

Managing Catastrophic Risks

A Research Program of Wharton's Financial Institutions Center
And Risk Management and Decision Processes Center.

On April 24, the Advisory Group of industry sponsors and research associates met with project researchers to review progress on Wharton's "Managing Catastrophic Risks" program. This was the first scheduled Advisory Group meeting held during this second year of the research program. What follows is a brief "snapshot" of the discussions.

During our last meeting in October, discussion focused on the projects that directly related to industry risk sharing and funding, with shorter updates on the other projects.

At this April meeting discussion focused on preliminary results from two of the projects with updates on the several other initiatives and a panel discussion on uncertainty issues in CAT Modeling. Bob Klein and Paul Kleindorfer outlined progress on their "Industry Structure and Regulation" research. David Cummins and Neil Doherty presented their further work on modeling industry capacity, "Can Insurers Pay for the Big One", illustrating their findings with data on the Florida market. David Cummins and Neil Doherty also provided brief updates on the "Basis Risk" project. Howard Kunreuther and Paul Kleindorfer briefly discussed progress on the "Mitigation" research project.

Most of the afternoon session was devoted to a panelled discussion of uncertainty and CAT modeling technologies. The panel, led by Howard Kunreuther, included representatives from our research partners Risk Management Solutions, EQECAT, and Applied Insurance Research, who each addressed different aspects of the uncertainty questions in today's CAT Models.

The final session, moderated by Anthony Santomero, served as an open forum to comment on the day's proceedings and the progress of the project. Much of the discussion centered on the linkages among the various projects.

At the meeting, two draft papers were distributed as part of the session on Industry structure and Regulation. They were:

"Preliminary Overview of Catastrophe Insurance Markets in the U.S." by Martin Grace and Robert Klein of the Center for Risk Management and Insurance Research, Georgia State University and Paul Kleindorfer of the Risk Management and Decision Processes Center of the Wharton School of the University of Pennsylvania.

"The Regulation of Catastrophe Insurance: An Initial Overview" by Robert Klein of the Center for Risk Management and Insurance Research, Georgia State University

Both of these papers will soon be available in PDF file format from our project website at :

<http://fic.wharton.upenn.edu/fic/wfic/catrisk.html>

The following shapshot summarizes the highpoints of the advisory group meeting.

The Research Agenda

Over the next year the research program will be evaluating the opportunities and challenges of utilizing alternative strategies for reducing and managing the risks from natural disasters. These strategies include:

- Mitigation programs for reducing losses
- Alternative programs for financing catastrophic losses. These include a combination of reinsurance, new catastrophic risk instruments, public-private partnerships [e.g the California Earthquake Authority (CEA), state catastrophe funds] and federal reinsurance.

In order to undertake these evaluations we need to have a clear understanding of the nature of the risk and the ability of the private sector in conjunction with public sector groups to provide protection. The following aspects of the Cat Risk project will address these issues.

- The nature of uncertainty associated with the risks from natural hazards. We will do this by working with the modeling groups and our Technical Advisory Committee (TAC).
- The ability of the insurance and reinsurance industry to provide protection against catastrophic risks. The capacity study will be addressing these issues.

- The tradeoffs between utilizing reinsurance and CAT risk instruments for providing protection against catastrophic losses. The basis risk and moral hazard study will be addressing these issues.
- The role of regulation as it affects the supply and demand for insurance coverage, the linkage of insurance with mitigation and public-private partnerships. The study with Insurance Services Office (ISO) on regulation and market structure of catastrophe insurance will provide insight into this aspect of the project.

The three model cities under analysis will provide a critical basis for evaluating the multiple strategies for better managing CAT risk.

The three model cities (Oakland and Long Beach, CA and Miami/Dade County, FLA) provide a laboratory for examining many of these questions. We will be working with the three modeling groups (AIR, EQECAT, and RMS) as well as the industry sponsors in undertaking analyses of the impact of alternative strategies on the different interested parties affected by natural disasters.

Industry Structure and Regulation

Discussions on this topic were led by Paul Kleindorfer and Bob Klein. Kleindorfer presented an overview of the analysis of catastrophe insurance markets and the impact of regulation. Klein then presented results of a broad analysis of catastrophe insurance markets and the effect of rate regulation, concentration of risk, and new entrants.

Industry Analysis

The principle objectives of the industry analysis project are to describe 1) the structure and performance of catastrophe insurance markets; 2) the nature and impact of regulation on pricing and financial risk. The central research goal is to ascertain what future sustainable states of the market are possible under different scenarios. Thus, the principal focus of activity in the coming year will be to outline the determinants of the demand and supply for catastrophe insurance such as pricing, sensitivity to price changes, coverage bundling, perceived quality of service and financial strength, and distribution channels. The analysis will also examine how the demand for insurance interacts with other risk management options, such as location choices, housing types and construction, and structural mitigation, as well as supply side factors such as the cost of structures and concentration/diversification of risk. Insurance Services Office Inc. will be collaborating in this study as a research partner.

Preliminary Results

Klein presented the initial results of analysis of annual statement information with respect to the profitability and structure of insurance markets that

are significantly affected by earthquakes and hurricanes. The severe spikes in calendar-year loss ratios caused by these events reinforce the case for diversification and liquidity mechanisms to enable insurers to cover losses from catastrophic disasters.

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In Florida, not surprisingly, hurricanes were demonstrated to have had the greatest effect on loss ratios in homeowners policies (990% in 1992), while fire, allied lines and commercial multi-peril, followed in that order. Thus, following Hurricane Andrew, the number of insurers in Florida decreased in all of these lines. Market concentration (and implicitly the concentration of risk) increased in the homeowners and fire lines where the windstorm peril is greatest and regulatory restrictions have been most severe. In California, earthquakes have had the greatest effect on loss ratios in earthquake policies (1,200% in 1994), followed by allied lines, commercial multi-peril, homeowners and fire, in that order. In California, following the Northridge earthquake of 1994, the number of insurers similarly decreased in all of these lines. However, concentration increased only in the commercial, multi-peril, and homeowners lines. High profits in earthquake lines in "low-cat" years and the introduction of the CEA may be helping to maintain insurers' relative market shares.

Other Issues

Klein presented a comparison between “indicated” and “implemented” ISO advisory loss costs for homeowners insurance in Florida broken down by standard rating territory. (The ISO indicated loss costs as presented included modeled CAT losses but did not include a risk load). Interestingly, the loss costs indicated by ISO’s actuarial analysis are much higher than the loss costs approved by the insurance department. Moreover, the absolute and relative magnitude of the disparity is actually

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greater in “higher-cost” areas. These areas typically have a high CAT exposure. This suggests that the rate deficiency (i.e. subsidy) is **relatively** greater for high-risk areas than for low-risk areas.

Klein went on to discuss the concentration of residential property exposures (measured by the count of housing units) broken down by county and insurers, based on data supplied by the Florida Insurance Department for 1996. The data indicate that coastal counties have higher market concentration than other counties. This disparity could prove to be even greater when measured by the amount of insurance and better distinguished with respect to proximity to the coast. Although most insurers have their exposures dispersed relatively evenly across the state, a subset

(roughly 550 insurers out of 240) appear to be highly concentrated in just a few counties.

Finally, Klein reviewed financial strength indicators for companies that have entered the homeowners insurance market in Florida since 1989. Indications are that these entrants as a group are more highly leveraged and have lower financial ratings from A.M. Best than firms who entered this market earlier. However, more analysis is needed to determine whether new entrants and insurers who have increased their market share tend to be more or less risky than other insurers.

Subsequent research will also focus on the analysis of supply and demand, more refined measures of insurers’ concentration of risk, and the influence of state CAT insurance funding mechanisms.

Insurance Capacity Research Project

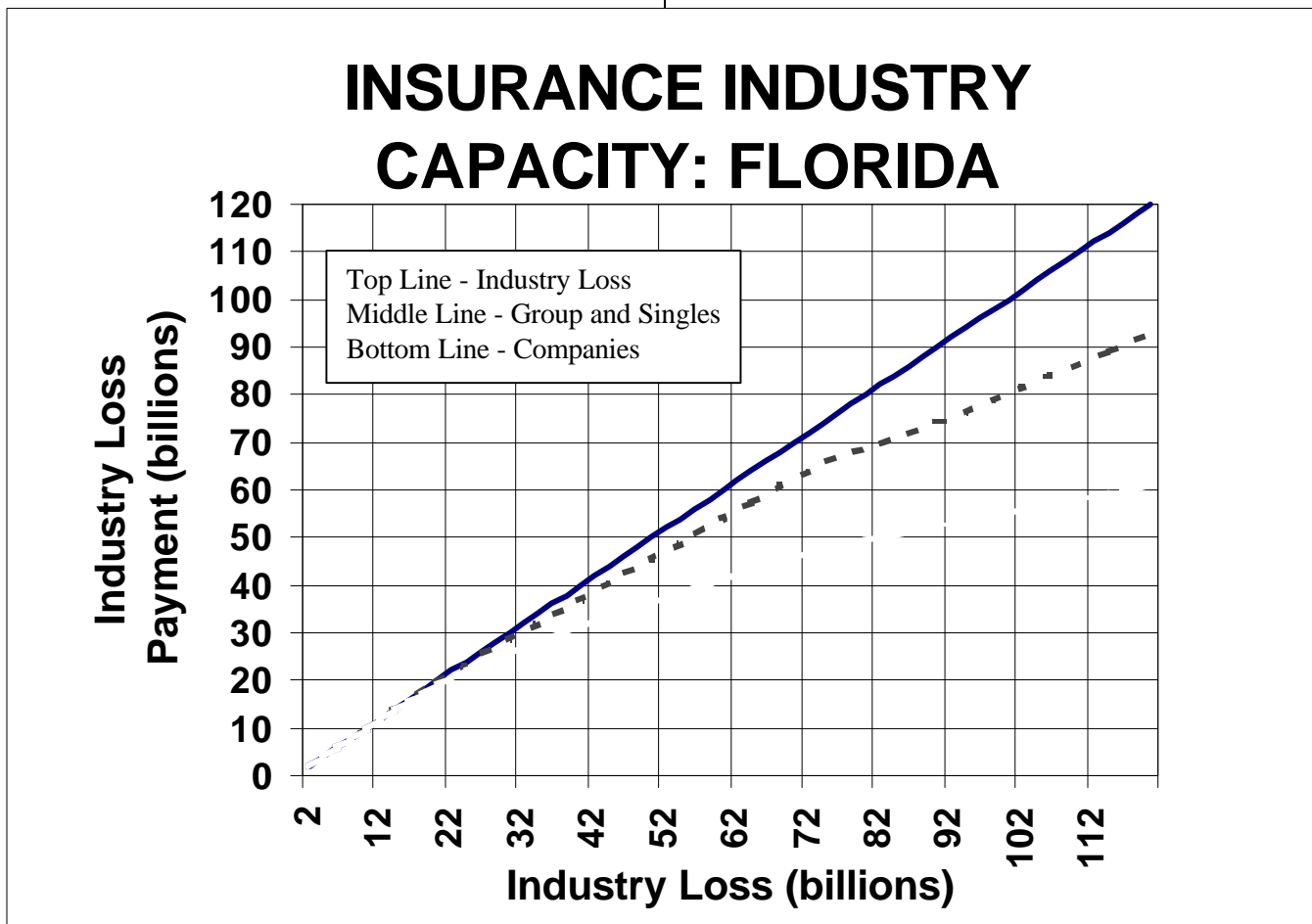
David Cummins and Neil Doherty presented a summary of their continuing work on assessing insurers capacity to fund catastrophic losses. Cummins presented an analysis of 1995 (post Andrew) Florida insolvencies indicating that in the event a \$75 billion Florida hurricane, the US Property-Liability Insurance Market would **not** have the capacity to cover the insured losses. Neil Doherty then outlined the summer ‘98 research plan to continue modeling the industry’s capacity to pay for various catastrophic losses.

Industry Capacity

The industry is currently thought to have some \$250 billion in equity capital and annual premiums of another \$280 billion. Therefore, a hurricane or earthquake of \$50 billion or more would appear at first glance to be a manageable disaster. Unfortunately, such a quick assessment ignores several impacts that industry structure has on the accessibility of assets for localized losses. First, the \$250 billion in reserves figure includes assets of many insurers that may not write coverage in affected states. Second, those insurers that do have subsidiaries writing in affected states may have “firewalls” to protect

the losses of the subsidiaries from bankrupting the parent companies. Third, while state guaranty funds mitigate these problems, they are of insufficient size to eliminate them.

Against this backdrop, Cummins and Doherty then examined the capability of Florida's insurance industry to pay covered losses. For annual industry losses of expected or slightly larger size, industry loss payments should indeed equal actual industry losses. However, if losses are sufficiently large, claims and actual payments will begin to diverge. Expected annual losses in Florida are \$12 billion, and the model



demonstrates that the industry can sustain losses up to \$22 billion before any real impact on its ability to pay claims is observed. Beyond this point though, claims and actual payments will diverge. If companies are viewed individually, the divergence is severe for extreme catastrophes. It is thus projected that a year with \$80 billion in insured losses would have only some \$50 billion that could be paid. However, this scenario ignores the cushioning effects of groups and allied companies and so presents a lower bound or worst-case scenario. Including these alliances in the analysis reduces the expected divergence, and indicates that approximately \$70 billion would be paid out in a year with \$80 billion in losses.

Extensions of this research will examine the effects of additional sources of capacity such as security market issues, and revised tax treatment of reserves on claims paying ability.

Update on Basis Risk Research Project

Cummins presented the objectives of the study he is conducting on CAT loss derivatives. Basis Risk Project collaborators are David LaLonde of Applied Insurance Research and Richard Phillips of Georgia State University. In essence, the goal of this study is to measure the effectiveness of traded CAT loss derivatives in hedging the risk of catastrophic property loss for insurers. It will focus on windstorm damage in the eastern United States, with specific emphasis on Florida and New York. The intent is to compare the use of traded, index linked derivatives such as CAT Call Spreads to CAT Bonds linked to the experience of different representative firms synthetically developed for the model.

Panel Discussion on Uncertainty Analysis.

After lunch, Howard Kunreuther began the discussion on understanding the role of uncertainty in the modeling of catastrophic risks. The key sources of uncertainty for modeling the hazards and disaster impacts are currently not well characterized. This poor characterization reduces modeling's potential usefulness for determining prudent underwriting strategy, as well as for providing a strong argumentative basis for changes in regulation.

Following Howard's remarks, there was a panel discussion with representatives from the three modeling groups: Karen Clark, Applied Insurance Research; Dennis Kuzak, EQECAT,; and Weimin Dong, Risk Management Solutions. Each presented their ideas on the sources and types of uncertainty in modeling both hurricane and earthquake hazards.

Modeling uncertainties have an impact on evaluating the effectiveness of mitigation, the availability of insurance coverage, and assessing the price of CAT securities.

These modeling uncertainties can have an impact on evaluating the cost-effectiveness of mitigation, on estimating the availability of insurance coverage, on determining the nature of reinsurance requirements and on assessing the viability of specific catastrophe instruments such as CAT bonds.

Three key future challenges for the project with regard to understanding uncertainty were then outlined. They are:

- Better specification of the frequency and severity of hazards
- Better estimation of the relative importance of different sources of uncertainty affecting the calculation of expected event losses
- Better understanding of the impact of uncertainty on portfolio structure and optimization by insurers

Update on the Mitigation Project

Howard Kunreuther and Paul Kleindorfer illustrated the impact of uncertainty on the effects of mitigation on insurers portfolios for one of the model cities. Uncertainties in mean damage estimates have impacts on insolvency probability, feasible book of business, revenue, and profitability. Therefore successful strategies for reducing uncertainty will enable insurers, reinsurers, and financial institutions to calibrate better the potential impacts of mitigation on their operations. They can also more accurately determine what type of premium reductions they can afford to offer property owners who take steps to reduce future losses.

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