



**Continuous  
Mortality Investigation**

Institute and Faculty of Actuaries

# **Mortality and Longevity Seminar 2017: CMI Update**

**Tim Gordon**

Mortality Projections Committee

**Mark Cooper**

Annuities Committee

High Age Mortality Working Party

# CMI

## CMI

- Wholly owned by Institute and Faculty of Actuaries
- Independent executive and management

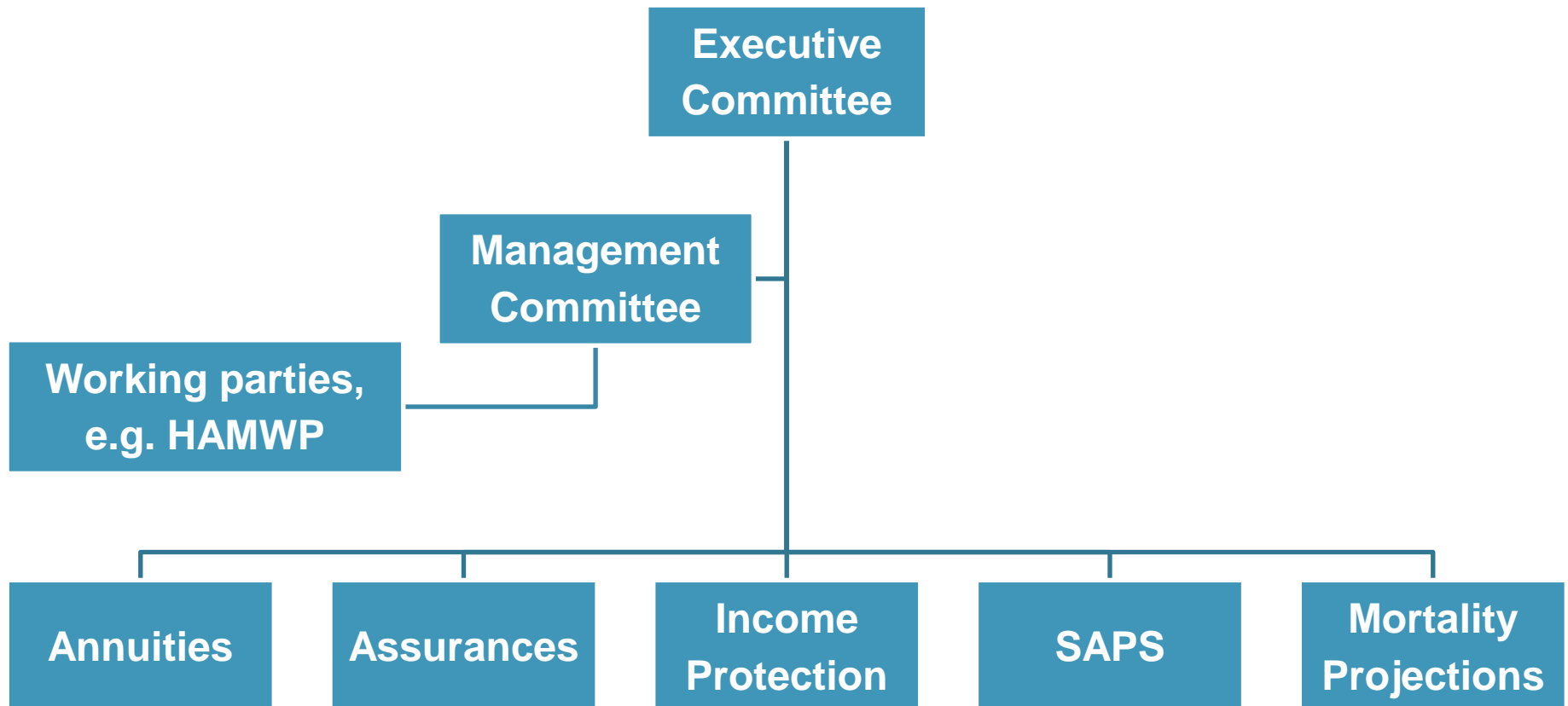
Funded by subscription but free for academics and non-commercial research

## 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.*

Our vision is 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

# CMI structure





## **Continuous Mortality Investigation**

Institute and Faculty of Actuaries

# **SAPS Committee update**

# SAPS Committee activity

Date	Activity
November 2015	Investigation into mortality experience by industry classification of SAPS pensioners for the period 2006-2013 released
February 2016	Mortality experience of SAPS pensioners for the period 2007-2014 released
February 2017	Mortality experience of SAPS pensioners for the period 2008-2015 released
<b>30 June 2017</b>	<b>Deadline for data submissions to be included in “S3” Series dataset</b>
November 2017	Mortality experience of SAPS pensioners for the period 2009-2016 expected to be released
February 2018	Proposed “S3” Series mortality tables expected to be released for consultation



## **Continuous Mortality Investigation**

Institute and Faculty of Actuaries

# **Assurances Committee update**

# Assurances Committee activity

Date	Activity
December 2014	Experience report for 2007-2010
May 2016	Proposed “08” Series accelerated critical illness tables released for consultation
October 2016	Proposed “08” Series term assurance mortality tables released for consultation
January 2017	Final “08” Series accelerated critical illness and term mortality tables released
<b>31 August 2017</b>	<b>Target date for data submissions for 2011-2016?</b>



## **Continuous Mortality Investigation**

Institute and Faculty of Actuaries

# **High Age Mortality Working Party update**

**Mark Cooper**

CMI High Age Mortality Working Party



# Background

- High Age Mortality Working Party (HAMWP) set up in June 2014 to investigate high age mortality
- Initial findings presented in Working Paper 85, released October 2015

Second phase of work, due to be published soon:

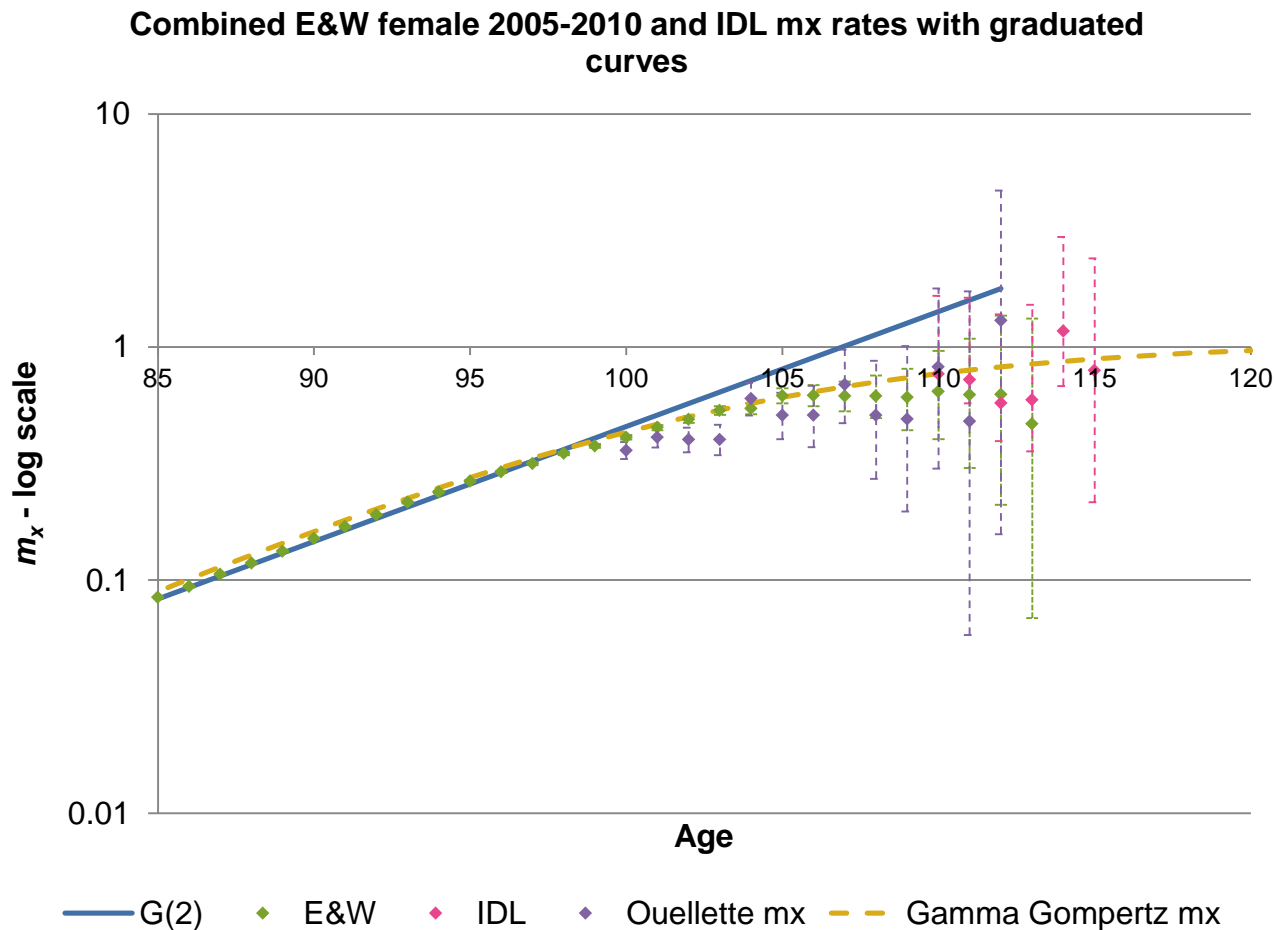
- Population exposure modelling
- Does mortality decelerate at high ages?
- Principles for closing off mortality tables

# Population exposure modelling: Variants to K-T methodology

Kannisto-Thatcher (K-T) methodology used by ONS to estimate population exposures at high ages (90+). Variants to K-T methodology considered:

- **Mortality trend:** Allowance for recent trend in survivor ratios
- **Parameters  $k$  and  $m$ :** Investigate impact of varying number of cohorts ( $m$ ) and number of ages ( $k$ ) included in K-T
- **Join age:** Test impact of including larger data by joining at younger age
- **Adjustments to death data:** More sophisticated approach to determine 'age at 1 January' death counts from 'age at death' input data
- **Exposure adjustments:** Adjust modelled population exposures for convexity and birth distribution

# Does mortality decelerate at high ages: Implications for mortality at the oldest old

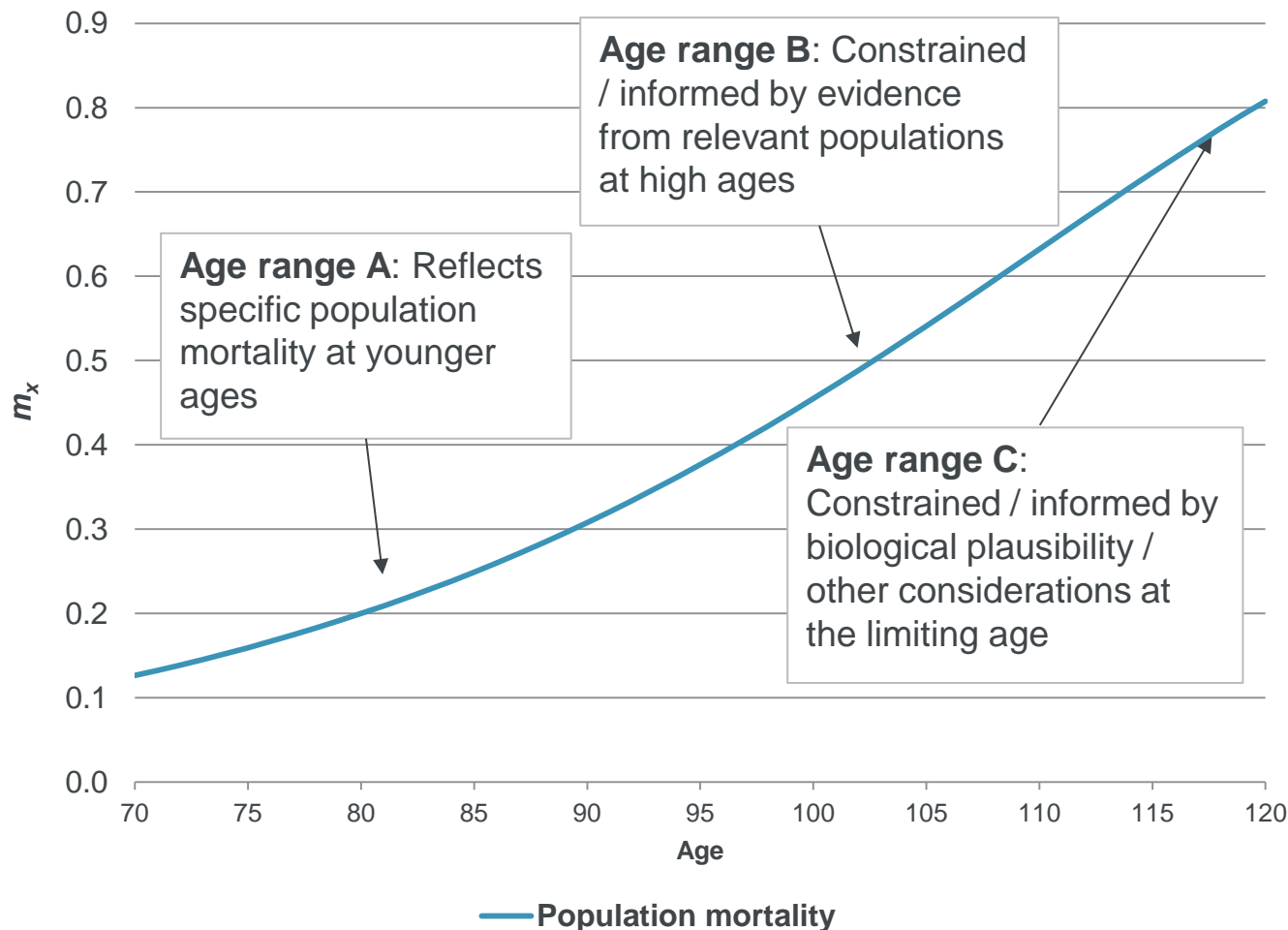


Recent studies by Gavrilov and Gavrilova (2015), Ouellette and Bourbeau (2014) and Rau et al (2016)

Our review and analysis supports a mortality curve with deceleration at highest ages

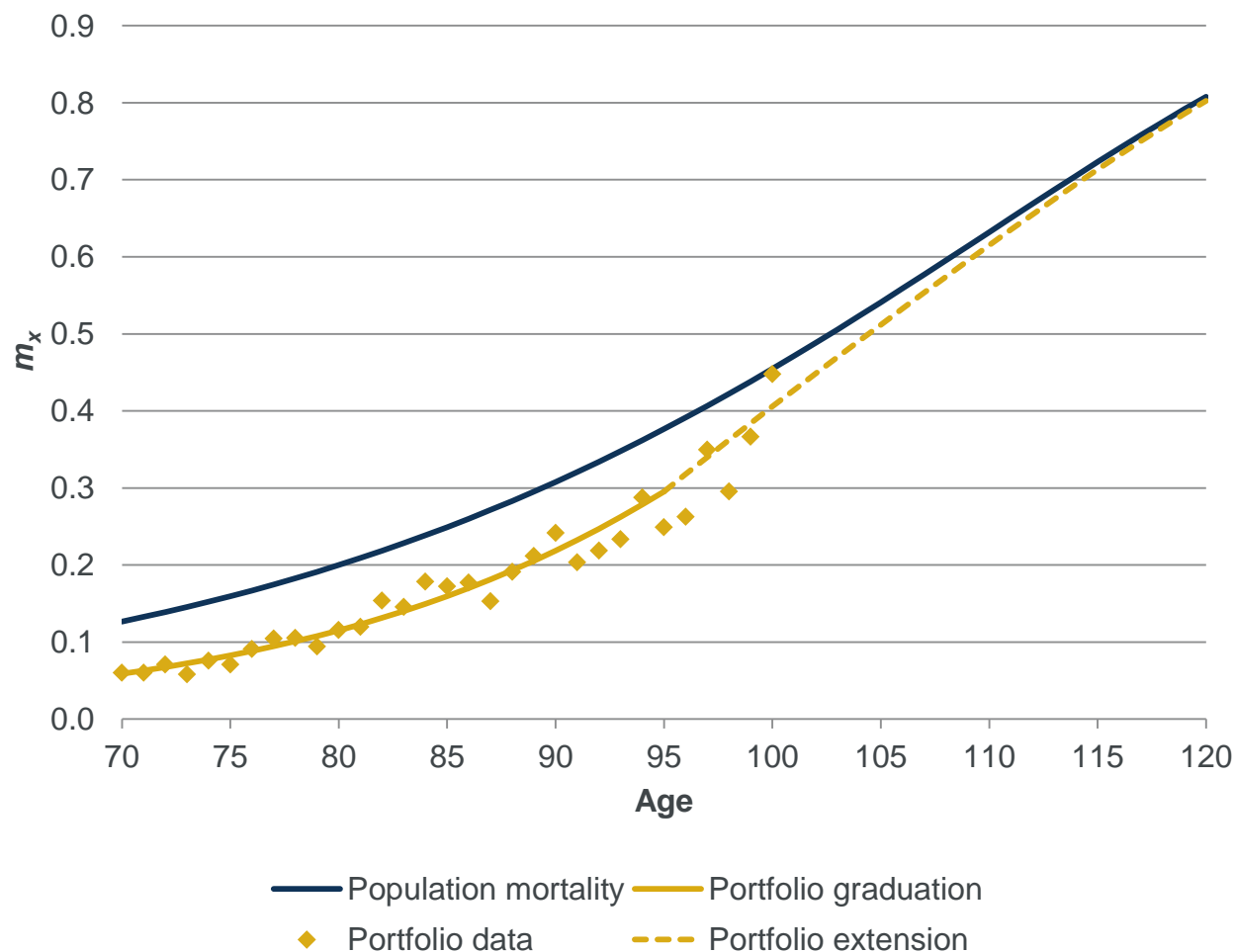
Considers  $m_x = 1$  at age 120 justifiable currently

# Closing mortality tables: Desirable features



- Plausibility
- Data compatibility
- Cohort features
- Trend allowance
- Smooth progression

# Closing mortality tables: Proposed framework



High level framework steps:

1. Graduate portfolio data to age where data not sufficient / reliable
2. Analyse convergence with population mortality in graduated age range
3. Extend graduation to ultimate age, allowing for smooth convergence between portfolio and population table



## Continuous Mortality Investigation

Institute and Faculty of Actuaries

# Draft Annuities 2011-2014 results

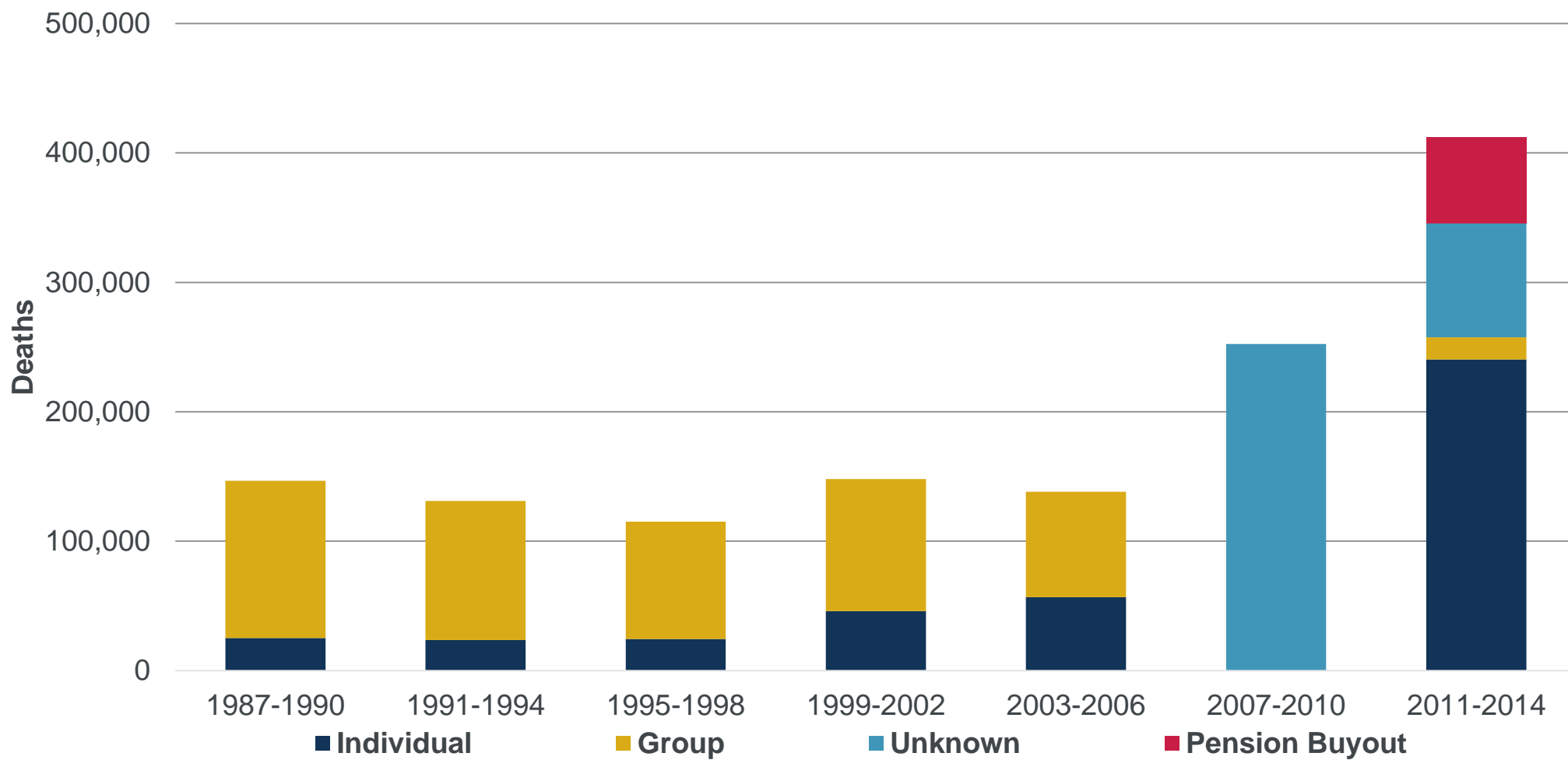
**Mark Cooper**

CMI Annuities Committee

# Annuities Committee activity

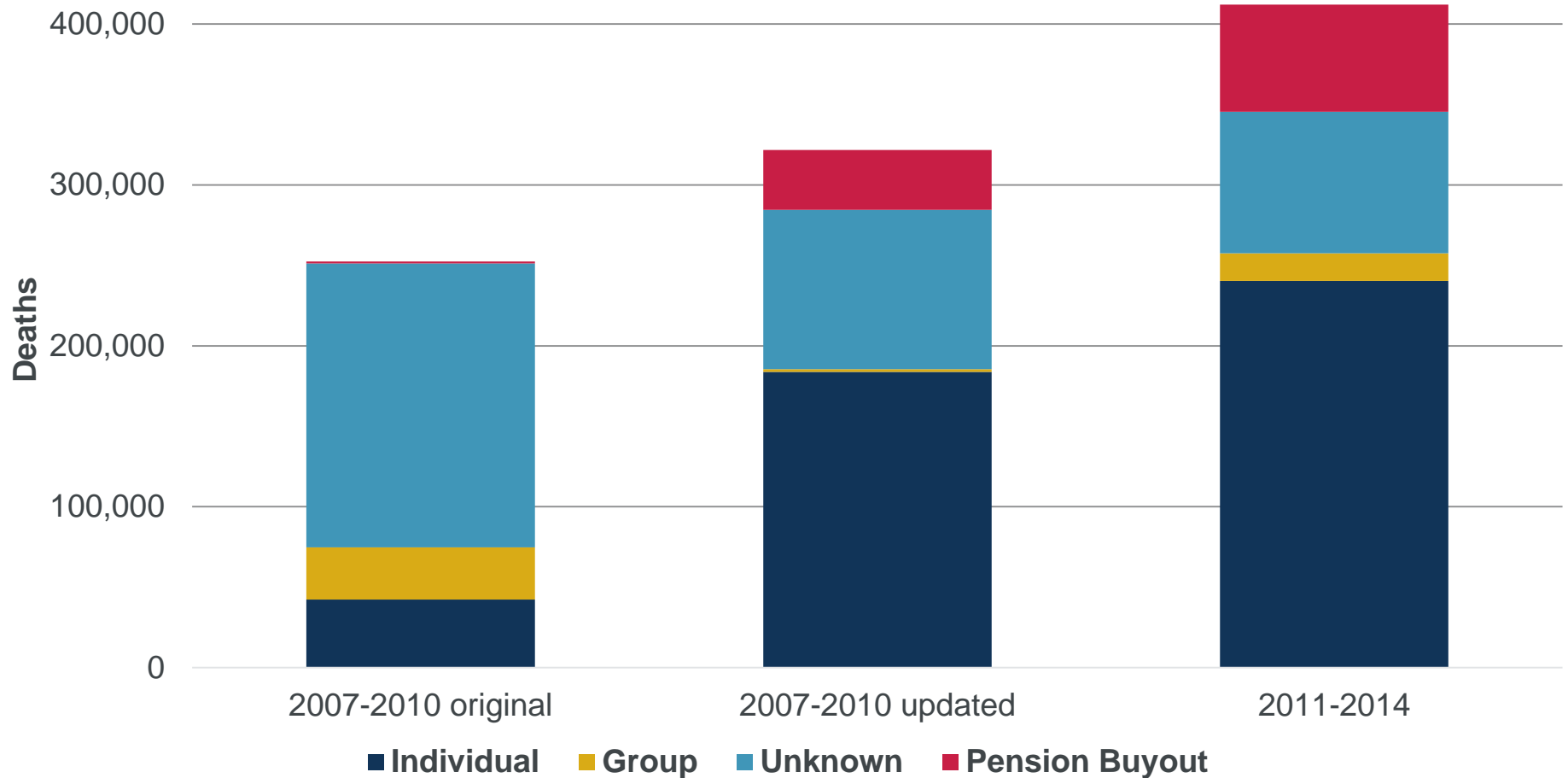
Date	Activity
October 2013	Experience report for 2007-2010
April 2015	Proposed “08” Series annuitant mortality tables released for consultation
June 2015	Final “08” Series annuitant mortality tables released
December 2015	Experience report for Enhanced Annuities in 2007-2010
July 2017	Experience report for 2011-2014
August 2017	Begin analysis on 2007-2014 dataset

# Data volumes: Pension annuities in payment

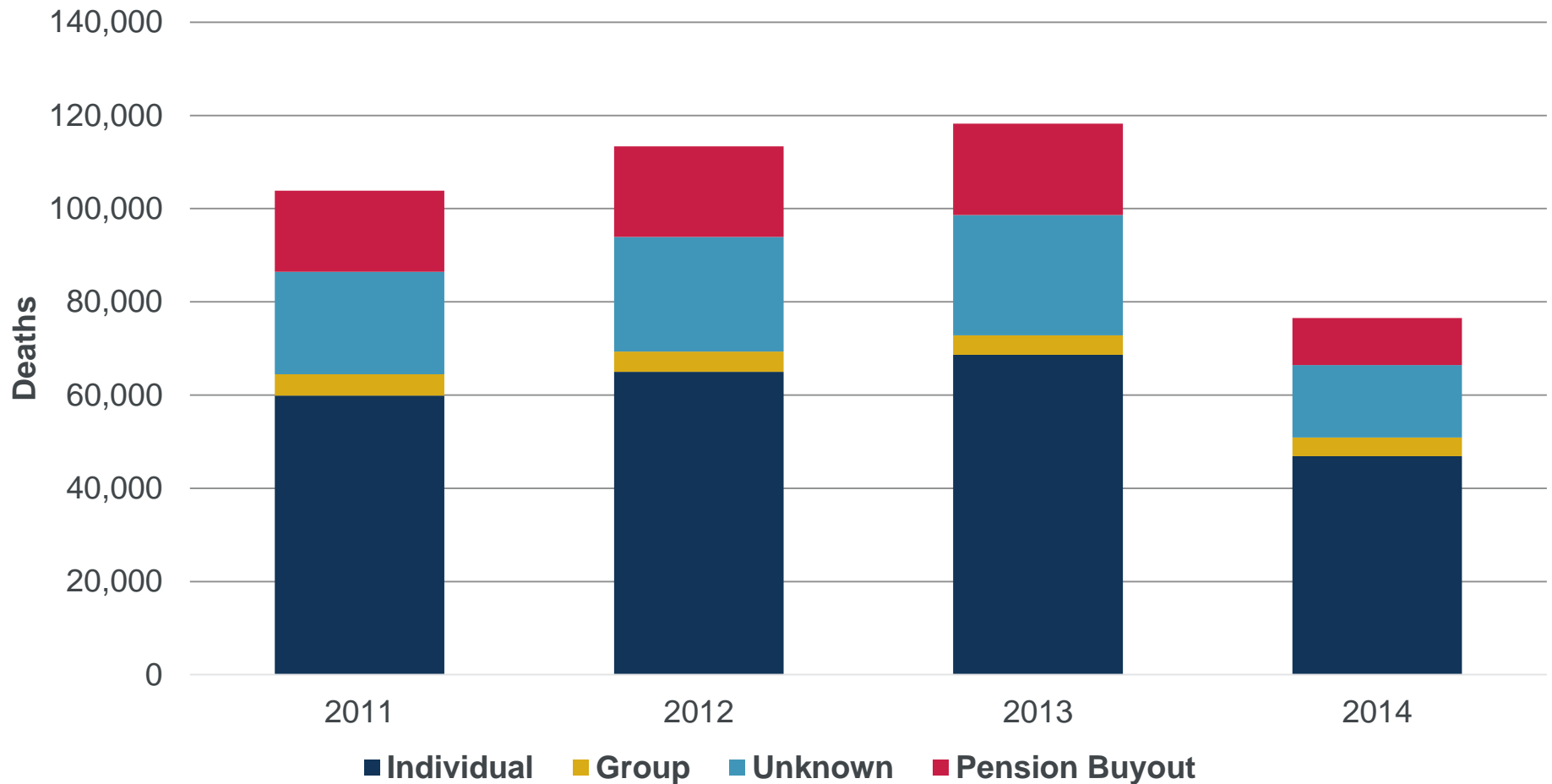




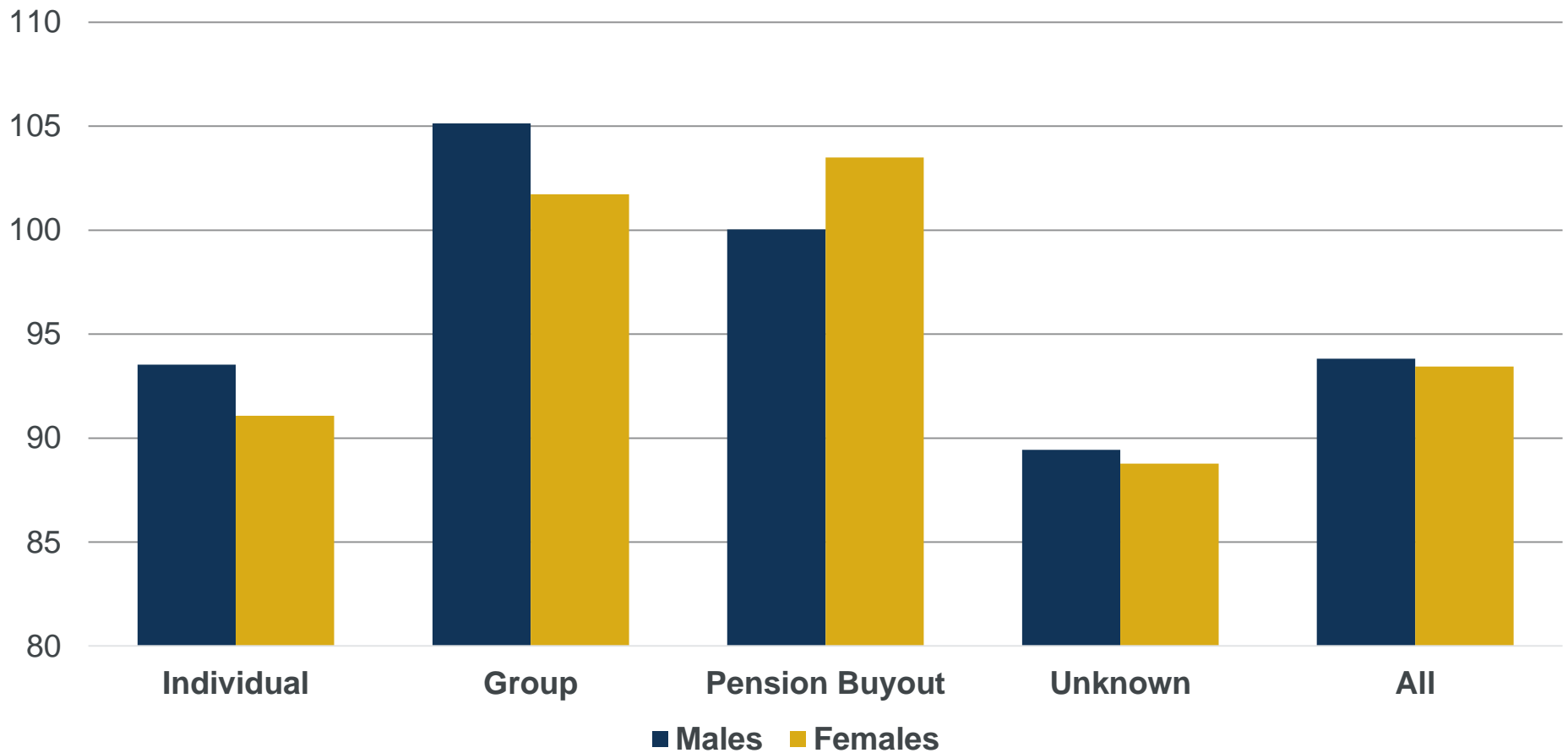
# Data volumes: Pension annuities in payment by product type



# Data volumes: Pension annuities in payment by calendar year (2011-2014)

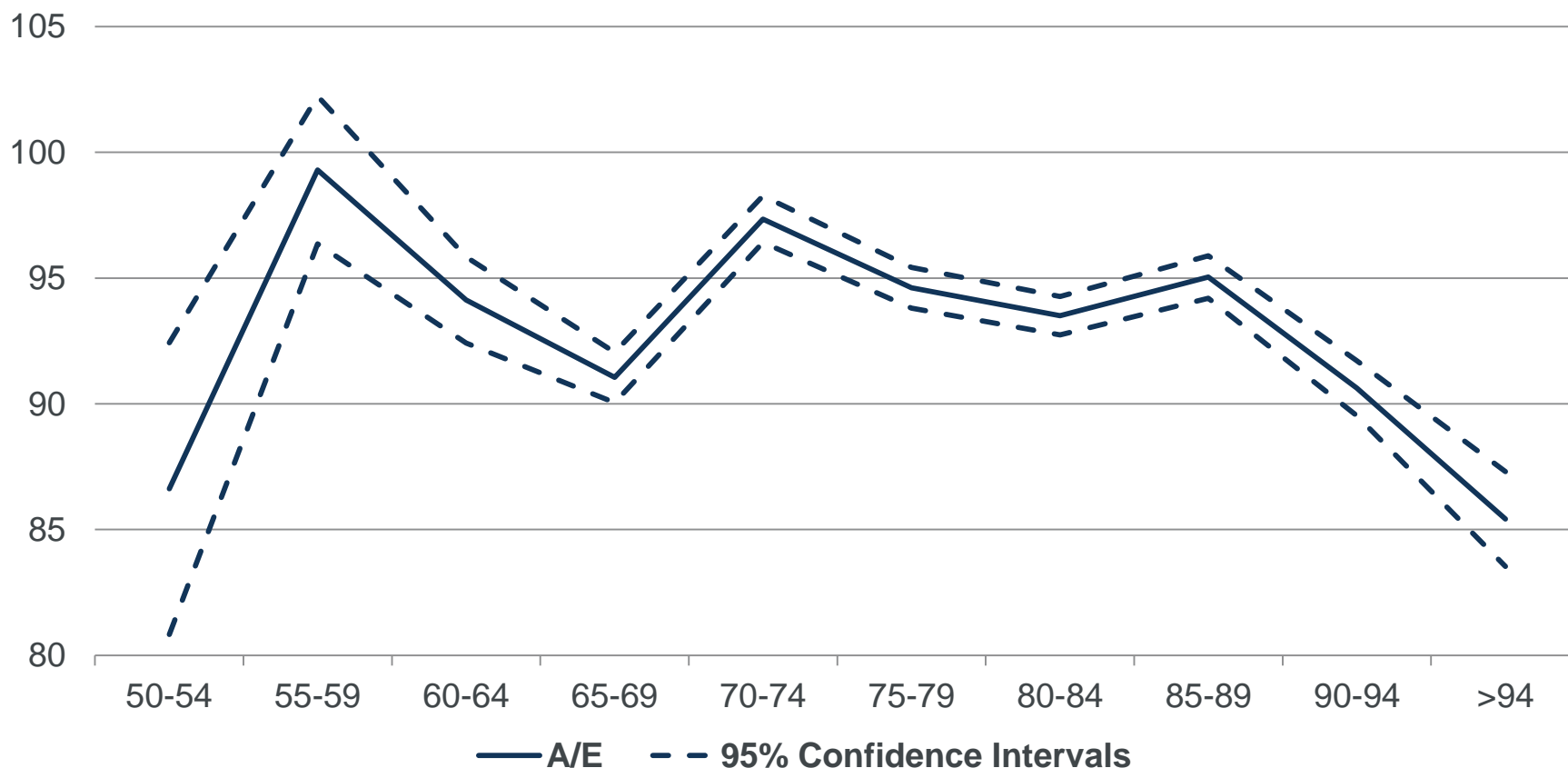


# DRAFT 100 x Actual/Expected by product type



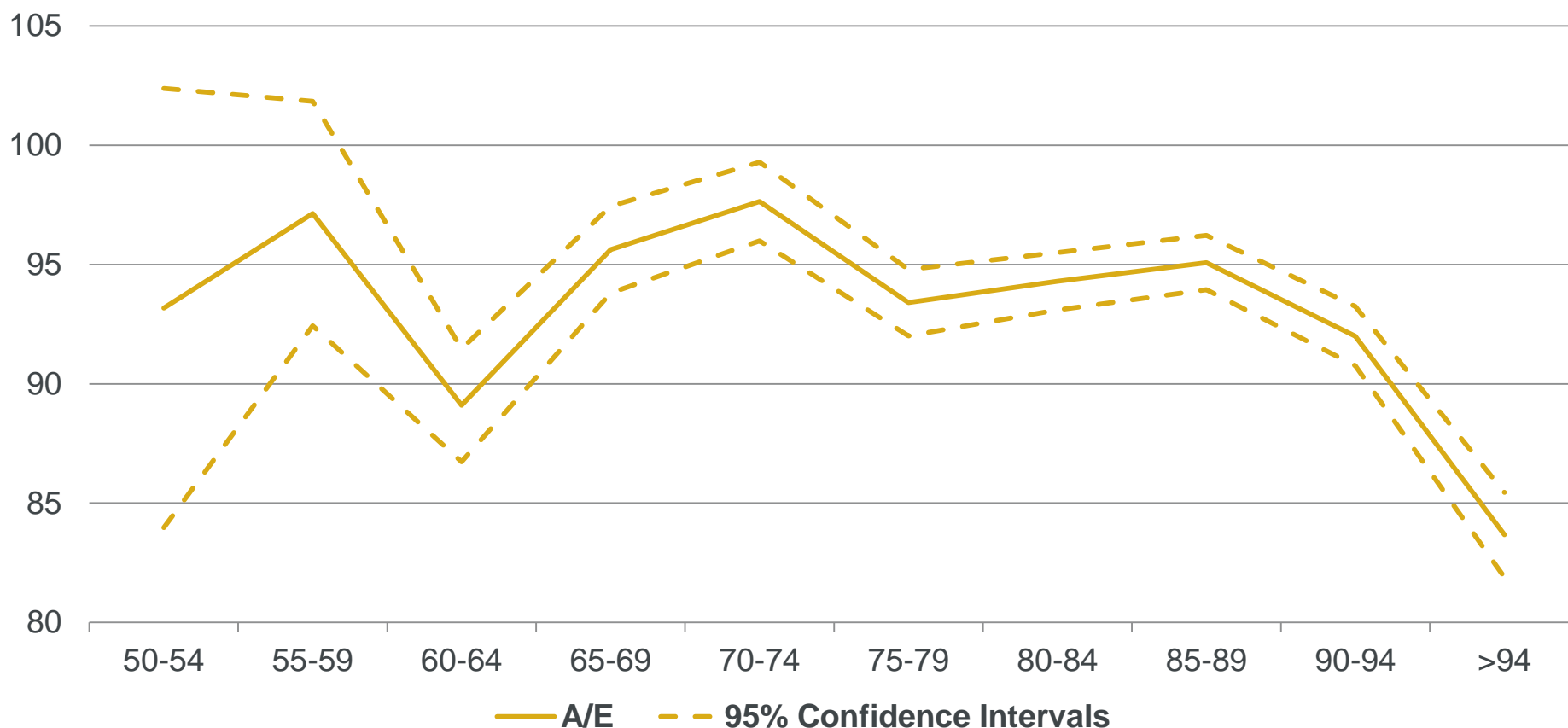
Expected calculated using PML08 and PFL08 without improvements

# DRAFT 100 x Actual/Expected by age band all product types combined) – males



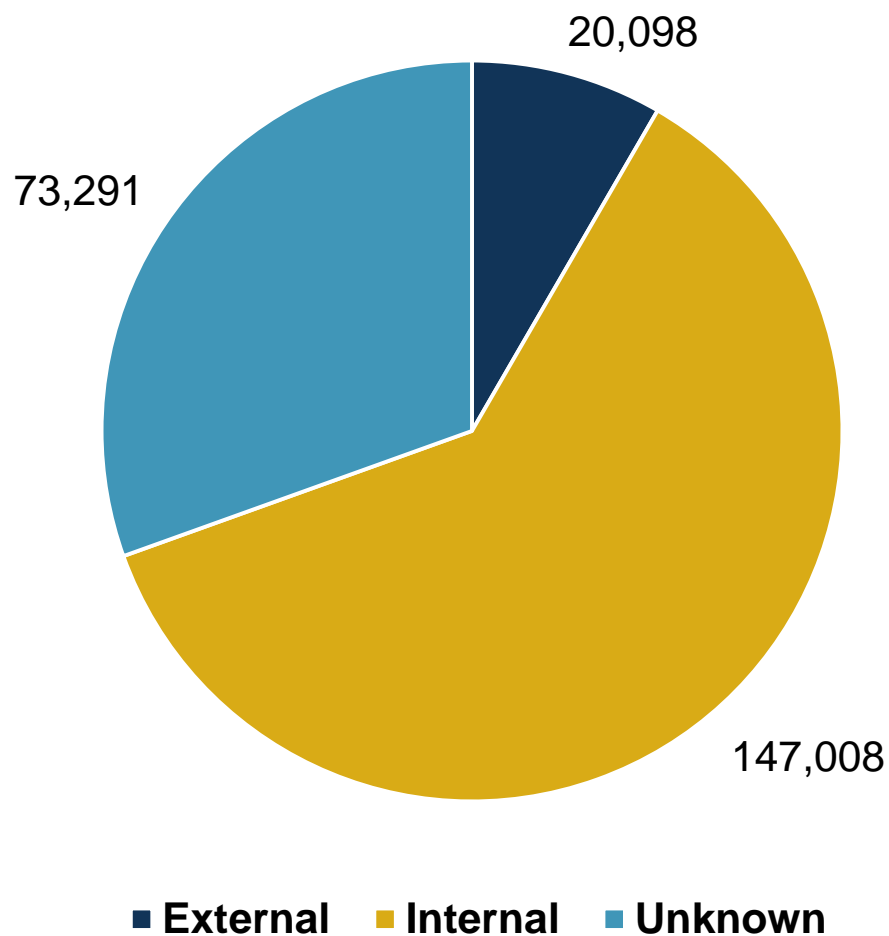
Expected calculated using PML08 without improvements

# DRAFT 100 x Actual/Expected by age band (all product types combined) – females

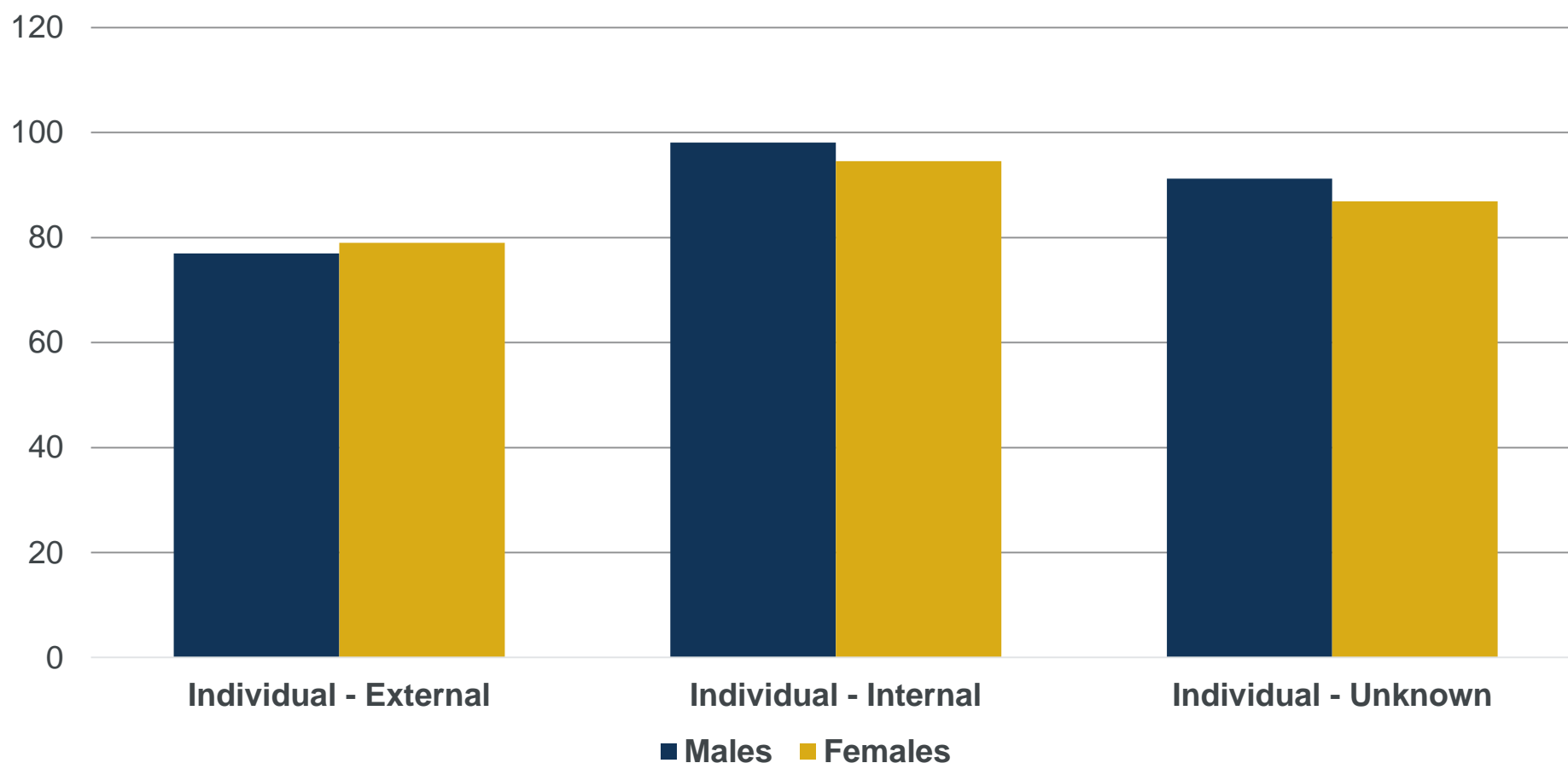


Expected calculated using PFL08 without improvements

# Data volumes: individual pension annuities in payment, 2011-2014, by distribution channel

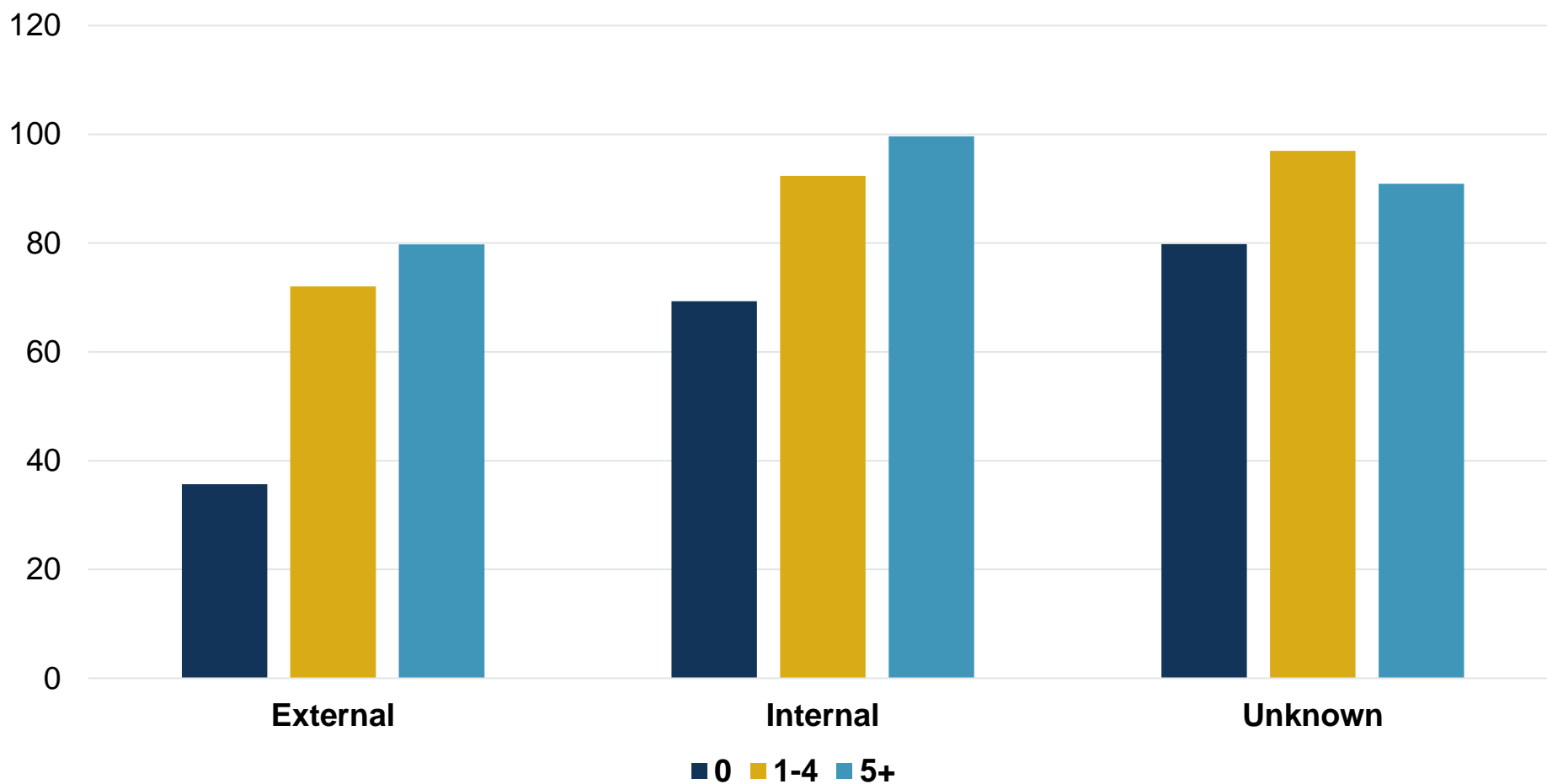


# DRAFT 100 x Actual/Expected by distribution channel (individual annuities)



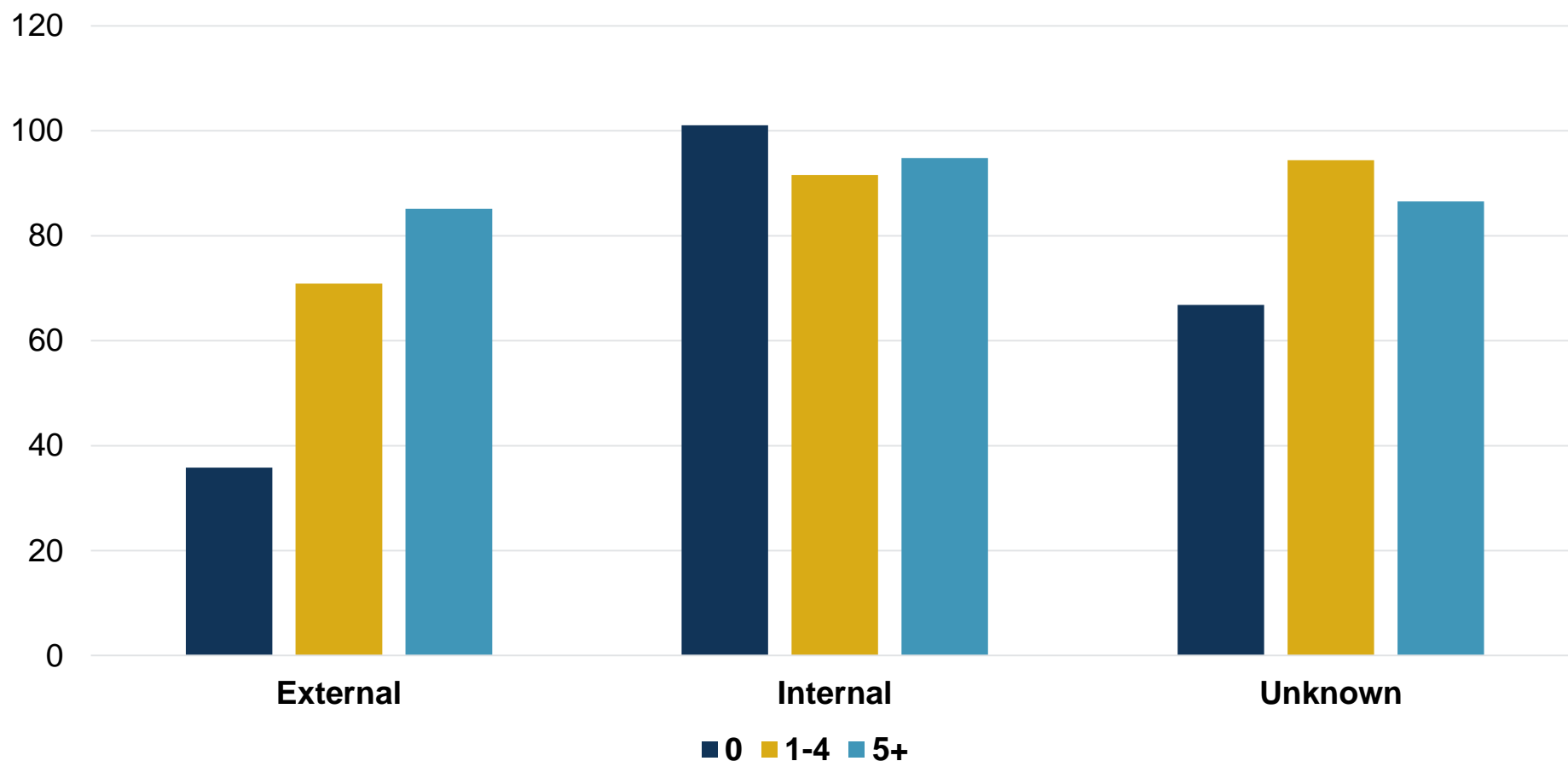
Expected calculated using PML08 and PFL08 without improvements

# DRAFT 100 x Actual/Expected by duration (individual annuities) – males



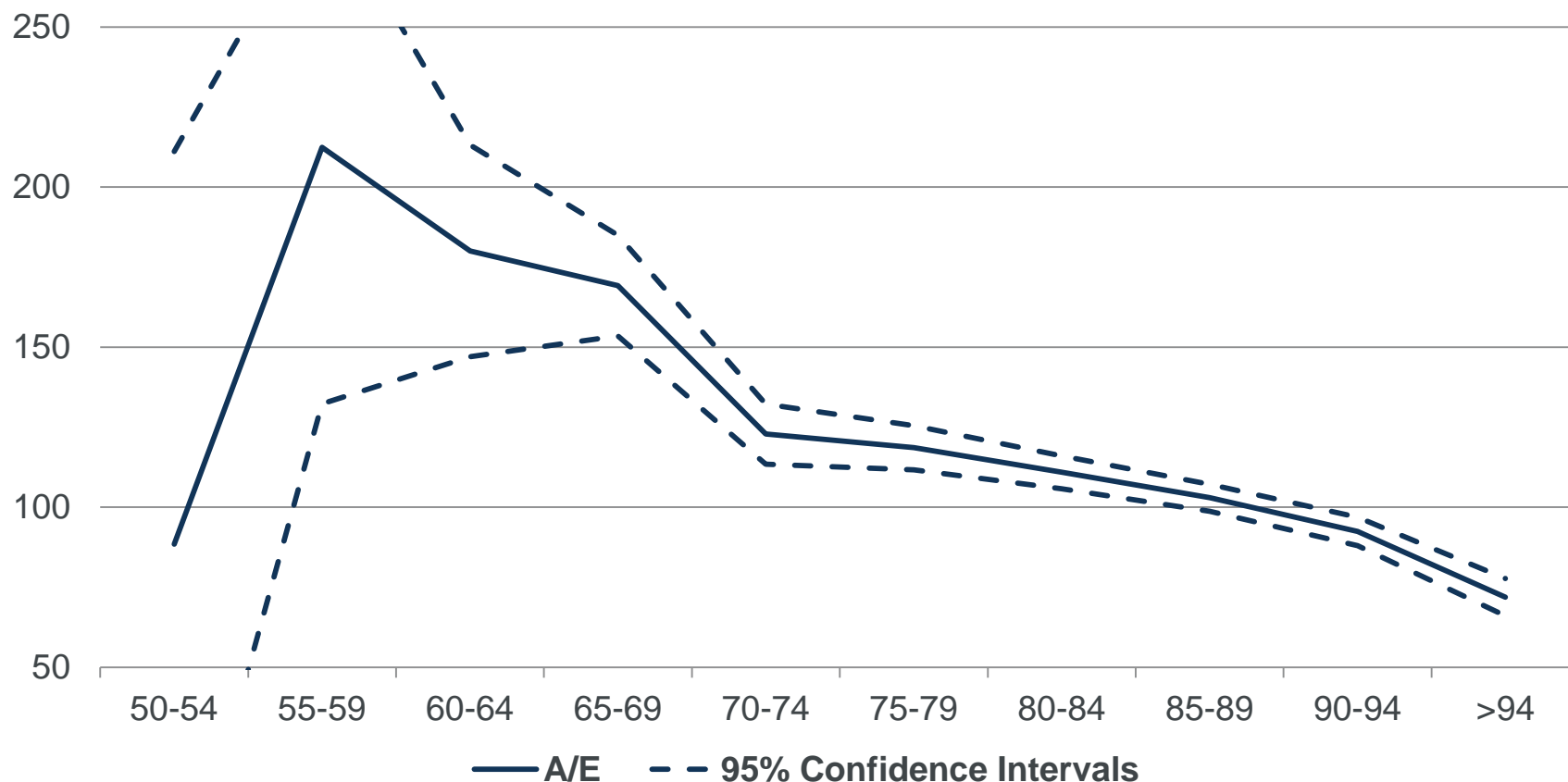


# DRAFT 100 x Actual/Expected by duration (individual annuities) – females



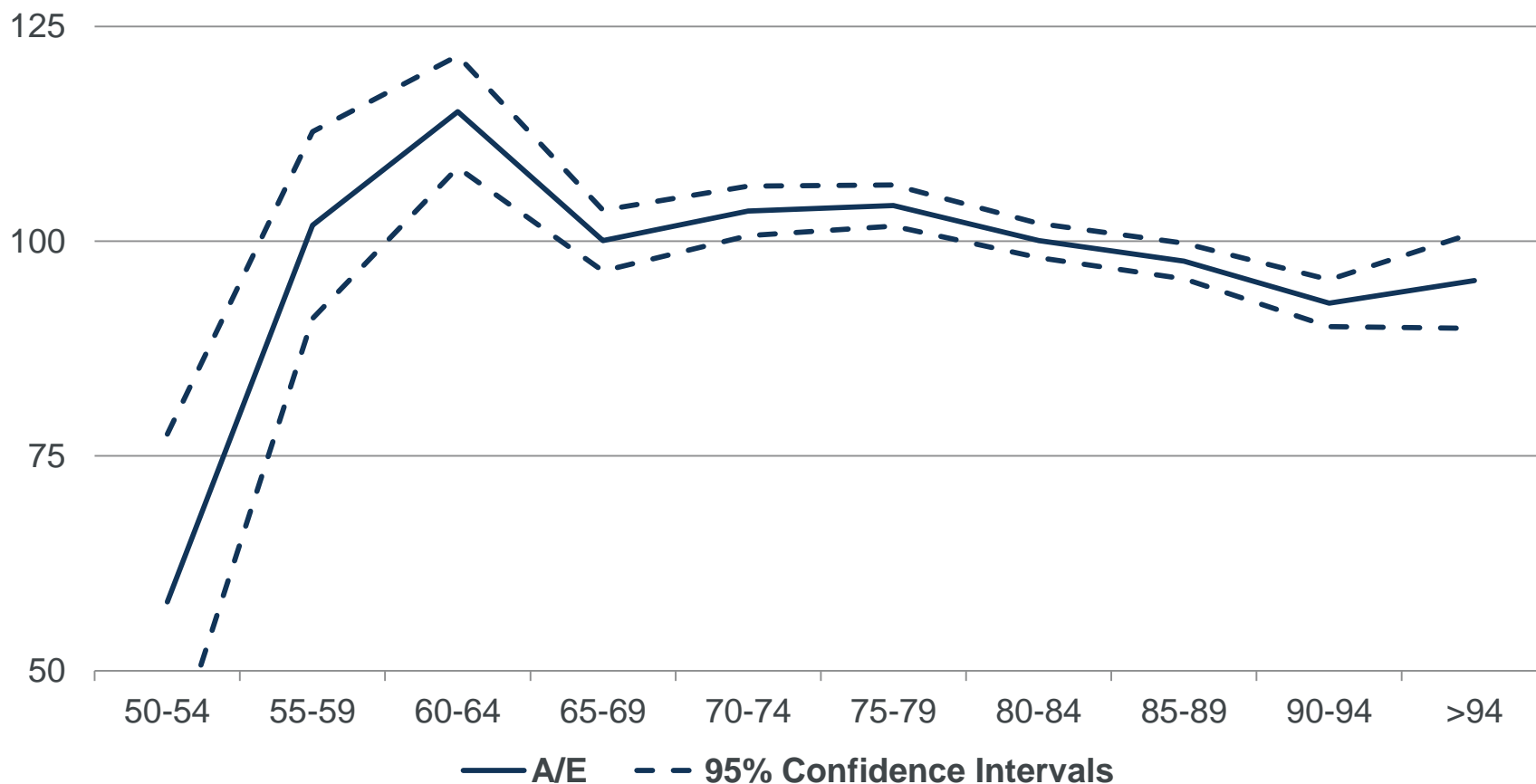
Expected calculated using PFL08 without improvements

# DRAFT 100 x Actual/Expected by age band (group) – males



Expected calculated using PML08 without improvements

# DRAFT 100 x Actual/Expected by age band (Pension buyout) – males



Expected calculated using PFL08 without improvements

# What next?

- 2011-2014 results for pension annuities in payment to be released – target date end of July
- Further analysis of extended dataset (2007-2014) to follow in a subsequent working paper
- >50% of recent data has a socio-economic indicator => scope to analyse differences
- Key question is whether to update “08” tables for High Age Mortality findings or to graduate the 2011-2014 data (including product type)
- Timescales for data collection of Enhanced annuities, deferred annuities and Life annuities yet to be set



## Continuous Mortality Investigation

Institute and Faculty of Actuaries

# The CMI Model

**Tim Gordon**

Chair, CMI Mortality Projections Committee

# Context

- CMI\_2016 (published March 2017)
  - Essentially similar to previous version of the model, although ...  
... faster, simpler, more transparent, more useable, pure Excel/VBA
  - The Core model is slightly less responsive than before, but ...  
... responsiveness can now be adjusted explicitly by users
- *National* mortality improvements have fallen off a cliff since 2011
  - Highlighted by Q1 2015, but it's much more than this
  - This is *not* a UK only phenomenon
  - Dramatic shift is a cause for concern in itself – what are the drivers?
  - How does this relate to longevity projections for liability portfolios?

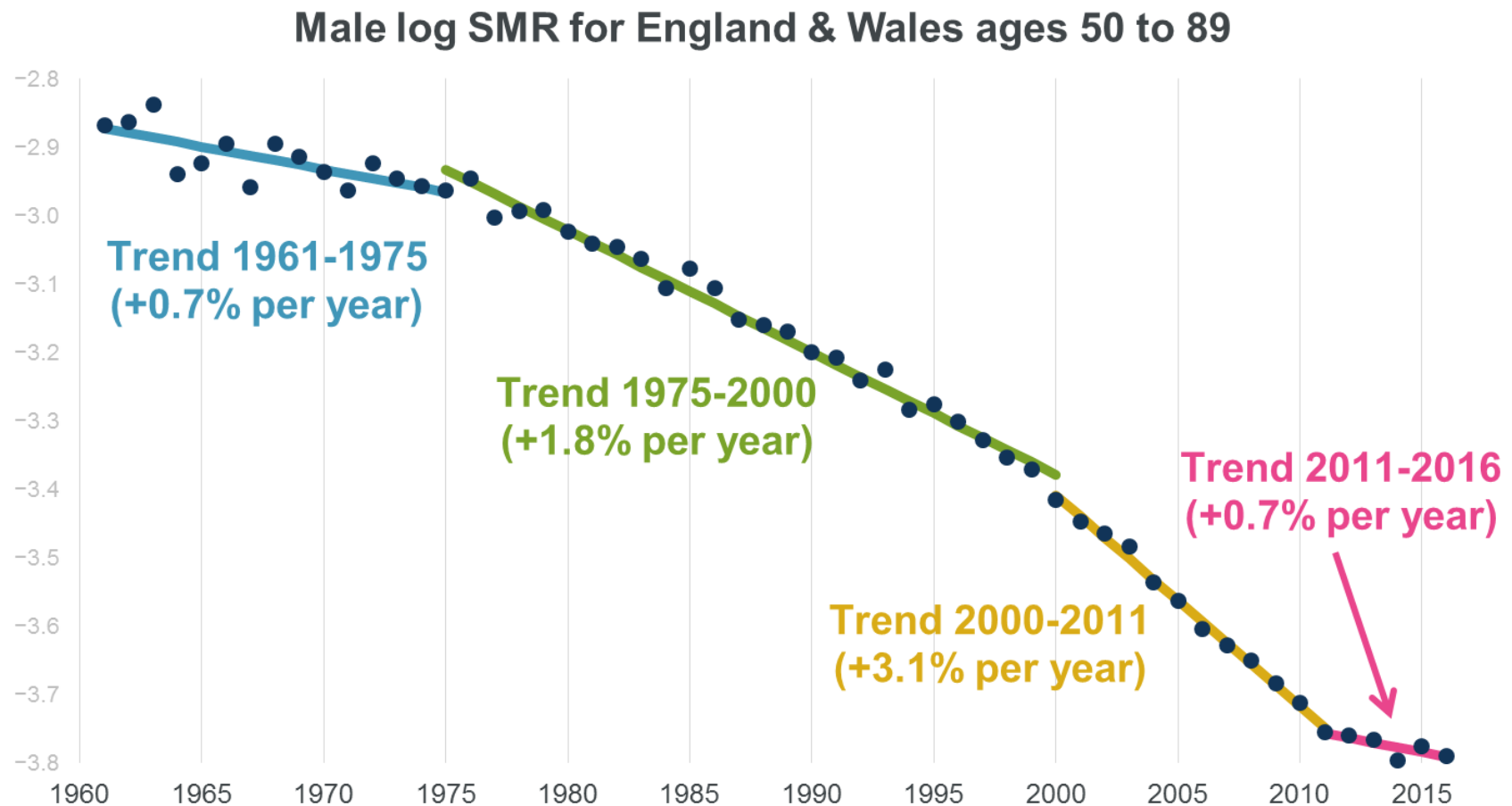
# Impact of CMI\_2016

## Impact on life expectancy of moving to CMI\_2016

	Projection	Age					
		35	45	55	65	75	85
Male	CMI_2014	-2.25%	-2.52%	-2.72%	-2.54%	-2.33%	-4.38%
	CMI_2015	-1.73%	-1.86%	-1.88%	-1.31%	-0.49%	-2.46%
Female	CMI_2014	-2.98%	-3.12%	-3.19%	-3.35%	-3.39%	-5.76%
	CMI_2015	-2.40%	-2.41%	-2.27%	-2.00%	-1.47%	-3.78%

*Life expectancies are based on the Core model using an illustrative long-term rate of 1.5% p.a. applied to S2PMA / S2PFA base.  
Source: CMI Working Paper 97.*

# Male standardised mortality ratio (SMR)



Source: CMI calculations. Standard population is European Standard Population 2013. Trend is  $\Delta \log \mu$ .

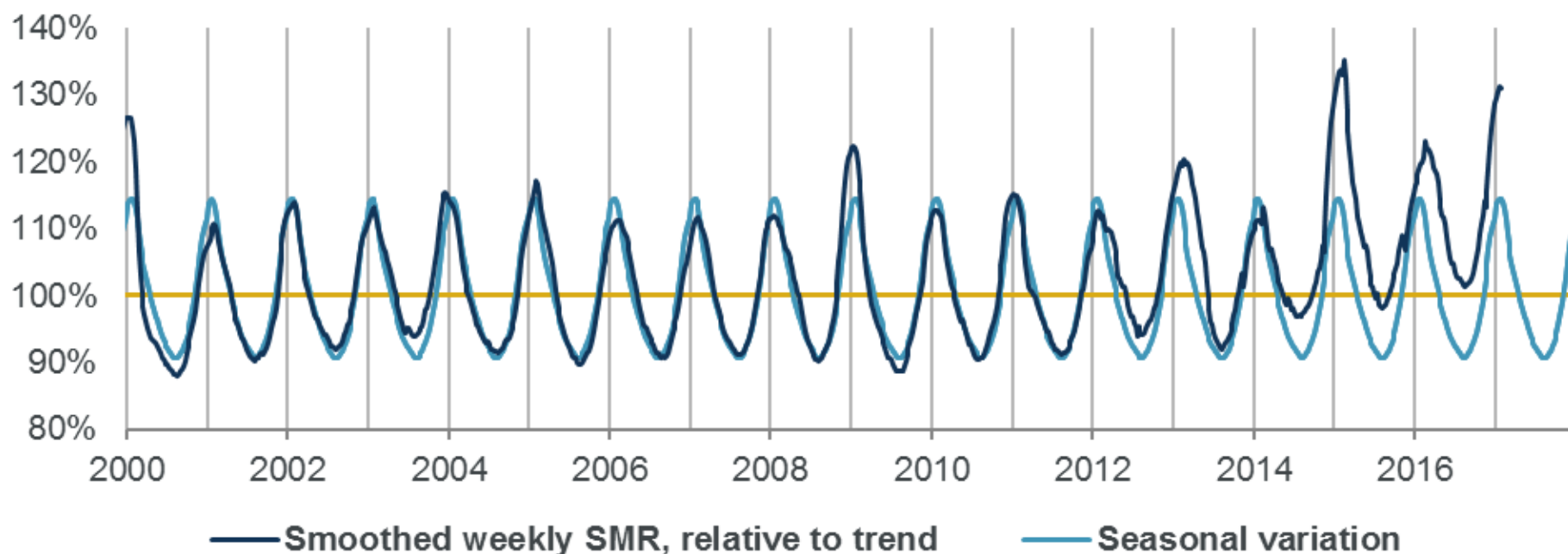


# Key questions

- 1. Is the recent fall in national mortality improvements a blip or persistent?**
- 2. How do we value specific portfolios?**

# Is it heavy winters (or 'flu epidemic in 2015)?

13 week average weekly SMR relative to 2000-2011 trend

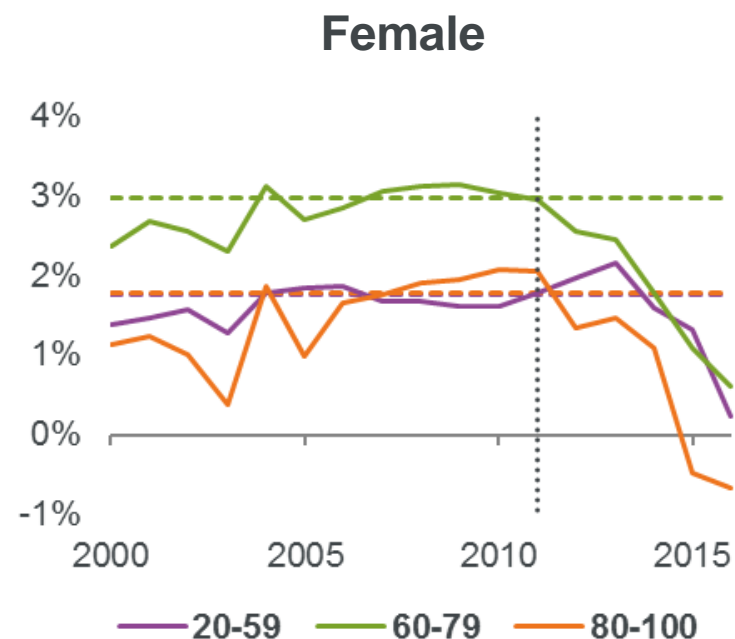
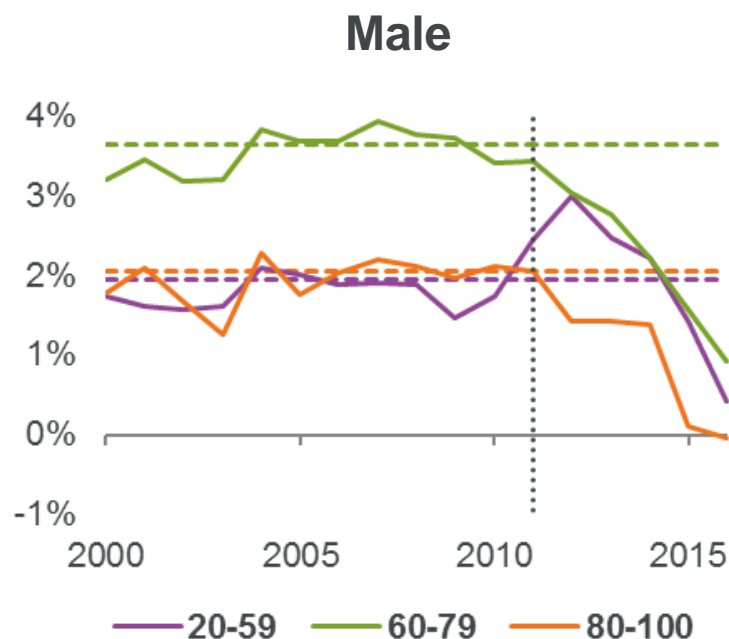


**Recent mortality has been heavier than trend *throughout the year***

Source: CMI Working Paper 97.

# Is it heavier recent mortality at older ages?

## Five-year average mortality improvements by age band



**Recent mortality improvements have been lower *at all ages***

Source: CMI Working Paper 97.

# 1. Is there basis risk per CMI's own data?

## SAPS vs England & Wales mortality improvements over 2011-2015 for ages 65-100

	E&W	SAPS (Lives)	SAPS (Amounts)	Difference (Lives)	Difference (Amounts)
Male	-0.1% $\pm$ 0.4%	+1.2% $\pm$ 1.4%	+0.4% $\pm$ 2.7%	+1.2% $\pm$ 1.4%	+0.5% $\pm$ 2.7%
Female	-0.9% $\pm$ 0.3%	+1.8% $\pm$ 1.5%	+2.6% $\pm$ 2.5%	+2.8% $\pm$ 1.5%	+3.5% $\pm$ 2.6%

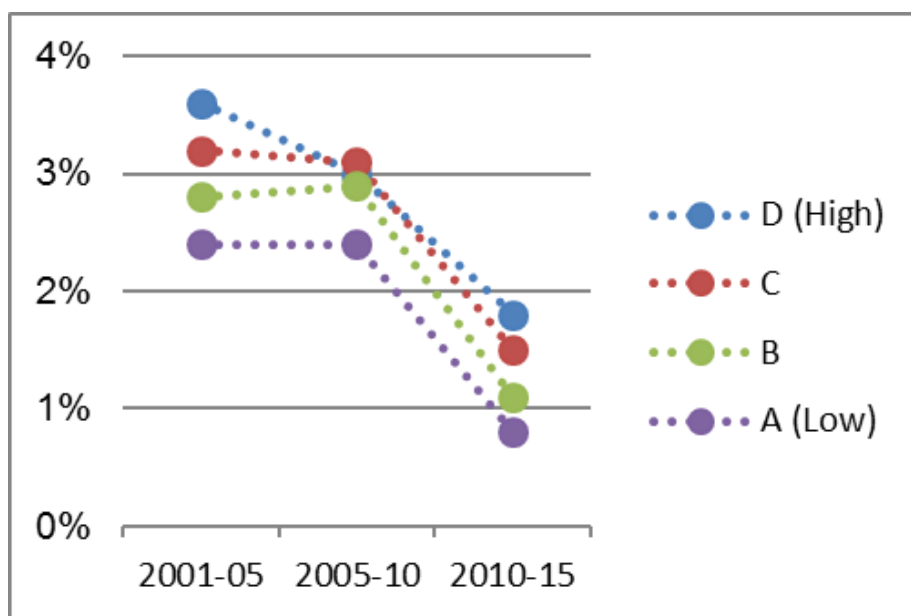
- Is this statistically significant (once we allow for all the noise)?
- Can mortality differentials be projected reliably?

Source: CMI Working Paper 97.

## 2. Is there basis risk per other data?

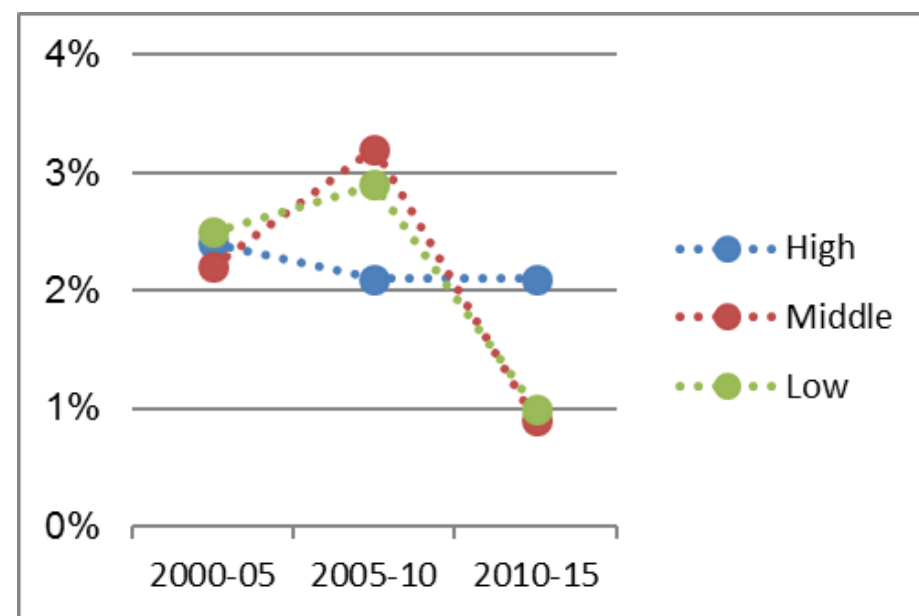
### Annual male mortality improvement by socio-economic group

ONS data (by RGA)



Source: RGA analysis of ONS data presented at CMI/SIAS meeting on 11 April 2017

Club Vita dataset



Source: Club Vita / Hymans Robertson presented at CMI/SIAS meeting on 11 April 2017

# Key questions

- 1. Is the recent fall in national mortality improvements a blip or persistent?**
- 2. How do we value specific portfolios?**



# 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](mailto:info@cmilimited.co.uk)



# Continuous Mortality Investigation

Institute and Faculty of Actuaries

Continuous Mortality Investigation Limited

Registered in England & Wales (Company number: 8373631)

Registered Office: 7<sup>th</sup> floor, Holborn Gate, 326-330 High Holborn, London, WC1V 7PP

Correspondence address: Cheapside House, 138 Cheapside, London, EC2V 6BW, United Kingdom

Email: [info@cmilimited.co.uk](mailto:info@cmilimited.co.uk)

Tel: +44 20 7776 3820

Website: [www.cmilimited.co.uk](http://www.cmilimited.co.uk) (redirects to [www.actuaries.org.uk](http://www.actuaries.org.uk))

Continuous Mortality Investigation Limited ('the CMI') is wholly owned by the Institute and Faculty of Actuaries.

Disclaimer: This document has been prepared by and/or on behalf of Continuous Mortality Investigation Limited (CMI). This document does not constitute advice and should not be relied upon as such. While care has been taken to ensure that it is accurate, up-to-date and useful, CMI will not accept any legal liability in relation to its contents.

© Continuous Mortality Investigation Limited

22 June 2017