



Continuous Mortality Investigation

Institute and Faculty of Actuaries

ACA Sessional Meeting: An update from the CMI

Tim Gordon
Mortality Projections Committee

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SAPS Committee

Mission, Vision, Aims & Objectives

Mission

- To produce high-quality impartial analysis, standard tables and models of mortality and morbidity for long-term insurance products and pension scheme liabilities on behalf of subscribers and, in doing so, to further actuarial understanding.

Vision

- To be regarded across the world as setting the benchmark for the quality, depth and breadth of analysis of industry-wide insurance company and pension scheme experience studies.

Mission, Vision, Aims & Objectives

Aims & Objectives

- Publish collated experience analysis results to subscribers on a regular basis, including relevant benchmarking of each firm's own results
- Publish standard decrement tables and projections (where appropriate) in line with the relevant actuarial standards for each product line
- Publish papers detailing the methods employed in producing the standard tables and the research conducted to justify these
- Publicise the work of the CMI to employees within subscribers and, where appropriate, more widely
- Obtain regular feedback from subscribers on what their needs are to ensure that output continues to remain valuable and relevant
- Maintain the number of firms subscribing to the CMI and increase the number where possible
- Identify new opportunities to provide data analysis for the benefit of our subscribers
- Provide value for money to our subscribers and produce all material for the benefit of our subscribers and not for profit
- Work with the Institute and Faculty of Actuaries to promote the expertise of the Actuarial Profession in the fields of mortality and morbidity.

Mortality Projections Committee

History of the Model

Name	Release date	Calibration data	Working Paper
CMI_2009	25 November 2009	1961-2008	41
CMI_2010	23 November 2010	1961-2009	49
CMI_2011	16 September 2011	1961-2010	55
CMI_2012	8 February 2013	1961-2011	63
CMI_2013	13 September 2013	1961-2012	69
CMI_2014	24 November 2014	1974-2014	74
CMI_2015	28 September 2015	1975-2015	84
CMI_2016	27 March 2017	1976-2016	97
CMI_2017	1 March 2018	1977-2017	105

CMI_2017

- Released 1 March 2018
- WP105 – numerical results and discussion
- “CMI_2017 methods” – technical detail (vs WP98 for CMI_2016)
- “CMI_2017 software user guide” (vs WP99 for CMI_2016)
- CMI_2017 Model software, to allow users to perform their own calculations
- Spreadsheets deriving the CMI_2017 datasets from ONS data

Business as usual

- 1977-2017 vs 1976-2016 for CMI_2016
- Estimates of deaths and exposures data for 2016 in CMI_2016 replaced by ONS data in CMI_2017
- We have estimated deaths and exposures data for 2017, using the method described in Section 3 of the methods paper
- The ONS use the Kannisto-Thatcher method to estimate populations at ages 90 and above – this method leads to revised estimates of historical populations when new data becomes available
- Minor change to estimation of annual data from weekly ONS deaths data (see Appendix 3 of WP105)

Future updates

CMI_2018

- Due by the end of March 2019
- May take account of High Age Mortality Working Party (WP100)
- No other changes for next few years

Quarterly monitoring

- The Committee intend to publish quarterly updates on recent mortality
- This will follow a similar format to WP103

Current context

- Still uncertainty about the causes of recent high mortality, which has implications for weight placed on recent experience
- Users encouraged to consider varying the period smoothing parameter, S_K
 - Core value is $S_K = 7.5$
 - $\lambda_K = 10^{S_K}$
- Meeting at Staple Inn on 3 April 2018, in conjunction with the Staple Inn Actuarial Society (SIAS), to discuss recent mortality experience and prospects for future mortality improvements – see [SIAS website](#)

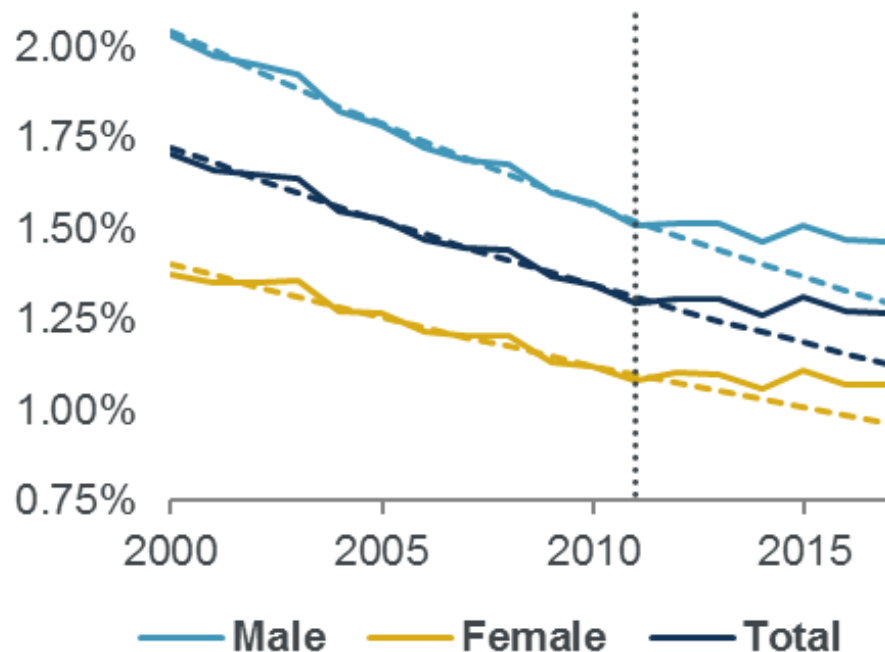
In what follows,

SMR = standardised mortality rate

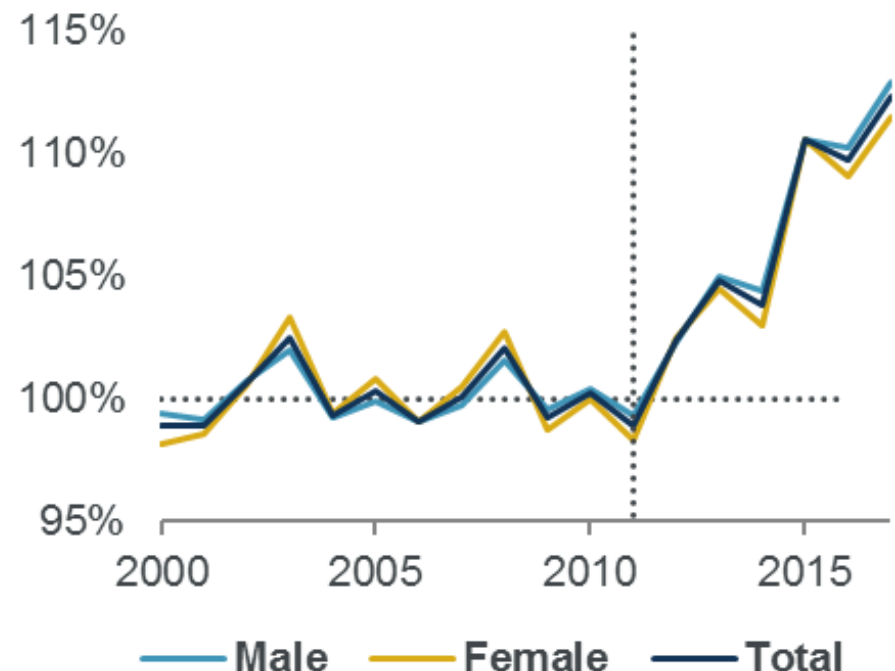
using the European 2013 Standard Population (possibly by age range)

Standardised mortality rates – recent mortality

SMRs (solid) compared to trends from 2000-2011 (dashed)



SMRs as a proportion of the corresponding 2000-2011 trend



Convergence of mortality rates by gender

Male SMR divided by female SMR



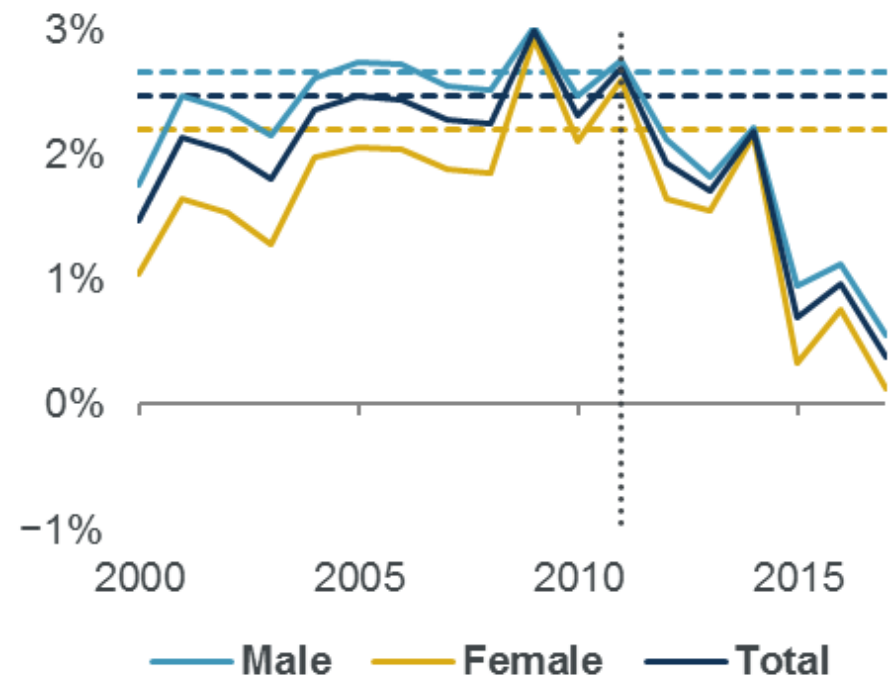
Mortality rates have converged by gender in relative terms, both before and after 2011, albeit at a slower rate in recent years

Improvements – comparison to 2000-2011

Annual mortality improvements (solid) compared to trends from 2000-2011 (dashed)



Six-year average mortality improvements (solid) compared to trends from 2000-2011 (dashed)



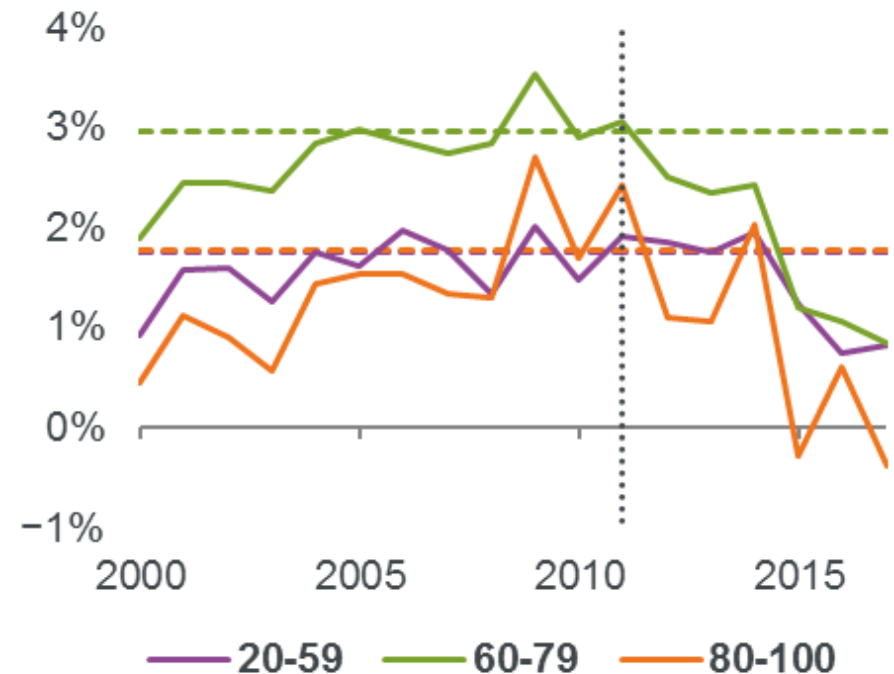
Improvements by age band

Six-year average mortality improvements for different age bands

Male

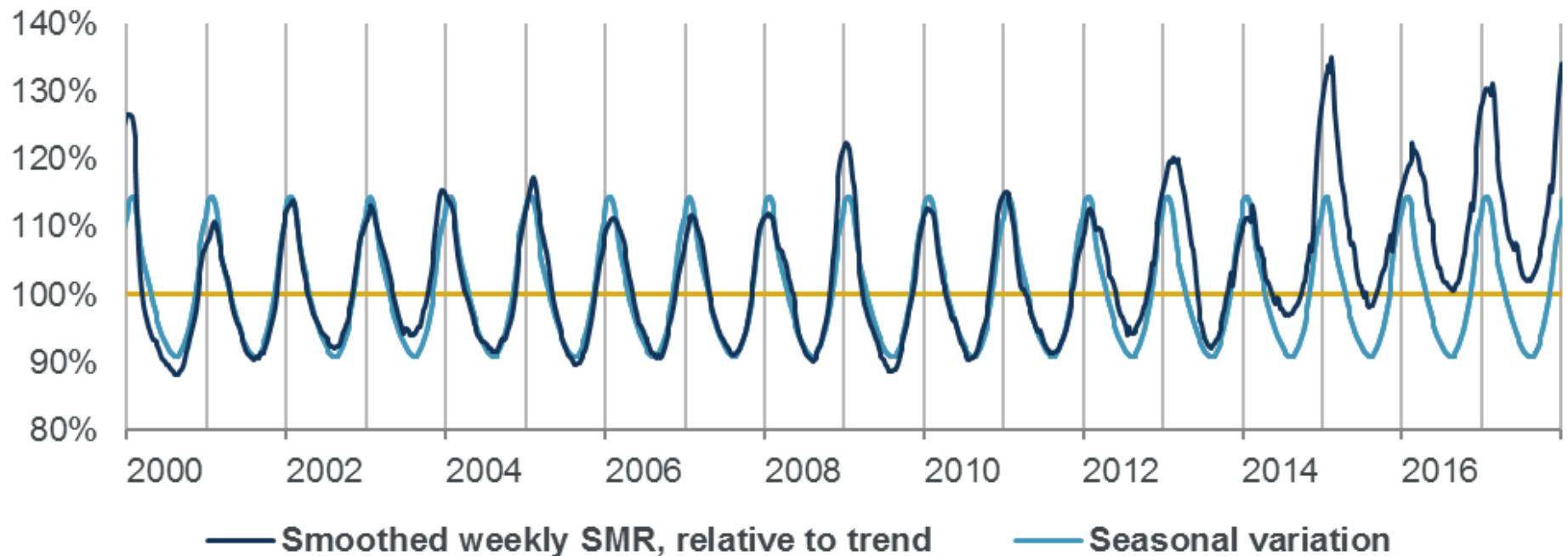


Female



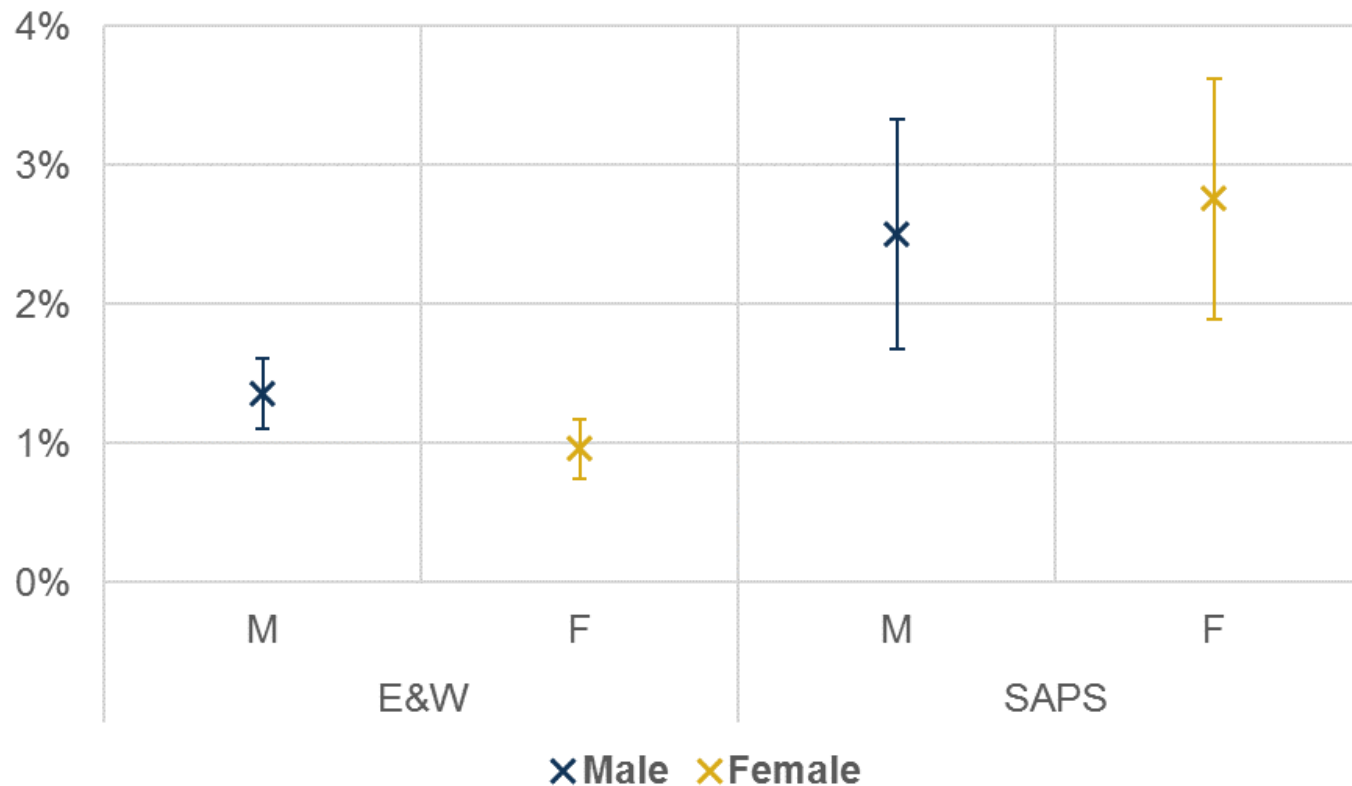
Seasonal mortality

Smoothed weekly SMRs, relative to 2000-2011 trend

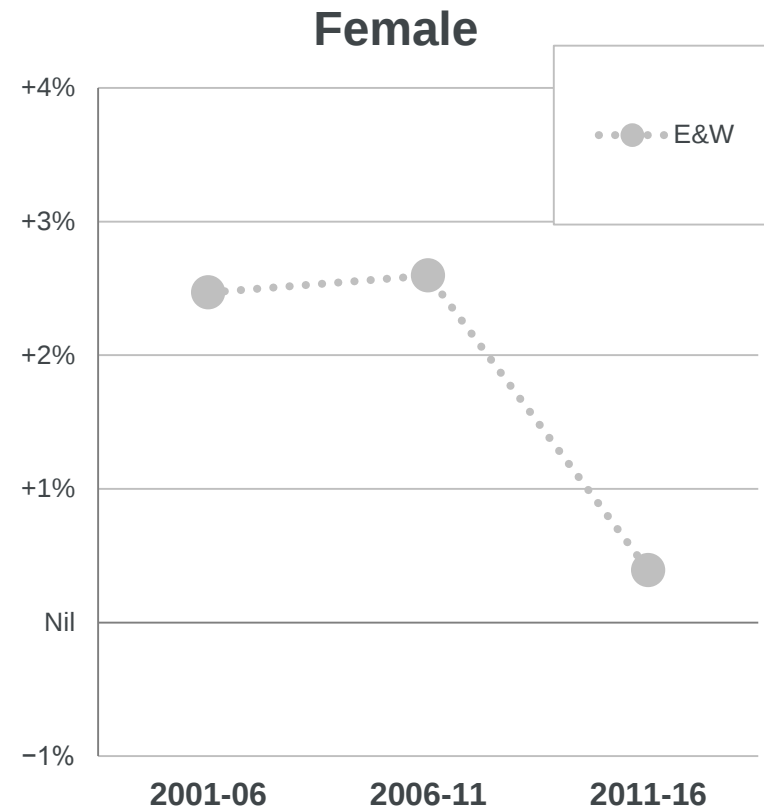
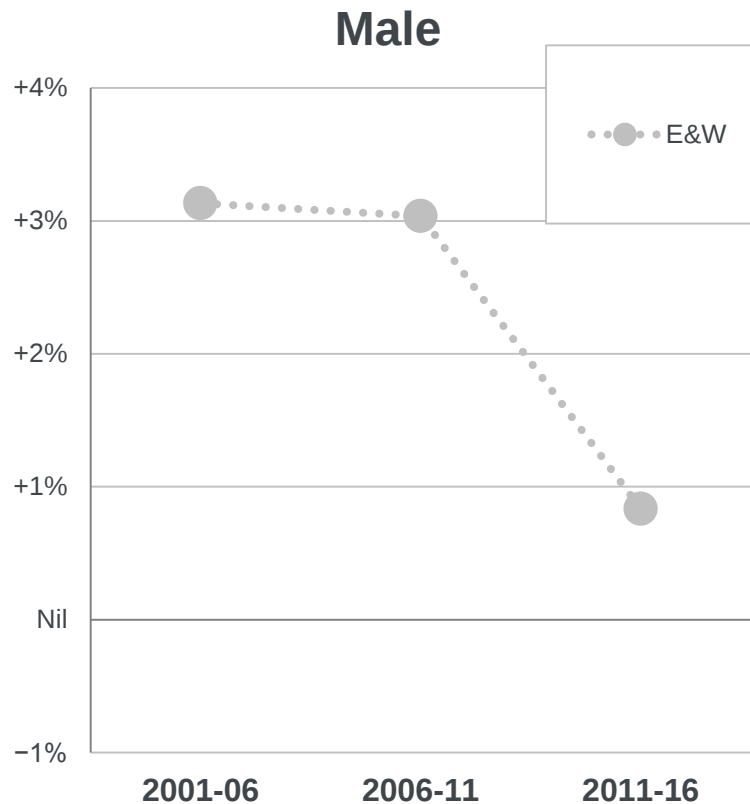


Mortality improvements in the SAPS dataset

- Average mortality improvements 2008-2015, with 95% confidence intervals
- Comparing the SAPS dataset and the England & Wales (E&W) general population (ages 65-100)



Mortality improvement by socio-economic group

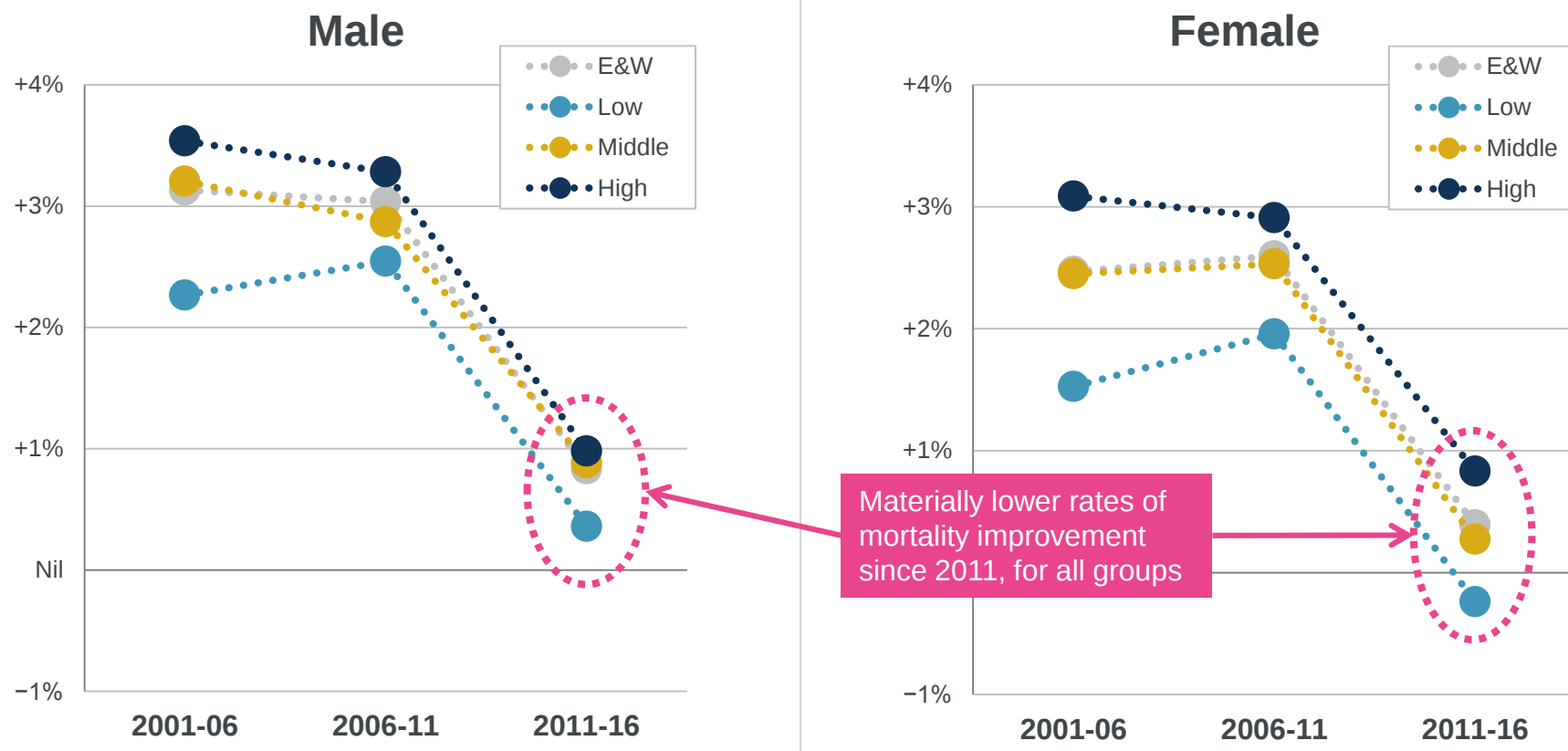


Calculations by Aon Hewitt using ONS data for England & Wales.

Mortality rates have been standardised using European Standard Population 2013 for ages 50 to 89 inclusive.

Improvements are $-\Delta \log SMR_t$.

Mortality improvement by socio-economic group



Calculations by Aon Hewitt using ONS data for England & Wales.

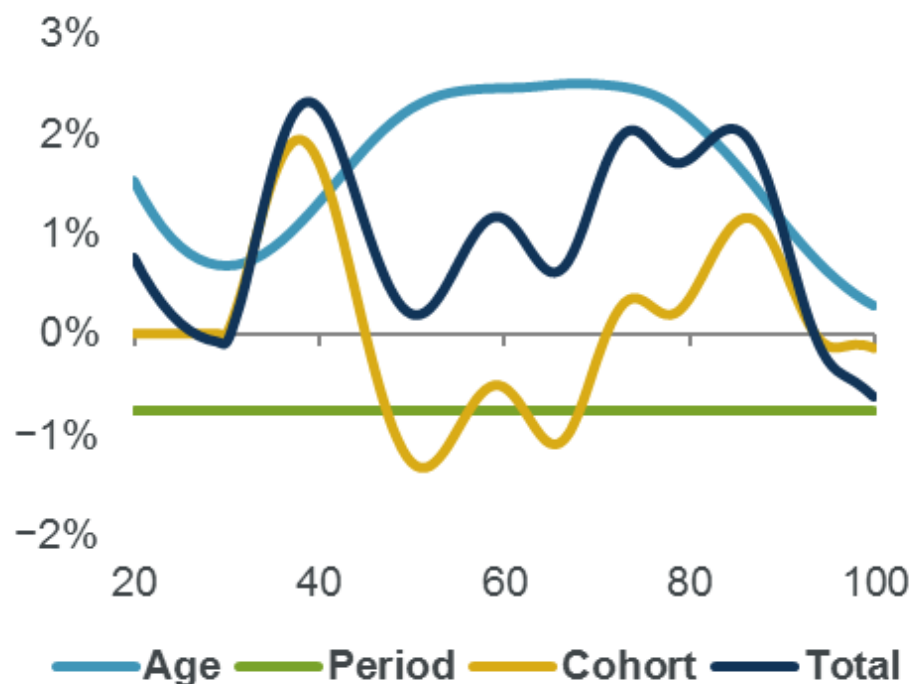
Mortality rates have been standardised using European Standard Population 2013 for ages 50 to 89 inclusive.

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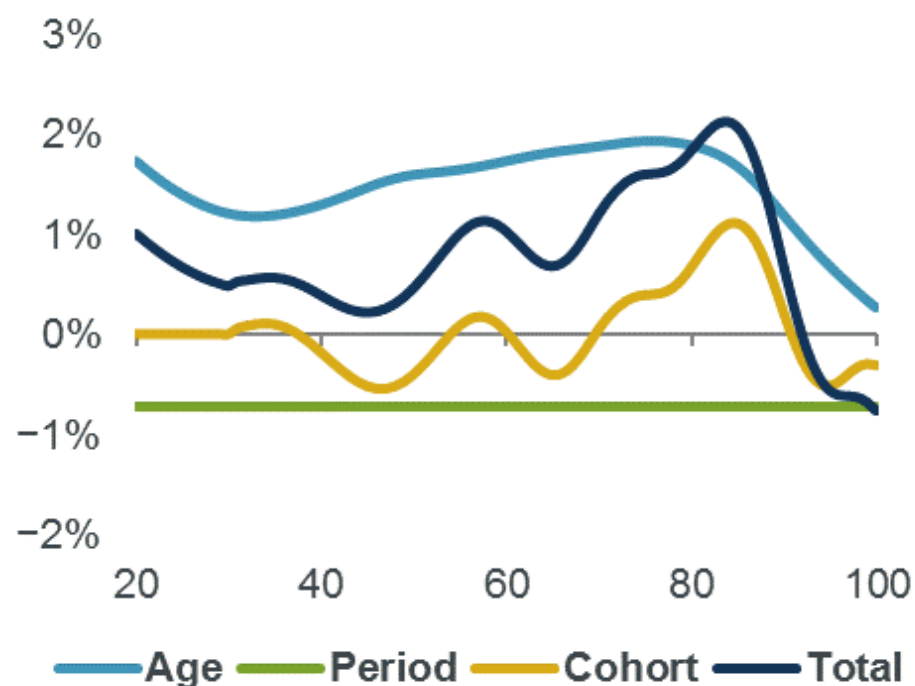
Initial rates of mortality improvement

Initial mortality improvements and components in CMI_2017

Male

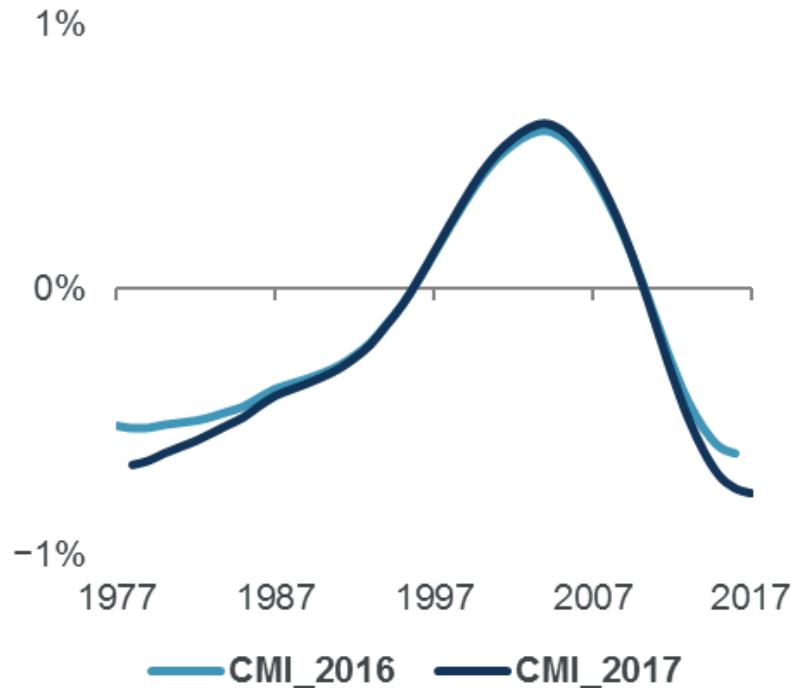


Female

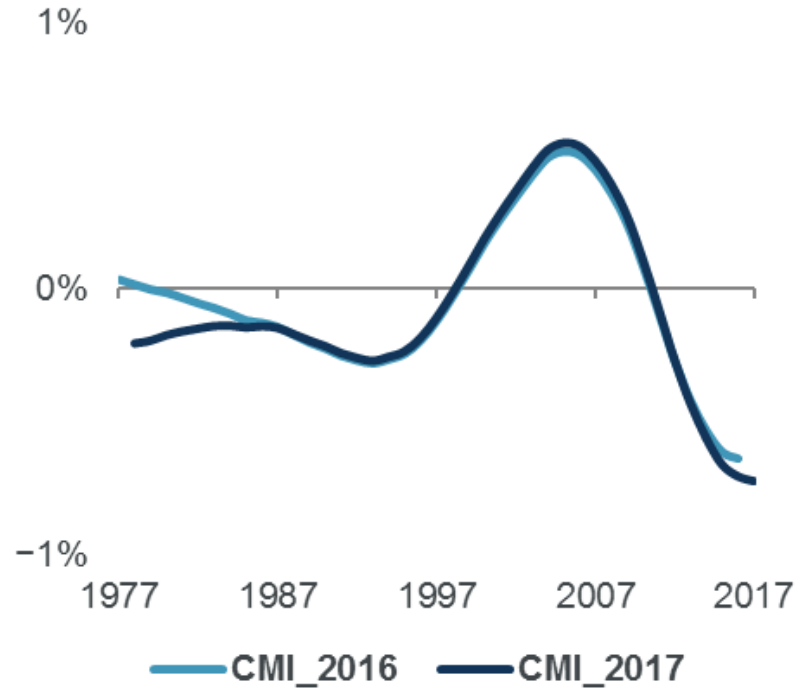


Period components and direction of travel

Period components (male)



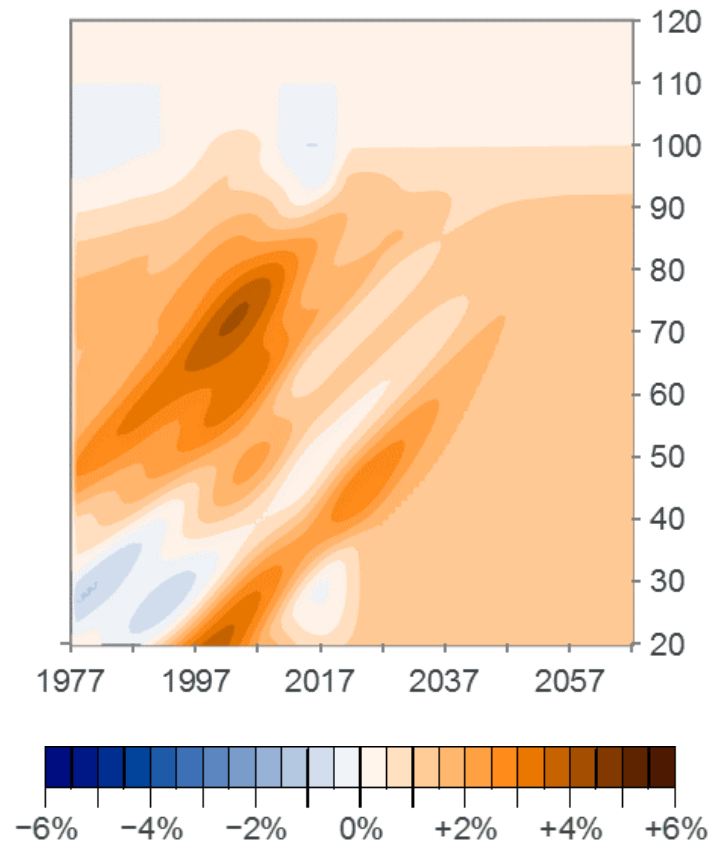
Period components (female)



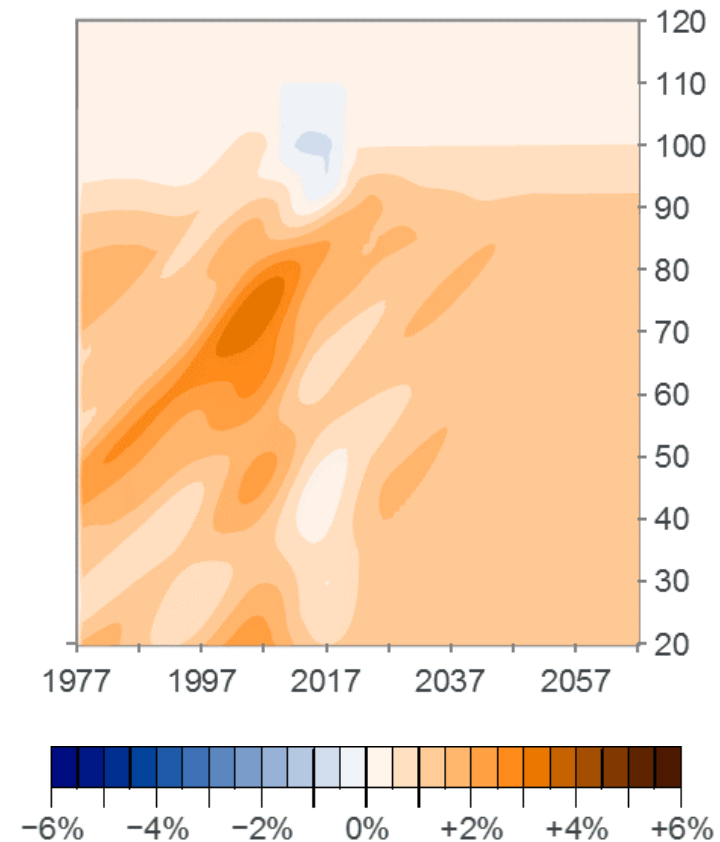
- Direction of travel is set to zero in the Core Model, but can be specified as an Advanced parameter
- Value implied by the APCI model, calibrated to the CMI_2017 dataset, is -0.019% for males and -0.018% for females (both slightly closer to zero than in CMI_2016)

Patterns of mortality improvements

Male

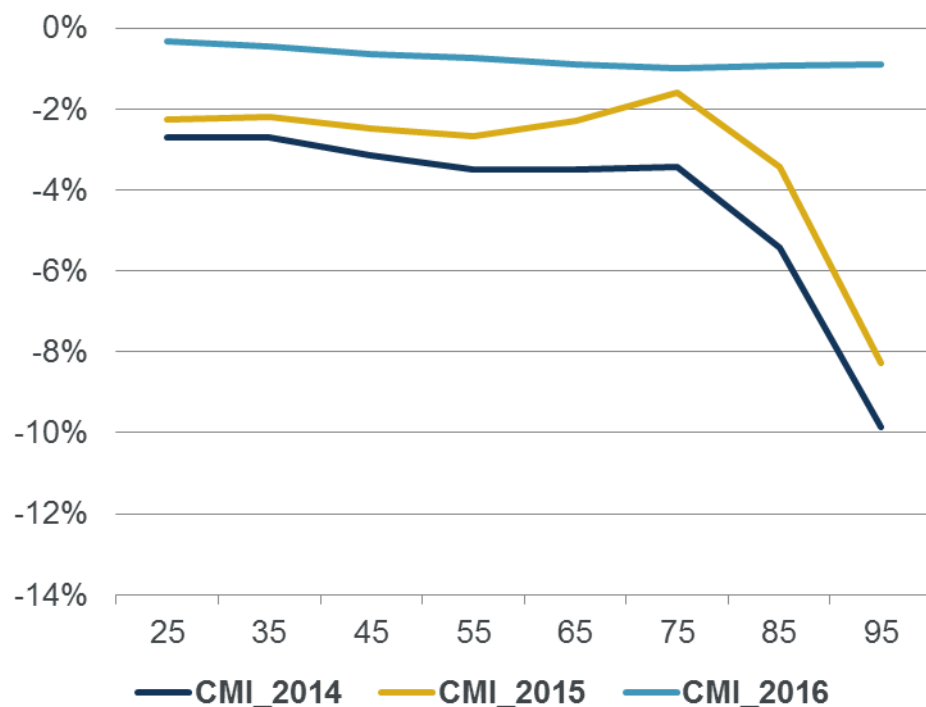


Female

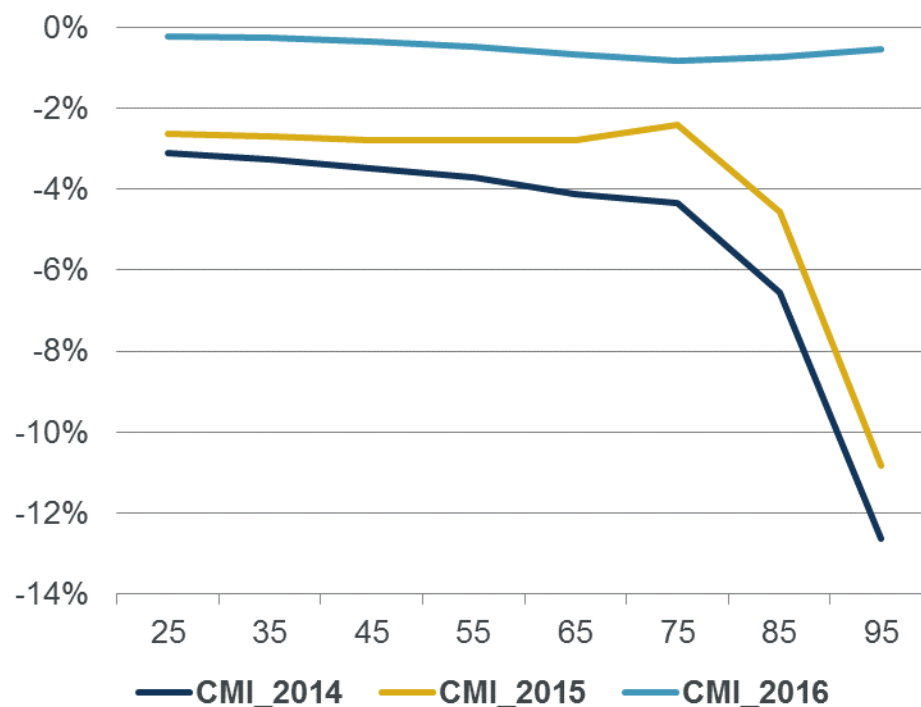


Life expectancies – comparisons to previous models

Males



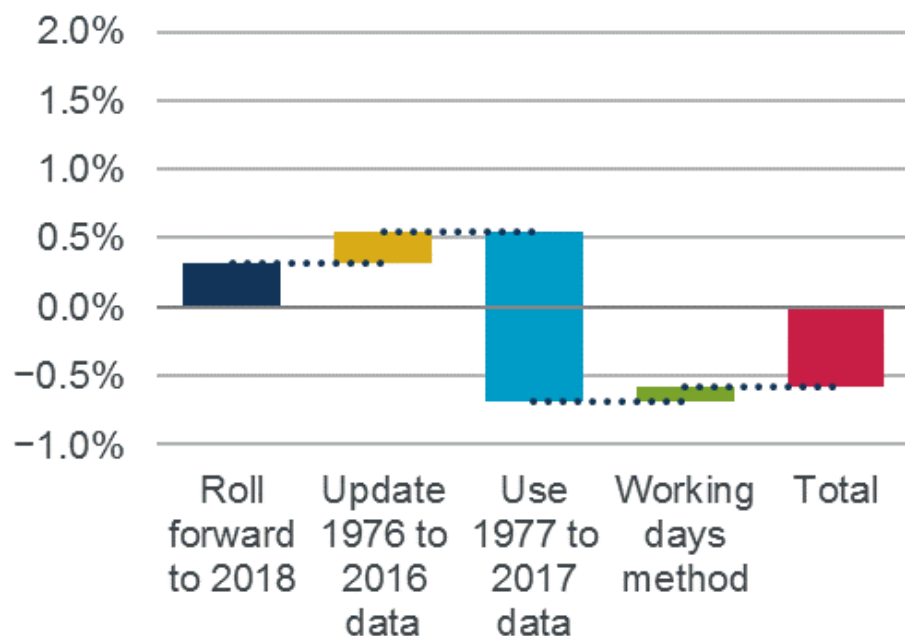
Females



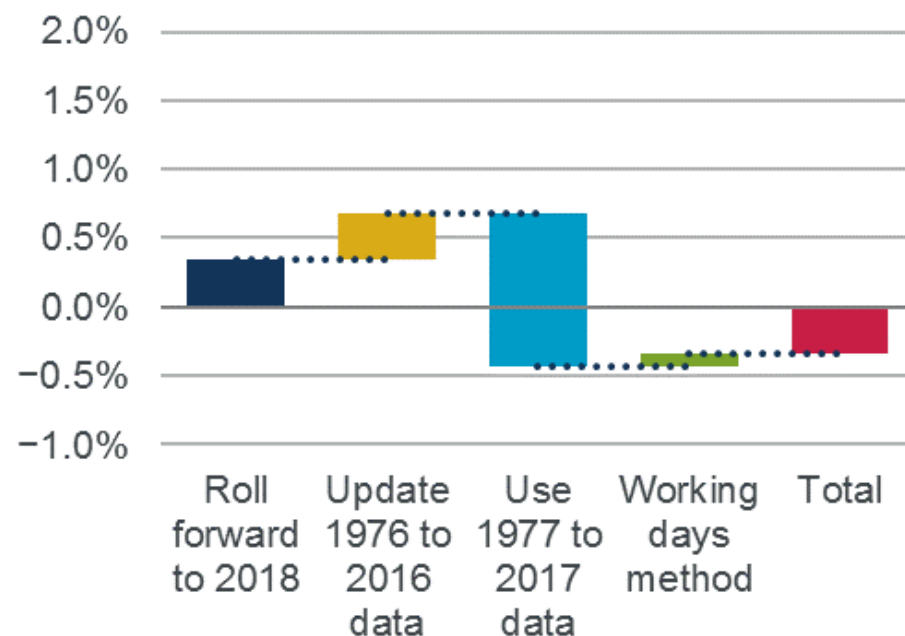
Components of changes: CMI_2016 to CMI_2017

Components – age 65

Males



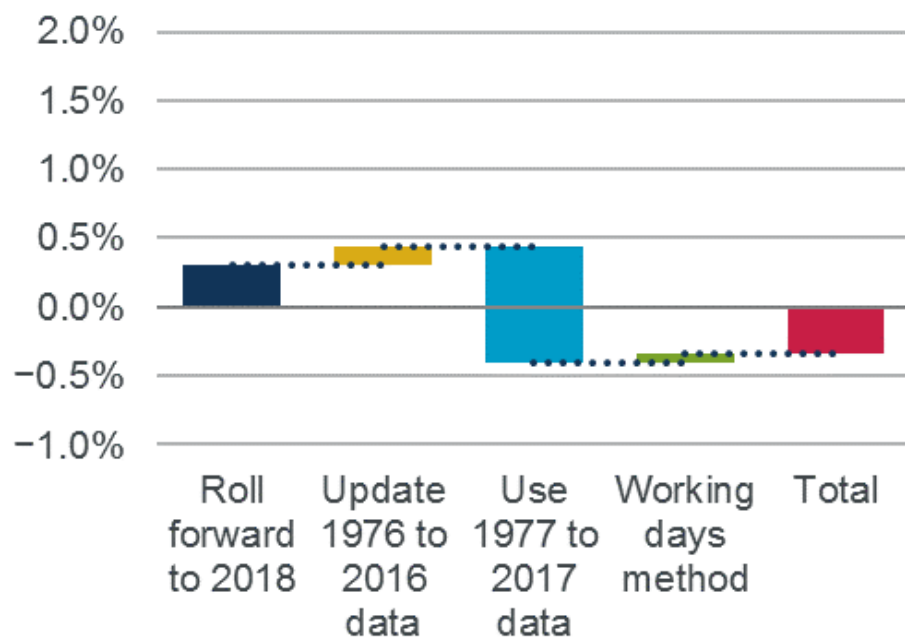
Females



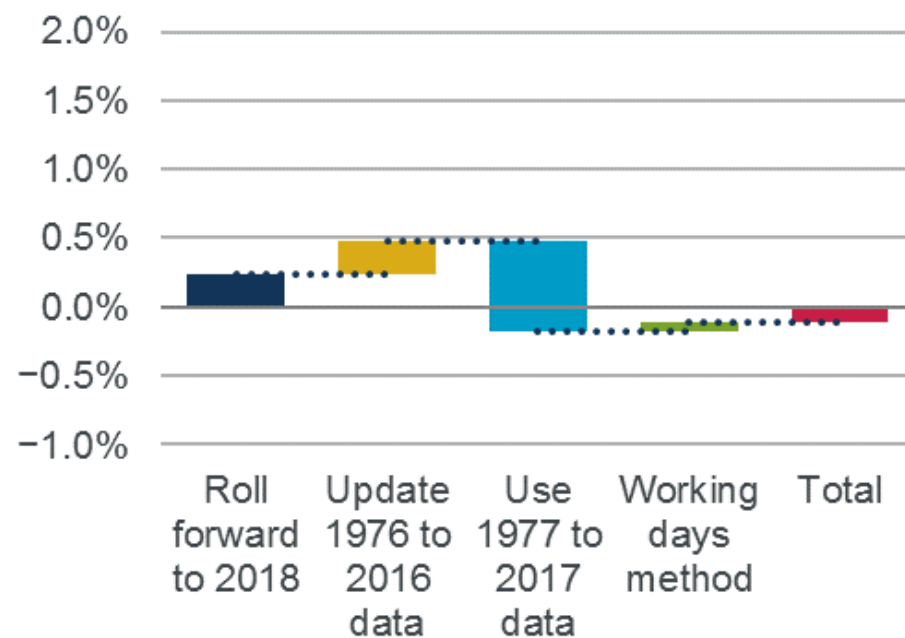
Components of changes: CMI_2016 to CMI_2017

Components – age 45

Males



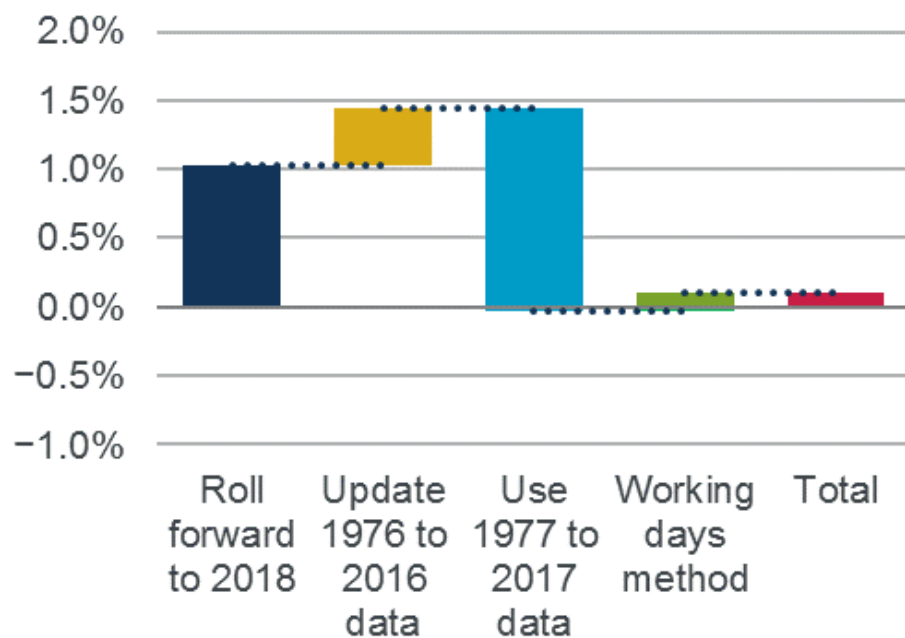
Females



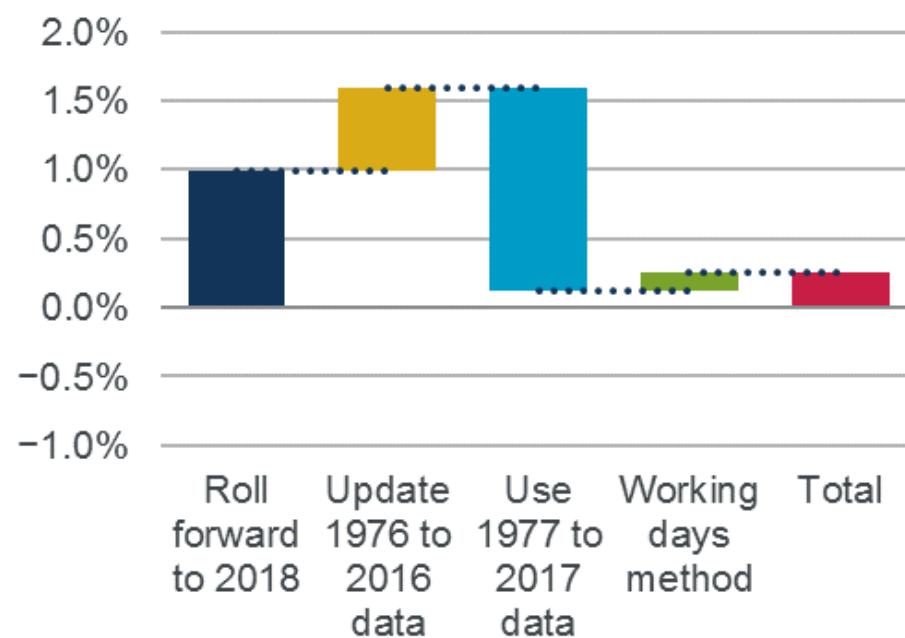
Components of changes: CMI_2016 to CMI_2017

Components – age 85

Males



Females



Sensitivities

Change in life expectancy for different ages

Age	Males				Females			
	25	45	65	85	25	45	65	85
LTR from 1.5% to 2%	+2.6%	+2.3%	+1.5%	+0.6%	+2.4%	+2.1%	+1.5%	+0.6%
S_k from 7.5 to 8	+0.7%	+1.1%	+1.6%	+2.1%	+0.6%	+0.9%	+1.3%	+1.7%
Age-Period improvements +1%	+1.0%	+1.6%	+2.2%	+1.9%	+0.8%	+1.4%	+1.9%	+1.7%
Cohort improvements +1%	+1.9%	+3.0%	+3.5%	+2.6%	+1.7%	+2.6%	+3.1%	+2.5%

Responsiveness to new data

Change in life expectancy between CMI_2017 and hypothetical versions of CMI_2018, at age 65

Improvement in 2018	Males				Females			
	-3%	0%	+3%	+6%	-3%	0%	+3%	+6%
$S_K = 6.5$	-2.8%	-0.9%	+0.9%	+2.6%	-2.3%	-0.7%	+0.9%	+2.4%
$S_K = 7.5$	-2.1%	-1.2%	-0.4%	+0.4%	-1.8%	-1.0%	-0.3%	+0.4%
$S_K = 8.5$	-1.3%	-0.9%	-0.5%	-0.2%	-1.1%	-0.8%	-0.4%	-0.1%

Responsiveness to new data

Approximate “breakeven” mortality improvement in 2018 to give the same life expectancy at age 65 in CMI_2017 and CMI_2018 for different values of S_{κ}

S_{κ}	6.5	7.5	8.5
Male	+1.6%	+4.4%	+7.3%
Female	+1.3%	+4.3%	+7.1%

SAPS Committee

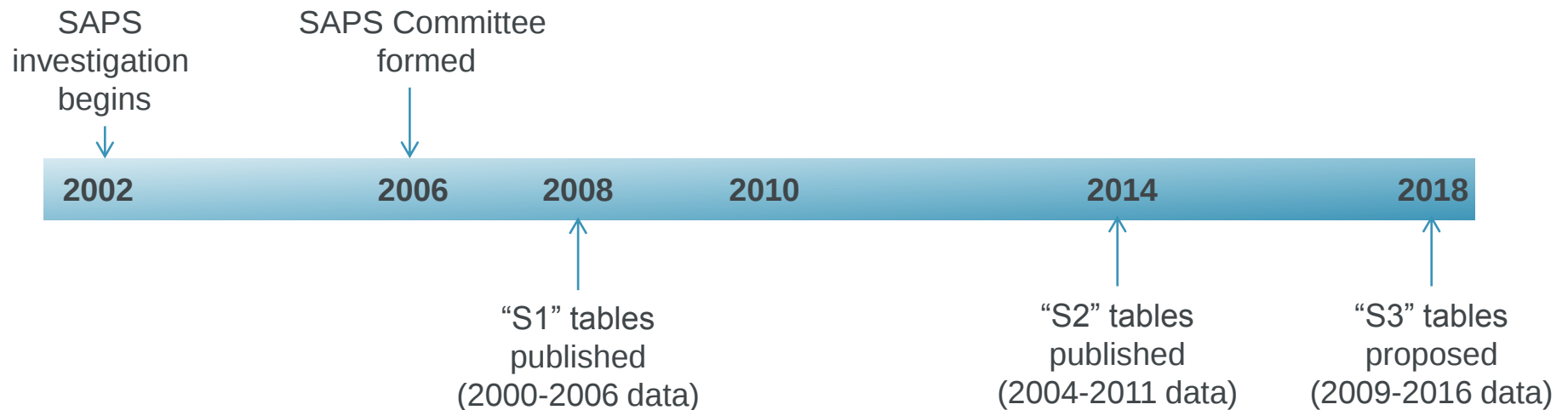
Outline

- Overview of the SAPS investigation
- Dataset for next SAPS graduations (“S3”)
- Plans and challenges for “S3”

Overview of SAPS investigation

- Gather data for UK self-administered pension schemes (SAPS) with >500 pensioners (“S3” dataset: 452 schemes, excluding the PPF)
- Produce, from time to time, graduated tables reflecting recent UK SAPS mortality experience

Key dates



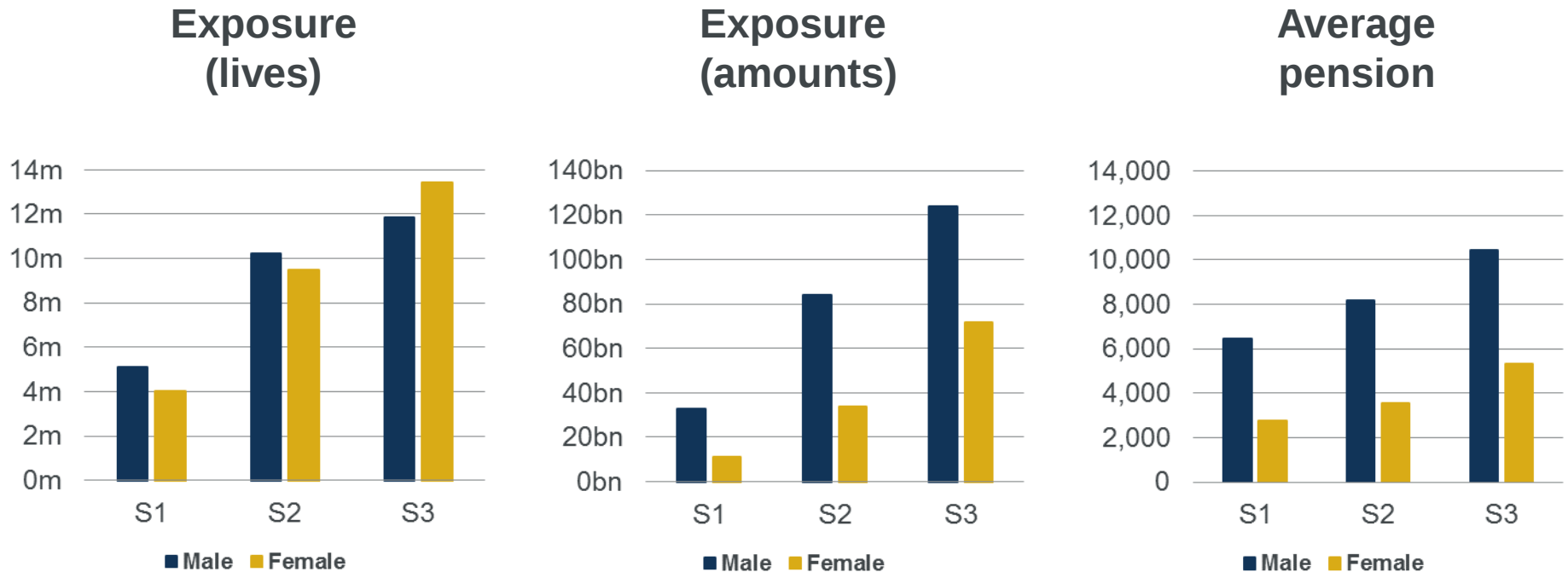
SAPS working papers

Description	Release date	Dataset	Working Paper
Pilot investigation	September 2001	1995-1999	CMIR20
Draft and final “S1” tables	January / October 2008	2000-2006	31/32 & 34/35
Annual update	April 2010	2001-2008	44
Annual update	May 2011	2002-2009	51
Improvement analysis	July 2011	2001-2009	53
Industry sector analysis	May 2012	2002-2009	61
Annual update	May 2012	2003-2010	62
Annual update – S2 data	April 2013	2004-2011	65
Draft and final “S2” tables	April 2013 / February 2014	2004-2011	66 & 71
Annual update	July 2014	2005-2012	73
Annual update	December 2014	2006-2013	76
Industry sector analysis	November 2015	2006-2013	86
Annual update	February 2016	2007-2014	88
Annual update	February 2017	2008-2015	95
Annual update – “S3” data	January 2018	2009-2016	104

SAPS and GDPR

- Data is submitted by consultancies and stored by Secretariat
- Some SAPS data could be viewed as being 'Personal data' under GDPR
- The CMI have formed an initial view and data contributors were asked for their views on these proposals
- Proposed changes to reduce the risk of individuals being identified:
 - Rounded dates of birth
 - Capping very high benefit amounts (e.g. capped at £50,000)
- The CMI also sought views on collecting Index of Multiple Deprivation (IMD) data as a form of socio-economic indicator for SAPS data

Growth of SAPS dataset



- Significant increase in size of dataset between “S2” and “S3”
- Particularly for females
- Note: male dependants have been included in the charts above but this data was not graduated for “S1” and “S2”

Composition of “S3” dataset

- Some very large public sector schemes submitted data for the first time, for 2012-2016
- Public sector data makes up 36% of total lives exposure in the 2009-2016 dataset
- Proportion increases in later years – 49% of total lives exposure for 2015-2016

SAPS “S3” – Aims

- The SAPS Committee interpret our remit for “S3” as:
 - Use the data we have available
 - To produce a sensible range of tables that are:
 - More up to date than “S2” tables
 - Sensibly shaped, reflecting the populations underlying the tables
 - Suitable for use by subscribers either ‘as is’ or as an input to postcode or other mortality models
- We want to publish a set of “S3” tables that the majority of users feel able to adopt

Timeline for “S3”

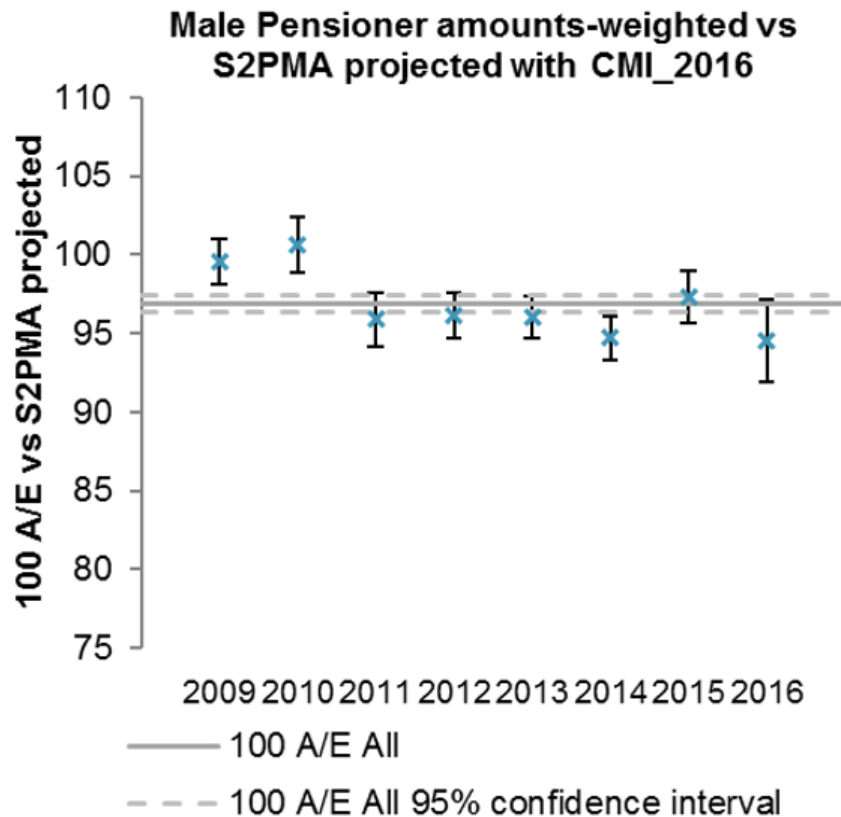
Date	Activity
May 2018	Proposed “S3” Series tables expected to be released for consultation
June 2018	IFoA Pensions Conference
June / July 2018	Consultation period
Aug / Sept 2018	Revisions following consultation
Oct 2018	Final “S3” Series tables expected to be published

SAPS “S3” – Key challenges

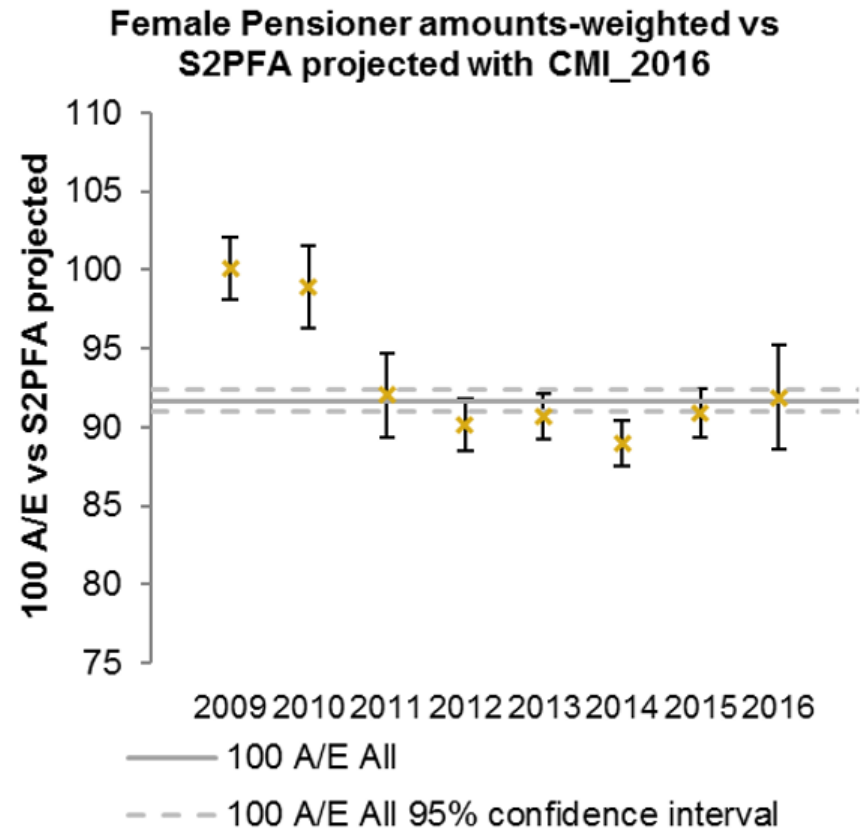
- **Public vs private**
 - Good to have more data – but experience differs between groups
- **Amounts banding**
 - Consistency with “S2”?
 - Distinctiveness of mortality between bands
 - Number of tables
- **High-age extension**
 - Use research to ensure best practice

WP104 – experience compared to “S2”

Male

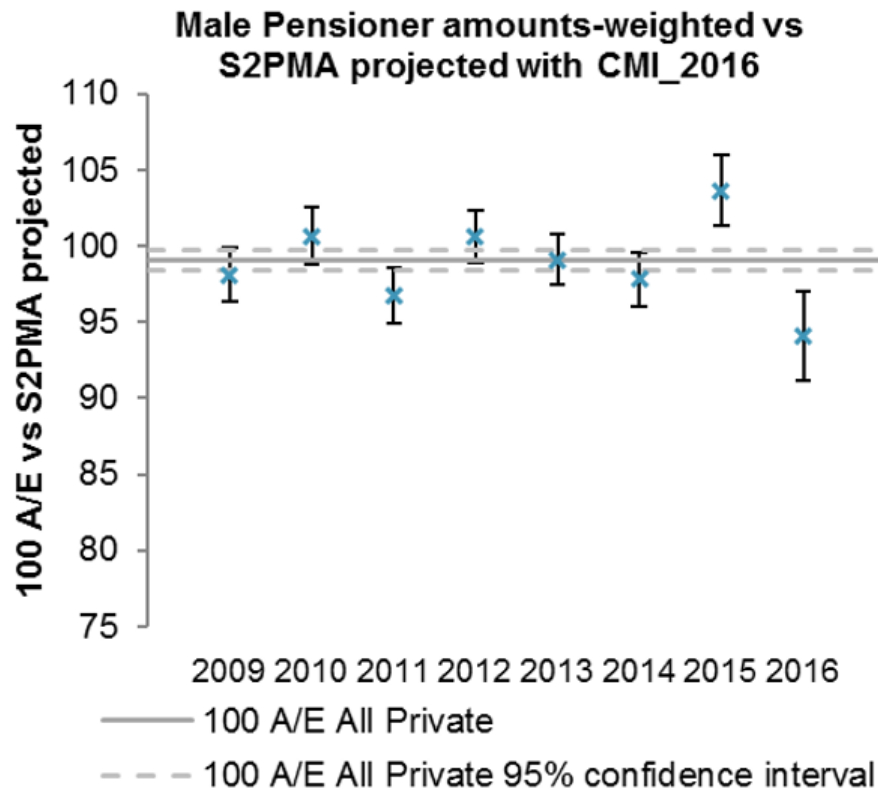


Female

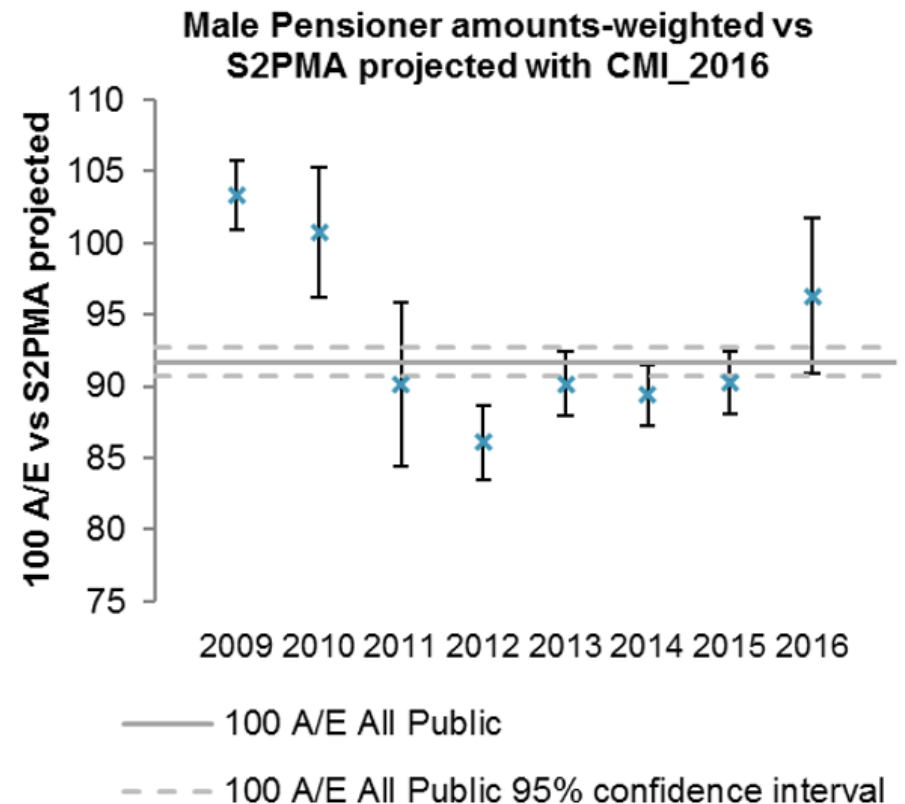


Male experience – public vs private

Private sector



Public sector

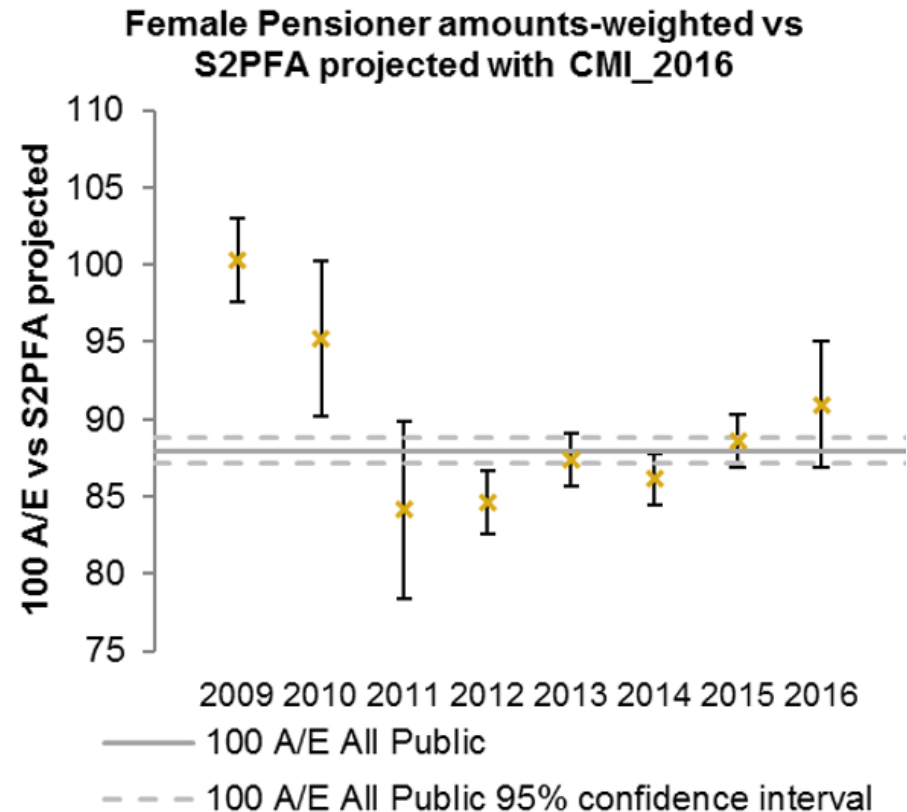


Female experience – public vs private

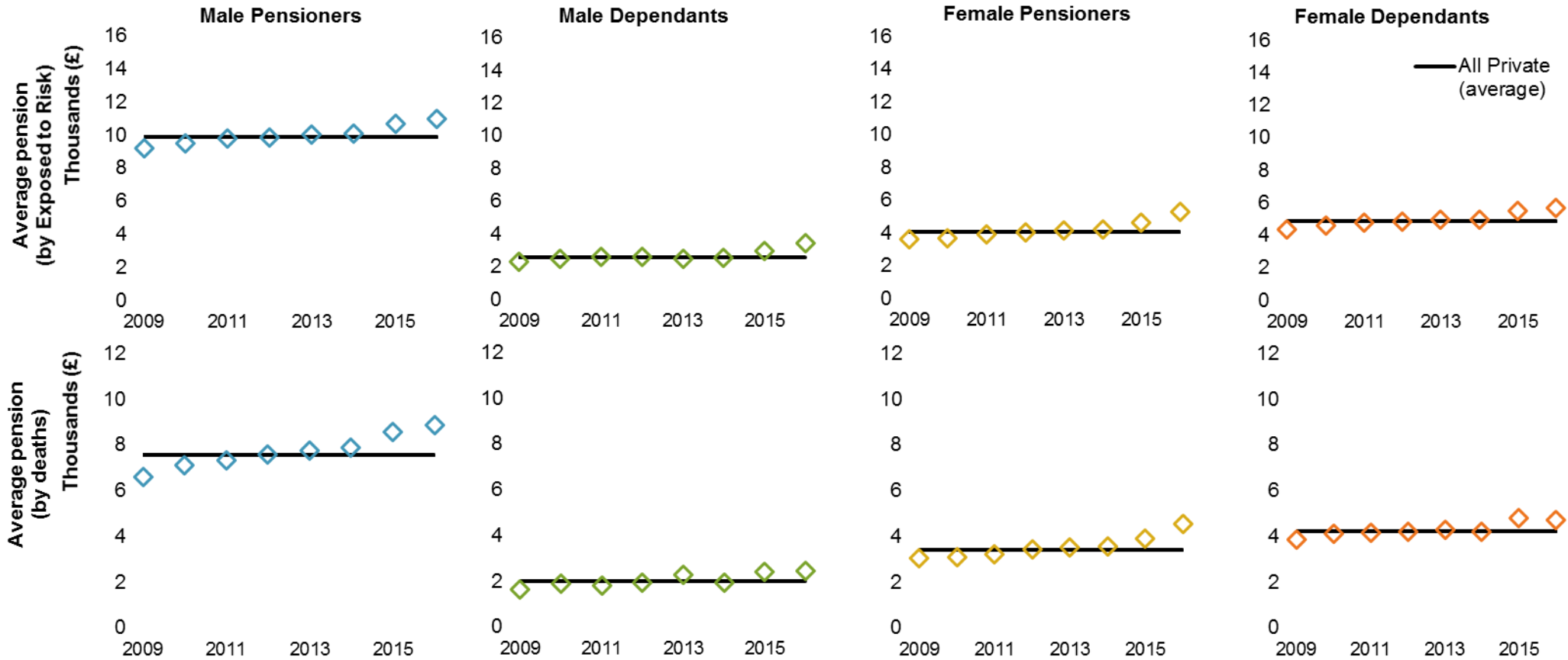
Private sector



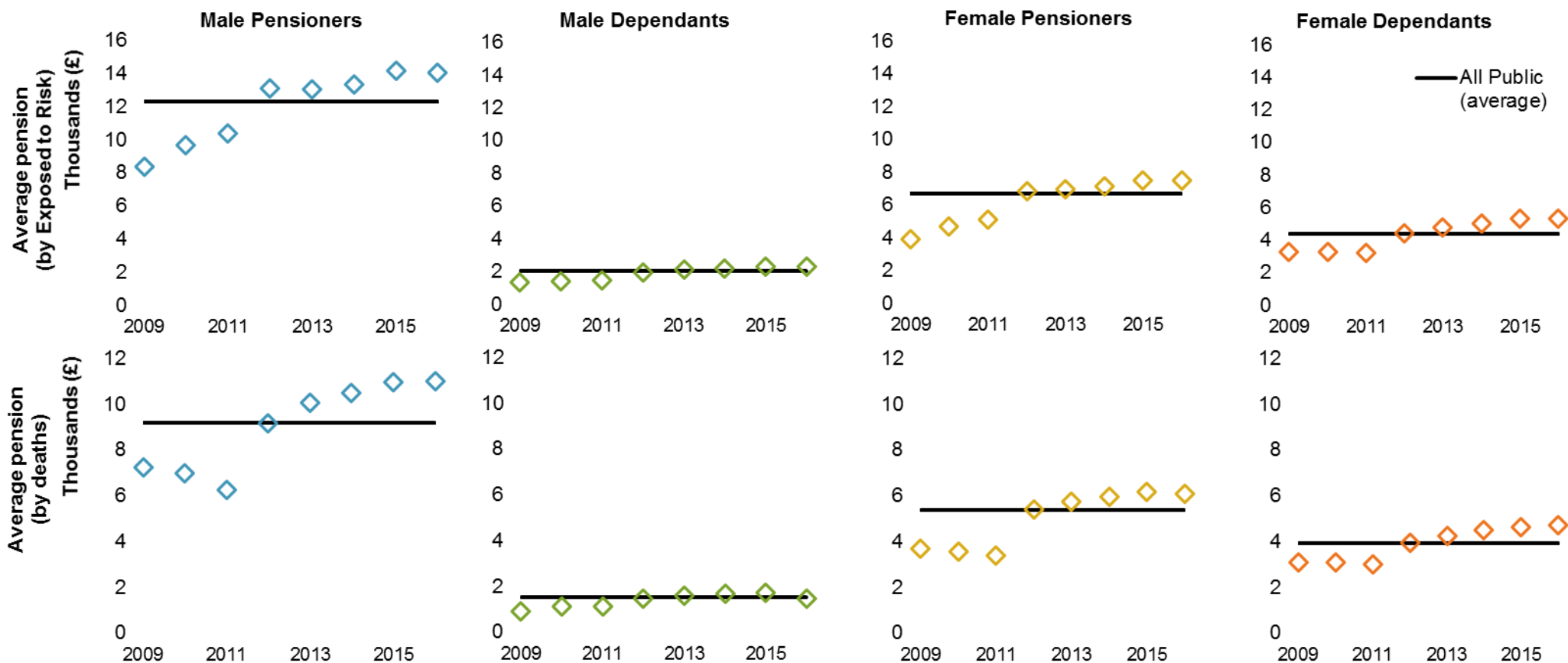
Public sector



Average pensions – private sector

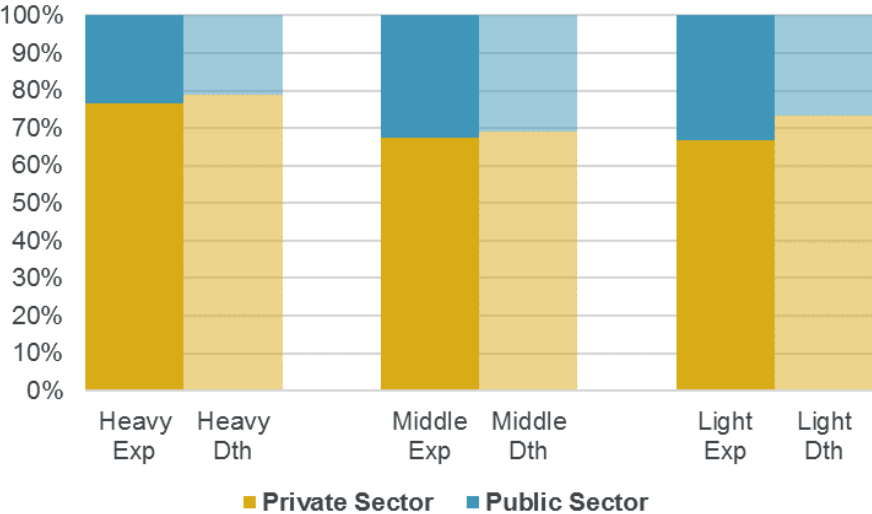


Average pensions – public sector



Data volume by sector and amount band

Males

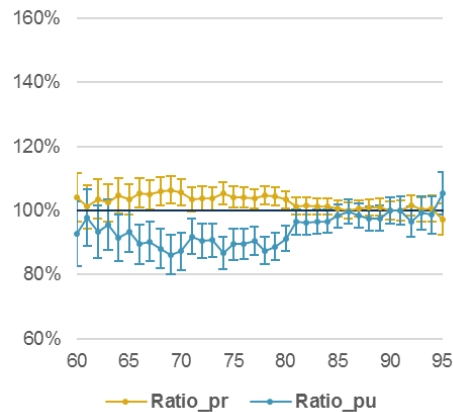


Females

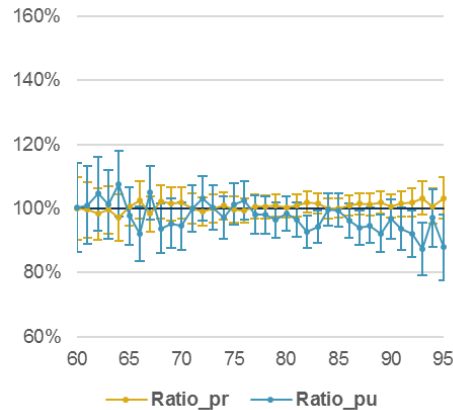


Relative mortality by sector

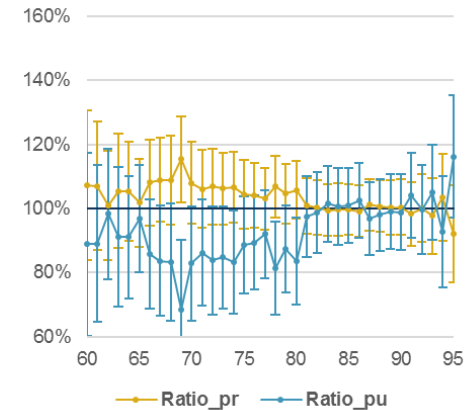
Males – All



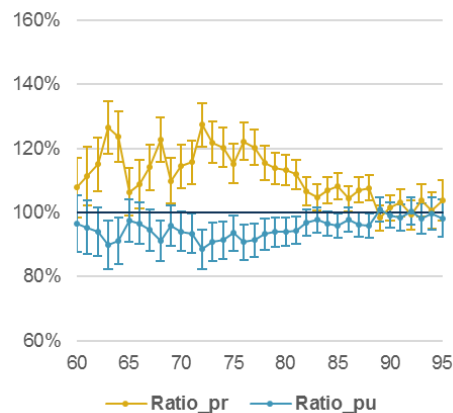
Males – Heavy



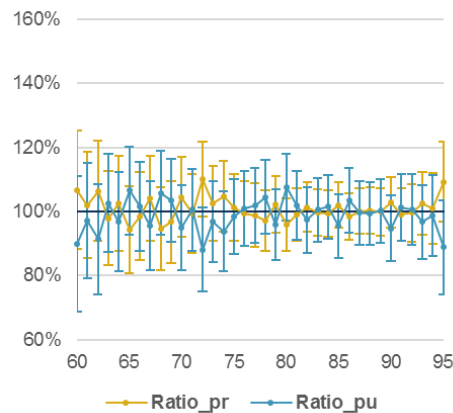
Males – Light



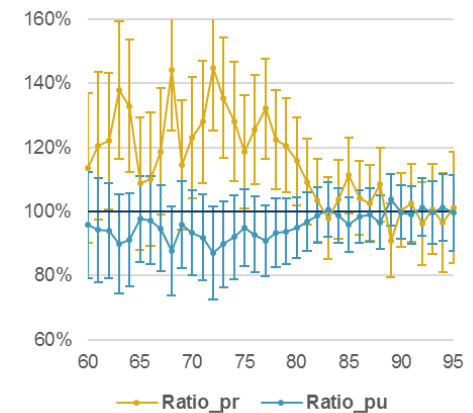
Females – All



Females – Heavy



Females – Light



Public vs private sector

- For the schemes that have been submitted to SAPS, public sector experience is lighter than private sector for each type of member, however:
 - Variation between schemes (split by industry in WP86) is greater than variation between public and private
 - Public sector schemes submitted do not necessarily reflect all public sector experience

Public vs private sector

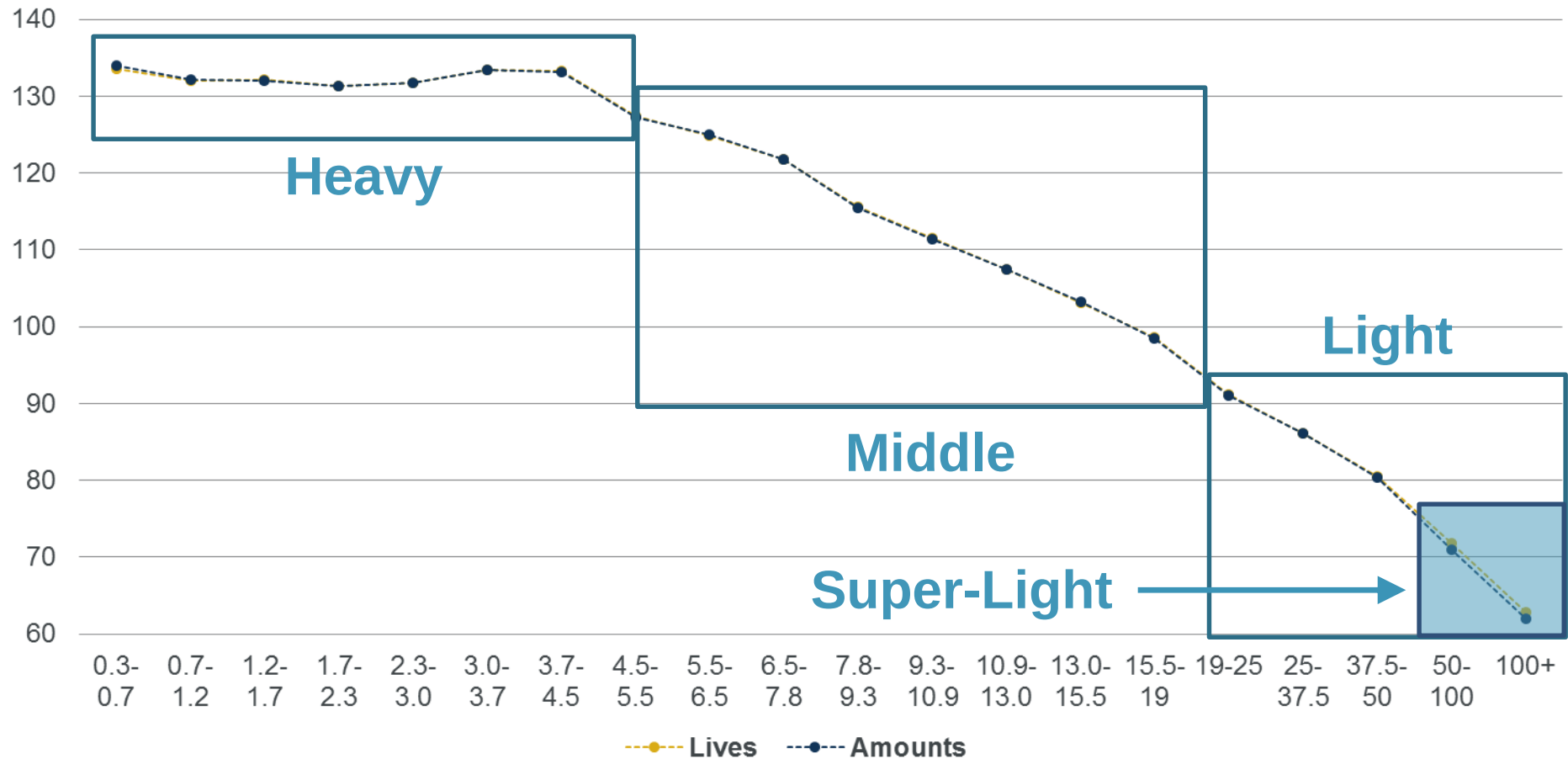
- Conclusion:
 - The Committee currently intends to publish combined tables i.e. not splitting these out by sector
 - Prefer to use as much of the data as possible
 - Shape of tables should be appropriate
 - Level of mortality generally reasonably consistent with “S2”
 - Females Light arguably different – but concentrated in public sector
 - Users may find that Heavy / Middle tables are more appropriate shape than All
- Suitable caveats and commentary about the differences will be included in the working paper published alongside the “S3” tables
- We are keen to hear your views on this

Amount bands – “S2” tables

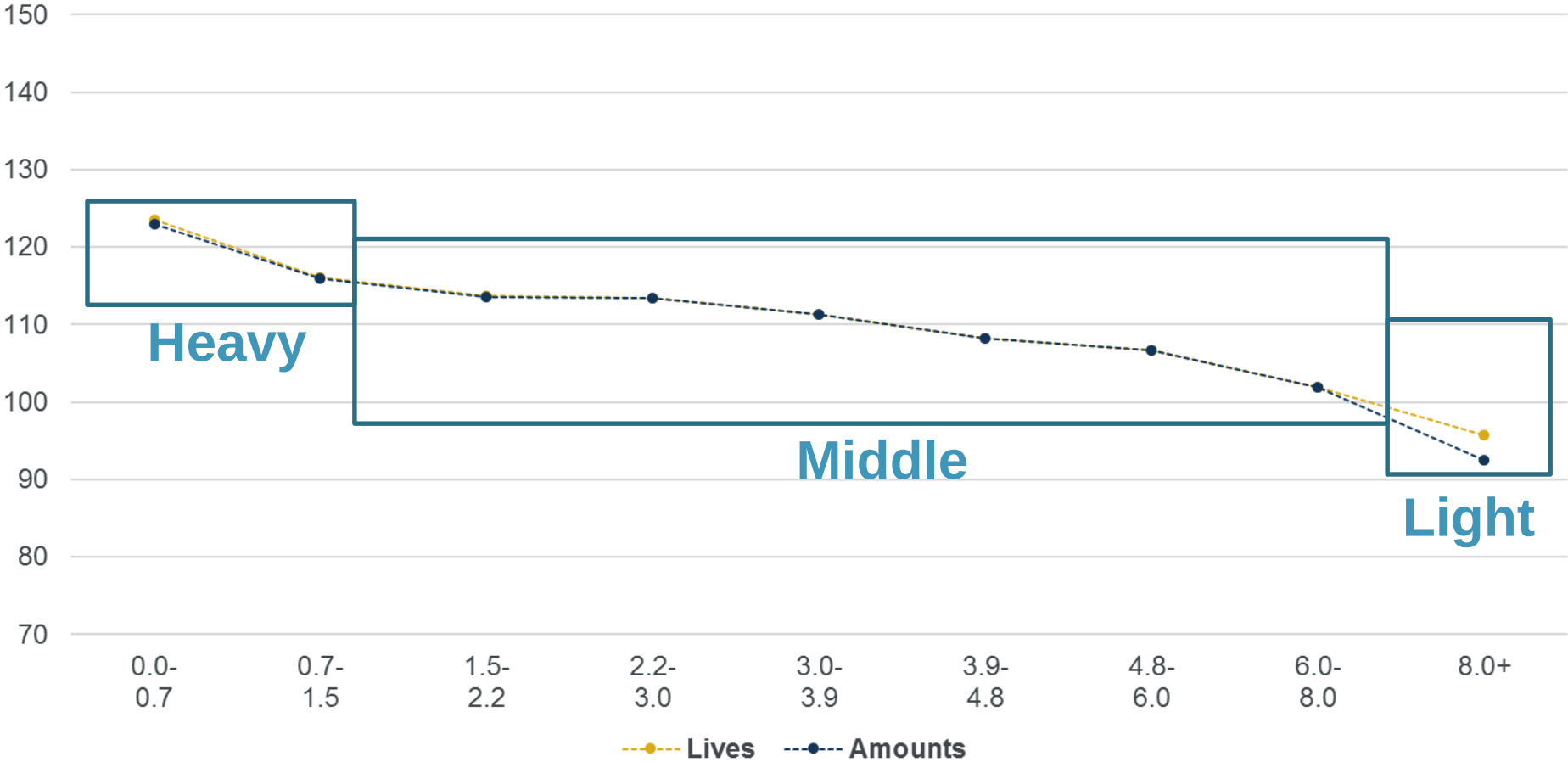
- Mortality experience in SAPS can be seen to vary by pension amount, particularly for males
- As part of the suite of tables for both “S1” and “S2”, we published Heavy and Light alongside All tables

Band	Heavy	Middle	Light
Male – “S2” % of lives	£0 – £1,700 (17%)	£1,700 – £14,750 (64%)	£14,750+ (19%)
Female – “S2” % of lives	£0 – £850 (22%)	£850 – £5,500 (60%)	£5,500+ (18%)

Relative mortality by amount band (males)



Relative mortality by amount band (females)



Amount bands – summary

Band	Heavy	Middle	Light
Male – “S2”	£0 – £1,700 (17%)	£1,700 – £14,750 (64%)	£14,750+ (19%)
Male – Proposed “S3”	£300 – £5,000 (40%)	£5,000 – £20,000 (45%)	£20,000+ (15%)

Band	Heavy	Middle	Light
Female – “S2”	£0 – £850 (22%)	£850 – £5,500 (60%)	£5,500+ (18%)
Female – Proposed “S3”	£0 – £1,000 (19%)	£1,000 – £8,000 (58%)	£8,000+ (23%)

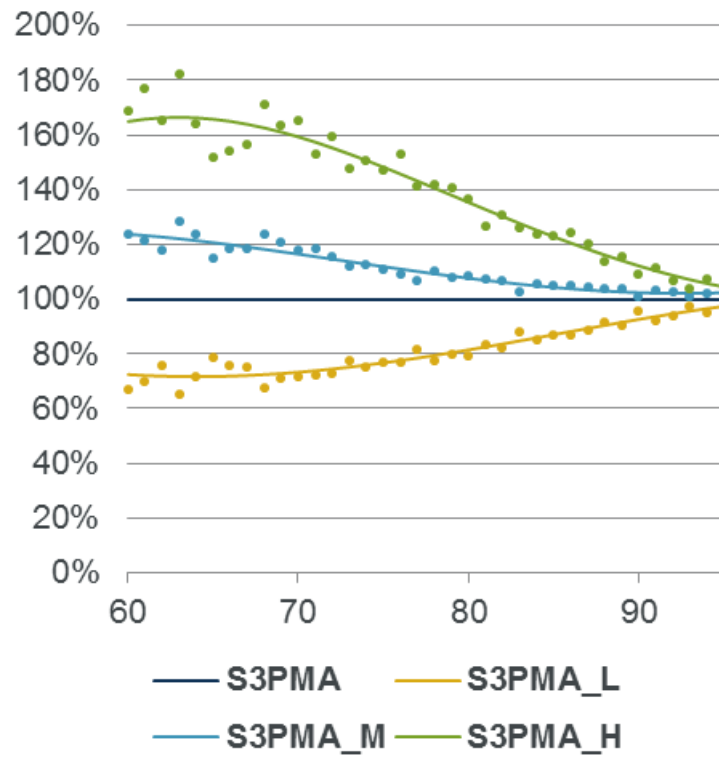
Amount bands – Super-Light?

- The Committee is intending to provide some analysis of “Super-Light” mortality for males:
 - Highest pensions – subset of Light data
 - Formal table or supplementary results?
- Initial suggestion £50,000+
 - £25,000+ not distinct enough from Light
 - £100,000+ insufficient data

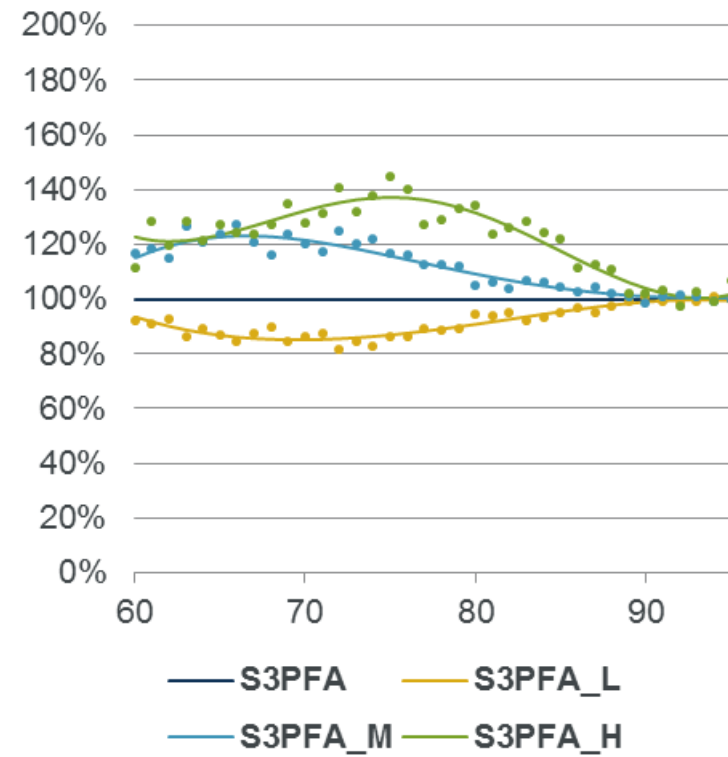
Results: relative variation by amount band

(trial graduation of “S3” tables)

Males

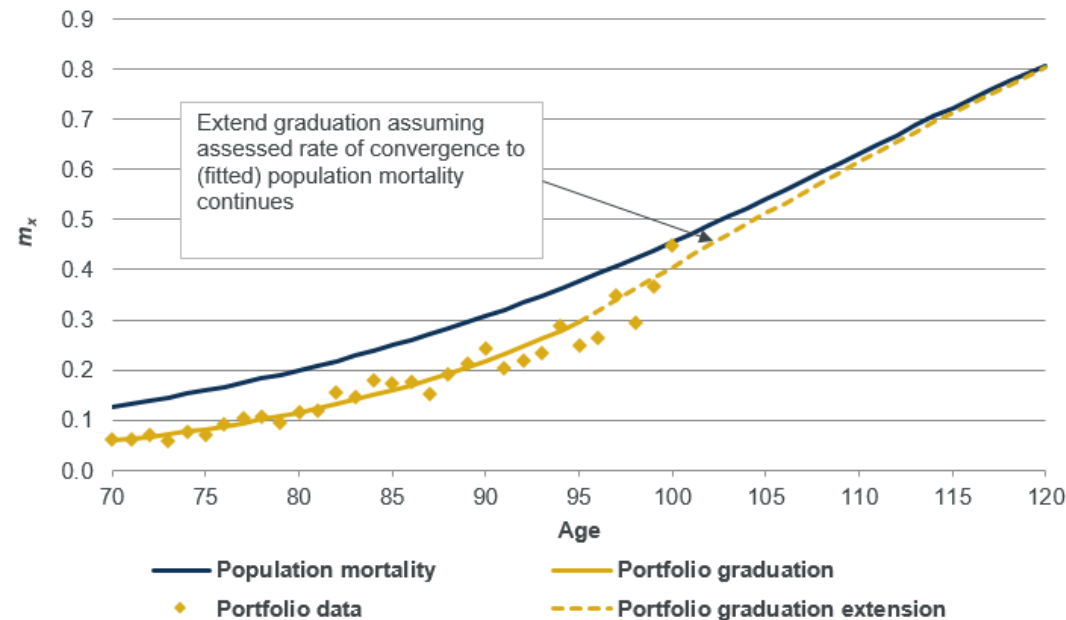


Females



High-age extensions

- The CMI published analysis of mortality at high ages in Working Paper 100
- Includes a new method for extending tables to high ages, where data is unreliable – mortality rates converge to national population rates as age increases
- HAMWP are refining their approach – “S3” likely to use this





Questions



Comments

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

Please send any questions, views or feedback to info@cmilimited.co.uk



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