ISSUE BRIEF
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Current Issues in Insurance Ratemaking for Catastrophic Events

The utilization and cost of reinsurance is a significant consideration in pricing insurance products that provide coverage for catastrophic events. The purpose of this issue brief is to provide insight into some of the issues that should be considered when pricing these insurance products.

This issue brief:

- *Provides a brief overview of the ratemaking issues associated with relying on historical data;*
- *Summarizes some of the approaches used to validate catastrophe models;*
- *Discusses some of the issues regarding the use of models in rate filings; and*
- *Highlights some of the issues associated with including the cost of reinsurance.*

RATEMAKING ISSUES

The Actuarial Standards Board (ASB) responded to the many issues surrounding the ratemaking challenges for insurance covering catastrophe losses through the 2000 publication of Actuarial Standard of Practice (ASOP) No. 38, Using Models Outside the Actuary's Area of Expertise, and ASOP No. 39, Treatment of Catastrophe Losses in Property/Casualty Insurance Ratemaking. Since that time, the use of catastrophe models generally has been accepted as the state of the art for property ratemaking. Catastrophe models are regarded as the best available tool to estimate the prospective costs of risk transfer from natural disasters. Because historical loss information is insufficient to reasonably predict future property insurance losses from hurricanes, earthquakes, and other major catastrophes, estimated loss costs based on insurance claim history are not actuarially sound. Using insurance history in this context for ratemaking is inadequate for some policyholders and potentially excessive for others, and the resulting subsidies may be viewed as unfairly discriminatory. However, if companies cannot use catastrophe models in rate filings, they will have to rely on in-

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adequate historical insurance losses as the basis for projecting future losses.

Several of the issues associated with relying on historical information are as follows:

- **Changes in value of exposed property**—Buildings and contents are worth more now than in the past; consequently, damages to property cost more to repair now than in the past. Any attempt to rely on historical losses has to adjust for changes in value, which increases expected losses, all else being equal.
- **Changes in building codes and building quality**—Loss levels for a given wind speed or a given earthquake intensity decrease as building quality improves. Any attempt to rely on historical losses requires an adjustment for changes in building code and quality and in structural design and orientation. To the extent that building stock is more resistant to damage due to improved codes, structural design, and building practices and/or the enforcement of building codes, losses can be expected to decrease.
- **Shifts in location of building stock**. Given an increase or decrease in the amount of property exposed to a given event, losses move in a corresponding direction. Insurers possess no historical loss information on areas where there were no properties in the past. Without this exposure base, aggregate historical losses are not useful. This is an important issue, as there has been a significant increase in the amount of building stock situated in areas of the United States that are most exposed to hurricanes and earthquakes.
- **Change in definition of a catastrophe**. Catastrophes have historically been defined as losses that exceed a certain dollar threshold for the industry. Companies have to adjust historical-event data to the current definition using different thresholds. At times this may mean treating certain events as catastrophic that previously were below that dollar threshold and for which there is limited data because they did not meet the earlier threshold.

In addition, the history of events is too brief for traditional ratemaking purposes. The homeowners' product has existed for less than 50 years. Modelers typically use at least 100 years of historical information to develop their models, applying scientific and statistical criteria to the historical period to create a stochastic event-set, generally simulating many thousands of years.

The expected loss to areas that have experienced historical events that are significantly above the long- term average are often overstated, since they are averaged over a short time frame. Conversely, the exposure in nearby areas that escaped such events is understated. This effect is exacerbated as rates are developed for smaller areas. For example:

- Because of severe data limitations for earthquakes, it would take a significantly longer history to capture the full range of frequencies and severities for this peril.
- When using a company's own loss experience, credibility issues affect statewide estimates and exponentially affect territorial outcomes Failure to properly load the catastrophe exposure in the correct territories creates cross-subsidies, usually with the less-exposed areas

subsidizing areas of greater exposure. Model results are often considered fully credible, so the results are not further adjusted by any credibility formulas.

- Rates are less stable over time. As events occur in an area, rates increase based on the recorded losses that correspond with event information being brought into the historical data. In addition, companies often lack information for earlier years. Such information was only available on paper before the advent of electronic computing and storage, if it was retained at all. Also, the quality of saved information often was dependent on whether a company used it for specific ratemaking purposes at the time.
- Forced to rely solely on historical information, companies must increase the charge for uncertainty in their catastrophe loss estimates. This translates to higher prices, leading to an increase in the surplus required to support the book. Ultimately, a larger profit margin is necessary to get an adequate return on the required capital.

Secondary Effects

If catastrophe models are prohibited or restricted in rate filings, the rate issues outlined above can lead to significant market dislocations. Lacking an actuarially sound rate structure, companies may use other means to ensure their financial ability to pay policyholder obligations and make a return commensurate with the risk accepted.

- If companies cannot use the proper rate because model results in filings are not approved, they still may use model results to shape marketing plans, underwriting guidelines and actions, agency locations, compensation, etc. If the rates become too incompatible with management needs of the underlying book, companies will limit their exposure through underwriting actions, agency management, or market withdrawal. This can lead to problems of availability and the overloading of involuntary markets, similar to the experience of Citizens Property Insurance Corp. in Florida.
- Availability issues have the greatest effect on owned residential structures, where coverage is required to obtain a mortgage.
- Reinsurers make extensive use of catastrophe models in their underwriting and pricing. If insurers are not allowed to pass any incurred reinsurance costs on to their policyholders through rates charged to their customers, further market contractions might be expected, even with insurers that prudently hedged some of the risk by purchasing reinsurance.

While insurers can attempt to use and adjust only historical losses, even the best results will fall short of the necessary information that is provided by catastrophe models.

REGULATORY OVERSIGHT OF CATASTROPHE MODELS

Current state regulation of catastrophe models runs the gamut from disallowing models that produce loss costs to requiring in-depth review of models and their components prior to their being used to produce direct property insurance loss costs.

Established by the Florida legislature in

1995, the Florida Commission on Hurricane Loss Projection Methodology is the gold standard for the review of hurricane models for producing property insurance loss costs. The commission's acceptance of models often forms the basis of model reviews performed by other organizations around the country. In founding the commission, the Florida legislature established that, "it is the public policy of Florida to encourage the use of the most sophisticated actuarial methods to assure that consumers are charged lawful rates for residential property insurance coverage." The Florida legislature specifically concluded that computer modeling had made it possible to improve on the accuracy of hurricane loss projections.

Each year, the Florida commission adopts standards that modelers must meet in the following year in order to be accepted. There are general, meteorological, vulnerability (structural engineering), actuarial, statistical, and computer standards. The standards are intended to insure that models are based on sound methodology and on data in each of these areas. To be found acceptable by the Florida commission, the model must be determined to be acceptable by a majority of voting commission members for each part of each standard. A model that is not determined to be acceptable for any given part is determined to be not acceptable for producing property insurance loss costs in Florida.

Hurricane-prone states enjoy the benefit of the work done by the Florida commission, a substantial amount of which is equally applicable to a determination of acceptability of loss costs produced for those states. The Florida process provides a detailed review to determine that particular models are structured and loss costs are consistent with currently accepted scientific principles and methods in the numerous disciplines used in developing the models. Standards are revised each year to make use of the most recent scientifically accepted criteria.

There are parts of the modeling process (such as the process used in the creation of a stochastic set of hurricanes and the relationship between wind speeds and damage for specific construction types) that are applicable regardless of the geographic area under consideration.

The Florida review process provides a wealth of information useful in determining that a particular model is appropriate for producing property insurance loss costs in, for example, North or South Carolina, Virginia, or Massachusetts,. It is much more efficient to review only those portions of the model that require a state-specific review. While the Florida review validates the model relative to historical storms, those historical storms are different from the storms that have affected other hurricane-prone states.

The Commissioner of Insurance in Hawaii has established a process to enable the Hawaii Division of Insurance to review the loss costs produced by hurricane models there. One of the requirements for deeming a model acceptable for producing loss costs in Hawaii is that the model was acceptable to the Florida commission.

As regulators and the industry struggle to define their roles in possible rate regulatory proceedings, the future of rate regu-

lation itself remains somewhat cloudy. While reinsurers and rating agencies are using short- and medium-term hurricane frequency models to produce their rates and ratings, the Florida commission has not yet considered a short- or medium-term model. One modeler submitted a medium-term model to the commission but replaced it with a long-term frequency model prior to final determination.

REINSURANCE COSTS IN RATEMAKING[1]

As is evident from the following tables, a significant and increasing percentage of the premium associated with products covering catastrophic risks is ceded to reinsurers.

There are two general methods for developing rates for insurance products that cover catastrophic losses—direct ratemaking and net ratemaking. As reinsurance costs become a larger factor in the ratemaking formula, rates are developed for these products in which the cost (or the net cost) of reinsurance is explicitly reflected in the ratemaking process. Additionally, insurers' reliance on models to estimate catastrophe losses is now the rule rather than the exception. As noted above, the ASB responded to many of the issues surrounding these ratemaking challenges by publishing ASOP No. 38 and ASOP No. 39. However, neither standard specifically addresses methodologies for considering the cost of reinsurance, nor do actuarial standards serve the purpose of providing detailed methodologies for specific ratemaking components.

Table 1: U.S. Insurance Industry Earthquake Premiums (in 1,000s)

EARTHQUAKE			
	DWP*	NWP**	% CEDED
2003	1,929,925	1,347,212	30.2%
2004	2,062,571	1,426,620	30.8%
2005	2,189,635	1,471,684	32.8%
2006	2,041,384	1,306,188	36.0%
2007	2,542,313	1,575,855	38.0%

*Direct written premium

**Net written premium

Source: A.M. Best

[1]While the focus of this section is reinsurance, the comments and considerations equally apply to other methods of risk financing such as catastrophe bonds.

Table 2: U.S. Insurance Industry Homeowners Premiums (in 1,000s)

HOMEOWNERS			
	DWP	NWP	% CEDED
2003	48,779,728	45,765,197	6.2%
2004	53,545,681	49,536,413	7.5%
2005	57,253,899	52,217,099	8.8%
2006	60,175,438	54,604,796	9.3%
2007	62,027,890	54,867,518	11.5%

*Direct written premium

**Net written premium

Source: A.M. Best

Methods for allocating reinsurance costs to a particular line or product have been described in actuarial literature.[2] They allocate reinsurance costs proportionate to the state and/or line of business using expected losses, exposure, premium, or some combination. Some states prohibit the explicit recognition of reinsurance costs in the rate filing. In some cases, the prohibition is contained in state statutes or regulations. In other states it may just be a long-standing practice. Issues associated with an implicit reflection of reinsurance costs will be discussed below. States that do allow explicit recognition of reinsurance costs, should consider the following when determining whether the allocated costs are appropriate.

- Are the projected costs of reinsurance consistent with historical costs?
- Should projected reinsurance costs be based on recent prices or longer-term averages?
- Do the projected reinsurance costs consider changes in exposure, limits, and attachment points?
- Is the data used to allocate the reinsurance costs consistent with the data used to project the losses of the product being priced?
- If a model is used to allocate reinsur-

[2]See, for example, http://www.casact.org/pubs/forum/96wforum/96wf347.pdf Catastrophe Ratemaking Revisited (Use of Computer Models to Estimate Loss Costs) (last viewed on December 1, 2008).

http://www.casact.org/pubs/forum/97wforum/97wf223.pdf Reflecting Reinsurance Costs in the Rate Indications for Homeowners Insurance (last viewed on December 1, 2008).

http://www.casact.org/pubs/forum/97wforum/97wf255.pdf Pricing the Earthquake Exposure Using Modeling (last viewed on December 1, 2008).

ance costs, is it the same model used to develop the projected losses in the primary product?

- Is the model used in accordance with ASOP No. 38?
- What states and perils do the reinsurance contracts historically cover?
- What methods, if any, historically have been used, to allocate reinsurance costs to the product being priced?
- Is there consistency across the pricing for individual states in how the reinsurance costs are allocated?
- Is there consistency across the pricing for individual lines of business and territories within a state?

If reinsurance costs are not explicitly recognized in rate development, they can be implicitly recognized through the profit provision. In that case, the issues are somewhat different and may include the following:

- How much capital is needed to support the state/product line if it is assumed there is no reinsurance available or purchased?[3]
- What is an appropriate rate of return to reflect the risk if it is assumed no reinsurance is purchased or available?

One aspect of the purchase of reinsurance is the use of the reinsurer's capital to support the risk in lieu of holding additional capital. Where reinsurance is not explicitly reflected in the rates, the profit load may need to be higher since the insurer is exposed to higher risk without the same opportunities as a reinsurer to spread the risk geographically. Interestingly, if the reinsurer's price reflects a lower cost of capital due to, for example, greater diversification, the required rate not reflecting reinsurance will be higher than the rate reflecting the reinsurance transaction.

CONCLUSION

Catastrophe models cannot nor should not be ignored by insurers, reinsurers, rating agencies, or analysts. State regulators may only potentially prohibit the reliance on catastrophe models for ratemaking, while reinsurers, rating agencies, and capital markets will likely continue to use these models. Determining an actuarially sound rate for insurance products that cover catastrophic exposure is a challenging process that will only get harder if complex catastrophe models are substantially prohibited in the rate-development process.

For capitalization criteria, state regulators have required the use of catastrophe models to ensure that new entrants into their states are sufficiently capitalized. Companies may also continue to use catastrophe models for exposure management and other internal applications, thereby creating disconnects between an insurer's view of the marketplace and what an insurer will be able to use to support its rate level needs.

[3]These questions are not meant to imply that reinsurance is prohibited, is not available, or was not purchased. However, from a ratemaking perspective, if the cost of reinsurance cannot be explicitly reflected, the ratemaking process implicitly assumes that all losses and costs are covered on a direct basis.

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