What is a 1-in-200?

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Introduction
Who are we?

- John Campbell
- Daniel Clarke
- Darren Farr
- Cameron Heath
- Gladys Hosken
- Gillian James
- Andrew Newman
- David Simmons
- Hannes Van Rensburg

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Introduction
What are we going to talk about?

- Definitions of a 1-in-200 – Andrew Newman
- Aid for arriving at a true 1-in-200 – John Campbell
- Modelling Dependency – Gladys Hoskins & Darren Farr

- Paper also covers
  - Generic ICA model structure & risks to be considered
  - Regulatory best practices
  - Literature review

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Introduction

What are we NOT going to talk about?

- The views expressed in this paper should be regarded as being our personal views and in particular, should not necessarily be regarded as being those of our employers.
- Rating Agency capital charges
- Individual entities' capital models

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Introduction

What do we want from you?

- Your opinions
- Your views
- Your thoughts
- Your comments
- Your observations

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What is a 1-in-200?

Definitions

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Definitions
Initial thoughts

- Probability theory is key in pricing insurance contracts
- Even more so in deriving distributions of outcomes
- Conceptual problems (human)
- Definitions - initial attempt to place into context

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Conventional Thinking

Reasonable foreseeable adverse events:

- Living memory 60-80 years
- Working memory 20-40 years
- Depends who you ask
- Traditional thinking of insurance capital
- MCR = best estimate plus a prudence

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Conventional Thinking

Size of Loss:

- Biggest loss expected to occur with 0.5% probability
- Exceedance probability akin to Cat model output
- Combination of events not considered, can extend idea to “Killer” scenario
- Correlations
- Useful check to capital modelling output
- Lloyd’s RDS model

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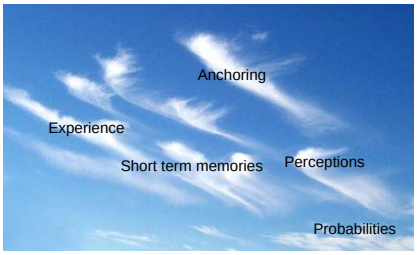
Behavioural Finance

Clouding the blue sky thinking…



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Definitions

1-in-200 Years

Sufficiently capitalised to withstand events of 199 out of next 200 years:

- Return periods of an event easy to conceptualise in principle, but…
  - Time changes everything
    - Environment
    - Technology
  - Biased by anchoring and past experience
  - Extremity of events for capital (Non-occurrence)
  - Combination of events

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Definitions

1-in-200 Companies

1-in-200 equally well-capitalised companies (relative to their risk) will fail over the next 1 year

- Ignores the systematic events impacting entire markets
- Global nature of business
- Failure of standalone risk assessment
- Change in dependency structures in extreme event
- Massive regulatory issue is inter company correlations

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Definitions
1-in-200 Chance

Capitalised to withstand the events of the next 1 year with a probability of 199 out of 200

- Up to date economic and risk environment
- Incorporate year and company definitions
- Holistic paradigm includes return period as well as systematic impacts, giving consideration to:
  - Common risk drivers
  - Extrapolation of reasonable foreseeable events
  - Size of loss

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What is a 1-in-200?
Aid

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Estimating a 1-in-200 position

1. Set expectations
   - Understand where a 1-10 or 1-20 loss may lie
     - Internal data
     - External data
     - Understand the business
     - Changes over time

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Estimating a 1-in-200 position

2. Choose the distribution
   - Consider the choice of a multi-modal distribution
   - Shift of the type of subjectivity inherent in the fit
3. Test expectations
   - RDS
   - External factors

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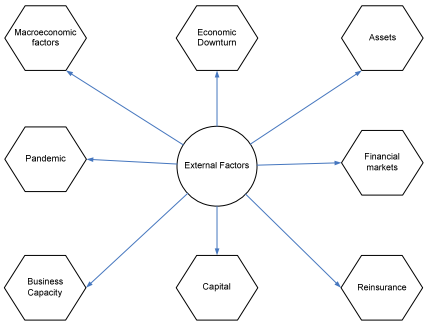
External factor considerations



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Estimating a 1-in-200 position

4. Recognise Contagion
   - Reinsurer failure
   - Capital market irrationality
   - Recession

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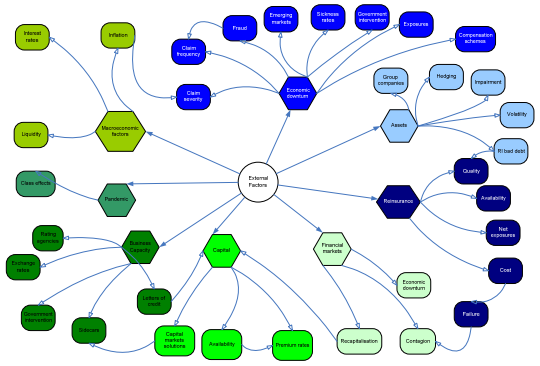

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Estimating a 1-in-200 position

5. Sense Checks
   - Input v Output
   - As if / Only if
   - ‘Pre-historic’ events
   - Scenario testing
   - Reverse scenario testing
   - How fast does the distribution tail off
6. Control Cycle

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What is a 1-in-200?

Modelling dependency

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Modelling dependency

- Interdependencies are one of the key drivers of the 1-in-200 year value.
- The model must find a robust way of dealing with such complex interdependencies.
- 4 approaches are considered:
  1. Linear correlation
  2. Copulas
  3. Cause & Effect
  4. Multi-state model

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Linear correlation

- PRO:
  - Relatively simple to create and explain.
- CONS:
  - Can't cope with one-way dependencies.
  - Insufficient data.
  - Large correlation matrix causes issues.
  - Can't handle tail-only dependencies.
  - 1-in-200 v 1-in-10 – problem with lack of linearity and level of correlation.

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Copulas

- PROS:
  - Non-linear cross-element correlations.
  - Mitigates issues with one-way & tail-only dependencies and extrapolation to 1 in 200.
- CONS:
  - Insufficient data even more of a problem.
  - Lack of transparency.
  - Loss of focus.
  - Computational challenge.

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"Cause & Effect" Model (1)

- PROS:
  - Draws out a number of 'common causes' and correlates risk types through the causes, rather than to each other.
  - Incorporates qualitative information.
  - Aids thought process.
  - One-way and tail dependencies.
  - More intuitive, so may be easier to explain.

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"Cause & Effect" Model (2)

- CONS:
  - Efficiency of estimates.
  - Potential 'causes'.
  - Loss of focus on extreme events.
  - More subjective.
  - Increased complexity.

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Multi-state model (1)

- CONCEPT
  - Two or more sets of distributions & correlation factors per risk element.
  - Each set associated with an external event / 'state'.
  - For each iteration simulate the state to determine the distributions and correlation set for that iteration.
  - Most iterations based on the main / 'benign' distribution set; remainder based on the alternative / 'extreme' distribution sets.
  - Thinking explicitly focussed on extreme events.

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Multi-state model (2)

- PROS:
  - As per the “Cause & Effect” model.
  - Transparent.
  - Focused on extreme shocks.
- CONS:
  - Highly subjective.
  - Is it Solvency II acceptable?

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Summary of approaches

	PROS	CONS
Linear correlation	Relatively simple to build	Too simplistic to explain complex dependencies
Copulas	Reduces issues with one-way & tail-only dependencies	Lack of transparency; determination of the family of copulas may be difficult
“Cause & effect”	More intuitive; incorporates qualitative information	Doesn’t necessarily focus on improving estimates of 1-in-200 year events
Multi-state model	Transparent; focused on extreme shocks	Highly subjective; is it Solvency II acceptable?

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Conclusion

In practice, a model may use a combination of these approaches to best capture the complex relationships between the different risk sources.

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