The Actuarial Profession
making financial sense of the future

Consultation Meetings:

The CMI Mortality Projections Model

Merchants Hall, Edinburgh, 7 July 2009
Staple Inn, London, 14 July 2009

Gordon Sharp, Richard Willets & Neil Robjohns

Consultation Meeting: Agenda

- Introduction & Background
- Aims and Working Party Deliverables
- The Structure of the proposed Model
- Key Points from the Working Party's Research
- The Consultation Exercise
- Open Discussion

Members of the Working Party

- Richard Willets (chair)
- Adrian Gallop
- Joseph Lu
- Brian Wilson
- Neil Robjohns (secretariat)

Acknowledgements

- The CMI would like to thank the Actuarial Profession for a research grant which has been used to fund the development of the Model.

- The Working Party is also grateful to:-
  - The ONS for providing population mortality experience data;
  - James Kirkby for fitting P-Spline models to cause-of-death data;
  - Adrian Pinington of the Mortality Projections by Cause-of-Death Research Group for a presentation of preliminary findings; and
  - Club Vita for supplying the Working Party with results from their analysis of pensioner experience.

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Towards a New Model

- Perceived Advantages of Interim Cohort Proj^{ns}
  - They offer a common currency
  - They can be easily modified
  - They can be applied to any base mortality table
- But significantly out-of-date

Working Party Goal

- To produce a projection model which shares the desirable features of the Interim Cohort Projections, but also:
  - reflects the latest experience on trends in mortality;
  - is relatively straightforward to understand and describe;
  - allows users the flexibility to modify projections to suit their own views and purpose; and
  - can be regularly updated over time to reflect emerging experience.

Working Party Deliverables

- Published for Consultation
  - A prototype version of the CMI Model: CPMv0.0
  - CMI Working Paper 38: Part I – Outline
  - CMI Working Paper 39: Part II – Detailed Analysis
  - A User Guide for CPMv0.0
  - Sensitivity tests results spreadsheet
- Consultation on the Model and its potential uses
  - Closes on 31 August 2009
  - CMI response and CPMv1.0 expected October 2009

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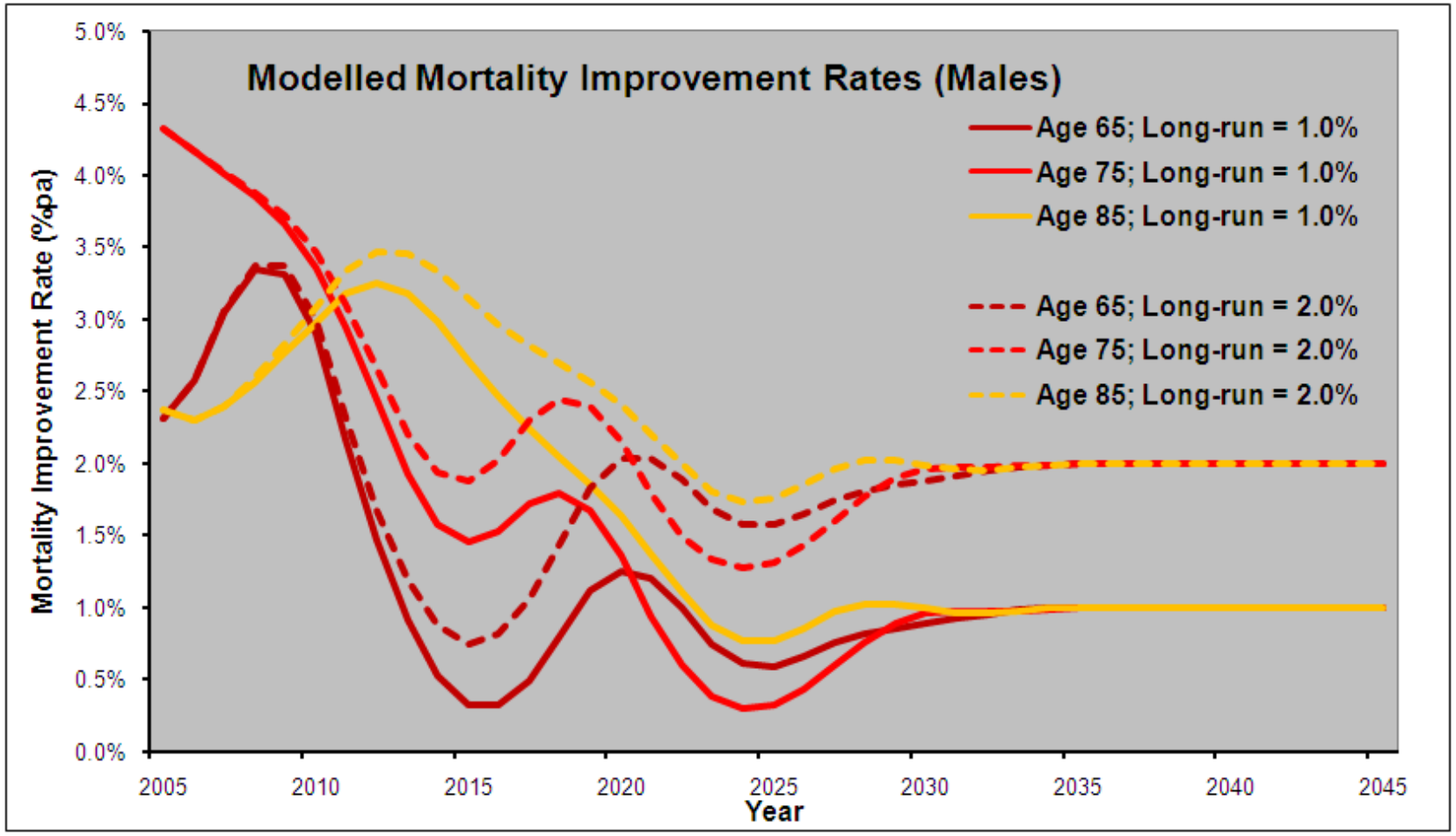
Model Structure

- Project mortality improvement rates
  - Relatively simple; Accessible; Flexible
  - Not a mathematical model of mortality fitted to data
- Deterministic projection driven by user inputs
  - Initial rates of mortality improvement
  - Long-term rate(s) of mortality improvement
  - Speed & pattern of convergence
  - Split projection by age or by year-of-birth cohort
- Core and Advanced parameter layers

Convergence to a Long-Term Rate



Advanced Parameter Layer

- Gives users considerable flexibility; allowing specification of:-
  - Initial Rates of Mortality Improvement
  - Cohort & Age/Period Components of Initial Rates
  - Long-term Rates of Improvement (by individual age & birth cohort)
  - Period of Convergence (by individual age & birth cohort)
  - Proportion of Convergence remaining after Mid-point (by individual age & birth cohort)
  - Initial Rates of Mortality

Core Parameter Layer

- Allows users to focus on two simplified parameters:-
  - A Long-Term Rate of Mortality Improvement
  - A Constant Addition to Rates of Mortality Improvement
- Default values are applied to other parameters
- 'Core Projections' – i.e. those produced using only the Core Parameter layer – can be described using a proposed naming convention

Naming Convention

- Core Projections from version 0.0 of the Model can be given names of the following form:-

CPMv0.0 [a%] +c% {gender}

where:-

- a% = Long-Term Rate of Mortality Improvement
- c% = Constant Addition to Rates of Improvement for all ages and calendar years (omitted if zero)

Long-Term Assumptions

- In the short-term, the best guide to the likely pace of mortality improvement is the most recently observed experience
- In the long-term, the forces driving mortality change are likely to be very different; more subjective, better informed by expert opinion
- The Working Papers include research on:-
  - Mortality improvement by cause-of-death
  - Long-run average rates of change in a range of countries

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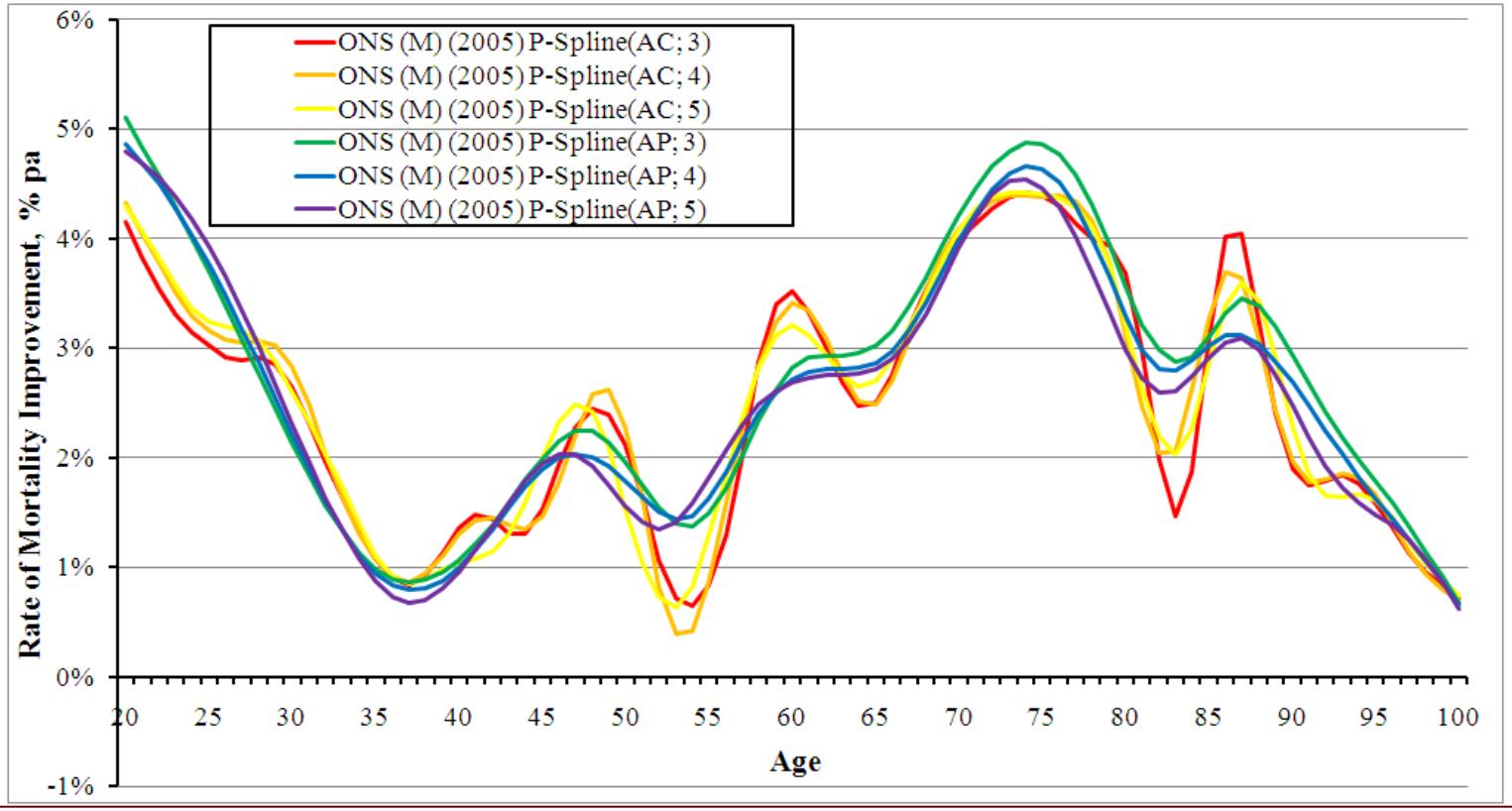
Working Party Research: Highlights

- Brief review of selected topics:
  - Estimating mortality improvement rates
  - Patterns of mortality change – by dataset
  - Observations on the effect of data volumes
- Round Up

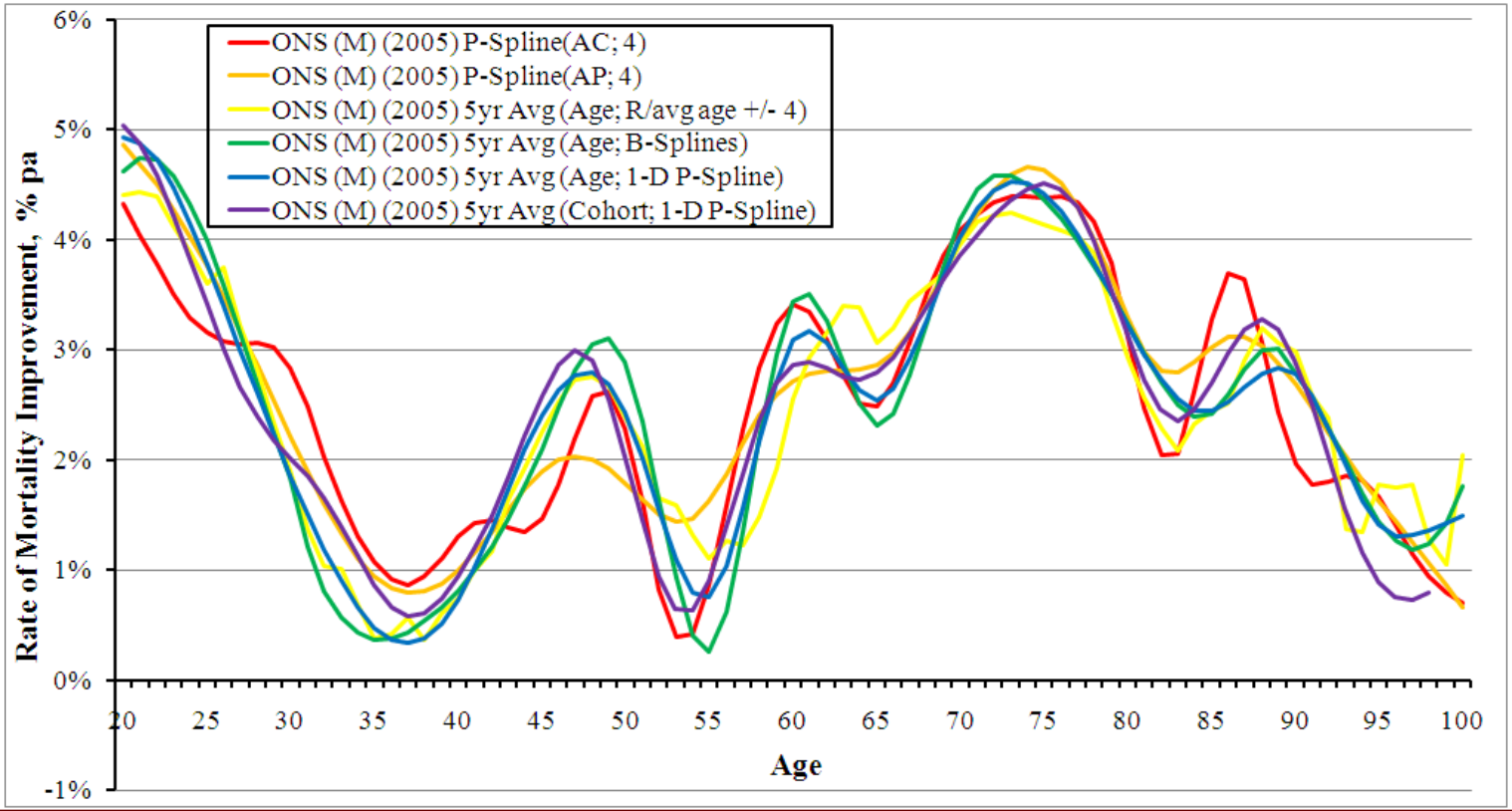
Estimating Mortality Improvement Rates

Estimates of Annual Rates of Mortality Improvement in 2005
P-Spline models; Population of England & Wales; Males



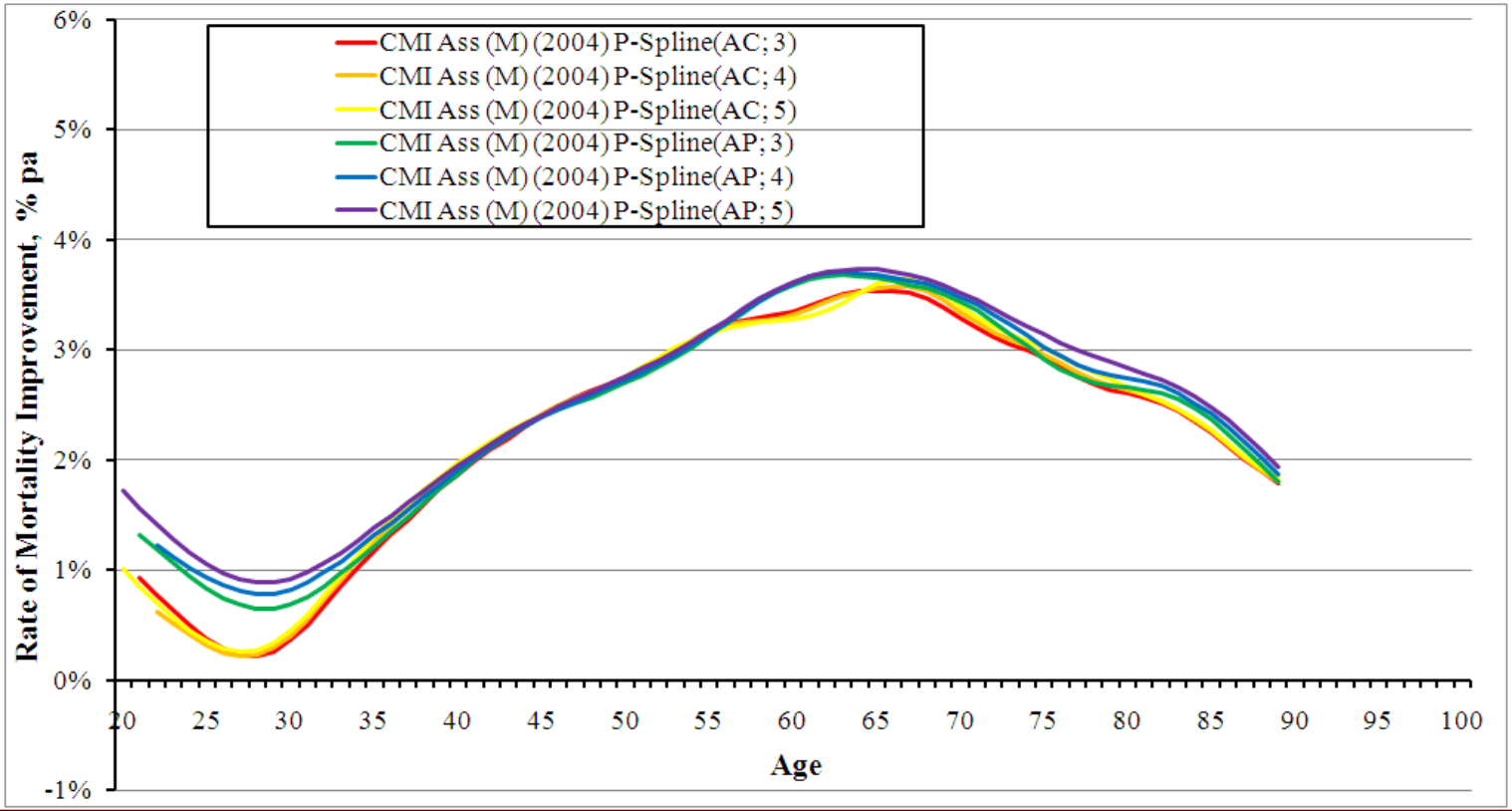
Estimating Mortality Improvement Rates

Estimates of Annual Rates of Mortality Improvement in 2005
Alternative methodologies; Population of E&W; Males



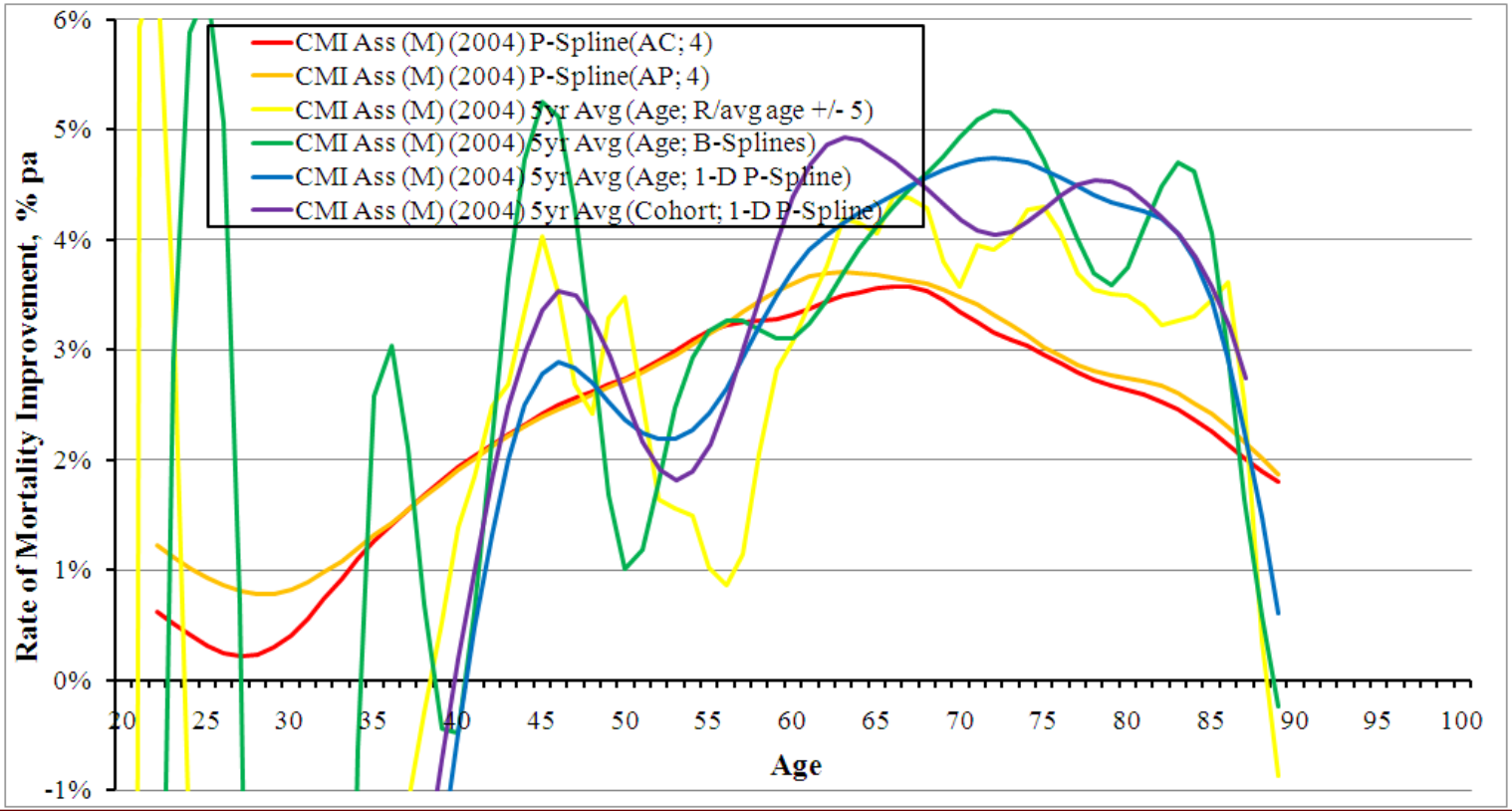
Estimating Mortality Improvement Rates

Estimates of Annual Rates of Mortality Improvement in 2004
P-Spline models; CMI Permanent Assurances; Males



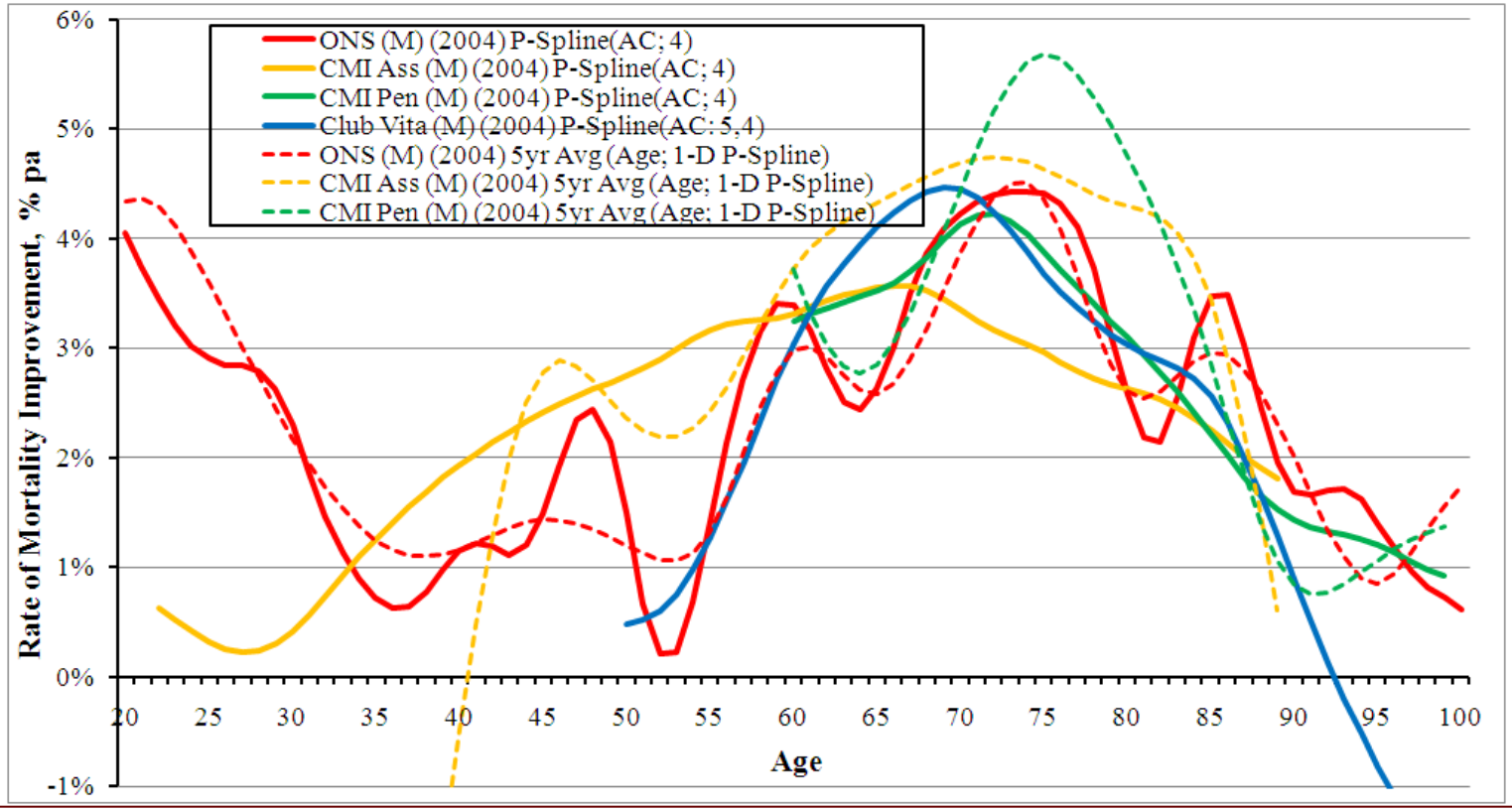
Estimating Mortality Improvement Rates

Estimates of Annual Rates of Mortality Improvement in 2004
Alternatives methodologies; CMI Perm Assurances; Males



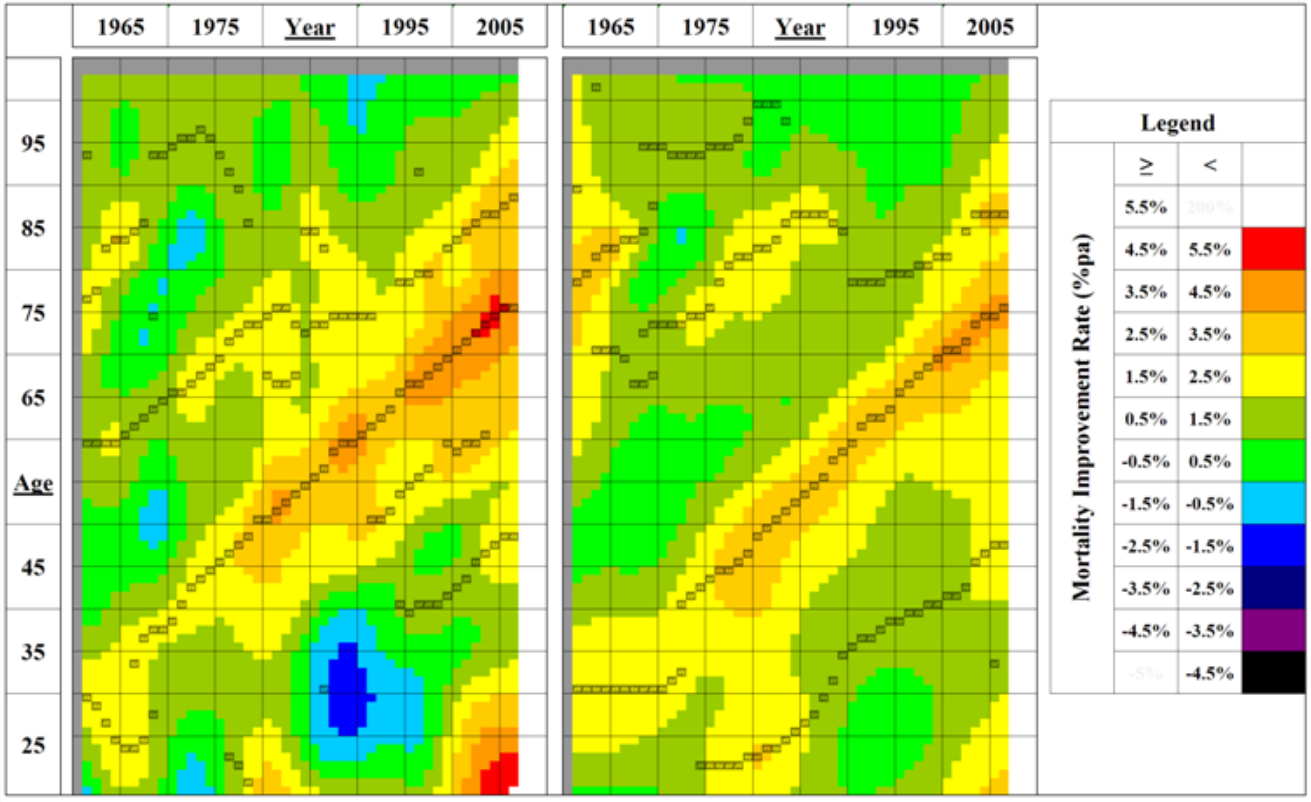
Estimating Mortality Improvement Rates

Estimates of Annual Rates of Mortality Improvement in 2004
Compare Estimates for 4 Datasets; Males



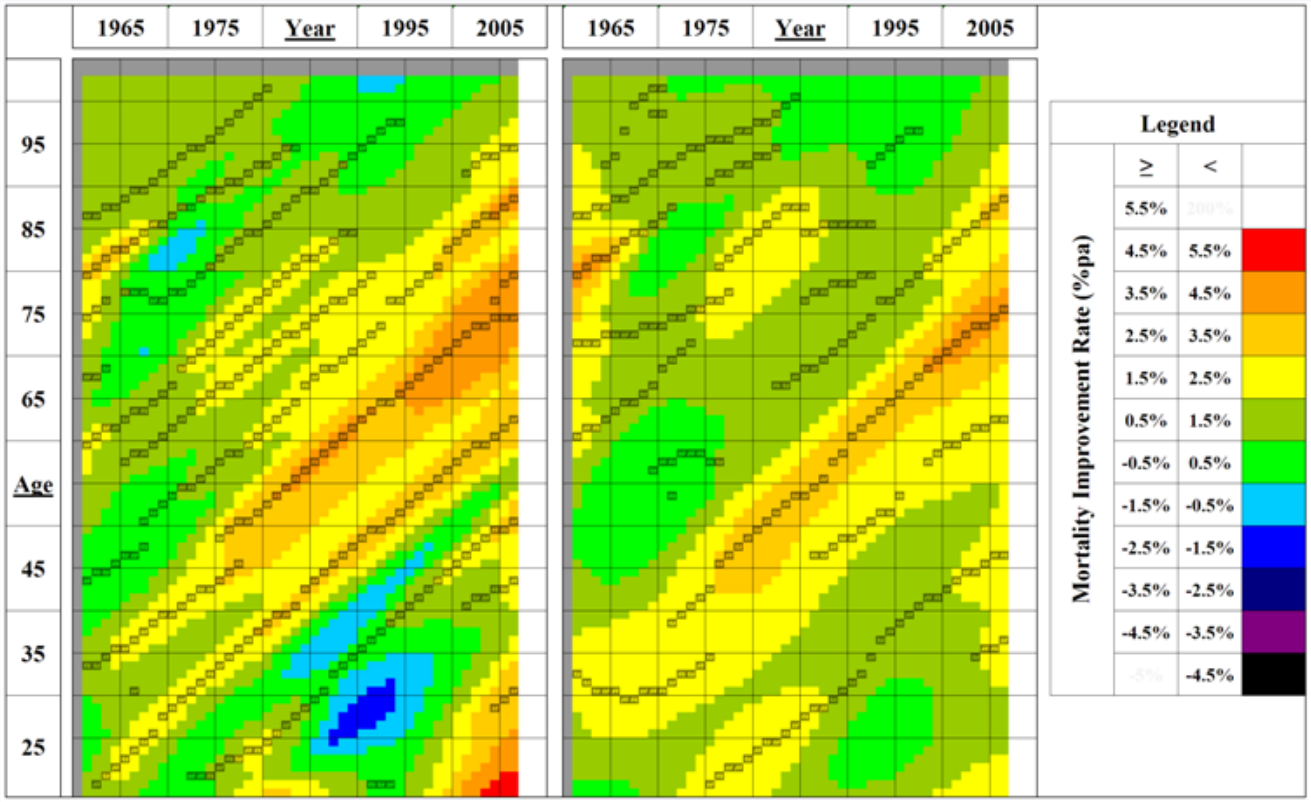
Patterns of Change: Population of E&W

Estimates of Annual Rates of Mortality Improvement
Left Panel: Males; Right Panel: Females; Age-period P-Spline



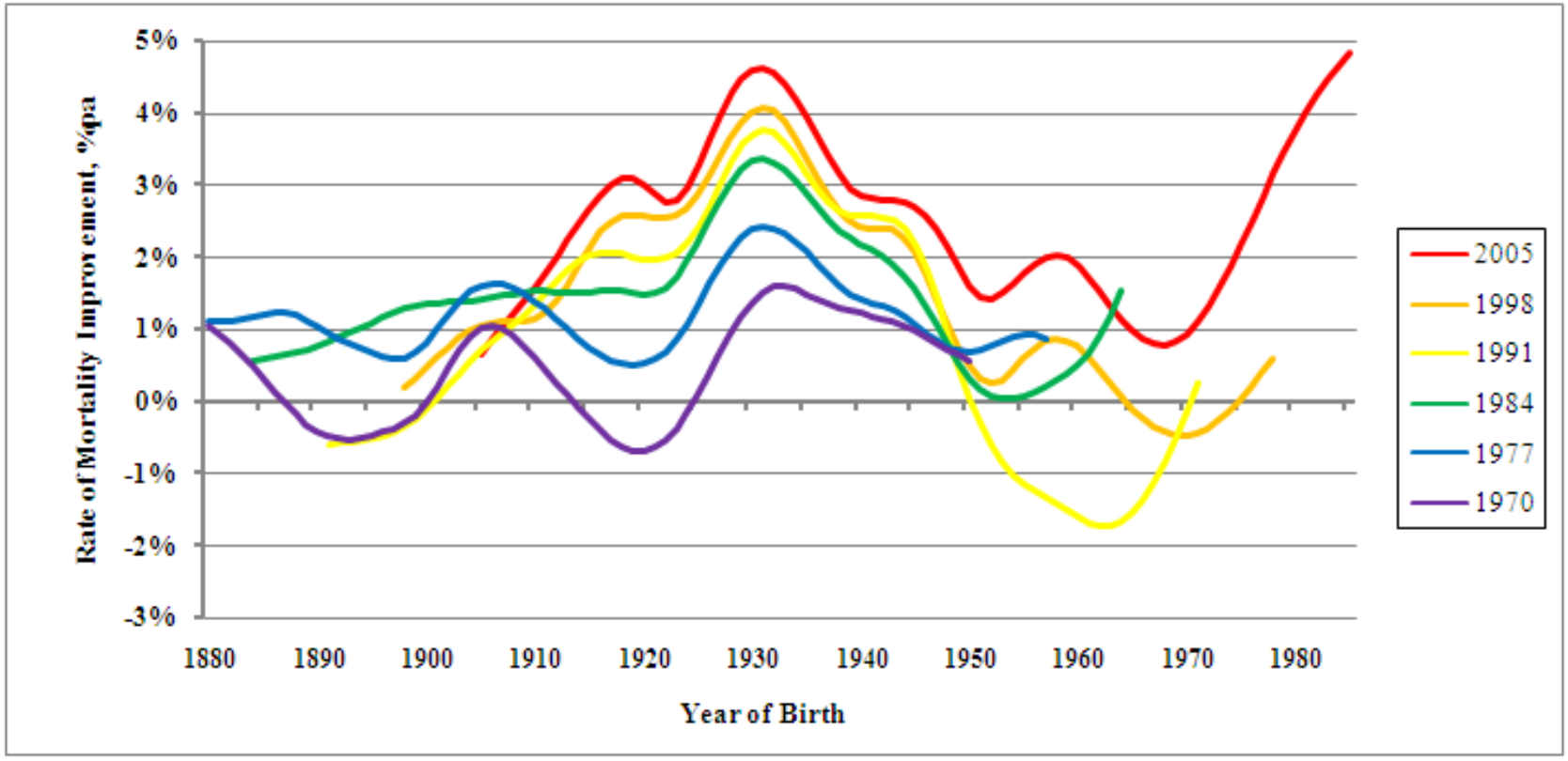
Patterns of Change: Population of E&W

Estimates of Annual Rates of Mortality Improvement
Left Panel: Males; Right Panel: Females; Age-cohort P-Spline



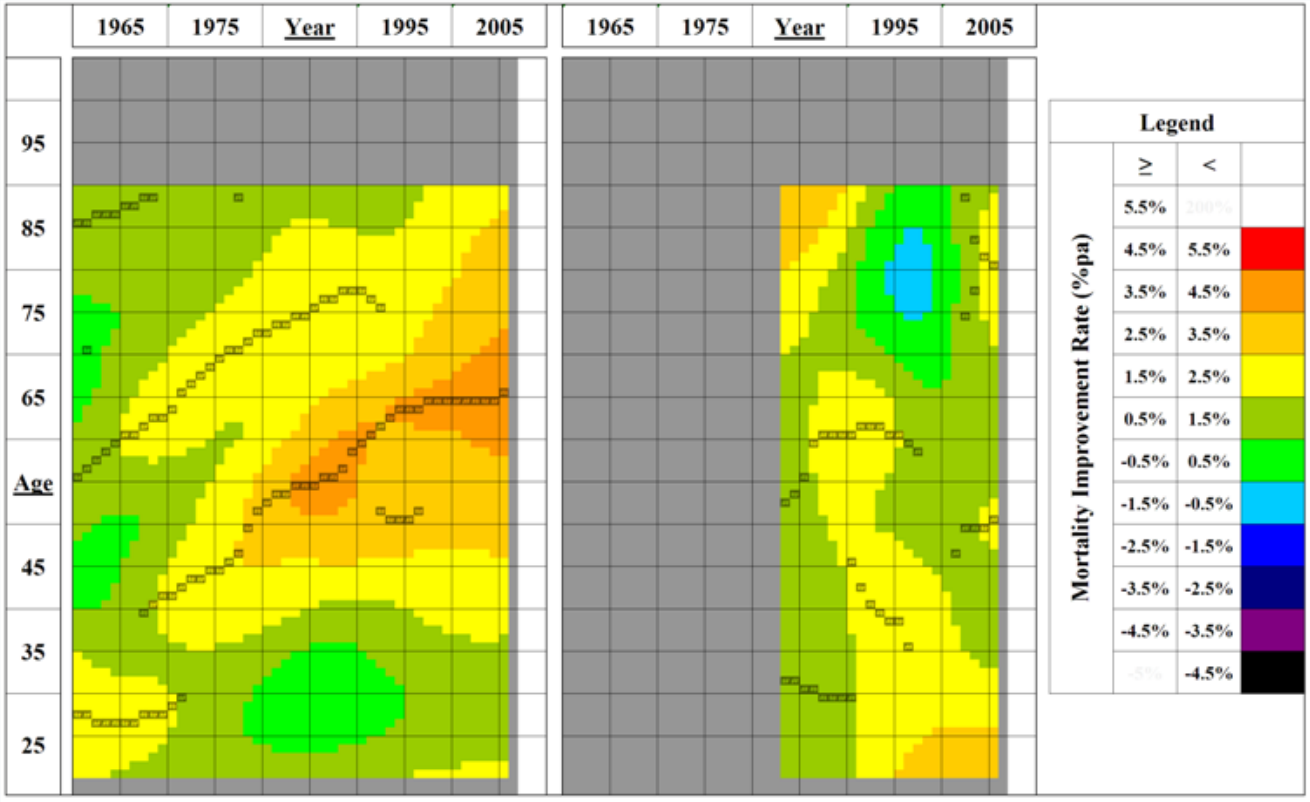
Patterns of Change: Population of E&W

Estimates of Annual Rates of Mortality Improvement by Year
Males; Age-period P-Spline



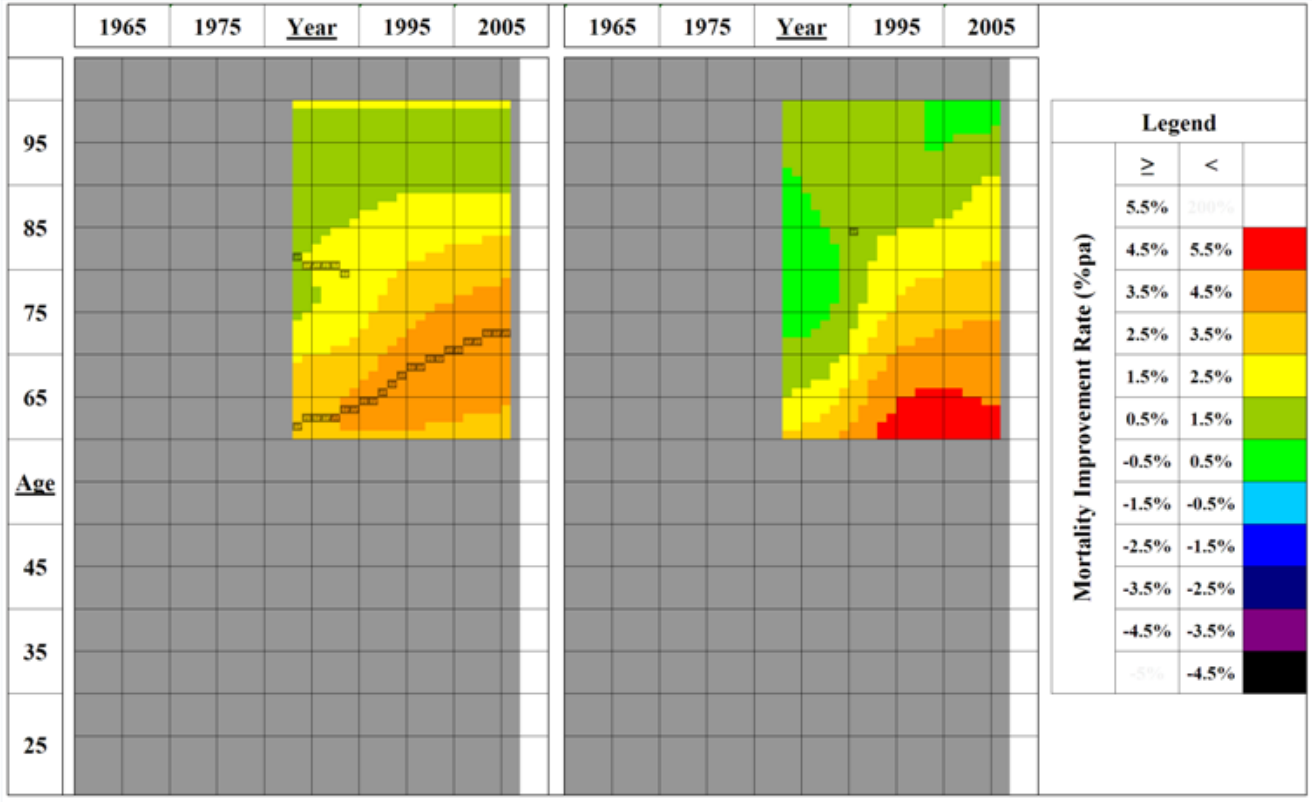
Patterns of Change: CMI Assurances

Estimates of Annual Rates of Mortality Improvement
Left Panel: Males; Right Panel: Females; Age-period P-Spline



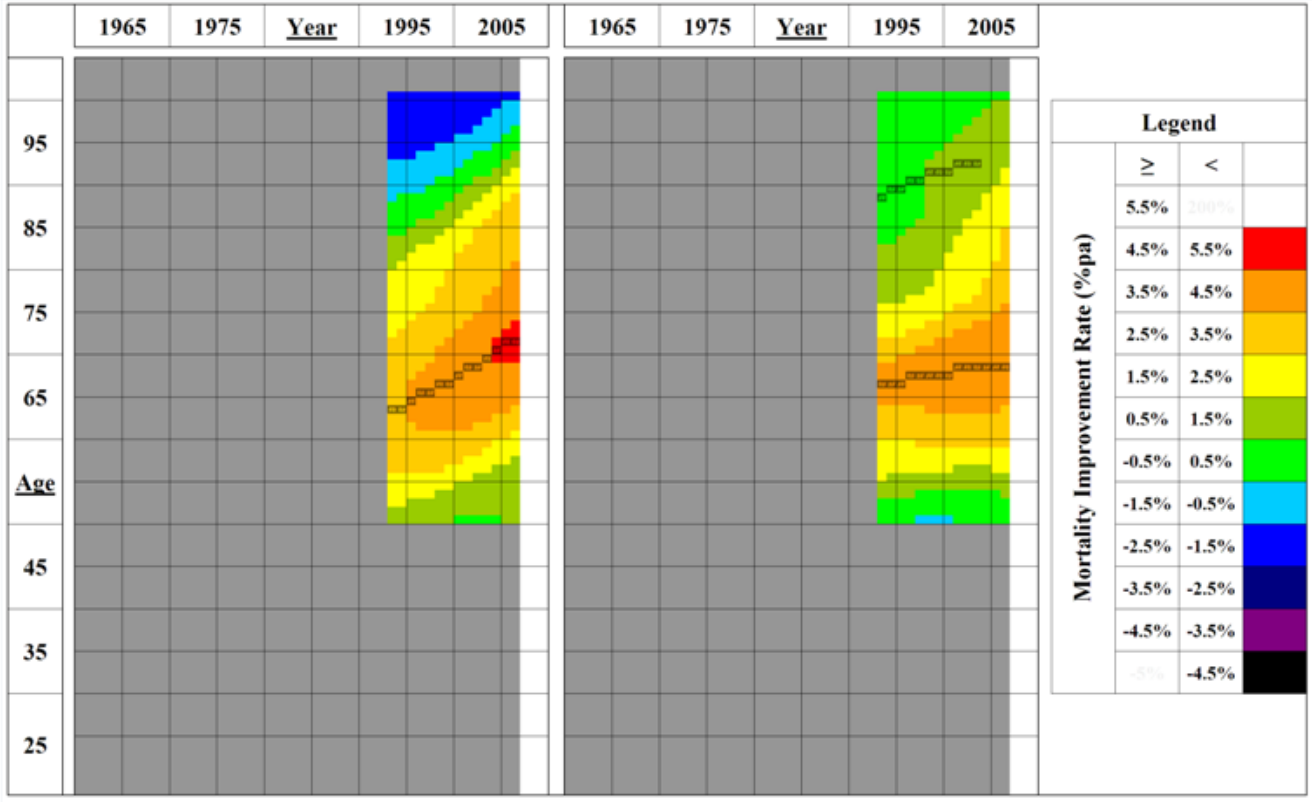
Patterns of Change: CMI Pensioners

Estimates of Annual Rates of Mortality Improvement
Left Panel: Males; Right Panel: Females; Age-period P-Spline



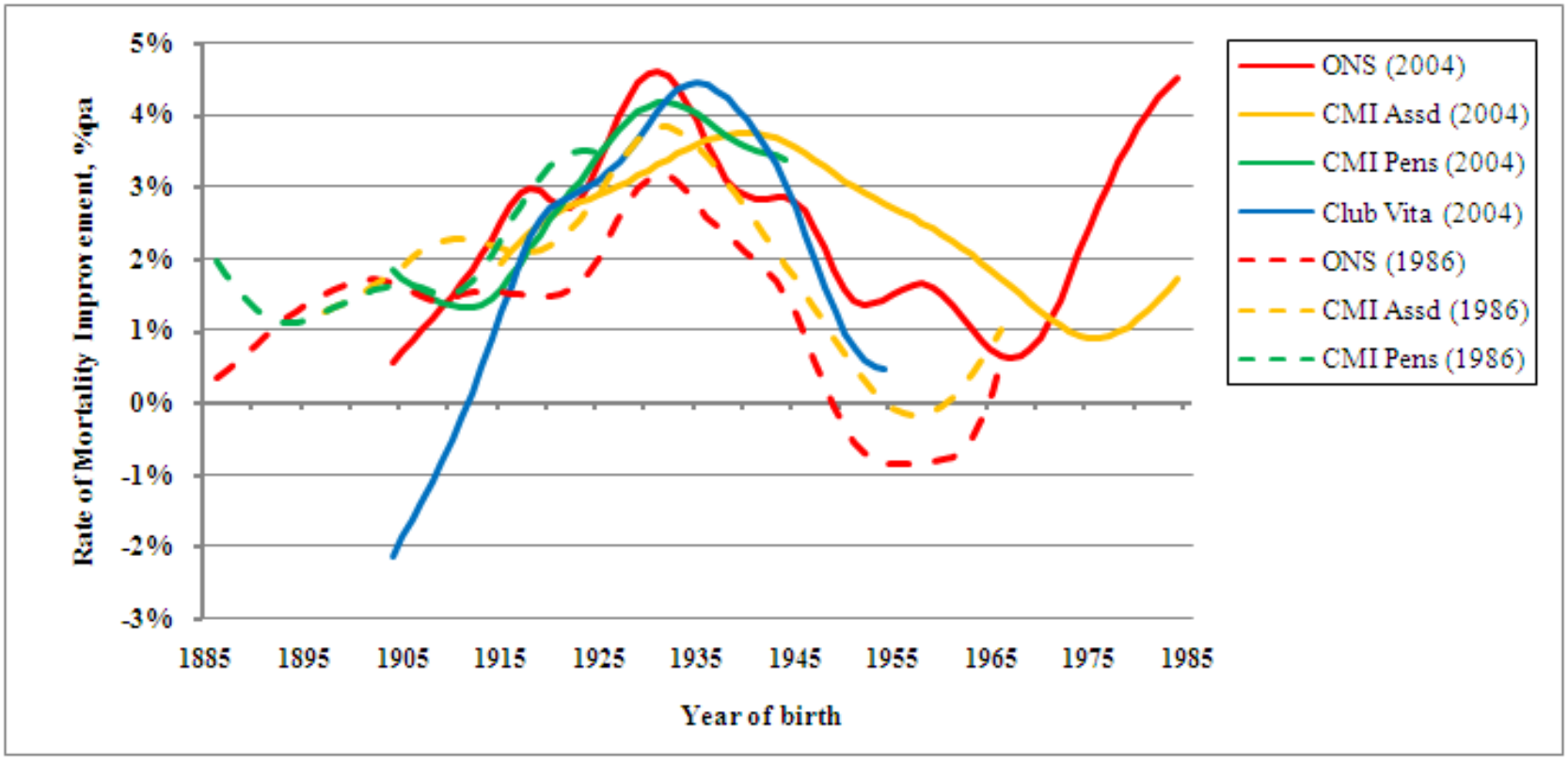
Patterns of Change: Club Vita

Estimates of Annual Rates of Mortality Improvement
Left Panel: Males; Right Panel: Females; Age-cohort P-Spline



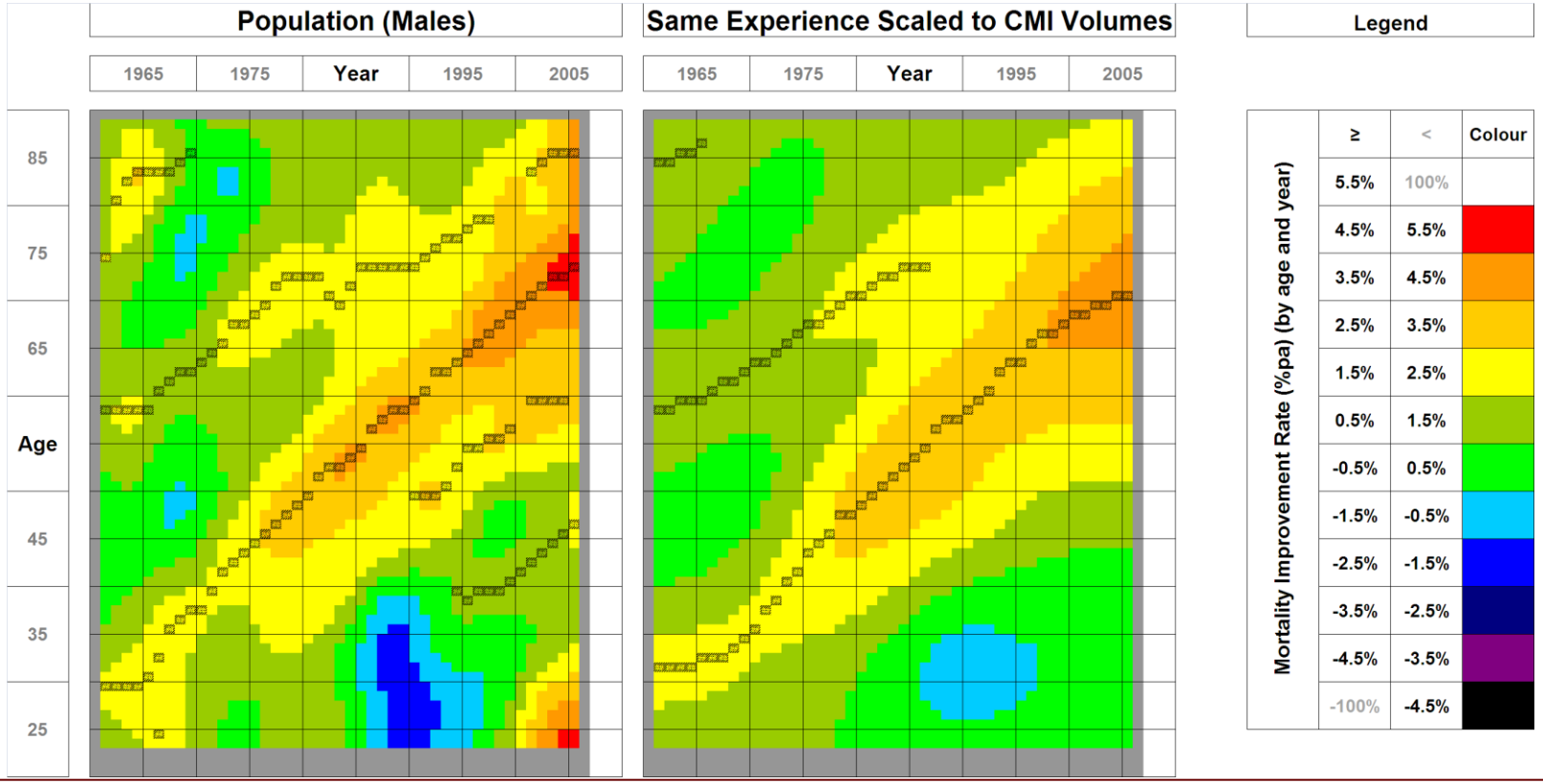
Patterns of Change in Mortality

Annual Rates of Mortality Improvement; 1986 & 2004
Compare Estimates for 4 Datasets; Males; P-Spline



Observation on Effects of Data Volume

Estimates of Annual Rates of Mortality Improvement
Population E&W; Males; Age-period P-Spline



Key Conclusions

- Population Data
  - Clearly shows 2 major features of mortality change
  - Persistent year-of-birth cohort peaks and troughs
  - A general increase across a wide age-range
  - **So model age/period and cohort components**
- Insured & Pensioner Data
  - Lower data volumes reduce clarity of observations
  - Unable to distinguish between concurrent features
  - Much more difficult to interpret trends
  - **So base defaults for Model on population data**

Round Up

- Evidence no longer supports 1926 cohort feature
- Step 2 years inside edge of data
- Variety of features of mortality improvement
  - cohorts (25+ yrs; above age 40);
  - age/period (typically shorter)
- Improvement rates tend to run to zero for age 100+
- No clear picture on trends by social class
- Even 25-year averages of mortality improvement rates vary significantly

The CMI Mortality Projections Model

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Consultation Questions (slide 1 of 3)

Feedback is sought on the following questions:-

- Do you agree that the CMI should be producing such a mortality projections model for use by practising actuaries? If not, why not?
- Do you agree with the broad structure of the proposed Model, i.e. a relatively simple, deterministic model with 'core' and 'advanced' level parameters, offering a common-currency against which alternative methodologies could be benchmarked? If not, why not?
- Do you have any comments or suggestions on the proposed structure of the Model?
- Do you agree with proposed number (two) of parameters at Core level and the choice these Core parameters?

Consultation Questions (slide 2 of 3)

Feedback is sought on the following questions:-

- Do you feel it would be useful to allow users to vary the long-term rate over time? So, for example, in the very long term the rate of change could be allowed to approach zero?
- Do you have any comments or suggestions on the default values given to parameters?
- Do you have any comments or suggestions on the proposed naming convention?
- Do you anticipate you would use this Model in practice? If so, for what purpose would you use it?

Consultation Questions (slide 3 of 3)

Feedback is sought on the following questions:-

- Do you have any thoughts on how the proposed Model should be developed in the future?
- Should the CMI maintain the proposed Model as new data becomes available? If so, should this be each year, or at some lesser frequency?
- Do you have any other comments?

Consultation Exercise

- Closes on 31 August 2009
- Response and CPMv1.0 expected to be published in October 2009

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  - We welcome all Feedback & Questions

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