

CAS Ratemaking and Product Management (RPM) Seminar

RR-3: Quantifying Risk Load for Property Catastrophe Exposure

USING CATASTROPHE BONDS TO INFER
RISK PREMIUMS/PROFIT LOADS/REINSURANCE COSTS

David Appel, Ph. D.
Milliman, Inc.
March 16, 2010
Chicago, Illinois


J:\Dere Cherrion\CAS Ratemaking Seminar 2010-Appel.pptx



OBJECTIVE: DESCRIBE AN APPROACH TO DEVELOP PROFIT LOADS OR EVALUATE REINSURANCE COSTS IN RATE FILINGS FOR LINES WITH CATASTROPHE EXPOSURE

- Why??
 - Costs of bearing cat risk are very high
 - In some lines/states comprise majority of premium
 - Justifying rate level to cover costs can be issue in regulation
 - Understanding risk financing options is important for insurers

1



STANDARD RATEMAKING PROCEDURE


Premium = E[Loss] + Exp + Net Cost of Reinsurance + Profit

Typical concerns in reviewing rates:

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

Rate approval process may become highly politicized

2



TYPICAL UNDERWRITING PROFIT MODEL

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

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

Normally, risk is addressed by selecting risk adjusted target ROE or leverage (P/S) ratio

3



ALTERNATIVE TO RISK ADJUSTED ROE/LEVERAGE

- Purpose of this presentation is to develop alternative method of estimating proper compensation for risk
- Vehicle is returns demanded by investors in capital markets; provides unbiased estimator of risk premium for catastrophe exposure
- Market is market for Insurance Linked Securities (i.e., catastrophe bonds)

4



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 If specified event occurs, SPV pays sponsor funds withdrawn from collateral account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

5



IMPORTANT CONCEPTS

- Absolute Yield Spread (Risk Premium) – Difference Between Yield on Bond and LIBOR
- PFL – Probability of First Loss
- CEL – Conditional Expected Loss – E[Loss|Event]
- EL – Expected Value of Loss = PFL * CEL
- EER – Expected Excess Return – (Yield Spread – EL)
- Relative Yield Spread – (Yield Spread/EL)
- Profit Multiple – (Yield Spread – EL)/EL

6



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

7



CATASTROPHE BOND PROFIT MULTIPLES ALL CAT BONDS ISSUED 2006 - 2009

Probability	2006	2007	2008-09
Less than 0.4%	11.79	38.48	35.16
1% to 0.4%	8.35	6.90	7.90
2% to 1%	4.43	4.07	4.69
5% to 2%	4.25	2.66	4.68
10% to 5%	2.23	1.47	2.14
20% to 10%	2.25	0.96	N/A
All Bonds	4.51	5.45	6.53

Source: Lane Financial LLC, Annual Securitization Reviews

8



CATASTROPHE BOND PROFIT MULTIPLES ALL CAT BONDS ISSUED 2006 - 2009

<u>Probability</u>	<u>All Years</u>
Less than 0.4%	15.70
1% to 0.4%	8.08
2% to 1%	5.53
5% to 2%	4.28
10% to 5%	2.15
20% to 10%	2.05
All Bonds	6.27

Source: Lane Financial LLC, Annual Securitization Reviews

9



USING THE DATA – PROFIT LOADS

Data Requirements

- Aggregate loss distribution (modeled losses) split between retained/ceded by layer
- Retained loss by layer as % of premium
- Profit multiples by layer

Estimate investor required profit by layer as product of retained loss by layer*profit multiple

10



STYLIZED LOSS DISTRIBUTION DATA

Layer	Expected Loss	Probability of Attachment	Probability of Exhaustion	Percentage of Expected Loss in Layer
Above 250 yr	\$1,467,101	0.40%	0	7.3%
100-yr to 250-yr	\$1,833,907	1.00%	0.40%	9.2%
50-yr to 100-yr	\$2,214,237	2.00%	1.00%	11.1%
20-yr to 50-yr	\$4,346,094	5.00%	2.00%	21.7%
10-yr to 20-yr	\$4,081,090	10.00%	5.00%	20.4%
5-yr to 10-yr	\$3,788,181	20.00%	10.00%	18.9%
Below 5-yr	\$2,269,390	100.00%	20.00%	11.3%
Total	\$20,000,000			100.0%

11



MORE TYPICAL COMPANY LOSS DATA

Layer (\$ Million)	Expected Loss	Percentage Expected loss in layer	Probability of Attachment (years)	Probability of Attachment (percent)	Probability of Exhaustion (percent)
2,000 & Up	1,981,064	9.6%	125.0	0.8%	0.0%
1,600-2,000	577,035	2.8%	94.0	1.1%	0.8%
1350-1,600	968,759	4.7%	74.3	1.3%	1.1%
1200-1350	292,690	1.4%	67.2	1.5%	1.3%
800-1200	3,013,864	14.5%	30.0	3.3%	1.5%
350-800	4,278,139	20.6%	12.2	8.2%	3.3%
0-350	9,616,270	46.4%	1.0	100.0%	8.2%
Total	20,727,820	100.0%			

12



CALCULATING THE REQUIRED PROFIT

Layer	Probability of Attachment (percent)	Provision for Gross Loss: % Proposed Prem.	Ceded % age	Provision for Retained Loss: % Proposed Prem.	Profit Multiple for Layer	Additional needed profit
2,000 & Up	0.80%	2.82%	0.00%	2.82%	10.0	28.20%
1,600-2,000	1.10%	0.82%	0.00%	0.82%	7.0	5.74%
1350-1,600	1.30%	1.38%	90.00%	0.14%	6.0	0.84%
1200-1350	1.50%	0.42%	70.00%	0.12%	5.0	0.60%
800-1200	3.30%	4.29%	88.60%	0.49%	3.0	1.47%
350-800	8.20%	6.08%	87.60%	0.76%	2.0	1.52%
0-350	100.00%	13.67%	0.00%	13.67%	0.0	0.00%
Total						38.37%

13



SUPPORTING REINSURANCE COSTS

- Main issue is high cost of reinsurance
- 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 is often contentious issue in rate approval process

Common concern is level of "reinsurance recovery ratio" – the % of reinsurance premium attributable to expected loss recovery

14



USING CAT BOND DATA TO ASSESS REINSURANCE COSTS

Catastrophe Bond Profit Multiples All Catastrophe Bonds Issued 2006 - 2009

Probability	Average Profit Multiple	Relative Yield Spread	Average Recovery Ratio
Less than 0.4%	15.70	16.70	6.0%
1% to 0.4%	8.08	9.08	11.0%
2% to 1%	5.53	6.53	15.3%
5% to 2%	4.28	5.28	18.9%
10% to 5%	2.15	3.15	31.7%
20% to 10%	2.05	3.05	32.8%
All Bonds	6.27	7.27	13.8%

Source: Lane Financial LLC, Annual Securitization Reviews

15



SUMMARY

- Capital market data can provide useful information on the cost of catastrophe risk transfer
- Cost in capital markets is pure cost of risk
- Use of capital market data avoids questions of target ROE, leverage, investment income, etc.
- Markets for cat bonds are becoming more efficient: more insurers, more transactions and larger volume

Evidence from market is:

COST OF CATASTROPHE RISK IS HIGH

16