive, but thrive.

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[1] Operationalizing Resilience Against Natural Disaster Risk: Opportunities, Barriers and A Way Forward. Zurich Flood Resilience Alliance. http://opim.wharton.upenn.edu/risk/library/ZAlliance-Operationalizing-Reslience.pdf

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What Motivates Households in Vulnerable Communities to Take Flood Preparedness Actions? *Findings from Applied Research in Tabasco, Mexico*

An outcome of the Alliance team's partnership with the **Mexican Red Cross** and **Zurich Insurance Mexico** (see the Wharton *Risk Management Review* 2015, page 8 https://riskcenter.wharton.upenn.edu/newsletters/) is our case study to determine what factors motivate individual households to reduce flood risk.

Using data collected from ten communities in Tabasco where the Zurich Mexico Alliance conducted baseline assessments in 2015, we measured what drives residents to:

- take action to protect belongings in advance of a flood
- identify a safe meeting point to go to during a flood
- change method of water purification during a flood
- participate in first aid training or disaster drills

We find that a number of factors already in place in the surveyed communities — such as knowledge of flood risk maps, early warning systems, availability of shelter — emerge as the significant drivers of preparedness actions.

For example, the probability of taking part in emergency preparedness is greater by 12 percent for those who know the risk maps — yet only 8 percent of the survey respondents indicated knowing their community's risk map. These results suggest opportunities to work with communities to better select interventions that are more likely to lead to concrete preparedness actions taken.

See the full case study at http://opim.wharton.upenn.edu/risk/library/ZAlliance-what-motivates-households-IB-2016.pdf.

What Motivates Households in Vulnerable Communities to Take Flood Preparedness Actions? Czajkowski, Jeffrey, Ajita Atreya, Wouter Botzen, Gabriela Bustamante, Karen Campbell, Ben Collier, Alexandra Herrera, Francisco Ianni, Howard Kunreuther, Erwann Michel-Kerjan, Marilyn Montgomery & Luis Perez Garcia. Zurich Flood Resilience Alliance - Mexico (2016).

The Wharton Risk Center joins the Alliance partners in welcoming Lucile Robinson to the team! In her role as Knowledge Catalyst, Lucile coordinates among the partners (Zurich, Wharton, IIASA and Practical Action) and IFRC countries for the Zurich Flood Resilience Program.

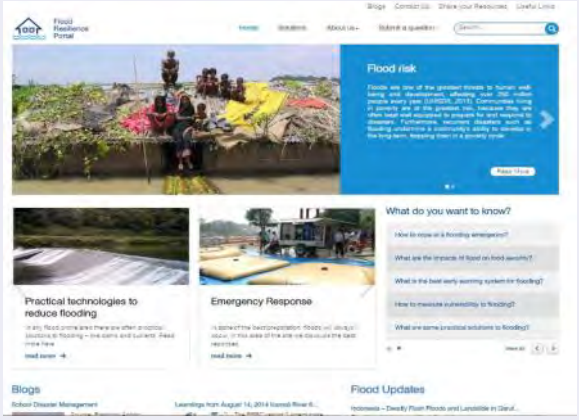
Making Flood Resilience Knowledge Accessible: New Flood Resilience Portal

Although there is a vast amount of information on disaster and risk reduction (DRR) available to government and civil society who work on flood resilience, a study by Alliance member Practical Action, reveals a knowledge gap between policy makers and academics, and community leaders and facilitators.

In response to this need, Alliance partners, led by Practical Action, developed the Flood Resilience Portal to facilitate sharing of knowledge about building resilience to flooding. Practitioners can use the interactive platform to share innovations and view videos, research reports, manuals, and toolkits to assist them in building flood resilience in hazard-prone communities. We invite input from all stakeholders working in flood resilience. Practical Action staff members synthesize the material to draw out lessons and actionable recommendations for practitioners in the field.

To increase its relevance to local contexts, the portal is being developed in Spanish and Nepali by the Zurich Flood Resilience partners in coordination with governmental and non-governmental stakeholders. These country and region-specific platforms will enable practitioners to access the most locally-relevant flood risk reduction resources.

Visit the portal at: http://floodresilience.net/. For more information, please contact semina.kafle@practicalaction.org.np.



Homepage of the flood resilience portal

OECD High-Level Advisory Board on the Financial Management of Catastrophic Risks

The Wharton Risk Center took an active role in the **OECD's** invitation-only conference on **Financial Management of Flood Risk: Building Financial Resilience in a Changing Climate** at OECD headquarters in Paris, May 10-13, 2016. The event brought together 150 senior policymakers (including several heads of national flood insurance programs in Europe and Asia, Oceana and the United States), executives from insurers, reinsurers, brokers, risk modelling firms, rating agencies, and leading experts from 40 countries, all concerned about the need to improve flood risk management and enhance flood insurance markets.

Wharton Risk Center executive director Erwann Michel-Kerjan, who chairs the OECD advisory board, opened the conference along with then-**OECD Deputy Secretary General** Rintaro Tamaki, **Alice Hill** (**White House**) and **Saad Mered** (**Zurich Insurance**). The event was supported by a financial contribution from Zurich Insurance (see p.age18).

Flooding is one of the most common and destructive natural disasters, affecting tens of millions of people around the world each year and causing, on average, more than USD 200 billion in damages. The financial management of flood risk presents a significant policy challenge in many countries, requiring consideration of the relative effectiveness various tools to manage flood risk, from investments in risk prevention and public awareness, to the use of risk transfer tools to protect against significant post-disaster costs. The OECD conference provided a unique forum for governments to compare policy experiences, seek answers to common problems, identify good practices and work to co-ordinate domestic and international policies. Participants exchanged knowledge and shared experience on managing flood risk, comparing different approaches across OECD countries. The session on the financial management of flood risk addressed the evolving nature of flood risk — understanding flood drivers and impacts, and building financial resilience against flood risk in developing countries. Howard Kunreuther and several of the Center's corporate partners presented on "Supporting insurability and affordability — challenges and innovations."

First OECD conference on "Financial Management of Flood Risk: Building Financial Resilience in a Changing Climate" in Paris, France, May 2016.

In addition to flood, the OECD continues its work on the **financial management of earthquake risk.** Earthquakes are among the most devastating of perils, causing significant economic losses around the world, requiring governments to develop sound approaches for managing their financial implications.

These topics follow the OECD's work on **terrorism and cyber risk,** specifically on the nature and level of the terrorism threat, market developments in terrorism risk insurance, compensation for victims of terrorism, cyber threats, and modeling terrorism scenarios. The fourth bi-annual international conference on **Global Terrorism Risk Insurance** took place in Australia in October 2016. OECD meetings on terrorism risk insurance were previously held at OECD headquarters in Paris in 2010 and 2012, and at the U.S. Department of the Treasury in Washington, DC in 2014.

For more information, see http://www.oecd.org/daf/fin/insurance/2016-oecd-conference-financial-management-flood-risk.htm.

Risk Center Partners with the World Economic Forum on *Global Risks 2016*

Now in its 11th year, the *Global Risks Report* highlights significant long-term risks worldwide. Close to 750 experts drawn from business, academia, civil society and the public sector, spanning geographies and age groups in the World Economic Forum's multistakeholder communities responded to the 2016 Global Risks Perception Survey to rank global risks of highest concern over two time horizons, 18 months and 10 years. The report also identifies global "trends" that can potentially drive global risks. Unlike risks, trends are occurring with certainty and can have both positive and negative consequences.

Trends can alter how risks evolve and interrelate, and they inform efforts at risk mitigation. Global risks that have recently been in the headlines — such as large-scale involuntary migration, interstate conflict and cyberattacks — tend to feature as short-term concerns, indicating that recent events significantly influence our thinking about risks and, hence, stakeholder action. Longer-term concerns are more related to underlying physical and societal trends, such as water crises and the failure of climate change mitigation and adaptation.

Interestingly, extreme weather events and social instability are considered a concern in both the short and long term, reflecting an expectation that the frequency and intensity of crises will continue to rise. Emerging global risks and major trends, such as climate change, cyber dependence and income disparity are impacting already-strained societies. Geopolitical concerns remain prominent in the minds of respondents to the Global Risks Perception Survey for the second year in a row. Three scenarios for possible futures inform new ways of building resilience to security threats through public-private collaboration. The report also focuses on the importance of long-term thinking about global risks, such as attempting to limit the extent of climate change and to adapt to the change that is already inevitable.

Survey respondents were asked to identify between three and six pairs of global risks they believe to be most interconnected. The global risk interconnection map and other graphics are at http://reports.weforum.org/global-risks-2016/shareable-infographics/.

The World Economic Forum's *Global Risks Report* is written with input from strategic partners Marsh & McLennan and the Zurich Insurance Group, and academic advisers from the National University of Singapore, the University of Oxford, and the Wharton Risk Management and Decision Processes Center, University of Pennsylvania.

Top 5 Global Risks (Likelihood) from the *Global Risks Report 2016*

	2008	2009	2010	2011	2012	2013	2014	2015	2016
1st	Asset price collapse	Asset price collapse	Asset price collapse	Meteorological catastrophes	Severe income disparity	Severe income disparity	Income disparity	Interstate conflict with regional consequences	Large-scale involuntary migration
2nd	Middle East instability	Slowing Chinese economy (<6%)	Slowing Chines e economy (<6%)	Hydrological catastrophes	Chronic fiscal imbalances	Chronic fiscal imbalances	Extreme weather events	Extreme weather events	Extreme weather events
3rd	Failed and failing states	Chronic disease	Chronic disease	Corruption	Rising greenhouse gas emissions	Rising greenhouse gas emissions	Unemployment and underemployment	Failure of national governance	Failure of climate-change mitigation and adaptation
4th	Oil and gas price spike	Global governance gaps	Fiscal crises	Biodiversity loss	Cyber attacks	Water supply crises	Climate change	State collapse or crisis	Interstate conflict with regional consequences
5th	Chronic disease in developed world	Retrenchment from globalization (emerging)	Global governance gaps	Climatological catastrophes	Water supply crises	Mismanagement of population ageing	Cyber attacks	High structural unemployment	Major natural catastrophes

Economic Environmental Geopolitical Societal Technological

The Risk Center Welcomes New Postdoctoral Fellows

Dr. Shereen Chaudhry

Shereen's research examines how the exchange of "credit" and "blame" affects emotional and behavioral responses to situations as well as attributions of character. Her work has demonstrated that failing to thank can harm both personal and working relationships, and furthermore, that people underestimate the value of thanking and apologizing to others. At the Risk Center, Shereen will examine the ramifications of thanking, apologizing, bragging, and blaming for teams and leadership when either the outcome of effort is uncertain or the share of one's responsibility is uncertain. She will also investigate the role of apologizing and blaming in impacting the public response to natural disasters and other public emergencies. Shereen received her Ph.D. in Behavioral Decision Research from the Department of Social and Decision Sciences at Carnegie Mellon University. She earned a B.S. in Brain and Cognitive Sciences at MIT and a Master of Health Administration at Cornell University.

Dr. Gina Tonn

Gina's research interests include risk analysis and management for natural hazards, resilient infrastructure systems, sustainable water resources management, and climate change adaptation. Her interdisciplinary studies involve the application of systems analysis methods in conjunction with water resources and environmental engineering methods to improve the understanding and management of risks associated with natural hazards in a changing climate. Gina's professional experience in environmental and water resources engineering includes floodplain modeling, mapping, and management, stormwater design, and cost-benefit analysis. Gina received her Ph.D. in Geography and Environmental Engineering from Johns Hopkins University where she was an IGERT Water, Climate, and Health trainee. She earned a B.S. in Biological Systems Engineering from Virginia Tech with a concentration in Land and Water Resources Engineering and an M.S. in Management of Technology from Vanderbilt University.

Prof. Alexander Muermann (Vienna University of Economics and Business) and a senior fellow of the Wharton Risk Center received the **Robert I. Mehr Award** for the paper published ten years ago in the ***Journal of Risk and Insurance*** that has best stood the test of time, for: Braun, M., and A. Muermann, 2004, The Impact of Regret on the Demand for Insurance, *Journal of Risk and Insurance,* 71(4), 737-767.

Prof. Muermann currently serves as President of the Risk Theory Society and as Vice President of the European Group of Risk and Insurance Economists (EGRIE).

2015 Paul R. Kleindorfer Scholar

Congratulations to **Fei Gao**, recipient of the *Paul R. Kleindorfer Scholar Award.*

The Operations, Information and Decisions (OID) department of the Wharton School established the *Paul R. Kleindorfer Memorial Fund* to honor the memory of Emeritus Professor Paul Kleindorfer, a former department chair and a co-director of the Wharton Risk Center. The award recognizes the OID doctoral student who is making the most outstanding progress towards the completion of his or her dissertation and provides $4,000 of research support.

Fei is a fourth year doctoral student in the OID department. His dissertation focuses on the impacts of different omnichannel strategies (e.g., in-store pickup, online showrooms, self-order apps) in the retail and quick-service restaurant industries.

Contributions to the Paul R. Kleindorfer Memorial Fund may be sent to the attention of Alison Matejczyk, 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" in the memo field.

Risk Regulation Seminars

Climate Change Regulations for the 21st Century

By Katie Cramer, http://www.pennreg.org/ppr-news

Drawing from his experience negotiating the first major global climate treaty at the Earth Summit in Rio de Janeiro in 1992, **Daniel Esty**, a professor at Yale Law School, brought his unique perspective on how to create effective climate policies to the Risk Regulation Seminar series.

Esty argued that the underlying international legal framework is strategically flawed. The Framework Convention placed primary responsibility for reducing greenhouse gas emissions with heads of state. But presidents and prime ministers actually have little control over carbon footprints. Instead, he argued, a new climate strategy must engage with a broader set of leaders, including CEOs, governors, and mayors. In addition, the Framework Convention mistakenly prioritized timelines and emissions-reduction targets over programs that enable countries to reduce emissions.

The Framework Convention also assigned emissions cuts to member states based upon each nation's status as a developing or developed country. Dividing member states in this manner missed an opportunity to frame climate change as a collective challenge, Esty argued.

Instead, a communal strategy could shift the focus to who pays rather than who emits, meaning firms and governments would pay for pollution costs based on relative emissions output, instead of ascribing emissions ceilings to nations based on development status. Such an approach could motivate more developing countries to proceed directly to clean energy sources instead of developing fossil fuel energy infrastructure.

Yale Law School Professor Daniel Esty delivers remarks at the Risk Regulation seminar co-hosted by the Penn Program on Regulation and the Wharton Risk Management Center.

The **Risk Regulation Seminar Series** brings distinguished speakers to address topics of importance to academia, industry and public policymakers. The series is sponsored by the Penn Program on Regulation and the Wharton Risk Center. Seminars are free and open to the public. For more information, see http://www.pennreg.org/events/.

April 5, 2016 (see page 17)
What's New in Terrorism Risk Analysis and Homeland Security?
SEMINAR RECORDING: http://whr.tn/29mVmrZ
Article: http://www.regblog.org/2016/08/25/xu-how-should-we-measure-terrorism-risk/
Detlof von Winterfeldt, Professor of Public Policy and Management, University of Southern California; Co-founder and Director, Center for Risk and Economic Analysis of Terrorism Events (CREATE)

March 1, 2016
Net Benefits of the Acid Rain Program
Maureen Cropper, Distinguished Professor of Economics, University of Maryland, and Senior Fellow, Resources for the Future. Formerly a Lead Economist at the World Bank and chair of the EPA Science Advisory Board Environmental Economics Advisory Committee

February 16, 2016
Living with Climate Change: Will Paris Make a Difference?
SEMINAR RECORDING: http://whr.tn/1QvY1dC
Dale Jamieson, Professor of Environmental Studies, New York University
Jennifer Jacquet, Asst. Professor of Environmental Studies, New York University
The force of the Paris agreement rests more on social and political obligations, and corporations than on legal authority. This talk examines the ways the Paris Climate Summit COP21 adds to the UNFCCC agreement of 1992.

November 17, 2015
Global Perspectives on the Dutch Climate Change Litigation
Article: http://www.pennreg.org/2015/12/09/bodnar-judges-solve-climate/
Jointly sponsored by the Kleinman Center for Energy Policy.
Roger Cox, Partner, Paulussen Advocaten (attorney for Urgenda Foundation)
Lucas Bergkamp, Partner, Hunton & Williams (Brussels)
Veerle Heyvaert, London School of Economics

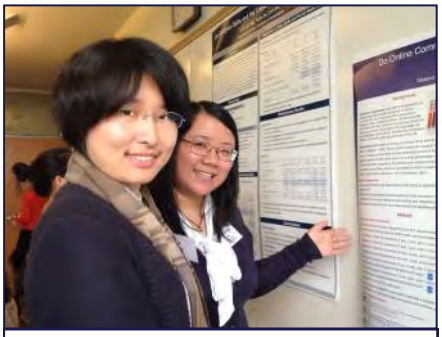
October 27, 2015 (see sidebar at left)
From 20th Century Environmental Protection to 21st Century Sustainability
Article: http://www.pennreg.org/2015/11/30/cramer-ppr-esty-climate-change-regulations/
Daniel C. Esty, Yale Law School & Yale School of Forestry & Environmental Studies
Modern environmental law builds on a 1970s model focused on "command and control" mandates from the federal government. An alternative 21st Century "sustainability" strategy might reinvigorate the response to today's residual environmental problems and related energy challenges.

October 13, 2015
Reshaping the Financial Regulatory System
Article: http://www.pennreg.org/2015/11/16/weeks-volcker-alliance-ppr/
Michael Bradfield, General Counsel, Volcker Alliance
Shelley H. Metzenbaum, Senior Advisor, Volcker Alliance
Gaurav Vasisht, Director, Financial Regulation, Volcker Alliance
Three members of the Volcker Alliance address regulatory vulnerabilities and weaknesses remaining after the Dodd-Frank Act and new vulnerabilities that have emerged in the financial system.

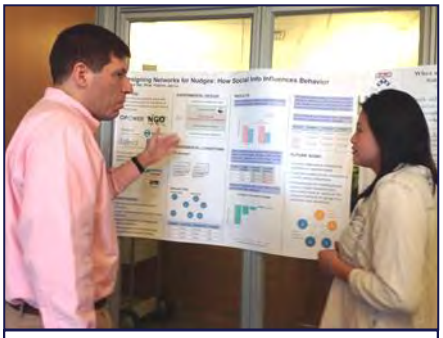
Russell Ackoff Doctoral Student Fellowship Awards 2016

The Wharton Risk Center is pleased to announce the recipients of its 2016 Russell Ackoff Doctoral Student Fellowships. Prof. Emeritus Russell Ackoff's (1919-2009) work was dedicated to furthering understanding of human behavior in organizations. The fellowships are funded by an endowment provided to the Wharton School by the Anheuser-Busch Charitable Trust that also funded a chair held by the late Prof. Emeritus Paul Kleindorfer, formerly a co-director of the Wharton Risk Center. The awards fund data collection, conference fees and other research expenses for studies in human decision making by doctoral students in Wharton and other schools at the University of Pennsylvania. See http://riskcenter.wharton.upenn.edu/russell-ackoff-doctoral-student-fellowships/.

Risk Center directors Howard Kunreuther, Bob Meyer and Erwann Michel-Kerjan



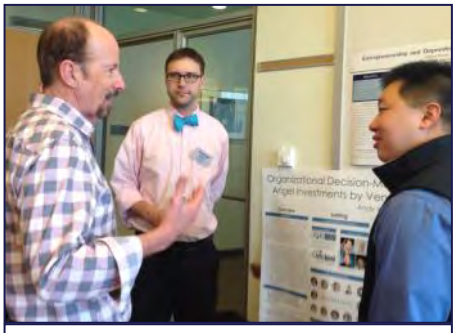
Fujie Jin (OID) and Jiaying Liu (Annenberg School)



Prof. Eric Bradlow (Marketing) and Joy Lu (Marketing)

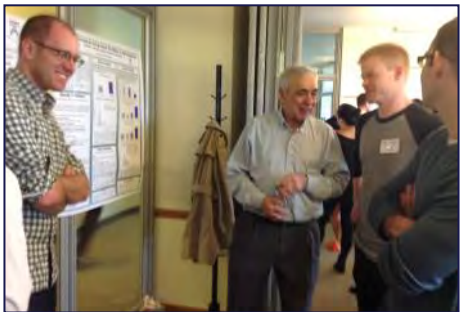
Ana Gazmuri (BEPP), Alix Barasch (Marketing), Evan Leive (Health Care Mgmt), and Preethi Rao (Health Care Mgmt)

An important component of the Ackoff program is the opportunity for doctoral students involved in decision research to connect with each other. Recipients of the 2015 Ackoff Doctoral Student Fellowships presented their research at the annual Ackoff luncheon. Some 50 students and faculty attended the event which coincided with the announcement of the 2016 awards. This year, fellowships were awarded to 26 doctoral students at Penn.



Prof. Bob Meyer (Marketing; co-director of the Risk Center), Andrew Boysen (Finance), and Andy Wu (BEPP)

Brook Kelly (Marketing), Jackie Silverman (Marketing), and Emma Boswell (Health Care Mgmt)



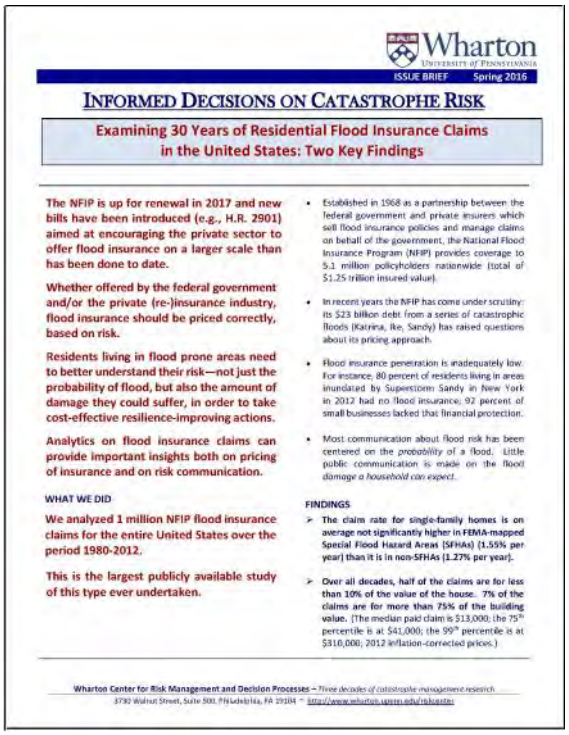
Rob Mislavsky (OID), Prof. Howard Kunreuther (OID; co-director of the Risk Center), and Berkeley Dietvorst (OID)

Prof. Roberta Iversen (Social Policy & Practice) with advisee Chenyi Ma, and Risk Center post-doc Marilyn Montgomery

RECIPIENT	DEPARTMENT	PROPOSAL TITLE
Josh Baker	Marketing	On the Evaluation of Beliefs: a Method for Assessing Credibility in Subjective Probability Judgment
Jiayi Bao	Business Economics & Public Policy (BEPP)	Equality and Equity in Compensation
T. Bradford Bitterly	Operations, Information & Decisions (OID)	The Impact of Power on Humor
Edward Chang	Operations, Information & Decisions (OID)	"Twokenism" on Corporate Boards: Threshold Effects and Gender Diversity
Shulamite Chiu	Health Care Mgmt & Economics	The Supply-Side Effects of Insurance Expansions – the Case of Dentistry
Amanda Chuan	Applied Economics	Online Peer to Peer Markets and Information Transmission Mechanisms
Andrea Contigiani	Management	Motivation, Experimentation, and Creativity
Celia Gaertig	Operations, Information & Decisions (OID)	The Effects of High vs. Low Confidence on Perceived Advisor Quality
Stephen Glaeser	Accounting	The Effects of Proprietary Information: Evidence from Trade Secrecy
Natalie Herbert	Annenberg School for Communication	Is Inequality Inescapable? Modeling and experimental studies on structural inequality
Zheng Huang	Business Economics & Public Policy (BEPP)	Click Here to Save the World: Slacktivism in Charitable Giving
Brooke Kelly	Marketing	The First-Mover Authentic Advantage
Kwon Lee	Statistics	Discovering Effect Modification in Matched Observational Studies with Multiple Controls
Stella Lee	Annenberg School for Communication	The Effect of Message Construal Level on Subsequent Conversational Content
Joshua Lewis	Operations, Information & Decisions (OID)	Differing Ethical Preferences for Friends and Leaders
Bowen Lou	Operations, Information & Decisions (OID)	Do Happy Workers Make Productive Firms? An Empirical Study of Online Job Evaluations, Hiring Outcomes and Firm Performance
Robert Mislavsky	Operations, Information & Decisions (OID)	Discrete Loss Aversion
Kate Odziemkowska	Management	Social Risk Mitigation: The Role of Firm-Community Contracting
Sydney Scott	Marketing	Naturalness of a Product is a Trustworthiness Cue
Shalena Srna	Marketing	The Perception of Multitasking and Performance
Basima Tewfik	Management	Quit While You're Ahead: Understanding the Impact of the Impostor Phenomenon on Decision Making at Work
Evan Weingarten	Marketing	Modeling Multiple Goals as Reference Points
Jia Xue	Social Policy	Social Media and Agenda-setting for Intimate Partner Violence in the US and China: Comparison between Twitter and Weibo
Sijia Yang	Annenberg School for Communication	Can Tailored Value Appeals Correct Misconceptions about Scientific Controversies and Motivate Online Commenting to Promote Consensus Among Scientists?
Lori Young	Annenberg School for Communication	The Influence of Poverty Discourse on the Political Attitudes and Preferences of Low-Income Citizens
Mingli Zhong	Business Economics & Public Policy (BEPP)	Optimal Defaults in 401(k) Plans

Wharton Risk Center Issue Briefs

The Wharton Risk Center's issue briefs are short, non-technical summaries distilling the Center's new research findings and the team's best thinking on how the findings can be applied to the management of catastrophic risks.



Wharton
University of Pennsylvania

ISSUE BRIEF Spring 2016

INFORMED DECISIONS ON CATASTROPHE RISK

Examining 30 Years of Residential Flood Insurance Claims in the United States: Two Key Findings

The NFIP is up for renewal in 2017 and new bills have been introduced (e.g., H.R. 2901) aimed at encouraging the private sector to offer flood insurance on a larger scale than has been done to date.

Whether offered by the federal government and/or the private (re-)insurance industry, flood insurance should be priced correctly, based on risk.

Residents living in flood prone areas need to better understand their risk—not just the probability of flood, but also the amount of damage they could suffer, in order to take cost-effective resilience-improving actions.

Analytics on flood insurance claims can provide important insights both on pricing of insurance and on risk communication.

WHAT WE DID

We analyzed 1 million NFIP flood insurance claims for the entire United States over the period 1980-2012.

This is the largest publicly available study of this type ever undertaken.

- Established in 1968 as a partnership between the federal government and private insurers which sell flood insurance policies and manage claims on behalf of the government, the National Flood Insurance Program (NFIP) provides coverage to 5.1 million policyholders nationwide (total of $1.25 trillion insured value).
- In recent years the NFIP has come under scrutiny: its $23 billion debt from a series of catastrophic floods (Katrina, Ike, Sandy) has raised questions about its pricing approach.
- Flood insurance penetration is inadequately low. For instance, 80 percent of residents living in areas inundated by Superstorm Sandy in New York in 2012 had no flood insurance; 92 percent of small businesses lacked that financial protection.
- Most communication about flood risk has been centered on the *probability* of a flood. Little public communication is made on the flood *damage a household can expect*.

FINDINGS

- The claim rate for single-family homes is on average not significantly higher in FEMA-mapped Special Flood Hazard Areas (SFHAs) (1.55% per year) than it is in non-SFHAs (1.27% per year).
- Over all decades, half of the claims are for less than 10% of the value of the house. 7% of the claims are for more than 75% of the building value. (The median paid claim is $13,000; the 75th percentile is at $41,000; the 99th percentile is at $316,000; 2012 inflation-corrected prices.)

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 2015-2016 series includes:

- A proposed voucher and loan program for cost-effective loss-reduction measures to make flood insurance affordable in Charleston County, South Carolina
- Key findings from an examination of 30 years of residential flood insurance claims in the United States
- The role of insurance and other strategies to increase resilience to floods

Issue briefs are available on the Center's website, http://riskcenter.wharton.upenn.edu/issue-briefs/ To request hard copies, please contact Carol Heller, hellerc@wharton.upenn.edu.

Proposal to Make Flood Insurance Affordable in Charleston County, South Carolina: Vouchers Coupled with Loans to Elevate Homes

Our study finds that if premiums reflected risk, the price of flood insurance for many properties in Special Flood Hazard Areas (SFHAs) in Charleston County, South Carolina could more than double over their current subsidized premiums. Elevating a house a few feet can decrease the risk-based premium by 70 to 80 percent, saving thousands of dollars annually. We find that coupling vouchers with mitigation loans to elevate homes can reduce government expenditures by more than half over a voucher program that does not require mitigation when the cost of elevating a house is about $25,000 in high hazard A zones. In the coastal V zones, cost savings can be achieved even when the cost of elevation is as high as $75,000.

Examining 30 Years of Residential Flood Insurance Claims in the United States: Two Key Findings

We find no statistically significant difference in the claim rates in FEMA-mapped 100-year floodplains (SFHAs) and outside the 100-year floodplains. This higher-than-expected claim rate in non-SFHAs could reflect inaccurate and out-of-date flood maps. It could also be due to adverse selection: only the riskiest properties in FEMA-defined non-SFHAs are insuring in these areas. Our results show that the majority of claims are for modest amounts. Half of the claims over the three decades of data we analyzed are for less than 10 percent of the building's value. Only a small portion of claims exceed three-quarters of a building's value.

Flood Insurance and Potential Improvements

A well-designed insurance program can play an important role in linking investment in cost-effective reduction measures with financial protection should a disaster occur. Measures to increase resilience to floods include improved accuracy of flood maps and communication on flood risk, elevation certification for at-risk structures, vouchers and/or other financial aid for homeowners to purchase flood insurance and undertake loss-reduction measures that will also address affordability issues, and government acquisition of at-risk properties for open space and flood buffer zones.

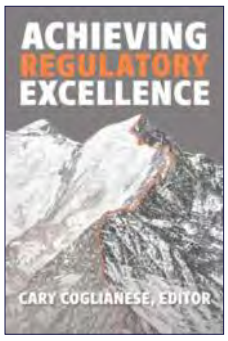
New Books

What defines success for a regulator?

Whether striving to protect citizens from financial risks, climate change, inadequate health care, or uncertainties of the emerging "sharing" economy, regulators must routinely make difficult judgment calls in an effort to meet the conflicting demands that society places on them. *Achieving Regulatory Excellence* offers insights from leading international experts on how regulators can set appropriate priorities and make sound, evidence-based decisions through processes that are transparent and participatory.

Contributors: Robert Baldwin, Angus Corbett, Daniel C. Esty, Adam M. Finkel, Ted Gayer, John D. Graham, Neil Gunningham, Kathryn Harrison, Bridget M. Hutter, Howard Kunreuther, David Levi-Faur, Shelley H. Metzenbaum, Donald P. Moynihan, Paul R. Noe, Gaurav Vasisht, David Vogel, Wendy Wagner.

Edited by Cary Coglianese, Edward B. Shils Professor of Law at the University of Pennsylvania, and director of the Penn Program on Regulation.



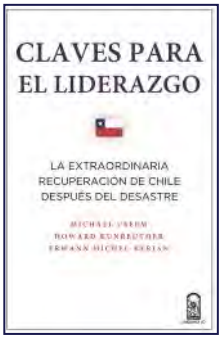
Hardcover
260 pages
Brookings Institution Press
ISBN: 9780815728429
https://www.brookings.edu/book/achieving-regulatory-excellence/

Following a series of severe earthquakes in Ecuador in 2016, its leaders are looking to learn from Chile's experience. About 50 executives from private firms in Ecuador and multinationals attended a video presentation by Luis Ballesteros, Michael Useem, Howard Kunreuther and Erwann Michel-Kerjan on *Leadership Dispatches: Chile's Extraordinary Comeback from Disaster* (Stanford University Press, 2015), that analyzed the leadership lessons that enabled Chile's success in managing the crisis and recovery from its massive earthquake in 2010. The presentation was organized by Santiago Hidalgo of Renaissance Executive Forums in Quito, Ecuador.

Audience questions focused on ways private sector firms could help their country by offering leadership, and monetary and in-kind contributions.

Recent seismic activity in several Latin American countries has spurred interest in a Spanish translation of *Leadership Dispatches.*

The new release is entitled *Claves Para El Liderazgo* (translation by Ediciones Universita Catholica; publication by Stanford University Press, forthcoming).



Stanford University Press
ISBN: 978-956-14-1814-1

Forthcoming Books

The Future of Risk Management
Howard Kunreuther, Robert Meyer and Erwann Michel-Kerjan, eds., with E. Blum (University of Pennsylvania Press) (see page 2)

Improving Homeland Security Decisions
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Rethinking Catastrophic Risks: How Corporate America Copes with Disruption
Howard Kunreuther, Erwann Michel-Kerjan and Michael Useem (Oxford University Press) (see page 6)

SELECTED PUBLICATIONS more at http://riskcenter.wharton.upenn.edu/publications/

Adaptation to Climate Risks: Political affiliation matters

Study looks at perceptions of New York City residents after Superstorm Sandy

People who affiliate with the Democratic Party have different views on the likelihood of floods and hurricanes, adopting protection measures, and expectations of government disaster relief than those who vote Republican or Independent. Study findings are based on survey data collected six months after Superstorm Sandy of 1,035 homeowners with ground level property in flood-prone areas of New York City. Political affiliation was determined by what party respondents voted for in the November 2012 presidential election. Among the findings:

- Democrats' perception of their probability of experiencing flood damage is significantly higher than Republicans'. They are also more likely to expect climate change will increase the flood risk in the future.
- Fewer than half of Democrats and a third of Republicans trust the government to address the flood risk posed in their area of residence.
- Twice as many Democrats as Republicans in the study expect to receive federal disaster relief after a major flood. In particular, 40% of Democrats expect to receive relief compared to only 27% of Republicans. Among those, the expected government compensation as a percentage of damage is higher for Democrats at 23%, versus 15% for Republicans.
- Take-up rates for flood insurance were similar among Democrats and Republicans in our study. We find that 66% of our respondents had flood insurance five months after Superstorm Sandy. A slightly higher proportion of Democrats (69%) had insurance compared with Republicans (64%). This similarity may be due to the U.S. mandatory insurance requirement for most homeowners in the 1-in-100 year flood zone.

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Botzen, Wouter, Erwann Michel-Kerjan, Howard Kunreuther, Hans de Moel, & Jeroen C.J.H. Aerts. **Political affiliation affects adaptation to climate risks: Evidence from New York City**. *Climatic Change,* 138(1): 353-360 (2016).

(When) Are We Dynamically Optimal? A Psychological Field Guide for Marketing Modelers

How should a firm best allocate its resources to maximize profits? Since the 1960s, a large stream of literature in experimental psychology and behavioral economics has examined the degree to which people act as intuitive statisticians when making decisions under uncertainty over time. The advice it offers seems bleak. Sometimes people pay too much attention to the data (display base-rate neglect) or too much attention to the priors (the representativeness heuristic).

Likewise, studies of strategic thinking have shown that people rarely consider consequences beyond the shortest of future horizons and almost never engage backward induction, the solution used to compute optimal behavior in many dynamic planning problems. Opportunities for learning are rare, and when they do arise, the feedback that is received is often ambiguous. Markets are viewed as natural experiments in which firms make naive choices and the winners are those that happen to stumble upon the right ones.

A reasonable take on the current state of affairs is that the extant technology for structural modeling offers a step in the right direction but is far from a policy panacea. The more a modeler needs to make unrealistic assumptions about a behavioral process to accommodate the limitations of a given data set, the less believable the insights from resulting policy simulations become. At some point, simple reduced form statistical models will offer a better source of guidance. But therein lies an opportunity: if the Holy Grail of empirical strategy work is to be found, it will be through a fusing of economic and psychological modeling, one that aims to capture the ideal decisions consumers aspire to make as well as the mechanisms through which contextual and cognitive constraints leave them short of that goal.

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KNOWLEDGE@WHARTON

July 9, 2016, Why the Climate Change Debate Has Cooled Off. (podcast) Howard Kunreuther and Erwann Michel-Kerjan discuss the climate change debate in the presidential election season.

February 5, 2016, How Risk Management Can Adapt to an Era of 'Truly Remarkable' Change. The 10 costliest natural disasters in modern history have occurred since 1985, the year when the Wharton Risk Management and Decision Processes Center was launched by co-director Howard Kunreuther.

December 17, 2015, What Have the Past 30 Years Taught Us About Managing Risk? (podcast) Howard Kunreuther, Robert Meyer and Erwann Michel-Kerjan discuss the Risk Center's research and how managing risk has changed over the past few decades.

December 1, 2015, Will the Outcome of the Paris Climate Summit Have Any Teeth? (podcast) Howard Kunreuther and Andrew Hoffman discuss the COP21 summit.

November 17, 2015, How Should Nations Respond to the ISIS Threat? Erwann Michel-Kerjan and Brendan O'Leary discuss the Paris attacks and strategies to counter ISIS.

Critical Infrastructure Resilience Institute
MEASURING AND REWARDING RESILIENCE

The Risk Center has begun a joint initiative supported by the **U.S. Department of Homeland Security (DHS)** with **Northeastern University** in Boston (collaborating with the **Center for Resilience Studies at Northeastern University** led by Stephen Flynn) and the **University of Illinois** (which leads the overall initiative). This multi-year effort, the **Critical Infrastructure Resilience Institute**, aims at measurably improving the resilience of our nation's critical infrastructure to natural and man-made disasters, specifically:

- Understanding the obstacles faced by owners/operators of critical infrastructure in preparing for and recovering from natural and man-made disasters and ways that they can strengthen their resilience capability. Obstacles can be economic, behavioral, technical, political or governance-related.
- Learning what actions owners of infrastructure have taken to reduce potential losses and facilitate recovery from natural and man-made disasters or other severe disruptions.
- Evaluating how disaster insurance and other financial tools can encourage preventive actions, provide adequate protection and enhance recovery efforts following a major disruption.

The Risk Center's work focuses on the role that the insurance industry can play in encouraging investment in pre-disaster actions to reduce infrastructure owners and operators' exposure and reliance on uncertain disaster relief from the federal government. Moreover, transferring some of the currently substantial public sector's exposure to the private sector will also allow DHS to more effectively allocate its limited budget.

The Risk Center has commenced discussions with executives at insurance trade organizations and major firms in the insurance and reinsurance industry that provide coverage to critical infrastructure owners and operators (particularly, transportation and energy sectors) as a first step in identifying and overcoming barriers that are hindering infrastructure resilience. To lay the groundwork, initial conversations center on the coverage that insurers offer to critical infrastructure.

The Wharton Risk Center is pleased to welcome Credit Suisse as a new corporate partner for its Managing and Financing Extreme Events project.

"As the leading investment banking advisor to the insurance industry, Credit Suisse has a strong interest in raising awareness about the importance of effective risk management and the role that insurance can play to bring stability to the market in times of natural and man-made peril. We believe that the Wharton Risk Center's ability to undertake critical research and facilitate a dialogue amongst various constituents uniquely positions it to help guide the industry towards making better risk decisions," says Alejandro Przygoda, Managing Director and Head of Credit Suisse's Global Financial Institutions Group.

During the past 15 years there has been increasing interaction between insurance and financial institutions in developing strategies for reducing future losses from natural and man-made disasters. Credit Suisse will enable the Risk Center to systematically examine alternative strategies that have a good chance of being implemented.

Credit Suisse AG is one of the world's leading financial services providers. Credit Suisse provides advisory services, comprehensive solutions and innovative products to companies, institutional clients and high-net-worth private clients globally, as well as to retail clients in Switzerland. Credit Suisse is headquartered in Zurich and operates in over 50 countries worldwide.

PENN WHARTON
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Penn Wharton Public Policy Initiative

The Penn Wharton Public Policy Initiative (PPI) is a hub for research and education, with offices on Penn's campus and in Washington, DC, focused on leveraging the University's resources to improve federal policymaking on issues impacting business and the economy. The Initiative works with faculty and research centers across the University to share their expertise with policymakers through the publication of nonpartisan, data-driven issue briefs. See *Insurance against Extreme Events: Pairing Short-Term Incentives with Long-Term Strategies* by Wharton Risk Center co-director Howard Kunreuther, at https://publicpolicy.wharton.upenn.edu/issue-brief/v4n7.php

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 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 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 in the United States and around the world..

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.

***Risk Management Review* is a publication of the Center for Risk Management and Decision Processes**
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