

# NATURAL CATASTROPHE PRICING

April 2019

# What is a Natural Catastrophe?

*“a sudden and terrible event in nature that usually result in serious damage and many deaths” – Merriam Webster*

# What is the Risk For Insurance Industry?

“Risk is the consequence of a Natural Catastrophe, only if the society and / or economic values are affected by that disaster”

# Contributors of Cat Price

## Natural Catastrophes are:

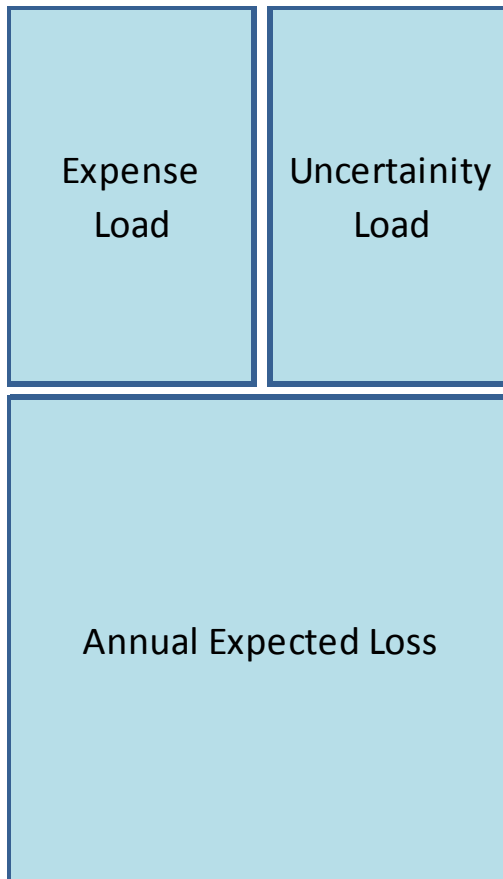
- Less frequent &
- Mostly severe incidents

## Cat Risk prices are dependent on:

- Perils
- Potential loss
- Risk profile
- Market Cycle

# Components of the Catastrophe Risk Premium

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- AEL: is a function of expected loss severity and frequency
- Expense Load: Combination of Non-Loss related costs
- Uncertainty Load: Additional buffer for unforeseen volatilities & profit margin

# Components of the Catastrophe Risk Premium

## AEL

Annual expected loss is also known as pure premium; is the average annual loss over a long horizon of time.

AEL depends on the frequency and the severity distributions considered and determined by historical data and scenarios embedded in models.

# Components of the Catastrophe Risk Premium Expense Load

Expense load is a combination of all non-loss related costs:

- Underwriting Expenses
- Claims Adjustment Costs
- Includes start up costs or development cost of a new line of business over certain period of time
- Retrocession Expenses

# Components of the Catastrophe Risk Premium

## Uncertainty Load

Uncertainty load is the amount charged for the lack of information, poor quality data, unmodelled perils etc.

Loading related with basically anything unforeseen



# CAT PML Estimation Approaches

## Evaluation Methods

- Statistical Approach
- In-house Models
- Vendor Models
- Standard Formula (Solvency II)

# Modelling Outputs

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## Cedant's Cat Portfolio Model Outputs

	OEP Results as at 3Q 2017	OEP Results as at 3Q 2018	Euro Δ
Mean	6,719,010	6,083,949	-9%
Standard Deviation	22,717,957	20,055,549	-12%
Coefficient of Variation	3.38	3.30	
2	899,550	836,146	-7%
5	5,297,476	4,962,934	-6%
10	13,262,211	12,381,521	-7%
25	35,181,555	32,008,310	-9%
50	68,655,367	61,530,209	-10%
100	121,301,549	106,731,606	-12%
200	175,566,653	151,488,011	-14%
250	189,452,927	163,853,929	-14%
500	234,753,713	203,758,862	-13%
1000	276,990,123	241,105,535	-13%

OEP stands for the Occurrence Exceedence Probability losses  
 AEP stands for the Aggregate Exceedence Probability losses

# Stochastic Modelling Outputs – Definitions

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- Layer Entry Return Period =  $1 / \text{Probability of Loss Hit to Layer}$
- Layer Mid Point Return Period =  $1 / \text{Probability of Loss Hit to Mid Point of the Layer}$
- Layer Exit Return Period =  $1 / \text{Probability of Total Loss the Layer}$
- Technical ROL =  $\text{Recoveries} / \text{Limit} / \#\text{Premiums}$  (with AP for Reinstatement)
- StDev ROL =  $\text{StDev} / \text{Limit} / \#\text{Premiums}$  (with AP for Reinstatement)



- **Market ROL = Technical ROL + (StDev ROL x Risk Factor)**

# Non Proportional Cat XL Programme Pricing

## 12 Risk Adjusted Flat Pricing



### 2018 Cat Programme Structure

1in250 OEP: 189,452,927

Euro

Layer	Coverage	Limit	Deductible	Reinstatement	Entry RP Yrs	Midpoint Yrs	Layer Mid Point Probability	Recoveries	Tech ROL	Recoveries StDev	TROL StDev	Market Risk Factor	Market ROL	Earns
1	Cat	60,000,000	10,000,000	1@100%	9.00	30.00	0.03333	2,571,307	4.11%	10,609,157	15.03%	2.60%	4.50%	2,700,000
2	Cat	120,000,000	70,000,000	1@100%	55.00	115.00	0.00870	1,119,031	0.92%	9,989,176	7.68%	9.45%	1.65%	1,980,000
		<b>180,000,000</b>			<b>255.00</b>								<b>2.60%</b>	<b>4,680,000</b>

Mean AEP = AEL = AAL

### 2019 Cat Programme Structure

1in250 OEP: 163,853,929

Reduction in modelled 1in250 loss: -14%

Reduction in modelled mean loss: -9%

Layer	Coverage	Limit	Deductible	Reinstatement	Entry RP Yrs	Midpoint Yrs	Layer Mid Point Probability	Recoveries	Tech ROL	Recoveries StDev	TROL StDev	Previous Year's Risk Factor	RAF ROL	Est Earns
1	Cat	60,000,000	10,000,000	1@100%	10.00	32.00	0.03125	2,250,069	3.61%	10,824,760	15.28%	2.60%	4.012%	2,407,132
2	Cat	120,000,000	70,000,000	1@100%	57.00	120.00	0.00833	915,913	0.76%	9,695,973	7.48%	9.45%	1.464%	1,756,620
		<b>180,000,000</b>			<b>272.00</b>								<b>2.31%</b>	<b>4,163,752</b>

Δ in Eur Earns - 516,248

-11%

# Non Proportional Cat XL Programme Pricing

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Soft Market



## 2018 Cat Programme Structure

1in250 OEP: 189,452,927

Euro

Layer	Coverage	Limit	Deductible	Reinstatement	Entry RP Yrs	Midpoint Yrs	Layer Mid Point Probability	Recoveries	Tech ROL	Recoveries StDev	TROL StDev	Market Risk Factor	Market ROL	Earns
1	Cat	60,000,000	10,000,000	1@100%	9.00	30.00	0.03333	2,571,307	4.11%	10,609,157	15.03%	2.60%	4.50%	2,700,000
2	Cat	120,000,000	70,000,000	1@100%	55.00	115.00	0.00870	1,119,031	0.92%	9,989,176	7.68%	9.45%	1.65%	1,980,000
		<b>180,000,000</b>			<b>255.00</b>								<b>2.60%</b>	<b>4,680,000</b>

## 2019 Cat Programme Structure

1in250 OEP: 163,853,929

Reduction in modelled 1in250 loss: -14%

Reduction in modelled mean loss: -9%

Layer	Coverage	Limit	Deductible	Reinstatement	Entry RP Yrs	Midpoint Yrs	Layer Mid Point Probability	Recoveries	Tech ROL	Recoveries StDev	TROL StDev	Soft Market Risk Factor	Market ROL	Est Earns
1	Cat	60,000,000	10,000,000	1@100%	10.00	32.00	0.03125	2,250,069	3.61%	10,824,760	15.28%	0.30%	3.660%	2,196,250
2	Cat	120,000,000	70,000,000	1@100%	57.00	120.00	0.00833	915,913	0.76%	9,695,973	7.48%	7.95%	1.352%	1,622,178
		<b>180,000,000</b>			<b>272.00</b>								<b>2.12%</b>	<b>3,818,428</b>

Δ in Eur Earns in Monetary Terms - 861,572  
-18%

% Δ from the Flat Pricing -8%

# Non Proportional Cat XL Programme Pricing

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Hard Market



## 2018 Cat Programme Structure

1in250 OEP: 189,452,927

Euro

Layer	Coverage	Limit	Deductible	Reinstatement	Entry RP Yrs	Midpoint Yrs	Layer Mid Point Probability	Recoveries	Tech ROL	Recoveries StDev	TROL StDev	Market Risk Factor	Market ROL	Earns
1	Cat	60,000,000	10,000,000	1@100%	9.00	30.00	0.03333	2,571,307	4.11%	10,609,157	15.03%	2.60%	4.50%	2,700,000
2	Cat	120,000,000	70,000,000	1@100%	55.00	115.00	0.00870	1,119,031	0.92%	9,989,176	7.68%	9.45%	1.65%	1,980,000
		<b>180,000,000</b>			<b>255.00</b>								<b>2.60%</b>	<b>4,680,000</b>

## 2019 Cat Programme Structure

1in250 OEP: 163,853,929

Reduction in modelled 1in250 loss: -14%

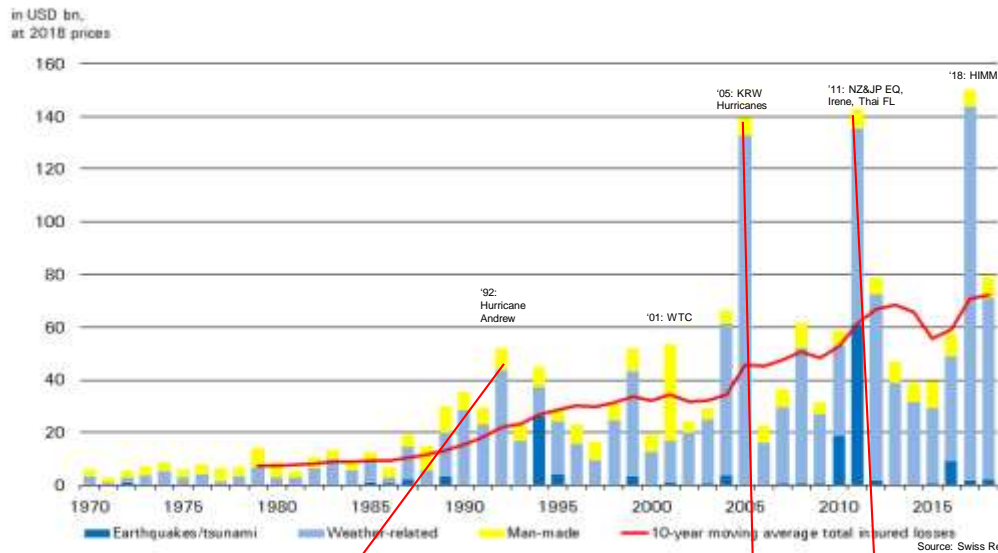
Reduction in modelled mean loss: -9%

Layer	Coverage	Limit	Deductible	Reinstatement	Entry RP Yrs	Midpoint Yrs	Layer Mid Point Probability	Recoveries	Tech ROL	Recoveries StDev	TROL StDev	Hard Market Risk Factor	Market ROL	Est Earns
1	Cat	60,000,000	10,000,000	1@100%	10.00	32.00	0.03125	2,250,069	3.61%	10,824,760	15.28%	3.40%	4.134%	2,480,530
2	Cat	120,000,000	70,000,000	1@100%	57.00	120.00	0.00833	915,913	0.76%	9,695,973	7.48%	11.96%	1.652%	1,981,919
		<b>180,000,000</b>			<b>272.00</b>								<b>2.48%</b>	<b>4,462,449</b>

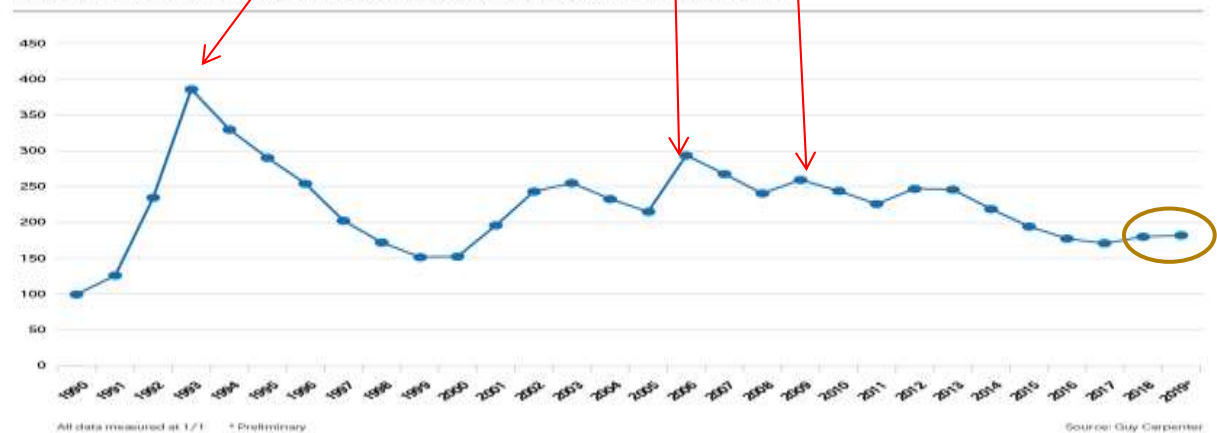
**Δ in Eur Earns in Monetary Terms - 217,551**  
-5%

**% Δ from the Flat Pricing 7%**

# Cat Related Insured Losses (1970 – 2018) & ROL Index



Guy Carpenter Global Property Catastrophe ROL Index – 1990 to 2019



# Other Factors Impacting the Cat Price

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- ❑ Model Related:
  - ❑ Presence of the Secondary / Unmodelled Perils
  - ❑ Data quality&granularity, capture date
  - ❑ Unmodelled Risks (Storm Surge, Economic Demand Surge, Fire Following EQ, Sprinkler Leakage, etc.)
- ❑ Loss Record
- ❑ Supply and demand
  - ❑ Role of alternative capital (ILS)
  - ❑ No more cycle ? Will the cycle lift off?



