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CMI Mortality Projections

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CMI Mortality Investigations


- Life Office Mortality Investigations
- Self-Administered Pensions Mortality Investigation
- Mortality Projections



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Mortality Projections

- Background
- Research to date
- What Next?



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Mortality Projections – the background

- "92" Series tables included projection of future mortality
- Single projection basis, derived from past trends
- Quickly found to understate actual mortality improvements
- Plus evidence had emerged of a "cohort effect"
- CMI published the "interim cohort projections" late in 2002
- MPWP established to explore possible projection methodologies for use with the "00" Series tables
- April 2006 – Working Paper 20 – Penalised-spline models
- March 2007 – Working Paper 25 – Lee-Carter models

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Recent CMI research: P-splines

- Regression model fitted to past data
- P-splines impose a penalty on differences in adjacent co-efficients
- Choice of penalties determines balance between smoothness and closeness of fit
- Model fitted to a surface, either:
 - age and calendar year (Age-Period) or
 - age and year of birth (Age-Cohort)
- Fitting process provides:
 - Fitted $\log(\mu) \Rightarrow$ mean values
 - Standard deviations \Rightarrow determine confidence intervals

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Recent CMI research: Lee-Carter

- Structured time-series model
$$\log \mu(x, t) = a(x) + b(x)k(t) + e(x, t)$$
- No allowance for parameter uncertainty, so CMI have introduced through bootstrapping
- Basic model does not capture cohort effects
 - \Rightarrow Poor fit when back-testing from 1992
- Renshaw & Haberman Lee-Carter APC model
$$\log \mu(x, t, c) = a(x) + b_1(x)k(t) + b_2(x)I(c) + e(x, t, c)$$
- Introduces extra parameter to model cohort effects

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Recent CMI research: Conclusions

Objective	P-Spline age-cohort	P-Spline age-period	Lee-Carter	Lee-Carter APC
Ease of use	Y	Y	Y	Y
Parameter Interpretation	N	N	Y	Y
Structure & fit	Y	Y	N	?
Cohort effects	Y	N	N	Y
Best estimate	Y	Y	Y	Y
Confidence Intervals	Y	Y	Y	Y
Sample paths	N	N	Y	Y

Working Paper 25

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Recent CMI research: Conclusions

- Issues with both P-spline & Lee-Carter
- Both dependent on improvements within past data
- CMI cannot recommend any specific method
- No "Holy Grail" !!

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Mortality Projections – What Next?

- CMI recognised its research not accessible to many actuaries
- Task Force formed to:
 - Illustrate the CMI's recent research to make it more accessible
 - Propose terminology to facilitate disclosure of mortality projections
 - Develop sets of projections which can be used as benchmarks
 - Collaborate with ECPD Board on education needs
- Membership of Task Force include life and pensions actuaries

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Mortality Projections – What Next?

- Task Force initial proposal is to construct a “library” of projections. This will include:
 - Existing projections, e.g. “92” Series and Cohort Projections
 - Variations on existing projections, e.g. applying an underpin to a Cohort Projection
 - Examples of P-spline and Lee-Carter projections
- “Library” will comprise a “spreadsheet” of projections and a supporting document

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Mortality Projections – What Next?

- What will the “library” achieve?
 - Single source of “recognised” projections
 - Standardisation of terminology for these
- What will the “library” not achieve?
 - No guidance on choice of projection

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