P-2: Catastrophes and Workers Compensation Ratemaking

Presented by

Thomas V. Daley, ACAS, MAAA

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Overview of Catastrophes and WC Ratemaking

- NCCI has modified its approach for determining a state's overall indicated loss cost (or rate) level change.
- Why was this change necessary and how does the methodology work?
- How was computer modeling applied in workers compensation (WC) to derive loss costs for catastrophic events?
- What were the results?

Workers Compensation Insurance Has Exposure to Catastrophic Losses

- L' Ambiance Plaza—Bridgeport, CT 1987
- Imperial Foods—Hamlet, NC 1991
- Murrah Federal Bldg.—Oklahoma City, OK 1995
- Texas City Event—Texas City, TX 1947
- September 11th, 2001

More details on these events located in Appendix.

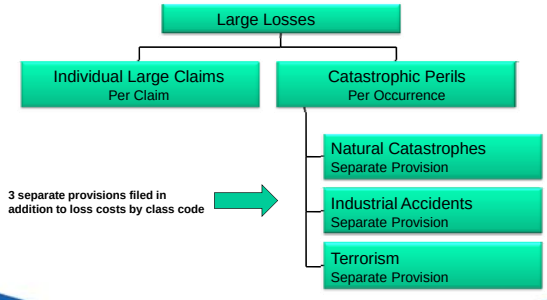
Why Was A Change Necessary?

- The claims from the previous catastrophes were removed from each state's ratemaking data.
- These events are very rare, yet exposure is very real (e.g. daytime earthquake potential).
- Analogous issues exist for large, single claim occurrences in WC, impacting smaller states.

Why Was A Change Necessary (cont.)?

- WC policies cannot exclude perils nor use per claim/ per occurrence loss limits.
- Even if a carrier opts not to write the risk, they may have to share in the results of residual market mechanisms in WC.
- Given the above, how are catastrophic losses funded in workers compensation insurance?

How Does the Methodology Work? Framework



Goals of the New Large Loss Methodology

- Standardize a methodology across states.
- Achieve long-term rate adequacy.
- Achieve rate stability at a state level.
- Define a large catastrophic event (and a large single claim).
- Collect the necessary data.

How Does the Methodology Work? Define A Large Event

- NCCI defines a "catastrophic occurrence" as a single event across all states whose WC claims equal or exceed a $50 million threshold.
- All ground-up losses from catastrophic occurrences are excluded from the ratemaking data across all states.
- Large individual claims are also limited, but a more stringent limiting approach is applied.
- Large individual claims are capped at lower loss limits T which vary by:
  - The size of the state, and
  - Maturity of the claim

How Does the Methodology Work? Analogous to Basic Limits Ratemaking

- Cap the given state's losses at its threshold in:
  - the experience period
  - loss development (de-trended thresholds)
  - trend calculations
- The actual dollars in excess of the cap are not included in the ratemaking data.
- Uses limited LDF's to derive limited ultimate losses.
- Uses per-claim excess ratios to bring the limited ultimate loss to full value by adding an expected excess provision.

How Does the Methodology Work? State Overall Loss Cost Change

Previously: LC Change = $\frac{\text{Unlimited Developed Losses}}{\text{Developed DSR Pure Premium}}$

New Method: LC Change = $\frac{\text{Limited Developed Losses}}{\text{Developed DSR Pure Premium}} \times \frac{1.000}{(1 - XS_T)}$

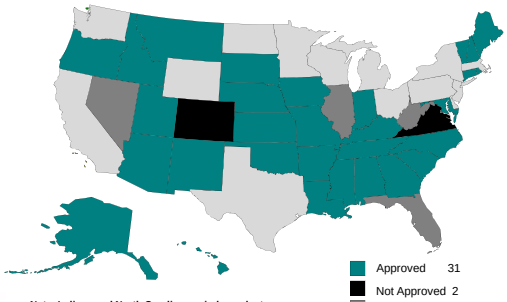
XS_T – State per claim expected excess ratio for loss threshold T.
DSR – NCCI 's designated statistical reporting level for the state.
Note: Premiums and losses above are trended and on-leveled.

- A state's threshold T was initially derived as 1.0% of its DSR premium in the experience period (excluding all expenses).

How Does the Methodology Work? Estimating the Tail Factor

- The WC tail factor is difficult to estimate.
- Issue: The NCCI tail methodology calculates an unlimited incurred tail (including IBNR). We needed a limited tail factor.
- Solution: NCCI derived a formula for computing a countrywide tail reduction factor (F_T) to account for losses capped at threshold T.

Adoption of Large Loss Methodology



Note: Indiana and North Carolina are independent bureaus which adopted the large loss methodology.

Summary of Results
Large Loss Methodology

- The new methodology was implemented starting with loss cost filings effective 10-1-04 and was adopted in 31 states.
- NCCI tracked the new methodology (limited) indications compared to the previous (unlimited).
- Below are examples of ranges of overall indications that NCCI observed across its states for the new filed methodology [= range of new method/prior method]:
  - ***First season of NCCI Filings 2004/05 — [.973, 1.028]***
  - ***Fourth season of NCCI Filings 2007/08 — [.959, 1.034]***
- The Catastrophe provisions allow for additional funding by the industry to cover large events beyond $50M

Catastrophe Provisions

Modeling the Catastrophic Perils

- The absence of recent large events in WC suggested the current loss costs did not reflect the exposure.
- NCCI partnered with EQECAT starting in 2002.
- EQECAT developed three models for NCCI, one for each of the following perils, to compute loss costs by peril:
  - Terrorism (7)
  - Earthquake (9)
  - Catastrophic Industrial Accidents (6)

Note: ( ) = # of NCCI states initially modeled for each peril

- The provisions for other states were derived using a modeled state as a "proxy state".

Modeling the Catastrophic Perils
The Approach

- Events were simulated for specific states using qualitative thresholds by peril:
  - Large industrial accidents likely to cause at least two fatalities or at least ten hospitalizations.
  - Terrorist attacks with potential to cause at least $25 million in WC losses.
  - All possible earthquakes were modeled.
- Simulated events with outcomes below $50M were excluded from the excess loss distributions.
- Expected Annual Losses (EAL) were computed for every state and peril analyzed, using casualty counts from simulated events and state-specific WC benefit payments.

Modeling the Catastrophic Perils
Computing the Loss Cost

- The EAL was divided by FTE employees.
- A pure loss cost per $100 of payroll was derived using annual wage per employee (CPS).
- This loss cost was derived for each of the three perils separately, and represents ground-up losses (i.e. first dollar) for events beyond $50M.
- The loss cost was primarily driven by the very largest of the simulated events, those events having return periods of 1 in every 100 or more years

Modeling the Catastrophic Perils
More About the Loss Cost

- Expense provisions are applied in rate states and the provision is rounded to nearest $0.01.
- Carriers may apply their own expense provisions via independent filings in most loss cost states.
- Premium derived from catastrophe provisions are additive, and not subject to any other modification:
  - Experience rating or Retrospective rating
  - Schedule rating or premium discounts
  - Rate deviations or tiers
- ***TRIPRA - 2008*** - NCCI redefined the two loss cost provisions for Certified Acts of Terrorism and Catastrophe (Other) in 2008.

Actuarial Standard Of Practice #38: Using Models Outside the Actuary's Expertise

- These models used specialized knowledge outside the actuary's (i.e. author's) expertise.
- The NCCI actuaries relied upon simulation models supplied by EQECAT to estimate expected losses.
- The accuracy of the estimates heavily depends upon the accuracy of seismological, engineering, meteorological, and expert claim frequency assumptions from experts in related fields.

Modeling the Catastrophic Perils How It Works

- All three models share the same primary components. They are:
  - Definition of the portfolio exposures
  - Definition of the peril hazards
  - Definition of the casualty vulnerability
  - Calculation of loss due to casualty

Primary Components of Terrorism Model

- Exposure Portfolio – Location (city block), number, and types of employees, pro-rated to account for part-time and self-employed. Likeliest during day shift.
- Peril Hazards – 3 primary elements were simulated:
  - Weapon types – Blast, N B C R
  - Target selection – Tall Buildings, dams, ports, etc.
  - Frequency of weapon attack– Events per year ranged from [0.25, 3.0] based on expertise from EQECAT, with the target being a consideration.
- Vulnerability – Casualty "footprints" measure distribution of intensity of an agent from initial target.
- Casualties/Loss – average costs by injury type by state.

Primary Components of Catastrophic Industrial Accidents

- Exposure Portfolio– Location (city block), number, and types of employees, pro-rated to account for part-time. Likeliest during peak hours of activities (day shift).
- Peril Hazards – 3 primary elements considered and simulated:
  - Facilities – Refineries, Chemical Plants, Water/Power Utilities, and Manufacturing Plants.
  - Accident types – Chemical releases, large explosions, etc.
  - Frequencies of Accidents - based on expert opinion from EQECAT and injury data from BLS and OSHA.
- Vulnerability – Similar to terrorism. Casualty "footprints" measure distribution of agent from plant based on atmospheric conditions, plant location, etc. Blast footprint is decreasing function of distance from the blast.
- Casualties/Loss – Average costs by injury type by state.

Primary Components of Earthquake Model

- Exposure Portfolio– Location (work site), types of employees, and structure type and age. # employees was varied across work shifts.
- Peril Hazards – 2 categories:
  - Regional hazard – Fault zones, location, and recurrence frequency that are expected to occur in the region.
  - Site hazard severity – Ground-shaking parameters, distance from the fault to the site, and soil conditions create site "classes".
- Vulnerability – Estimation in 2 separate stages. They are:
  - Given a level of ground shaking at the site, the probability of damage using "building vulnerability functions" is determined based on age, height, and structure type.
  - Estimation of worker casualties is based on building damage
- Casualties/Loss – # casualties by different work shifts per site per event is determined prior to applying avg. costs by injury type.

Summary of Results Catastrophic Events

- Filed in 37 states by NCCI, all 37 states currently allow a provision for Certified Acts of Terrorism net of the federal backstop provided by TRIPRA.
- The terrorism provision in most states is 0.01, but does vary significantly for a few states (see next slide)
- Filed in 37 states by NCCI, 32 states currently allow a Catastrophe provision (other than Certified Acts of Terrorism)
- The following slide provides the current approved values of the two provisions for each state

Summary of Results: Catastrophe Provisions by State (as of April, 2011)

State	Terrorism / Other Cat	State	Terrorism / Other Cat
Alabama VLC	.01/.01	Maryland VLC	.03/.01
Alaska VLC	.01/---	Mississippi VLC	.01/.01
Arizona VR	.01/.01	Missouri VLC	.01/---
Arkansas VLC	.01/.01	Montana VLC	.01/.01
Colorado VLC	.01/.01	Nebraska VLC	.01/.01
Connecticut VLC	.01/.01	New Hampshire VLC	.01/.01
DC VLC	.05/.01	New Mexico VLC	.01/---
Florida VR	.02/---	North Carolina VLC	.01/.01
Georgia VLC	.01/.01	Oklahoma VLC	.01/.01
Hawaii VLC	.01/.01	Oregon VLC	.01/.01
Idaho VR	.02/.01	Rhode Island VLC	.01/.01
Illinois VR	.03/.01	South Carolina VLC	.01/.01
Indiana VR	.01/.01	South Dakota VLC	.01/.01
Iowa VR	.01/.01	Tennessee VLC	.01/.02
Kansas VLC	.01/.01	Utah VLC	.01/.01
Kentucky VLC	.01/.01	Vermont VLC	.01/.01
Louisiana	.01/.01	Virginia VLC	.03/---
Maine VLC	.01/.01	West Virginia VLC	.01/.01

Remaining Sections of the Paper

- A hypothetical example of a loss exceedance curve
- Pros and Cons of Catastrophe Modeling in WC
- Possible Future Enhancements to the Catastrophe Modeling in WC

NCCI National Council on Compensation Insurance, Inc.

Thank you!

Any Questions?

L' Ambiance Plaza Event Summary

April, 1987—Bridgeport, CT

- Collapse of partially completed 16 story residential project
- 28 construction workers died
- 12 more injured
- All claims removed from data used in aggregate ratemaking

Imperial Foods Event Summary

September, 1991—Hamlet, NC

- Hydraulic line ruptured near 26 ft long deep fat fryer causing intense, rapidly moving fire and thick black smoke
- Fire exits locked, no sprinklers or windows
- 33,000 sq. ft. plant with only 1 fire extinguisher
- 25 deaths, 54 injuries, 49 children orphaned
- No safety inspections in 11 year history of plant
- $800,000 in fines for 83 safety violations
- 102 civil claims settled for $16M
- All these claims removed from data used in aggregate ratemaking

Oklahoma City Event Summary

April, 1995—Oklahoma City, OK

- 20 ft. Ryder truck loaded with 2 tons of ammonium nitrate parked in front of 9 story Murrah Federal building
- Explosion felt 55 miles away
- Registered 6.0 on Richter scale
- 600 workers, 250 visitors in building
- 168 dead, 853 injured
- 324 buildings damaged in 50 block area
- $125 million in damages according to Insurance Information Institute
- Federal workers not covered by Workers Compensation

Texas City
Event Summary

April, 1947—Texas City, TX

- Two ships laden with ammonium nitrate blow up 300 feet from Monsanto chemical plant
- Plant covered 40 acres, several hundred structures
- Estimates of 512-600 fatalities, 145 at Monsanto
- Entire Texas City volunteer fire department dead
- 3000 injuries
- 326 deaths, 521 injuries covered by Workers Compensation
- $3M in Workers Compensation losses

September 11th, 2001
Event Summary

- Approximately 2,976 fatalities
- Approximately 2,250 injuries
- NCCI estimated ultimate direct losses for workers compensation range from $1.3 billion - $2.0 billion.
- Another 15% were self-insured losses (NYC Firefighters and NYPD)
- $32.5 billion* in total insured losses for all lines of business.
- III estimates $1.8 billion* for WC.

* Source: Insurance Information Institute (dollars at 2001 level)