

Reflecting Cat Losses in Property Rates: Is There a Right Answer?

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Good morning to my colleagues and friends, and thanks to the CAS Committees on Ratemaking and Special Interest Seminars for the opportunity to talk with you today. I'm Chief Actuary at Florida Farm Bureau, responsible for day-to-day actuarial operations such as rate filings and reserves, solely in the state of Florida. The issue of ratemaking for catastrophic events is very important to us, of course. I will ask you to hold major questions until the end, when we will allow plenty of time for debate.

Overview

- What's at Stake for Insurers? Consumers?
- Reinsurance Costs versus Direct Risk Loads
- Allocations to Line and Territory using Models
- Market Implications of Ratemaking Methods

Mr. Homan has presented one method for dealing with the significant, complex, and volatile item of catastrophe costs in residential property ratemaking. I would like to put his method in context against some alternatives and examine the economic and actuarial consequences of choosing a method to reflect the total cost of catastrophic events (losses and transaction costs) in rates.

Does Treatment of Cats Really Matter?

- In Florida, YES! Cost of catastrophes is:
 - ◆ **Significant:** 35% or more of premium
 - ◆ **Complex:** involves
 - ◆ Operation/interpretation of cat models
 - ◆ Cutting-edge theory on risk loads
 - ◆ Reinsurance market economics
 - ◆ **Volatile:** model evolution, global reinsurance capacity determine consumers' rates

If you are lucky enough that you can afford not to worry about cat loads in property rates, “tu salud”. In my business, the right handling of catastrophe costs determines whether we are profitable or insolvent. Of course, the regulators don’t want too much of either one.

Our last rate indication showed that non-cat losses made up 35% of our premium dollar, modeled cat losses 25%, and the non-loss portion of cat reinsurance costs about 13%. Cat costs are greater than non-cat loss costs!

Consumers pay cat premiums for three things: modeled losses, costs of capital, and underwriting expenses, whether directly rated or “buried” in reinsurance costs. Modeling science, actuarial science, and economics all influence the amount and distribution of these costs. Because these costs depend on evolving science and external markets, they will always be volatile. It is critical that we explore all reasonable methods for distributing them and managing their volatility in rates.

Who Should Care How It's Done?

- **Consumers:** Accepted method affects property insurance premiums in several ways:
 - ◆ Average rate level
 - ◆ Cross-subsidy among territories
 - ◆ Volatility from year to year
- **Companies:** Accepted method affects profitability in several ways:
 - ◆ Reflection of true costs in rates
 - ◆ Risk classification and selection

What is the “Cost of Cats”? Breakdown

- **Expected (Modeled) Losses:** Revenue needed for long-term average cat loss cost
 - ◆ *What about cyclical loss adjustment?*
- **Risk Load:** Cost of capital committed to cover events not funded by expected loss provision
- **Transaction Costs:** Administrative costs of obtaining capital, usually external reinsurance
 - ◆ *Should consumers pay for this?*

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There is general agreement that the historical cat losses should be removed in favor of, or blended with, modeled expected cat losses in primary ratemaking. Mark showed one way to blend historical “excess wind” experience with modeled possibilities. Modeled expected losses may be directly loaded by the company from model output, inferred from reinsurance premiums, or both, but double-counting expected losses must be avoided in ratemaking methods.

An aside: the long-term average expected losses from the model may not resemble the **CONDITIONAL** expected losses for next year **GIVEN** next year’s expected level of hurricane activity. El Nino and other cyclical phenomena may necessitate adjustments to expected losses from the 50,000 year average from the model. This problem has not been addressed adequately by either actuaries or cat modelers, but it’s another topic.

Risk load reflects the skewed nature of annual cat losses - less than expected in most years, astronomical in the extreme seasons. The primary company must commit capital, either from its own equity or “rented” from reinsurers or capital markets, to ensure its ability to honor claims in the extreme season. If the capital is rented, its cost is implicit in the reinsurance rate. While determining the amount of required capital is beyond the scope here, the decision on where to account for its cost in the rates is germane.

If external sources of capital are used, additional transaction costs, such as brokerage commissions or underwriting fees, will be incurred. These are costs of doing business, but is it appropriate to reflect them in rates? We will discuss later.

Ratemaking Options

$$\text{Premium} = \text{Non-Cat Losses} + \text{U/W Expenses} +$$

- A. Retained $E[\text{Cat Losses}]$ + Reinsurance Premium
- B. Modeled $E[\text{Cat Losses}]$ + Non-Loss portion of Reinsurance Premium
- C. Modeled $E[\text{Cat Losses}]$ + Modeled Risk Load + Reinsurance Transaction Costs

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Assume that losses include LAE and underwriting expenses include a primary profit load (in many states, prescribed by rule or statute). How do we reflect cat costs and what do we use to measure each component?

Option A resembles Mr. Homan's method. While historical data may be a poor predictor of gross cat losses, it may be an adequate source for retained cat losses. Then the total reinsurance premium, appropriately divided into fixed and variable expenses, covers all the remaining cat costs.

Option B is essentially what I use in ratemaking. The cat model is run to generate a modeled loss distribution for each line. At each year-end, actual reinsurance premiums are allocated to line based on the model and a "non-loss reinsurance cost provision" as a percent of direct premium is calculated for each line. When rates are made, the modeled expected losses are added to the non-cat losses and the reinsurance cost factor is added to fixed expenses.

Option C is most closely aligned with ratemaking for non-cat lines. The modeled loss distribution is used to calculate expected losses as well as a measure of uncertainty. The charge for uncertainty is directly loaded into the rate based on prevailing risk theory and the measure chosen. At this point, the reinsurance premium is reduced for the loss costs AND risk load, and the leftover portion - administrative costs - may be included in the rates as a variable expense.

The choices, particularly Option C, each have powerful implications for the company's competitive position as well as consumer economic welfare.

Pros and Cons: Option A

- Avoids direct use of cat models and associated scrutiny
- Simplest breakdown
- “Provides for all costs associated with the transfer of risk”, no mismatch between overall rates and costs
- Does not breakdown costs into expected loss, risk load and transaction costs
- Does not provide data for use in allocating overall rate change to line or territory
- Does not allow regulators to evaluate efficiency of reinsurance deals

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Using Option A will ensure all risk transfer costs are covered, as required by the CAS Statement of Principles on Ratemaking. It will also free the actuary from compiling or interpreting cat model output. However, an indication of the relative cat costs for each risk classification variable is needed for any non-judgmental method of calculating relativities. Management and regulators also have a vested interest in understanding the company's expected losses, cost of capital, and transaction costs for rented capital. Management cannot evaluate the optimal financing structure (amount of reinsurance to buy) without costs of capital. Regulators, in turn, cannot identify when the cost of poor management and bad reinsurance deals are being unfairly passed along to consumers.

Pros and Cons: Option B

- Model output indicates expected costs, their degree of uncertainty, and allocation to territory
- Provides for all risk transfer costs
- Allows management to evaluate transaction costs and costs of capital in reinsurance deals
- Still passes all costs to consumers, whether capital structure efficient or not
- Still does not separate true risk load from reinsurance transaction costs
- Regulators may question need to pass through non-loss reinsurance premium

With Option B, we solve the data problem. Model output, with its complete cat loss distributions, allows allocation of expected losses and risk loads to any business subdivision using almost any conceivable measure of the risk charge. Yet the total revenue need in the rates is still based on actual reinsurance costs, not a “black box”. The data can also be used to show management the reinsurer’s expected losses, and therefore the cost of capital and transaction costs implicit in the reinsurance premium, allowing evaluation of quotes and programs. However, the efficiency of reinsurance is also revealed to regulators and may raise questions about how cat costs are passed through and allocated to consumer groups (territories).

Pros and Cons: Option C

- Ratemaking is returned to a direct basis, reflective of both costs and uncertainty
- Consumers pay actuarial premiums, isolates bad reinsurance deals
- Indicated risk loads provide best rate allocations by territory
- Regulators may challenge risk loads as unsupported by actual costs
- Complex calculations required for ratemaking

Option C incorporates a charge for both average and extreme cat events directly into the rates. The company decides what risk load to charge and how to allocate it among its business groups. But it must be careful to include all risk transfer costs in the rates by “mopping up” its residual reinsurance transaction costs and making sure the rates balance back. Also, the risk load by territory will depend on the actuarial technique for determining the risk charges from the cat loss distribution and must be defensible.

Option B: Sample Rate Indication

ITEM	SOURCE	DESCRIPTION	VALUE
[1]	data	Direct Non-Cat Loss+LAE	90,000
[2]	cat model	Modeled Cat Losses	60,000
[3]	[1]+[2]	Loss+LAE Including Cat	150,000
[4]	data	Present-Level Earned Premium	250,000
[5]	[3]/[4]	Experience Ratio	60.0%
[6]	data	Fixed Underwriting Expenses	6.0%
[7]	next page	Non-Loss Reinsurance Provision	15.0%
[8]	data	Variable Expenses and Profit	20.0%
[9]	<u>[5]+[6]+[7]</u>	Overall Rate Level Change	1.3%
	1-[8]		

Option A was presented in detail by Mr. Homan. Here is an example of how the cost components would fit together in an overall rate indication produced under Option B. Note the modeled losses are simply added into the experience loss ratio, and the additional cost of reinsurance (determined earlier as a ratio to direct premium) is like a fixed underwriting expense.

Option B: Reinsurance Cost Provision

ITEM	SOURCE	DESCRIPTION	VALUE
[1]	data	Direct Earned Premium	50,000
[2]	data	Cat Reins. Subject Premium	40,000
[3]	cat model	Modeled Cat Losses	12,000
[4]	data	Cat Reins. Premium Ceded	15,000
[5]	treaty	Cat Reins. Retention (% of SP)	10%
[6]	treaty	Cat Reins. Coinsurance %	95%
[7]	$([3]-[5] \times [2]) \times [6]$	Reinsured Portion of Loss	7,600
[8]	$[4]-[7]$	Implied Non-Loss Reins. Costs	7,400
[9]	$[8]/[1]$	Cat Reins. Fixed Cost Provision	15%

Determining the reinsurance cost provision could be done in advance, for each line, once a year with Annual Statement premiums and modeled losses. We adjust the modeled losses to remove the retained portion, then subtract them from the actual reinsurance premium to determine the non-loss cat costs. These are expressed as a ratio to direct premium for ratemaking.

Option C is Not a Pipe Dream...

- Cat model can produce complete empirical loss distribution for N-year simulation by territory
- Straightforward calculation of most risk measures, such as variance, “tail value at risk”
- Covariance matrix by territory, along with allocation methodology (e.g. Meyers) can be used to create marginal risk load by territory
- My example of territory ratemaking will stick to expected loss allocations

While I won't cover the topic of risk loads, I will state that the empirical nature of the cat model output lends itself to easy construction of measures of uncertainty for the book of business as a whole and by territory. At the very least, expected cat losses by territory can be used in developing rate relativities.

Cat-Loaded Territory Factors

ITEM	SOURCE	DESCRIPTION	NORTH	CENTRAL	SOUTH	TOTAL
[1]	data	Earned House-Years	300	500	200	1,000
[2]	data	Present Level Earned Premium	120,000	300,000	180,000	600,000
[3]	data	Non-Cat Incurred Losses	60,000	120,000	45,000	225,000
[4]	filed rates	Current Territory Relativity	0.80	1.00	1.20	1.00
[5]	[2]/[4]	PLEP at Base Territory Rates	150,000	300,000	150,000	600,000
[6]	[3]/[5]	Non-Cat Loss Ratio at Base Rates	40.0%	40.0%	30.0%	37.5%
[7]	[6]/[6T]	Indicated Non-Cat Terr Rel	1.07	1.07	0.80	1.00
[8]	$([1]/[1T])^{.5}$	Credibility	0.55	0.71	0.45	
[9]	$[8] \times [7] + (1 - [8])$	Z-Weighted Non-Cat Terr Rel	1.04	1.05	0.91	1.01
[10]	[9]/[9T]	Balanced Non-Cat Terr Rel	1.03	1.04	0.90	1.00
[11]	$[5] \times [10] \times [6T]$	Expected Non-Cat Losses	57,707	116,598	50,695	225,000
[12]	cat model	Modeled Expected Cat Losses	24,000	60,000	60,000	144,000
[13]	$([11] + [12]) / [5]$	Expected Loss Ratio	54.5%	58.9%	73.8%	61.5%
[14]	[13]/[13T]	Indicated Terr Rel With Cat	0.89	0.96	1.20	1.00

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This slide presents one way to adjust territory factors for modeled expected cat losses. There is a lot of detail here, so you may want to review the paper handout later. The key actuarial puzzle is that non-cat territory experience should be subject to credibility considerations, but modeled cat losses should (in theory, at least) be fully credible. In Rows 1-10, we do a “normal” relativity analysis with non-cat losses, exposures, premiums, and credibility. The expected non-cat losses under the implied non-cat relativities are just the average non-cat loss ratio, modified by the PROPOSED non-cat relativity, divided by earned premium on present base territory rates. The modeled cat losses are added to the non-cat losses and the indicated relativity, now with (fully credible) cat losses and credibility-weighted non-cat losses, is recalculated.

Market Effects of Ratemaking Options

- Many states prohibit **cat modeled losses** in ratemaking, and/or **risk charges in primary rates**, but allow reinsurance costs (Option A).
- This policy has several harmful effects:
 - ◆ Forces consumers to pay **higher overall rates** due to reinsurance transaction costs;
 - ◆ Forces consumers to **bear market volatility** in reinsurance risk loads.
 - ◆ Removes territory-rating precision and results in **cross-subsidies** among regions;

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Having objectively (I hope) presented three basic options for cat-load ratemaking, I will now present an argument against being content with Option A, the pass-through of total reinsurance premium. As Homan explains in his paper, Option A is consistent with a regulatory environment prohibiting the use of cat model output in ratemaking, which leaves pass-through as the only way to reflect the true overall cost of doing business in a state's property insurance market. However, this creates a tremendous incentive for the primary company to over-buy reinsurance, since its ability to charge adequate rates now depends directly on its risk financing structure, with reinsurance receiving favorable treatment over internal capital. Given positive transaction costs, total insurer costs are higher than they otherwise would be and the excess brokerage and expenses are directly charged to consumers.

Second, reinsurance rates vary with macro and micro-economic conditions, sometimes wildly from year to year, whereas internal costs of capital reflect only the economics of the firm and are less variable. The primary company, forced to file rates every year reflecting current reinsurance costs, passes on to consumers the "market whiplash". Alternatively, if primary rates are suppressed in hard markets by regulators, the primary company bears this burden and may drastically reduce the quantity of insurance written when it is writing policies at a loss because of the cost mismatch.

Finally, prohibiting modeled losses from territory indications distorts the picture of true expected loss costs by territory, and therefore leads to geographical rating subsidies, with all the associated actuarial and economic consequences of insufficient risk classification.

Exposure Management Implications

- Hypothesis: the underwriting goal is to write policies where **marginal expected profit** (in rates) exceeds **marginal expected cost of capital**.
- If reinsurance used, cost of capital will be marginal risk load plus share of transaction costs.
- Unless risk loads are directly built into rates, these two items will NOT generally be equal.

Under the general assumption of economics, each policy is evaluated for its marginal revenue and marginal costs. The difference, marginal profit, should be a constant percentage of premium if cat costs are accurately reflected in the rates. Reinsurers, however, charge a risk load based on the composition of their portfolios, not the primary company's. The company has no way of knowing exactly how much it will cost in ceded premium to put the marginal risk on the books, so it makes an educated guess. Extensive use of reinsurance, as incited by prohibition of primary risk loads, makes this a very high-stakes gamble.

Exposure Management Implications

- Conclusion: for every company, there will be regions where **no exposure should be carried**. “Reinsurance redlining” may result.
- **Consumers pay more on average, see more volatility in rates, and experience sometimes unpredictable shortages, when regulators prohibit direct use of cat models and risk charges in rates.**

Making our best guess, the company will identify territories and classes of risks where it expects to lose money because the cost of capital it collects, spread evenly over the book of business due to the ratemaking method, does not cover the cost of capital charged for that risk by the reinsurer. Of course, the primary company will restrict writing in those areas. Worse yet, those areas may change dramatically from year to year depending on overall market conditions and the exposure management strategy of our reinsurers!

To summarize, when companies are incited to overbuy reinsurance because it is the only cost of capital allowed in primary rates: excessive transaction costs are incurred, costs of capital vary significantly over time, and insufficient ability to classify and rate different risks will lead to shortages which do not necessarily depend on the overall adequacy of the rates.

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Thank you for listening to myself and Mark. I appreciate your attention and we may now take some questions.