#SIASJun15

The Nature of Longevity Risk

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Demographic Risk Actuary, Partnership Assurance

9 June 2015

Agenda

- Conceptual Framework
- Systemic Behaviours
- Specific Behaviours
- Variation in Longevity Exposure

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Conceptual Framework

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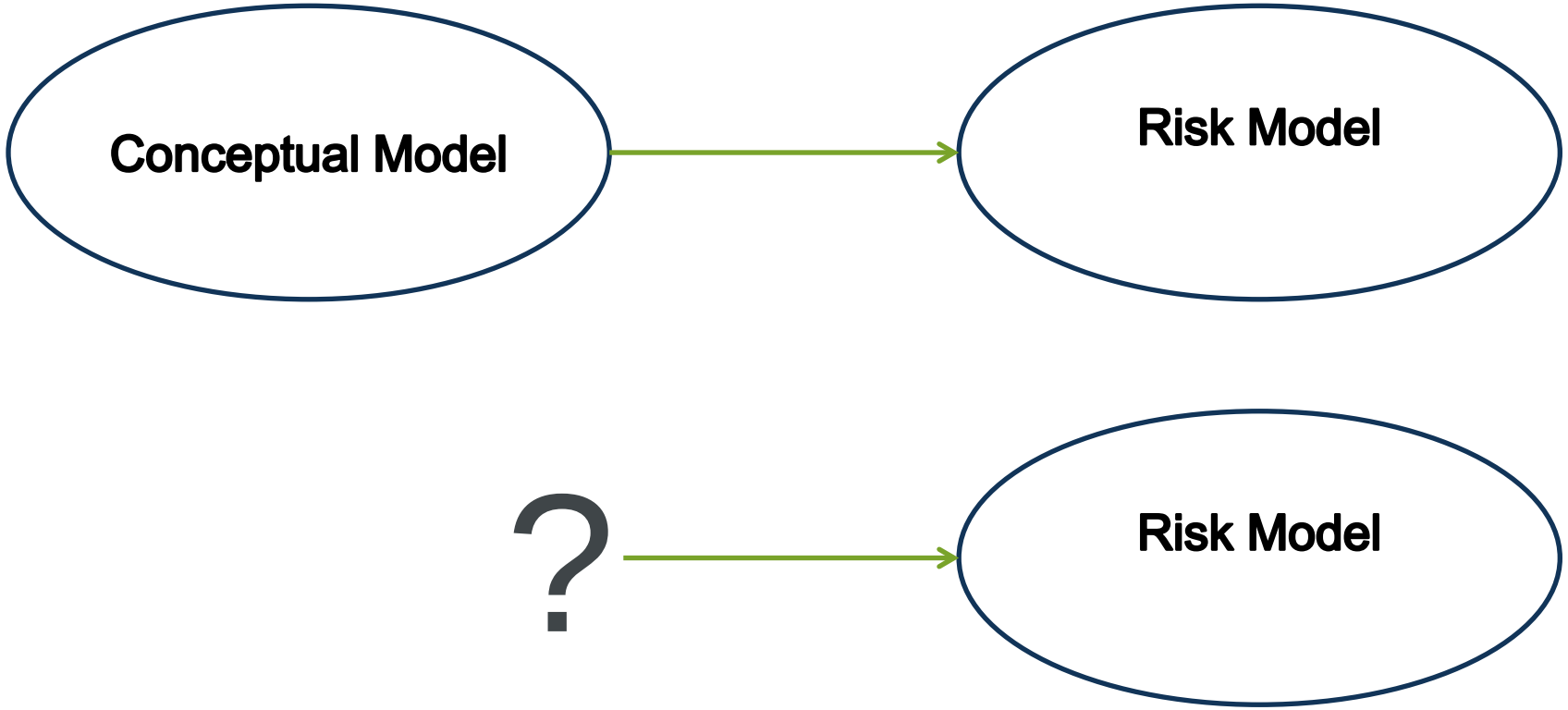
Why is a Conceptual Approach Important



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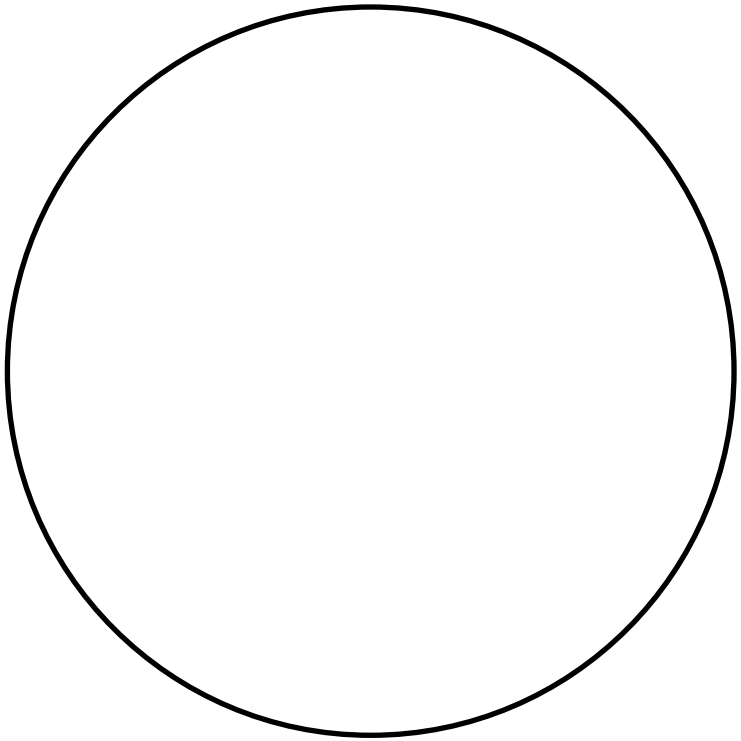
Longevity Risk Universe



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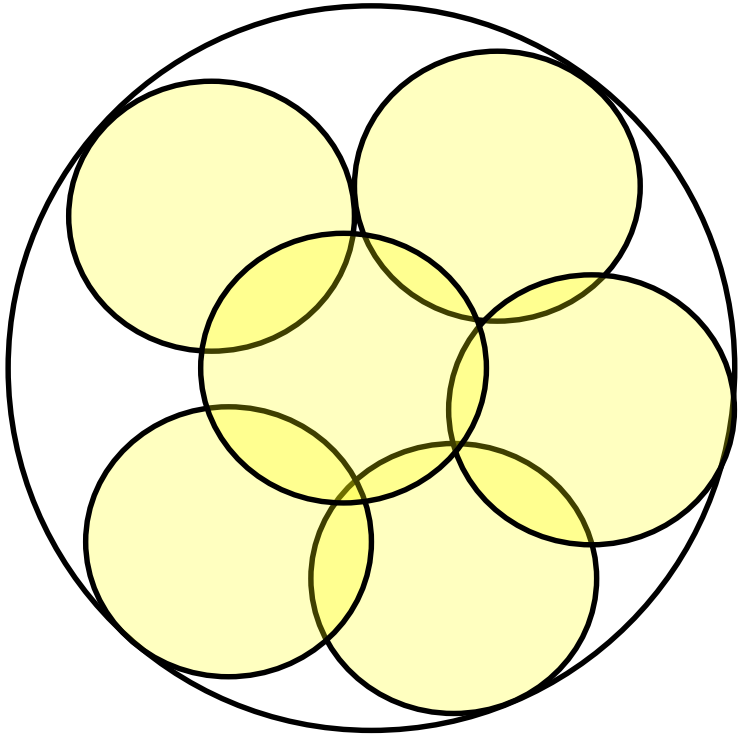
Direct Mathematical Approach



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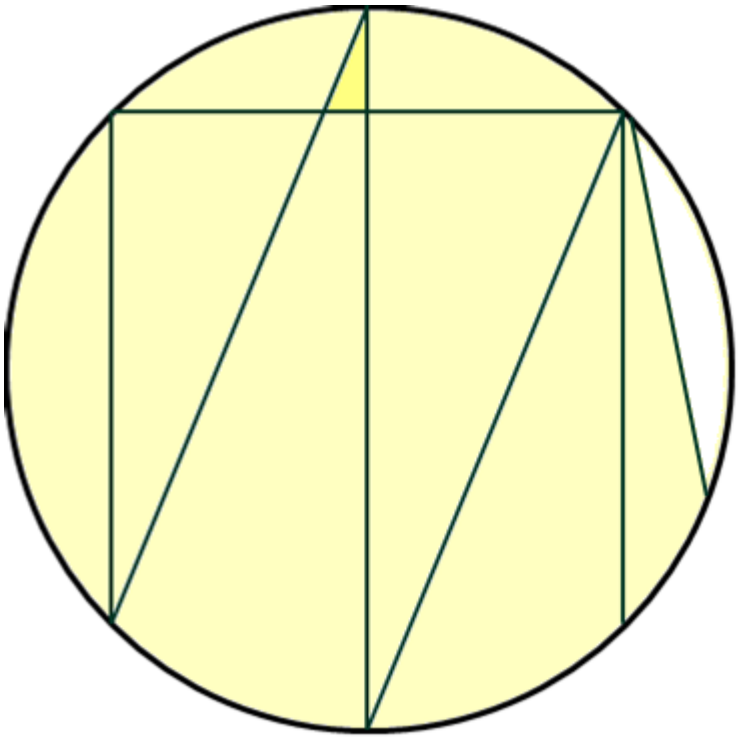
Conceptual Modelling Approach



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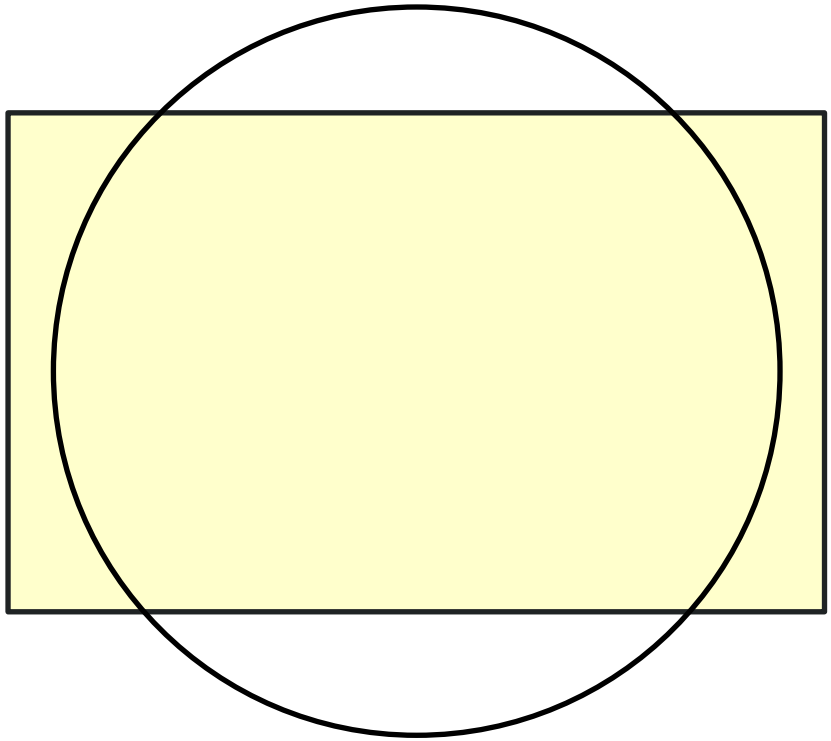
Overly Simplistic Approach



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Conceptual Framework

- Trend Uncertainty
- Trend Volatility
- Catastrophe
- Basis Risk
- Underwriting Risk
- Mis-estimation Risk
- Statistical Volatility

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Foundation Assumptions

- Uncertainty & Volatility
  - Uncertainty: the risk of getting the average wrong
  - Volatility: the risk of getting the average right, but being unlucky
- Systemic & Specific
  - Systemic: risk arising in the reference population
  - Specific: risk arising in the portfolio

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Division of Risk Behaviours

	Uncertainty in setting the "right" assumptions	**Volatility** in experience relative to the "right" assumptions
Systemic (or population risks)		
Specific (or portfolio risks)		

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Division of Risk Behaviours

	Uncertainty in setting the "right" assumptions	**Volatility** in experience relative to the "right" assumptions
Systemic (or population risks)	Trend Uncertainty	Trend Volatility
	Catastrophe	
Specific (or portfolio risks)	Mis-Estimation Basis Underwriting	Volatility

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Systemic Behaviours

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Systemic Longevity Risk

Trend Uncertainty	Uncertainty in the trend of mortality improvements
Trend Volatility	Volatility in the trend of mortality improvements
Catastrophe	A “catastrophic shift” in mortality rates

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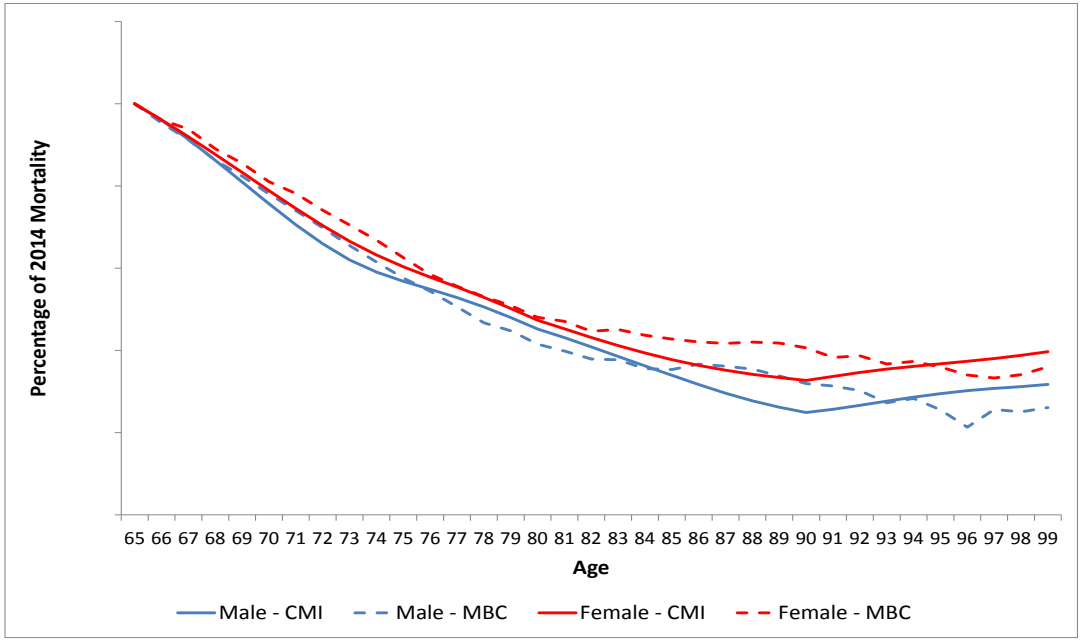
Trend Uncertainty

Trend uncertainty is the risk relating to the ability to predict mortality rates in the future as mortality is influenced by a range of drivers such as:

- Development in medical treatments
- Lifestyle factors
- Economic circumstances
- Public policy
- Etc . . .



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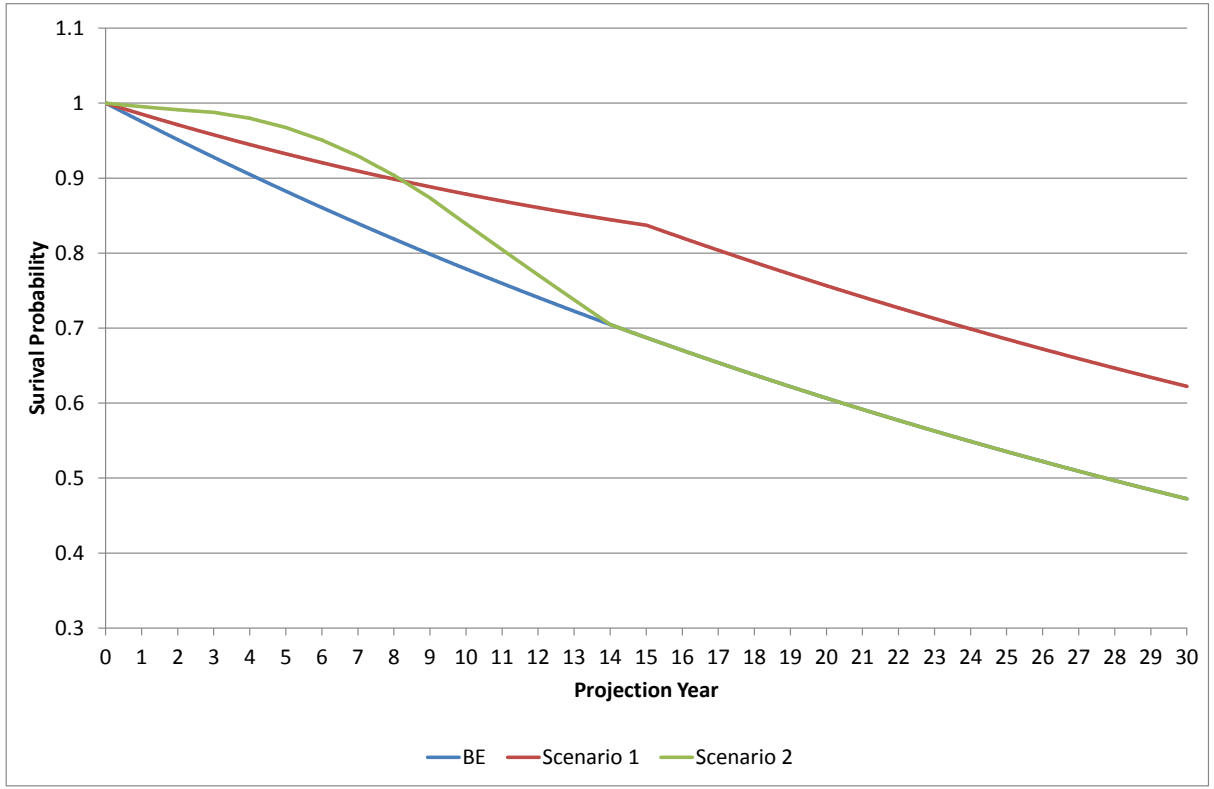
Trend Volatility

Two Scenarios:

1. The survival curve is shifted to the right – permanent increase in LE
2. The future survival curve is unchanged after the period of volatility – temporary increase in LE



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Catastrophe

???

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Catastrophe

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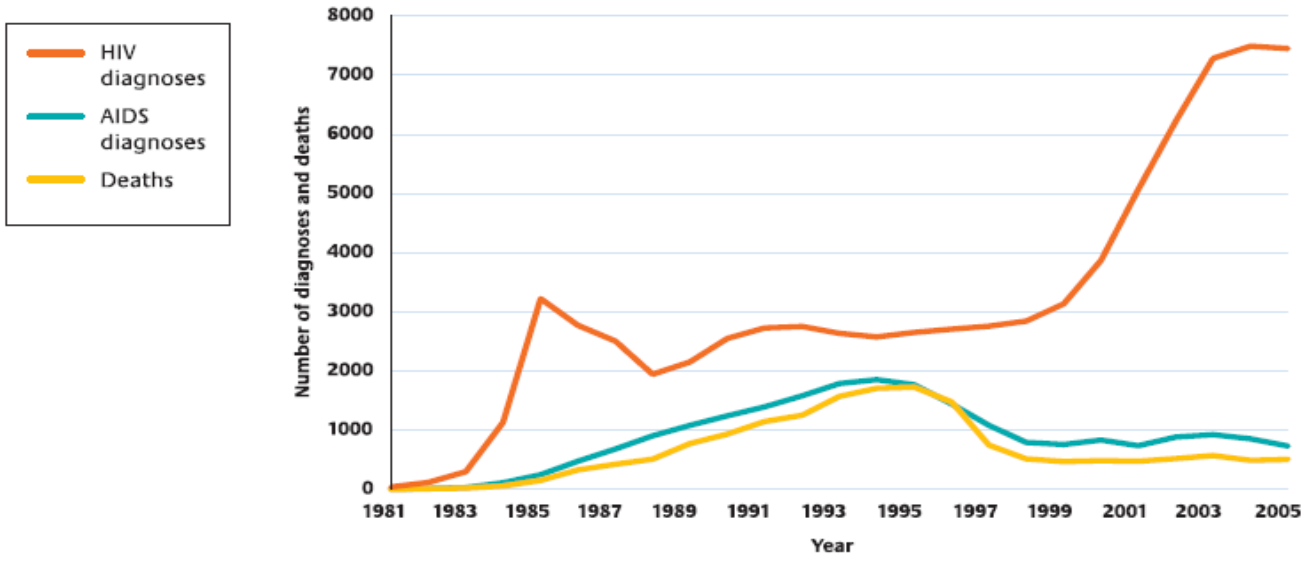
HIV and AIDS in 1990s

Figure 2.2: HIV and AIDS diagnoses and deaths in HIV-infected people, United Kingdom: 1981 to 2005[1]



[1] Numbers will rise, for recent years, as further reports are received.

Data source: HIV/AIDS and death reports. Reports received by the end of September 2006.

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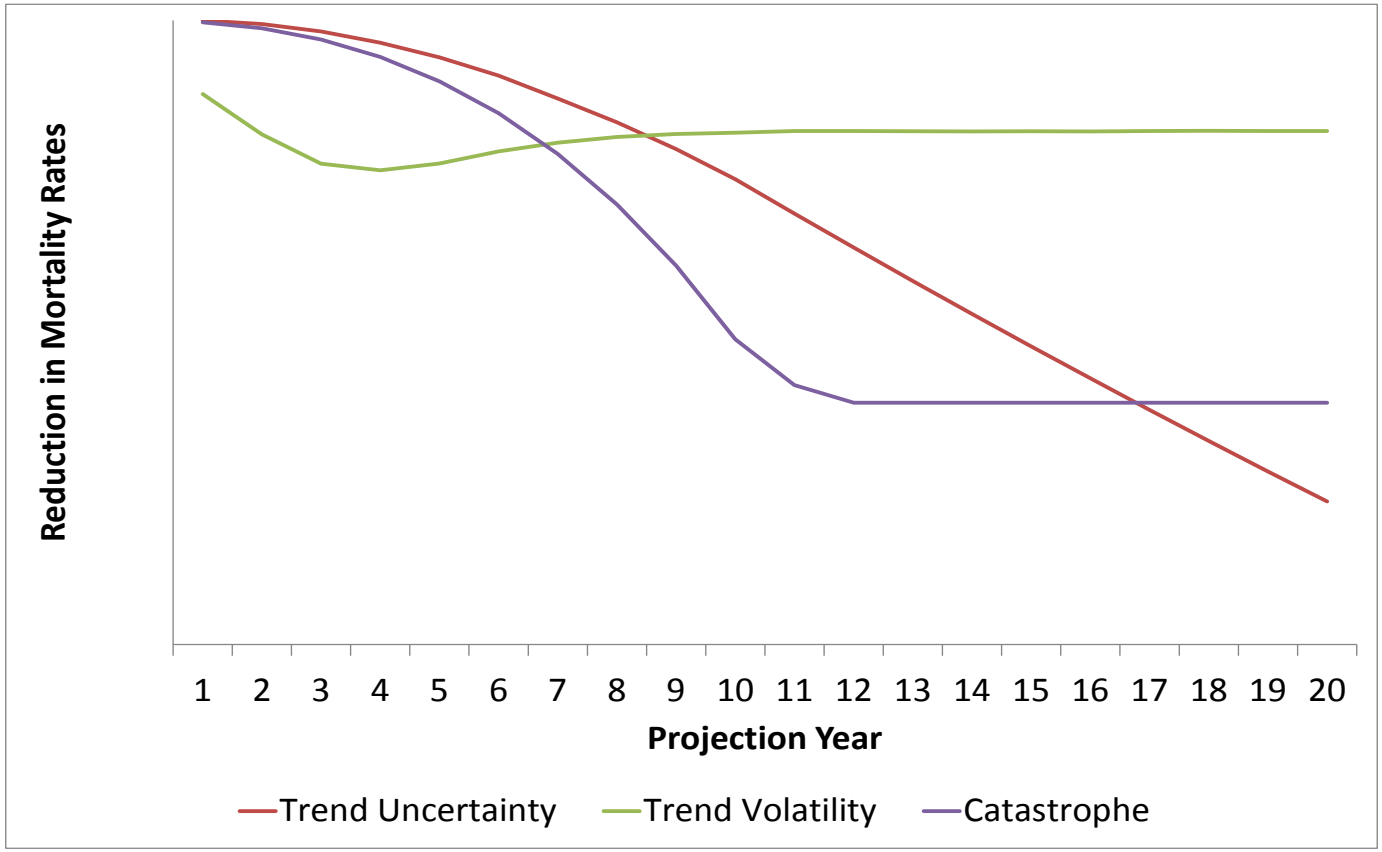
Comparison of Systemic Shapes



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Specific Behaviours

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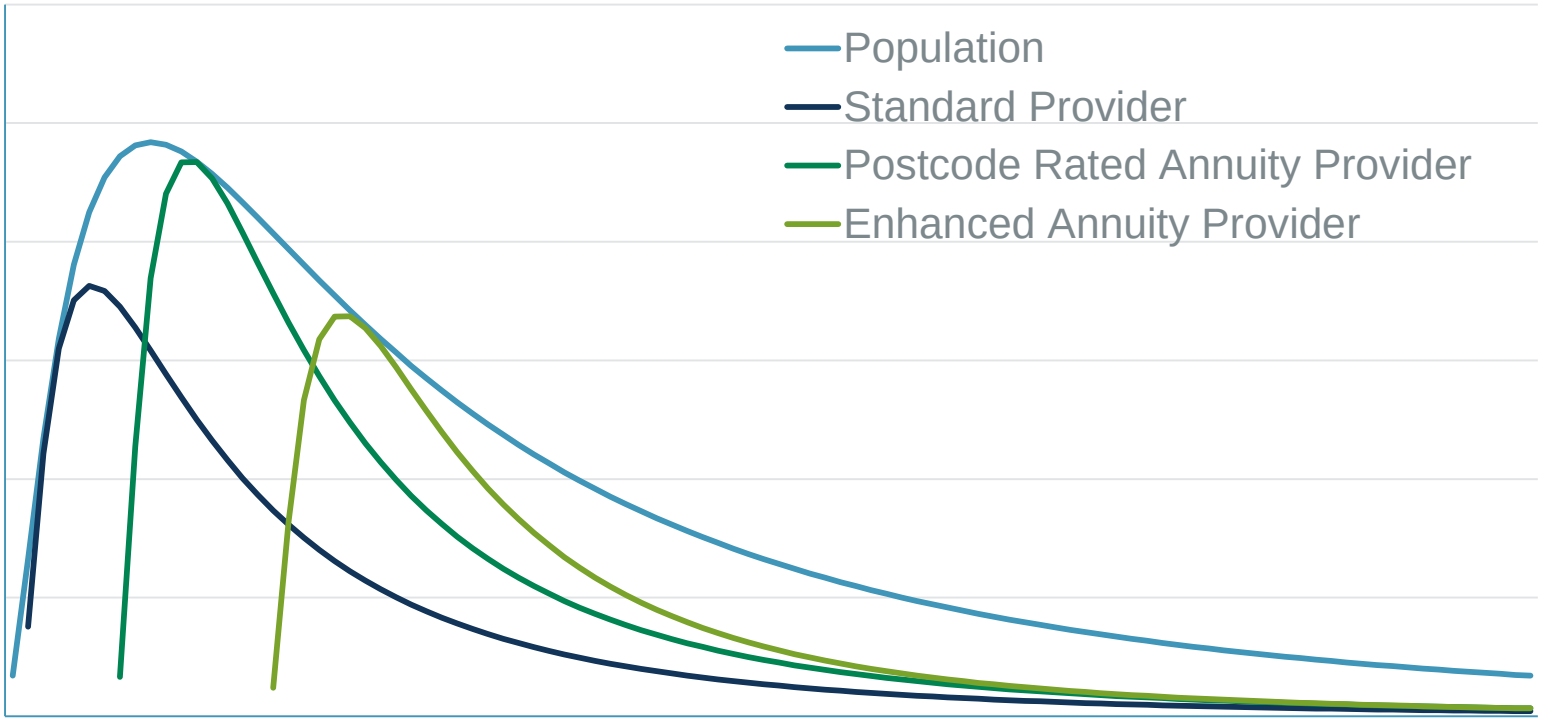
Provider Variation



Increasing number of years of life lost

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Managing Longevity Risk

Longevity Risk is managed using information from three source:

- External mortality experience or related analysis from a reference population
  - E.g. base tables, trend assumptions, postcode rating, scheme rating, etc
- Individual life information
  - Medical underwriting, lifestyle underwriting, etc
- Past mortality experience of the portfolio

This leads to residual risks . . .

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Specific Longevity Risk

Mis-estimation	Statistical error in the calibration of the mortality basis to past experience
Basis	Uncertainty in the assumptions drawn from “external” experience
Underwriting	Uncertainty in the assumptions from specific information by the individual
Volatility	Random chance of portfolio deaths

These are portfolio specific and will vary by the nature of the annuity provider

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Specific Longevity Risk

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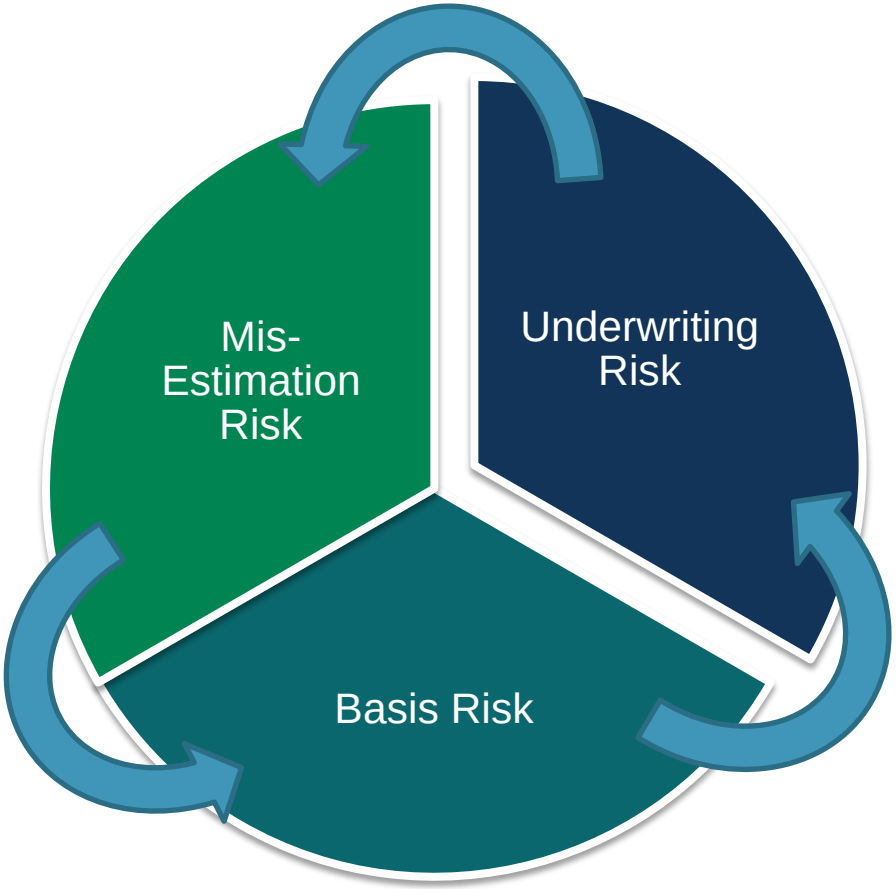
Specific Longevity Risk



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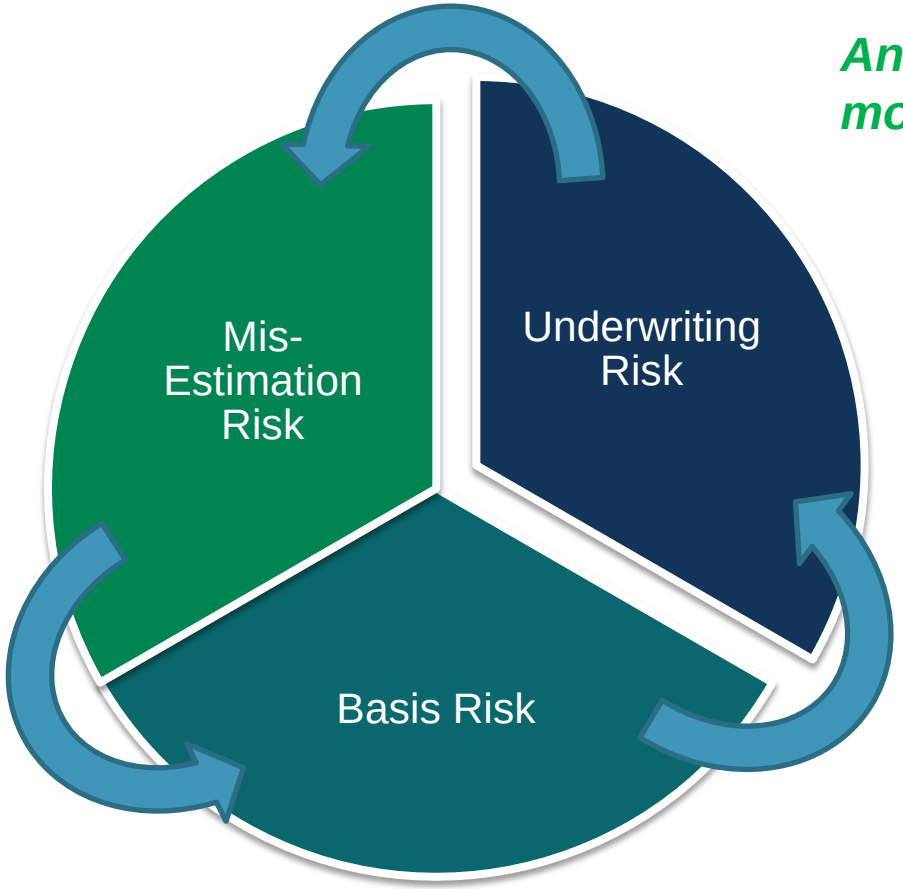
Specific Longevity Risk



And don't forget the model risk!

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Basis Risk

- Relevance
- Heterogeneity
- Selection Risk
- Survivorship Bias
- Risk Factor Weighting Bias

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Basis Risk

- Relevance
- Heterogeneity
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- Survivorship Bias
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- Level
- Trend
- Shape
- Model

. . . All add up to the assumptions not being appropriate to the lives they are being applied to

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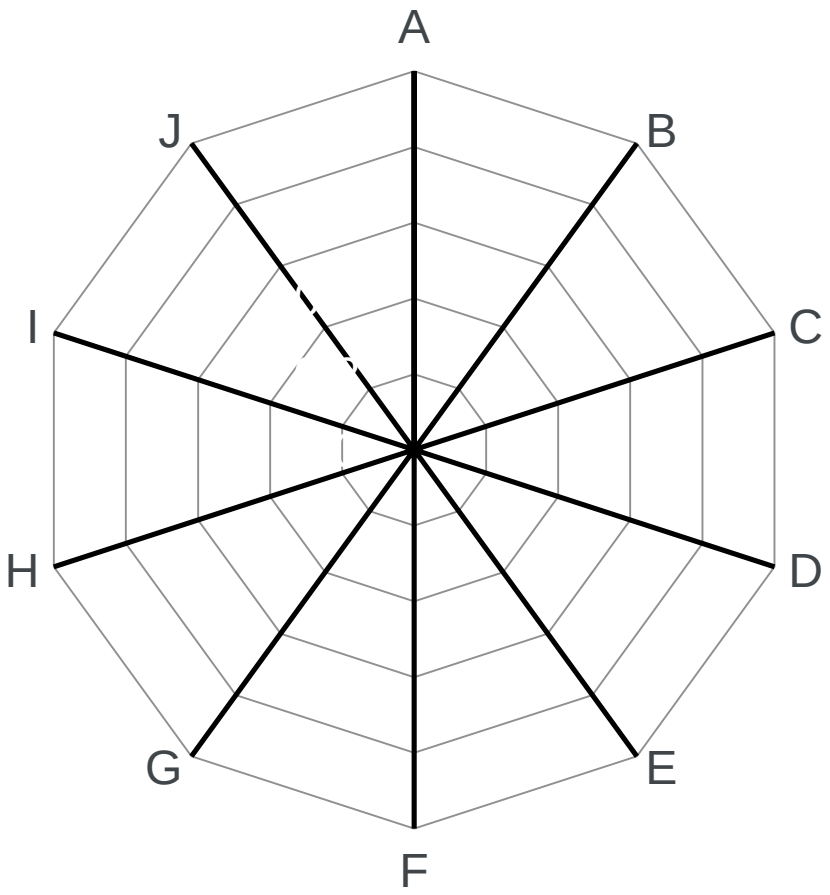
Mis-Estimation Risk

- Parameter
- Model

Relevance, whilst a basis risk, is a critical aspect of utilising past experience

Credibility of Experience



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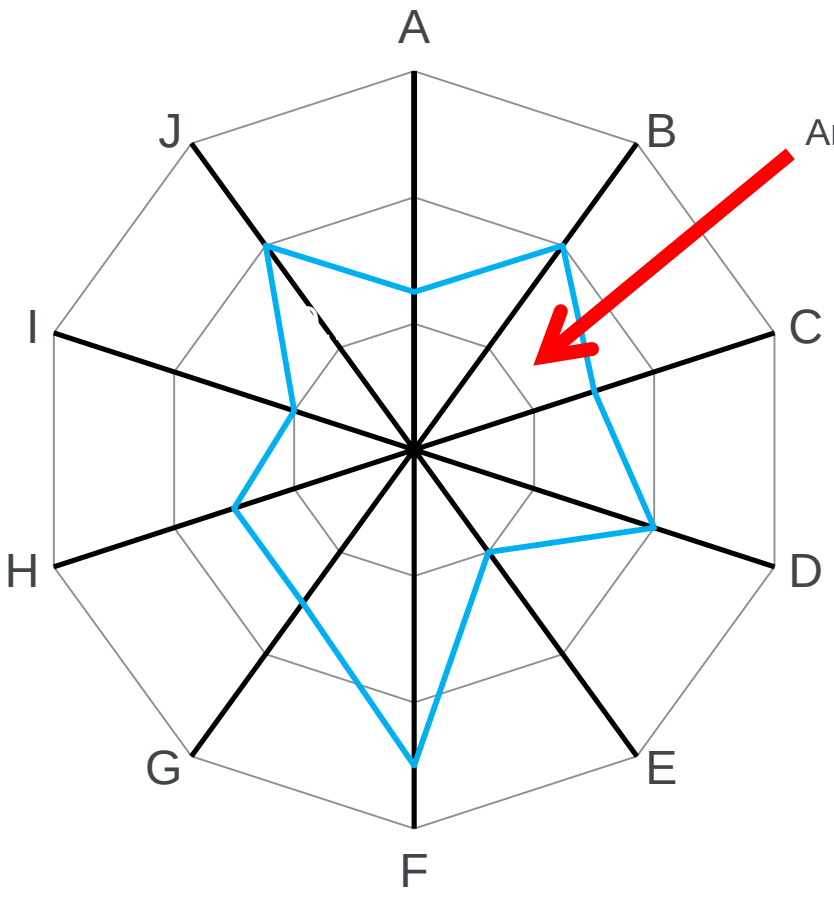
Credibility of Experience



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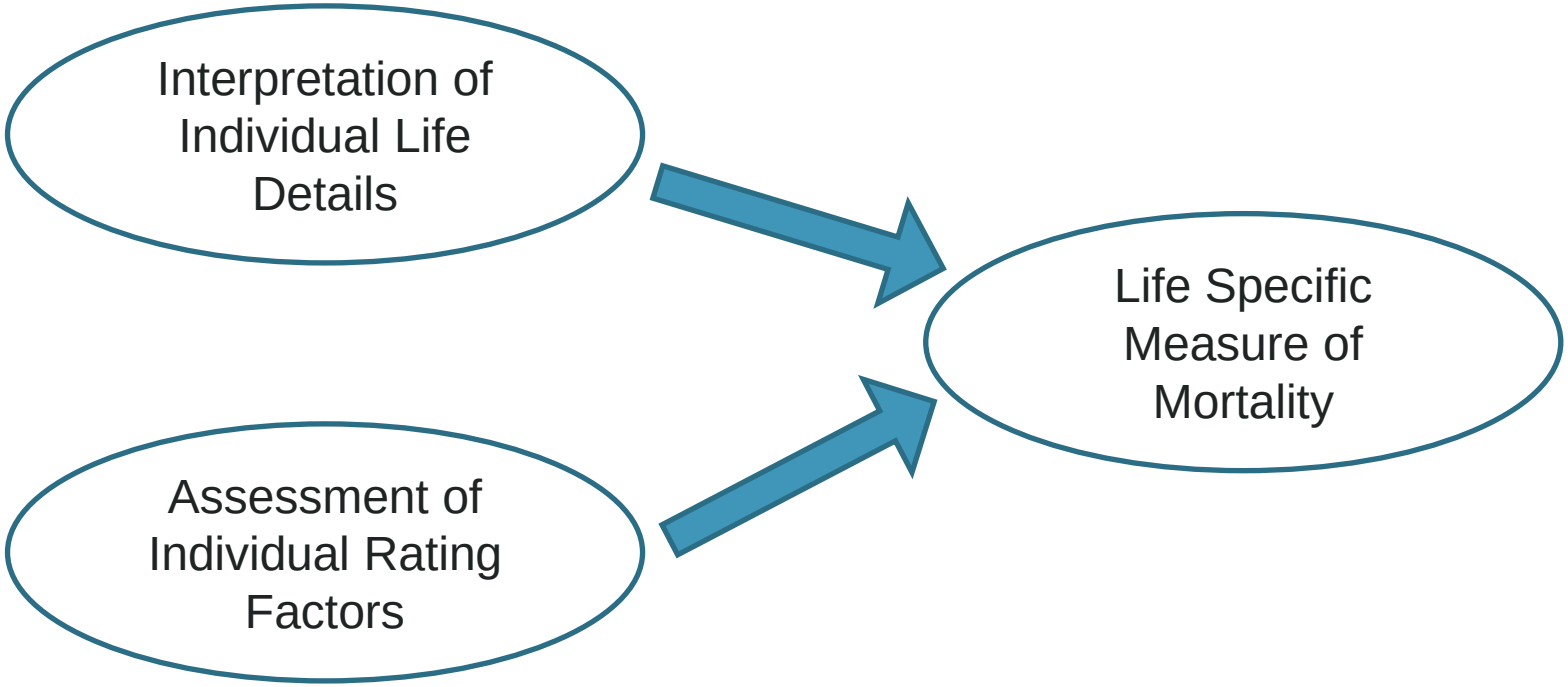
Underwriting Risk



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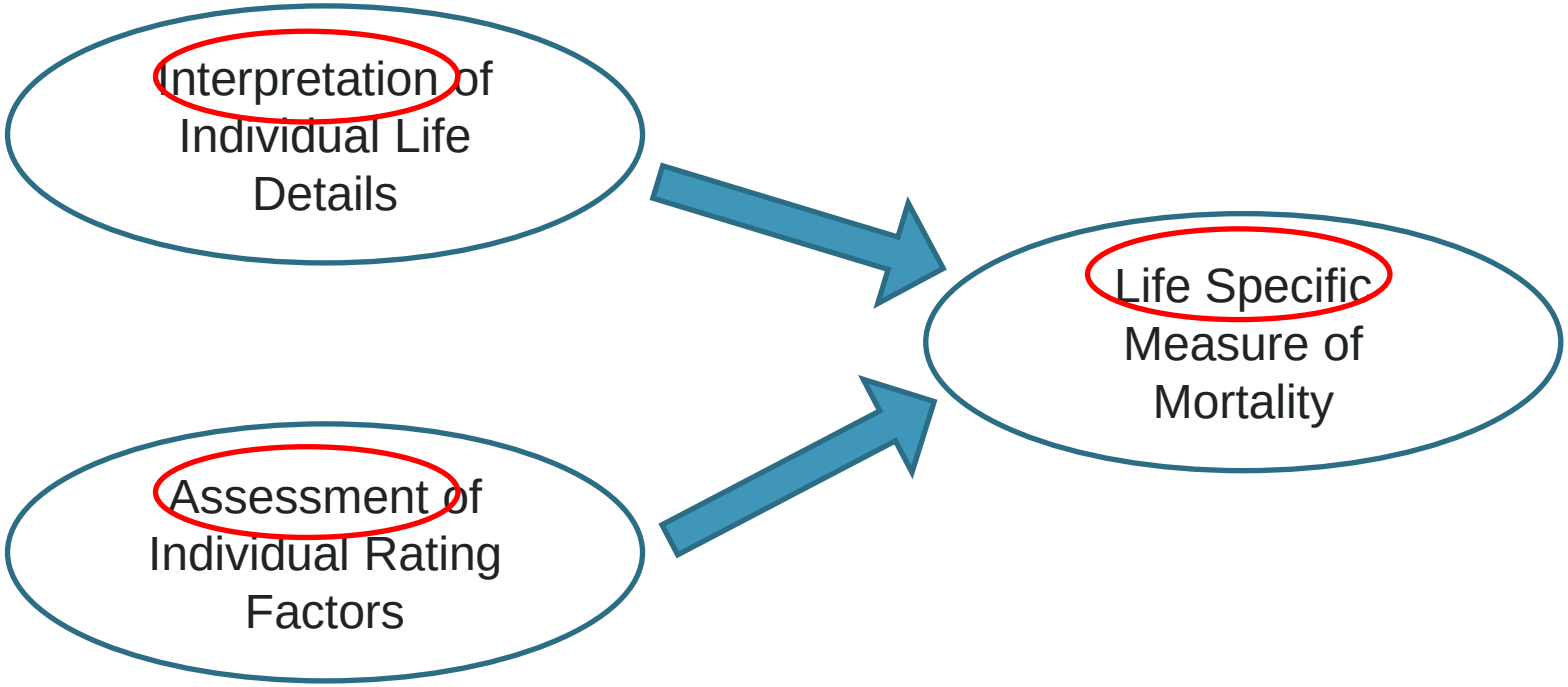
Underwriting Risk



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Underwriting Risk

- Starting Point
- Trends in Risk Factor Effect
- Data Quality & Reporting Bias
- Relevance

Underwriting Risk

- Starting Point
- Trends in Risk Factor Effect
- Data Quality & Reporting Bias
- Relevance

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Comparison of Frameworks

<table>
<tr><th>IAA Risk Behaviours</th><th>Richards Risk Behaviours</th><th>Proposed Risk Behaviours</th></tr>
<tr><td>Volatility</td><td>Idiosyncratic</td><td>Statistical Volatility</td></tr>
<tr><td>Catastrophe</td><td rowspan="2">N/a</td><td rowspan="2">Catastrophe</td></tr>
<tr><td rowspan="4">Trend Uncertainty</td></tr>
<tr><td>Volatility</td><td rowspan="2">Trend Volatility</td></tr>
<tr><td rowspan="2">Trend</td></tr>
<tr><td rowspan="2">Trend Uncertainty</td></tr>
<tr><td>Model</td></tr>
<tr><td rowspan="3">Level Uncertainty</td><td rowspan="2">Basis</td><td rowspan="2">Basis</td></tr>
<tr><td>Mis-estimation</td><td>Mis-estimation</td></tr>
<tr><td>N/a</td><td>Underwriting</td></tr>
</table>

Sources:
A Global Framework for Insurer Solvency Assessment,
A value-at-risk framework for longevity trend risk, Richards, Currie and Ritchie, 2012

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Variation in Longevity Risk

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Variation in Longevity Risk

- Mortality Rating Approach
- Credibility of Experience
- Size of Portfolio
- And many others!

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Mortality Rating Approach

- “Standard” provider;
  - no account is taken of the mortality differences resulting health status or geographical location and the mortality basis is likely to be a modified base and trend.
- Postcode rating provider;
  - account is taken of the geographical variation as a proxy for health and socio-economic variation.
- Underwriting provider;
  - account is taken of individual health status

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Insurance Company Example (1)

- Time 1 – Company A buys an annuity company (with existing liability and active in the market)
  - comes with no experience and limited policy holder information (dob, gender, postcode, premium).
  - assumptions are derived from external sources of information
- Time 2 – Adopts an underwriting approach
  - For all lives (past and new) medical information is available to base the mortality assumptions on.
- Time 3 – Underwriting assumptions are experience rated
- Time 4 – Externally derived assumptions are experience rated

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Insurance Company Example (2)

Risk	Time 1	Time 2	Time 3	Time4
Population	50	50	50	50
Volatility	10	10	10	10
Basis	60	30	30	20
Underwriting	0	30	20	20
Mis-estimation	0	0	10	20
Total	120	120	120	120

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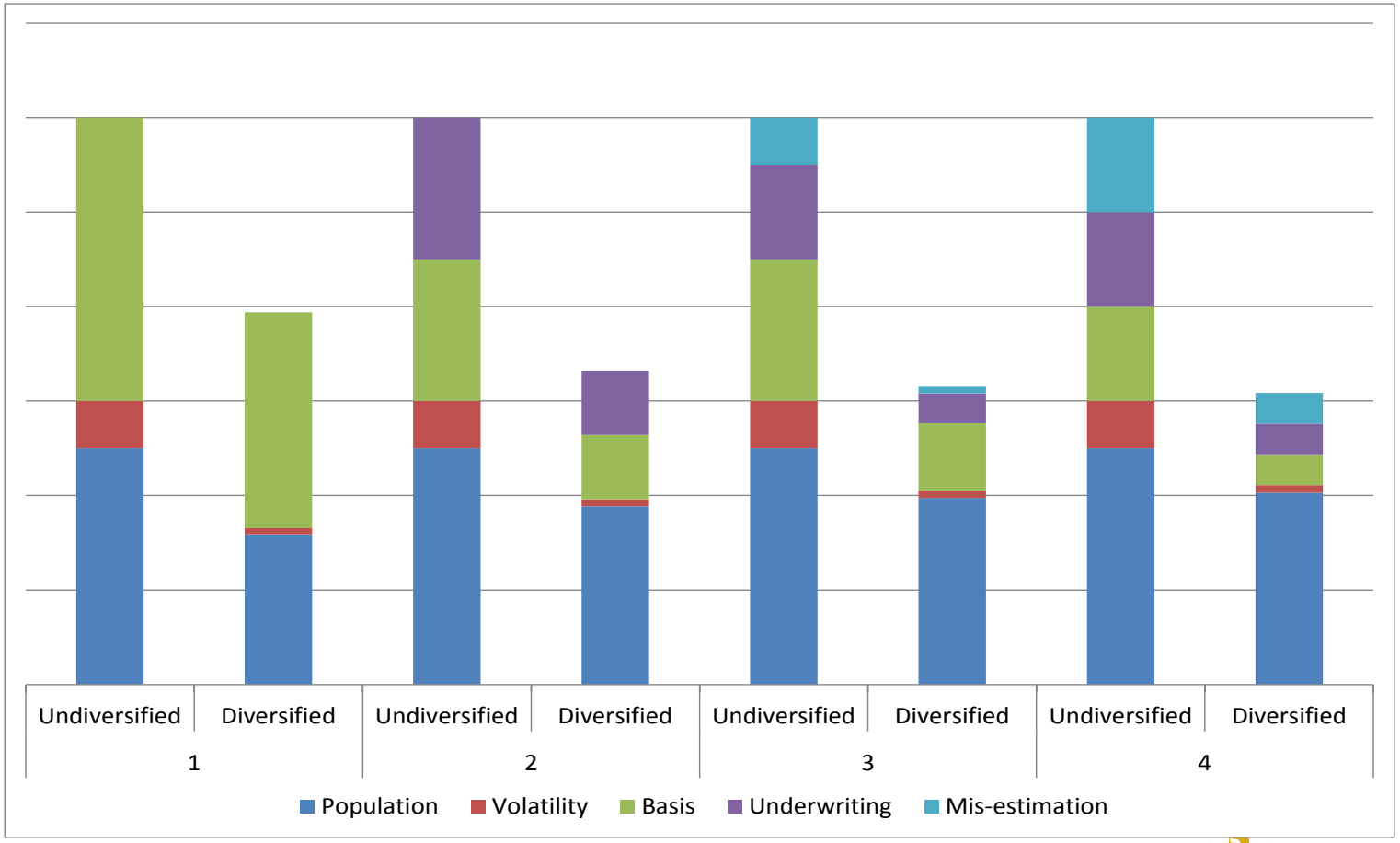
Insurance Company Example (3)



Diversified calculated using the Euler Method assuming independence

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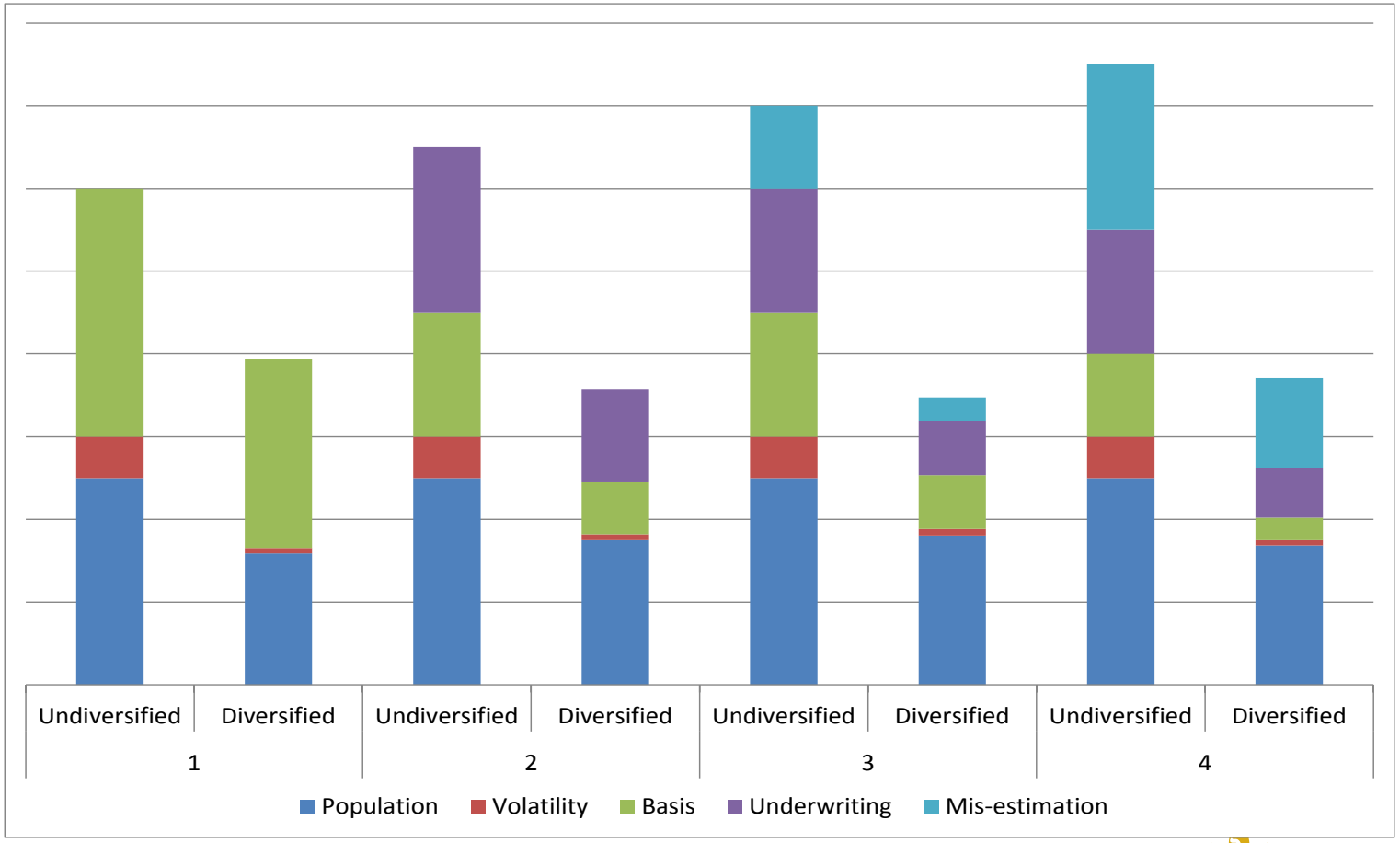
Insurance Company Example (4)



Diversified calculated using the Euler Method assuming independence

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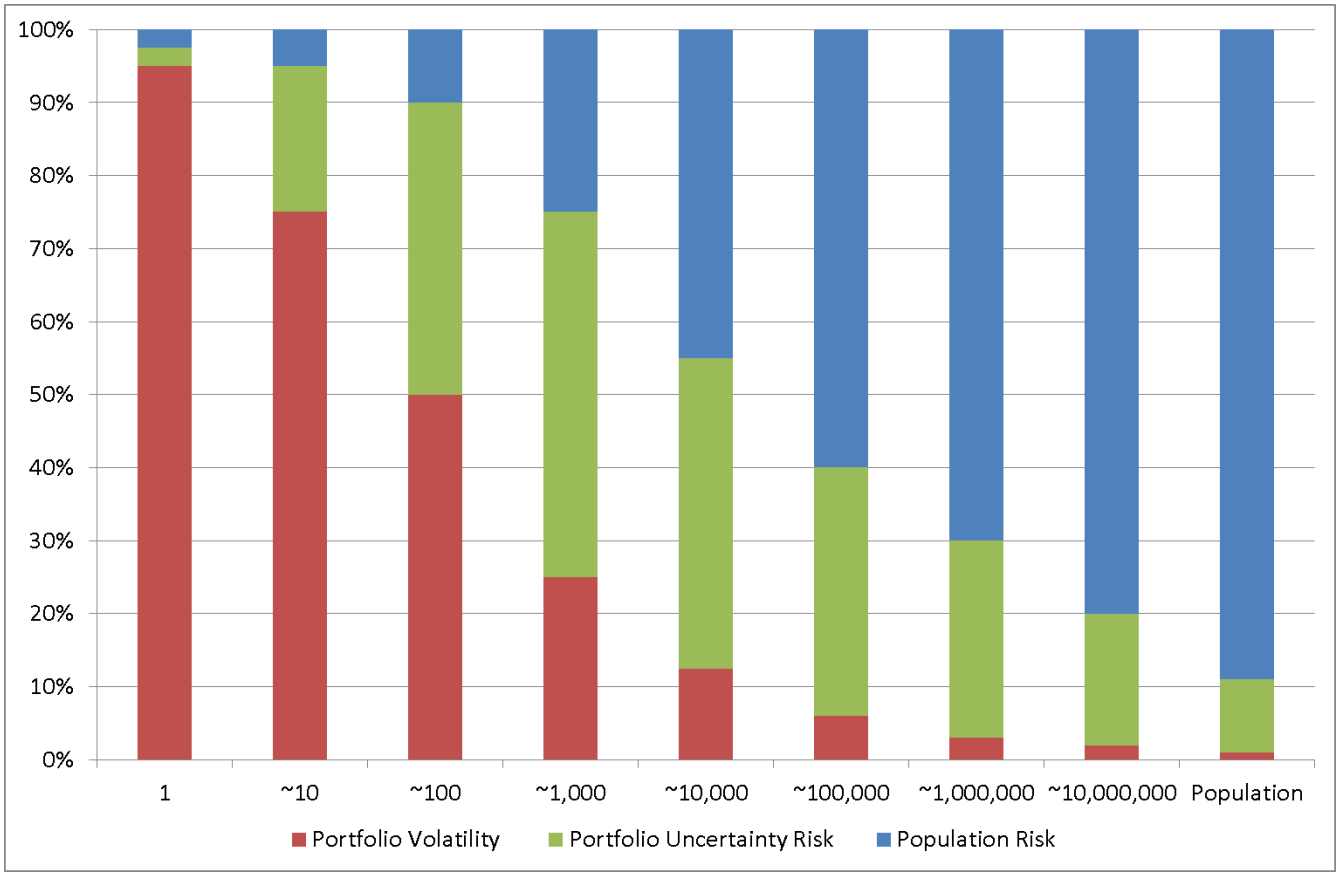
Size of Portfolio



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Final Thoughts

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Summing up . . .

- A conceptual framework can lead to stronger risk management and better decision making
- More longevity risk than is appreciated – primarily for reasons of selection and the risk management approach (specifically the information used and the reliability of the approach)
- Key Point – focus should be on understanding the longevity risk and then the mathematical modelling
- NO ONE RIGHT ANSWER

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Questions

Comments

Expressions of individual views by members of the Institute and Faculty of Actuaries and its staff are encouraged.

The views expressed in this presentation are those of the presenter.

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