Natural catastrophes

Property Catastrophe Modeling

- 100+ years of events
- Incorporates current weather environment data
- Risk location, construction, and occupancy data
- Accepted and used for 15+ years
- Industry standard for risk management even with known shortcomings
Causes of financial impairment – AM Best

- Long tail classes dwarf other threats in terms of financial impairment
- No consistent approach to measuring downside risk for casualty / liability business
  - Little understanding of casualty accumulations and concentrations
  - Struggle to articulate casualty PMLs and return periods

Might not kill quickly but doesn’t mean it can’t be fatal
What is a casualty catastrophe?

- Occurrences giving rise to multiple claims across multiple policies across multiple underwriting years
- Significant quantum
- Occurrences can man be made or naturally occurring
- Impacts one insured or multiple insureds
- Single Events or Systemic Risks
Casualty catastrophe (examples)

Grenfell Tower Disaster

- >80 people killed (total still unknown)
- Total loss estimated > GBP1B
- Multiple Insured’s affected, each with their own GL, PI & D&O insurance policies
  - Local Council and Housing Associations
  - Architects & Engineers
  - General Contractors
  - Project Managers and service providers
  - Builders
  - Consumer goods manufacturers
  - Building product manufacturers
Casualty catastrophe (examples)

Natural Catastrophes

- NZ Earthquakes 2011
  - WC & Injury (ACC) est >$200M
  - Multiple PI claims against architects & insurance brokers
  - GL claims against property owners

- Brisbane Floods 2011
  - Dam operators & Qld Government possibly >$500M
  - PI Losses Brisbane Council possibly >$500M

- Victorian Bushfires
  - Power company, maintenance contractors & Vic Govt’s losses approximately $900M
  - Motor Vehicle (OD) losses $190M
  - WC possibly $10M
Casualty catastrophe (examples)

Systemic Risks

- Products Liability
  - Spiral Foods Bonsoy Claims: Single Insured with renewed policies spread across multiple policy years - Original estimate $50M
  - Introduction Claims: Multiple Insured’s, multiple years, industry segment

- Professional Indemnity
  - UK Pensions mis-selling – Total Claims >GBP30B
    Multiple insured entities, bad financial advice (“one product, one activity”)

- Cyber Liability
  - Wannacry Ransomware – affected >200,000 computers in 150 countries, demanded bitcoin. Insurance loss considered ultimately small.
  - Petya Ransomware – starting in Russia & Ukraine, demanded $300 affected only approximately 2,000 computers
Risk Management Framework
Advancing the risk management framework

- Stakeholders will continue to demand change
  - Regulators, rating agencies, shareholders, etc.
  - Much quicker pace of change than for Property Catastrophe

- Heightened recognition of need to improve risk quantification
  - Identify major risk factors in casualty portfolio
  - Minimize risk of surprise both internally and externally
  - Improve confidence in the overall portfolio

- Large global companies must develop capability quickly
  - Casualty Cat PML requirements will emerge much more quickly than Property Cat
  - Cannot afford to lag their peer group
  - Enhanced focus and adoption of ERM
## Spectrum of casualty downside modeling

<table>
<thead>
<tr>
<th>Experience-based methods only</th>
<th>Stand-alone deterministic RDS</th>
<th>Stand-alone sophisticated cat based methods</th>
<th>Cat modeling fully integrated with company-wide modeling</th>
</tr>
</thead>
</table>

- **Majority of industry estimates model based on company claims experience although data sample typically lacks credible time horizon**
- **A.M. Best now requires companies to demonstrate that they think about casualty catastrophe analysis**
- **The most sophisticated companies seek to incorporate casualty cat modeling with property cat modeling**

**Best methods synthesize historical claims data with forward-looking exposure based Casualty cat model**

More information about all cat models pros and cons in appendix
Management of casualty risk tolerance

“Target an X% combined ratio for Casualty”

- Reasonable profitability goal, but not a risk tolerance statement

“Limit Casualty exposure in a given RDS to no more than $Y”

- Getting close: based on exposure and downside
- But has no associated return period

“Our 100 Year TVaR for Casualty risk is Z% of capital”

- Ultimate goal
- Exposure-based framework focused on downside tail risk
- Tied to the capital that supports the business

A start
Better
Goal
Compare measured risk vs. risk tolerance

Gross downside exceeds risk tolerance: explore options for mitigating retained risk

Option 1 reduces risk below tolerance range: may be spending too much for unnecessary protection

Option 2 reduces retained risk to within tolerance range
Casualty risk dashboard

Portfolio Exposure

- Casualty Lines $3.1B
- Casualty Lines $1550B
- Financial Lines $0.75B
- Financial Lines $200B

Portfolio Distribution

- Business Lines
  - Construction materials
  - Food products
  - Durable goods
- Casualty Lines

Downside Measure

- 250 year AEP
- Billions
- Single Professional
- Single Physical
- Systemic Professional
- Systemic Products
- All Perils

Downside Distribution

- Aggregate Exceedence Percentile
- Exceedence Probability
- Aggregate Loss
- Millions

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Willis Re – eNTAIL

- Quantifies downside from all Casualty Risk sources due to sudden and systemic events
- Forward looking scenarios are informed by historical events but generalized to allow for black swans

- Descriptive scenarios can be used on a deterministic basis, or can be run in the full stochastic model
- Transparent model can easily be understood, explained, and edited

- In some cases there are limited historical events to describe certain forward looking scenarios
## eNTAIL – key attributes

<table>
<thead>
<tr>
<th>Goal</th>
<th>Framework</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Measure extreme risk concentrations</td>
<td>- Exposure-based methodology driven by forward looking scenarios</td>
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<tr>
<td>- Single incident</td>
<td>- Avoid opaque models</td>
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<tr>
<td>- Systemic contagion</td>
<td>- Use historical data</td>
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<tr>
<td></td>
<td>- Recognises future Cat events will be structurally similar but not</td>
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<tr>
<td></td>
<td>identical to past events</td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Data &amp; Output</strong></td>
<td><strong>Integration</strong></td>
</tr>
<tr>
<td>- Use data currently collected – LOB, industry, limits exposed</td>
<td>- Casualty cat one component of broader ERM landscape</td>
</tr>
<tr>
<td>- Produce full distribution of return period losses</td>
<td>- Integrates with internal economic capital modeling</td>
</tr>
</tbody>
</table>
**eNTAIL** – historical data to create forward looking RDS

### Actual Historical Events (examples)
- L'Ambiance Plaza Apartment Building Collapse (US 1987)
- Hyatt Hotel Building Collapse (US 1981)
- Sampoong Department Store Building Collapse (S Korea 1995)
- Deepwater Horizon (US 2010)
- Piper Alpha (UK 1988)
- Exxon Valdez Oil Spill (US 1989)
- Enron Bankruptcy (US 2001)
- Worldcom Bankruptcy (US 2002)
- Parmalat Bankruptcy (US/Italy 1999-2003)
- Storm Financial Collapse (Aus 2009)
- Westpoint Bankruptcy (Aus 2005)
- Subprime Mortgage (Credit Crisis) (US 2008)
- LIBOR Rate Rigging (US 2007-2011)
- Broker Bid Rigging (US 2004)
- Lloyd’s Underwriting "Members’ Agents" (UK 1988-1992)
- Tobacco Related Health Care Costs (US 1954-1997)
- U.S. Asbestos (US 1924-2016)
- Chinese Drywall (US 2001-2007)
- Pelvic Surgical Mesh Devices (US 1997-2011)
- Metal Hip Replacements (US 1999-2012)

### Forward looking scenarios (examples)
- Building Collapse
- Offshore Oil Spill
- Firm Failure
- Public D&O and FI E&O
- Accountants, Agents, and Advisors
- Food Products
- Construction Materials
- Medical Products

### Four Perils
- Single Physical
- Single Professional
- Systemic Professional
- Systemic Products
Four peril categories used in eNTAIL

**Single physical**
- Building fire
- Building collapse
- Terror event
- Offshore oil spill
- Trucking event
- Industrial accident
- Tower crane collapse
- Natural catastrophe

**Single professional**
- Firm failure
- Rogue medical
- Cyber – single firm

**Systemic product**
- Food products
- Construction materials
- Pharmaceuticals
- Chemicals
- Durable goods
- Medical products
- Environmental

**Systemic professional**
- Medical
- Fiduciary
- Architects & Engineers
- Attorneys
- Public D&O
- Cyber – industry
- FI E&O
eNTAIL – casualty catastrophe model

Simulation methodology parallels development of Property catastrophe models

- Forward-looking scenarios inspired by attributes of historical events
- Applied to Client’s portfolio of exposures
- Add uncertainty surrounding events
- Output is ELT
- Incorporates directly into simulation engine of existing economic capital models
Stochastic output

- ELT format allows for understanding of full loss distribution through stochastic modeling.
- Non-cat dynamics determined separately.
- Better estimate of the impact of "worst case scenario" across a financial year.

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Exposure magnitude and composition

- Visualize accumulations by eNTAIL category across BU and SIC industry group
- Larger bubbles represent greater exposure
- Largest industry: Construction Materials is 23% of the total exposed limit
Conclusion

- No consistent approach to measuring downside risk for casualty lines
- Acquiescent environment is changing quickly
- Developing a risk management framework for casualty lines of business is important
- Casualty Catastrophe models exist in the market and have varying characteristics
- Incorporating catastrophe modelling for casualty within the risk management framework is an important first step