

Risk Management REVIEW



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Interdependent Security Workshop Convenes at the Risk Center

On May 31 and June 1, 2006 an interactive Interdependent Security (IDS) Workshop was held at the Wharton School co-hosted by CHPRA (Center for Human Performance and Risk Analysis at the University of Wisconsin-Madison), CREATE (Center for Risk and Economic Analysis of Terrorism Events at the University of Southern California) and the Wharton Risk Center. Participants were mainly from academia with diverse backgrounds including the decision and management sciences, economics, psychology, risk management, computer science, and policy analysis. Leading the discussions were David Bell, Harvard Business School, Vicki Bier, CHPRA and Howard Kunreuther, Wharton Risk Center.

A classification of different types of IDS problems (illustrated by specific examples, in the form of concrete scenarios, see Kunreuther column on page 2 for examples) was distributed to all participants in advance of the workshop. These scenarios included airline security, crime, corporate governance, computer network security and vaccinations against diseases. This document served as a catalyst for discussing future theoretical and applied research. Participants provided a brief response to the scenarios, and during the first part of the workshop introduced a set of research issues that he or she felt are important to pursue in the future. Small group discussions suggested specific research projects that could be undertaken over the course of the coming year. These ideas were then pre-

sent and critiqued at a final plenary session.

One of the objectives of the Workshop was to create a network for sharing ideas on future research projects on different aspects of IDS. This has been accomplished and a web site to encourage further communication will be established. A project on networked space has been initiated. It would monitor aspects of computer usage and design that can lead to invasion by outsiders. This would require a voluntary user-installed monitoring system. Possibly along with this project, an effort to understand hackers' decisions in terms of their goals, beliefs and decision methods could be undertaken. It was suggested this might provide insight to terrorists' decision processes.

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Interdependent Security in an Uncertain World



An interdependent security (IDS) setting is one in which a group of agents decides independently whether to adopt protective strategies, but the economic incentive of any agent to invest in protective actions depends on how she expects the others to behave. The protective strategies can be direct risk-reducing measures, as well as information-gathering and preparedness strategies. The fact that such events are typically probabilistic, and that the risk that one agent faces is often determined in part by the behavior of others, give a complex structure to the incentives that agents face to reduce their exposures to these risks.

For many IDS problems, if an individual or firm thinks that others will *not* invest in security, then this reduces the incentive for it to do so. On the other hand, should the individual or firm believe that others will invest in security, then the optimal strategy will be for it to also take protective measures. So, there may be two equilibrium solutions: one where no one invests in protection, even though all would be better off if they had incurred this cost, and one where everyone invests in protection. This situation does not have the structure of a prisoners' dilemma game, though it has many similarities.

Here are several IDS scenarios illustrating the types of problems that fall under this rubric:

Example 1: Security against terrorist actions

An airline has to determine whether it wants to invest in baggage security, knowing that even if it takes this action, it may face a security risk from a dangerous bag loaded onto its plane by another airline. It faces this risk unless it inspects all transferred bags. Lest this point be considered only theoretical, recall the crash of Pan Am 103 in 1988. Terrorists checked a bag containing a bomb in Malta on Malta Airlines, which had minimal security procedures. The bag was transferred in Frankfurt to a Pan Am feeder line, and then loaded onto Pan Am 103 in London's Heathrow Airport. The bomb was designed to explode above 28,000 feet, a height normally first attained on this route over the Atlantic Ocean. Thus, in this case, the terrorists deliberately exploited the widely varying security procedures across the airlines. This problem is common to other transportation modes, where there are interconnections between nodes in the network.

Example 2: Protecting against catastrophic losses

Consider the possible bankruptcy of a firm due to a catastrophic loss to one of its plants or divisions. An example would be a Bhopal-like accident to a chemical plant where the losses are so large that they cause bankruptcy of the entire operation. Another example is an ownership group such as Lloyd's, which controls a number of syndicates, all operating in a semi-autonomous fashion. If one of the syndicates experiences a severe enough loss, it can lead the ownership

Co-Director's Corner

group to declare bankruptcy. Recently, Arthur Andersen was sent into bankruptcy by the actions of its Houston branch. Similarly, several years ago, Barings was likewise destroyed by the actions of a single trader in its Singapore division. Given such an institutional structure, what economic incentive does any unit have to incur the costs of protective measures that adversely affect its balance sheet, if other divisions in the organization are not taking similar actions? A culture of risk-taking can spread through the firm, because knowledge that a few groups are taking risks reduces the incentives that others have to manage their operations carefully.

Example 3: Interdependent critical infrastructures

In the wake of 9/11 and hurricane Katrina, the private and public sector share an interest in making social and economic systems less vulnerable to disasters. There is a growing interest in protecting the critical infrastructure that assures the social and economic continuity of the nation (transport, water distribution, telecommunication, electricity, emergency services, finance sector, etc). One of these challenges is the existence of interdependent operations between multiple infrastructures in different sectors. For example, financial systems or emergency services are highly dependent on telecommunication operations, which are highly dependent on electricity. When the interdependencies cut across sectors the nature of the risks is often not well understood, so that they pose special policy challenges.

A group of researchers and practitioners participated in a workshop at

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Co-Director's Corner

This past summer, as Hurricane Katrina bore down in the central Gulf coast, newspapers throughout the country were filled with articles warning of a potential calamity, such as the following from *USA Today*:

Mayor Nagin said he would "aggressively recommend" people evacuate, but that it would be difficult to order them to, because at least 100,000 in the city rely on public transportation and have no way to leave....Despite the potential need for emergency housing, no shelters had been opened in the city as of (last) night. Nagin said the city was working on setting up a shelter of "last resort" and added that the Superdome might be used, but a spokesman for the stadium said earlier that it was not equipped as a shelter.

We all know what happened next, right? New Orleans, submerged by a catastrophic flood, suffered one the greatest losses of human life and property in U.S. history. But one detail is amiss: that's not actually what happened in this case. The above article was written in September 2004—eleven months before Katrina—and was describing the city's preparations for Hurricane Ivan, a storm that, fortunately, spared the city from all but some healthy rain showers.

What did the city of New Orleans learn from its close call with Ivan? Obviously very little. A year later the deficiencies in the city's emergency preparedness plans made transparent by Ivan remained unaddressed. Rather than spurring action, the fact that the city had escaped Ivan without harm seemed to have almost the opposite effect. It was only after the catastrophe of Katrina that hard ac-

The Wharton Disaster Lab: Understanding how we learn (and fail to learn) from disasters



tion to remedy previous deficiencies was enacted.

This failure to learn from close calls is, of course, hardly unique to New Orleans and Katrina. Just two months after Katrina, thousands of South Florida residents stood in long lines waiting for basic water and gasoline supplies, having failed to adequately prepare for Hurricane Wilma. While several explanations could be offered, the most likely culprit is simply history: Wilma was the fourth hurricane to affect the area that summer, but the first to impose major damage. Rather than seeing the previous near-misses as reminders about the dangers posed by storms, many residents seemed to have taken from them the lesson that hurricanes are quite survivable without the full precautions recommended by preparedness agencies.

Why we don't learn: evidence from the disaster lab

Spurred by the plethora of natural disasters that occurred throughout the world in 2004 and 2005, the Risk Management and Decision Process Center has recently sponsored a series of research studies aimed at understanding why we seem to have such a hard time learning about how to protect against disasters—and what can be done about it. The studies make use of laboratory simulations in which participants are faced with the task of protecting their home against the threat of one of two types of natural disasters, hurricanes or earthquakes. In either case, participants are endowed with a pool of funds that can be used either to pay for protection against hazards (which are highly uncertain in timing and strength) or invest in a bank. At the end of the

simulation participants are paid an amount that is tied to their total wealth, which is the value of the house—minus the cost of repairs—plus money they have earned by private investing. Like in the real world, participants are faced with the fundamental choice of whether they should use their money to keep their house safe from natural hazards—forgoing money that could be earned by investing it—versus investing it for private gain, forgoing the chance to protect it against hazards.

In the simulations we see the same kind of learning biases that are repeatedly observed in the real world. Investments in protection display a dysfunctional cyclical pattern: participants enter the simulations skeptical about the value of mitigation investments, but this changes quite quickly the first time they suffer actual damage from an hurricane or earthquake. Much in the same way that it took Katrina to spur investments in the repair of New Orleans' levee system, participants in our simulations are quick to purchase mitigation after they suffer their first episodes of damage. But then something curious happens: because, by definition, hazards occur infrequently, participants gradually lower their investments in protection with time, as they fail to see clear payoffs from the investments—until, of course, the next disaster occurs, and the cycle repeats itself.

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(“Meyer” Continued from page 3)

While observed in a lab, these cycles seem to closely mirror those observed in natural settings. The California earthquakes of 1989 and 1994 spurred a surge of purchases of earthquake insurance, but over the past decade—a period of relative calm—the proportion of homes holding such coverage has dropped by half. Likewise, in New Orleans, floods caused by Hurricane Betsy in 1965 spurred a commitment to build a levee system that would protect the city against a 200-year storm event. But such a system was never developed, caused, primarily, by the lack of need made apparent by a dearth of storms in the 1970s and 80s.

What causes these cycles? Our research suggests that it stems from three related biases in how we make decisions about protecting against rare events:

1. A tendency to base inferences on short-term personal experience rather than long-run base rates;
2. A tendency to repeat behaviors for which we receive tangible positive feedback and cease behaviors when there is no such feedback (learn by trial and error); and
3. A tendency to base investment decisions on the experienced average severity of a hazard rather than the most extreme severity.

Note that in most walks of life these heuristic instincts have a good adaptive basis; trial-and-error learning, for example, is how we developed walking and speaking skills, and the average is indeed a much better predictor of the most likely next value of an event than the extreme. But the functionality of these heuristics breaks down when applied to decisions about rarely-occurring hazards—a domain where good behaviors are rarely positively reinforced, long-term base rates

matter more than recent experience, and where extreme values rather than means are the key driver of normative investment decisions.

How do we remedy dysfunctional mitigation cycles? We suggest that the best chance we have is to put in place public and private policies that not only describe how to prepare for hazards, but also how best to *learn* from them. For example,

1. Following the norm of branches of the military and the private sector, have post-hoc assessment programs that treat near-misses with the same rigor as actual disasters—i.e., treat them as if they had actually occurred;
2. Remove mitigation decisions from the loop of short-term budget planning. By definition mitigation investments are long-term investments whose value will not be observable in most years. As such, a process that constantly revisits its value will be prone to under-funding investments as years go by without a major hazard; and
3. Work to keep the public focused on long-term risk levels rather than recent experiences—as a means of curbing both over-reactions to recent hazards (such as the massive over-evacuation that was associated with Hurricane Rita in Texas) as well as under reactions.

One of the ongoing objectives of the disaster simulations is to test the actual viability of these and other mechanisms for improving learning.

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(“Kunreuther” Continued from page 2)

the Wharton School two weeks ago (see cover story) to explore future studies for better understanding behavior in these and other IDS situations and examining strategies involving the private and public sectors for improving individual and social welfare. Over the course of the coming academic year the Wharton Risk Center in conjunction with USC CREATE Center and the Center for Human Performance and Risk Analysis at the University of Wisconsin-Madison will be supporting research in this area and will provide feedback on new findings and their policy implications.

Howard Kunreuther
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(“IDS Conference” continued from page 1)

Other potential projects were suggested. One could look at individuals’ behavior in the context of emergencies with respect to risk communication, framing/context, intertemporal choice and fairness. Another proposed project was to investigate the effectiveness of protective systems, and yet another would address group behavior and vigilance in IDS systems. Ideas for extending the Kunreuther-Heal IDS model were suggested as was the area of information management that would examine the trade-off of privacy versus mitigation of potential terrorist incidents and the challenge associated with information sharing. Participants agreed that it would be useful to reconvene another meeting next spring under the assumption that a set of interesting research and papers will be completed in the coming months.

NIOSH and Risk Center Sign Cooperative Agreement

On February 22nd John Howard, M.D., Director of the US National Institute for Occupational Safety and Health (NIOSH) and Howard Kunreuther, Co-Director of the Wharton Risk Center, signed an agreement to work cooperatively in order to provide outreach, communication and professional development regarding occupational safety and health.

The objectives of this agreement are to:

- Stimulate research aimed at a better demonstration of findings that firms can utilize to implement effective safety and health environments and programs that benefit employees (well being and job satisfaction), the firm's customers (quality and reliability of supply) and the community (reduction in low probability-high consequence accidents) as well as provide competitive returns on the firm's investment;
- Encourage development of research that assesses the risk and magnitude of the burdens imposed on industries, sectors, and national productivity by occupational injury and illness;
- Promote the transfer and workplace implementation of research findings on effective occupational injury prevention strategies and technologies;
- Stimulate and participate in public meetings, conferences and other key events where the assessment, management and control of occupational safety and health issues are addressed;
- Develop and disseminate information on occupational safety and health at appropriate conferences and through print and electronic media;
- Improve the effectiveness of occupational safety and health research; and

- Advance the public good and the cause of corporate citizenship by encouraging research on assessment of the various mechanisms by which the economic burdens associated with occupational safety and health hazards can attach to business and public entities.

The signing ceremony was the culmination of an initiative by Elyce Biddle, Chair of the Division of Safety Research at NIOSH, and took place during the course of an all-day meeting at Wharton. It was attended by members of different University faculties interested in working with NIOSH. Various members of the faculty and NIOSH gave presentations on areas of their research that were pertinent to the cooperative agreement's objectives.

The breadth of common interests is large and can be visualized by examining a partial listing of the areas of research that participants from Penn and NIOSH discussed because they were deemed pertinent to the Agreement:

- "Research to Practice at NIOSH - Conducting Research That Results in Impact", DeLon Hull, Associate Director for Research and Technology Transfer, NIOSH
- "Economics - A Coordinated Emphasis Area of the NIOSH Program

Portfolio", Rene Pana-Cryan, Senior Economist, NIOSH

- "Epidemiology Studies on Low Probability-High Consequence Accidents", Irv Rosenthal, Wharton Risk Center
- "Insurance Research at Wharton", Stephen Shore, Assistant Professor of Insurance and Risk Management
- "Economic and Health Outcomes: Occupational Medicine Research and Training at Penn", Edward Emmett, Director of Academic Programs, Occupational Medicine, University of Pennsylvania
- "Learning from Small-Scale Failures" (at hospitals), Anita Tucker, Assistant Professor of Operations and Information Management

After the general discussions, signing ceremony and presentations were completed, members of NIOSH started discussions with members of the faculty on next steps toward implementing and sponsoring specific projects

These discussions were continued in a subsequent visit by Dr. DeLon Hull on April 5th and 6th. As a result of these efforts a number of different initiatives are in the active discussion stage and will hopefully move on to fruition.

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NIOSH Director Dr. Jon Howard and Risk Center Co-Director Howard Kunreuther, with Judith McKenzie, Anita Tucker, Irv Rosenthal, and Erwann Michel-Kerjan in the background.

Wharton Initiative on Insuring and Mitigating Risks of Large-scale Natural Disasters

A Totally New Scale of Destruction

In the past few years we have observed a radical change in the scale of disasters, and in their frequency. We used to refer to disasters as low probability-high consequence events. While the second element is accurate, I argue that the “low probability” component is becoming more and more questionable. A consequence of this is that catastrophes might very well become the norm rather than the exception in our daily life.

Take the 20 most costly disasters the insurance sector has experienced over the past 35 years (1970-2005). For the sake of comparison, correct these figures for inflation so all costs are given in 2005 dollars. Of the 20 most costly events over this 35-year period, 18 occurred in the past 15 years. Perhaps even more surprising, 10 of them occurred in the last 5 years alone.

Three times in the last five years, new records have been set for the most costly disaster ever in the insurance industry, all from disasters in the U.S. In 2005, Hurricane Katrina alone is estimated to have caused \$45-\$55 billion in insured losses. Worldwide, major catastrophes in 2005 inflicted damage twice as costly as those of 2004: \$230 billion in economic damage, \$83 billion of which was covered by insurance. Will 2006 or 2007 be worse?

One must recognize that these large-scale events are especially challenging because they require a totally different approach (preparation, crisis management, risk coverage) than when dealing with comparatively small events (let's say below 5 billion dollars of loss).

The U.S. Challenge

Growing population and increasing value of assets in high-risk areas in the US make the protection of the country a complex task. For example, the popula-

tion of Florida will have increased by 600% between 1950 and 2010 (from 2.8 million up to nearly 20 million inhabitants). At the end of 2004, 80% of the total insured residential value in the state of Florida was located on the coast. And the total value of coastal exposure (high risk areas) represented nearly 2 trillion dollars. It is common sense to expect that any major hurricane there would inflict billions of dollars in economic losses.

Recent hurricane activity in the U.S., culminating in the devastation caused by Hurricane Katrina, has focused public attention on how to minimize the social costs associated with such disasters and how to reduce future losses and facilitate recovery through the use of insurance in combination with other mechanisms.

Reassessment of the increased risk of hurricanes has imposed additional pressure on affected property insurance markets, compelling insurers to readjust their exposure and price structures, often with significant consequences for property owners. At the same time, the purchase of earthquake insurance in California has plunged drastically and flooding associated with recent hurricanes has revealed unresolved problems with the National Flood Insurance Program.

In one sense, concern by the public sector with disasters is not new; regulators in various states have sought alternatively to lower the price or enhance the supply of insurance through various policy devices. However, Katrina coupled with Rita and Wilma has focused attention on the debate. This is the case not only because of the partial failure of state and national insurance programs to operate without additional government funding or *ex post* assistance, but also because it has heightened the political debate on the adequacy of private insurance markets

to manage and finance the risk of natural disasters. Also, Katrina led to the largest post-disaster federal aid in US history.

In turn, these catastrophic disasters have underscored the potential for extreme losses to affect the capital base of the insurance industry. For their part, insurers and reinsurers must address how they can continue to supply insurance and generate an appropriate return for their investors. But they must do so in a highly charged political environment in which public expectations do not necessarily match the economic realities of private insurance supply. In fact, insurers must deal with regulators in various states who have sought to lower the costs and enhance the supply of insurance.

A New Wharton Initiative

Building on a major research effort undertaken last year on the future of terrorism risk financing in the US, the Wharton Risk Center launched a new study this spring that focuses on natural disaster mitigation and financial coverage. This study, undertaken in conjunction with the Insurance Information Institute and Georgia State University, benefits from input from 14 private sector partners and active interaction with state and federal organizations that run public insurance programs.

The short-term goal of the Wharton study is to develop a strategy document to help inform the current policy debate on the role that the private and public sectors can



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play in reducing future disaster losses through mitigation measures and financing the recovery process through insurance and other means.

We propose to first consolidate our understanding of how well catastrophe insurance has performed in the past in both lower-loss and higher-loss disaster periods coupled with shifting assessments of the underlying risk. However, we will go beyond a simple economic analysis of whether supply and demand are in balance to clear the market. We will also ask whether private market activity has produced an outcome that is acceptable to the general public and its political representatives at state and national levels. Accordingly we will examine (among others):

- The factors determining the demand and supply of insurance and reinsurance;
- The link between historic claims, mitigation measures in place and price of coverage;
- The prices at which insurance is traded given demand and available supply ;
- The extent to which private markets fail to clear (e.g. insufficient capacity) ;
- The extent to which prices are distorted from the underlying risk by regulatory strategies;
- The extent of insurance coverage and the impact of free market or regulated prices on different socio-economic groups;
- The extent to which premiums reflect risk in different risk zones and what explains possible differences (e.g., competitive market versus rigid regulation);
- The impact of residual market mechanisms and *ex post* assess-

ments on private supply and demand, especially in high-risk areas;

- The degree to which the market hardens after catastrophic losses and recovers with the inflow of new capital;
- Whether the incentives implicit in free, or regulated, insurance supply lead to appropriate levels of mitigation;
- How the industry and policymakers are adapting to potential shifts in the level of catastrophe exposure; and
- The impact that national insurance programs, disaster relief and other programs have had on the private insurance market.

Our work will focus on the following states using real data: *California, Florida, New York, South Carolina and Texas* and the following metropolitan areas: *San Francisco, CA, Miami, FL, New York City, NY, Charleston, SC and Houston, TX.*

Developing and Evaluating Alternative Insurance-Based Programs

We will examine a set of alternative disaster insurance and mitigation programs that includes the status quo, a non-regulated insurance market and various public-private partnerships that involve multi-state pools as well

as state and/or federal funding. All the programs are guided by the following principles:

Risk-based premiums: Insurance premiums should, to the extent possible, be based on risk 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.

Special treatment of low income residents: There is a need for a special treatment for low income people, but this should come from explicit public funding (at the state or federal government level) and not through insurance premium regulation or cross-subsidies.

The first step of the study will be the release of a report by the end of the year, which may lead to additional research to be undertaken on these critical issues. We also envision organizing a conference in the fall of 2006, so the Risk Center can bring together a broad range of interested parties from the private and public sectors.

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Risk Center in the News

- Risk Center Co-Director **Howard Kunreuther** was interviewed on CNBC's *Closing Bell with Maria Bartiromo* on May 23rd and NPR's *Morning Edition* on June 1st in connection with the start of the 2006 hurricane season.
- The Risk Center took part in a December 1st, 2005 **National Symposium on Risk & Disasters** that led to the publication of *On Risk and Disaster: Lessons from Hurricane Katrina*, an edited volume from the University of Pennsylvania Press that takes a cross-disciplinary look at disaster preparedness and recovery.
- The Risk Center's collaborative efforts with the World Economic Forum were featured in a brochure on *Global Risks 2006* at this year's meeting in Davos.

Insurance, Finance and Climate Change

As part of joint research activities on climate change and insurance undertaken between the Wharton Risk Center and Carnegie Mellon's Center on Climate Decision Making, an invitational workshop was held in Washington, DC on May 8 and May 9, 2006. The objective of this workshop was to have an open discussion on where the industry stands on this issue and identify decision research needs for the next few years related to climate change and the insurance and reinsurance industries as well as the broader financial community.

Participants included representatives from several firms (including AIG, AIR Worldwide, AXA, Marsh, SwissRe, St. Paul Travelers), as well as from trade associations (AIA, PCIAA, RAA), the US Government Accountability Office and research institutions in the US and abroad.

Topics for discussion during these two days focused on four major areas of impact:

- Direct climate and weather-related impacts (e.g., catastrophes);
- Liability issues (including D&O);
- New technologies, emissions control policies and trading systems; and
- Impacts on insurer/reinsurer portfolio and shareholder value.

This workshop was an important step to a better understanding of what the key priorities are for a broad range of stakeholders representing different agendas.

One of the major outcomes of the workshop was a recognition that time horizons differ tremendously between the scientific community

and the business community when it comes to risk and business opportunities due to global warming. Insurers and reinsurers are concerned with the impact climate change will have on their performance in the next few years; scientists think in terms of decades. On a positive note, it seems that as consensus about the reality of climate change is growing among the scientific community, the business world is paying more attention to ways that changes in weather patterns influences their business activities.

In the coming years, we are likely to see a shift from what until recently has been a science-driven debate to a dialog where the business community plays a major role in shaping key priorities. Should this occur, a better understanding –and measuring– of how senior executives process decisions in a highly uncertain world will be of critical importance.

One of the challenges of the work undertaken here will be to develop tools that will be not only based on robust scientific evidence, but also provide decision makers in the private and public sectors with concrete answers on which they can base their short-term decisions and justify specific capital allocations.

For more information, contact Howard Kunreuther (kunreuther@wharton.upenn.edu) or Erwann Michel-Kerjan (erwannmk@wharton.upenn.edu).

Terrorism Insurance: An Update

The Terrorism Risk Insurance Act of 2002 (TRIA) established a public-private program to cover commercial enterprises against foreign terrorism on US soil. It was a temporary measure to increase the availability of risk coverage for terrorist acts by requiring insurers to provide coverage. Initially established to sunset on December 31, 2005, the legislation was extended for two years by Congress and signed by President Bush in December.

The Risk Center completed an intensive 9-month study last summer, but continues with new research to address this issue. Howard Kunreuther and Erwann Michel-Kerjan provide, in their recent NBER working paper (#12069), an extensive series of empirical analyses of loss sharing under this program in 2005, and a prospective analysis for 2006. By simulating the explosion of a 5-ton truck bomb in major cities in the United States and using data collected on the top 451 insurers operating in the US, they examine the impact of TRIA on loss sharing between the key stakeholders: victims, insurers and their policyholders, and the taxpayers. The paper also reviews a set of possible long-term alternatives or complementary options to the current design of TRIA that could be important features of a more permanent program.

They conclude that more than four years after 9/11, the question as to who should pay for the economic consequences of a terrorist attack on the US has not yet received the attention it deserves. Congress or the White House should consider establishing a national commission on terrorism risk coverage leading to the enactment of permanent legislation.

Survey of ISO 14001 – Environmental Management System Standard

As an extension of the work that the Risk Center has been doing in the area of third party certifications, we have entered into a partnership with ANAB, the ANSI (American National Standards Institute) -ASQ (American Society for Quality) National Accreditation Board and QSUP Publishing (QSUP) to carry out a survey of all US ISO 14001 certificate holders to resolve questions that have been raised about the value of being registered to this Environmental Management System (EMS) standard. We have been working with Bob King, President of ANAB, and Paul Scicchitano, President of QSUP and Publisher of Quality Systems Update and Environmental Systems Update.

Haitao Yin, a doctoral candidate from the Wharton Business and Public Policy Department, has been heavily involved with this project. Gabe Silvasi of OPIM IT created the electronic survey instrument from the survey developed by the project group.

A key issue that has been explored about voluntary environmental management programs in general and the ISO 14001 certification in particular is whether they really lead to better environmental performance. Studies have been done on this specific question, but no consensus seems to have been reached. Some researchers argue that ISO certification has improved participants' environmental performance because of the element of third party audit. Others argue that ISO certification has had no impact or negative effects on facilities' environmental performance. The ISO 14001 survey was developed to evaluate the benefits and costs of having a certified EMS. A number of hypotheses about the characteris-

tics of the firms and the value they received from certification were also posited with the aim of resolving these from the survey responses. To our knowledge, no similar survey directed at all the ISO 14001 certificate holders had been carried out. Two similar surveys have been completed for ISO 9000 in the late 1990's which attempted to reach all registrees.

Working with the ISO 9000 survey as a template, we soon discovered that while there were similarities in some areas, it was necessary to take the survey instrument in different directions. A major struggle was to balance length and information requirements. We knew that the shorter the survey was, the better the response rate would be, but we didn't want to compromise the information that we needed to do a sound analysis of the responses received. We sent the survey out to our colleagues involved in the environmental area and to the ANAB EMS Council for review and incorporated their comments as appropriate. The end product was a survey that was 16 pages long and from comments we have received took anywhere from 15 to 45 minutes to complete. We solicited feedback about the survey instrument and were pleased that those that responded had good words for the survey and its web format.

The dissemination of the survey has been done entirely on the internet. QSUP publishes a list of ISO 14001 certified facilities which it obtains from the certifying bodies (CBs). QSUP requested from the CBs the contact person for each certificate they were responsible for and these were the e-mail addresses to which the survey information, including the link to the survey, were sent. A complicating factor was that some contacts cover multiple certificates or

sites so two versions of the survey instrument were available, one for a single facility and one for multi-facilities. The initial e-mailing started in late February 2006, and several follow-up e-mails have been sent. As of the end of April, 450 responses have been received and since some of these represent multi-facility situations, we estimate the response rate to be around 10-15% of the over 5000 certified facilities. We would obviously prefer to achieve a larger response and this will be attempted by making direct phone calls to the contacts who haven't responded.

Preliminary analysis of 210 single facility responders was done for a presentation at the National Association of Manufacturers Conference on March 21, 2006. Regarding costs, 50% of the respondents reported that external costs to implement were less than \$25,000 and 33% reported this level for internal costs. At the same time, about 50% of savings reported were estimated to be less than \$25,000 so one could generally postulate that implementation is cost neutral. Internal benefits seemed to override the external benefits, with the only high rated external benefit being "Fulfilled Customer Requirements." The largest barriers to maintaining ISO 14001 were "Document Maintenance" and "Training Requirements" but these were cited by less than 40% of the respondents as highly important. We noticed a big positive difference in performance on specific environmental impacts for facilities that identified the impact as a major EMS goal versus those that didn't. About 50% of the facilities that reported the environmental impact performance improvement responded that ISO certification contributed to this achievement to a large extent. This is a snapshot of the preliminary results. We hope to have the full analysis available by the end of the summer.

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Thoughts from Europe



By Paul Kleindorfer

It has been scarcely a year since I began my sabbatical year in Paris in July, 2005. As many of you know, we intend to stay here in France for a while, enjoying the culture and participating in one or another research endeavor along the way. For the next year or so, I will continue my association with INSEAD (Wharton's sister institution in the Alliance, located in Fontainebleau just outside Paris). There is much to do on the risk front in Europe, as the twin forces of European Union (EU) deregulation and globalization continue to produce huge changes in business models and political realities.

One of the most important areas of change in the EU has been in the de-regulation of network industries, from energy to telecommunications to postal and logistics services. The EU (guided by its executive arm, the European Commission) is pushing hard to lower all barriers to full market opening in these network sectors. I have had the pleasure this year of contributing to a few of these sectoral "deregulation" activities, including participating in a major study for the European Commission on liberalization of postal and delivery markets. As we know so well from insurance markets, there is nothing like the fun that begins

with partial deregulation. Open the gates to competition, while continuing to monitor or regulate the prices of one or another of the established actors, and what is supposed to become a graceful exit of existing regulators turns into a complicated mix of re-regulation and political maneuvering. This is what is likely to continue for some time in the network industries in Europe, lending increased importance to strategic risk management tools such as scenario planning, political risk assessment, and good old fashioned lobbying. Added to the on-going problems of managing the national regulatory agenda for companies in these sectors is now the need to predict, and influence, various levels of decision making in the EU. All of this is very exciting, even as a spectator sport.

I have also been involved in two issues that are directly related to on-going research at the Risk Center. The first is what I have come to call "sustainable operations", by which I mean the intersection of the sustainability paradigm with the management of operations. This includes integrating environmental management with product and process design, closed loop supply chain management and related areas of quality and process safety management. These are very important issues in Europe where legislative activities (e.g., product take-back legislation) have reinforced private sector sustainability initiatives. I just published a paper (co-authored with Kalyan Singhal and Luk Van Wassenhove) surveying this very rich area of research opportunity, to which the Wharton Risk Center has made a number of important contributions over the years. I have also continued to work with Irv Rosenthal and Bob Lowe on the Center's

EPA/OEM sponsored work in the area of chemical accident preparedness and prevention, now analyzing the second tranche of data that was collected under section 112(r) of the Clean Air Act Amendments. There are parallel efforts in the EU, which fly under the banner of the Seveso II Directive and the Major Accident Reporting System (MARS), and I expect the Center's work in this area to continue to find stimulating common ground with these related efforts in Europe to improve chemical process safety.

As you will gather from the above comments, we are having a good time over here, both in working on on-going projects with the Center as well as in exploring a few new areas from our Parisian base of operations. I look forward to a strong continuing interaction with the Risk Center. Look me up if you are in the neighborhood.

Risk Center Unveils New Web Site

The Risk Center recently launched a redesigned and modernized internet site. The new site is more dynamic and easily navigable, and new features include pages devoted to specific research activities and a searchable database of Risk Center working papers and journal reprints.

We are still located on the Web at <http://opim.wharton.upenn.edu/risk>, so check out the new site and give us your feedback as we continue to make improvements.

The Corporate Associates program is a vital part of the Risk Center's operation. Corporate Associates sit on the Center's Advisory Committee, participate in roundtable discussions and offer information and insight into the value, direction and timing of research projects.

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Since its creation more than 20 years ago, the mission of the Wharton Risk Management and Decision Processes Center has been to carry out a program of basic and applied research to promote effective corporate and public policies for low-probability events with potentially catastrophic consequences. The Risk Center has focused on natural and technological hazards through the integration of risk assessment and risk perception with risk management strategies. After 9/11, research activities have extended to include national security issues (e.g., terrorism risk insurance, protection of critical infrastructure).

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

Providing expertise and a neutral environment for discussion, Risk Center research investigates the effectiveness of strategies such as incentive systems, risk communication, insurance and regulation, in the context of extreme events. The Center is also concerned with training decision-makers and promoting a dialogue among industry, government, interest groups and academics through its research and policy publications and through sponsored seminars, roundtables and forums. A regular Newsletter and Project Snapshots provide an update of Center activities and publications.

Risk Center on the World Wide Web

Visit the Wharton Risk Management and Decision Processes Center's homepage on the World Wide Web at:

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