Catastrophe Models: What Can Go Wrong

Casualty Actuarial Society Annual Meeting
Honolulu, HI
November 11 & 13, 2019

James Lynch, FCAS MAAA, Chief Actuary
Insurance Information Institute • 110 William Street • New York, NY 10038
Tel: 212.346.5533 • jamesl@iii.org • www.iii.org
I.I.I. Mission Statement

The trusted source of unique, data-driven insights on insurance... to inform and empower consumers.
# What is a Model?

**A Definition**

“A simplified representation of relationships among real world variables, entities or events using statistical, financial, economic, mathematical or scientific concepts and equations.”

**Components**

- Information (Input)
- Processing Component (turns input into estimate)
- Output Component (translates estimates into useful business information)

Source: Actuarial Standards Board (proposed standard).
A Simple Model
It’s in the Bible!

Red Sky in the Morning . . .

Red Sky at Night . . .

Issues

Pros
- Easy to Understand, Use
- Time-tested

Cons
- Not Mutually Exclusive and Exhaustive
- Insufficiently Quantitative for Actuarial Analysis

Source: Photos from Wikimedia Commons.
The Traditional Actuarial Model
Nonwind vs. Nonexcess Wind vs. Excess Wind

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<th>(13/13)</th>
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**MEDIAN (4) = M = 257**
**AVG. EXCESS WIND RATIO (4) = .328**
**EXCESS WIND FACTOR = 1.0 + (.098) X (.016)**

*The wind to nonwind ratio for a year also must be at least .250 for that year to qualify as an excess year.*

Source: Mark Homan, “Homeowners Insurance Pricing.”
The Traditional Actuarial Model
An Assessment

- Not Too Bad for Pricing
  - Leveraged Internal Data
  - Worked Fairly Well – Property Lines Were Profitable Across Time
  - Still in Syllabus, Still in Use
  - No Projection for Individual Events (PCS Did That)
  - Didn’t Really Work for Capital Management

- The System Worked . . .
  - Hurricane Hugo (1989)
    - Early Estimate: 3.9
    - Final Estimate: 4.2
  - Hurricane Andrew (1992)
    - Early Estimate: 7.3
    - Final Estimate: 15.5

Hurricane Andrew: What Happened? Why Did the Models Fail?

Hurricanes w/in 75 Miles of Miami, 1964-1990

- Isbell, 1964, Cat 3
- Betsy, 1965, Cat 3
- David, 1979, Cat 1
- Floyd, 1987, Cat 1
- Inez, 1966, Cat 1
- Cleo, 1964, Cat 2

Lots of People, Few Storms

Source: National Oceanic and Atmospheric Administration.
Anatomy of a Cat Model
One Model . . . Or Six?

- Event Generation
- Intensity Calculation
- Exposure Information
- Damage Estimation
- Policy Conditions
- Financial Calculation
Event Generation
Finding Fault

NZ Active Faults

Who Knew?

- Major Faults in NZ Are Far From Christchurch
- Faults That Ruptured Were Unknown
- NZ EQC Claims Staff: 49 to 1,000 One Month

Source: Te Ara, the Encyclopedia of New Zealand, Swiss Re.
Intensity Calculation
We Learn From Every Event … For a Long Time

A Silly Little Millibar

Andrew: the Great Validator

Ambient (Far Field) Atmospheric Pressure Lowered to 1012 From 1013 MBs

Impact of 1 MB Change

Sources: Image from National Oceanic and Atmospheric Administration; BAMS (Bulletin of the American Meteorological Society).
Exposures
When Is a Barge a Building?

When It’s a Casino.
Damages, Insurance & Money
Lots of Lessons

Demand Surge
- Lessons from Andrew
- Lessons from 2004-2005

Policy Terms
- Christchurch: Uncapped Replacement Cost (Bring Up to Code)
- RC > Insured Sum

Business Interruption

9/11 Losses by Line
- Aviation Liability: 11%
- Property - WTC 1 & 2: 11%
- Liability - Other: 12%
- Property - Other: 19%

Source: Swiss Re, Insurance Information Institute.
Summary

- Catastrophe Models Aren’t Perfect (What Is?)
- The Industry is Young
- It is Improving
- It is Much Better Than What Preceded It
Thank you for your time and your attention!