CAS SEMINAR ON RATEMAKING

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

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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

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

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

Purpose of this presentation is to develop alternative method of estimating proper compensation for risk

Vehicle is returns in capital markets – unbiased estimator of risk premium demanded by investors

WHAT ARE CAT BONDS?

- ILS - Insurance Linked Securities: Any security with a payoff that is conditional on a future contingent event

- Cat Bond – Specific ILS with feature that issuer may default on principal and/or interest if specified catastrophic event occurs

- ILW – Industry Loss Warranties: Cat bonds traded by and between insurers; specific features give rise to favorable tax treatment

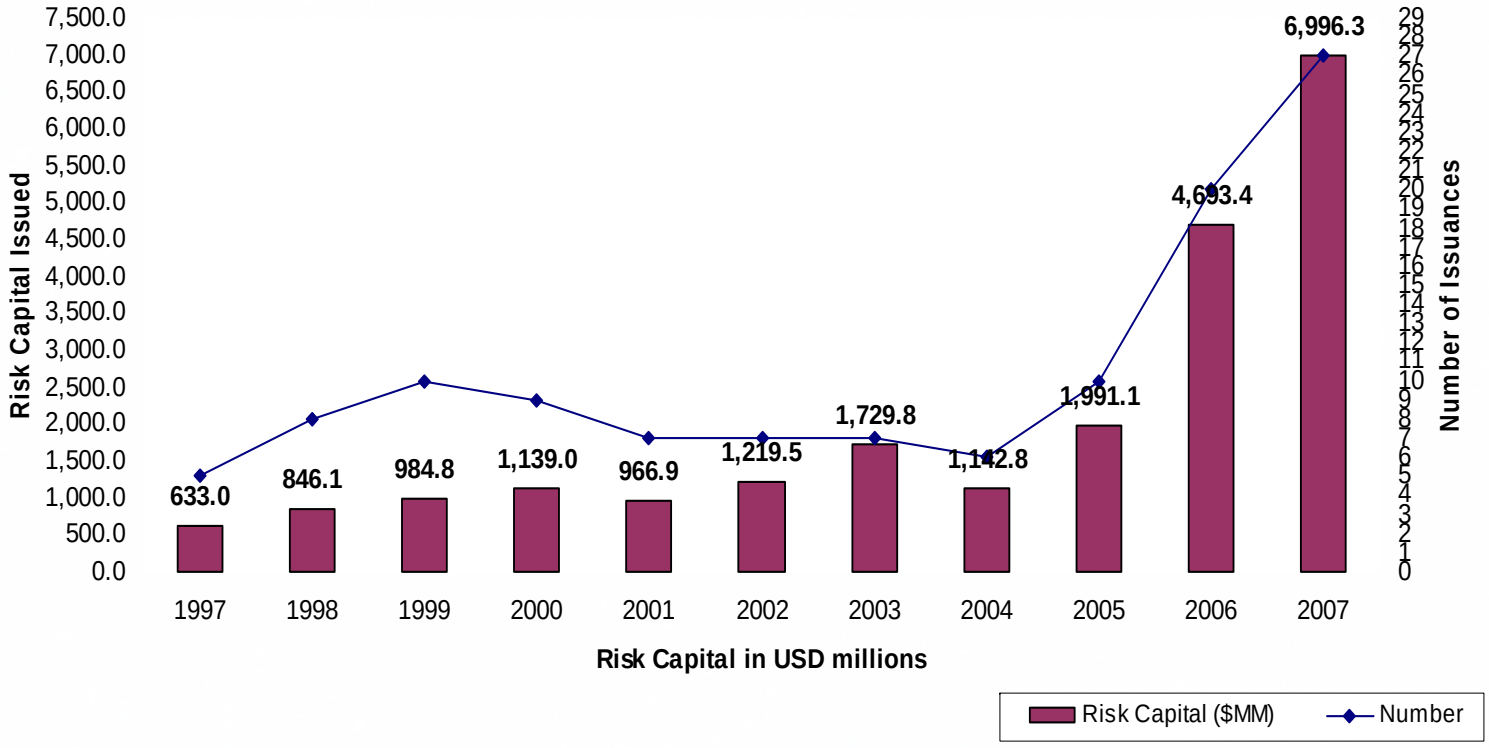
HOW DO CAT BONDS WORK?

1. Sponsor (insurer) establishes SPV to issue bonds and sell reinsurance
2. Issuer 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 If specified event occurs, SPV pays sponsor funds withdrawn from collateral account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

CAT BOND TRIGGERS

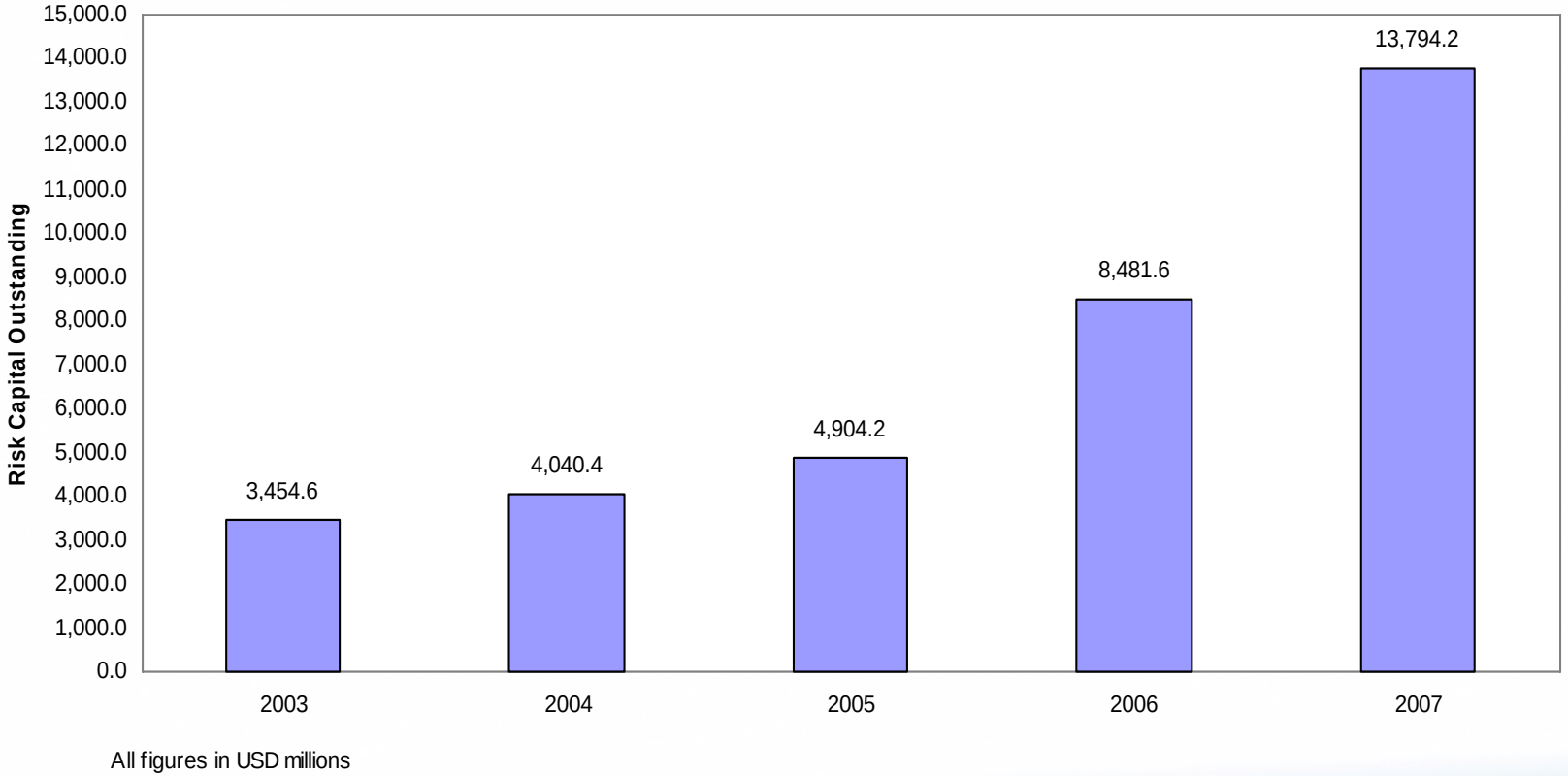
- Indemnity – Sponsor specific loss – Potential Problem:
  Informational Asymmetries
- Index - Industry loss index – Potential Problem:
  Basis Risk
- Parametric – Model parameter – Potential Problem:
  Basis Risk and Model Risk

CATASTROPHE BONDS - ANNUAL RISK CAPITAL ISSUANCE AND NUMBER OF TRANSACTIONS



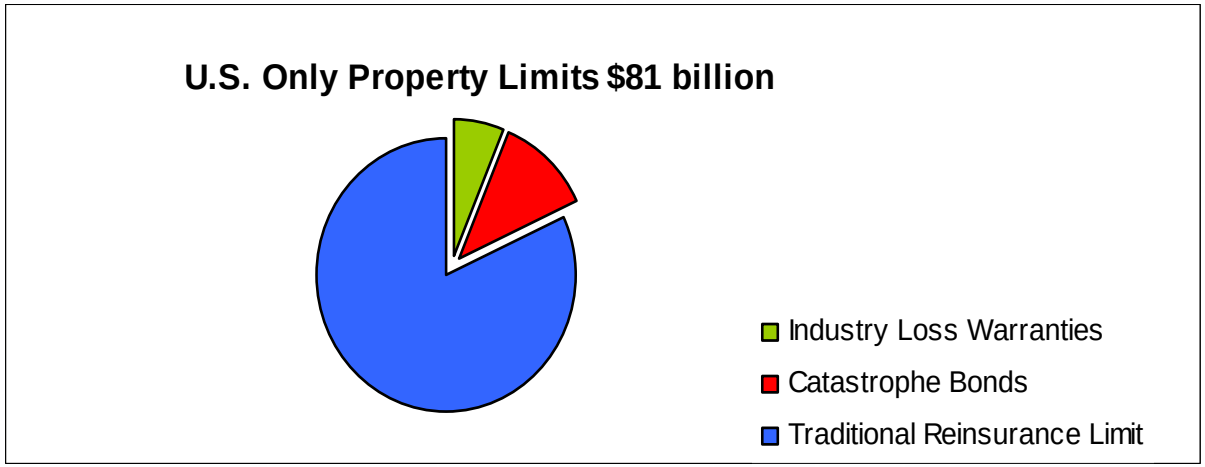
Source: GC Securities

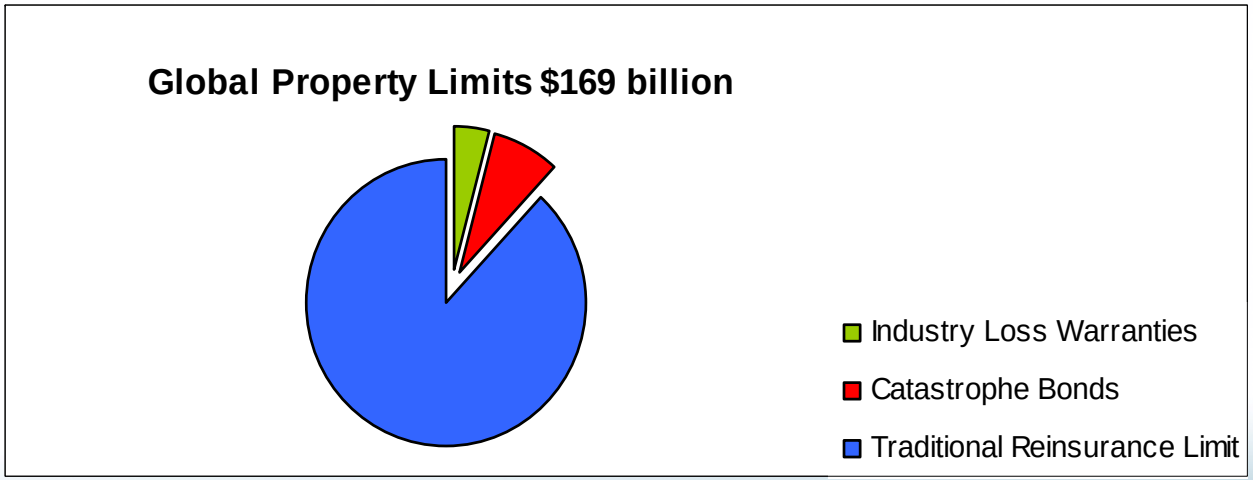
YEAR-END RISK CAPITAL OUTSTANDING



Source: GC Securities

CAT BONDS AS A PROPORTION OF LIMITS OUTSTANDING FOR WORLD AND U.S. ONLY





Source: GC Securities

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

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

CAT BOND PROFIT MULTIPLES

	2005	2006	2007
All issues adjusted[1]	7.59	6.22	6.97
Probability			
0.4% or Less	27.43	18.52	16.81
1.0% to 0.4%	7.18	7.04	7.81
2.0% to 1.0%	3.81	4.94	5.67
5.0% to 2.0%	2.83	4.56	2.62
10.0% to 5.0%	1.91	2.95	1.33
20.0% to 10.0%	NA	2.01	1.28
100.0% to 20.0%	NA	NA	NA
1.0% and lower	13.87	10.23	8.23

PROFIT MULTIPLES

ALL CATASTROPHE BONDS 2005-2007

All 2005-07 issues adjusted	6.67
Probability	**Average Profit Multiple**
0.4% or Less	19.25
1.0% to 0.4%	7.27
2.0% to 1.0%	5.13
5.0% to 2.0%	3.53
10.0% to 5.0%	2.58
20.0% to 10.0%	1.83
100.0% to 20.0%	NA
1.0% and lower	9.91

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

STYLIZED LOSS DISTRIBUTION DATA

Layer	Expected Loss	Probability of Attachment	Probability of Exhaustion	Percentage of Expected Loss in layer
Above 500 yr	$23,872,802	0.20%	0	2.4%
250-yr to 500-yr	$29,680,857	0.40%	0.20%	3.0%
100-yr to 250-yr	$60,020,996	1.00%	0.40%	6.0%
50-yr to 100-yr	$81,992,654	2.00%	1.00%	8.2%
10-yr to 50-yr	$360,319,672	10.00%	2.00%	36.0%
5-yr to 10-yr	$197,726,423	20.00%	10.00%	19.8%
Below 5-yr	$246,386,595	100.00%	20.00%	24.6%
Total	$1,000,000,000			100.0%

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%			

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	0.8%	2.82%	0.0%	2.82%	7	19.72%
1,600-2,000	1.1%	0.82%	0.0%	0.82%	6	4.92%
1350-1,600	1.3%	1.38%	90.0%	0.14%	5	0.69%
1200-1350	1.5%	0.42%	70.0%	0.12%	4	0.50%
800-1200	3.3%	4.29%	88.6%	0.49%	3	1.46%
350-800	8.2%	6.08%	87.6%	0.76%	2	1.51%
0-350	100.0%	13.67%	0.0%	13.67%	0	0.00%
Total						**28.80%**

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

USING CAT BOND DATA TO ASSESS REINSURANCE COSTS

CATASTROPHE BONDS ISSUED 2005-2007

Probability	Average Profit Multiple	Relative Yield Spread	Average Recovery Ratio
All 2005-07 issues adjusted	6.67	7.67	13.0%
0.4% or Less	19.25	20.25	4.9%
1.0% to 0.4%	7.27	8.27	12.1%
2.0% to 1.0%	5.13	6.13	16.3%
5.0% to 2.0%	3.53	4.53	22.1%
10.0% to 5.0%	2.58	3.58	27.9%
20.0% to 10.0%	1.83	2.83	35.3%
100.0% to 20.0%	NA		
1.0% and lower	9.91	10.91	9.2%

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