

# The Great 99.5<sup>th</sup> Percentile Swindle

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## Internal Model SCR

### What is it?

- The SCR represents a point from a near-flat area at the extreme of a skew distribution which itself represents the aggregation of numerous complex underlying skew distributions.
- The data available is inherently and unavoidably inadequate for the purpose of identifying and parameterising the underlying distributions and identifying and parameterising their dependency relationships. This is particularly problematic at the extremes.
- Expert judgment is applied due to the inadequacy of the data. Reliance on expert judgment is necessarily greater at the extremes.

## Internal Model SCR

### Article 101: Calculation of the SCR

1. The SCR shall be **calculated** in accordance with paragraphs 2 to 5
2. ....
3. [The SCR] shall correspond to the Value-at-Risk of the basic own funds of an insurance or reinsurance undertaking subject to a confidence level of 99.5% over a one-year period
4. ....
5. ....

## Internal Model SCR

### Definition of 'calculate'

#### ***cal-cu-late*** (Collins English Dictionary)

1. To solve by a mathematical procedure; compute.
2. To determine beforehand by judgment, reasoning, etc; estimate.
3. To design specifically; aim.
4. To depend; rely.
5. To suppose; think.

## Internal Model SCR Validation

- From CP56 (8.10):
  - “... the primary reason that supervisory authorities will require undertakings to take appropriate steps to validate that the internal model is appropriate for the calculation of regulatory capital is ...”
  - “... **to ensure** that the level of regulatory capital is not materially misstated ...”

## Data Data Quality

- Article 121(3) states:
  - “data used for the internal model **shall** be accurate, complete and appropriate”
- CP56 (5.177) defines these terms as follows.
  - **Accurate** refers to the degree of confidence that can be placed in the data. Data must be sufficiently accurate to avoid material distortion of the model output.
  - **Complete** means that the data provides comprehensive information for the undertaking.
  - **Appropriate** means that the data does not contain biases that make it unfit for purpose.

## Data

### Data Quality

- CP56 (5.184) gives a get out on data quality:  
“Expert judgment may be used to complement or substitute data ...”
- ... but then tells us (5.185):  
“Where expert judgment as complement to or substitute for data has a material impact, its use must be well-founded and is admissible only if its derivation and usage follows a scientific method, i.e.:
  - a. The expert judgment must be **falsifiable**, i.e. circumstances under which the expert judgment would be considered false can be clearly defined even though they may only be realised at a point in time far in the future”.
  - b. ...

## Data

### Expert Judgment

- It could have been much worse: from the original (pre-consultation) draft of CP56 (my italics):
  - “Under what conditions are undertakings **allowed to** supplement available data with expert judgment?” (5.126)
  - “CEIOPS recognises that **in a great many cases** expert judgment comes into play in model design, operation and validation” (5.159)
  - “Expert judgment shall have a known or potential **error rate**” (5.184)

## Expert Judgment Methodology

- Bootstrapping commonly used to quantify reserving risk
- The ROC/GIRO Reserving Uncertainty Working Party reports 2007/2008 suggested that the method underestimated the upper tail of the outstanding liabilities
- England/Cairns at GIRO 2009 refuted the ROC/GIRO Working Party analysis but still produced results that indicated upper tail could be underestimated
- Jessica Leong yesterday presented a backtesting analysis that suggested bootstrapping tended to significantly underestimate tails
- Are the actuaries using bootstrapping keeping up to date with the research?
- Do they understand the statistical subtleties of the method?

## Expert Judgment Parameterisation

- 'Best fit' methods lead to over-fitting
- Over-fitting leads to underestimation of variance
- If you are setting 100 parameters and testing to 95% confidence then, if the model is correct, on average five parameters should fail the test.
  - Using best fit methods, probably none will fail
  - Do you deliberately set some parameters so that fail?
  - If a parameter that did pass subsequently fails as new data emerges, when do you refit?

## Expert Judgment Dependencies

- CP56 tells us (5.253):
  - “Supervisory authorities shall be satisfied that the system of measuring and recognising diversification effects is adequate if, as a minimum, the undertaking:
    - ...
    - Provides support for the existence of **diversification effects**
    - ...
    - Takes into particular consideration extreme scenarios and **tail dependencies**
    - ...

## Expert Judgment Dependencies

- Modelling starting point:
  - Full independence, evidence dependence
- Regulatory starting point:
  - Full dependence, evidence diversification
- Experts starting from opposite ends of the spectrum may reach significantly varying conclusions on same data
- Need to focus on tail of distribution, but problem exacerbated in tail due to extreme scarcity of data.

## Expert Judgment

### Are Actuaries Really Experts?

- Have data, have models, have brains
- Horribly generalised and honourable exceptions, but:
  - Too little appreciation of the limitations of the data (information vs. noise)
  - Too little appreciation of the assumptions underlying and limitations of the statistical models being applied
  - Overconfidence in validity of expert judgments in areas of little or no experience (personal or real world for 1:200)
- Need much better training and more research in these areas
- Profession should take the lead

## Morris Review

### Background

- Set up in March 2004 to review the professional and regulatory framework within which actuaries operate
- Established in the aftermath of the collapse of Equitable Life and in the midst of various life and pensions mis-selling scandals
- General insurance included within scope

## Morris Review Reports

- Interim Assessment published December 2004: identified key issues and set out policy options
- Final Report published March 2005: summarised feedback to policy options and gave recommendations for change
- No link from 'The Actuarial Profession' website
- Now found in the HM Treasury section of "The National Archives"

[http://webarchive.nationalarchives.gov.uk/+http://hm-treasury.gov.uk/independent\\_reviews/morris\\_review/review\\_morris\\_index.cfm](http://webarchive.nationalarchives.gov.uk/+http://hm-treasury.gov.uk/independent_reviews/morris_review/review_morris_index.cfm)

## Morris Review Conclusions

- Interim Assessment, paragraph 1.17:
  - “... there is a clear sense in which too much has been expected of actuaries and, explicitly or otherwise, too much has been promised by them ...”
  - “ ... But it has repeatedly emerged that most of those involved have tended to avoid or resist clear presentation of the unavoidable risks inherent in assessment of an uncertain future ...”

## Morris Review Conclusions

- Interim Assessment, Paragraph 1.18:
  - ... clients have often sought the apparent comfort of a single point estimate of future outcomes ...
  - ... actuaries have often provided a very high degree of confidence to clients by reducing numerous elements of uncertainty to 'best' or point estimates ...
  - ... it is arguable that consumers have been reluctant to hear about, or to face up to these inherent risks and to an extent have acquiesced in such an approach ...
  - ... and the regulatory regime may well have contributed to this through emphasis on the need for specific figures to be calculated and presented in ways that encourage such confidence.

## The Actuarial Profession Strategy

- According to the strategy paper published June 2011:
- "Major elements of the proposed new strategy are:
  - ....
  - A greater presence in public affairs, speaking out on issues where the Institute or Faculty can contribute, raising public awareness of the work of actuaries and the value we add to society whilst working with government and others who shape policy"
  - A reinvigoration of learned society and thought leadership activities which is the life blood of our long term sustainability".

## Real Thought Leadership?

- John Kay, Financial Times, 2 March 2011  
“But today the modellers are in charge, not the poets. Like practitioners of alchemy and quack medicine, these modellers thrive on our desire to believe impossible things. But the search for objective means of controlling risks that can reliably be modelled externally is as fruitless as the quest to turn base metal into gold. Like the alchemists and the quacks, the risk modellers have created an industry whose intense technical debates with each other lead gullible outsiders to believe that this is a profession with genuine expertise”

## Real Thought Leadership?

- John Kay (continued).  
“We will succeed in managing risk better only when we come to recognise the limitations of formal modelling. Control of risk is almost entirely a matter of management competence, well-crafted incentives, robust structures and systems, and simplicity and transparency of design”.

## Conclusions

1. Regulatory capital is based on a figure that is impossible to calculate accurately to any meaningful level of confidence
2. The regulations are drafted in a way that promotes a misleading level of confidence in that regulatory capital figure.
3. Actuaries play a central role in the calculation of regulatory capital and have implicitly colluded in this charade. (Don't bite the hand that feeds).
4. The Profession seems to have learned nothing from previous failures. Same mistakes identified by Morris in 2004 being repeated with Solvency II.

## Actions

### What should Actuaries do?

- Investigate and understand the limitations of the data
- Understand the implications of the assumptions underlying methods used and the limitations of those methods
- Keep up to date with relevant research
- Ensure limitations of analysis are adequately communicated to users
- All of the above is required under Solvency II

## Actions

### What should Companies do?

- As little as possible at the extremes of the distribution as is necessary to get internal model approval.
- Not believe the results from the extremes of the distribution.
- Concentrate on design, parameterisation and use between the [5<sup>th</sup>] to [95<sup>th</sup>] percentile, where:
  - Data is more complete
  - History may be a guide
  - Expertise is more relevant
- It is in the central part of the distribution that models can provide valuable insights and, used correctly, add material commercial value.

## Actions

### What should The Profession do?

- Be proactive in performing in the public interest ...
- ... and also in the long-term interests of its members.
- Issue a statement setting out how actuaries can add value to the SCR but also making very clear the inherent impossibility of calculating the 99.5<sup>th</sup> percentile with confidence

## Actions

### What should The Profession do?

- Where regulation introduces a role that requires actuarial involvement ...
- ... Insist that the requirements are documented in language that clearly reflects the limitations of what actuaries can deliver.

## Actions

### What should The Profession do?

- Make its thought leadership claims meaningful
- Improve actuarial education to improve understanding of limitations of data, methods, etc. (practical application of the theory).
- Facilitate a programme of research to investigate and report on the implications of data and method limitations on standard actuarial techniques (deterministic and stochastic) and ensure results adequately communicated.

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