



Managing and Financing Extreme Events

A Research Program of the Wharton Risk Management and Decision Processes Center

The Managing and Financing Extreme Events research program was initiated in 1996 as a joint activity between the Wharton Risk Management and Decision Processes Center and the Wharton Financial Institutions Center. Initially, it was concerned with the role of mitigation, insurance and capital markets instruments in managing catastrophic risks arising from natural hazards. Given the growing terrorism threat, the project has expanded in focus to deal with terrorism and other extreme events. In the post-9/11 and Katrina Eras, these issues have taken center stage. Furthermore, the globalization of economic and social activities increases interdependencies, so actions taken 5,000 miles away can affect us tomorrow; and vice versa. These global risks call for a new model of risk management.

What follows is a “snapshot” summary of the most recent research activities undertaken at the Center on this program. Summaries of recent working papers, journal publications and books written by faculty at the Center are also presented. More information on all of the publications presented here is available online.

The Wharton Risk Center looks forward to working on these issues with its industry partners, public sector agencies and international organizations, as well as with other institutions interested in joining this program. More details on the Wharton Risk Center can be found at: <http://opim.wharton.upenn.edu/risk/>

Howard Kunreuther

Erwann Michel-Kerjan

Insuring and Mitigating Risks of Large-Scale Natural Disasters

Progress is continuing on the Wharton Risk Management and Decision Processes Center's initiative, *Managing Large-Scale Risks in a New Era of Catastrophes*. This initiative, launched in 2006, brings together leading companies and trade associations in the insurance, reinsurance, banking and defense industries as partners in this project undertaken by the Wharton School in conjunction with Georgia State University and the Insurance Information Institute. The project team has also been in close contact with organizations in the private and public sectors concerned with the role of insurance and mitigation in reducing losses from future disasters and providing financial assistance to victims of these catastrophes. A report on Phase I of the study was issued in February 2007.

Building on these preliminary findings, the current Phase II Report provides a series of in-depth analyses of the efficiency and equity of current disaster insurance and mitigation programs in the U.S. market and its state-based regulatory environment, and their impact on loss distributions between different stakeholders. We focus specifically on hurricane risk and flood hazard and on protection to homeowners. The draft of the Phase II Report (380 pages) has been distributed to interested parties and is the focus of a conference on October 12, 2007 at the American Association for the Advancement of Science in Washington, DC. We anticipate that the Phase II Report will be completed at the end of 2007.

Characterizing the Problem

The natural disasters that have occurred in the United States and other parts of the world during the past few years have exposed us to an entirely new scale of devastation due to increased development in hazard-prone areas. In 2005, three major hurricanes – Katrina, Rita and Wilma – made landfall in the Gulf of Mexico within a six-week time period, killing over 1,400 people and leading to insurance reimbursements and federal disaster relief of over \$180 billion in the United States alone; a historical record. These three hurricanes occurred after four other hurricanes had caused severe damage in Florida in 2004. Even though alarming weather forecasts predicted a highly turbulent 2006 hurricane season in the North Atlantic Ocean, not a single major hurricane made landfall in the United States in 2006. To date (October 10, 2007), there have been no damaging hurricanes in the United States in 2007.

Our principal purpose in undertaking these in-depth studies is to examine alternative long-run sustainable strategies for reducing disaster losses and providing financial support to victims of these events. We are mindful that from a political vantage point this is extremely difficult to do because our country has *not* experienced any severe disasters during the past two years. There is a tendency for all of us, whether in the role of homeowner, decision maker in a private or public sector organization, or as a political representative at the state, local or federal level, to pay attention only to short-run crises. We need a coherent strategy for assuring a sustainable recovery in the aftermath of the next extreme event. The Phase II Report provides the elements for moving in this direction by focusing on the roles that mitigation, insurance and other risk transfer instruments can play in this regard.

Guiding Principles

The following two principles underlie the proposed strategies for dealing with natural disasters detailed in the Phase II Report:

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

Principle 2: Dealing with Equity and Affordability Issues. Any special treatment given to lower income residents in hazard-prone areas who cannot afford the cost of living in those locations should come from general public funding and not through insurance premium subsidies.

Nature of the Phase II Report

The Phase II Report addresses the following five questions:

- *What is the current status of disaster insurance markets and government regulatory programs?*
- *What alternative strategies should be considered for reducing future disaster losses and providing financial support for victims of these events?*
- *What economic impact do the current program and proposed strategies have on the key interested parties affected by natural disasters?*
- *Who will pay for future losses?*
- *What are the implementation challenges?*

In order to provide specificity to these questions, we focus on four states where there is a large exposure to the hurricane risk but with significant differences in insurance market regulation and public/private risk sharing: *Florida, New York, South Carolina and Texas* and the following metropolitan areas in each of these states: *Miami-Dade County, FL, New York City area, NY, Charleston area, SC and Houston area, TX.*

There are currently several pending legislations that would modify the way disasters are insured in the United States. Decisions by Congress and other legislative bodies should be based on a sound conceptual framework and well-documented empirical analyses. The Phase II Report is written with these two criteria in mind. We believe that it provides ingredients for evaluating alternative insurance and mitigation programs for reducing future disaster losses.



Major Activities

1. Mitigation of hazards via building and other retrofits: This part of the project concerns assessing the effects of mitigation on expected losses, and on insurer solvency and profitability. The project has also considered the implications of such mitigation for insurance industry practices and for homeowner decisions to invest in mitigation measures.

2. Insurance regulation and industry analysis: This research entailed a large-scale empirical analysis of the supply and demand determinants of market offerings of catastrophe insurance products, and the effects of regulation on solvency and pricing of such products.

3. Securitization of insurance risk: Over the past ten years, new financial instruments in the form of insurance - linked security (ILS) have been developed to complement catastrophe risk coverage provided by traditional reinsurance. The project has studied the design and pricing of such securities (e.g., industry loss warranties, catastrophe bonds, and sidecars) and the determinants of their market acceptance. More recently, we have studied some of the main drivers of the radical upward shift in the ILS market after the 2004 and 2005 hurricane seasons. The project continuously analyzes the creation of new innovative solutions.

4. Measuring the capacity of insurance and reinsurance markets to respond to catastrophic losses: The reason for such strong interest in catastrophic risks has been the occurrence of extreme events, such as Hurricane Andrew in 1992 or the Northridge Earthquake of 1994, and the 2004 and 2005 hurricane seasons more recently. The project has developed a number of conceptual and computational tools for assessing the capacity of the insurance and reinsurance industry to respond to such events. Recently, it has also focused on terrorism in the aftermath of 9/11 and natural disasters in the post-Katrina era.

5. Interdependent security risks: The project has recently expanded its scope to confront issues of insurability and risk management for *security risks*, especially those involving multiple parties whose actions may give rise to interdependencies in the mitigation or financing of such risks. The project has also been concerned with the insurance issues that arise from the ambiguity and strategic nature of the risks from terrorism and the appropriate roles for the government and private sector in managing and financing such risks. The policy/strategy challenges associated with the protection of the nation's critical infrastructure are now also part of the project.

The Extreme Events research program has been fortunate to have had considerable input from sponsoring member institutions from the insurance and reinsurance sectors as well as the banking, finance and defense industries. Research partners are drawn from selected modeling and consulting firms.

Several comprehensive publications have resulted from the Extreme Events Project to date. These include four recent books:

Seeds of Disaster, Roots of Response: How Private Action Can Reduce Public Vulnerability, edited by Philip Auerwald, Lewis M. Branscomb, Todd M. LaPorte, and Erwann Michel-Kerjan, Cambridge University Press (2006).

On Risk and Disaster: Lessons from Hurricane Katrina, edited by Ronald Daniels, Donald Kettl, and Howard Kunreuther, University of Pennsylvania Press (2006).

Catastrophe Modeling: A New Approach to Managing Risk edited by Howard Kunreuther, Patricia Grossi and Chandu Patel, Kluwer Academic Publishers (2005).

Catastrophe Insurance: Supply, Demand and Regulation by Martin F. Grace, Robert W. Klein, Paul R. Kleindorfer and Michael R. Murray, Kluwer Academic Publishers (2003).

Recent Papers

Natural Disasters

- **“Climate Change, Insurability of Large-Scale Disasters and the Emerging Liability Challenge,”** by Howard C. Kunreuther and Erwann O. Michel-Kerjan, published in *Penn Law Review*, Vol. 155, No. 6, June 2007, pp. 1795-1842
<http://opim.wharton.upenn.edu/risk/library/07-01.pdf>

This paper focuses on the interaction between uncertainty and insurability in the context of some of the risks associated with climate change. It discusses the evolution of insured losses due to weather-related disasters over the past decade, and the key drivers of the sharp increases in both economic and insured catastrophe losses over the past 20 years. In particular, we examine the impact of development in hazard-prone areas and of global warming on the potential for catastrophic losses in the future. In this context we discuss the implications for insurance risk capital and the capacity of the insurance industry to handle large-scale events.

A key question that needs to be addressed is the factors that determine the insurability of a risk and the extent of coverage offered by the private sector to provide protection against extreme events where there is significant uncertainty surrounding the probability and consequences of a catastrophic loss.

The paper also focuses on the liability issues associated with global climate change, and possible implications for insurers (including D&O), given the difficulty in identifying potential defendants, tracing harm to their actions and apportioning damages among them. The paper concludes by suggesting ways that insurers can help mitigate future damages from global climate change by providing premium reductions and rate credits to companies investing in risk-reducing measures.

- **“Disasters and Public Policy: Can Market Lessons Help Address Government Failures?”** by Erwann O. Michel-Kerjan, published in *The National Tax Journal*, 2007. (forthcoming)
<http://opim.wharton.upenn.edu/risk/library/07-04.pdf>

Hurricane Katrina was a wake-up call for the entire country, and in some sense the world, much like the September 11, 2001 terrorist attacks: both underscored the undeniable reality that we are facing a new dimension of destruction combined with a lack of preparedness to deal with this new scale. Are we better off today? According to the 2006 House of Representatives’ report on the Hurricane Katrina crisis, we are not. “If 9/11 was a failure of imagination, then Katrina was a failure of initiative. It was a failure of leadership. If this is what happens when we have advance warning, we shudder to imagine the consequences when we do not.”

In the wake of 9/11 and Hurricane Katrina, executives and policymakers more than ever share an interest in (i) avoiding new disasters on U.S. soil and (ii) making social and economic systems less vulnerable should they occur. On paper, these are two complementary components of a global homeland security approach to deal with catastrophes. Unfortunately, the roles and responsibilities of the public and private sectors in protecting the homeland are still not clearly defined, nor have enough market incentives been developed to enhance self-protection. Thus the coming years have the potential to inflict even larger losses than what we have seen recently.

Natural Disasters cont.

- **“Extreme Events, Global Warming, and Insurance-Linked Securities: How to Trigger the ‘Tipping Point,’”** by Erwann O. Michel-Kerjan and Frederic Morlaye. August, 2007. (Forthcoming in *The Geneva Papers on Risk and Insurance*) Working Paper #2007-09-13
<http://opim.wharton.upenn.edu/risk/library/WP2007-09-13.pdf>

Large-scale disasters have occurred at an accelerated rhythm in the past five years. Further the continuous increase of exposed values in high risk areas and the potential impact of global warming on intensity of weather-related events shall accelerate the number and increase the scale of mega-catastrophes in the near future. That is a new era for catastrophe risk management which calls for the development of new solutions, in complement to the traditional insurance and reinsurance. The authors discuss some of the main drivers of the radical shift that happened in the insurance-linked security (ILS) market after the 2005 hurricane season in the Atlantic basin, which has rapidly become one of the world peak-zones in terms of exposure.

- **“Reflections on U.S. Disaster Insurance Policy for the 21st Century,”** by Howard Kunreuther, in *Risking House and Home: Disasters, Cities, Public Policy*, Berkeley Public Policy Press (2007) (forthcoming).
<http://opim.wharton.upenn.edu/risk/library/06-19.pdf>

The devastation caused by hurricanes during the 2004 and 2005 seasons has been unprecedented and is forcing the insurance industry to reevaluate the role that it can play in dealing with future natural disasters in the United States. Eighteen of the 20 most costly disasters occurred between 1990 and 2005 and 10 occurred in the 21st Century. This context is totally different than the scale of economic loss the country has suffered from natural disasters and other extreme events in the 20th century.

- **“Strategies for Better Protection against Catastrophic Risks,”** Howard Kunreuther, Robert Meyer and Erwann Michel-Kerjan, September, 2007. Working Paper # 2007-09-14
<http://opim.wharton.upenn.edu/risk/library/WP2007-09-14.pdf>

Even after the devastating 2004 and 2005 hurricane seasons, a large number of residents had still not invested in relatively inexpensive loss reduction measures with respect to their property, nor had they undertaken emergency preparedness measures. A survey of 1,100 adults living along the Atlantic and Gulf Coasts undertaken in May 2006 revealed that 83 percent of the responders had taken **no** steps to fortify their home, 68 percent had no hurricane survival kit and 60 percent had no family disaster plan.

We feel it is necessary to design sustainable policies based on our understanding of how individuals behave with respect to catastrophic risks. This article discusses in detail why some individuals do not invest in cost-effective mitigation measures while others do. We also propose long-term insurance and home improvement loans tied to mortgages to induce individuals to invest in cost-effective mitigation measures. We show that this program, coupled with well-enforced building codes, can significantly improve both individual and social welfare.

Global Risks and Interdependent Security

- **“Deterministic and Stochastic Prisoner’s Dilemma Games: Experiments in Interdependent Security”** by Howard Kunreuther, Gabriel Silvasi, Eric T. Bradlow and Dylan Small. July 2007. Risk Center Working Paper #2007-07-09, NBER #t0341 <http://opim.wharton.upenn.edu/risk/downloads/StochPrisDilem2007%20NBER%20341.pdf>

This paper examines experiments on interdependent security prisoner’s dilemma games with repeated play. By utilizing a Bayesian hierarchical model, we examine how subjects make investment decisions as a function of their previous experience and their treatment condition. Implications for individual decisions and the likely play of a person’s counterpart are discussed in detail.

- **“Modeling Interdependent Risks,”** by Geoffrey Heal and Howard Kunreuther, in *Risk Analysis*, Vol. 27. No. 3, 2007 <http://opim.wharton.upenn.edu/risk/library/RiskAnalysis-2007.pdf>

In an interdependent world the risks faced by any one agent depend not only on its choices but also on those of all others. Expectations about others’ choices will influence investments in risk-management and the outcome can be sub-optimal for everyone.

We model this as the Nash equilibrium of a game and give conditions for such a sub-optimal equilibrium to be tipped to an optimal one. We also characterize the smallest coalition to tip an equilibrium, the minimum critical coalition, and show that this is also the cheapest critical coalition, so that there is no less expensive way to move the system from the sub-optimal to the optimal equilibrium. We illustrate these results by reference to airline security and the control of infectious diseases via vaccination.

- **“Goals and Plans in Decision Making,”** by David H. Krantz and Howard C. Kunreuther, published in *Judgment and Decision Making*, Vol. 2, No. 3, June 2007, pp. 137–168 <http://opim.wharton.upenn.edu/risk/library/06-18.pdf>

We propose a constructed-choice model for general decision making. The model departs from utility theory and prospect theory in its treatment of multiple goals and it suggests several different ways in which context can affect choice.

It is particularly instructive to apply this model to protective decisions, which are often puzzling. Among other anomalies, people insure against non-catastrophic events, underinsure against catastrophic risks, and allow extraneous factors to influence insurance purchases and other protective decisions. Neither expected-utility theory nor prospect theory can explain these anomalies satisfactorily. To apply this model to the above anomalies, we consider many different insurance-related goals, organized in a taxonomy, and we consider the effects of context on goals, resources, plans and decision rules.

The paper concludes with suggestions on some prescriptions for improving individual decision making with respect to protective measures.

Terrorism Risk

- “Evaluating the Effectiveness of Terrorism Risk Financing Solutions,” by Howard C. Kunreuther and Erwann O. Michel-Kerjan. September 2007. National Bureau of Economic Research
<http://opim.wharton.upenn.edu/risk/library/07-02.pdf>

The 9/11 attacks in the United States raise important questions related to the economic impact of terrorism. What are the most effective ways for a country to recover from these economic losses? Who should pay for the costs of future large-scale attacks?

To address these two questions, we propose five principles to evaluate alternative programs. We first discuss how a federal insurance program with mandatory coverage and a *laissez faire* free-market approach for providing private insurance will fare relative to these principles. We conclude that neither solution is likely to be feasible here in the United States given the millions of firms at risk and the current structure of insurance regulation.

We then evaluate how well the U.S. Terrorism Risk Insurance Act (TRIA), a public-private program to cover commercial enterprises against foreign terrorism on U.S. soil, meets the five principles. In particular, we show that TRIA has had a positive effect on availability of terrorism coverage and also has significantly contributed to reducing insurance premiums. TRIA is scheduled to terminate at the end of the year, but pending legislation would extend the program for fifteen years after December 31.

We show that if TRIA were extended for a long period of time in its current form, some very large insurers could “game” the program by collecting *ex ante* a large amount of premiums for terrorism insurance, while being financially responsible for only a small portion of the claims *ex post*. The general taxpayer and the general commercial policyholder (whether or not covered against terrorism) would absorb the residual insured losses. This raises major equity issues inherent in the design of the program.

- “How Does the Corporate World Cope with Mega-Terrorism? Puzzling Evidence from Terrorism Insurance Markets,” by Erwann O. Michel-Kerjan and Burkhard Pedell, *Journal of Applied Corporate Finance*, Vol. 18, Issue 4, pp. 61-75, Dec. 2006
<http://opim.wharton.upenn.edu/risk/library/06-25.pdf>

Terrorist attacks that have succeeded abroad since 2001, as well as others that were prevented, indicate that the threat of a large-scale attack is real and will be with us for a long time. Focusing on the United States, the United Kingdom, and Germany, this article analyzes the role that insurance can play in providing commercial enterprises with financial protection against the economic consequences of major terrorist attacks.

Is terrorism coverage under the U.S. insurance program now drastically underpriced? If so, what would be the likely consequences of another large-scale attack in the U.S.? On the demand side, the authors observe a dramatic increase in take-up rates in the U.S. since 2003, revealing increased corporate concern. By contrast, the market penetration in Germany remains remarkably low.

The article also discusses the concept of pricing by contrasting two possible measures of price: premium over total insured value (measure commonly used today) versus premium over maximum annual compensation (real quantity of insurance purchased). Empirical evaluation of these two measures using data on these markets reveals a significant contrast.

As the Congress studies the future of terrorism risk financing after 2007, a better understanding of these programs in the U.S. and Europe and of the recent evolution of these markets will be critical.

Nuclear Non-Proliferation

- **“A New Energy Paradigm: Ensuring Nuclear Fuel Supply and Non-proliferation through International Collaboration with Insurance and Financial Markets,”** by Debra K. Decker and Erwann O. Michel-Kerjan. March 2007. Wharton Risk Center/Harvard’s Kennedy School Working Paper #07-06
<http://opim.wharton.upenn.edu/risk/library/07-06.pdf>

Increases in world population and per capita energy demand in the next few decades are expected to cause a substantial rise in world energy use. In addition, growing concern over carbon-based energy’s effect on global warming has revived interest in non-carbon-based energy sources such as nuclear power. Seeking ways to dissuade more states from contemplating launching their own uranium enrichment programs (which could produce not only material for nuclear fuel but also for nuclear weapons), the International Atomic Energy Agency (IAEA) is considering different mechanisms to assure these states that they can obtain fuel supplies from the market without political interference.

Building on the experience of the nuclear safety/security and catastrophic risk financing fields, we discuss ways the international community could facilitate the development of an insurance market to provide added security. Specifically, we recommend the financial indemnification for economic losses suffered by nuclear utilities (public and private) due to a disruption of supply over the full fuel cycle (enrichment, fabrication, and transportation). One way to achieve that is to establish an international insurance mechanism (e.g., a mutual company) that would both limit the fuel risk of the nuclear facilities and benefit from coverage from a consortium of private insurers and reinsurers. The mechanism could benefit from an additional layer of protection by being backstopped by IAEA member countries.

Chemical Safety and Environmental Risks



- **“Analysis Reveals Positive Return on Certification Investment,”** by Peter J. Schmeidler and Haitao Yin published in *Environmental Systems Update*, Vol. 14, No. 4, 2007
<http://opim.wharton.upenn.edu/risk/library/07-07.pdf>


The analysis of the first-ever survey of U.S. facilities certified to ISO 14001 is almost complete. The aim of the survey is to obtain information on the motivation of companies in attaining third-party certification to the international environmental management system standard, to determine what — if any — barriers exist to maintaining it and examine the associated costs and benefits.

- **“Linking OII and RMP Info Data: Does Everyday Safety Prevent Catastrophic Loss?”** by Michael Elliott, Paul Kleindorfer, Joseph DuBois, Yanlin Wang, and Isadore Rosenthal
http://opim.wharton.upenn.edu/risk/library/2007%20Elliott,PRK,etal_%27EverydaySafety%27.pdf

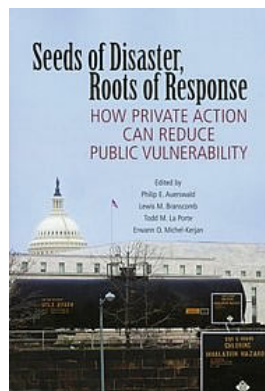
We link the Risk Management Program (RMP) database of accident histories collected by the U.S. Environmental Protection Agency for the period 1996-2000 under section 112(r) of the Clean Air Act Amendments and OSHA reported Occupational Illnesses and Injuries (OII) for the same period. If we think of OIIs as reflecting everyday safety performance and RMP accidents as reflecting major accidents, then the analysis can be considered a test of whether good everyday safety performance is a foundation for preventing or mitigating relatively rare major accidents. We find only weak evidence that this is the case for the U.S. chemical facilities reporting in the RMP database.

Joint Initiatives with International Organizations

	<h3>World Economic Forum (WEF)</h3> <h4><i>Global Risk Initiative</i></h4>
 <p>A World Economic Forum Report In collaboration with Citigroup Marsh & McLennan Companies (MMC) Swiss Re Wharton School Risk Center</p>	<p>For the past two years, the Wharton Risk Center has partnered with the World Economic Forum as part of the <i>Global Risks Network Initiative</i>, which was founded by the WEF in 2004 in response to a concern that the international community and global businesses were not able to respond adequately to a changing global risk landscape. The initiative became the Global Risk Network at the Annual Meeting 2006 in Davos, Switzerland. One of its main goals is to better aggregate information about global risks and to act as a clearinghouse for future risk mitigation and risk financing solutions.</p> <p>The Global Risk Network methodology selected 23 risks ranging from international terrorism, climate change, natural disasters and pandemics to asset price collapse, liability regimes, and critical infrastructure disruption. A survey of experts estimates a range of likelihood and potential losses associated with these risks. A barometer of these risks is updated several times a year. The Global Risk Network also provides top decision makers with policy recommendations to address global risks mitigation challenges, and develop new ways to benefit from emerging risks.</p> <p>You may request a copy of the 2007 WEF Global Risk Network Report by contacting Erwann Michel-Kerjan at the Wharton Risk Management Center at erwannmk@wharton.upenn.edu. The 2008 edition of the WEF Global Risk Network Report will be presented in Davos in January, 2008.</p>

	<h3>Organization for Economic Cooperation and Development</h3> <h4><i>International Network on Financial Management of Large-Scale Catastrophes</i></h4>
<p>Risk Center Co-Director, Howard Kunreuther and Managing Director, Erwann Michel-Kerjan are among twenty-one founding members of the High Level Advisory Board of the OECD's <i>International Network on Financial Management of Large-Scale Catastrophes</i>. The OECD Network is a strategic forum for the discussion of key issues related to the financial management of large-scale catastrophes at a global level, with a view to providing policymakers with state-of-the-art expertise and policy advice. The OECD is composed of the 30 highest-income countries internationally. The Board, which was launched by the new OECD Secretary General Angel Gurría in 2006, plays a leading role in identifying and discussing the major policy issues related to the financial management of large-scale catastrophes, and makes relevant recommendations to governments and businesses of its 30 member countries, and to non OECD countries as well.</p>	

Recent Books Published



*Seeds of Disaster,
Roots of Response:
How Private Action
Can Reduce Public
Vulnerability*
**Cambridge University
Press: New York,
September 2006**

Philip Auerswald,
Lewis Branscomb,
Todd La Porte and
Erwann Michel-Kerjan
(editors)

Some chapters available at www.SeedsofDisaster.com

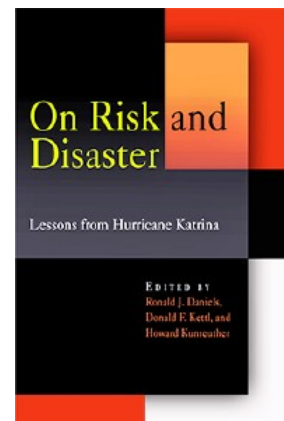
A joint project of the Wharton Risk Center, Harvard University (Kennedy School) and George Mason University (School of Public Policy), *Seeds of Disaster* is the first published volume devoted entirely to analyses of relationships between private decision-making and aggregate security outcomes in the context of critical infrastructure protection. This is a particularly challenging issue, as 85% of critical infrastructure assuring the continuity of our social activities and our economic competitiveness, is operated by the private sector. As a result, physical, cyber, and financial protection programs are much likely to be successful if they build on strengths of both the public and private sectors. It builds on five complementary aspects:

- 1) *enlightening public and private responsibilities;*
- 2) *increasing organization's resilience;*
- 3) *integrating interdependent security;*
- 4) *creating markets (competition, rate regulation, price signal, risk financing);* and
- 5) *building trust and developing collective initiatives by recognizing breakthrough best practices at national and international levels.*

We are pleased to have contributions from 30 experts selected from a highly distinguished group of business practitioners, scholars, as well as current and former public officials. Preface by General Robert Marsh, former Chairman of the President's Commission on Critical Infrastructure Protection.

*On Risk and Disaster:
Lessons from Hurricane
Katrina*
**of Pennsylvania Press:
Philadelphia, 2006,
pp. 293.**

Ronald Daniels,
Donald Kettl, and
Howard Kunreuther
(editors)



Hurricane Katrina not only devastated a large area of the nation's Gulf coast, it also raised fundamental questions about ways the nation can, and should, deal with the inevitable problems of economic risk and social responsibility. This volume gathers leading experts to examine lessons that Hurricane Katrina teaches us about better assessing, perceiving, and managing risks from future disasters.

In the years ahead we will inevitably face more problems like those caused by Katrina, from fire, earthquake, or even a flu pandemic. America remains in the cross hairs of terrorists, while policy makers continue to grapple with important environmental and health risks. Each of these scenarios might, in itself, be relatively unlikely to occur. But it is statistically certain that we will confront such catastrophes, or perhaps one we have never imagined, and the nation and its citizenry must be prepared to act. That is the fundamental lesson of Katrina.

The 20 contributors to this volume address questions of public and private roles in assessing, managing, and dealing with risk in American society and suggest strategies for moving ahead in rebuilding the Gulf coast.

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or contact:

Howard Kunreuther
Co-Director
Risk Management and
Decision Process Center
(215) 898-4589
kunreuther@wharton.upenn.edu

Erwann Michel-Kerjan
Managing Director
Risk Management and
Decision Processes Center
(215) 573-0515
erwannmk@wharton.upenn.edu