

INSIDE THIS ISSUE:

| | |
|--|----|
| Effective Corporate Leadership in Catastrophic Risk Management | 1 |
| Leading the Company When Disaster Strikes | 2 |
| Risk and Uncertainty in Developing Climate Change Policies | 4 |
| Sparking Interest in Solar | 5 |
| When Ignorance Can Be Bliss: Miami and the Costs of Climate Change | 6 |
| Flood Resilience Partnership with the Zurich Alliance | 8 |
| Decision-Support Tools for Disaster Risk Reduction | 9 |
| Resilience Strategies for Coastal Mega-Cities: Illustration with New York | 10 |
| Insurance Choices Identify How Individuals Prioritize Risks | 12 |
| NFIP's Community Rating System | 13 |
| Well-Enforced Building Codes Reduce Hail Storm Losses in Missouri | 14 |
| Terrorism Insurance: TRIA after 2014 | 16 |
| Risk Center's Involvement in Policymaking | 19 |
| Joint work with the World Economic Forum: <i>Global Risks 2014</i> | 20 |
| Risk Management for Economic Development — Report from the World Bank | 21 |
| Lessons from Hurricane Sandy | 22 |
| News and Notes | 23 |
| Ackoff Doctoral Student Fellowship Awards | 24 |
| Issue Briefs | 26 |
| New Book: <i>Leadership Dispatches: Chile's Extraordinary Comeback from Disaster</i> | 27 |
| Journal Publications | 28 |
| In the News | 29 |
| Research Sponsors | 31 |

Risk Management REVIEW



Effective Corporate Leadership in Catastrophic Risk Management: Project with Travelers, Inc. Reaches a Milestone

Through a fruitful partnership, the **Travelers Companies** and the Wharton School are transforming cutting-edge knowledge into real-world action in the field of corporate risk management.

Now in its fourth year, the **Travelers - Wharton Partnership for Risk Management and Leadership** is enabling groundbreaking investigation in risk management leadership and policy as well as risk analysis, and promoting the dissemination of new knowledge to academia, industry, and the public. The dedicated support of the Travelers Companies has been integral in making this critical work possible.

Progress in the research was highlighted in the project's Year 3 conference, **Catastrophic Risk Leadership and Governance Among Large U.S. Corporations**, attended by over 100 experts and executives from S&P 500 companies who participated in the study (see pages 2-3).

A collaboration of the Risk Center and the **Wharton Center for Leadership**, the study examines the risk management practices of large, publicly traded companies to identify effective strategies for detecting, preparing for and coping with catastrophic events. An important outcome of this

research will be a set of business and policy guidelines and related leadership strategies to manage catastrophic risk in large companies. The research has yielded several key insights, including:

- **Need for improved risk assessment:** There is an identified need for improved risk assessment, including an increased awareness of specific risks, better mechanisms for identifying risks, and an enhanced ability to see the "big picture" (risks internal and external to the firm). Also identified were the need for better crisis planning and preparation, improved communication about risks, the need for improved procedures for managing specific types of events, and the creation of system redundancies to maintain business continuity in the midst of a crisis.
- **Late changers vs. early changers:** The research indicates that energy companies that have been doing business in challenging environments since the 1970s have developed more effective risk management strategies than firms that are late-comers. The latter includes North American retailers and computer firms that were unaccustomed to dealing with adverse events on U.S.

soil prior to the events of September 11, 2001, and many U.S.-based financial firms that lacked adequate risk metrics prior to the financial crisis of 2008.

- **Proactive boards:** The research shows that firms that have suffered from a significant crisis have boards that are more proactively involved in managing risk than their counterparts. These boards have members with extensive background in risk, committees that focus exclusively on risks, and regular discussions about risk with senior management.

The ongoing research encompasses a range of measures, including analysis of S&P 500 stock price events to assess significant price drops/gains that can be correlated to catastrophic events. Eleven years of public stock prices for 504 companies have been extracted using data from the Center for Research in Security Prices (CRSP) and filtered by project analysts. We are using this data to better understand what steps S&P 500 companies can take to increase their financial resiliency based on historically successful strategies that they and their competitors have implemented. Results are being prepared for publication.

Leading the Company When Disaster Strikes

Global corporations have been hit by a series of disasters over the last 10 years — natural and financial — that have caused tectonic shifts in thinking about risk planning and readiness. These disasters include the financial crisis of 2008 and such extreme weather events as the Indian Ocean and Tohoku earthquakes and tsunamis, and hurricanes Katrina and Sandy.

To analyze some of the ways companies are responding to global disasters, the Wharton Risk Management and Decision Processes Center led by Howard Kunreuther, Bob Meyer and Erwann Michel-Kerjan, and the Wharton Center for Leadership and Change Management led by Michael Useem, are collaborating on an ongoing study, “Effective Leadership and Governance Practices in Catastrophic Risk Management.” The study looks at ways that executives at large companies can build and sustain practices to reduce the likelihood and consequences of catastrophes. The project is supported by funding from the **Travelers-Wharton Foundation for Leadership Fund**.

This research was the subject of a recent conference at the Wharton School. The Wharton team brought together over 100 experts and leaders from S&P 500 companies who participated in the study to present the research findings and facilitate discussion on “Corporate Strategies for Managing Catastrophic Risks: Linking Intuitive and Deliberative Thinking.” The Wharton team interacted with the group on lessons learned and key directions the study should take to develop benchmarks for preparing and managing catastrophic risks facing firms today and in the future.

The conference program featured a remarkable group of business leaders participating on a variety of panels including Managing Corporate Risks Effectively: The Question of Risk Appetite; Preparing for and Dealing with Catastrophes; and How the Board of Directors Can Strengthen Catastrophic Risk Management. (For more information, see the conference agenda at <http://opim.wharton.upenn.edu/risk/conference/>.)

Leading the Company When Disasters Strike panelists were from three top financial services companies: **William Egan, global head, financial institutions group corporate and investment banking, Bank of America-Merrill Lynch**; **Keishi Hotsuki, chief risk officer at Morgan Stanley**; and **Ellen Richey, chief enterprise risk officer at Visa**.

The discussion focused first on the various risk-management processes companies have been adopting in response to these recent disasters. Egan began by noting that “at BoA-ML, the risk reporting we have to do, the risk meetings we have to do ... [are] much more significant than the days when Merrill Lynch had a different balance sheet [from BoA.]”

At Morgan Stanley, Hotsuki noted, “we [now] have much more stringent risk testing and analysis.” Before the financial crisis, the chief risk management executive at many Wall Street firms mostly had reported to the CFO. Now, however, “the majority report to the CEO. In my case, I report to both the CEO and the board, and we spend between 25 and 30 hours with the board per year focusing on risk management. That’s a lot of time.”



Conference highlights included opening remarks by **Alan Schnitzer, Vice Chairman of Travelers Companies, Inc.**, (top) and a keynote by Nobel laureate, **Professor Daniel Kahneman** (bottom left). Fashioned as a conversation with Howard Kunreuther (bottom right), Prof. Kahneman — author of the book, *Thinking, Fast and Slow* — addressed questions on how corporate executives might be prompted to engage in more deliberative thinking about risk.

The past five or six years, Hotsuki added, have been marked by three major developments at his firm. “The first was to rebuild our defense, post-financial crisis.... Obviously, the industry has lost some credibility around risk management, so we had to rebuild the defense of knowing where the risk is and how to monitor it, and making sure there are no surprises.” The second trend involved going on the offense, which meant developing “a platform that recognizes that risk capital is one of the scarcest resources.... We have to maximize our return on equity.... Risk has started to be used as an optimization tool” to improve the firm’s return on capital.

The third theme, which has emerged more recently, is a greater focus on enterprise risk management. Hotsuki said that the challenge facing the financial sector now is gradually changing from financial-market risks to reputational risks, including “technology, cyber security and many types of more qualitative risk management.”

Visa's Richey noted that the firm faces a very different set of disaster risks. "Visa is probably one of the least understood well-known brands" because many people — including millions of Visa cardholders — mistakenly think of Visa as a credit card company. "We do the processing for the technologies of Visa, but we are not a credit card company." Nevertheless, she added, "We are a very young company with a lot of risks. From a risk perspective, we have such an incredibly valuable brand and highly concentrated processing risk. We are not a bank; [but] we were previously owned by banks, and so Visa inherited a lot of risk assessment practices from the banks" before it became independent six years ago.

What kind of nightmarish scenario keeps Visa executives up most at night? The company, noted Richey, pays a lot of attention to avoiding "system down time." In such a scenario, "people would go to use their Visa card, and if it suddenly didn't work for a period of time, we would consider that a big blow.... Reliability is part of Visa's value proposition and brand promise.... We worry a lot about system down time, and we manage to very, very high standards." Those concerns have paid off: Visa has suffered only two minutes of total system downtime over the last 10 years, says Richey, adding that "We worry about it, so we have this very elaborate system of controls."

At Morgan Stanley, noted Hotsuki, a key risk-management lesson from the economic crisis has been "the importance of the connectivity effect. When Lehman [Brothers] went down [in 2008], many of the banks felt, 'I'm OK,' because their direct exposure to Lehman was very manageable. But what all of us underestimated was the indirect second- or third-order negative connectivity effect."

The under-assessed complexity of the financial system created a "cascade effect that could bring everyone down." That came as a surprise, and the situation got worse every hour, every day, according to Hotsuki. The cumulative factor and the complex-system issues "are definitely something that we need to focus much, much more on. The historical cases of [this sort] are not frequent and therefore we need to think" a great deal about the lessons these cases offer for risk-



Left to right: **William Egan (Bank of America-Merrill Lynch), Keishi Hotsuki (Morgan Stanley), and Ellen Richey (Visa, Inc.)** discuss risk management practices.

management specialists. He added that "at Morgan Stanley, we do have board members who are familiar with complex technology risks, such as cyber security."

Hotsuki warned that while "a lot of good processes are being developed and the system is much safer than before," there is an ever-present challenge that "the risk will move somewhere else" beyond those targets that executives have identified as priorities.

The Evolving Role of the Board

Are board members in these companies approaching risk management executives in search of solutions? Are the strategies for addressing these risks being developed or fine-tuned in partnership with the boards? These were some of the questions posed to the panelists. Visa's Richey said that her company's board members "want us to be able to articulate for them in, say, a maximum of a one-hour period, a problem that they can engage with us in partnership to resolve."

Visa's "board has become a bit more interested in delving into the specifics of risk management, which creates a significant challenge," Richey added. This process can involve what she called a "translation challenge," when senior management and the board get together to discuss issues of cyber-security risk. The overall challenge is to "get the right level of information to the senior executives at the right time, and out to the rest of the organization."

At Morgan Stanley, the board has a different perspective. Noted Hotsuki, "The board is very engaged because our management is not just engaged in issues of how much they could lose [as a result of risk], but [because] in the investment banking world, risk is a source of income. It is not just about how much we could lose, but also what kind of risks we are taking to make money."

What role should the board play in evaluating the technicalities of risk management? "At financial institutions, board members sometimes lack the technical knowledge required to understand the growing complexities of global risk management," said Egan. "When the CIO [chief information officer] tries to explain such complexities, the board may need to have someone with more expertise so that it can properly evaluate key decisions."

Hotsuki argued that when it comes to cyber security, a board could have much more value to the firm if there were at least one member who could ask informed questions about the highly complex issues of vital concern for managing operational or reputational risk.

Yet, maintained Richey, "You don't want to have just one person who is a technical person interpreting [technical issues] to the board. We want to make sure that they are not overly reliant on [just] one expert."

A previous version of this article appeared in Knowledge@Wharton
<http://knowledge.wharton.upenn.edu/article/riskmgmt/>



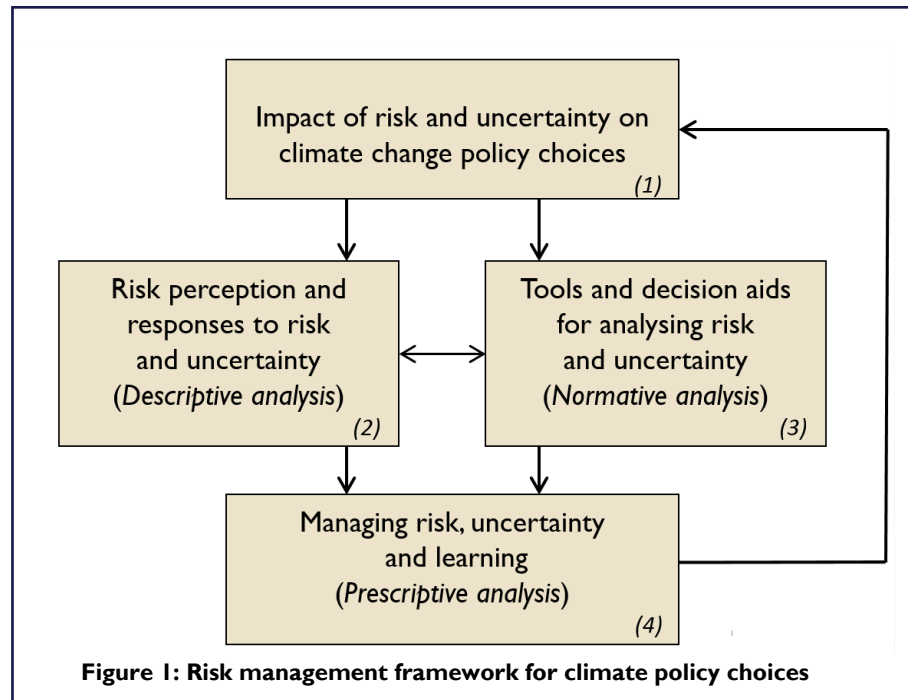
Dealing with Risk and Uncertainty in Developing Climate Change Policies

The Intergovernmental Panel on Climate Change (IPCC) in its recent reports has stressed the importance of understanding how individuals, groups, organizations and countries perceive climate change risk and make choices regarding climate policies, as well as the available tools and decision aids for designing climate policies. The IPCC is the leading international body in this field, established in 1988 by the United Nations and the World Meteorological Organization.

Figure 1, taken from Chapter 2 of Working Group III of the IPCC's Fifth Assessment Report where I served as a Coordinating Lead Author, proposes a framework for considering how descriptive and normative analyses interact when developing policies to address climate change. These policy decisions are highly sensitive to uncertainties and risk associated with the climate system and the actions of other decision makers (Figure 1, Box 1).

Effective strategies for managing risk, uncertainty and learning will take into account how stakeholders perceive risk and their behavioral responses to uncertain information.

They include long-term temperature targets and pathways to achieve these targets, such as stocks and flows of carbon and greenhouse gases, the deployment of technologies, the behavior of firms, and public sector regulatory actions. Other climate change policy options involve mitigation actions for stabilizing temperature change, international treaties for implementing greenhouse gas emission targets that require measurement, reporting and verification programs for ensuring compliance, and well-enforced regulations with penalties for violating specified emissions targets.



In developing a strategy for dealing with climate change, it is important to understand stakeholders' perceptions of the likelihood and consequences of climate change, and factors that will influence their decision processes when presented with different policy options (Figure 1, Box 2). A large empirical literature has revealed that individuals tend to focus on short time horizons in choosing between alternatives. For example, a community and its residents may decide not to undertake measures for reducing future flood losses due to sea level rise because they feel that climate change is a very slow process and hence its impacts are below their threshold level of concern.

Proposed policies can be evaluated in a systematic manner through the use of formal methodologies. Decision tools such as cost-benefit analysis or cost-effectiveness analysis can assist with this process even when probabilities are difficult to characterize and/or outcomes are uncertain (Figure 1, Box 3). For example, cost-benefit analysis or

cost-effectiveness analysis can be useful to governments debating the merits of a carbon tax. Policy analysts will also want to consider that firms may utilize tools such as decision analysis and decide not to reduce their greenhouse gas emissions because they believe the carbon tax will not be well enforced.

Effective strategies for managing risk, uncertainty and learning (Figure 1, Box 4) will take into account how stakeholders perceive risk and their behavioral responses to uncertain information and data and the methodologies and decision aids for systematically addressing climate change policy issues. The way climate change is managed will have an impact on policy choices as shown by the feedback loop in Figure 1. Such choices may be driven by financial incentives. For example, individuals may be willing to invest in solar panels if they are able to spread the upfront cost over time through a long-term loan. Firms may be willing to promote new energy technologies that provide social benefits with respect

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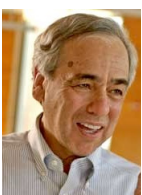
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to climate change if they are given a grant to assist them in their efforts. National governments are more likely to implement carbon markets or international treaties if they perceive the short-term benefits of these measures to be greater than the perceived costs.

Findings from research that support the above risk management framework can be found in Chapter 2, “Integrated Risk and Uncertainty Assessment of Climate Change Policies” in Working Group III of the IPCC’s Fifth Assessment Report, “Mitigation of Climate Change” available online at <http://www.ipcc.ch/report/ar5/wg3/>.

The chapter concludes with a discussion of future research needed to design long-term mitigation and adaptation strategies coupled with short-term incentives to overcome myopic behavior. For example, it recommends a study on cross-cultural differences in human perception and reaction to climate change and one on the role of structured expert judgment in characterizing the nature of uncertainties associated with climate change and the design of mitigation and adaptation policies.

A related paper, “Risk Management and Climate Change” (www.nature.com/nclimate/journal/v3/n5/pdf/nclimate1740.pdf) co-authored with colleagues (Geoffrey Heal, Myles Allen, Ottmar Edenhofer, Chris Field and Gary Yohe) discusses the value of robust decision-making tools for examining alternative climate changes policies and emphasizes that one can make good choices without requiring well-specified probabilities for characterizing future climate risks.



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Sparking Interest in Solar Power

The Wharton Risk Center, as part of the Solar Energy Evolution and Diffusion Studies (SEEDS; funded by the **U.S. Department of Energy**), is investigating what factors motivate homeowners to adopt solar energy. With our academic partners at the **Wharton School** and **Vanderbilt University**, national laboratories **Sandia National Laboratories** and **National Renewable Energy Laboratory**, and field partners at **California Center for Sustainable Energy**, we aim to understand the most effective ways to increase residential solar adoption. Among the methods we are using to assess this question are controlled lab and field experiments, in-depth surveys of adopters and non-adopters, and agent-based modeling based on adoption data.

Previous research by the Risk Center has shown that messaging used to communicate about energy is influential, particularly when these messages resonate with individuals’ political values. Therefore, in the present studies, we examined the effect of different messages — and their interaction with political ideology — on individuals’ choice to spend time learning about installing solar panels in their homes.

Solar power campaigns typically focus on how installing solar panels can reduce greenhouse gas emissions. These *reduce* messages are likely to be effective in motivating liberals to invest in solar power, as they see themselves as personally responsible for reducing the negative aspects of energy use. However, this language may fail to engage more conservative individuals who might not share this sense of obligation.

In Study 1 (N = 904 California homeowners), participants were given the choice to learn about one of four different home improvement options, one of which was installing solar panels. Our key dependent measure was whether participants chose to learn more about solar when solar panel installation was framed as reducing a negative or increasing a positive aspect of energy use. We also varied which benefit of solar energy was described (environmental, monetary, or independence from utilities). Regardless of which feature was described, liberals were more inclined than conservatives to choose to learn about solar when a *reduce* message was used; this ideological divergence was lessened when an *increase* message was used.

In Study 2 (N = 621 California homeowners), we aimed to investigate why this political divergence occurs. Participants had only two home improvement options from which to choose, again one of which was solar panels. Once again, liberals were more inclined than conservatives to choose to read about installing solar panels when the *reduce* message was used; this pattern was reversed when the *increase* message was used. Additional questioning revealed that *reduce* messages were more appealing to liberals for two reasons: (1) these messages communicate that individuals have a personal responsibility to conserve energy, and (2) these messages lead to the perception that solar will be more effective at lowering carbon emissions. *Increase* messages, in contrast, convey greater personal material benefit, which has broader trans-ideological appeal.

These findings demonstrate that the emphasis on reducing a negative versus increasing a positive aspect of energy use can affect individuals’ interest in adopting solar energy, driven primarily by how these messages resonate with individuals’ politically-based views and sense of personal responsibility for addressing energy issues.

This research was presented at the [SunShot Grand Challenge Summit](#) in May. Organized by the Department of Energy, the conference brought together researchers, industry leaders, and policymakers in solar power (and renewable energy more generally in the United States) to review the progress and discuss the challenges to make solar energy more affordable and widespread across the United States. Our ongoing work will continue to examine how different messages, coupled with different financial incentives, affect individuals’ adoption of solar energy.



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When Ignorance Can Be Bliss: Miami and the Costs of Climate Change

As a city sitting virtually at sea level, Miami has been called “ground zero” for the problems posed by climate change, a place where rising sea levels threaten its very future existence. The latest (2013) IPCC forecast of sea level rise, for example, predicts that by later this century, global sea levels will be 2 feet higher than they are today, and quite possibly higher. Under that scenario, the nuisance flooding that now periodically comes with high tides will be a daily affair, the storm surge impact of hurricanes will be amplified, and lower-lying areas of the city will be uninhabitable.

And that’s actually not the worst of it: under higher sea levels, the Biscayne aquifer—where southeast Florida draws its drinking water—will increasingly suffer from salt-water intrusion, a problem for which there is no foreseen solution other than the investment of billions of dollars in water-treatment facilities.

But as bleak as this future would seem to be, few with real skin in the game in Miami—residents, real estate investors, and companies—are backing away from long-term investment. Exhibit A: Miami is currently undergoing a nearly unprecedented surge in real estate construction, with planning discussions centering less on who will leave first and more on how high new projects can be built. Among the projects underway, for example, is an 80-plus story behemoth in Brickell Center, the city’s urban core. If the city is on the verge of being a modern-day Atlantis, those who would have the most to lose are apparently not worried about it.

Why this apparent deafness to the dire warnings? Well, here’s a paradox. If one talks to developers and city commissioners in the area it’s hard to find evidence of overt

denial of current and future risk; it was a city, after all, that was almost completely destroyed by a hurricane in 1926, and most concede that a reoccurrence is a matter of when, not whether. Likewise, few deny that the city’s unique geography makes it vulnerable to the effects of rising sea levels. It is a long-term problem that the planning commissions of both Miami and Miami Beach acknowledge exists and threatens to worsen.

Under higher sea levels, the Biscayne aquifer—where southeast Florida draws its drinking water—will increasingly suffer from salt-water intrusion.

Where locals disagree with outsiders, however, is about how best to deal with the problem. Rather than sounding alarms and cutting back on development, there is an implicit sense that the best approach may be, ironically, to do the opposite. And while a strong case can be made that this behavior has no rational basis, it may represent Miami’s best long-term hope for dealing with the threats posed by climate change, one that other cities might be advised to mimic: the best strategy may, in fact, be to foster a collective belief that there is no threat—or at least not one serious enough to lose sleep over.

Before I explain why, let me first address the two standard explanations for the building boom, explanations that are indeed part of the puzzle. The first is that real estate developers, by their nature, are gamblers with short planning horizons.

In the late 2000s, the real estate and equities crash quickly wiped out many builders. One might assume that would have made them skittish. To the contrary, the quick recovery that followed taught most that big risks are worth taking, and are survivable. While developers today may concede that the sea levels are rising, it is a risk that lies well beyond their investment horizons, and in any case is dwarfed by the more immediate risk of a returning recession.

The second explanation is that many of the buyers for all the new condo units are cash investors from Latin America, and the risks of Miami real estate—over-development, speculation, environmental unsustainability—remain small relative to similar investments back home. No one is saying that real estate isn’t risky in Miami, or that sea level rise is fiction. What they are saying is that all investment carries risk, and development there is simply a bet they are prepared to take.

But there’s another rational reason why even risk-averse residents in south Florida might, paradoxically, hope that buyers and sellers remain collectively naïve, or at least act as if they are, about the risks of sea level rise. South Florida relies almost exclusively on real estate taxes to fund public infrastructure. If the threat

Many of the buyers for all the new condo units are cash investors from Latin America, where the risks of Miami real estate are small relative to the riskiness that similar investments would incur back home.

(Continued on page 7)

(or reality) of sea level rise suppresses property valuations, there will be less public money to address the risk. As an illustration, the head of public works on Miami Beach recently argued that the city would be wise to accelerate its investments in storm-water drainage improvements (\$100 million now and \$400 million planned) simply because the city had the tax base to afford it now—something it could not necessarily count on in the future.

Because buyers and sellers on Miami Beach have yet to connect the dots between nuisance flood events and the future consequences of sea level rise, property buyers continue to be drawn into the area, and development projects continue unabated—both of which are essential for a continued healthy tax base.

But if and when buyers and sellers do connect the dots, everything will change; it could spark a rapid downward wealth spiral that, once initiated, would be difficult to reverse. Lowering property valuations would reduce the city's tax revenue which, in turn, would leave it with less money to shore up the city against sea level rise.

The city would then be forced to choose between two losing remedies: increase taxes on those who choose to stay, or decline to make the needed improvements—both of which, of course, would only exacerbate the problem.

Miami's best move at that point would be to go hat-in-hand to the state and federal government for a bailout, but that seems unlikely. Quite aside from the "I-told-you-so" reactions that such pleas might evoke, almost all coastal communities would be facing similar problems and asking for commensurate help.



Miami Beach as we know it now could cease to exist long before the Atlantic reclaims Collins Avenue.

South Florida is potentially facing a huge adaptation bill down the road, and paying for it will require a healthy tax base.

Given this, south Florida's best shot at coping with the long-term environmental threat may be a strategy that no doubt seems perverse to environmentalists: aggressively foster a collective belief that sea level rise is not something we urgently need to worry about. South Florida is potentially facing a huge adaptation bill down the road, and paying for it will require a healthy tax base. Keeping that tax base flush depends on a cooperative

equilibrium where buyers and sellers maintain an optimistic view that it's tomorrow's problem, one that will be easily tackled when the time comes. This keeps the coffers filled and provides the resources needed to pay for the engineering adaptations needed to keep the game going.

In this light, Miami's construction cranes aren't monuments to climate-change denial. Quite to the contrary—they are the instruments that may, indirectly, allow the city to survive it. Controlled ignorance, in some cases, can be a good thing.



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Update on Community Flood Resilience Work — Partnership with the Zurich Alliance

Losses from worldwide flood events nearly doubled in the ten years from 2000 to 2009 compared with the prior decade—not even accounting for major losses in Australia, China, Germany, the UK and the U.S. since 2009. This increase in severe flooding around the world has focused greater attention on finding practical ways to address flood risk management.

Empirical evidence suggests that flood risk prevention, when well-designed, can be highly cost-effective. Research shows across a large number of studies that for every \$1 spent on flood risk reduction measures, an average of \$5 is saved through avoided and reduced losses. Nevertheless, more resources are put into helping communities to recover *after* a flood, as opposed to enhancing flood resilience. Over the past two decades, 87 percent of aid spending went toward emergency response, reconstruction and rehabilitation, and only 13 percent toward reducing and managing the risks before they became disasters.

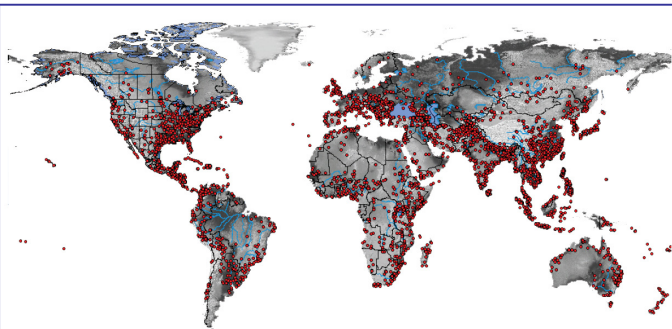


Figure 1: Location of over 3,700 large floods observed 1985 to 2010.

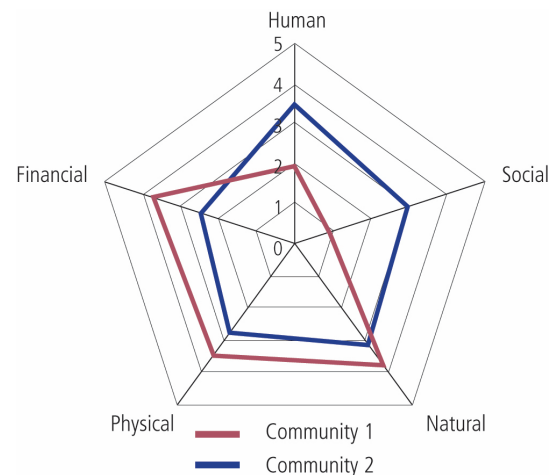
Source: Dartmouth Flood Observatory

The Wharton Risk Center and its collaborators are undertaking research to assess decision-making tools for flood resilience measures, determine ways to remove obstacles to catastrophe risk reduction, develop and provide a perspective on risk transfer solutions and recovery measures, and improve public dialogue on these issues. Lessons learned in case studies will help the team to establish flood risk reduction strategies for use in other communities and countries.

The project, funded by the **Zurich Insurance Foundation**, is part of a multi-year agreement between the Zurich Insurance Group, the Wharton Risk Management Center, the International Institute of Applied Systems Analysis (IIASA), the International Federation of Red Cross and Red Crescent Societies, and the international non-governmental organization Practical Action.

The alliance has produced several white papers and issue briefs in its first year. [Operationalizing Resilience](#) proposes a framework to measure a community's resilience, using a metric based on community capital (the Five Cs):

- Physical (infrastructure, equipment, improvements in crops, livestock, etc.)
- Financial (level, variability, diversity of income sources and access to other financial resources)
- Human (education, skills, health)
- Social (relationships and networks that aid cooperative action, links to exchange and access ideas and resources)
- Natural (natural resources including water, land and other resources that sustain lives and livelihoods)



Judicious use of these resources can increase personal and collective wealth, provide a sense of security and enhance environmental stewardship. From an analytical perspective, the Five Cs provide greater richness of data about a community's resilience than any single metric to provide a more holistic picture of a community's resilience level.

This coming year we will also enhance this framework by testing it in a number of flood prone communities, starting in Mexico. We also hope to use this framework in communities in the United States and improve it using findings from analyses we are conducting on the U.S. National Flood Insurance Program's Community Rating System which links community action with insurance premium reductions in over 1,000 participating communities across the United States (see page 13).

**For every \$1 spent on
flood risk reduction
measures, an average of
\$5 is saved through avoided
and reduced losses.**

The Role of Cost-Benefit Analysis and Other Decision-Support Tools in Disaster Risk Reduction

Economic efficiency is only one decision-making criterion for prioritizing flood risk reduction investments. Criteria such as risk-effectiveness, robustness, equity and distributional concerns, and acceptability have been found to be key for deciding which projects to implement. Other decision support techniques include cost-effectiveness analysis (CEA), multi-criteria analysis (MCA) and robust decision-making approaches (RDMA) that can be used to measure achievement of these criteria. One challenge in using these tools is that they do not lead to easily communicable metrics for presenting the results, such as benefit-cost ratios. These decision-support tools are applicable for different objectives can be used to inform various types of decisions in many different contexts, including project appraisal, evaluation, informational/advocacy study, and iterative decision-making.

Table 1: Applicability of different decision-support tools for assessing flood risk reduction

| Tool | Opportunities | Challenges | Typical Application |
|--------------------------|--|---|--|
| CBA | Rigorous framework based on comparing costs with benefits | Need to monetize all benefits, difficulty in representing intangible impacts, such as value of life | Well-specified <i>hard-resilience</i> projects with economic benefits (e.g., flood risk prevention) |
| CEA | Ambition level fixed, and only costs to be compared. Intangible benefits, particularly loss of life, do not need to be monetized | Ambition level needs to be fixed and agreed upon | Well-specified interventions with important intangible impacts, which should not be exceeded (loss of life, etc.) |
| MCA | Consideration of multiple objectives and plural values | Subjective judgments required, which hinder replication | Multiple and systemic interventions involving plural values (e.g., investing in infrastructure and education) |
| Robust approaches | Address uncertainty and robustness | Technical and computing skills required | Projects with large uncertainties and long timeframes (context of climate change where flood return periods may become more uncertain) |

Note: CBA = Cost Benefit Analysis; CEA = Cost-Effectiveness Analysis; MCA = Multi-Criteria Analysis

The white paper, [The Role of Cost Benefit Analysis and Other Decision-Support Tools in Disaster Risk Reduction](http://www.wharton.upenn.edu/riskcenter/research.cfm) explores different decision-support tools for assessing flood risk reduction. In addition to economic efficiency, decision-support tools must assess intangible impacts such as community values which are very important, especially in developing countries, where reportedly over 95% of deaths from natural hazards occur. Analysis must also account for uncertainty and change over time. The Wharton team is working closely with the Red Cross and Zurich Mexico to help a community in Tabasco, Mexico better understand these decision tools and use them to prioritize their flood protection investment. More information about the Zurich flood resilience alliance is on the Wharton Risk Center's website at <http://www.wharton.upenn.edu/riskcenter/research.cfm>.



Evaluating Flood Resilience Strategies for Coastal Mega-Cities: Illustration with New York City

As part of our ongoing work on community flood resilience in partnership with the Zurich Insurance Foundation, I had the pleasure to team up with Jeroen Aerts, Wouter Botzen, and Hans de Moel in Amsterdam, Kerry Emanuel at MIT and Ning Lin at Princeton University to perform one of the largest cost-benefit analyses undertaken for an entire coastal city, working closely with local policymakers. Our full methodology and data are described in more detail in our article published in *Science* magazine.

Prompted by Hurricane Irene in 2011 and especially Hurricane Sandy in 2012, different flood risk reduction strategies have been proposed for New York City (NYC) by scientists, engineers, NGOs and policymakers.

Some measures are effective in lowering the probability of the flood hazard and protecting large parts of the city, for example, through barriers, levees, wetland restoration or beach strengthening. However, some of these large scale engineering options have received criticism since their initial investment costs are very high.

Other measures lower exposure and vulnerability by linking to current policies, for example, through zoning regulations and enhancing building codes. These measures may considerably reduce the potential damage that floods cause, and entail lower investment costs than flood protection infrastructure such as storm surge barriers, but they do not prevent flood waters from entering the City.

We provide a comprehensive cost-benefit analysis of flood risk reduction strategies by focusing on both main strategies (preventing flooding and reducing vulnerability), and some derivatives:

- The “Resilient Open City” strategy (S1) builds upon enhancing current building codes in NYC, by elevating or wet- or dry-flood proofing of both existing and new buildings.

- The “Storm surge barrier” strategies 2a, b and c (S2a,b,c) aim at lowering flood probabilities in NYC and parts of New Jersey (NJ), with different sets of storm surge barriers and, additionally, protective measures such as levees and beach nourishments.
- S2a, “Environmental dynamics” consists of three barriers to close off parts of NYC and NJ, while preserving the wetland dynamics of Jamaica Bay.
- S2a is expanded to S2b, “Bay closed” by adding a fourth barrier that closes off Jamaica Bay.
- S2c, “NJ-NY connect” replaces three barriers from S2b with one large barrier in the Outer Harbor, thereby protecting a larger area. The barriers systems are designed to withstand an extreme surge of 25-30ft.
- S3, the “Hybrid solution” combines cost-effective building code measures of S1 only in high risk 100-year return flood zones (defined by the U.S. Federal Emergency Management Agency, FEMA) with protection of critical infrastructure to reduce economic losses due to business interruption. S3 includes moderate local flood protection measures, such as levees and beach nourishment that are also part of S2c. These building code measures and local protection measures are adjustable to future climate change as they can be upgraded if flood risk increases.

None of S2a,b,c nor S3 is economically beneficial under current levels of flood risk and the low climate change scenario, although the proposed S3 shows the highest Net Present Value (NPV) and benefit cost ratio.

Under the middle climate change scenario and high discount rate (7%) S3 is the only strategy that would make sense economically. When a low 4%

discount rate is considered, all strategies make economic sense if sea level rise occurs and climate change increases storminess. In that case, S2c results in the highest NPV. All storm surge barriers are economically feasible if flood risk develops according to the high rapid ice melt scenario.

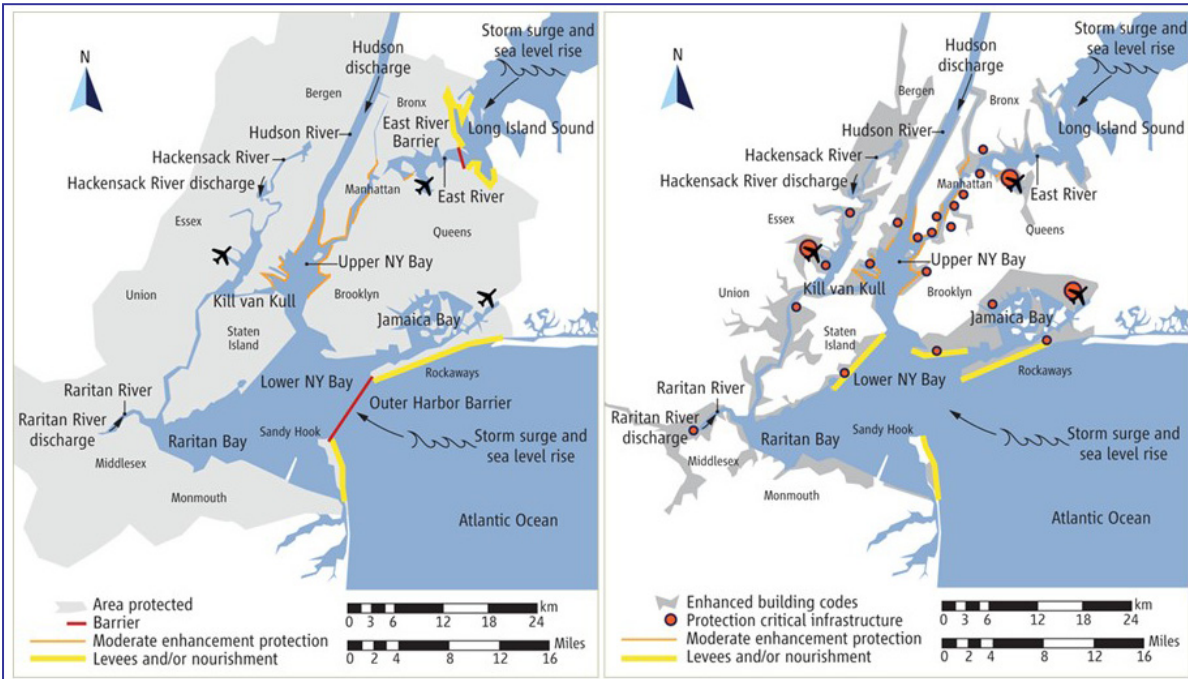
Flood management strategies for coastal cities must also be flexible to allow for a change in policy when more detailed and reliable information becomes available, for example, on sea level rise. Therefore, we propose that the city start by implementing building code measures that are part of S3 which are already cost effective under current climate conditions: namely, elevating new buildings +4ft in A zones (defined by FEMA as areas with a 1 percent or greater annual chance of flooding) and +6ft in V zones (defined as coastal areas with a 1 percent or greater annual chance of flooding and an additional hazard associated with storm waves).

Moreover, critical infrastructure should be protected against flooding by mainstreaming adaptation measures into recovery and repair works. If climate develops according to the middle climate change scenario — meaning that storminess increases — then NYC should consider investing in storm surge barrier S2c.

Overall, this study shows that a comprehensive and spatially detailed flood risk analysis on a large scale can provide a robust cost-benefit evaluation for policy makers, despite the modelling of large uncertainties related to discounting, risk estimates, time horizons of investments, and future scenarios of development of flood risk.



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Strategies for protection vs. reducing vulnerability.

(Left) Strategy S2c reduces the length of the coastline of the NYC-NJ area as much as possible, to minimize flood protection costs. Two storm-surge barriers are developed: one large barrier that connects Sandy Hook, NJ and the tip of the Rockaways in Queens, NY, and a barrier in the East River. Some lower spots (bulkheads, levees, or landfill) on the inside of the protection system will be elevated to accommodate rising water levels caused by Hudson River peak discharges during a storm event.

(Right) Strategy S3 combines cost-effective flood-proofing measures with local protection measures of critical infrastructure. Such a “hybrid solution” aims at keeping options open: either (a) building codes can be enhanced in the future with additional local protection measures or (b) storm-surge barriers can be developed.

| | Where/ how much | Environ.dyn. S2a | Bay closed S2b | NJ-JY connect S2c | Hybrid solution S3 |
|---|--------------------|---------------------|---------------------|----------------------|-----------------------|
| Costs | | | | | |
| Total investment | NYC | \$16.9–21.1 billion | \$15.9–21.8 billion | \$11.0–14.7 billion | \$6.4–7.6 billion |
| Total investment | NJ | \$2 billion | \$2 billion | n/a | \$4 billion |
| Total investment | NYC+NJ | \$18.9–23.1 billion | \$17.9–23.8 billion | \$11.0–14.7 billion | \$10.4–11.6 billion |
| Maintenance | NYC+NJ | \$98.5 million | \$126 million | \$117.5 million | \$13.5 million |
| BCR for current climate | | | | | |
| BCR | 4% discount | 0.21 (0.11; 0.35) | 0.21 (0.11; 0.34) | 0.36 (0.18; 0.59) | 0.45 (0.23; 0.73) |
| | 7% discount | 0.13 (0.07; 0.21) | 0.12 (0.07; 0.20) | 0.23 (0.12; 0.37) | 0.26 (0.13; 0.43) |
| BCR for middle climate change scenario | | | | | |
| BCR | 4% discount | 1.32 (0.67; 2.16) | 1.29 (0.65; 2.11) | 2.24 (1.14; 3.67) | 2.45 (1.24; 4.00) |
| | 7% discount | 0.60 (0.30; 0.98) | 0.60 (0.30; 0.97) | 1.06 (0.54; 1.74) | 1.09 (0.55; 1.78) |

Costs and main BCA results of flood management strategies.

(Top) Total costs. Environ. dyn., environmental dynamics; inv., total investment as billions of U.S. dollars; maintenance, maintenance costs as millions of U.S. dollars per year; n.a., not applicable.

(Bottom) BCA results with modeling uncertainty as 95% confidence intervals (in parentheses). If BCR > 1, then the measure is cost effective. For S3, BCA results are shown for the scenario of high effectiveness of wet flood-proofing.

Source: Aerts, J.C.J.H., Botzen, W.J.W., Emanuel, K., Lin, N., de Moel, H., and Michel-Kerjan, E. (2014). [Evaluating Flood Resilience Strategies for Coastal Mega-Cities: The Case of New York City](#). *Science* 344: 473-475.

Insurance Choices Identify How Individuals Prioritize Risks

Households make difficult tradeoffs when insuring their homes, paying premiums today to protect themselves against minor or major adverse events that might happen tomorrow. Two questions that homeowners face related to this decision are the amount of coverage to purchase and the amount of their deductible. Their choices provide insight into how individuals prioritize protection across a range of possible outcomes.

In an ongoing project with Howard Kunreuther and Erwann Michel-Kerjan, we are studying the deductibles and coverage limits that households select when insuring against floods.

The deductible represents a financial loss that households incur following a property loss. The coverage limit is the maximum amount the insurer will pay. Any losses above the coverage limit are borne by the household unless they obtain disaster assistance. For example, a coverage limit of \$80,000 on a home valued at \$100,000 implies that a household is willing to accept a \$20,000 loss if a flood destroys the home entirely. Lower deductibles and higher coverage limits both increase insurance premiums.

The federally-run National Flood Insurance Program (NFIP) provides an excellent opportunity to study decision making in this regard. We look specifically at policy-level data from 1978-2012, benefiting from the Risk Center's unique access to the NFIP's database for those years. The NFIP covers households and firms across the U.S., today issuing 5.6 million policies for a total insured value of about \$1.3 trillion.

The NFIP provides several advantages for undertaking this study. First, it does not require homeowners to purchase a specific quantity of insurance. Typically, property insurers require that policyholders insure at least 80 percent of the value of their home. Having no such requirement, the NFIP provides greater flexibility to households, improving our ability to understand their decisions. Also, the NFIP data contains the homes' structural values for claims. One complication of the NFIP data is that households with federally backed mortgages in designated flood zones are required to insure against floods, potentially constraining household policy choices. We are able to partially assess the influence of this requirement by comparing flood insurance policies in and outside designated flood zones.

People so strongly prefer low deductibles that many are willing to risk tens of thousands of dollars in losses from a catastrophic event by reducing their coverage limits.

We find that approximately 95 percent of households in the NFIP choose the lowest deductibles, usually \$500 or \$1,000 (options are available up to \$5,000). People so strongly prefer low deductibles that many homeowners are willing to bear the risk of tens of thousands of dollars in losses from a catastrophic event by reducing their coverage limit rather than raising their deductible. In other words, people prioritize high-frequency, low-consequence risks over catastrophic events which can much more seriously impact them.

The consequences of these preferences can be severe. Our preliminary analysis of flood insurance policies finds that a significant percentage of policyholders only partially insure their homes.

One extreme case is Louisiana during 2005, in which 63 percent of households had the lowest deductible. Of these households, 70 percent were only partially covered (insuring 72 percent of property value, on average). When Hurricane Katrina struck, 30 percent of partially insured households suffered a complete loss of their home. Seventy-five percent of partially insured households had losses that exceeded their coverage limit, with a median loss of \$12,000 above coverage limits (about 10 percent of the median property value for this group). With the benefit of hindsight, we find that on average, if households with the \$500 deductible had increased it to \$1,000, they could have increased their coverage limit by \$12,400 and kept the same premium.

Our preliminary results also suggest an interesting dichotomy: homeowners overestimate the probability of a severe flood when making their deductible choice, but underestimate that probability when choosing their coverage limit — even though both decisions are made for the same policy. Consistently, we find that the household choices can be better explained when the decisions to protect against moderate and severe risks are considered as two separate choices, rather than treating them as a decision made jointly.

Ultimately, we hope these insights will provide better understanding of these priorities, fundamental to reducing the consequences of catastrophic events.

Expected utility theory (EUT) predicts that people should be more concerned about protecting themselves against severe losses rather than moderate ones, implying that for a given premium they should prefer a policy with a higher deductible and increased coverage limits. However, recent research suggests that this model does not predict household deductible choices well. Barseghyan et al. (2011) find that EUT poorly explains household preferences for deductible choices for different types of insurance coverage. Sydnor (2010) finds that cumulative prospect theory (CPT) — a behavioral economic model developed by Tversky and Kahneman (1992) — is much better at predicting household deductibles than EUT. To date, no one has examined these behavioral models for household decisions when examining data on different loss severities for a specific risk.

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Linking Mitigation to Insurance — the NFIP’s Community Rating System

Residential flood insurance in the U.S. is primarily provided through the federally run National Flood Insurance Program (NFIP). Today, the NFIP covers 5.6 million policyholders and about \$1.3 trillion in assets. Communities that participate in the NFIP are required to adopt and enforce a set of minimum floodplain management ordinances to reduce future flood damage.

In the early 1990s, the NFIP adopted the Community Rating System (CRS), a voluntary incentive program that recognizes, encourages, and rewards — by the use of flood insurance premium reductions — community and state activities that go beyond the minimum NFIP requirements. The goals of the CRS program are to reduce flood damage to insurable property, encourage communities to adopt a more comprehensive and coordinated approach to floodplain management, and strengthen and support the role of flood insurance.

There are 19 creditable activities, organized under four categories: public information activities, mapping and regulations, flood damage reduction activities, and warning and responses.

Premium discounts of up to 45 percent correspond to credit points accrued by each community depending on the degree to which the com-

munity performs mitigation activities against the risk of flood. (See <http://training.fema.gov/EMIWeb/CRS/> for more information). Class 10 does not participate in the CRS and receives no discount; class 9 policyholders receive a 5 percent premium discount; class 8 policyholders receive a 10 percent premium discount; class 1 policyholders receive a 45 percent premium discount.

As of 2013, 1,229 communities participate in the CRS out of a total of nearly 21,000 in the NFIP. While this is only a 5.7% participation rate across the nation, these CRS communities account for two-thirds of all NFIP insurance policies.

Empirical evidence sheds light on the effectiveness of the program. For example, in an analysis of 832 large scale flood events in Texas between 1997 and 2001, the odds of a flood-related casualty decreases with the extent to which localities had enacted CRS mitigation strategies (Zahran et al., 2008).

Benefitting from data provided by the Federal Emergency Management Agency (FEMA), along with Jeffrey Czajkowski, Howard Kunreuther and Erwann Michel-Kerjan, we are conducting a study to understand the dynamics of CRS participation and whether communities achieve CRS class improvements over time.

We find that on average, over the period 2002-2011, the rate of retention in the program is high, at 99.4 percent each year. On average, 33 new communities joined the CRS program each year; seven communities dropped out of the program annually during that time period. Communities that dropped out were, on average, active for about nine years, with an average class of 8, which would qualify them for a 10 percent reduction in homeowners’ flood insurance premiums.

Several communities have made improvements over time, such as Fort Collins, Colorado and Santa Rosa, Florida, which moved from class 9 up to class 4 and 5 respectively since they first joined the CRS. Both these communities earned most of their points from public information activities and mapping and regulations. On the contrary, few other communities dropped in rating class, mostly due to failing to perform the aforementioned activities.

The Risk Center, in collaboration with industry partners and FEMA, is continuing to study CRS participation to learn why some communities perform better than others and what can be done to enhance activities leading a community towards greater flood resiliency.

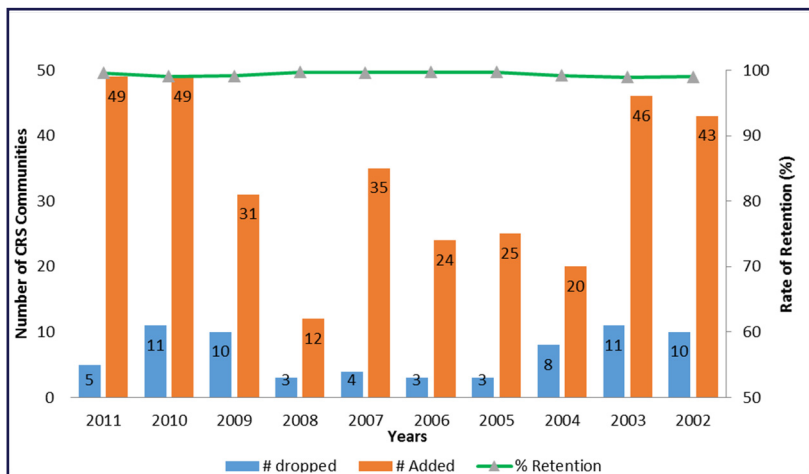


Figure 1 Dropouts, Add-Ins and Retention Percentage of CRS communities, 2002-2011

Reference

Zahran, S., Brody S.D., Peacock, W.G., Vedliz A., and Grover, H. (2008). Social Vulnerability and the natural and built environment: A model of flood casualties in Texas. *Disaster*, 32(4): 537-560.



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THE ROLE OF WELL-ENFORCED BUILDING CODES IN REDUCING NATURAL DISASTER PROPERTY LOSSES: HAIL STORMS IN MISSOURI

Strong building codes are a critical component to reducing total property damage due to natural disasters. However, many states in the U.S. have no statewide building code in place; adoption is left to individual municipalities.

Even if localities adopt building standards, it is unlikely that all jurisdictions would equally and properly enforce their codes once they have been adopted. Critically, in order to reduce losses from natural disasters, effective building codes must not only be in place, but also properly enforced.

Hail storms are a persistent and chronic source of property losses for homeowners and insurance companies in the United States. Hail-related U.S. property insurer losses are conservatively estimated at \$1.6 billion per year. In recent years, the incidence of severe weather damage has increased significantly. For example, in 2011 the insurance industry experienced its worst wind/tornado/hail year ever, at over \$26 billion in claims.

Approximately 44 percent of the United States is at “average risk” (2-3 hailstorms per year on average) or above of being hit by a hailstorm, with 75% of the cities in the continental U.S. experiencing at least one hailstorm per year.

In the state of Missouri (MO) from 2008 to 2010, hail losses were the second largest cause of insured property loss, as well as the most frequent source of a loss claim incurred. MO is a state where building code adoption and enforcement is at the local jurisdictional level.

We take advantage of MO’s local building code variation to model hail claims insurance data from 2008 to 2010 in order to examine and quantify the role that effective and well-enforced building codes play in the mitigation of residential property damage from hail.

We take advantage of Missouri’s local building code variation to model hail claims insurance data in order to quantify the role that effective and well-enforced building codes play in mitigating residential property damage.

We utilize data on insured losses from 2008 to 2010 to explain the observed damage, focusing on the role of building code ratings while controlling for hazard (e.g., hail size and frequency), exposure, and vulnerability variables (e.g., roof type and construction type) that can either increase or decrease loss. The property loss data comes in two forms: (1) Insurance Services Office (ISO) property/casualty insurance industry claim data aggregated at the ZIP code level; and (2) data from a national property insurer.

Based upon various industry and exposure-based estimated models, the more favorably rated ZIP codes in MO with effective and well-enforced building codes have significantly reduced damage from hail from 12% to 28% on average, as compared to less favorably rated and unclassified ZIP codes.

By enforcing building codes, a midsize community that experiences a moderate hail storm could reduce losses by \$4 to \$8 million.

In other words, by adopting and enforcing appropriate building codes, a midsize community of 50,000 people that experiences a moderate hail storm could reduce losses by approximately \$4 to \$8 million on average.

Highlighting this type of substantial savings is critical for decision makers weighing the costs and benefits of implementing more effective and well-enforced building standards.

Adhering to local building codes, as well as communities’ ensuring the proper licensing and enforcement of contractors, plays an important role in the mitigation of hail losses.

For example, proper roof installation (e.g., only one layer of shingles) and the quality of materials used to construct the roof and supporting structures can affect how much damage a structure will sustain if exposed to hail.

We also find that it is better to have some minimally effective and enforced code in place as opposed to none at all. Our results also illustrate that effective and well-enforced building codes have an additional positive effect beyond the primary hazards they may be designed for, such as protection from high winds and/or earthquake.

This research was presented at the [Transforming Mitigation Awareness into Action Conference](#) held in December 2013 at the Insurance Institute for Business & Home Safety Research Center in Richburg, South Carolina, and at the [Verisk Commercial Property Roundtable](#) in Orlando, FL in May 2014.

Source:

Czajkowski, J., Simmons, K. 2014. Convective Storm Vulnerability: Quantifying the Role of Effective and Well-Enforced Building Codes in Minimizing Missouri Hail Property Damage. *Land Economics*, 90(3):482-508.



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ISO's Building Code Effectiveness Grading Schedule (BCEGS®) ratings provide a joint assessment of both the stringency of adopted codes and how well communities enforce those adopted codes.

Since 1995, the Insurance Services Offices (ISO) has primarily administered the Building Code Effectiveness Grading Schedule (BCEGS®) ratings for the property/casualty insurance industry across the entire country. The ratings place special emphasis on the mitigation of natural hazard losses and the role of code enforcement. For our loss models we use a discrete group of BCEGS ratings in the empirical analysis of “more favorable” (average ratings of 1 to 4), “less favorable” (average ratings of 5 to 10), and unclassified (average rating of 99). By incorporating ISO's BCEGS rating in our loss estimation we have a joint assessment of both the stringency of adopted codes in addition to how well these adopted codes are enforced.

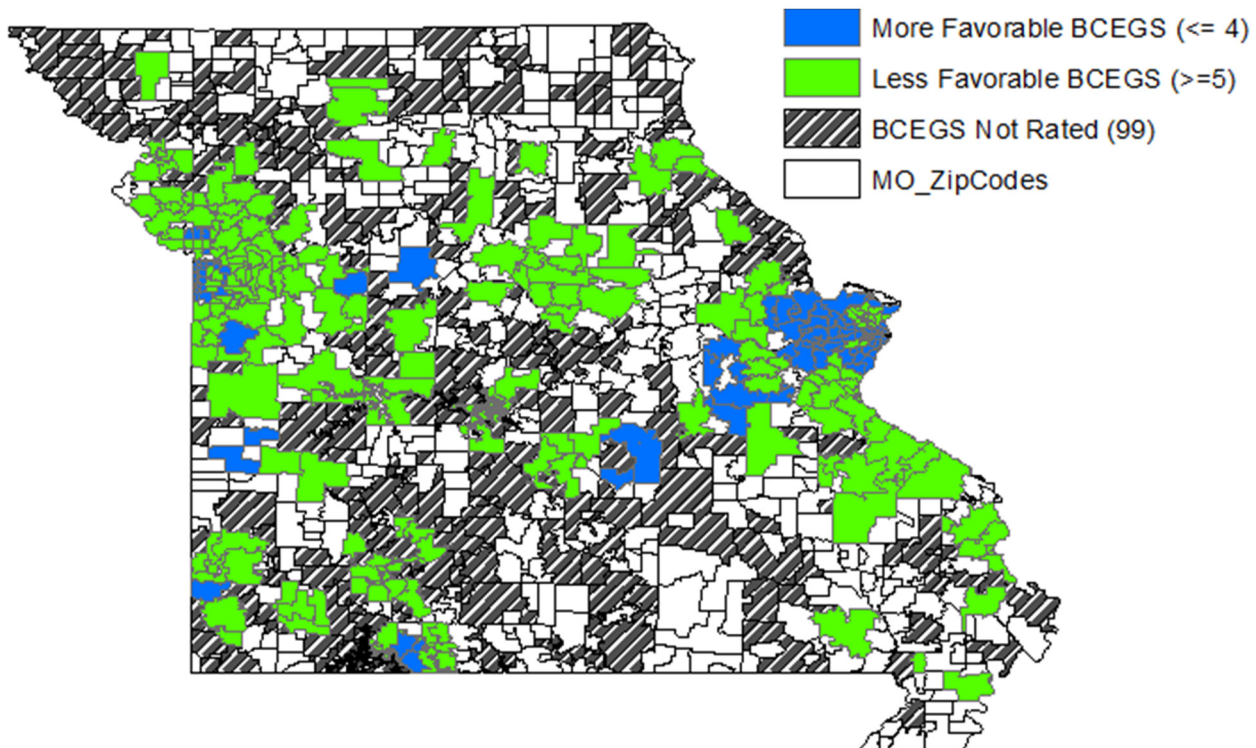


FIGURE I. 532 UNIQUE ZIP CODES IN MO WITH A HAIL LOSS IN AT LEAST ONE OF THE THREE YEARS FROM 2008 TO 2010, WITH ASSOCIATED BCEGS RATING

Figure I shows the location of each of the 532 unique ZIP codes in MO with a hail loss in at least one of the three years from 2008 to 2010, overlaid with their determined average BCEGS rating. Among the 532 unique ZIP codes with at least one claim, 59 percent of these ZIP codes have at least some BCEGS rating – either more favorable (19%), or less favorable (40%). Thus, for our analysis conditional upon the occurrence of the hazard, only 41 percent of MO zip codes used in the loss analysis have an unclassified 99 BCEGS rating. The more heavily populated areas of the state such as Kansas City, St. Louis, Joplin, and Springfield have determined BCEGS ratings in place.

Terrorism Insurance — TRIA After 2014

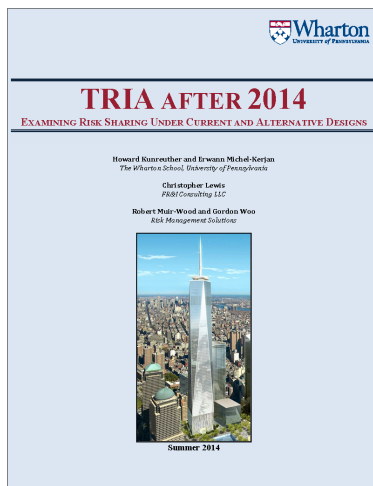
The Terrorism Risk Insurance Act (TRIA) is set to expire at the end of 2014 and is currently under debate in U.S. Congress. As we issue this report, the Senate and the House of Representatives are considering different TRIA extension bills. The Senate passed S. 2244 in July 2014; the House Financial Services Committee passed H.R. 4871 in June 2014.

In collaboration with the risk modeling firm **Risk Management Solutions (RMS)**, and benefiting from helpful comments by industry experts and corporate partners, the Risk Center's report, "**TRIA After 2014: Examining Risk Sharing Under Current and Alternative Designs**" analyzes terrorist attack scenarios in Chicago, Houston, Los Angeles and New York City.

The report provides an examination of the impact of terrorism loss sharing for the different stakeholders under the current program and alternative risk-sharing designs.

Findings were presented at a [Penn-Wharton Public Policy Initiative briefing in the U.S. Senate on July 24, 2014](#).

The report is available for free download at http://opim.wharton.upenn.edu/risk/library/TRIA-after-2014_full-report_WhartonRiskCenter.pdf.



Following the terrorist acts of 9/11 that resulted in record insured losses of nearly \$44 billion (2014 dollars), insurers and reinsurers began to exclude coverage for terrorism, and businesses operating in the United States found it increasingly difficult to purchase commercial property insurance that included the risk of terrorism.

The Terrorism Risk Insurance Act (TRIA), passed in 2002, established a public-private risk-sharing arrangement between the federal government, the insurance industry and all commercial insurance policyholders in the U.S. for covering losses from future terrorist attacks.

TRIA was designed as a temporary program, but the continued absence of a viable private market for terrorism insurance led to the Terrorism Risk Insurance Extension Act in 2005 and the Terrorism Risk Insurance Program Reauthorization Act in 2007 which renewed the program for seven years.

Different Loss-Sharing Mechanisms for a Modified Renewed TRIA

Analysis of Deductible/Surplus (D/S) Ratio

One measure of particular interest to insurers, regulators and rating agencies alike is the ratio of the insurer's TRIA deductible amount in relation to its surplus. A higher deductible/surplus (D/S) ratio implies that the insurer is more exposed to losses from a terrorist attack. While there is no specific threshold that applies to all insurers given their different portfolios, a D/S ratio greater than 0.15 is generally regarded as a high measure of relative exposure to terrorism.

Accessing market data from the rating agency AM Best, we were able to determine the D/S ratios of 764 insurance groups operating in the United States, and then calculate changes in the D/S ratio as the TRIA deductible percent (D*) is varied from 15% (2005 level) to 20% (current level), to 25% (hypothetical) for each of the top 30, top 50, top 100 and top 450 insurers.

Our analysis reveals that a D/S ratio of 0.15 — considered an important exposure threshold by rating agencies — has already been reached or exceeded by a number of insurers under the current design of the TRIA program. (See Figure 1 on page 18.)

Mandatory Recoupment Mechanism

The federal government can recoup federal outlays made under TRIA by levying surcharges on all commercial insurance policyholders via a mandatory recoupment component and a discretionary one. More specifically, under the program's mandatory recoupment mechanism, the federal government is required to recoup 133% of its payments below the insurance industry marketplace aggregate retention and above the industry-wide insurer losses based on their individual deductible and coinsurance during the calendar year. Additional recoupment is at the discretion of the federal government.

Senate bill S. 2244 proposes an increased retention of \$37.5 billion after five years; House bill H.R. 4871 introduces a variable retention based on the sum of insurers' deductibles under TRIA. The House bill would also increase the mandatory recoupment rate against all commercial insurance policyholders (whether they have purchased terrorism insurance or not) from the current 133% to 150%. As we show in our analysis, this recoupment has not received the attention it deserves given the significant financial burden it could impose on businesses in America.

Program Trigger

If a certified act of terrorism occurs, no compensation is paid under TRIA unless aggregate insurance industry losses exceed a program trigger of \$100 million. The program trigger was raised from \$50 million to \$100 million in 2007. Under the House bill, the program trigger would be incrementally raised to \$500 million for conventional terrorist attacks [i.e., non-chemical, biological, radiological or nuclear (CBRN)] while it

would remain at \$100 million in the Senate bill. Of the 764 insurance groups in the AM Best database, 58 currently have a TRIA deductible that is already in excess of the \$100 million trigger, effectively invalidating the impact of the TRIA trigger in determining loss-sharing by the federal government for these larger firms. Our analysis shows that the program trigger is more of a potential concern for small insurance firms who may not have been able to achieve an acceptable spread of risk, possibly due to geographic restrictions, lack of reinsurance or limited risk management actions.

Who Will Pay? Loss Sharing under Different TRIA Designs

We undertake a series of analyses to assess the impact of varying four TRIA design parameters: (a) insurers' deductibles; (b) level of the sharing arrangement (i.e., coinsurance) between insurers and the federal government; (c) insurance industry marketplace aggregate retention that determines what portion of the insured losses paid by the federal government will be mandatorily recouped against all commercial policyholders in the U.S.; and (d) percentage rate of the mandatory recoupment against all commercial policyholders.

Note: These analyses assume that firms that suffer losses from a terrorist attack will not receive compensation from the federal government for the uninsured portion of their loss. However, past experience from 9/11, the financial crisis and recent natural disasters suggests that the government might assist firms suffering uninsured losses. (See Figure 2 on page 18.)

Sample Findings

Should an attack occur in New York City:

Under the current design of TRIA:

- American taxpayers will not be responsible for any payments after mandatory recoupment until the total commercial losses (insured and uninsured) from an attack exceed \$40 billion.
- Commercial policyholders will always have to pay a portion of the cost of a terrorist attack under the current TRIA program if the total insured loss to all firms is less than \$80 billion. We feel the significant exposure of commercial policyholders has not been widely discussed.
- Under the mandatory recoupment of 133%, commercial policyholders would always pay more than \$10 billion when total losses from terrorist attacks are in the \$38 billion to \$82 billion range. The maximum they would pay – \$17.9 billion – is reached when total losses are \$54 billion.

Based on Senate bill S. 2244:

[Insurers' deductible remains at the current level of 20%; insurers' share of losses above their deductible (i.e., co-insurance) increases to 20%; insurance industry retention incrementally increases to \$37.5 billion over five years and the recoupment rate against commercial policyholders remains at the current level of 133%]:

- American taxpayers will not be responsible for any payments after mandatory recoupment by the federal government until the total commercial losses from a terrorist attack (insured and uninsured) exceed \$59 billion.
- Insurers will always pay more than the federal government after the mandatory recoupment has been levied even when total commercial insured and uninsured losses are as high as \$100 billion. When damage reaches this level, insurers will be responsible for \$33 billion in payments, the federal government almost \$31 billion, commercial policyholders over \$5.7 billion. The remaining \$30 billion would be paid by the uninsured firms that suffer the loss. The government has the option to recover its almost \$31 billion in outlays by a discretionary recoupment levied against commercial policyholders.

Based on House bill H.R. 4871:

[Insurers' deductible remains at the current level of 20%; insurers' share of losses above their deductible (i.e., co-insurance) increases to 20% for non-CBRN attacks on which our analysis focuses; insurance industry retention is determined by the sum of insurers' deductibles that can vary over time; recoupment rate against commercial policyholders increases to 150%]:

With a retention of \$32 billion:

- American taxpayers will not be responsible for any payments after mandatory recoupment by the federal government until the total commercial losses from a terrorist attack (insured and uninsured) exceed \$52 billion. (The difference from the \$59 billion in the Senate bill is due to the House bill's lower insurance industry retention used to determine the mandatory recoupment mechanism, based on 2012 data.)
- Insurers will pay more than the federal government after the mandatory recoupment has been levied, until total insured and uninsured losses reach \$91 billion.
- At \$100 billion loss, insurers will be responsible for the same \$33 billion as they would under the Senate bill, but commercial policyholders will not pay anything under the mandatory recoupment mechanism because the insurance industry retention of \$32 billion is below the insurers' aggregate payments. Hence, the government recoups nothing from the policyholders and pays the entire \$36.84 billion unless it elects to exercise its authority to levy a discretionary recoupment against commercial policyholders.
- Despite the higher 150% recoupment rate, at a retention rate of \$32 billion, commercial policyholders would be less exposed to the mandatory recoupment

(Continued on page 18)

(Continued from page 17)

under the proposed House bill compared to the Senate bill. They would always pay more than \$10 billion when losses from terrorist attacks are in the \$36 billion to \$59 billion range. The maximum they would pay – \$15.3 billion – is reached when losses are \$46 billion.

With a retention of \$44 billion:

- American taxpayers will not be responsible for any payments after mandatory recoupment by the federal government until the total commercial losses from a terrorist attack (insured and uninsured) exceed \$74 billion.
- Insurers will always pay more than the federal government after the mandatory recoupment has been levied, even when total commercial insured and uninsured losses are as high as \$100 billion.
- At \$100 billion loss, insurers will be responsible for the same \$33 billion as they would under the Senate bill, but commercial policyholders will now pay \$16.26 billion (i.e., \$44 billion minus \$33 billion multiplied by 150%). Taxpayers would pay more than \$20.58 billion.
- With the higher 150% recoupment rate and a retention of \$44 billion, commercial policyholders would typically be much more exposed to the mandatory recoupment under the proposed House legislation; they would always pay more than \$10 billion when losses from terrorist attacks are in the \$36 billion to over \$100 billion range. The maximum they would pay – \$26.8 billion – is reached when losses are \$63 billion.

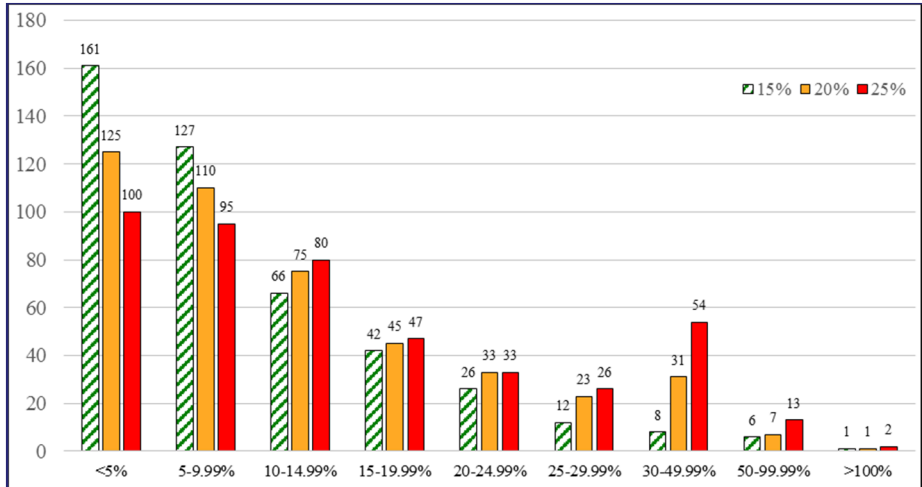


Figure 1 depicts the evolution of the D/S ratio for our sample of 450 insurers. When $D^*=15\%$, 95 of these 450 insurers would have a D/S ratio greater than 15%. This number increases to 140 when $D^*=20\%$ (current design of TRIA) and to 175 insurers (39% of the top 450 insurers) if $D^*=25\%$. Should the deductible level increase again, some companies could face a significant risk of insolvency after a severe terrorist attack because they will not have adequate levels of capital. Other insurers might stop selling insurance to some of their commercial clients to avoid having too high a concentration of terrorism exposure in one location (e.g., a large city).

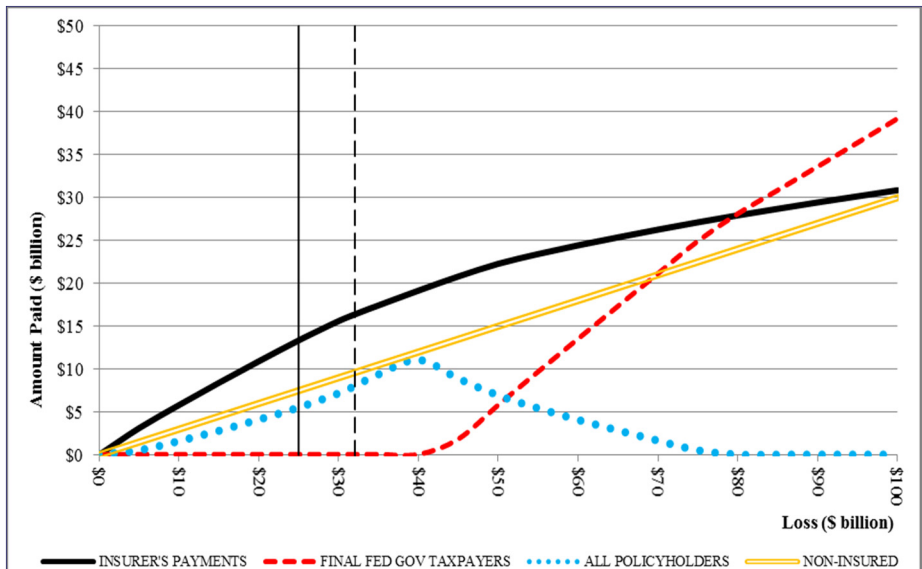


Figure 2 depicts loss sharing through the entire continuum from the current minimal program trigger of \$100 million up to \$100 billion under current TRIA loss-sharing arrangements, that would be paid by the relevant stakeholders as a function of losses to New York City from terrorist attacks. The two vertical lines in the figure represent scenarios of losses of \$25 billion (estimated for a Sarin gas attack) and \$32 billion (estimated for a 10-ton truck bomb attack). It would take a very large loss under the current design of TRIA for taxpayers to pay anything as a result of a terrorist attack. Under the current program, insurance companies and policyholders will bear all of the losses when losses are \$32 billion or lower. Even when the losses are as high as \$50 billion, the federal government will pay only 10.5 percent (or \$5.78 billion) of the \$50 billion insured loss, with the option to recover the federal outlays through discretionary recoupment provisions.



Risk Center's Involvement in Policymaking

Howard Kunreuther, co-director, and Erwann Michel-Kerjan, executive director, of the Wharton Risk Center addressed a full room of U.S. House and Senate staffers and government agency representatives to present key findings from their quantitative analyses of loss-sharing under the Terrorism Risk Insurance Act (TRIA). The event, [TRIA After 2014](#), took place at the Russell Senate Office Building on July 24, 2014, followed by separate meetings with staffers of the House Financial Services Committee.

On March 7, 2014, the Risk Center directors presented [The NFIP: The Way Forward](#) to legislators in Washington, DC. The strategies put forth by Kunreuther and Michel-Kerjan include (1) premiums that reflect the risk associated with future flood damage, and (2) steps the government can take to address affordability issues if premium increases create financial hardship for some residents in flood-prone areas. Insurance vouchers based on income level, combined with grants and long-term loans can offset the upfront cost of loss reduction measures. The amount of the vouchers will be reduced when the property is made safer since the risk-based premiums will be lower.



Both events were organized by the [Penn-Wharton Public Policy Initiative](#) (Penn-Wharton PPI), a hub for public policy research and education with one overarching goal across its Philadelphia and Washington, DC offices: to leverage the University's resources to foster better-informed policymaking on issues related to business and the economy. Audio recordings are available on the Penn-Wharton PPI [iTunes](#) channel. For more information on the Penn-Wharton PPI, contact Jacquie Posey, 215-898-6460 or jposey@upenn.edu.

TERRORISM RISK INSURANCE: A GLOBAL PERSPECTIVE

Third International Meeting on Terrorism Risk Insurance

Commemorating the attacks of September 11, 2001, the Organisation for Economic Co-operation and Development (OECD) convened the heads of national terrorism insurance programs worldwide, representatives from the White House, Government Accountability Office, Congressional Budget Office, and leading international experts from the public sector, the insurance industry and research institutions to review the current status of international terrorism risk insurance programs and markets, and provide a forum to discuss current and emerging challenges relating to terrorism risk insurance programs and markets. The conference



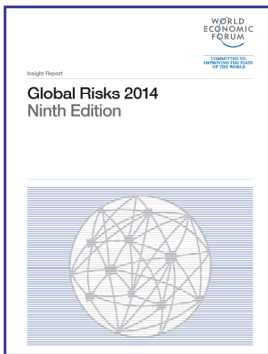
was organized by the OECD under the aegis of the High-Level Advisory Board on the Financial Management of Large-Scale Catastrophes chaired by Erwann Michel-Kerjan, in cooperation with the U.S. Department of the Treasury, which hosted the event on September 10, 2014. View the agenda at <http://www.oecd.org/daf/fin/insurance/2014-Terrorism-Risk-Insurance-Agenda.pdf>. See also a related editorial, [How Terror-Proof Is Your Economy?](#) in the journal, *Nature*.



Risk Center faculty and fellows serve on these national committees:

- Science and Technology Directorate Homeland Security & Technology Advisory Committee (Stephen E. Flynn)
- National Research Council's Committee on the Analysis of Costs and Benefits of Reforms to the National Flood Insurance Program (Carolyn Kousky)
- National Research Council's Committee on the Analysis of Costs and Benefits of Reforms to the National Flood Insurance Program (Howard Kunreuther)
- National Research Council's Roundtable on Risk, Resilience, and Extreme Events (Howard Kunreuther)
- FEMA's Technical Mapping Advisory Committee (Howard Kunreuther)
- National Research Council's Committee on Risk-Based Methods for Insurance Premiums of Negatively-Elevated Structures in the National Flood Insurance Program (Erwann Michel-Kerjan)

Risk Center Partners with the World Economic Forum on *Global Risks 2014*



The systemic nature of our most significant global risks calls for procedures and institutions that are globally coordinated yet locally flexible. As international systems of finance, supply chains, health, energy, the Internet and the environment become more complex and interdependent, their level of resilience determines whether they become bulwarks of global stability or amplifiers of cascading shocks.

Strengthening resilience requires overcoming collective action challenges through international cooperation among business, government and civil society.

Based on a survey of the World Economic Forum's multi-stakeholder communities, [Global Risks 2014](#) maps 31 global risks according to level of concern, likelihood and impact and interconnections. Findings:

- The risks of highest concern to respondents are fiscal crises in key economies, structurally high unemployment and underemployment, and water crises.
- The risks considered high impact and high likelihood are mostly environmental and economic: greater incidence of extreme weather events, failure of climate change mitigation and adaptation, water crises, severe income disparity, structurally high unemployment and underemployment and fiscal crises in key economies.
- The risks perceived to be most interconnected with other risks are macroeconomic: fiscal crises and structural unemployment and underemployment, with strong links between this macroeconomic risk nexus and social issues, such as rising income inequality and political and social instability. The failure of global governance emerges as a central risk that is connected to many different issues. Mapping perceived interconnections between risks helps to understand the potential transmission channels between them.
- The decline of trust in institutions, lack of leadership, persisting gender inequalities and data mismanagement were among trends to watch, according to survey respondents. Experts added further concerns including various forms of pollution, and accidents or abuse involving new technologies, such as synthetic biology, automated vehicles and 3-D printing.

Global Risks 2014 is published by the **World Economic Forum** in Geneva, Switzerland. The report was developed with contributions from **Marsh & McLennan**, **National University of Singapore**, **Swiss Re**, **University of Oxford**, **Wharton Risk Center** and the **Zurich Insurance Group**. The **Wharton Risk Center** has been the academic partner of the World Economic Forum since the inception of the Global Risks Project in 2004.

How Firms Approach Risk

Over the past decade, risk management has assumed a much more important role in many firms across different industry sectors. [Global Risks 2014](#) includes a section on "Strategies for Managing Global Risks" based on the Wharton Risk Center's study (see page 1) that interviewed over 100 high-level executives in S&P 500 companies to examine ways in which firms approach risk, and suggests strategies for firms and governments to build resilience to shocks from systemic global risks that, through interdependencies, may impact them in unexpected ways.

In general, there is a trend away from technical planning for individual risks and towards holistic planning for a range of unspecified risks. A spate of crises and extreme events in recent years has convinced many companies that the benefits of globalization have been accompanied by a much greater degree of interdependency and interconnectedness, bringing new vulnerabilities from unexpected directions.

A related trend is for risk management to be approached from a more strategic and enterprise-wide perspective, typically with a chief risk officer (or senior executive playing this role) reporting to the chief executive officer and the board, rather than decentralized to departments or reporting to the chief financial officer.

This dynamic applies to governments, too, where there is also a tendency for departments to argue for attention to their own sector-specific risks rather than take a holistic view of the risks of the greatest national importance that may interact with and reinforce others if not mitigated.

TEN GLOBAL RISKS OF HIGHEST CONCERN in 2014

| No. | Global Risk |
|-----|--|
| 1 | Fiscal crises in key economies |
| 2 | Structurally high unemployment/underemployment |
| 3 | Water crises |
| 4 | Severe income disparity |
| 5 | Failure of climate change mitigation and adaptation |
| 6 | Greater incidence of extreme weather events (e.g. floods, storms, fires) |
| 7 | Global governance failure |
| 8 | Food crises |
| 9 | Failure of a major financial mechanism/institution |
| 10 | Profound political and social instability |

Source: Global Risks Perception Survey 2013-2014.

Note: From a list of 31 risks, survey respondents were asked to identify the five they are most concerned about.

http://www3.weforum.org/docs/WEF_GlobalRisks_Report_2014.pdf

Risk Management as an Instrument for Economic Development

By Silki Patel, Penn Program on Regulation at the University of Pennsylvania.

Condensed and reprinted with permission of the Penn Program on Regulation. [PPR News](#), Dec. 10, 2013.

Despite progress in reducing poverty around the world, more than 75% of the population in developing countries lives on less than \$4.00 a day, according to [World Bank data](#).

The [World Development Report 2014](#), issued by the **World Bank**, asserts that governments in developing countries need to engage in more proactive and systematic risk management in order to build a more solid foundation for economic growth.

“Mounting evidence shows that adverse shocks — above all, health and weather shocks and economic crises — play a major role in pushing households below the poverty line and keeping them there,” according to the report, “[Risk and Opportunity: Managing Risk for Development](#).”

The team that produced the report, **Stéphane Hallegatte**, **Kyla Wethli** and **World Development Report Director Norman Loayza** presented their [findings](#) at the Wharton School, University of Pennsylvania as part of the Penn Program of Regulation Risk Regulation Seminar Series.

The authors argued that preparation and recovery efforts by governments, communities, and individuals have become more essential in the face of social unrest, economic crises, and more frequent environmental disasters. Effective risk management practices can provide both resilience to withstand future events and the ability to take advantage of development opportunities.

The benefits of preparing and managing risk will usually outweigh the costs, sometimes overwhelmingly so. Bangladesh, a country that has faced three devastating cyclones in the past four decades, provides an example. Due to the implementation of a nationwide program to build shelters, improve forecasting capacity, and extend a simple public alert system, the casualties from cyclones in Bangladesh have been

greatly reduced — from 300,000 lives lost in 1970 to 4,000 in 2007.

Even when risk preparation is cost-effective and saves lives, many individuals and societies remain ill-equipped to respond to shocks. Constraints and obstacles posed by a lack of information and resources, cognitive and behavior failures, missing markets and public goods, and unintended social and economic consequences make risk a “special challenge” for development policy. Because individuals have limited capacity to respond to shocks, a supportive environment is needed for effective preparation and response to risk.

The World Bank calls for “shared action and responsibility at different levels of society, from the household to the international community.” The report’s authors stressed that risk can never be completely eliminated. But people and institutions can build resilience to risk by applying a balanced approach that includes structural policy measures, community-based prevention, insurance, education, training, and effective regulation. The report recommends that countries set up national risk boards to systematically assess risks and coordinate public and private actions to address them.

In addition to lessening the uncertainty and impact of risks, governments must also provide the right incentives to people and institutions to do their own planning and preparation. According to Director Norman Loayza, “To manage risks effectively, two changes in people’s mindset related to individual and social responsibility are critical: moving from dependency to self-reliance and from isolation to cooperation. Providing the right incentives can contribute in both regards.”

The [Risk Regulation Seminar Series](#) is jointly sponsored by the Penn Program on Regulation, the Wharton Risk Management and Decision Processes Center, and the University of Pennsylvania’s Initiative for Global Environmental Leadership. The seminar was moderated by Erwann Michel-Kerjan, executive director of the Wharton Risk Center.

[Video](#) of the session can be viewed at <http://www.wharton.upenn.edu/riskcenter>.

The full version of this article is online at the Penn Program on Regulation <http://www.regblog.org/2013/12/10-patel-ppr-risk-management.html>.

PENN PROGRAM ON REGULATION
REGBLOG



Erwann Michel-Kerjan (Wharton Risk Center), Stéphane Hallegatte (World Bank), Kyla Wethli (World Bank), and Norman Loayza (World Bank)



Lessons from Hurricane Sandy

By Daniel E. Walters, Regulation Fellow at the Penn Program on Regulation at the University of Pennsylvania. Condensed and reprinted with permission of the Penn Program on Regulation. [PPR News](#), Jan 21, 2014.

On the first anniversary of Hurricane Sandy, the Wharton Risk Management Center organized an expert panel to discuss steps to reduce losses from hurricanes and floods. Panelists shared their thoughts on the Biggert-Waters National Flood Insurance Reform Act of 2012, passed three months before Hurricane Sandy, that addressed ways to reduce future losses while providing better financial protection to disaster victims.

The Biggert-Waters legislation of 2012 was criticized in that some homeowners would face drastic increases in their flood insurance premium when their property is reclassified into a high-risk flood plain. The premium spikes might prompt some to leave the floodplain. These effects are precisely what Biggert-Waters sought to achieve, to at least some degree, in an effort to make NFIP solvent and to deal with the long-term threat of rising sea levels. But critics argued that the reforms pushed too far and too fast.

Speaking to a standing-room-only audience, the panel addressed questions on risk mitigation strategies, the behavioral and equitable impacts of risk-rated premiums and the ways that federal, state, and local governments and communities are interacting to rebuild from Sandy and prepare for future events.

Roy Wright, Deputy Associate Administrator for Mitigation at the **Federal Emergency Management Agency (FEMA)**, recounted the development of the NFIP in the late 1960s in response to a shortage of availability of flood insurance by the private market. To encourage communities and homeowners to purchase flood insurance, the program developed a system of subsidies for houses built before flood insurance maps were drawn. About 19 percent of the policies sold have discounts applied through subsidies or grandfathering, making some of the NFIP program not actuarially sound. The recent superstorms in the United States—Hurricane Katrina and

Hurricane Sandy—put new pressure on the program, driving it into a deep deficit. Wright described FEMA's role as a "catalyst for resilience" in communities that face flood risks.

Marion Mollegen McFadden, Chief Operating Officer, Hurricane Sandy Rebuilding Task Force and **Supervisory Attorney** at the **Department of Housing and Urban Development** pointed out the major distributional and equitable effects of Biggert-Waters' reform of subsidies, grandfathering, and consequent recalibration of insurance premiums in high-risk areas. About 40 percent of the people living in the floodplain are of low and moderate income. She recounted the efforts of the Obama Administration to set up a cabinet-level taskforce that would address the problems with NFIP while retaining its ability to provide for those who are most seriously impacted by catastrophic flooding.

Katherine Greig, Senior Policy Advisor, New York City Mayor's Office of Long-Term Planning and Sustainability, discussed some of the practical difficulties that the city has faced in planning for future disasters, from reworking building codes to finding ways to keep businesses open during disasters. The city's concern about the viability of its neighborhoods in the wake of changes in premiums will have to be balanced by the legitimate need for valid price

signals of the risk associated with specific locations. The principal way to appropriately balance these concerns is through inter-governmental collaboration.

Sean Kevelighan, Government and Industry Affairs, Zurich North America, provided an insurer's perspective on the problems faced in preparing for storms. Kevelighan detailed efforts being made by insurers to adequately communicate via social media and text with policy owners in the time surrounding major events, as well as to use site visits in the immediate aftermath of storms to expedite claims processing and deal with the uncertainty and confusion that existing plans leave in the wake of disasters. Like the other panelists, Kevelighan emphasized how important it is for the insurance industry to keep reaching out to academics and others to continue developing a "multi-dimensional web of resilience," and for public entities to continue to work with private actors.

The panel was moderated by Howard Kunreuther and co-sponsored by the [Penn Program on Regulation](#).

Video of the discussion is available at the website of the [Wharton Risk Management Center](#). The full version of this article is online at the Penn Program on Regulation <http://www.regblog.org/2014/01/21-walters-pbr-flood.html>.

PENN PROGRAM ON REGULATION
REGBLOG



From left: Howard Kunreuther (Wharton School); Roy Wright (Federal Emergency Management Agency); Marion McFadden (U.S. Dept. of HUD); Katherine Greig (New York City Mayor's Office); Sean Kevelighan (Zurich North America).

News and Notes



The Risk Center welcomes **Dr. Marilyn Montgomery** as a post-doctoral fellow. Marilyn's research interests include environmental justice, social vulnerability, flood risk, and flood insurance. In August 2014, she earned her Ph.D. in geography and environmental science and policy from the University of South Florida. Her dissertation research investigated the environmental justice implications of coastal and inland flood hazards in Miami, Florida. Part of this dissertation research was the development of an expert decision system of various spatial interpolation techniques to estimate residential populations exposed to flood hazards. Marilyn has been using geographic information science technology for over ten years, and she earned her certification as a Geographic Information Systems Professional (GISP) in January of 2012. During her time at the University of South Florida, she was a research assistant funded by the National Science Foundation (grants CMMI-1129984/1130191); she has co-authored four peer-reviewed journal articles. She holds Bachelor's and Master's degrees in environmental science from the University of West Florida.

At the Wharton Risk Center, Marilyn will continue her research on geo-spatial analyses of environmental justice and social vulnerability to flood hazards, and flood insurance. She is part of the Wharton team's research alliance with Zurich Insurance Group for Flood Resilience Research. Marilyn also contributes to ongoing research with the Federal Emergency Management Agency concerning the National Flood Insurance Program and the Community Rating System.



Wharton Risk Center postdoctoral fellow **Dr. Benjamin Collier** was selected to receive the Agricultural & Applied Economics Association's prestigious Outstanding Doctoral Dissertation Award for his dissertation, *Financial Inclusion and Natural Disasters*. Ben formally received the award at the AAEA Awards & Fellows Recognition Ceremony on July 28 at the 2014 AAEA Annual Meeting in Minneapolis.

Paul R. Kleindorfer Award

Congratulations to OPIM Ph.D. student **Hengchen Dai**, recipient of the *Paul R. Kleindorfer Scholar Award*.

The Operations and Information Management department at the Wharton School established the *Paul R. Kleindorfer Memorial Fund* to honor the memory of Paul Kleindorfer, Emeritus Professor who passed away in August 2012. The award recognizes the OPIM doctoral student who is making the most outstanding progress towards the completion of his or her dissertation and provides \$4,000 of research support. Hengchen is also an Ackoff Student Fellow of the Risk Center.



Contributions to the Paul R. Kleindorfer Memorial Fund may be sent to Alison Matejczyk at the Wharton School, University of Pennsylvania, 344 Vance Hall, 3733 Spruce Street, Philadelphia PA 19104. Please make checks payable to the Trustees of the University of Pennsylvania, with "Kleindorfer Fund" in the memo field.



Congratulations to the Center for Risk and Economic Analysis of Terrorism Events (CREATE) on its 10-year Anniversary

On April 24, a group of over 100 representatives from academia, industry and well-known experts in government and homeland security gathered in Los Angeles to recognize CREATE's contributions and advancements to homeland security research, a milestone for the DHS Center of Excellence at the University of Southern California. The Wharton Risk Center team collaborates with CREATE on multidisciplinary research projects in risk analysis, economic assessment and disaster insurance.

Bloomberg Businessweek Companies & Industries

Bloomberg Businessweek and the Wharton Risk Center have begun a new series on risk management written by the Center's directors, Howard Kunreuther, Robert Meyer and Erwann Michel-Kerjan.

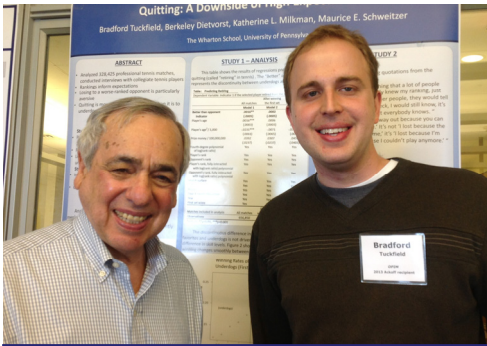
The inaugural column, "To Get People to Buy Insurance, Change How You Talk About Risk," is online at:

<http://www.businessweek.com/articles/2014-09-22/to-get-people-to-buy-insurance-change-how-you-talk-about-risk>.

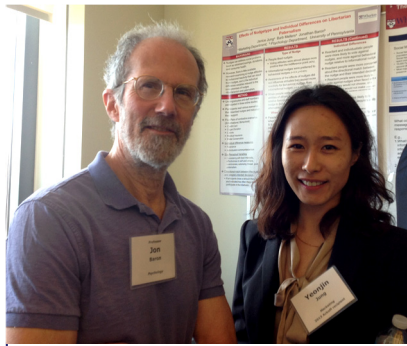
Russell Ackoff Doctoral Student Fellowship Awards, 2014

The Wharton Risk Center is pleased to announce the recipients of its 2014 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 Paul Kleindorfer, former co-director of the Wharton Risk Center. The grants fund data collection, conference fees and other research expenses for studies in human decision making by doctoral students in Wharton and other departments at the University of Pennsylvania. More information can be found at www.wharton.upenn.edu/riskcenter/ackoff.cfm.

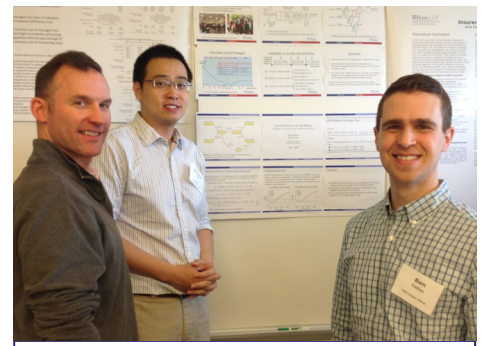
| RECIPIENT | DEPARTMENT | PROPOSAL TITLE |
|----------------------|---------------------------------|---|
| Alixandra Barasch | Marketing | Paper, plastic, or penalty? The motivating force of carrot versus stick incentives |
| Nora Becker | Health Care Mgmt & Economics | The Impact of State Contraception Coverage Mandates on Contraceptive Utilization |
| T. Bradford Bitterly | Operations and Information Mgmt | Risky Business: How Humor Increases Status and Trust |
| Andrea Contigiani | Management | Extrinsic Rewards, Intrinsic Motives, and Innovation |
| Hengchen Dai | Operations and Information Mgmt | The Effects of Task Categorization & Temporal Focus on Productivity |
| Kaitlin Daniels | Operations and Information Mgmt | Learning by Doing and Product Differentiation in the Solar Panel Installation Industry |
| Berkeley Dietvorst | Operations and Information Mgmt | Understanding Algorithm Aversion |
| Katrina Fincher | Psychology | Look me in the eye: Eye contact mediates the empathic giving via perceptual dehumanization |
| Andrew Johnston | Business Econ & Public Policy | Optimal Teacher Compensation & Teacher Preferences |
| Yeonjin Jung | Marketing | Good Policies that Are Too Effective to be Good |
| Theresa Kelly | Operations and Information Mgmt | Why and When does Question Specificity Affect Prediction Quality |
| Minji Kim | Annenberg School | Character-Audience Similarity & Persuasion: Moderating Role of Message Themes in Anti-Smoking Campaign Messages |
| Dokyun Lee | Operations and Information Mgmt | The Impact of Recommender Systems on Consumers: Study of Sales Volume & Diversity |
| Adam Leive | Health Care Mgmt & Economics | Dying to Win? Olympic Gold Medals & Longevity |
| Emma Edelman Levine | Operations and Information Mgmt | Ethical Dilemmas and Trust |
| Robert Mislavsky | Operations and Information Mgmt | The Effect of Pride and Disappointment on Motivation |
| Jihae Shin | Management | How People Perceive Serendipity & How It Affects Their Decision Making |
| Shalena Srna | Marketing | Influence of Income Tax |
| Bradford Tuckfield | Operations and Information Mgmt | The Marginal Propensity to Consume an Employer Bonus |
| Evan Weingarten | Marketing | What Drives "Clumpy" Consumption? |



Prof. Howard Kunreuther (OPIM, co-director of the Risk Center) and Brad Tuckfield (OPIM, 2014 Ackoff Fellow)



Prof. Jon Baron (Psychology) and Yeonjin Jung (Marketing, 2014 Ackoff Fellow)



Dr. Jeff Czajkowski (Risk Center Fellow), John Shiliang Cui (OPIM, 2013 Ackoff Fellow) and Dr. Ben Collier (Risk Center Fellow)



Prof. Bob Meyer (Marketing, co-director of the Wharton Risk Center), introduces the event.

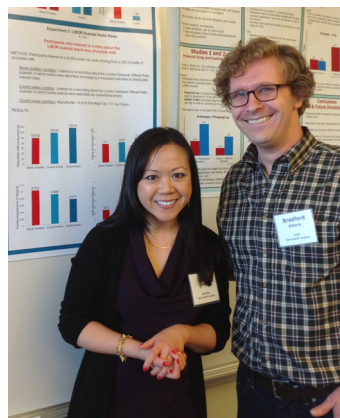
Recipients of the 2013 Ackoff Doctoral Student Fellowships presented their research at the Risk Center's annual Ackoff luncheon and poster session. Some 50 students and faculty members attended the event which coincided with the announcement of the 2014 award recipients. This year, fellowships were awarded to 20 doctoral students at Penn.



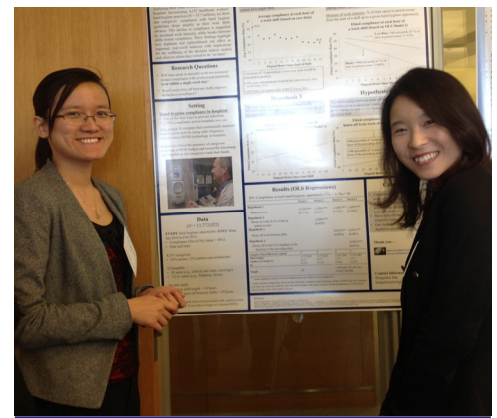
Nora Becker (Health Care Mgmt, 2014 Ackoff Fellow) and Prof. Scott Harrington (Health Care Mgmt)



Facing: Kaitlin Daniels (OPIM, 2013-14 Ackoff Fellow), Dokyun Lee (OPIM, 2013 Ackoff Fellow) and Theresa Kelly (OPIM, 2014 Ackoff Fellow)



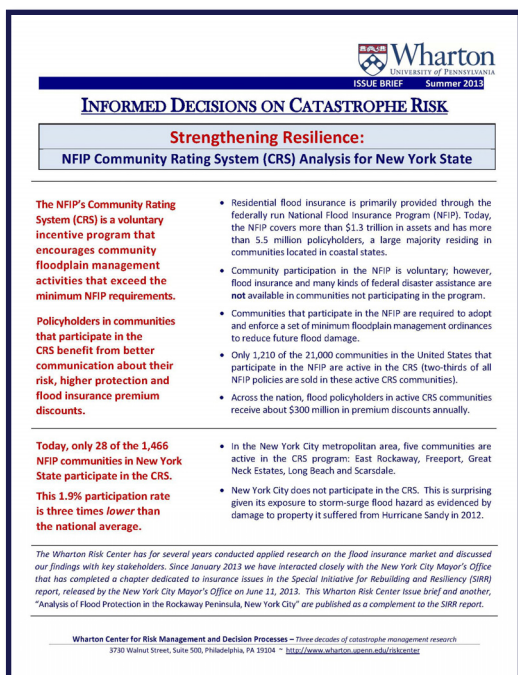
Cindy Chan (Marketing, 2013 Ackoff Fellow) and Brad Bitterly (OPIM, 2014 Ackoff Fellow)



Hengchen Dai (OPIM, 2013-14 Ackoff Fellow) and Jihae Shin (Management, 2014 Ackoff Fellow)

Wharton Risk Center Issue Briefs

The Wharton Risk Center's issue briefs are non-technical 4-page 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.



The 2013-2014 series includes research on

- [New York City residents' perceptions of flood risk and insurance purchase choices](#)
- [Analysis of corporate demand for terrorism insurance in the U.S.](#)
- [Effective building codes](#)
- [Improving insurance decisions](#)

Issue briefs are available on the Center's website, www.wharton.upenn.edu/riskcenter/issuebriefs.cfm. To request hard copies, please contact Carol Heller, hellerc@wharton.upenn.edu.

Flood Risk Perceptions and Flood Insurance Choices: A Survey of New York City Residents

Six months after Hurricane Sandy, we surveyed over 1,000 homeowners in New York City who live in a flood-prone area about their flood risk perceptions and flood insurance purchases. Among the findings: most people underestimate the damage a flood could cause. 44% of respondents stated they purchased flood insurance because it was mandatory. Only 21% bought flood insurance voluntarily, 33% did not have coverage, and 2% did not know if they had flood coverage.

An Economic Analysis of Corporate Demand for Insurance in the U.S.

The U.S. Terrorism Risk Insurance Act (TRIA) was established in 2002 as a temporary measure to make terrorism insurance widely available to corporations. If renewed, the government might require insurers to assume more risk which could increase prices. We find that under current market conditions, firms' demand for terrorism insurance is strong and is not very sensitive to gradual price changes.

The Role of Effective and Well-Enforced Building Codes: The Case of Hail Storms in Missouri

A midsize community (50,000 people) that experiences a moderate hail storm could expect to reduce losses by approximately \$4 to \$8 million by adopting and enforcing appropriate building codes.

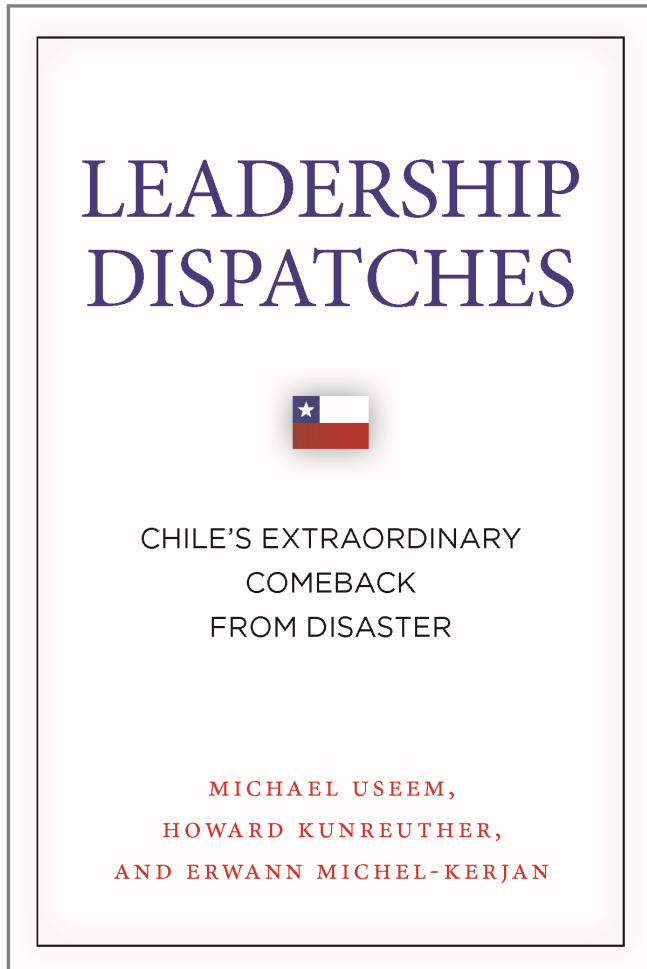
Addressing Affordability: The National Flood Insurance Program

We propose a voucher/loan program that will assist homeowners to afford risk-based insurance premiums and also make improvements to their home that will reduce their future risk. The lowered flood risk will lead to reductions in the risk-based premiums charged by the NFIP.

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

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

New Book—Forthcoming



Leadership Dispatches: Chile's Extraordinary Comeback from Disaster

by Michael Useem, Howard Kunreuther and Erwann Michel-Kerjan

Lessons from the Chilean Earthquake of 2010

In the early hours of February 27, 2010, a powerful earthquake rocked Chile for nearly two minutes. At Mw 8.8, it was the eighth largest seismic event of the modern era, five hundred times more powerful than the quake just six weeks earlier that had killed more than a quarter million in Haiti. The F27 event in Chile devastated homes, schools, hospitals, roads and telecommunications, paralyzing the country for days. The damage was equal to 18 percent of Chile's GDP, the equivalent of a \$2.7 trillion loss in the U.S., more than twenty times greater than that caused by Hurricane Katrina in 2005.

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

Leadership Dispatches imparts lessons learned from the actions of Chile's leaders and the country's recovery in the aftermath of the earthquake.

Stanford University Press, 2015. ISBN: 9780804793872. 256 pp.
More information online at <http://sup.org/book.cgi?id=25059>

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The authors serve as advisers to **Chilean President Sebastián Piñera** and his Ministers on matters of catastrophic risk management. This book was written with the active cooperation of the Government of Chile, with Aldo Boitano, Eugenio Guzmán, Rodrigo Jordán, and Matko Koljatic of **Vertical S.A.** and **Catholic University, Santiago, Chile**, and in collaboration with the **World Economic Forum**.

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Erwann Michel-Kerjan notes that most companies will pay 3% to 5% of their property premium on terrorism insurance, but if the Terrorism Risk Insurance Act is not renewed, those costs will be higher.

September 22, 2014, *Businessweek.com*. [To Get People to Buy Insurance, Change How You Talk About Risk](#)
Op-ed by Howard Kunreuther, Bob Meyer and Erwann Michel-Kerjan: Ask homeowners to consider how they would handle their recovery process if they were uninsured.

August 26, 2014, *The Washington Post*. [Fewer American homeowners are buying earthquake insurance](#)
Howard Kunreuther comments on California homeowners' lack of interest in earthquake insurance, in an article following the quake in the San Francisco Bay area on August 24.

July 30, 2014, *Boston Globe Online*. [Teaching people to take natural disasters seriously](#)
Robert Meyer: The problem is not that we're cavalier about hurricanes and tornadoes—it's that we're really bad at imagining how natural disasters actually unfold, and what it would mean to truly prepare.

July 22, 2014, *CNBC*. [The future of terrorism insurance for Corporate America](#)
Op-ed by Howard Kunreuther and Erwann Michel-Kerjan: Taxpayers would be more exposed to losses from a future terrorist attack without the Terrorism Risk Insurance Act (TRIA).

May 24, 2014, *New York Times*. [Buying Insurance Against Climate Change](#)
Article by Robert Shiller cites the book, [Insurance and Behavioral Economics: Improving Decisions in the Most Misunderstood Industry](#) by Howard Kunreuther, Mark Pauly and Stacey McMorrow.

March 31, 2014, *Re:Connect*. [Three Important Lessons From the Oso Mudslide Tragedy](#)
Op-ed by Stephen Flynn: In the critical moments after disasters strike, the first responders are rarely professionals.

March 24, 2014, *AP, NPR, MSNBC.com, ABC News, Times-Herald*.
[No easy fix on flood insurance, but experts say options exist to improve program](#)
Article cites Carolyn Kousky and Howard Kunreuther's proposed system in which property owners could get vouchers offering relief from high premiums in exchange for raising their homes up on pilings, a high foundation or other supports.

March 6, 2014, *The Hill*. [Maintain the Best Features of Biggert-Waters](#)
Op-ed by Howard Kunreuther and Erwann Michel-Kerjan: "Congress should focus on the long-term goal of making America more resilient to future flood catastrophes and fiscal responsibility."

February 14, 2014, *CNBC*. [Four Tips for Managing Catastrophic Risk](#)
Howard Kunreuther draws on findings from a Wharton Risk Center study about how chief risk officers in S&P 500 companies are dealing with catastrophic risks. The study was featured in the World Economic Forum's *Global Risks Report 2014*.

January 27, 2014, *CNBC*. [Stop the Davos Bashing!](#)
Erwann Michel-Kerjan, a collaborator with the World Economic Forum, provides a five-point reality check about what is maybe less known about Davos.

November 4, 2013, *Insurance Journal*. [World Needs Insurance Industry to Be "Bold" and "Sexy"](#)
Interview with Erwann Michel-Kerjan at the Professional Liability Underwriting Society (PLUS) International Conference.

October 29, 2013, *Huffington Post*. [A Proposal for Insuring Public Facilities and Infrastructure Against Disaster Losses](#)
Howard Kunreuther and Erwann Michel-Kerjan propose that states and local governments start purchasing (multi-year) insurance contracts to protect their infrastructure assets.

October 10, 2013, *Pittsburgh Tribune*. [Disaster relief not flowing to flood victims](#)
Interview with Howard Kunreuther on the availability of small business loans that provide disaster funding.

October 9, 2013, *CNN Money*. [Government shutdown's biggest villain? Pride](#)
"Pride," says Michael Useem, professor of management at the Wharton School, "is a great enemy of decision making."

October 8, 2013, *Inc. Online*. [Leading in Crisis: 3 Tips from the Fukushima Nuclear Disaster](#)
Howard Kunreuther, Robert Meyer and Erwann Michel-Kerjan discuss lessons learned from the 2011 Japan disaster.

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Mark Pauly discusses ways that Obamacare is similar to and differs from Medicaid.

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October 14, 2013 (see page 21)

[Risk and Opportunity: Managing Risk for Development](#)

Moderated by: **Erwann Michel-Kerjan**, Wharton Risk Center
Norman Loayza, World Bank
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November 12, 2013 (see page 22)

[Learning from Hurricane Sandy: A Panel Discussion on Reducing Future Disaster Losses](#)

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Katherine Greig, New York City Mayor's Office
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December 3, 2013

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February 18, 2014 (right)

[Does Regulation Kill Jobs?](#)

Moderated by **Cary Coglianese**, Director, Penn Program on Regulation, and Edward B. Shils Professor of Law and Professor of Political Science, University of Pennsylvania

Richard L. Revesz, Dean Emeritus and Lawrence Kind Professor of Law, New York University

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Hon. Howard Shelanski, Administrator,
[Office of Information and Regulatory Affairs \(OIRA\)](#)

March 25, 2014

[How Well is Obamacare Working?](#)

Three of the nation's foremost authorities on health care and insurance policy discussed what impacts the ACA is having on small businesses and insurers and how the law and its implementation might be improved.

Moderated by: **Howard Kunreuther**, Wharton Risk Center
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Mark Duggan, Rowan Family Foundation Professor, Wharton School
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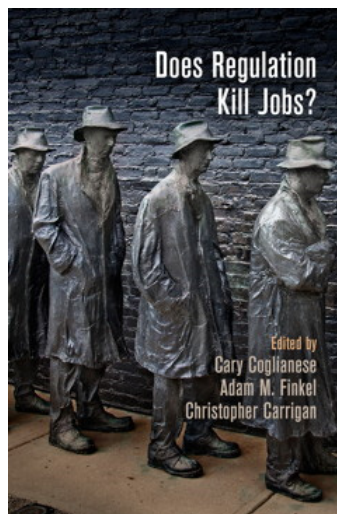
Does Regulation Kill Jobs?



Cary Coglianese, Director of the Penn Program on Regulation and Edward B. Shils Professor of Law and Professor of Political Science

Competing and extreme claims about the relationship between regulation and jobs pervade political debate in Washington, DC. Some politicians claim that regulations kill significant numbers of jobs by increasing the cost of production, while others claim that regulations create jobs by creating new products and new opportunities for investment. Ultimately this heated debate provides little insight into what is, at root, an important empirical question in an era of bleak economic conditions: Does regulation actually kill jobs?

Organized around the recent publication of the book [Does Regulation Kill Jobs?](#) the panel, moderated by Cary Coglianese, showed how difficult it is to find any evidence to support claims that regulations systematically kill jobs. Political rhetoric notwithstanding, the book's introductory chapter states that "the existing empirical research suggests that regulation does relatively little to reduce or increase overall jobs in the United States."



Edited by Cary Coglianese, Adam M. Finkel, and Christopher Carrigan

University of Pennsylvania Press, 2014

Cloth: ISBN 978-0-8122-4576-9

312 pages

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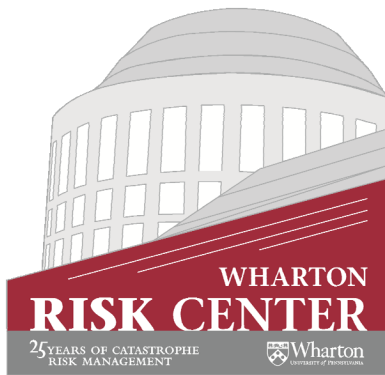
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Over the past three decades, the Risk Management and Decision Processes Center at the Wharton School has been at the forefront of basic and applied research to promote effective corporate and public policies for low-probability events with potentially 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).

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