CAS Ratemaking & Product Mgmt Seminar

Severe Weather Workshop:

Using Cat Bonds to Develop Risk Loads

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Using Cat Bonds to Develop Risk Loads

Discussion Topics:

- History of Homeowners Ratemaking
- Introduction of the Profit Multiple
- Background of New Risk Load Methodology
- Overview of Catastrophe Bonds
- Catastrophe Bond Data – The Profit Multiple
- Application of the Profit Multiple

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History of Homeowners Ratemaking

- Hurricane Andrew made landfall in South Florida on August 24, 1992
- The amount of devastation & insured loss was a dramatic wake-up call for property insurers and actuaries

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Audience Participation – Question 1

In comparing Homeowners and Auto insurance, which of the following statements do you agree with most?

A. The amount of Profit / Risk Load should be similar
B. The amount of Profit / Risk Load for Auto should be more than Homeowners
C. The amount of Profit / Risk Load for Auto should be significantly more than Homeowners
D. The amount of Profit / Risk Load for Homeowners should be more than Auto
E. The amount of Profit / Risk Load for Homeowners should be significantly more than Auto

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History of Homeowners Ratemaking

§ Homeowners Insurance has large variation in Loss Ratio from year to year
§ Existence of potential mega-catastrophes significantly increases variation
§ Potential losses in a single year are many times a single year's premium
§ Significant amounts of capital are exposed to mega-catastrophe events
§ We have developed a method for quantifying a risk load to account for the large amount of capital required to cover potential insured losses in catastrophe prone areas

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The Profit Multiple

In catastrophe bond data:

§ YS = Yield Spread = Bond Yield – LIBOR
§ EL = Expected Loss (based on catastrophe models)
§ EER = Expected Excess Return = YS – EL
§ Profit Multiple = EER/EL

In a reinsurance contract:

§ Profit Multiple = (Reinsurance Premium – EL) / EL

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Audience Participation – Question 2

§ Assume you're reviewing a reinsurance contract with a Profit Multiple of 2.0

§ What is the expected loss ratio of the reinsurer?

A. Greater than 80%
B. 60%-80%
C. 40%-60%
D. 20%-40%
E. Less than 20%

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Answer (Q2)

Expected Loss Ratio (ELR) = 1 / (PM + 1)

ELR = 1 / (2 + 1)
= 1 / 3
= 33.3%

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Audience Participation – Question 3

Given the following:

- Cat Reinsurance Cover for hurricane losses in Texas
- Reinsurance Layer is 100% of $636 Million excess of $1,600 Million
- Expected Covered Losses = $19.5 Million
- Attachment Probability = 3.5%
- Exhaustion Probability = 2.5%

What is the expected loss ratio for the reinsurers issuing this reinsurance?

A. Greater than 80%
B. 60%-80%
C. 40%-60%
D. 20%-40%
E. Less than 20%

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Audience Participation – Question 4

- Assume further that the Rate-on-Line is 17%

What is the expected loss ratio for the reinsurers issuing this reinsurance?

A. Greater than 80%
B. 60%-80%
C. 40%-60%
D. 20%-40%
E. Less than 20%

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Answer (Q4)

Reinsurance Premium = Reinsured Layer x ROL
= $636 M x 17% = $108.12 M

ELR = EL / Reinsurance Premium
= $19.5 M / $108.12 M = 18.0%

Ø ***Is there any reason that primary insurers should charge less than reinsurers for the risk of losing large amounts of capital to losses caused by catastrophic events?***

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Background – New Risk Load Methodology

Objective

- *To describe a new methodology for quantifying the cost of exposing capital to large catastrophic events*

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Background – Profit Provision in Ratemaking

§ Traditional Ratemaking for Property Insurance
- ü P = (L + FE) / (1 – VER – Pr)

§ Essentially the same level of profit is generated for each dollar of expected loss and expense

§ Alternative Methodology
- ü P = (L_{nc} + FE) / (1 – VER – Pr) + L_c / (1 – VER) + Risk Load

Note: L_{nc} = Non-cat & non-modeled cat losses
L_c = Modeled cat losses above 1-in-5 year event

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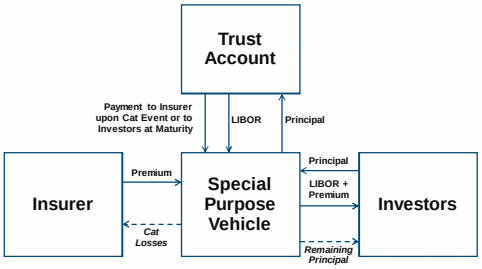
Overview of Cat Bonds – How They Work



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Overview of Cat Bonds – Important Concepts

Included in Cat Bond data:

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

Calculated by Milliman:

- **Profit Multiple** = EER / EL

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Overview of Cat Bonds – Sample Data

Year	Month	Amount (in $ Mil)	Probability of First Loss	Yield Spread	Expected Loss	Expected Excess Return	Profit Multiple
2010	Dec	80	8.74%	16.63%	6.24%	10.39%	1.67
2010	May	90	7.35%	14.19%	4.97%	9.22%	1.86
2010	Dec	65	5.84%	12.93%	4.77%	8.16%	1.71
2010	Nov	100	2.56%	6.34%	1.67%	4.67%	2.80
2010	Dec	50	2.12%	7.35%	1.48%	5.87%	3.97
2010	May	250	1.99%	8.36%	1.66%	6.70%	4.04
2010	Jul	96	1.76%	7.10%	1.47%	5.63%	3.83
2010	May	185	1.07%	6.59%	0.97%	5.62%	5.79
2010	Dec	100	0.88%	5.07%	0.55%	4.52%	8.22
2010	Oct	100	0.69%	3.80%	0.52%	3.28%	6.31

Source: Lane Financial LLC, Annual Securitization Reviews

16

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The Profit Multiple – What is it?

Profit Multiple = Expected XS Return / Expected Loss

- The compensation the investor requires to expose their capital to catastrophe losses
  - ü *This is exactly the same risk faced by direct writers for the retained portion of catastrophe risk*
- Instead of relating reinsurance costs to the layer of coverage (ROL), the Profit Multiple uses a risk-related value in the denominator (expected losses in the layer)
- Increases as the layer of catastrophe cover increases (i.e. probability of loss decreases)

17

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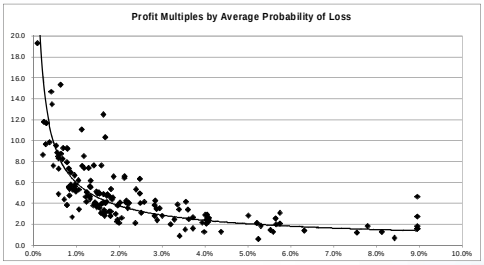
Profit Multiple – Relation to Loss Probability

All Cat Bonds Issued on U.S. Exposures: 2006 - 2012



Source: Lane Financial LLC, Annual Securitization Reviews

18

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Profit Multiple – Application #1

1. **Develop Risk Load for Catastrophe Exposure**
   - ü Define the layers (Reinsurance Layers, PMLs, etc.)
   - ü Allocate the gross losses from each event into the layers
   - ü Gross Risk Load = Expected Loss in Layer x Profit Multiple
   - ü Risk Load on Retained Losses:
     - Split the gross losses into ceded and retained by applying reinsurance contracts to each event
     - Risk Load for Retained Catastrophe Exposure = Net Loss in Layer x Profit Multiple

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Profit Multiple – Application #2

2. **Estimate Reinsurance Premiums**
   - ü Can quickly calculate estimated reinsurance premiums for any potential reinsurance contract
   - ü Indicated Rate-on-Line =
     (Indicated Risk Load + Expected Loss) / Size of Layer
   - ü Can be easily compared to actual Rate-on-Line in quoted or purchased reinsurance contracts

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Spreadsheet Demonstration

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Audience Participation – Question 5

Going back to Question 3, given the following:

- Reinsurance Layer is 100% of $636 Million excess of $1,600 Million
- Expected Covered Losses = $19.5 Million
- Attachment Probability = 3.5%
- Exhaustion Probability = 2.5%

If a primary insurer elected to retain the exposure described above, what would be the indicated Risk Load required by that company based on the Cat Bond methodology?

A. Greater than $60 million
B. $40-60 million
C. $30-40 million
D. $20-30 million
E. Less than $20 million

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Answer (Q5)

Risk Load = Expected Loss in Layer x Profit Multiple

= $19.5 M x $\int_a^b 0.45364\ y^{-0.52591} dy$ / (b-a)

(where a = 3.5% and b = 2.5%)

= $19.5 M x 2.88

= $56.14 M

(compared to traditional profit provisions of 5-10%, which result in only $1-2 M of profit)

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Audience Participation – Question 6

Using the same information…

- Reinsurance Layer is 100% of $636 Million excess of $1,600 Million
- Expected Covered Losses = $19.5 Million
- Attachment Probability = 3.5%
- Exhaustion Probability = 2.5%

What is the indicated Rate-on-Line for the reinsurance layer described above?

A. Greater than 20%
B. 16-20%
C. 13-16%
D. 10-13%
E. Less than 10%

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Answer (Q6)

Indicated Rate-on-Line =

(Indicated Risk Load + Expected Loss) / Size of Layer

= ($56.14 M + $19.5 M) / $636 M

= $75.64 M / $636 M

= 11.9%

(compared to the quoted Rate-on-Line of 17.0%)

25

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Audience Participation – Bonus Question

Using similar information …

- Reinsurance Layer is ***80%*** of $636 Million excess of $1,600 Million
- Expected Covered Losses = $19.5 Million
- Attachment Probability = 3.5%
- Exhaustion Probability = 2.5%

What is the indicated Risk Load on the primary insurer's *retained* exposure based on the Cat Bond methodology?

A. Greater than $15 million
B. $12-15 million
C. $10-12 million
D. $8-10 million
E. Less than $8 million

26

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Answer (Bonus)

Retained Risk Load =

Net Loss in Layer x Profit Multiple

= ($19.5 M x 20%) x 2.88

= $11.23 M

27

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Questions?

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28

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