



Institute
and Faculty
of Actuaries

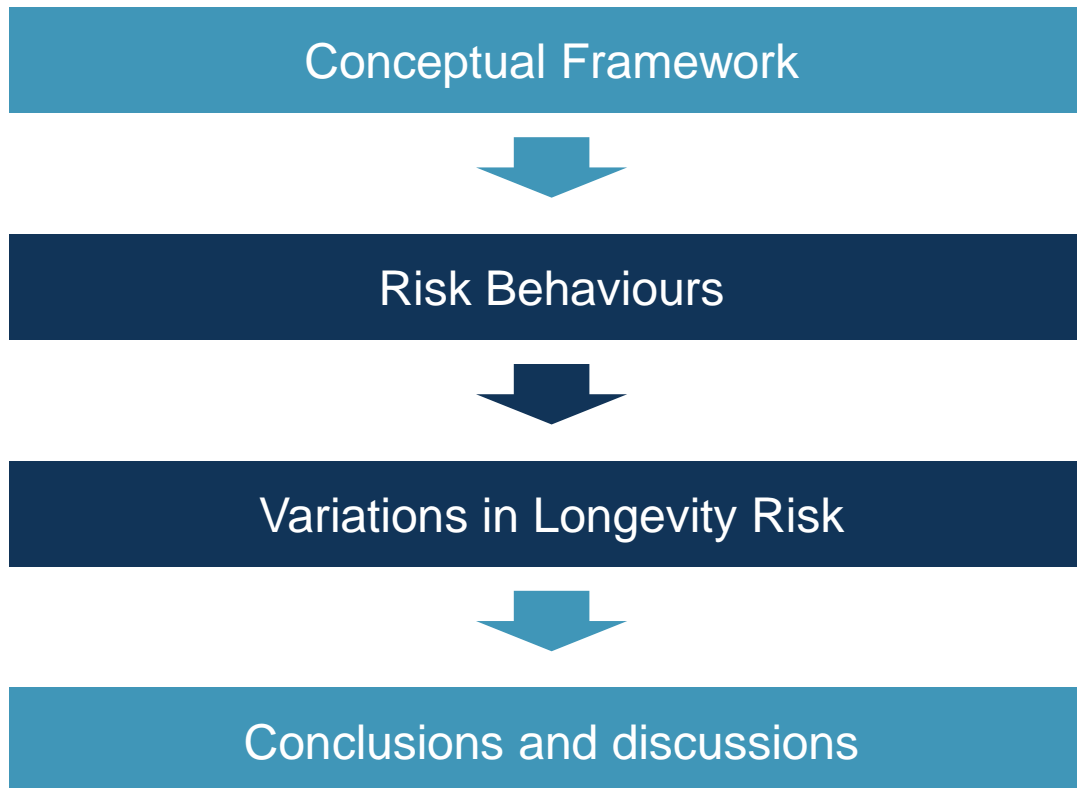
B3: Nature of Longevity and its Behaviours

Sacha Dhamani

Demographic Risk Actuary, Partnership Assurance



Agenda

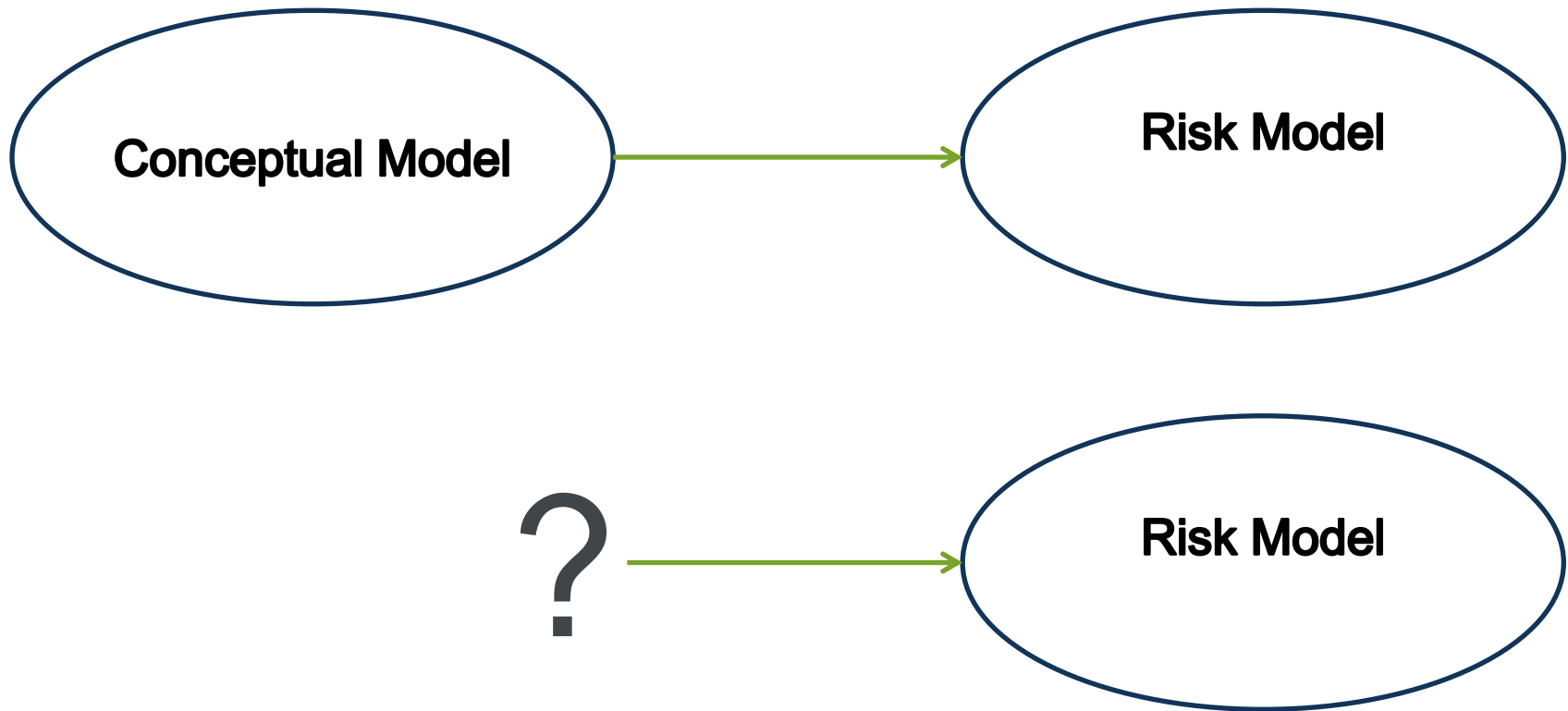


Conceptual Framework

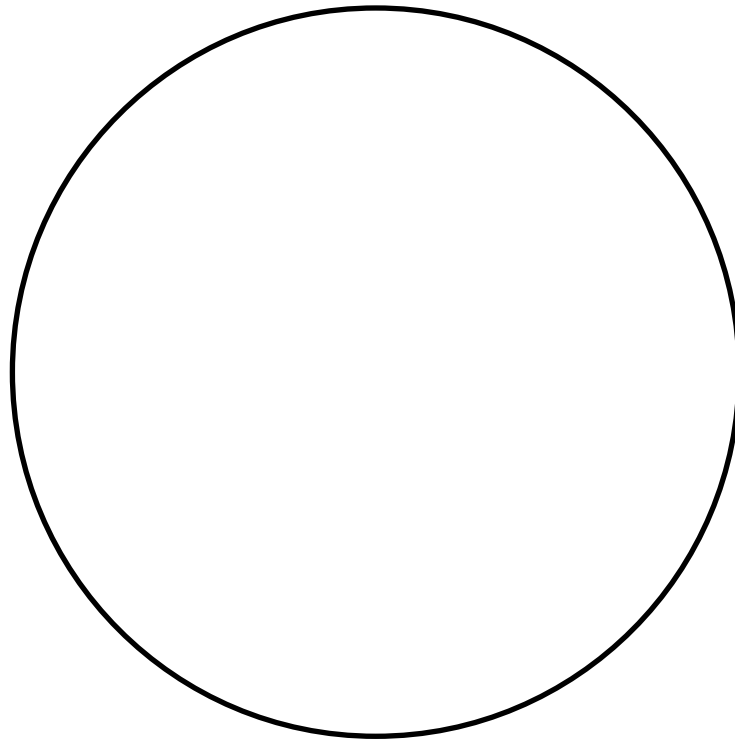


Institute
and Faculty
of Actuaries

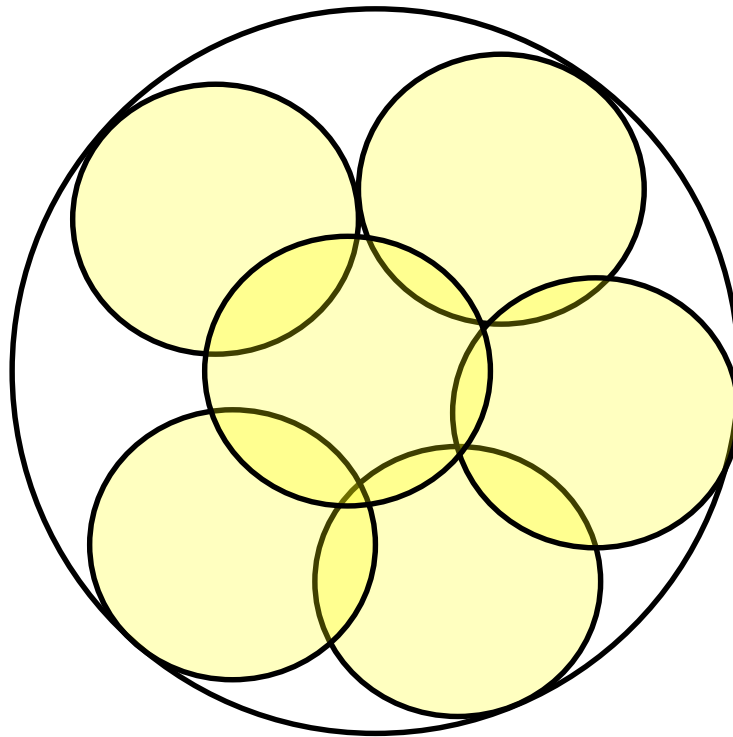
Why is a Conceptual Approach Important



Longevity Risk Universe

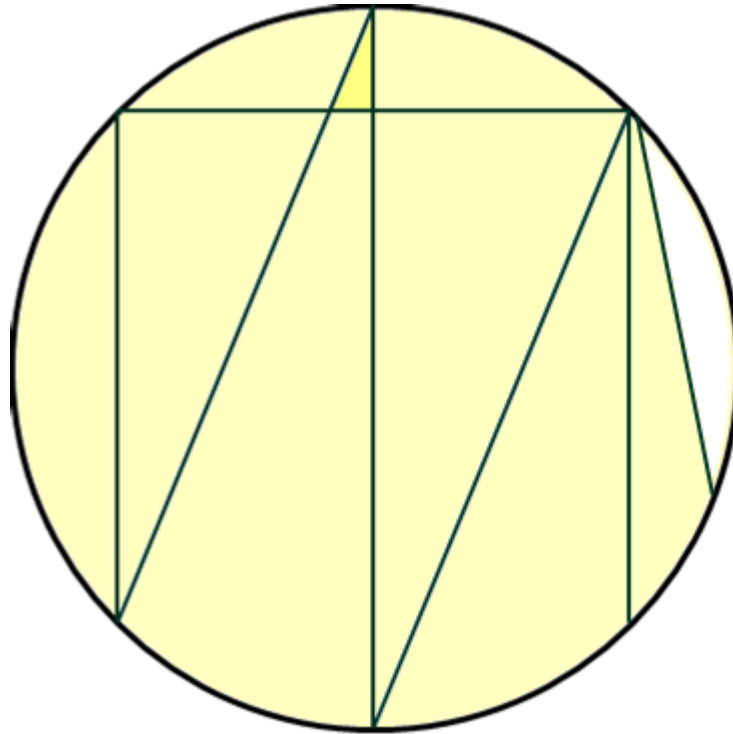


Direct Mathematical Approach



Institute
and Faculty
of Actuaries

Conceptual Modelling Approach



Institute
and Faculty
of Actuaries

Conceptual Framework

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



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



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)		



Institute
and Faculty
of Actuaries

Division of Risk Behaviours

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



Risk Behaviours



Institute
and Faculty
of Actuaries

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

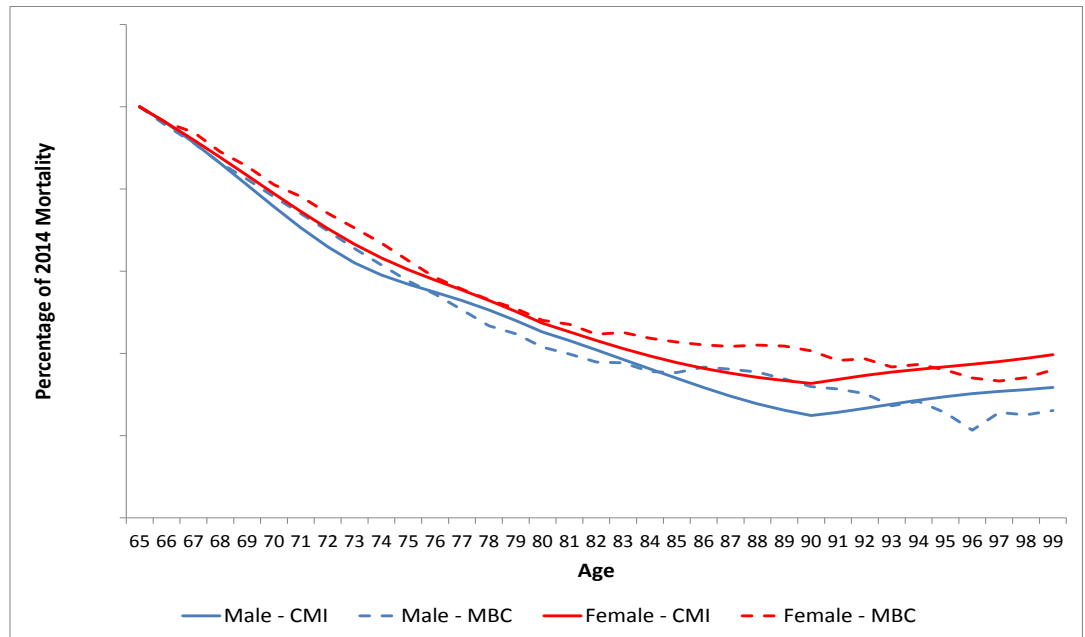


Institute
and Faculty
of Actuaries

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 . . .

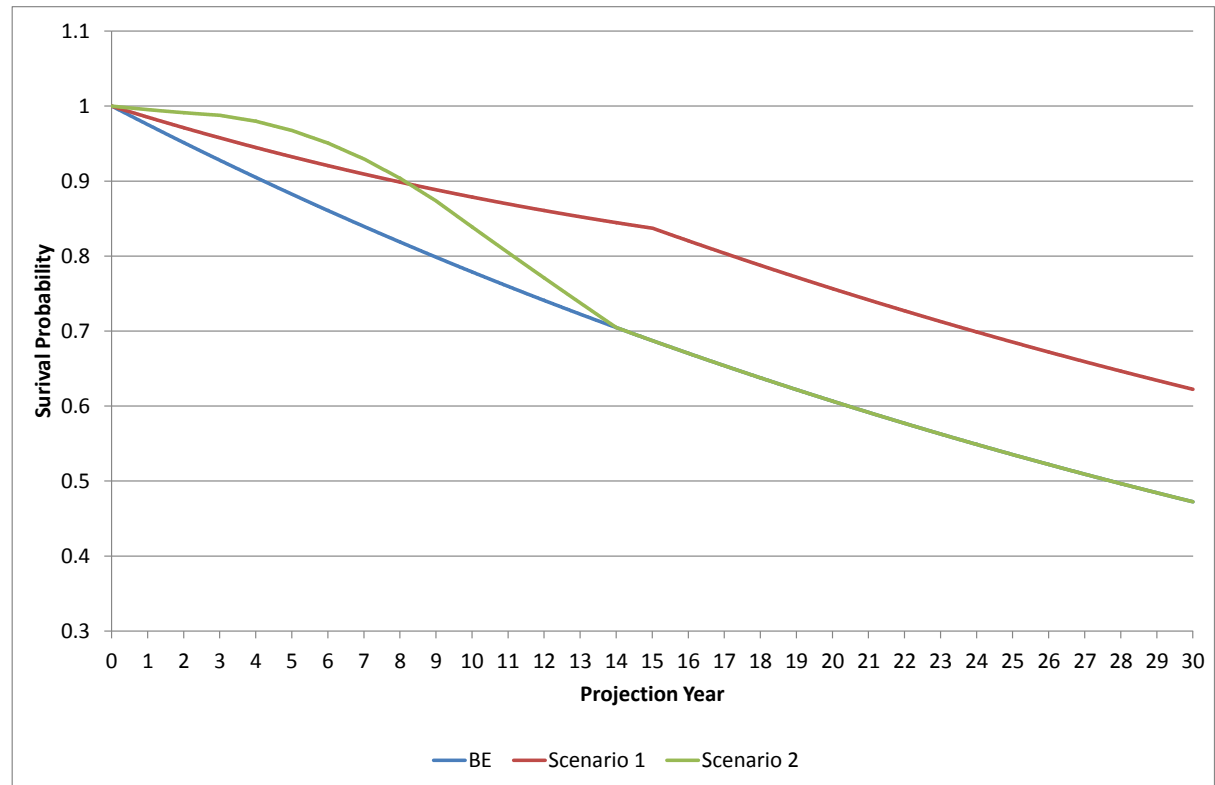


Institute
and Faculty
of Actuaries

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



Institute
and Faculty
of Actuaries

Catastrophe



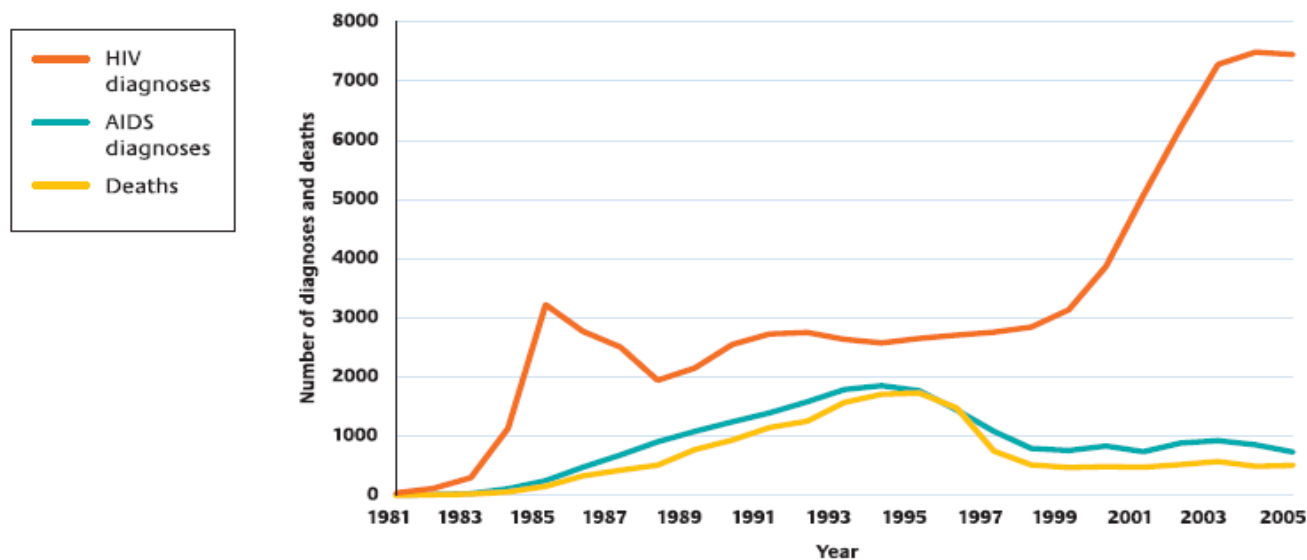
Catastrophe



Institute
and Faculty
of Actuaries

HIV and AIDS in 1990s

Figure 2.2: HIV and AIDS diagnoses and deaths in HIV-infected people, United Kingdom: 1981 to 2005¹



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.



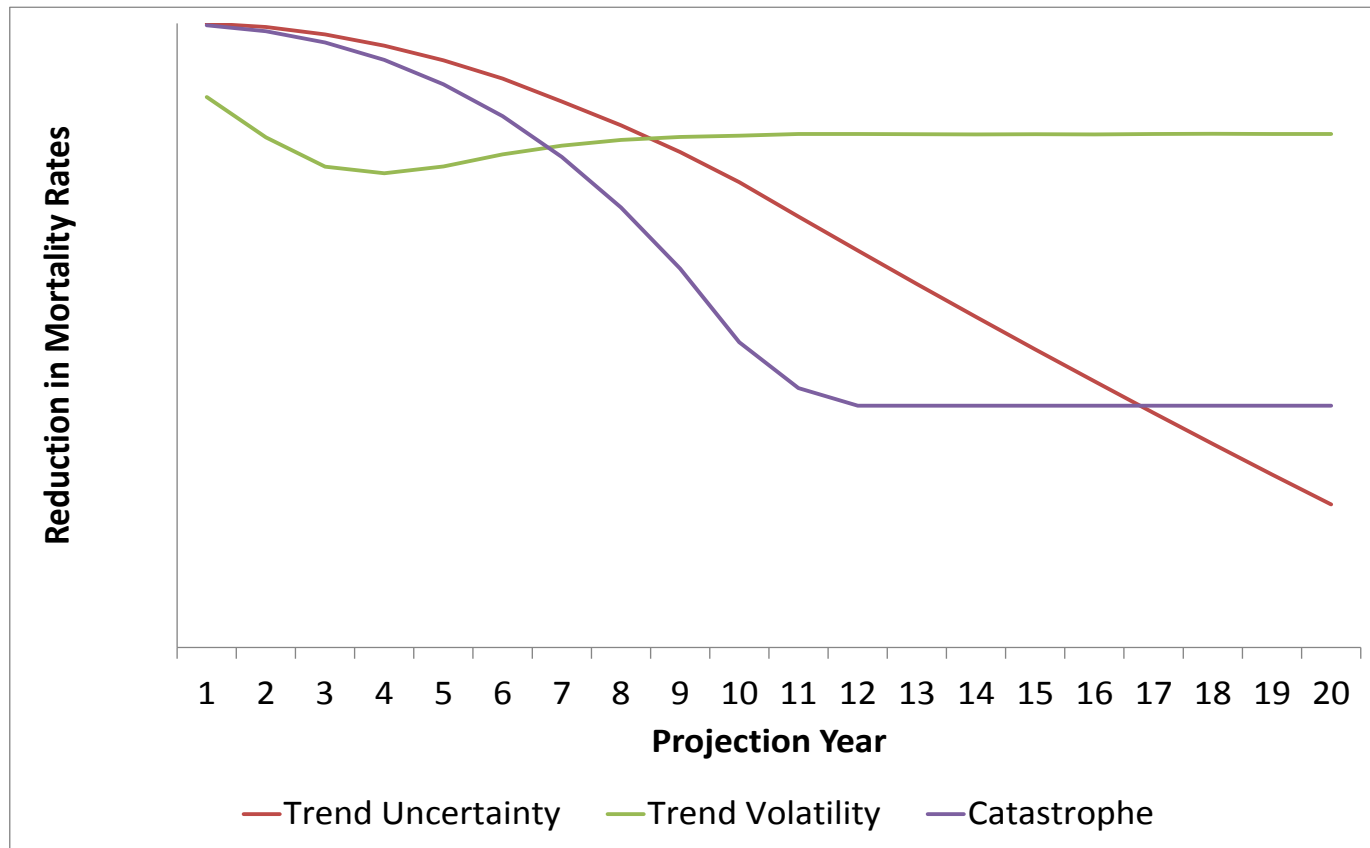
Institute
and Faculty
of Actuaries

What do you think?

- Question 1 – Which is most likely? A cure for:
 - Cancer
 - Respiratory Conditions
 - Diabetes
 - Mental Nervous Conditions
- Question 2 – Relative to a cure for cancer how likely is a cure for:
 - Respiratory Conditions
 - Diabetes
 - Mental Nervous Conditions



Comparison of Systemic Shapes



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 . . .



Institute
and Faculty
of Actuaries

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



Institute
and Faculty
of Actuaries

Specific Longevity Risk



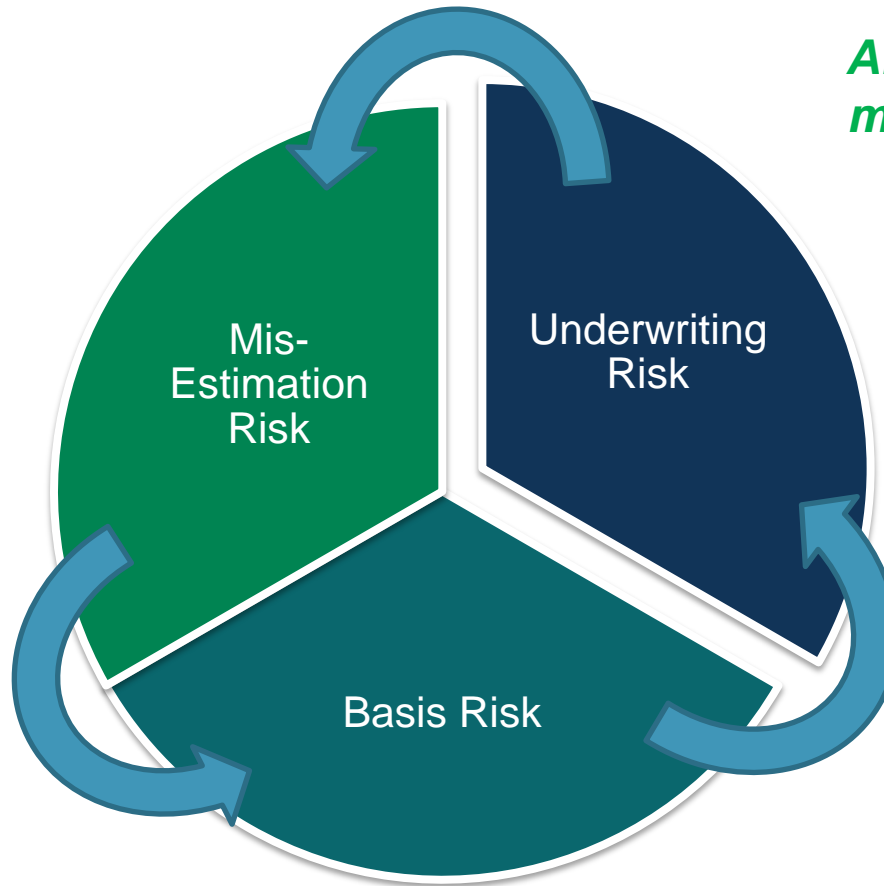
Institute
and Faculty
of Actuaries

Specific Longevity Risk



Institute
and Faculty
of Actuaries

Specific Longevity Risk



*And don't forget the
model risk!*



Institute
and Faculty
of Actuaries

Comparison of Frameworks

IAA Risk Behaviours	Richards Risk Behaviours	Proposed Risk Behaviours
Volatility	Idiosyncratic	Statistical Volatility
Catastrophe	N/a	Catastrophe
Trend Uncertainty		Volatility
	Trend	Trend Uncertainty
	Model	
	Basis	Basis
	Level Uncertainty	Mis-estimation
N/a		Underwriting

Sources:

A Global Framework for Insurer Solvency Assessment,

A value-at-risk framework for longevity trend risk, Richards, Currie and Ritchie, 2012



Institute
and Faculty
of Actuaries

Variation in Longevity Risk



Institute
and Faculty
of Actuaries

Variation in Longevity Risk

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



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



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



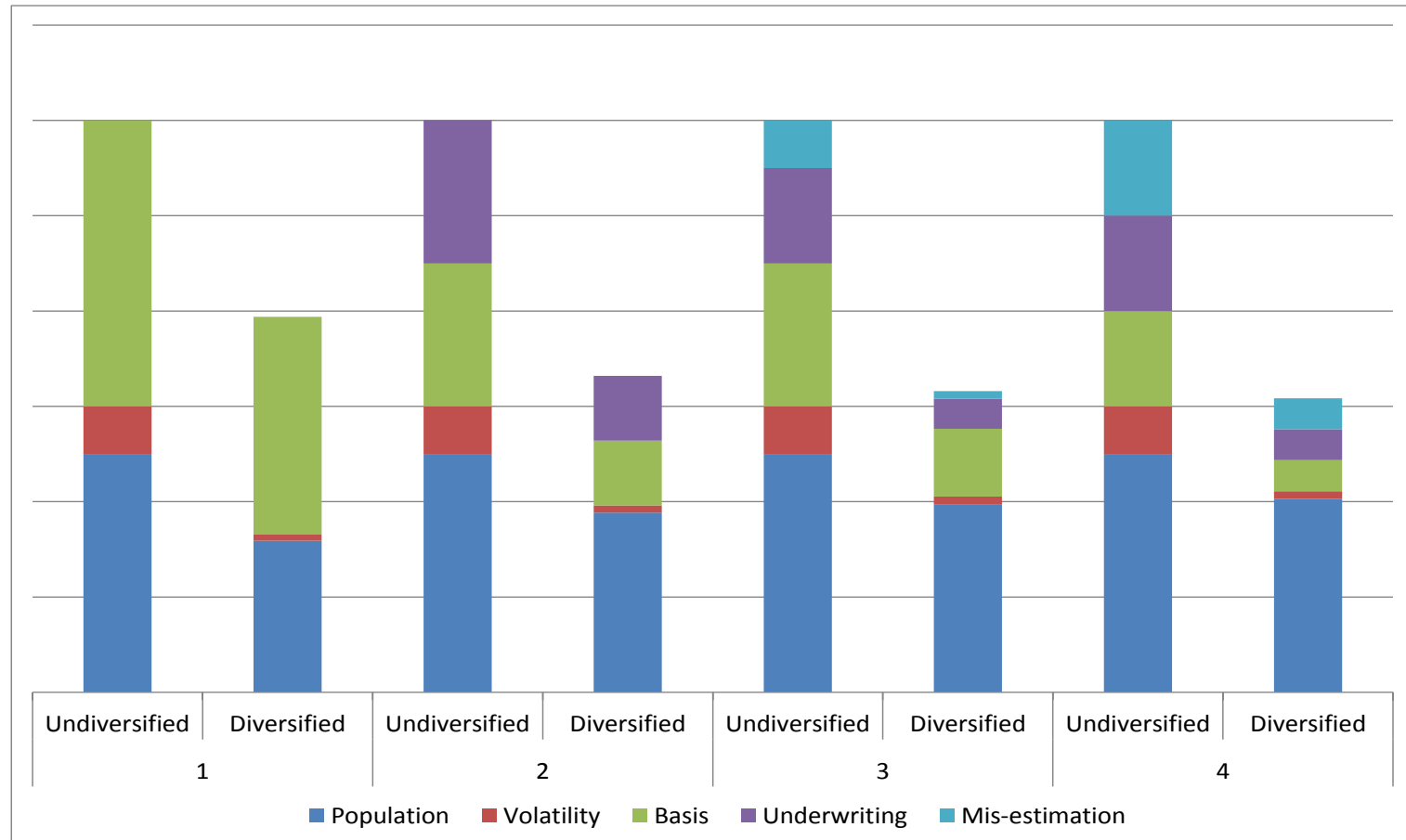
Insurance Company Example (2)

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



Institute
and Faculty
of Actuaries

Insurance Company Example (3)

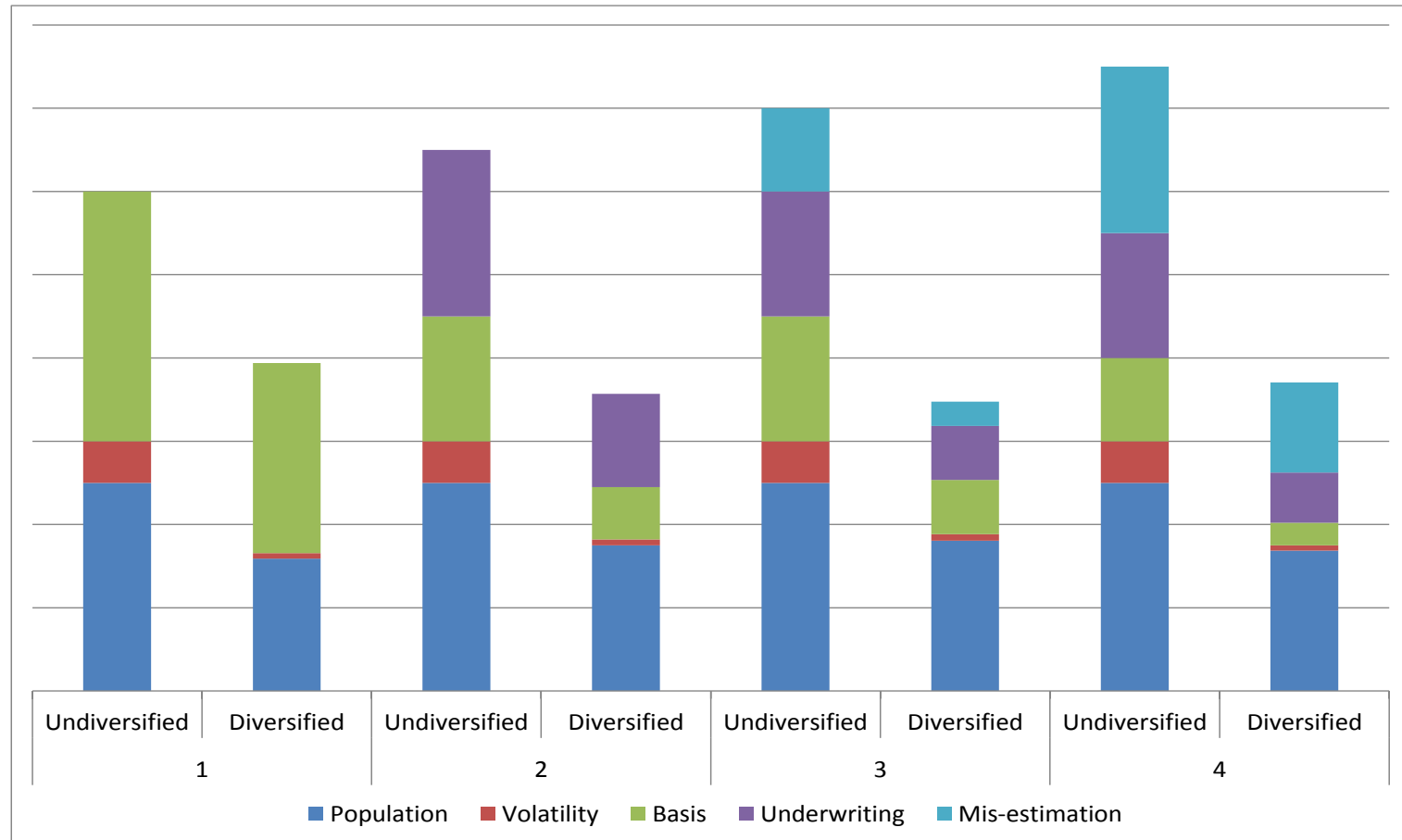


Diversified calculated using the Euler Method assuming independence



Institute
and Faculty
of Actuaries

Insurance Company Example (4)



Diversified calculated using the Euler Method assuming independence



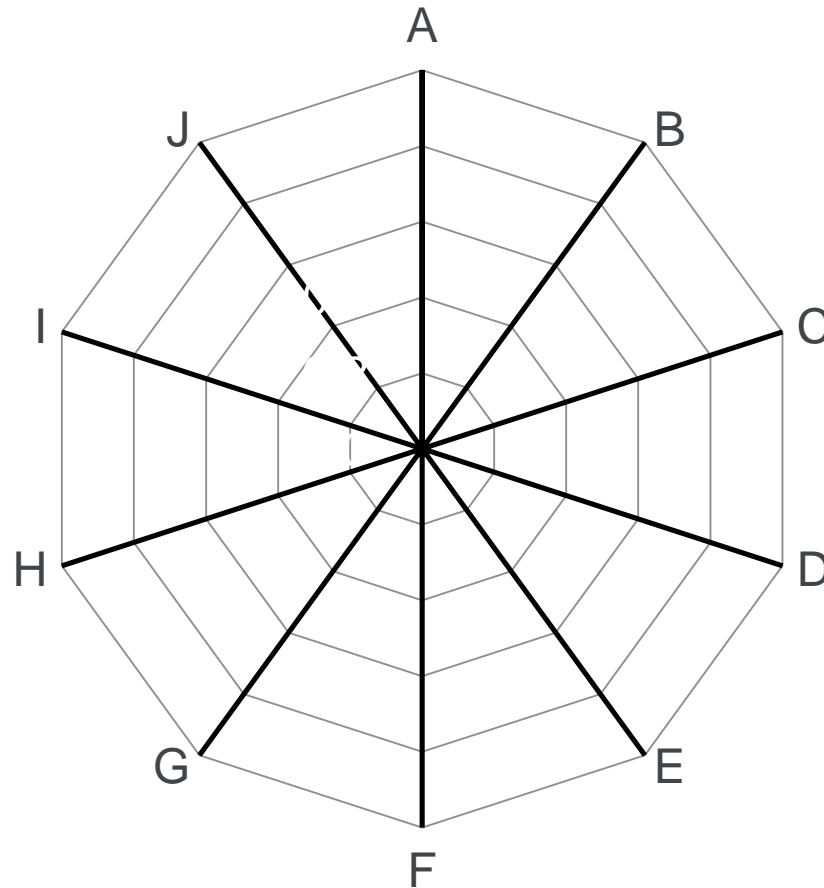
Institute
and Faculty
of Actuaries

Credibility of Experience

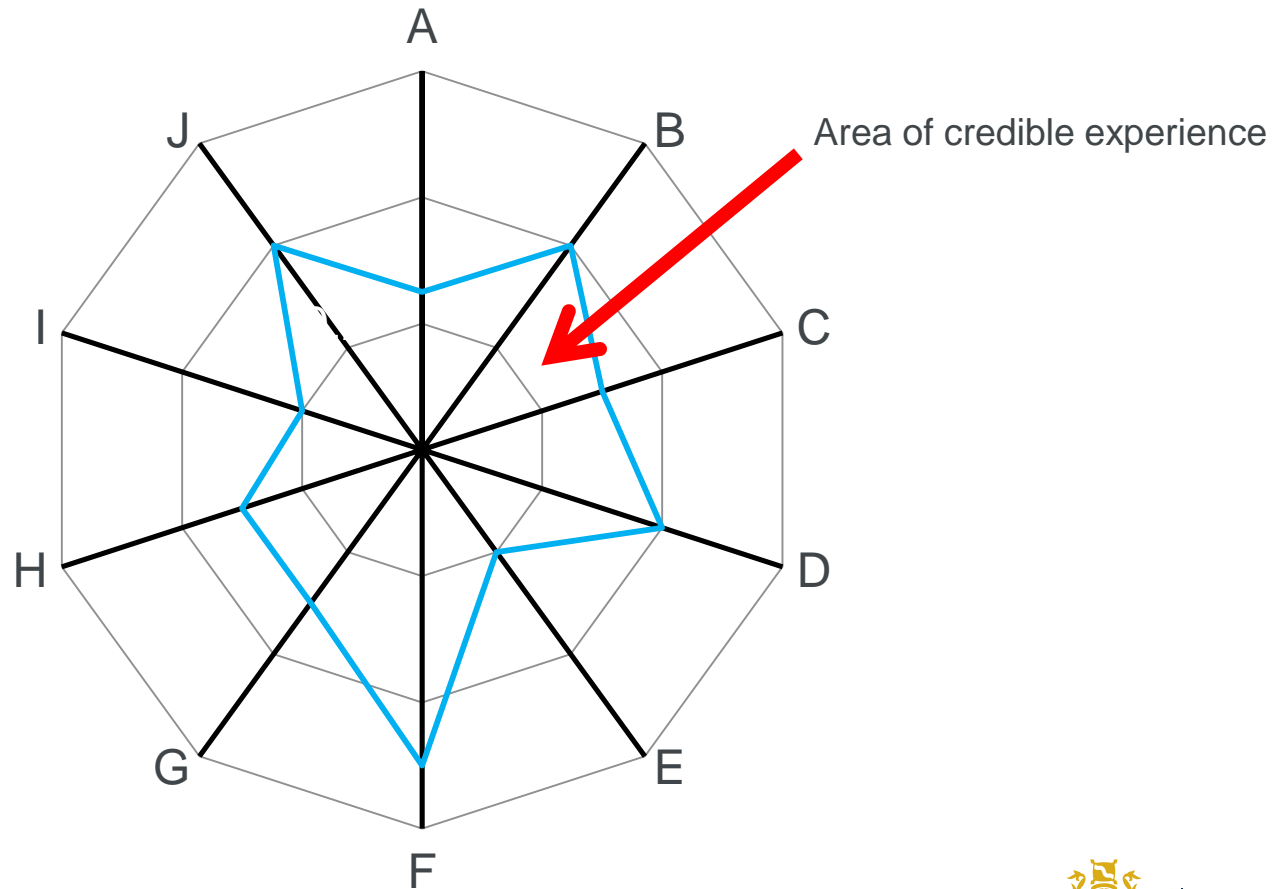
- Relevance of Experience
- Spread of Experience



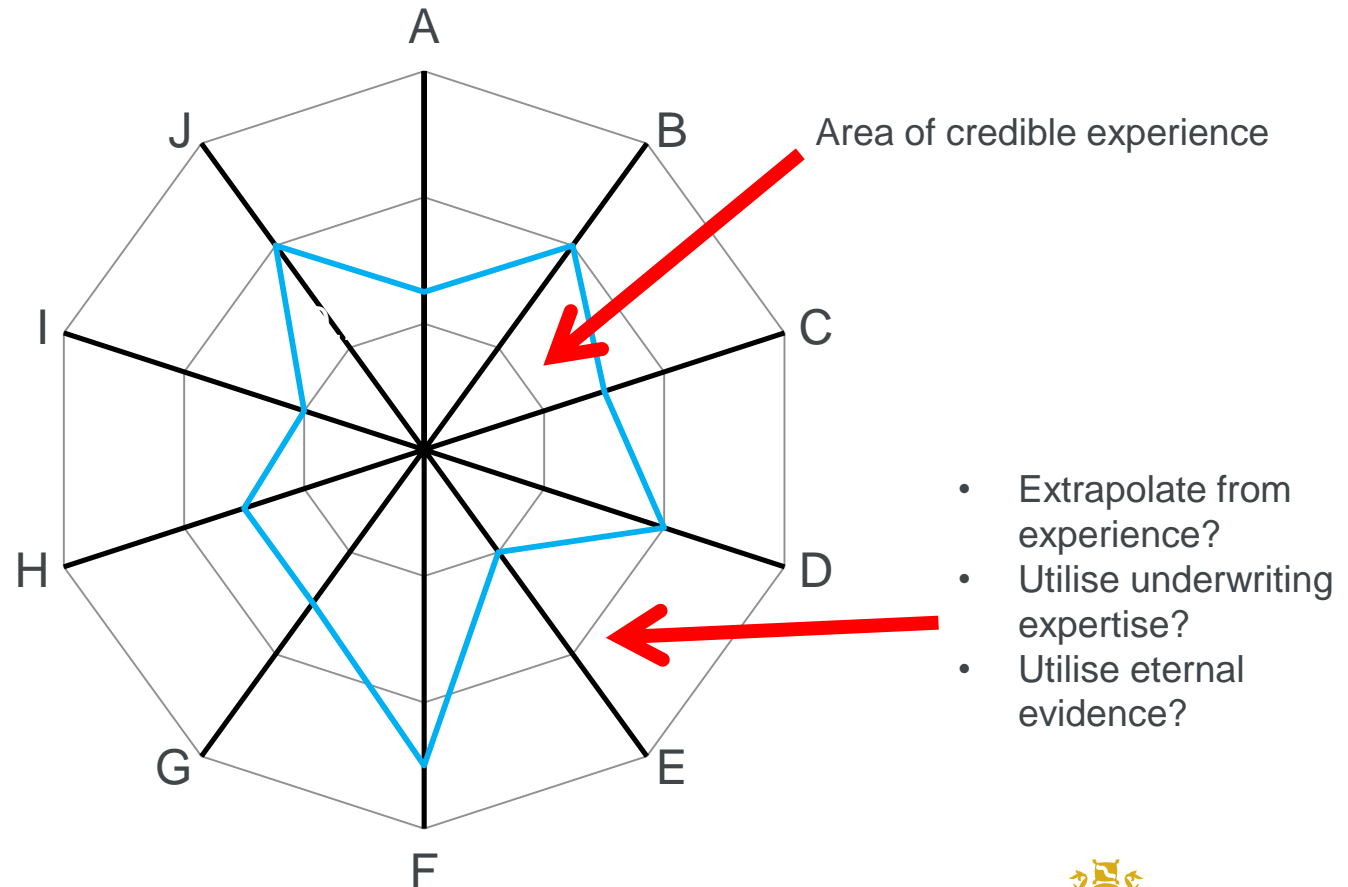
Credibility of Experience



Credibility of Experience

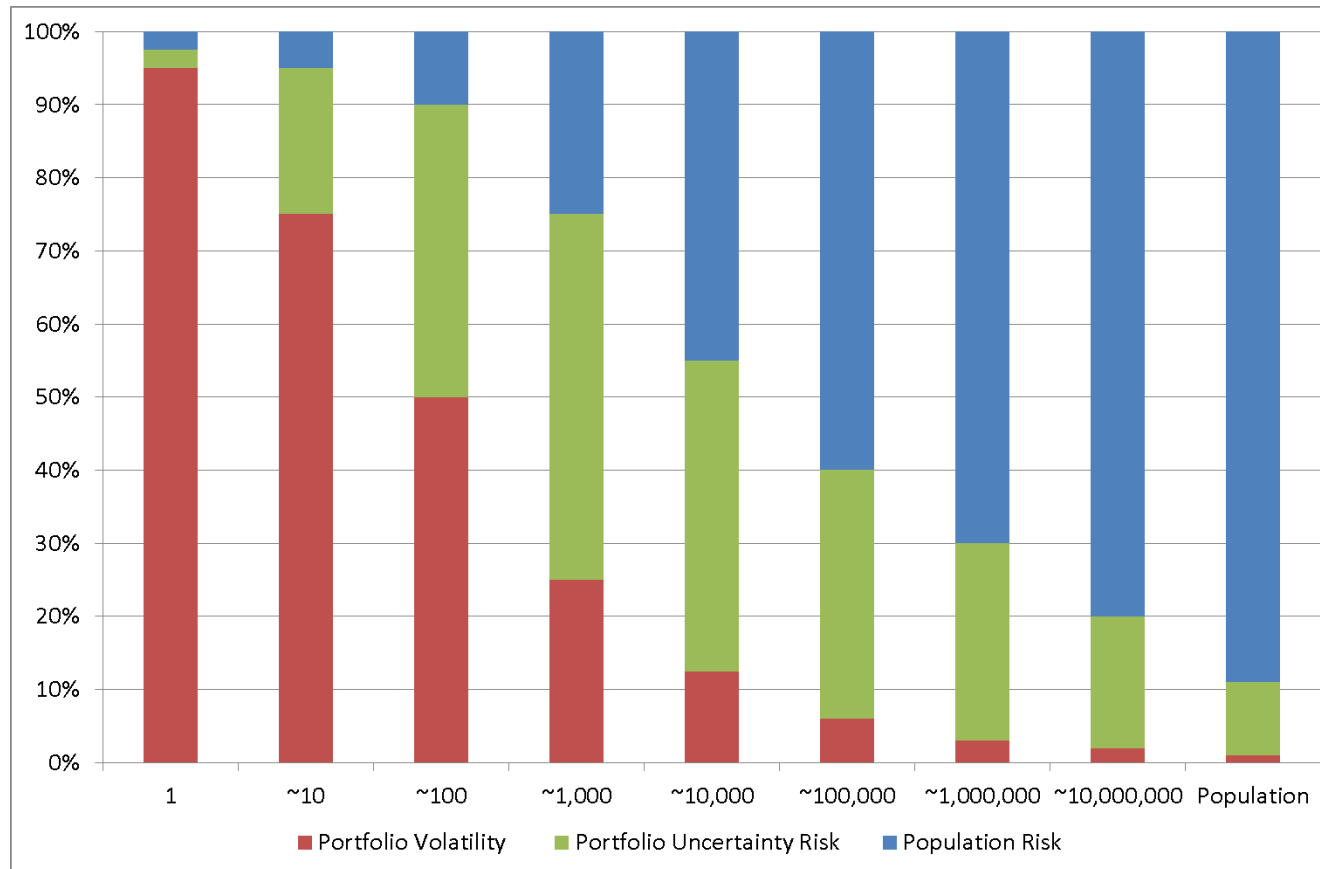


Credibility of Experience



Institute
and Faculty
of Actuaries

Size of Portfolio



Final Thoughts



Institute
and Faculty
of Actuaries

Summing up . . .

- What further development should the conceptual framework consider?
- 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
- Key Point – focus should be on understanding the longevity risk and then the mathematical modelling
- NO ONE RIGHT ANSWER



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.



Institute
and Faculty
of Actuaries