# CMI Update

Tim Gordon, CMI Chairman

Dave Grimshaw, CMI Secretary

29 January 2015

# Agenda

- The CMI

- SAPS (Self Administered Pension Schemes)

- Working parties

- Annuities

- Assurances

- Mortality Projections

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# The CMI

- We aim to be regarded across the world as setting the benchmark for the quality, depth and breadth of analysis for graduation and projection

- CMI tables and models are the UK actuarial lingua franca

- The CMI works because of
  - industry support – sharing data and supporting volunteers
  - dedication of individual actuaries
- Quality of CMI output derives from
  - diversity of CMI committees
  - dedicated secretariat
  - consultation and openness

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# CMI structure
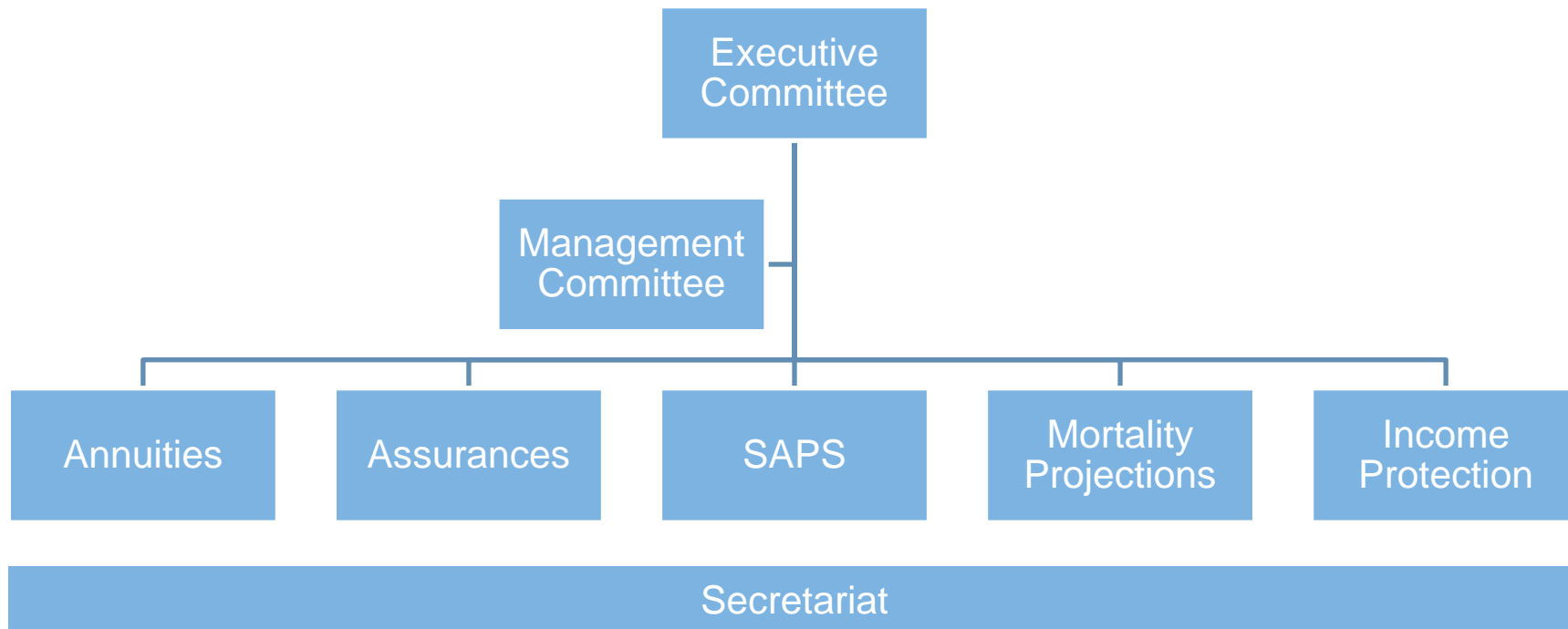
# Roadmap

- Overhaul graduation and modelling methods and tools

- Business as usual e.g. SAPS S2 (2014), annuities graduation (2015)

- Ongoing/planned

  – High age mortality

  – Review projections model

  – SAPS mortality improvements analysis

- International co-operation / consistency / coherence

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# SAPS
# (Self Administered Pension Schemes)

# SAPS

- Tables published
  - S1 (2009) – 2000-06 experience
  - S2 (2014) – 2004-11 experience

- Good range of sub group calibrations:
  - all / heavy / (mid) / light
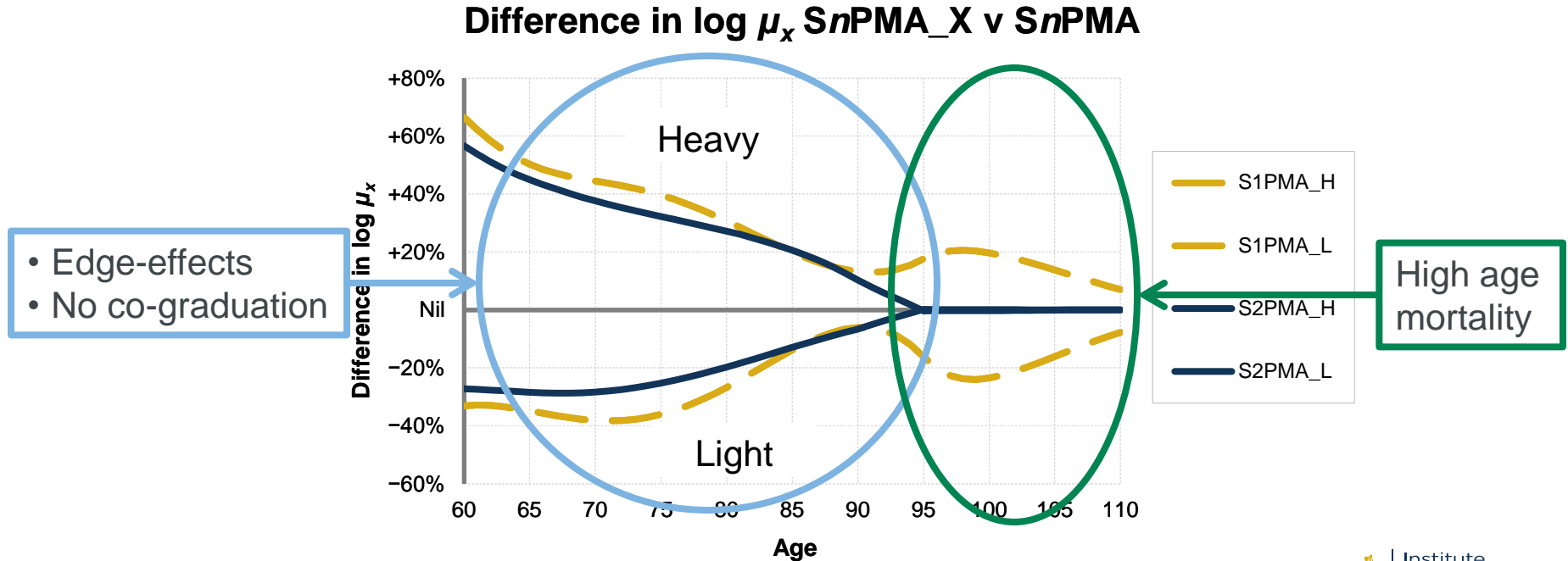  - all / normal / ill / dependants

  Table selection + scaling 100% ±10% leads to good shape

- S2 v S1
  - Similar approaches – stable
  - Timing locked down to CMI (and other) projection models
  - Different high and young age extrapolations

- Forthcoming
  - Industry-based analysis
  - SAPS + mortality improvement

# High age extrapolation S2 v S1

**Difference in log $\mu_x$ S$n$PMA_X v S$n$PMA**



- Edge-effects
- No co-graduation

Heavy

Light

High age mortality

Legend:
- S1PMA_H
- S1PMA_L
- S2PMA_H
- S2PMA_L

Y-axis: Difference in log $\mu_x$ (+80%, +60%, +40%, +20%, Nil, −20%, −40%, −60%)

X-axis: Age (60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110)

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# Working parties

# Graduation and Modelling Working Party

- Issues: CMI methods specific to CMI, edge effects/unpredictable extrapolation, intractability, over-fitting and overdispersion

- Objective: overhaul CMI graduation and modelling methods and tools

- Initial report to CMI Management Committee in January 2014

- Findings already fed into

  – CMI_2014 Model – ONS data quality and overdispersion

  – Annuities graduation – co-graduation and visualisation of results – also used to test and harden the software

- Plan to publish initial report and (beta) software

# High Age Mortality Working Party

- Issue: poor data at high ages, inconclusive academic view, but view required for base tables (annuity and SAPS) and projections

- Objective: investigate estimation of mortality at high ages (90+)
  - Survey current state of knowledge and make it accessible to actuaries
  - Undertake further research on high age mortality

- Ongoing:
  - Active but inconclusive debate on pattern of mortality at high ages
  - Data and modelling affect – and may bias – high age mortality analysis

- Working towards a paper / presentation in Summer 2015

# Annuities

# 2007-2011 data: timeline

- May 2012 – exercise launched at CILA

- June 2012 – first data received

- Sept 2012 – Secretariat started focussing on annuities over assurances

- May 2013 – last annuities data received

- Oct 2013 – Working Paper 70 / All Office annuities results

- May 2014 – last assurances data received

- Dec 2014 – Working Paper 75 / All Office assurances results

*NB 2011 data used to "complete" claims data for 2007-2010; no allowance for subsequent late-reporting*

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# Data Volumes: Pension annuities in payment
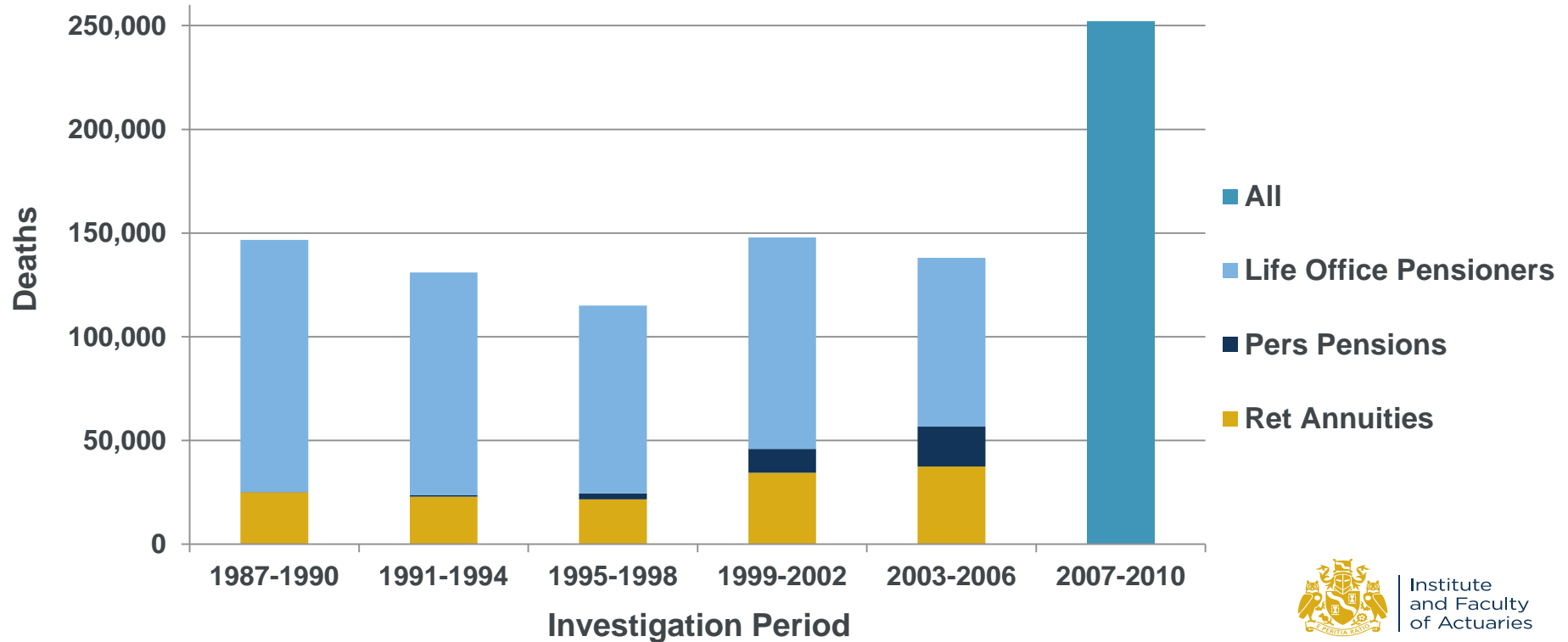
# Proposed annuities graduations (1/2)

| "00" Series | | "08" Series | |
|---|---|---|---|
| **Name** | Description | Description | Additional information |
| **IML00** | Immediate Annuitants, males, lives | Life Annuitants, males, lives | Experience for amounts vs lives |
| **IFL00** | Immediate Annuitants, females, lives | Life Annuitants, females, lives | Experience for amounts vs lives |
| **PNML00** | Pensioners, males, Normal, lives | Pension Annuitants, males, lives | Experience by duration<br><br>Experience by distribution channel |
| **PEML00** | Pensioners, males, Early, lives | | |
| **PCML00** | Pensioners, males, Combined, lives | | |
| **RMV00** | Retirement Annuitants, males, vested | | |
| **PPMV00** | Personal Pensioners, males, vested | | |
| **PNFL00** | Pensioners, females, Normal, lives | Pension Annuitants, females, lives | Experience by duration<br><br>Experience by distribution channel<br><br>Widows/pensioners experience |
| **PEFL00** | Pensioners, females, Early, lives | | |
| **PCFL00** | Pensioners, females, Combined, lives | | |
| **RFV00** | Retirement Annuitants, females, vested | | |
| **PPFV00** | Personal Pensioners, females, vested | | |
| **WL00** | Widows, lives | | |

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# Proposed annuities graduations (2/2)

| "00" Series | | "08" Series | |
|---|---|---|---|
| **Name** | Description | Description | Additional information |
| **PNMA00** | Pensioners, males, Normal, amounts | | Experience by duration |
| **PEMA00** | Pensioners, males, Early, amounts | Pension Annuitants, males, amounts | Experience by distribution channel |
| **PCMA00** | Pensioners, males, Combined, amounts | | Experience by amount band |
| **PNFA00** | Pensioners, females, Normal, amounts | | Experience by duration |
| **PEFA00** | Pensioners, females, Early, amounts | | Experience by distribution channel |
| **PCFA00** | Pensioners, females, Combined, amounts | Pension Annuitants, females, amounts | Experience by amount band |
| **WA00** | Widows, amounts | | Widows/pensioners experience |
| **RMD00** | Retirement Annuitants, males, deferred | Deferred Pensioners, males (lives) | [None] |
| **PPMD00** | Personal Pensioners, males, deferred | | |
| **RFD00** | Retirement Annuitants, females, deferred | Deferred Pensioners, females (lives) | [None] |
| **PPFD00** | Personal Pensioners, females, deferred | | |
| **RMC00** | Retirement Annuitants, males, combined | | |
| **RFC00** | Retirement Annuitants, females, combined | [None] | |
| **PPMC00** | Personal Pensioners, males, combined | | |
| **PPFC00** | Personal Pensioners, females, combined | | |
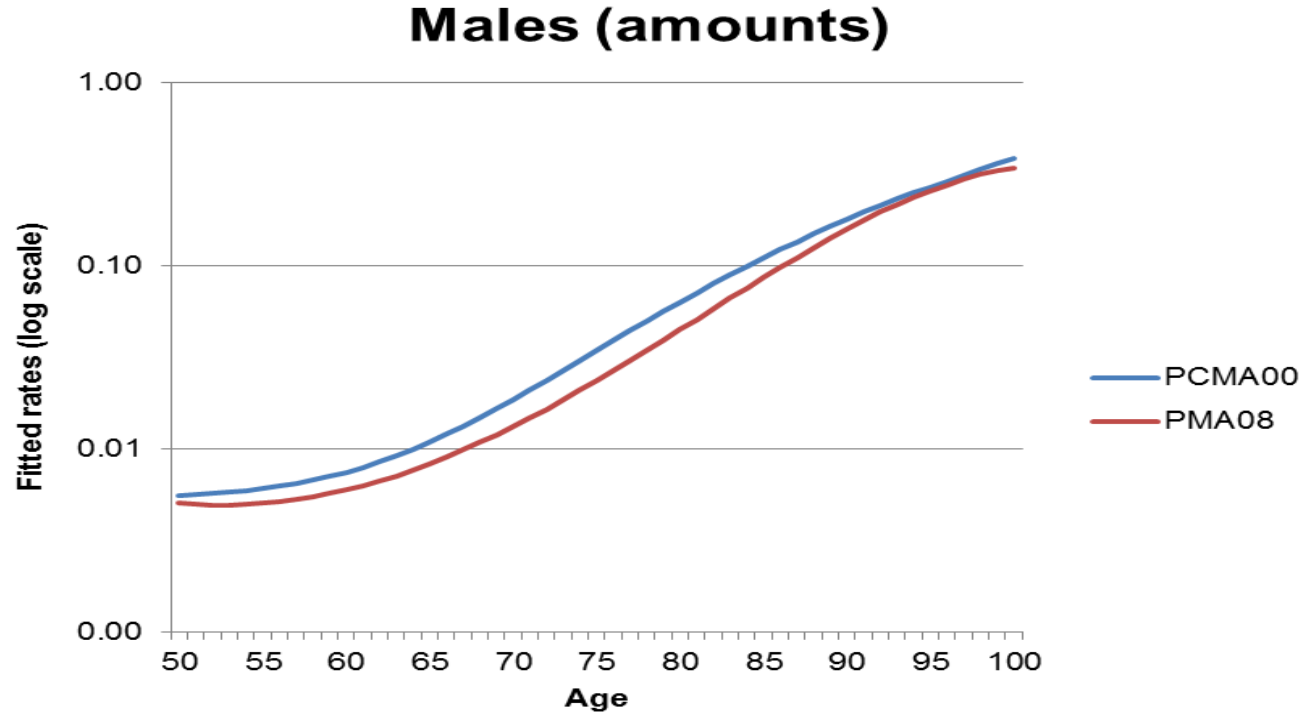
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# Proposed graduations – Pension Annuitants



Males (amounts)
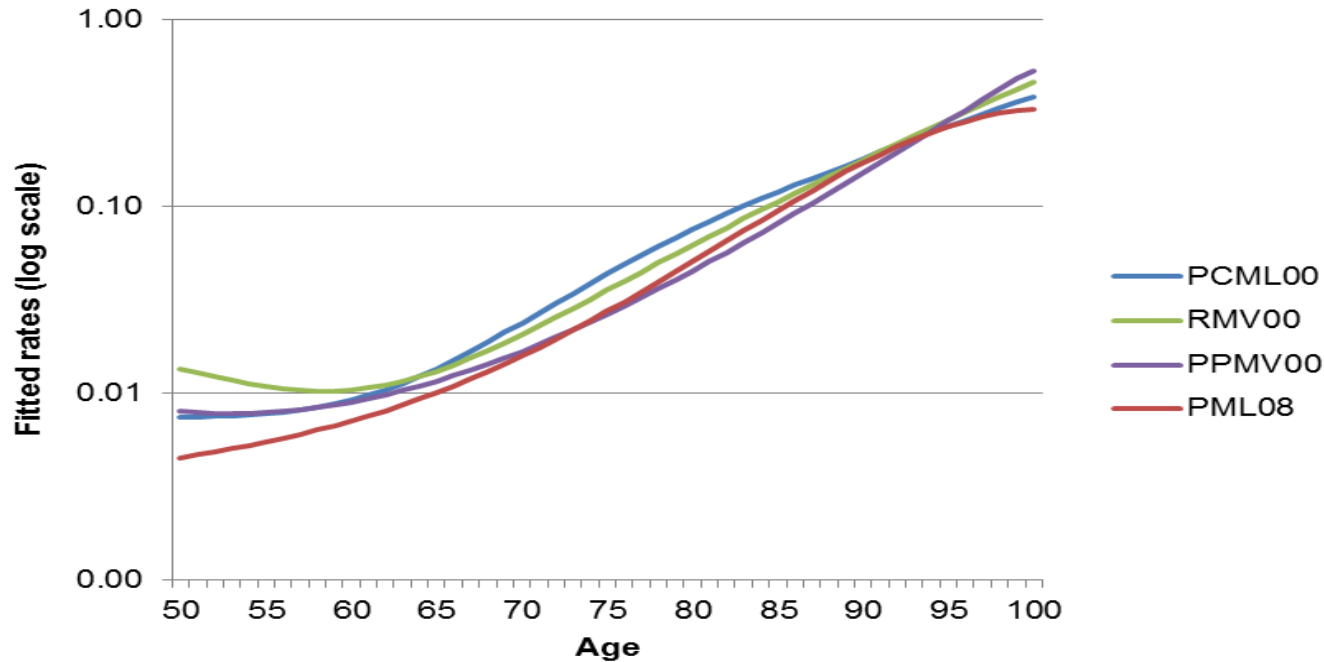
# Proposed graduations – Pension Annuitants



Males (lives)

# CMI Annuities Committee – Next steps

- Consult on proposed graduations
  - Proposed graduated tables
  - Extensions to younger / older ages
  - Target by Feb 2015

- Graduated "08" Series tables
  - Final tables + accompanying working paper
  - Target Q2 2015 – but dependent on responses to draft tables

- What's next?
  - Enhanced Annuities
  - All-Offices results for standard annuities for 2011 (and 2012)
  - Individual Offices' experience by GLM?

# Assurances

# CMI Assurances – 2007-2010 results

- Working Paper 75 described data and high-level commentary

- Summary results produced by:
  - Age (last birthday; 5-year age bands)
  - Duration (curtate; 0, 1-4, 5+)
  - Gender and Smoker status (where relevant)
  - Product category (separately for mortality, accelerated CI and stand-alone CI)

- Datasheets:
  - Individual age / duration + sum assured band and distribution channel

- No allowance for IBNS

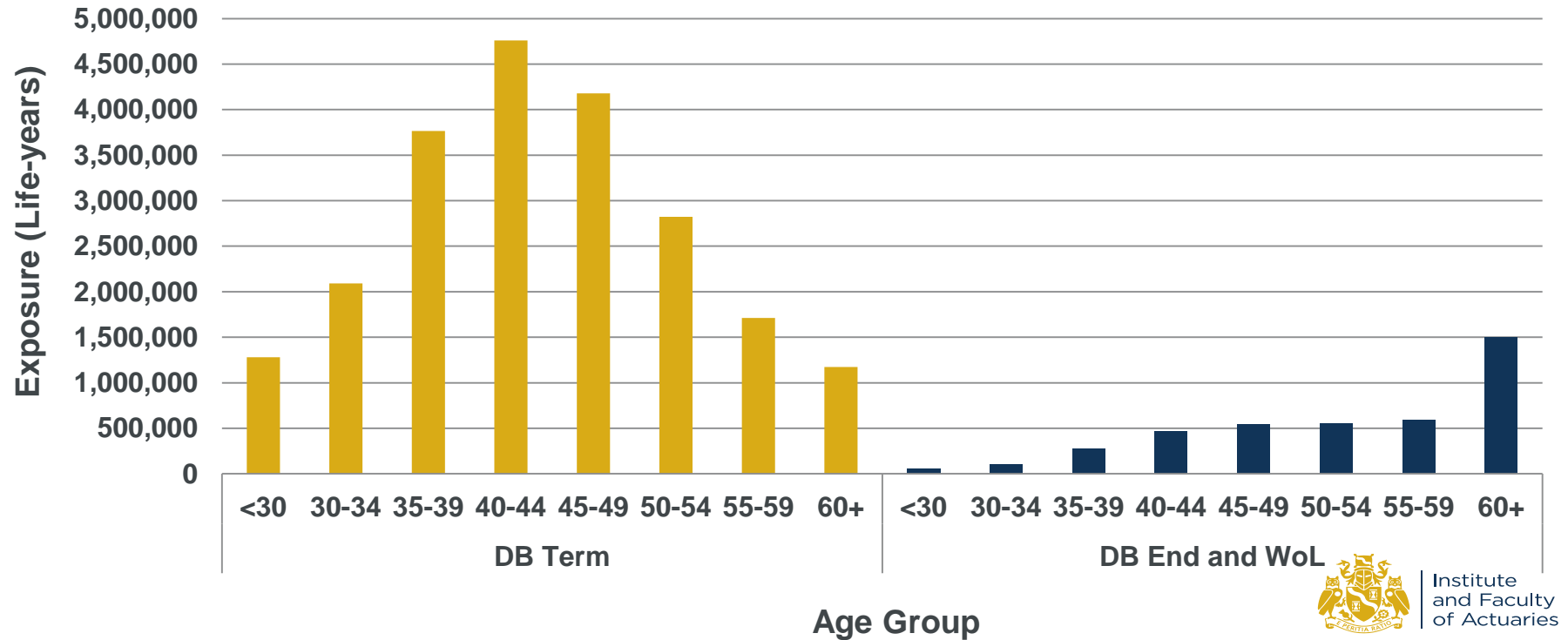- Further analysis now underway -> additional working papers and graduated tables.

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# Change in mix of offices (Mortality / Term)



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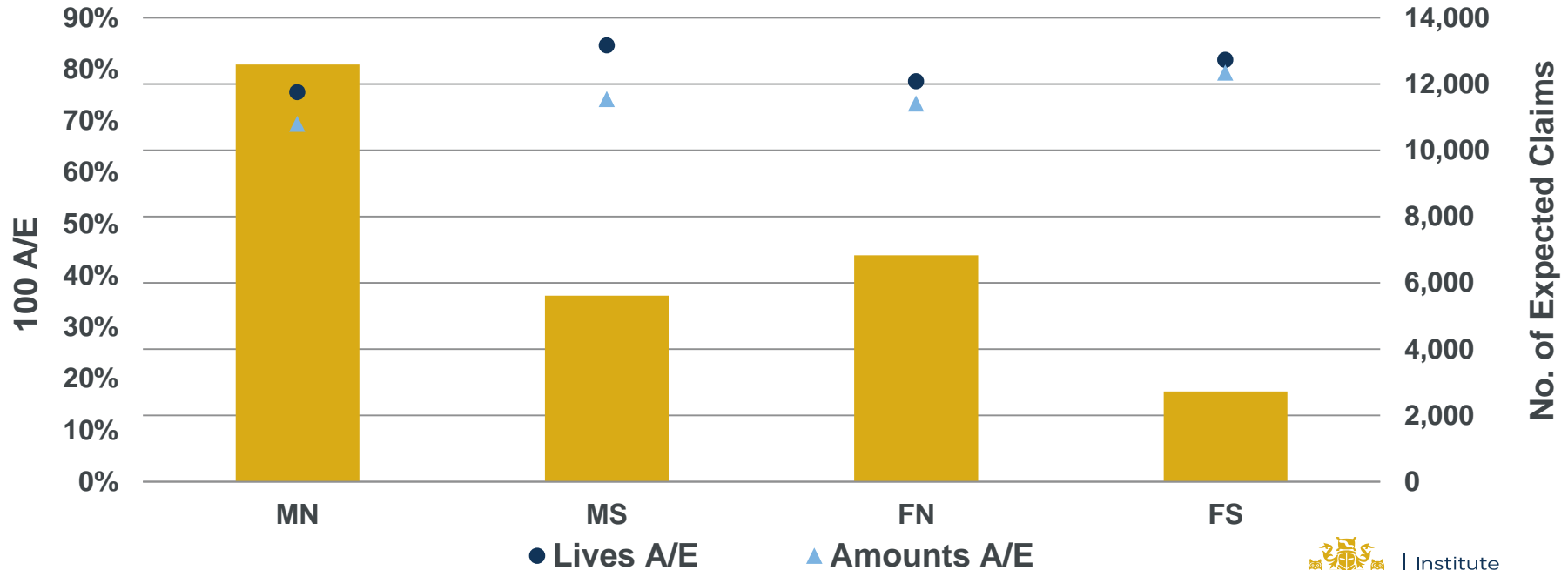# Change in mix of offices (Mortality / Endowment and Whole Life)



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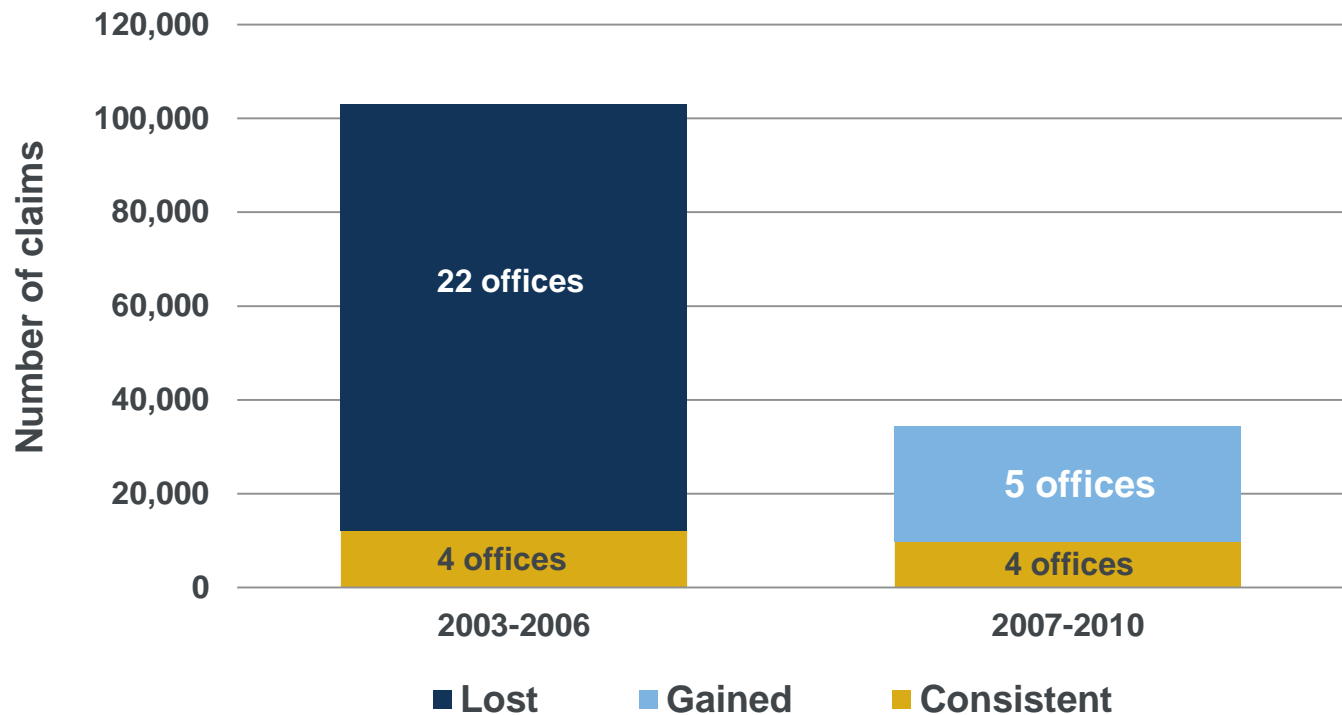
Exposure by Age (Term v EA/WL)

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# Mortality / Term Results: Lives vs. Amounts



Expected claims calculated using T*xy*00

# Mortality / Term Results by Age – Males



Lives A/E ●    Amounts A/E ▲
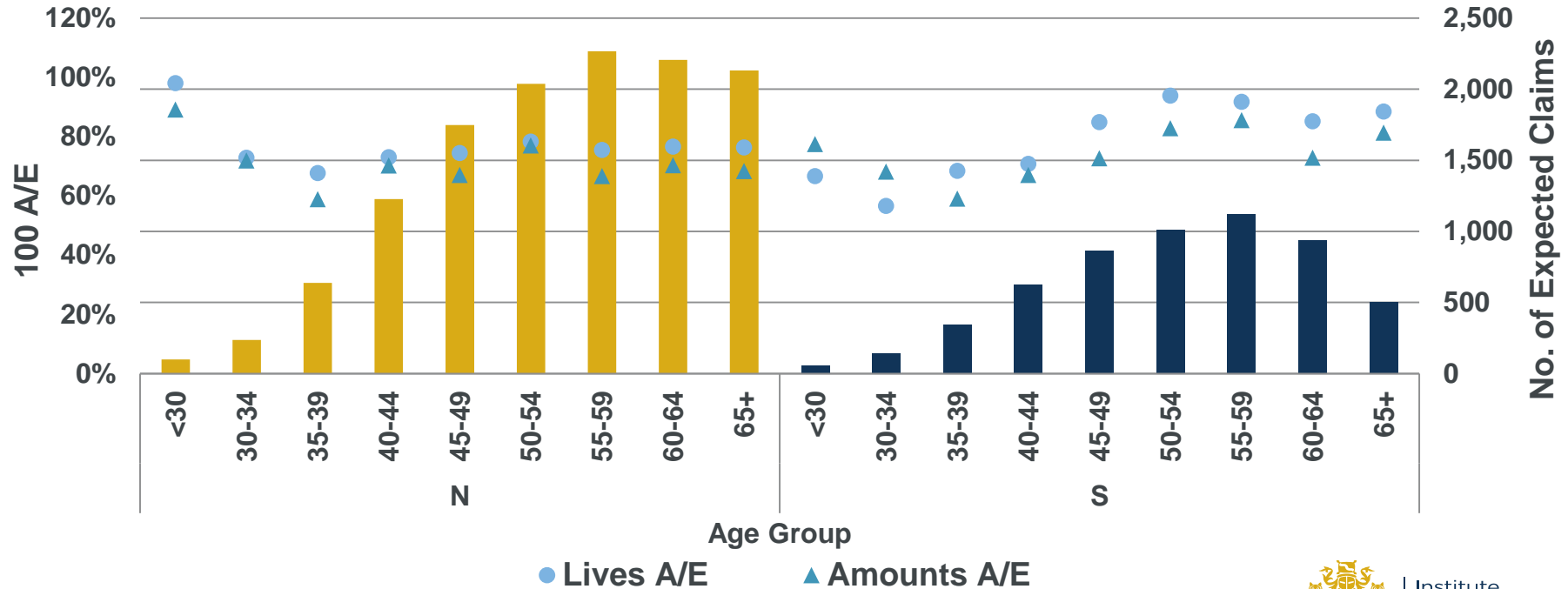
Expected claims calculated using T*xy*00

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# CMI Assurances – 2007-2010 graduations

- Do we need to update the 00 tables?

  - Critical Illness tables look like they are in more need of work

  - T00 tables look a better fit

  - A00 will largely be used at ultimate durations

- Issues to consider:

  - Graduate (a) Term only or  (b) Term + Endowment + WoL?

  - Should the tables vary by:- distribution channel, sum assured?

  - Lives tables only, or lives and amounts?

- Should we conduct a specific investigation in GA WOL?

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# Mortality Projections

# CMI_2014 changes to initial rates calibration

- Driven by population data quality:

  – Start from 1974 to avoid lower quality earlier data – expect to use a 40-year rolling period going forward

  – Adjust exposure data for age/year cells which are anomalous

  – Allow for overdispersion when fitting the p-spline model – smoother fit

- Driven by perceived need for up-to-date fit:

  – Use weekly deaths data 1 January 2013 to 30 September 2014

    - more up-to-date

    - reduces volatility due to 2013/14 experience

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# Population data quality/artefacts

- P-spline model fits data less well than would be expected

  - over-dispersion in general

  - particular issues with 1960s calendar years and 1919 birth cohort

- Informed by:

  - Graduation and Modelling Working Party

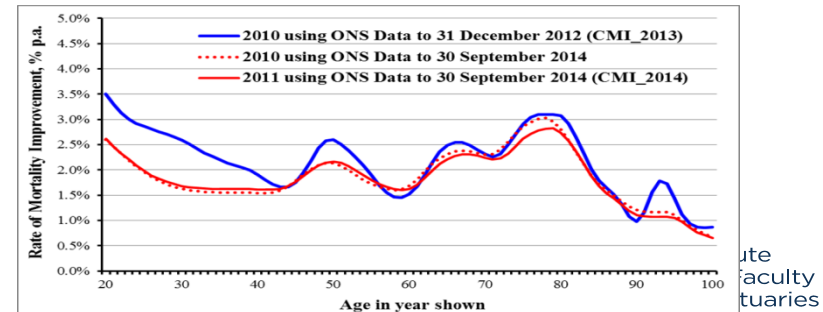  - Cairns et al – 'Phantoms never die' (2014)



Extreme deviance residuals
(1-in-10,000 probability)
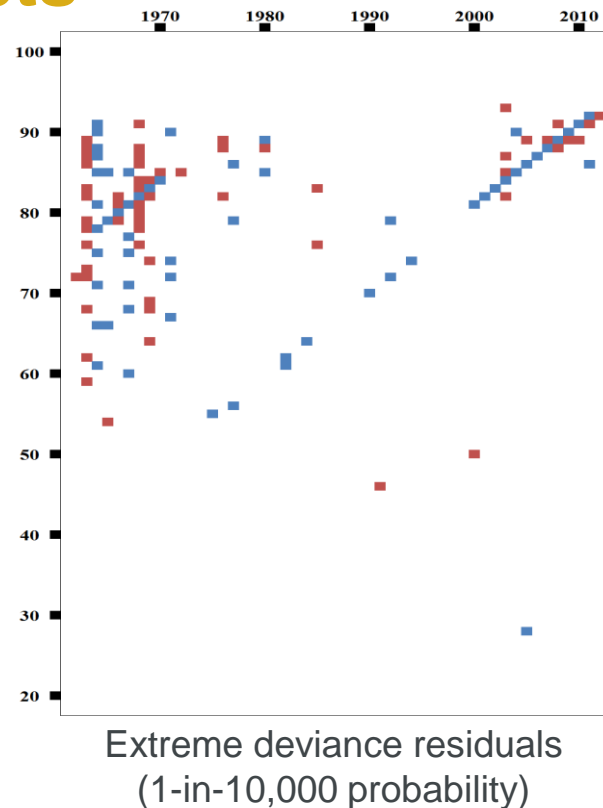
# Mortality improvements in 2013 and 2014

- Crude improvements of
  - ~0% in 2013
  - 4-5% in 2014

- CMI_2014 improvements lower than CMI_2013 at most ages

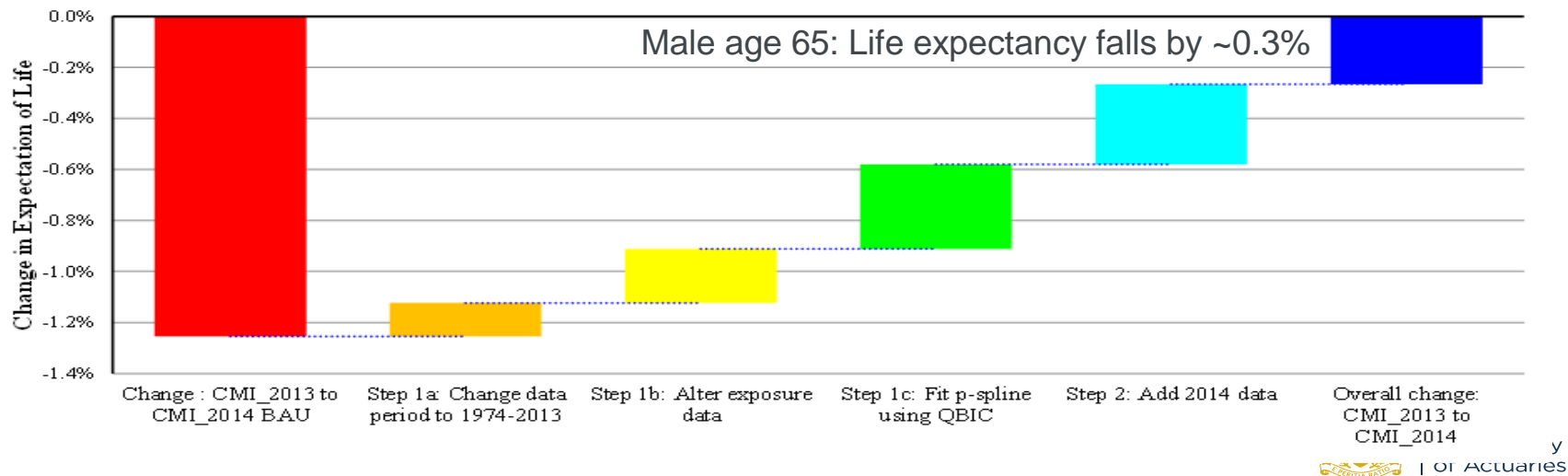- CMI_2014 improvements have less extreme cohort effects, due to changes in calibration method.

Male
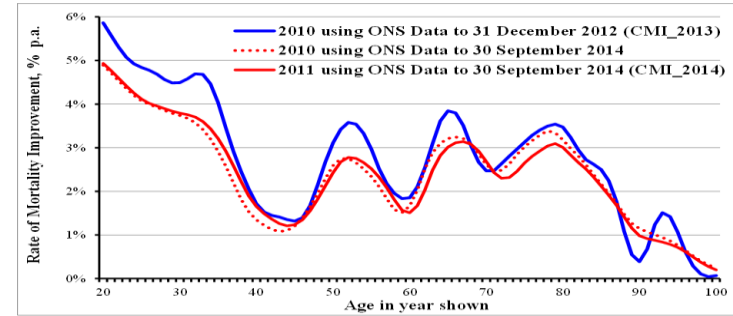


Female

# Impact on (male) life expectancy

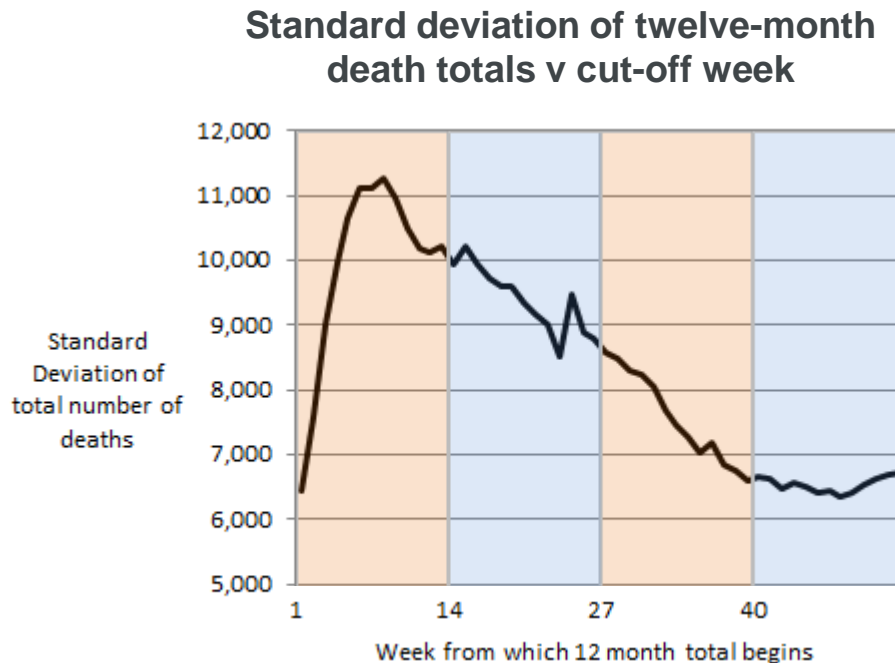- Most ages see a modest fall in life expectancy

- Changes to CMI_2014 led to a lower fall v 'business as usual' (BAU)



Male age 65: Life expectancy falls by ~0.3%

Chart y-axis: Change in Expectation of Life, ranging from 0.0% to -1.4%

Categories:
- Change : CMI_2013 to CMI_2014 BAU
- Step 1a: Change data period to 1974-2013
- Step 1b: Alter exposure data
- Step 1c: Fit p-spline using QBIC
- Step 2: Add 2014 data
- Overall change: CMI_2013 to CMI_2014

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# Release timing

- Release timing driven by ONS data availability

- Problem for life offices:
  - November too late for year-end
  - Auditors need justification for not using the latest model

- Can achieve September *provided no issues arise*, but this is still late

- Consultation planned shortly

**Standard deviation of twelve-month death totals v cut-off week**



Standard Deviation of total number of deaths

Week from which 12 month total begins

# Future versions of the Model

- SoA (US), CIA (CA) and AG (NL) recently improved their projections

- Projections Committee is actively reviewing:
    - More objective statistical approach – e.g. how volatile should projections be?
    - Review current deterministic method and consider alternatives
    - Not cause of death, but cause of death data does inform the philosophy
    - Coherent modelling: males v females, UK v Western World, SAPS

- Best guess
    - CMI_2015 – business as usual
    - CMI_2016 – new approach/model (subject to prior consultation)?

# International comparison – England & Wales
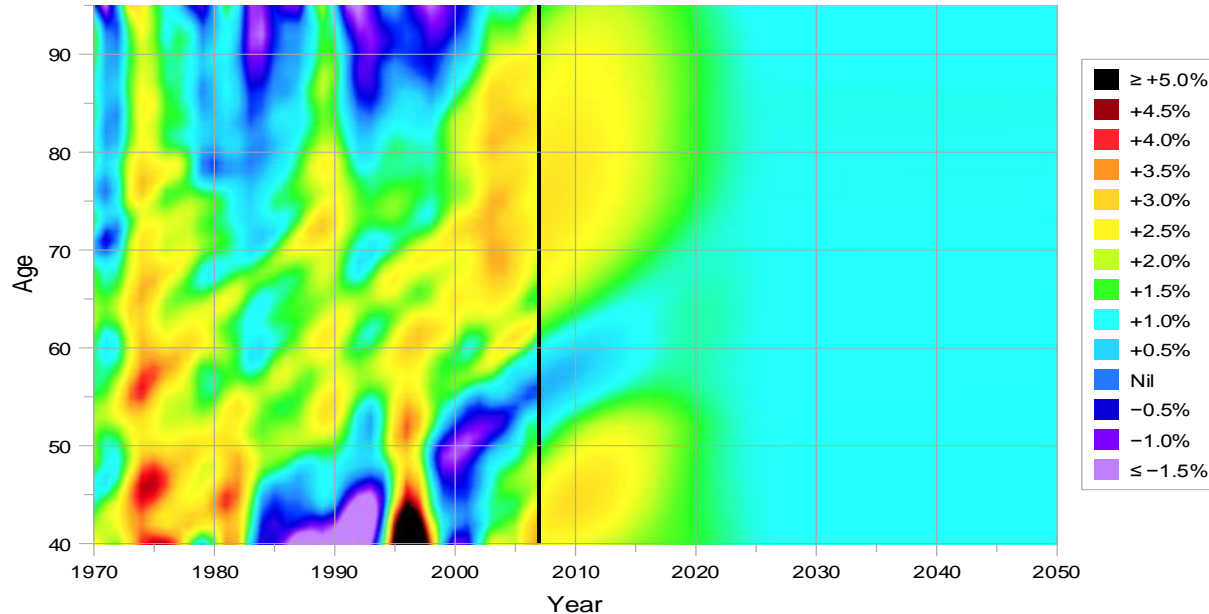
**England & Wales males / CMI_2013 Core (LTR=1.5%)**
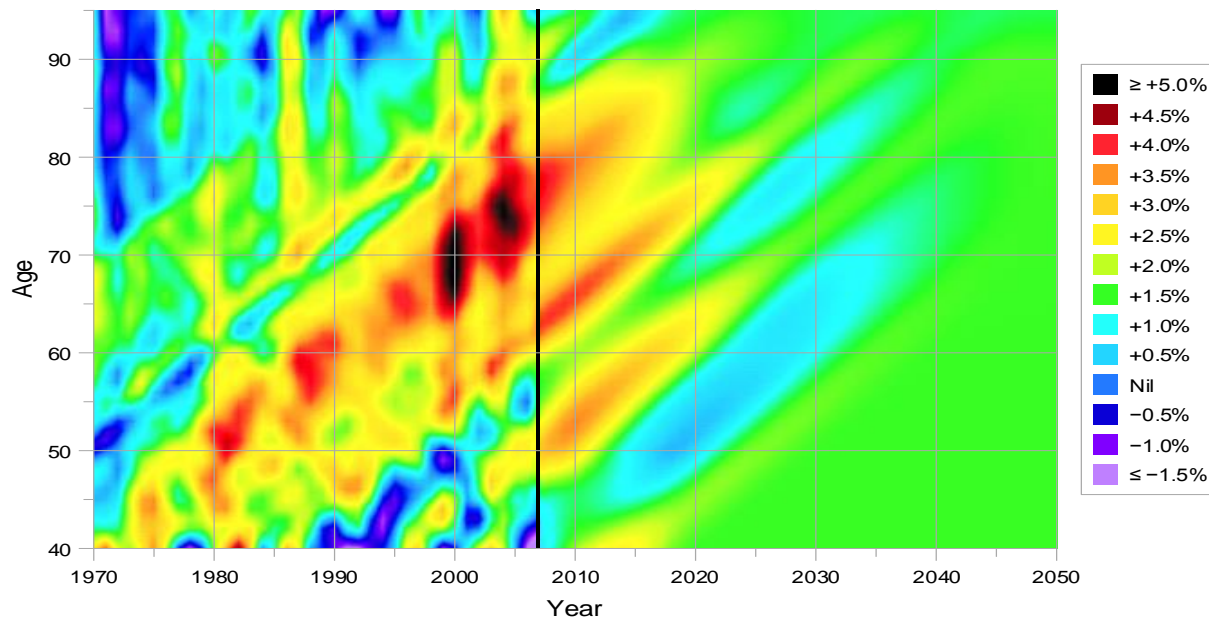


Source: Human Mortality Database/CMI. Graphs provided by Aon Hewitt. Mortality improvement is annual difference in –log(deaths/exposure) with LOESS smoothing over ±3 years over age and period for the experience data.

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# International comparison – US
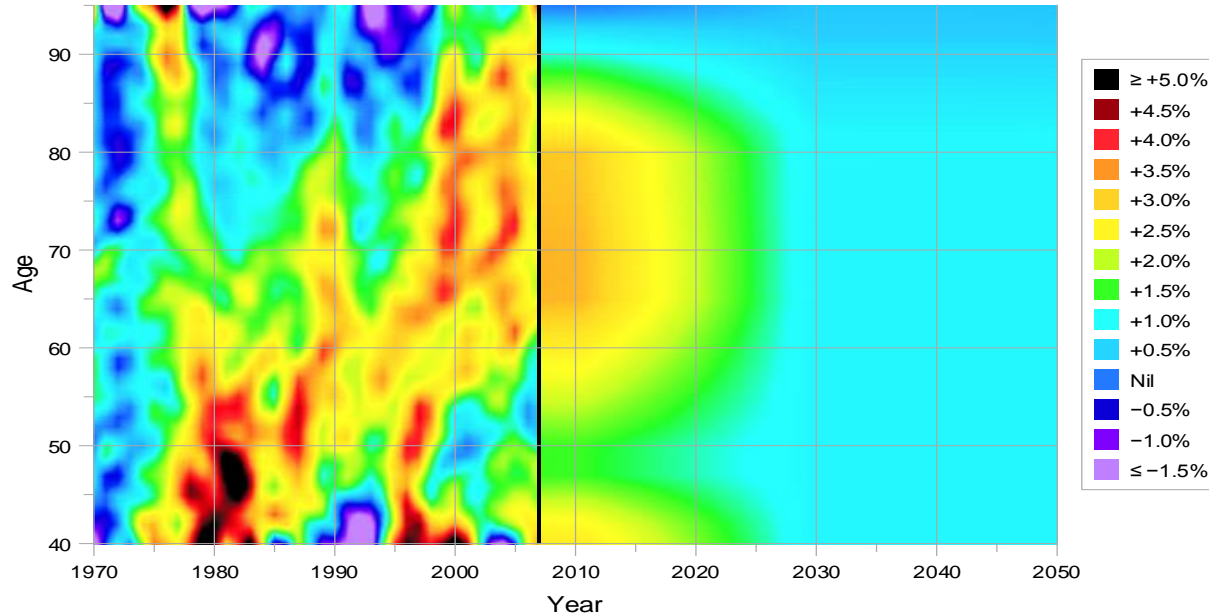
## US males / MP-2014 exposure draft



Source: Human Mortality Database/Society of Actuaries. Graphs provided by Aon Hewitt. Mortality improvement is annual difference in –log(deaths/exposure) with LOESS smoothing over ±3 years over age and period for the experience data.

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# International comparison – Canada

## Canada males / CPM-B



Source: Human Mortality Database/Canadian Institute of Actuaries. Graphs provided by Aon Hewitt. Mortality improvement is annual difference in −log(deaths/exposure) with LOESS smoothing over ±3 years over age and period for the experience data.

# International comparison – Netherlands



Netherlands males / AG2014

(NB more smoothing compared with previous heatmaps)
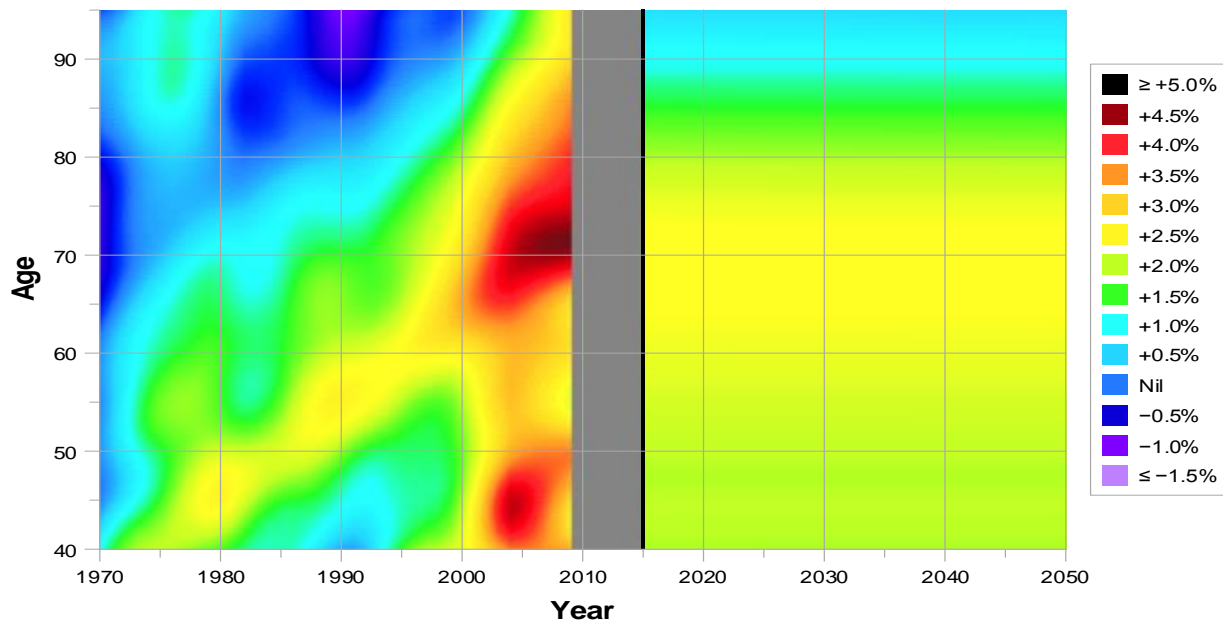
*Source: Human Mortality Database/Actuarieel Genootschap. Graphs provided by Aon Hewitt. Mortality improvement is annual difference in –log(deaths/exposure) with LOESS smoothing over ±3 years over age and period for the experience data.*

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- Best guess
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# Disclaimer and statutory information

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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.

Feedback always welcome: info@cmilimited.co.uk.