RR-2: Quantifying Risk Load for Property Catastrophe Exposure

USING CATASTROPHE BONDS TO INFER RISK PREMIUMS, PROFIT LOADS, & REINSURANCE COSTS

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QUANTIFYING RISK LOAD FOR PROPERTY CATASTROPHE EXPOSURE:

APPLYING CATASTROPHE BOND DATA

Discussion Topics

- Current Profit Provision Methodologies
- Overview of Cat Bonds
- Results Based on New Cat Bond Methodology

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OBJECTIVE

To describe an approach to develop Profit Loads or evaluate Reinsurance Costs in rate filings for lines with catastrophe exposure

Why?

- Costs of bearing catastrophe risk are very high
- May comprise majority of premium in some lines & states
- Justifying rate level can be issue in regulated environment
- Understanding all available risk financing options is important for insurers

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STANDARD RATEMAKING PROCEDURE

Premium = Expected Loss and Expense
+ Net Cost of Reinsurance + Profit

Typical concerns in reviewing rates:

- Net cost of reinsurance can be very high
- Not all catastrophe risk is reinsured
- Profit should include compensation for all retained risk
- Retained risk requires market equivalent compensation

Additionally, the rate approval process may become highly politicized

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TYPICAL UNDERWRITING PROFIT MODEL

UW Profit = $[(ROE - IY_s)/(P/S) - IY_{op}]/(1 - t)$

Where:

ROE	=	Target Return on Equity (Surplus)
IY_s	=	Investment Income on Surplus
P/S	=	Premium to Surplus (Leverage) Ratio
IY_{op}	=	Investment Income on Operations
t	=	Tax Rate

Catastrophe risk can be addressed by selecting:

- ✓ Risk-Adjusted Target ROE
- ✓ Risk-Adjusted Leverage (P/S) Ratio

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ALTERNATIVE TO RISK-ADJUSTED ROE/LEVERAGE

- Develop reasonable compensation for risk using Catastrophe Bond data
  - ✓ Independent of target ROE and leverage ratios
  - ✓ Based on return demanded by investors in capital market
  - ✓ Provides unbiased estimate of risk premium for catastrophe exposure
- Catastrophe Bonds
  - ✓ Type of Insurance-Linked Security (ILS)
  - ✓ Payoff conditional on future contingent event (like reinsurance)

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HOW DO CAT BONDS WORK?

1. Sponsor (insurer) establishes SPV to issue bonds and sell reinsurance
2. SPV sells bonds to investors: proceeds deposited in collateral account earning LIBOR
3. Sponsor pays premium to issuer, enabling issuer to pay interest in excess of LIBOR on bonds
4. If specified event occurs, SPV pays sponsor funds withdrawn from collateral account
5. At maturity, any remaining funds from collateral account repaid to investors

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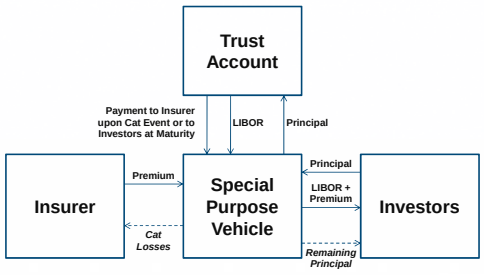
HOW DO CAT BONDS WORK?



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IMPORTANT CONCEPTS

- **Yield Spread** (Risk Premium) = Bond Yield – LIBOR
- **Probability of First Loss** (PFL)
- **Expected Value of Loss** (EL)
- **Expected Excess Return** (EER) = Yield Spread – EL
- **Relative Yield Spread** (RYS) = Yield Spread / EL
- **Profit Multiple** = EER / EL

Profit Multiple is the compensation an investor receives (net of the expected loss on bond) per dollar of expected loss

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TYPICAL CAT BOND DATA

Month	Year	Yield Spread	Long Term Probability			EER	Rel. Risk Premium	Profit Multiple	Amount (in Mill)
			PFL	CEL	EL				
4	2007	3.19%	0.77%	70.00%	0.54%	2.65%	5.9	4.9	150
4	2007	6.34%	2.20%	88.00%	1.94%	4.40%	3.3	2.3	100
5	2007	6.08%	0.59%	71.00%	0.42%	5.66%	14.5	13.5	155
5	2007	7.86%	1.02%	75.00%	0.77%	7.09%	10.3	9.3	100
5	2007	5.32%	0.98%	85.00%	0.83%	4.49%	6.4	5.4	500
6	2007	2.03%	0.09%	59.00%	0.06%	1.97%	33.8	32.8	60
6	2007	3.04%	0.16%	38.00%	0.06%	2.98%	50.0	49.0	140
5	2007	14.19%	5.73%	81.00%	4.62%	9.57%	3.1	2.1	100

Source: Lane Financial LLC, Annual Securitization Reviews

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CAT BOND PROFIT MULTIPLES

All U.S. Cat Bonds Issued 2006 - 2009

Probability of Loss	2006	2007	2008-09
Less than 0.4%	11.79	38.48	N/A
0.4% to 1%	9.31	7.86	6.68
1% to 2%	5.56	5.51	5.97
2% to 5%	5.22	3.04	5.20
5% to 10%	2.76	1.46	2.05
10% to 20%	2.48	0.98	N/A
Total	5.65	6.78	4.97

Source: Lane Financial LLC, Annual Securitization Reviews

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CAT BOND PROFIT MULTIPLES

All U.S. Cat Bonds Issued 2006 - 2009

Probability of Loss	All Years
Less than 0.4%	31.81
0.4% to 1%	8.08
1% to 2%	5.69
2% to 5%	4.38
5% to 10%	2.08
10% to 20%	2.05
Total	5.83

Source: Lane Financial LLC, Annual Securitization Reviews

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USING CAT BOND DATA TO DETERMINE PROFIT LOADS

Data Requirements:

- Aggregate loss distribution by layer
  - ✓ Using modeled catastrophe losses
  - ✓ Ceded and retained losses by layer
- Retained losses by layer as % of premium
- Profit multiples by layer

Calculate investor required Profit by layer as …

Retained Losses by Layer x Profit Multiple

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STYLIZED LOSS DISTRIBUTION DATA

Layer	Probability of Attachment	Probability of Exhaustion	Expected Loss	Percentage of Expected Loss in Layer
Above 250-yr	0.4%	0.0%	$1,467,101	7.3%
100-yr to 250-yr	1.0%	0.4%	1,833,907	9.2%
50-yr to 100-yr	2.0%	1.0%	2,214,237	11.1%
20-yr to 50-yr	5.0%	2.0%	4,346,094	21.7%
10-yr to 20-yr	10.0%	5.0%	4,081,090	20.4%
5-yr to 10-yr	20.0%	10.0%	3,788,181	18.9%
Below 5-yr	100.0%	20.0%	2,269,390	11.3%
Total			$20,000,000	100.0%

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TYPICAL COMPANY LOSS DATA

Layer ($ Millions)	Probability of Attachment (Years)	Probability of Attachment (Percent)	Probability of Exhaustion (Percent)	Expected Loss	Percentage of Expected Loss in Layer
Above 2,000	125.0	0.8%	0.0%	$1,981,064	9.6%
1,600-2,000	94.0	1.1%	0.8%	577,035	2.8%
1,350-1,600	74.3	1.3%	1.1%	968,759	4.7%
1,200-1,350	67.2	1.5%	1.3%	292,690	1.4%
800-1,200	30.0	3.3%	1.5%	3,013,864	14.5%
350-800	12.2	8.2%	3.3%	4,278,139	20.6%
0-350	1.0	100.0%	8.2%	9,616,270	46.4%
Total				$20,727,821	100.0%

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CALCULATING THE REQUIRED PROFIT

Layer ($ Millions)	Probability of Attachment (Percent)	Expected Gross Loss (% of Prem)	Percent Ceded	Expected Retained Loss (% of Prem)	Selected Profit Multiple	Additional Needed Profit
Above 2,000	0.8%	2.82%	0.0%	2.82%	10.0	28.2%
1,600-2,000	1.1%	0.82%	0.0%	0.82%	7.0	5.7%
1,350-1,600	1.3%	1.38%	90.0%	0.14%	6.0	0.8%
1,200-1,350	1.5%	0.42%	70.0%	0.13%	5.0	0.6%
800-1,200	3.3%	4.29%	88.6%	0.49%	3.0	1.5%
350-800	8.2%	6.08%	87.6%	0.75%	2.0	1.5%
0-350	100.0%	13.67%	0.0%	13.67%	0.0	0.0%
Total						**38.4%**

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EVALUATING REINSURANCE COSTS

- High cost of reinsurance can be considerable issue
- Reinsurers charge significant margins to absorb risk of catastrophe losses
- This implies profit component of reinsurance rate can be sizable portion of total reinsurance premium
- Net cost of reinsurance can be contentious issue in rate approval process

Common concern is level of “Reinsurance Recovery Ratio”

= % of reinsurance premium attributable to expected loss recovery

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USING CAT BOND DATA TO ASSESS REINSURANCE COSTS

All U.S. Cat Bonds Issued 2006 - 2009

Probability of Loss	Average Profit Multiple	Relative Yield Spread	Average Recovery Ratio
Less than 0.4%	31.81	32.81	3.0%
0.4% to 1%	8.08	9.08	11.0%
1% to 2%	5.69	6.69	15.0%
2% to 5%	4.38	5.38	18.6%
5% to 10%	2.08	3.08	32.4%
10% to 20%	2.05	3.05	32.7%
Total	5.83	6.83	14.6%

Source: Lane Financial LLC, Annual Securitization Reviews

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SUMMARY

Evidence from market is:

COST OF CATASTROPHE RISK IS HIGH

- Use of capital market data is independent of target ROE, leverage ratios, investment income, etc.
- Market for Catastrophe Bonds is becoming more efficient
  - ✓ More insurers, more transactions and larger volume
- Capital market data can provide useful information on the cost of transferring catastrophe risk

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QUANTIFYING RISK LOAD FOR PROPERTY CATASTROPHE EXPOSURE:

PRACTICAL CONSIDERATIONS

Discussion Topics

- A New Methodology
- Calculation and Implementation
- Interaction with Other Ratemaking Concepts

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A NEW METHODOLOGY

- New methodologies are often met with a certain amount of skepticism, regardless of their theoretical strengths
- Regulators may be unfamiliar with the methodology and may need additional explanation and information
  - The cat bond market is an integral aspect of the methodology, but it is still relatively new
- This methodology can result in large increases in catastrophe prone areas, which may prevent regulators in those areas from fully approving or accepting the methodology

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CALCULATION AND IMPLEMENTATION

- Data Considerations for Insurer
  - Must be able to assess its retained catastrophe risk
    - Catastrophe Loss Modeling
    - Expected Loss Distributions
  - Must account for the interaction between expected losses and reinsurance
    - Insurer and reinsurer may have different loss adjustment expense (LAE) assumptions
    - Multiple reinsurance contracts can add several complications

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CALCULATION AND IMPLEMENTATION

- Interaction with Reinsurance – Different LAE Assumptions
  - Scenario for Company A
    - LAE represents 17% of catastrophe losses
    - However, their reinsurance contract with Reinsurer B for 95% of the layer from $100 to $1,000 assumes LAE to be 15%
  - In this scenario, adjustments need to be made, as a $100 loss from Company A's perspective would only be a $98.29 loss from Reinsurer B's perspective (= $100 * (1.15/1.17))
  - In order to pierce the $100 contract threshold, Company A would need to incur a loss of $101.74

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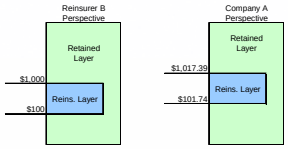
CALCULATION AND IMPLEMENTATION

- Interaction with Reinsurance – Different LAE Assumptions
  - Example continued:



  - An adjustment must be done to ensure that the calculated amount of the retained loss is correct

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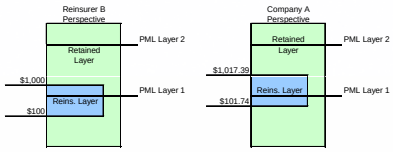
CALCULATION AND IMPLEMENTATION

- Interaction with Reinsurance – Different LAE Assumptions
  - Example continued:



  - In addition, the LAE adjustment is necessary in order to properly determine in which probable maximum loss (PML) layers retained losses fall

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CALCULATION AND IMPLEMENTATION

- Interaction with Reinsurance – Multiple Reinsurance Contracts
  - Different contracts may have different LAE assumptions, all of which may vary from the primary insurer
  - Appropriate application of inuring rules
  - Some contracts may be annual aggregate, while others are per occurrence
  - Some contracts may cover the entire country, while others are regional or state-specific
  - Issued catastrophe bonds should be considered

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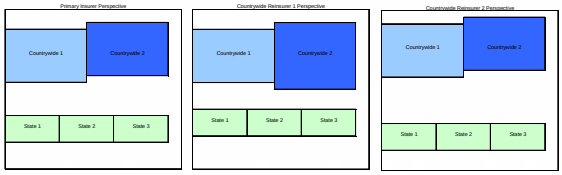
CALCULATION AND IMPLEMENTATION

- Interaction with Reinsurance – Multiple Reinsurance Contracts
  - Real World Example:



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CALCULATION AND IMPLEMENTATION

- Diversification should be considered
  - Calculation of PML layers on an individual state basis assumes the perspective of a stand-alone insurer in that state
  - Calculation of PML layers on a countrywide basis can result in much of the risk load being concentrated with the company's largest PML risks
  - Blended options are available and are reasonable

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CALCULATION AND IMPLEMENTATION

- Diversification Example:

State	1-in-100 Year Event	1-in-250 Year Event	Risk Load Using By-State Layers	Risk Load Using Countrywide Layers	By-State Distribution	Countrywide Distribution	Blended Option	Blended Distribution
A	100,000	500,000	150,000	5,000	0.0%	0.0%	78,428	0.0%
B	600,000,000	1,000,000,000	100,000,000	20,000,000	30.8%	11.8%	52,285,099	30.8%
C	1,200,000,000	2,300,000,000	225,000,000	150,000,000	69.2%	88.2%	117,641,473	69.2%
		Total:	325,150,000	170,005,000	100.0%	100.0%	170,005,000	100.0%

  - A blended option can be calculated by applying the By-State distribution to the total risk load using countrywide layers

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INTERACTION WITH OTHER RATEMAKING CONCEPTS

- Insurers should consider the interaction between a risk load and their profit provision
  - Profit provisions and risk loads are both used to cover the cost of capital (or a portion of it)
  - Depending on how the profit provision was determined, an adjustment may be needed to account for the income earned through a risk load
- Risk loads and contingency provisions serve different purposes and do not overlap

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INTERACTION WITH OTHER RATEMAKING CONCEPTS

- Multiple approaches to implement the risk load in the rates:
  - Vary by amount of insurance
  - Vary by premium
  - Flat rate by state
  - Vary by geographical area

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QUESTIONS?

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