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- General Prop. Pricing
 - Components
 - Other Influencing Aspects
- Unique Challenges
 - Volatility
 - Hurricane Example
 - Risk Appetite
- CAT Models
 - Purpose
 - Strengths v Limitations
- Profit Models
 - Target ROC
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 - Reinsurance
 - Multi Model Approach
 - Risk Steering
 - Risk Indifferent Pricing
- Summary

Integrated Capital / Risk Pricing Model

General Overview

- Components & Influencing Aspects

Unique Challenges

- Cat Perils are Volatile
- Understanding Risk Appetite is Important

Cat Models

- Purposes & Responsible Use

Profit Model Discussion

- Example Pricing Model

Calibration

- Reinsurance & Multi-Model Examples

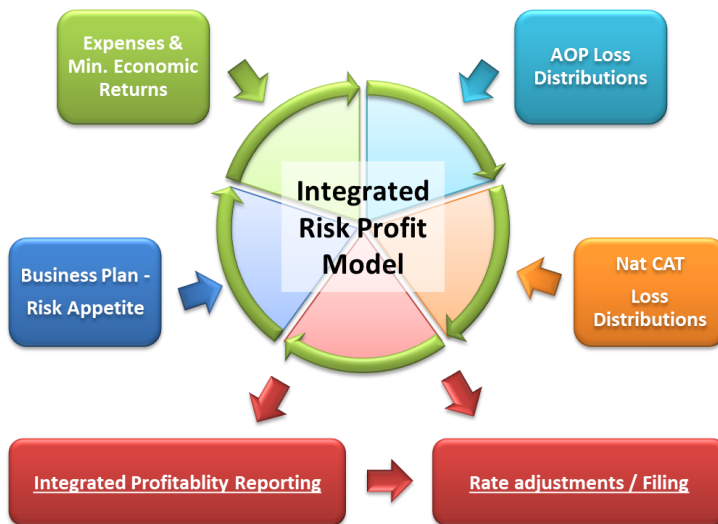
Questions

AVONDALE More than just AAL - Capacity Based Prop. Cat Pricing

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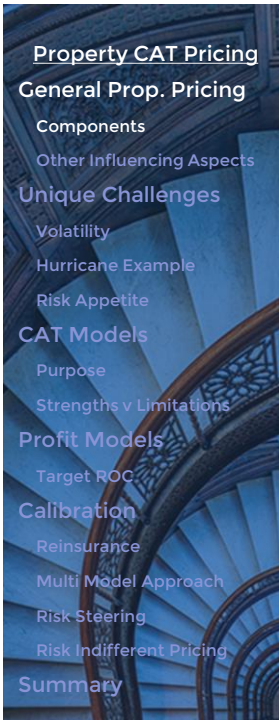
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Goal: Maximize Long Term Profit for Allocated Capital



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Premium Components

Premium = Expenses + Expected Losses + Target Profit

➤ Expenses

- External (Acquisition)
- Internal (Operational and Claims Handling)

➤ Expected Losses – E[L] (AAL)

- All perils – Fire, Flood, Water, Freeze, Wind, Earthquake, etc.
- Actual Claims vs Projected Losses
 - Historical Experience (lots of events / data)
 - ISO based loss reporting
 - Individual company loss history
 - Exposure Rated (limited data / events)
 - Individual large losses
 - CAT peril modeling

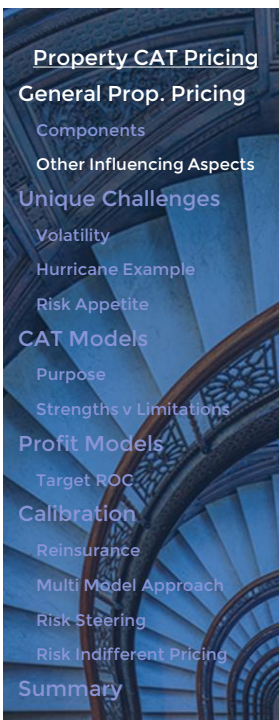
➤ Profit

- Target Loss Ratios
- Target Return on Capital Allocation
 - Based on key statistics from underlying loss frequency curves

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Other Influencing Aspects

Expenses

➤ Allocation by Perils Covered

- Claims handling – Attritional vs CAT shock

Expected Losses

➤ Exposure Base TIV

- vs. Premium Based Loss Projections
- Not all TIV has the same loss potential

Market Segment

➤ Admitted Carriers

- Transpose Target Premiums into buckets of ‘Like Kind & Quality’
- Rate Change Management – Timing / Lag
- Reinsurance Impact – Costs and Risk Management

➤ Surplus Lines Carriers

- Opportunistic – Agile Pricing options v Prevailing Market opportunities

➤ Reinsurance

- Agile pricing options v Elastic Market Demand & Diversified capital options
- Most adept at setting Target Returns & Target Premiums

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CAT - Unique Challenges

Volatility

- Potential for large loss accumulation – impacting profits or solvency
- Understanding sources of volatility (uncertainty)
 - Peril Frequencies & Severities
 - Reference time frames exceed those of human experience
 - Vulnerability of Structures
 - Engineers already know which buildings are most susceptible

Market Cycles

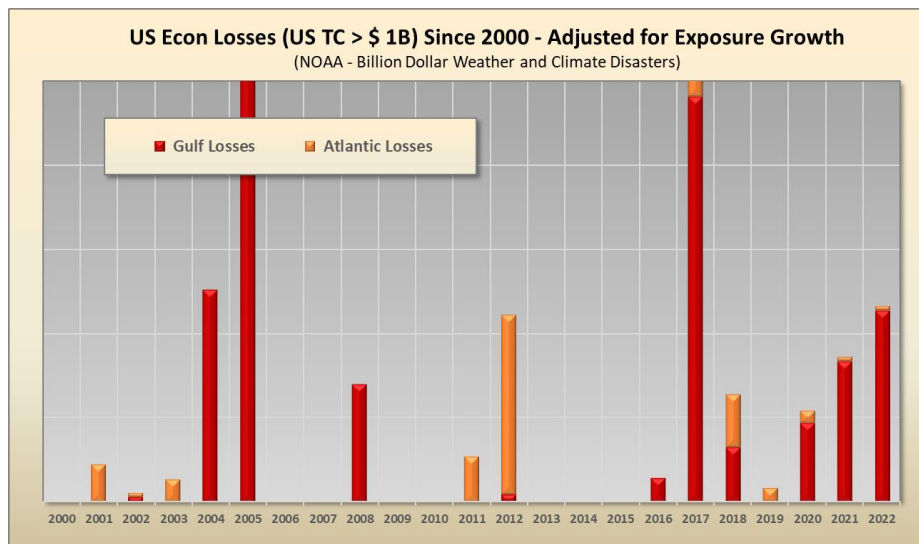
- Different Phases for Different Market Segments
- Industry Denial or Convenient Memory Impact
 - 2006 to 2015 – ‘Drought’ of US Landfall Hurricanes
 - Last 6 years – Consecutive years with Major US Landfalls
- External Capital Agility v Other Investment Opportunities

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It’s not about the models – it’s about the peril

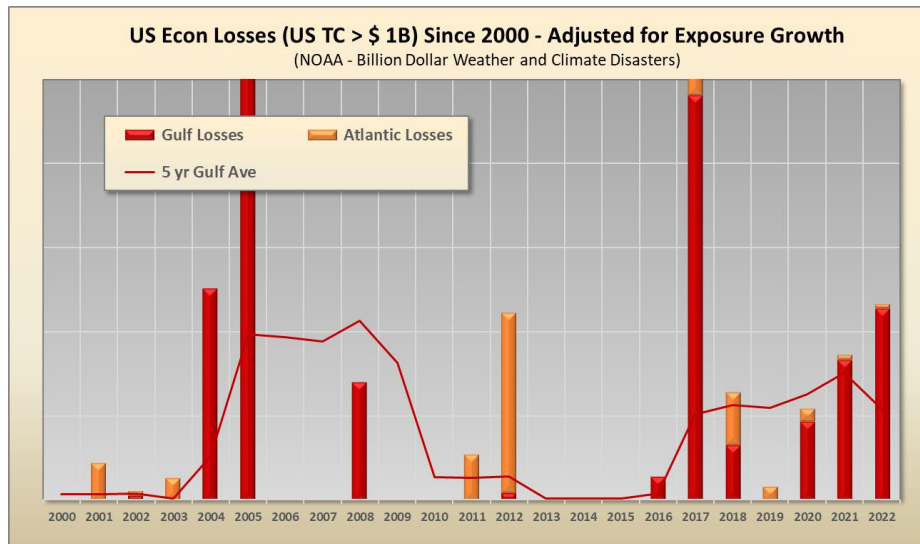


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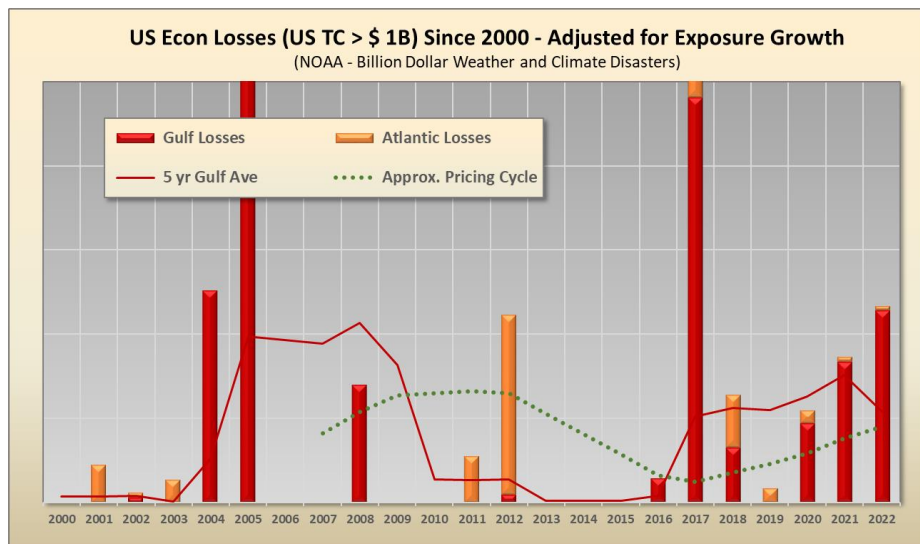
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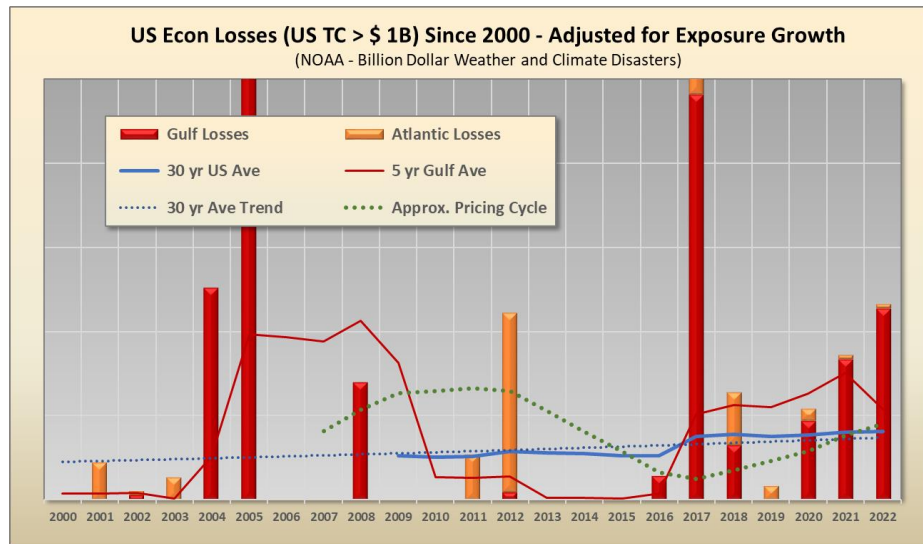
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It's not about the models - it's about the peril



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CAT - Unique Challenges

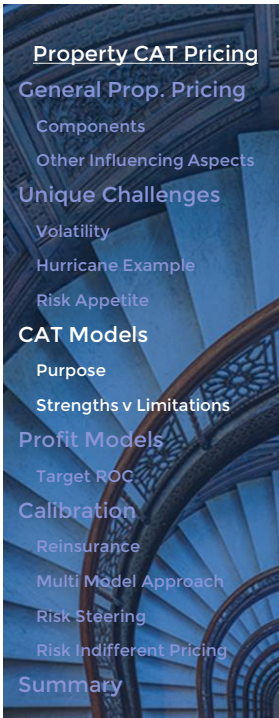
Risk Appetite

- **Balancing Act**
 - Focus - Short Term v Long Term
 - Stability of results - between years
 - Target Returns - higher returns = taking on more risky business (i.e. CAT)
- **Requires Acknowledging Corporate Tolerance**
 - CAT business is risky - Full stop
 - Can't have your cake and eat it too!
 - Pricing needs to be aligned with Corp Risk Appetite
 - C level alignment / signoff
 - Understanding the gap between actual experience & future possibilities
- **Establishing Guardrails**
 - Scenario Testing
 - Confirm risk tolerance independent from probabilistic fog - i.e. Real Risk Mgmt
 - Simulations of Economic Outcome
 - Sensitivity testing & refining final pricing parameters
 - Pricing as portfolio steering option when integrated with Risk Appetite.

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CAT Models

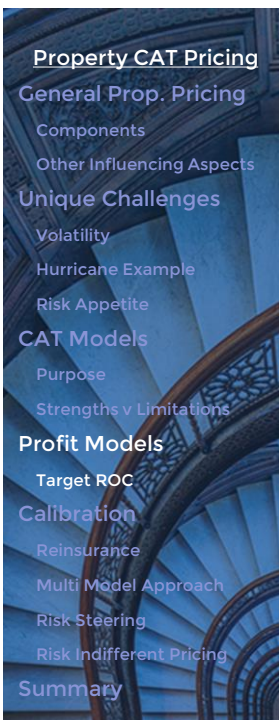
Probabilistic Models

- **What need do they fulfill?**
 - Traditional Loss Experience Analytics are not sufficient for projections
- **What do Cat Models Provide?**
 - Latest Science & Engineering Understanding
 - Emulate Peril Characteristics - Frequency & Severity
 - Building Damageability - Differentiating impact characteristics
 - Loss Frequency Curves - (more than just one statistic)
- **What Can't Models do?**
 - Can't predict losses
 - Can't change the natural characteristics of the perils
 - Can't do our job for us
- **What are our responsibilities?**
 - Accurate and Relevant Input
 - Appropriate Replacement Costs
 - Appropriate Construction Characteristics
 - Best Practice Understanding & Use of Models

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More than just AAL - Capacity Based Prop. Cat Pricing

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Risk Capital Pricing Models

Premium = Expenses + Expected Losses + Target Profit

- **Expenses**
 - Allocation by LOB
 - Claims handling - Attritional vs CAT shock
- **Expected Losses - Loss Distributions**
 - Individual Policy Losses
 - Attritional (Experience Rating) & Large Loss (Exposure Rating)
 - Catastrophe Losses - multi-policy losses
 - Know what models include or do well and vice versa (spend time on this)
 - Think sensitivity testing, etc.
 - Large Events - model adjustments
 - Smaller Events - Blended model with higher frequency historic losses
- **Target Profit / ROC Considerations**
 - Volume - Estimated Claims / Expected Losses
 - Variability of Loss Estimates
 - Profitability Risk - General variance from Expected Losses (e.g. Std Dev)
 - Solvency Risk - Tail Distribution Statistics (e.g. TVaR, xTVaR)

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Risk Capital Pricing Models - Target Profit

Relative Target Rate of Returns

- **Estimated Losses = E[L] (AAL)**
 - This can be set aside directly from Premiums so return could be very low
 - Opportunity analogy - Checking Account Interest
- **Variability of E[L] (AAL)**
 - Volume variability - Low Variation so required return can be medium
 - Opportunity analogy - Returns on Government Bonds or Low Risk Stocks
 - Extreme Event Variability - High Variation so higher return required
 - Opportunity analogy - High Risk Stock Returns

By Loss Category

- Higher Risk
- Higher ROR

Reserve Component	Relative Rate of Return Requirements by Loss Category			
	AOP		CAT	
	Attritional	Large Losses	Small	Major
E[L]	Low to zero	Low to zero	Low to zero	Low to zero
Variance in E[L]	Low to medium	Medium	Medium	Medium
Extreme Event	NA	NA	High	Very High

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Risk Capital Pricing Models - Target Profit

Example:

- **Volume Variability Profit**
 - General Construct = $\min [x\% , \sum f_x \text{ (Loss Distribution) }]$
 - Where x and f_x can vary by peril / categories
 - Simplified Form (as multiple of E[L])
 - $(a\% * \text{Attritional}) + (b\% * \text{Large Loss}) + (c\% * \text{Small CAT}) + (d\% * \text{Large Cat})$
- **Extreme Event Variability Profit**
 - General Construct = $\min [y\% , \sum g_x \text{ (Loss Distribution) }]$
 - Where y and g_x can vary by peril / region
 - Simplified Form (as multiple of TVaR₁₀₀)
 - E.g. Hurricane = $(r\% * \text{US}) + (s\% * \text{FL}) + (t\% * \text{Gulf}) + (u\% * \text{MidAtl})$
 - E.g. Quake = $(v\% * \text{US}) + (w\% * \text{CA}) + (x\% * \text{PNW}) + (y\% * \text{NM}) + (z\% * \text{SE})$
 - Factors based on All Perils convolution and independent peak regions

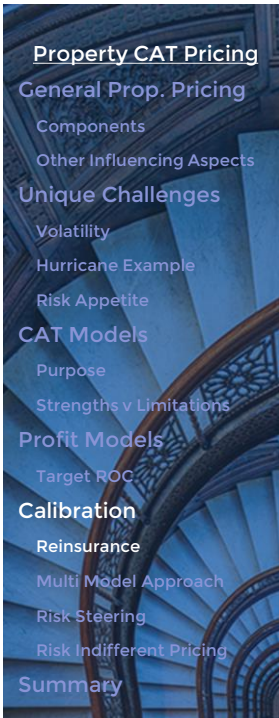
General / Simplified Form of Premium Equation

➤ **Target Prem = $\{ \sum E[L] + \sum \text{target profit} \} / (1 - \text{Exp ratio})$**

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Calibration

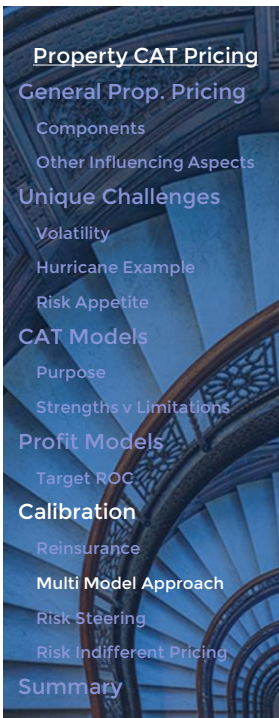
Reinsurance – NOT just an additional Expense

- **When to use?**
 - When the cost is cheaper than holding the risk
- **For simple CAT XOL, where to attach and how much limit?**
 - Again, comparing to your risk pricing model can inform.
- **Concept Example: 2 parameter profit model (CAT contribution only)**
 - $a * E[L] + b * TVaR_{100}$
 - 2 CAT XOL reinsurance treaties purchased
 - $Price\ XOLx = aE[L]_x + bTVaRx_{100}$
 - Price, $E[L]$ & $TVaR_{100}$ are known for both layers – solve for a & b.
 - Represents market check for a segment of your total target profit frontier
- **Validation / Calibration**
 - Check factors a & b across the full portfolio (not just the purchased layers)
 - How does current reinsurance market cycle compare to your long term targets?

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Calibration

Multi-Model Approach – NOT just averaging E[L]s

- **Remember – each CAT model produces different EP curves**
 - We need to be aware of and understand those differences
- **Reinsurance Consensus Pricing**
 - Despite multiple reinsurers / models, there is still only one price
- **Multiple Models**
 - AAL model 1 \neq AAL model 2
 - $TVaR_{100}$ model 1 \neq $TVaR_{100}$ model 2
 - \therefore Volume & Extreme factors will not be the same either
- **Blending Multiple models**
 - Calculate premium using each model and their unique factors
 - THEN blend the resulting target premiums – not just one statistic

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Calibration

Risk Steering & Indifferent Pricing

- **Balancing Portfolio Distribution**
 - Steering business through adjusting regional & pricing parameters
- **Principles – Relativity Parameter Calibration**
 - Based on Company Risk Appetite
 - Price to be otherwise indifferent to deploying capacity
 - Between perils (think attritional vs Cat losses)
 - Between Different Cat perils
 - Between different regions (within in specific Cat Peril)
- **Regional Risk Accumulation**
 - Scarcity of capacity
 - Risk Appetite for Maximal loss
 - Availability of reinsurance to further Cap CAT losses
- **Example: 1 risk using 250k TVaR₁₀₀ vs 5 risks with 250k TVaR₁₀₀ in total**

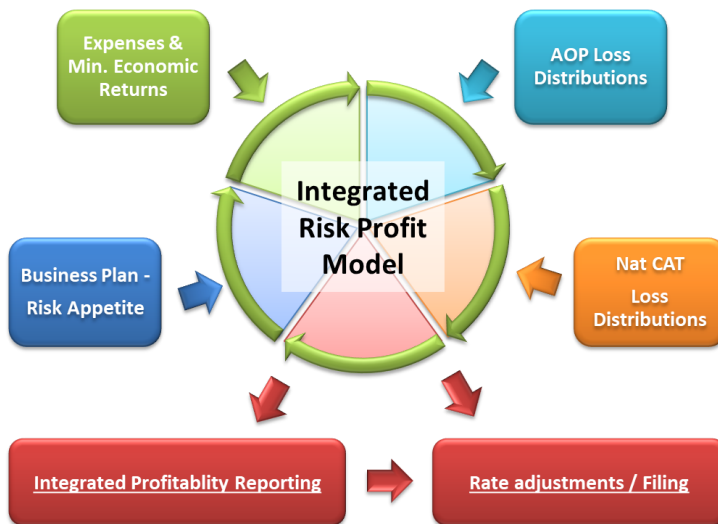
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Summary - Questions



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