

## Practical Aspects of Catastrophe Risk Management

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## A Useful Reference

### ***“Catastrophe Modelling: A New Approach to Managing Risk”***

Edited by:

*Patricia Grossi*

*Howard Kunreuther*

[Springer: ISBN 0-387-24105-1]

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## Contents

- Introduction
- A Little Theory
- Ten Practical Tips
- Recap and Questions



[www.news.bbc.co.uk/sport1/1/athletics/photo\\_galleries/default.stm](http://www.news.bbc.co.uk/sport1/1/athletics/photo_galleries/default.stm)

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## Theory of Risk Management

- The Real World
  - Hazards
    - act upon
  - Exposed Values
    - generating
  - Financial Losses
    - as a series of random numbers
- The World is Complex
  - Chaotic and only partially known
- We wish to control loss potential
  - To protect revenue and profit
  - To protect capital and security



[www.nasa.gov/losses/show2\\_article.php?id=02-011](http://www.nasa.gov/losses/show2_article.php?id=02-011)

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## Theory of Risk Management

- Our Model of the World
  - Simulated and historical events
    - applied to
  - Exposure data
    - to determine
  - Loss estimates
    - random numbers
- Models can be simple and fully known
  - or complex, chaotic and only partially understood
- We can manage loss potential through
  - Risk selection
  - Adjusting accepted exposure
  - Reinsurance purchase
- We can manage its impact through
  - Holding capital
  - Managing claims



[www.globalchicago.org/files/graphics/map/world.jpg](http://www.globalchicago.org/files/graphics/map/world.jpg)

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## Ten Top Tips

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# 1. Accumulations, Accumulations, Accumulations

- Portfolio Theory in Insurance
  - Building a book of risks to get greater diversification
  - But THINGS happen which have consequences
  - Sometimes those THINGS have multiple impacts
- We need to identify and record what these aggregating THINGS are
  - Deduce from past experience and causal links
  - Speculate what other THINGS might happen

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# 1. Accumulations, Accumulations, Accumulations



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# 1. Accumulations, Accumulations, Accumulations

- Common Loss Drivers
  - Class, region, peril
  - Any THING that might lead to multiple losses/claims
- Understand and Measure Exposure
  - Monitor overall levels
    - Objective
    - Indicator of change
    - Better for insurance than reinsurance

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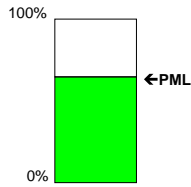
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## 2. PML Ratios are just Estimates



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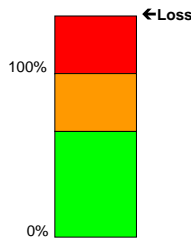
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## 2. PML Ratios are just Estimates



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## 3. Use Scenarios



- We're wired to imagine THINGS happening
- Can link to experience
- Can draw on research
- Should be challenging, even scary, but not existential

[www.dnr.mt.gov/brp/press/2004/tinghNov06/enoq/flood%20.jpg](http://www.dnr.mt.gov/brp/press/2004/tinghNov06/enoq/flood%20.jpg)  
[www.nasa.gov/images/content/106494main\\_0205\\_hurricane\\_temi](http://www.nasa.gov/images/content/106494main_0205_hurricane_temi)

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## 4. Know Your Reinsurance



- The net result matters most
- R/I doesn't just scale or crop
  - R/I recovery depends on loss circumstances
- Probe net result with specific scenario
  - Then, given gross loss, how might net vary?
  - Where are holes in programme?
  - What might fall through cracks?

[www.fosterandpartners.com/interstate.html?Project.asp?JobNo=1004&](http://www.fosterandpartners.com/interstate.html?Project.asp?JobNo=1004&)  
[www.soyouaregeni.com/munchwaking.html\\_1081\\_30thday.html](http://www.soyouaregeni.com/munchwaking.html_1081_30thday.html)

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## 5. Insurance ≠ Reinsurance

- Consider loss as %age of exposure
  - Diverse insurance portfolios ⇒ low %age
    - Relying on "law of large numbers" and "miss factor"
  - Focused reinsurance protection ⇒ high %age
    - Near binary behaviour
- Information typically incomplete for R/I, but
  - Reinsurance ≡ "Distillation" of Risk
  - ILWs ≡ "Abstraction" of Risk
  - So characteristic features can be predicted

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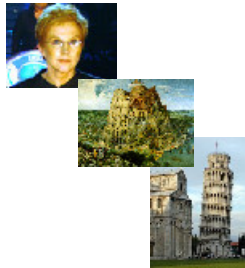
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## 6. Think "Weakest Link"

- Models estimate losses
  - Using estimated impacts
  - On estimated exposures
  - From estimated hazards
- No natural correction in bias
  - Limited benefit in improving best elements in model
- Need to focus on weakest part
  - Exposure?
  - Vulnerability?
  - Hazard?



<http://www.bbc.co.uk/weakestlink/>  
[www.hope.edu/bandstra/RTOT/CH1/CH1\\_BAB.HTM](http://www.hope.edu/bandstra/RTOT/CH1/CH1_BAB.HTM)  
[www.en.wikipedia.org/wiki/Pisa](http://www.en.wikipedia.org/wiki/Pisa)

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## 6. Is Data Quality the Weakest Link?

- Many cases of understated insured values
  - Lloyd's introducing averaging and limit clauses
  - Valuations cannot be kept totally up-to-date
- Clear need for standards (e.g. ACORD)
- Need to consider treatment of missing data
  - Attribute data often missing or questionable
- However, ultimately, will have to rely on data

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## 7. Use More than One Method

- Different models and approaches have
  - Different strengths
  - Different biases
- Using more than one method
  - Introduces the potential for correcting bias
  - Creates opportunity for insight into differences
    - If you look at them
- For instance, could use top-down and bottom-up
  - Portfolio market-share v. sum of policy estimates

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## 8. Ranking good, Likelihood less so

- Relative loss levels relatively well behaved
  - If Exposure  $\uparrow$  then Loss  $\uparrow$
  - If Magnitude  $\uparrow$  then Loss  $\uparrow$
- Likelihood (return periods) not well behaved
  - Difficult to calibrate, practically impossible to verify
  - Extreme events rare and the world keeps changing
- So what?
  - Can identify personal catastrophes
  - Can map to industry loss levels and benchmark loss scenarios
  - Can estimate anticipated market share of losses

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## 9. Know Your Limits

- Limit Risk
  - To protect revenue & profit
  - To protect capital & security
- But all Risk?
  - Post-apocalyptic pay out?
  - Accept most extreme risks
- How to define appetite
  - Industry loss ruin level?
  - Probability of ruin?
  - Against peers?



[www.rspb.org.uk/birds/guides/robin/index.asp](http://www.rspb.org.uk/birds/guides/robin/index.asp)



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## 10. Think and be Cynical

- Apply logic to considering
  - The mechanisms of loss
  - Potential losses
  - The consequences of events (THINGS)
- Cat. Modelling = "The study of bad THINGS"
  - THINGS can take a turn for the worse
  - THINGS (and people?) can go against you
  - Unexpected THINGS do happen!

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## Recap

1. Accumulations, Accumulations, Accumulations
2. PML Ratios are just Estimates
3. Use Scenarios
4. Know Your Reinsurance
5. Insurance  $\neq$  Reinsurance
6. Think "Weakest Link"
7. Use More than One Method
8. Ranking good, Likelihood less so
9. Know your Limits
10. Think and be Cynical

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## Addendum

11. Think about the un-modelled risk!

- Is it fundamentally different?
- Or just missing from the exposure data?
- Is it likely to be a stable proportion of modelled losses?
- What do we need to do to make it model-able?
- If we can't model it, should we be writing it?

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## Any Questions?



[http://news.bbc.co.uk/1/hi/sport1/19141163/photo\\_galleryes/default.stm](http://news.bbc.co.uk/1/hi/sport1/19141163/photo_galleryes/default.stm)

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