

Mortality improvements in the next decade

Discussion hosted by SIAS and the
CMI Mortality Projections Committee

11 April 2017
Staple Inn Hall, London

The views expressed in this presentation are those of the presenters and not necessarily those of their employers, the CMI or the Staple Inn Actuarial Society.

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

Agenda

10 mins Introduction / scene setting

30-40 mins Panel presentations with 5 to 10 mins per speaker

Speaker	Role	Employer
Richard Willets	Expert Longevity Consultant	Just
Stephen Courquin	Head of UK Actuarial Research	RGA Re
Steven Baxter	Head of Longevity Innovation & Research	Hymans Robertson
Stuart McDonald	Head of Longevity	Lloyds Banking Group

30-40 mins Comments and questions from the floor

5 mins Wrap up / close

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?

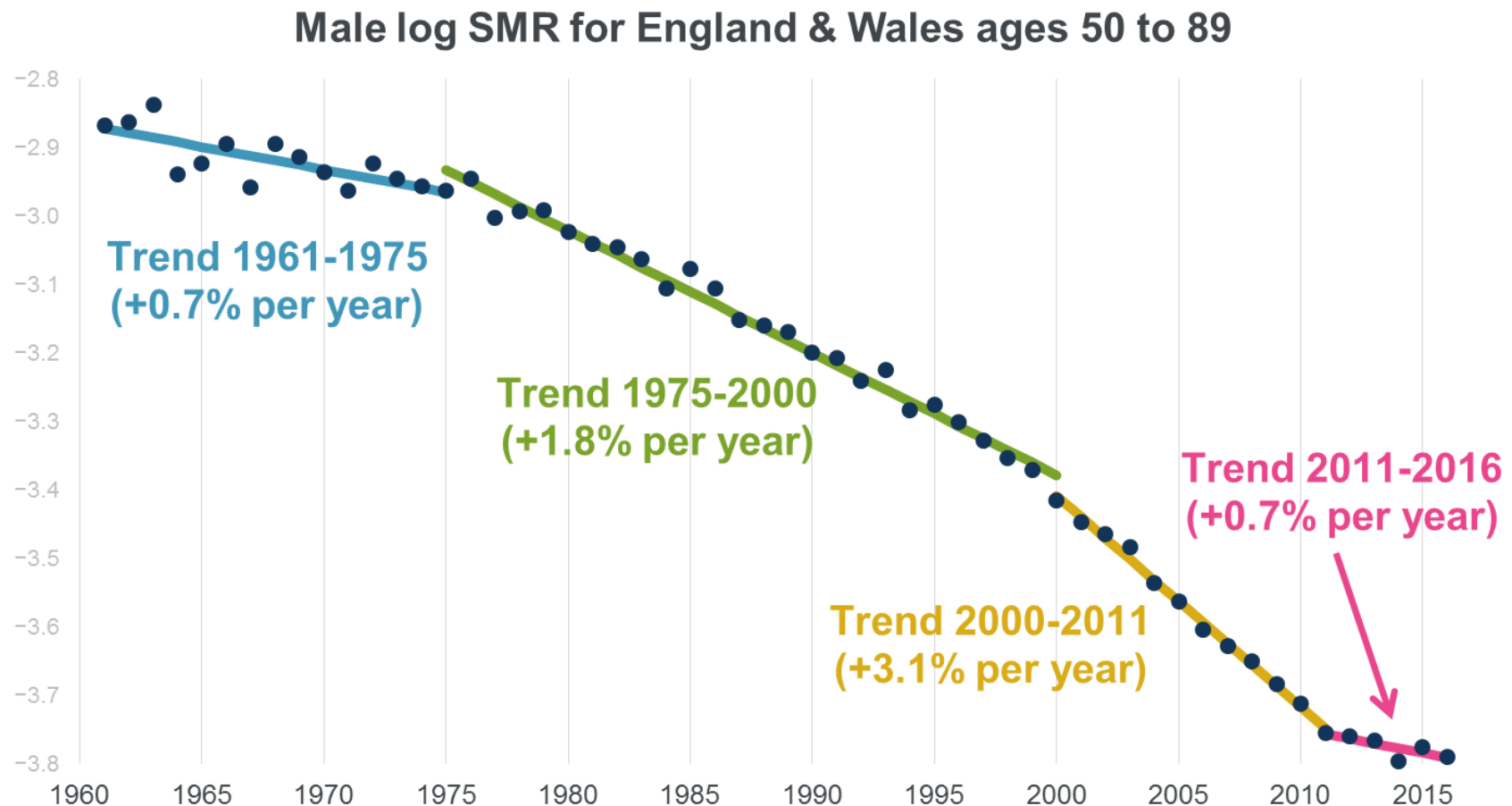
Impact of CMI_2016

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.*

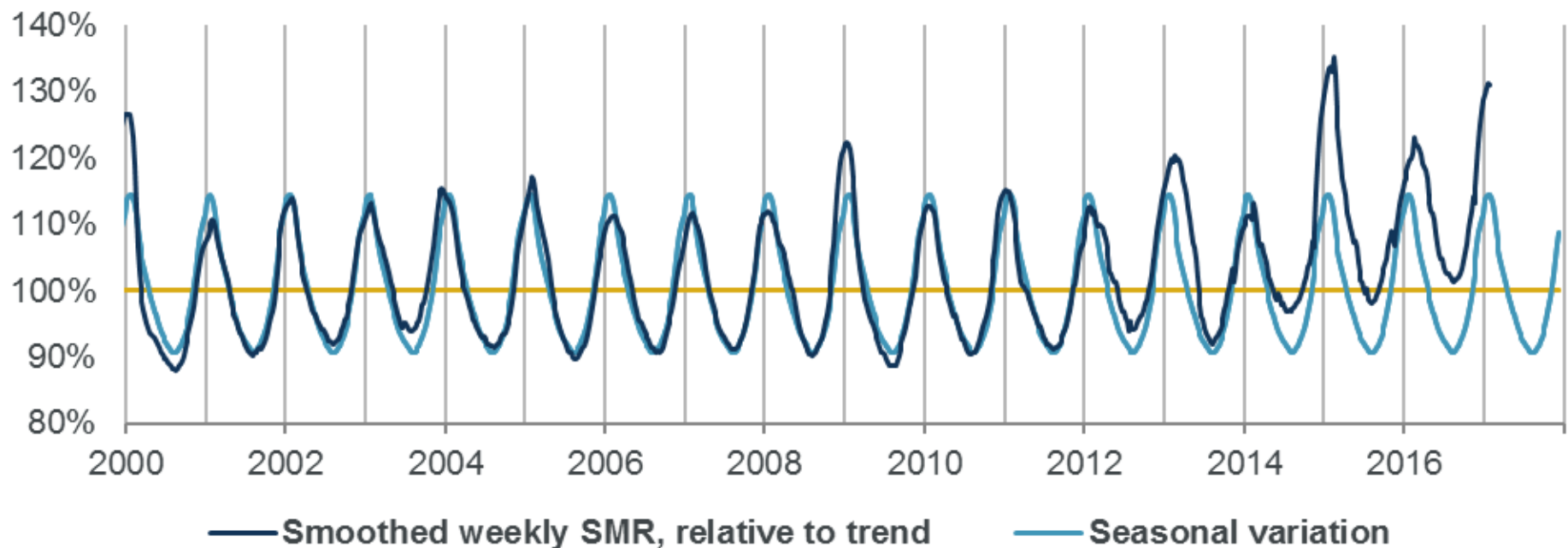
Male standardised mortality ratio (SMR)



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

Is it heavy winters?

13 week average weekly SMR over relative to 2000-2011 trend

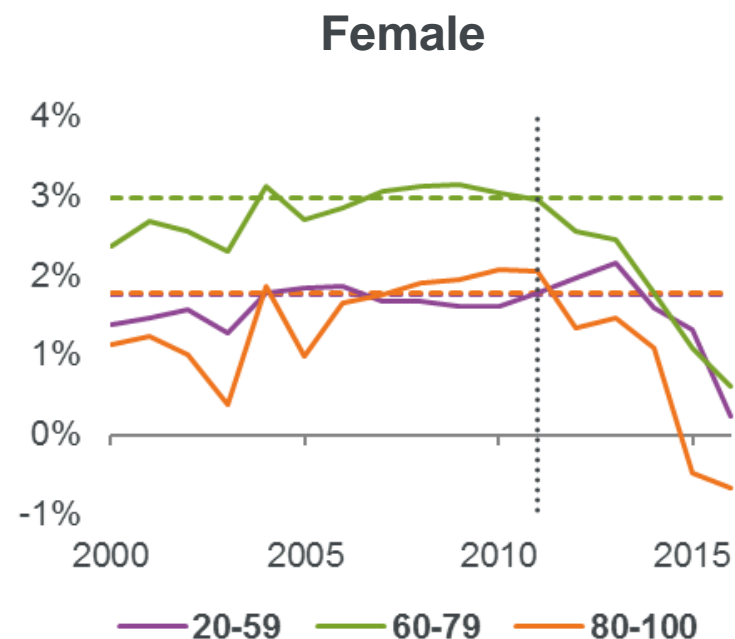


Recent mortality has been heavier than trend *throughout the year*

Source: CMI Working Paper 97.

Is 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.

Is there basis risk?

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.

Key questions

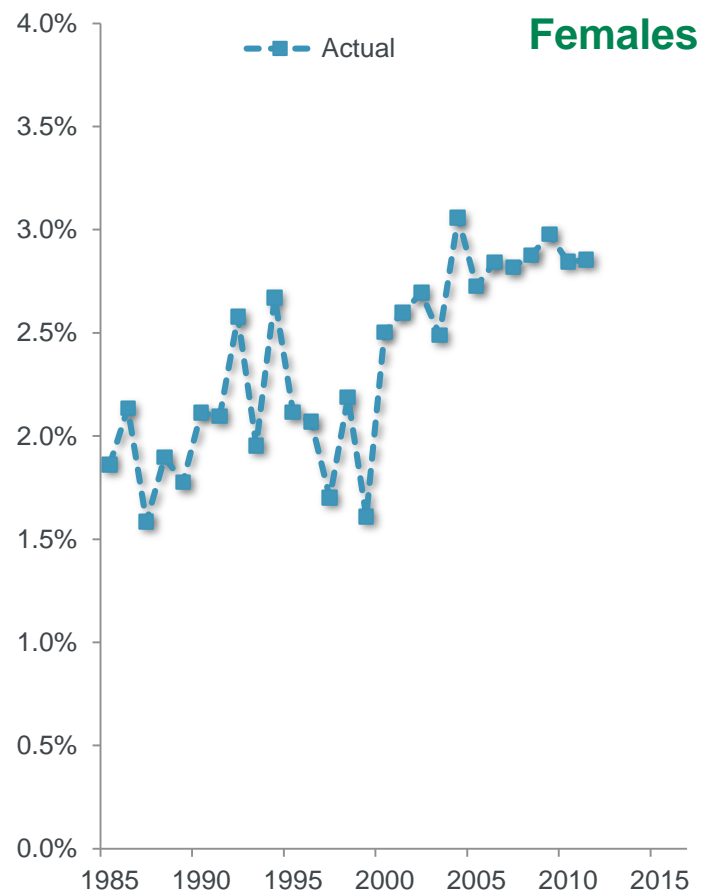
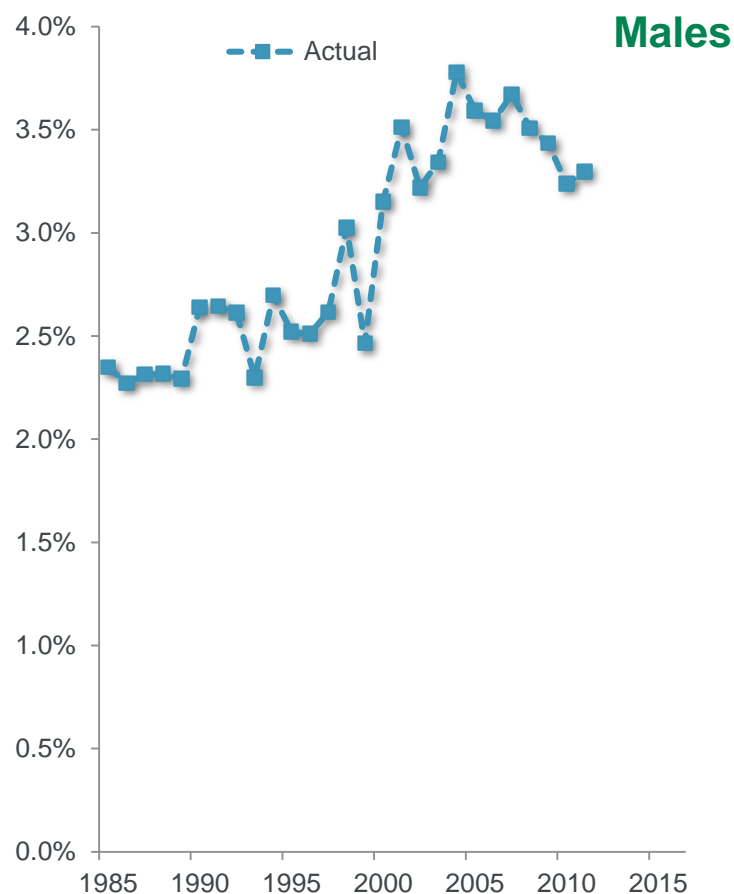
- 1. Is the recent fall in national mortality improvements a blip or persistent?**
- 2. How do we value specific portfolios?**

Richard Willets

Expert Longevity Consultant
Just

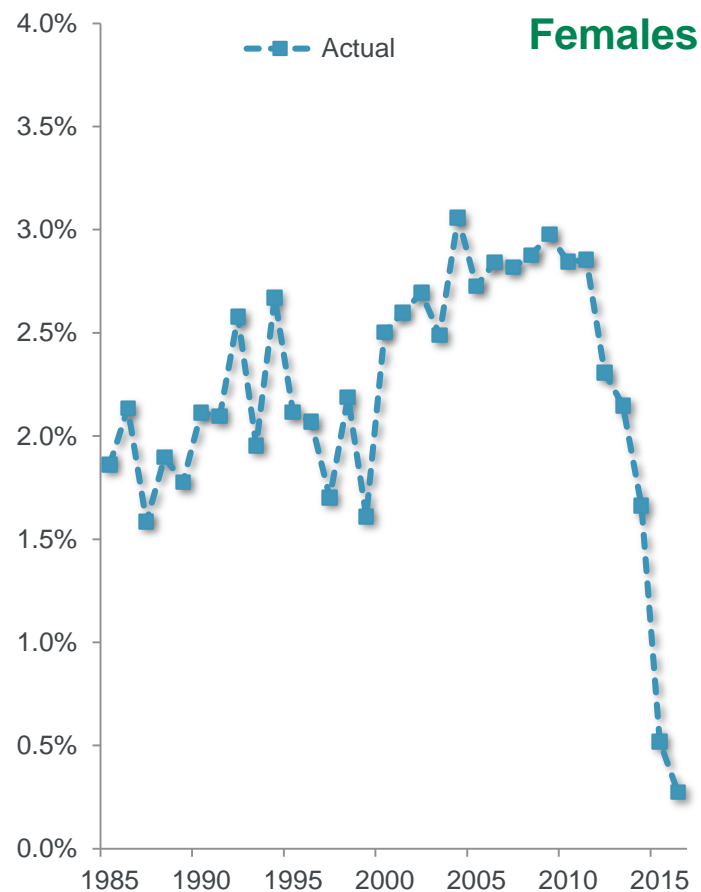
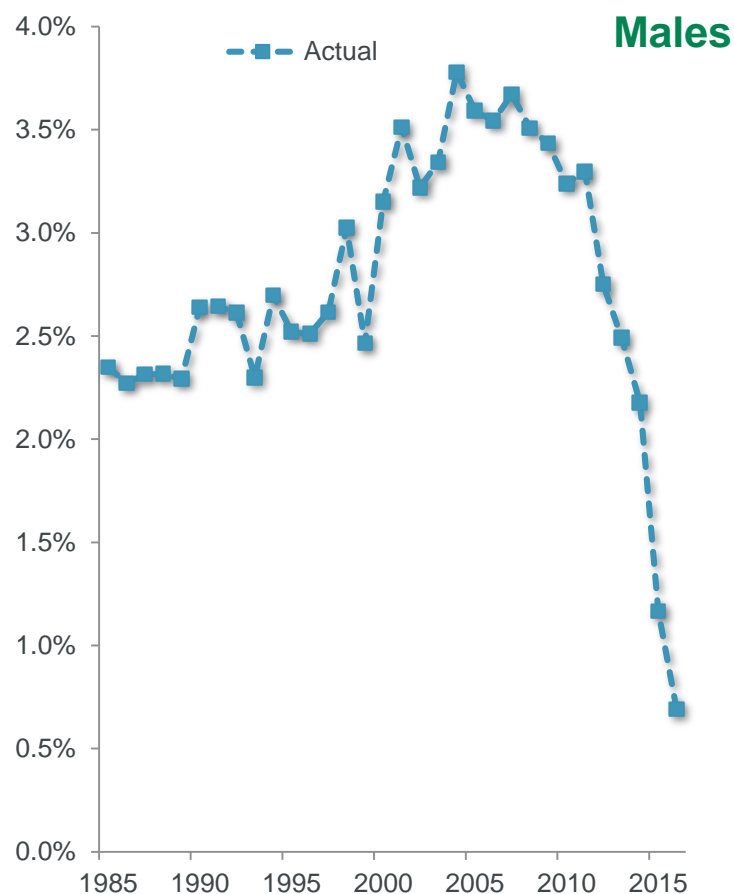
How CMI_2016 reflects the fall in improvements

Average annual improvement rate over previous 5 years, 1925-45 birth cohort, England & Wales



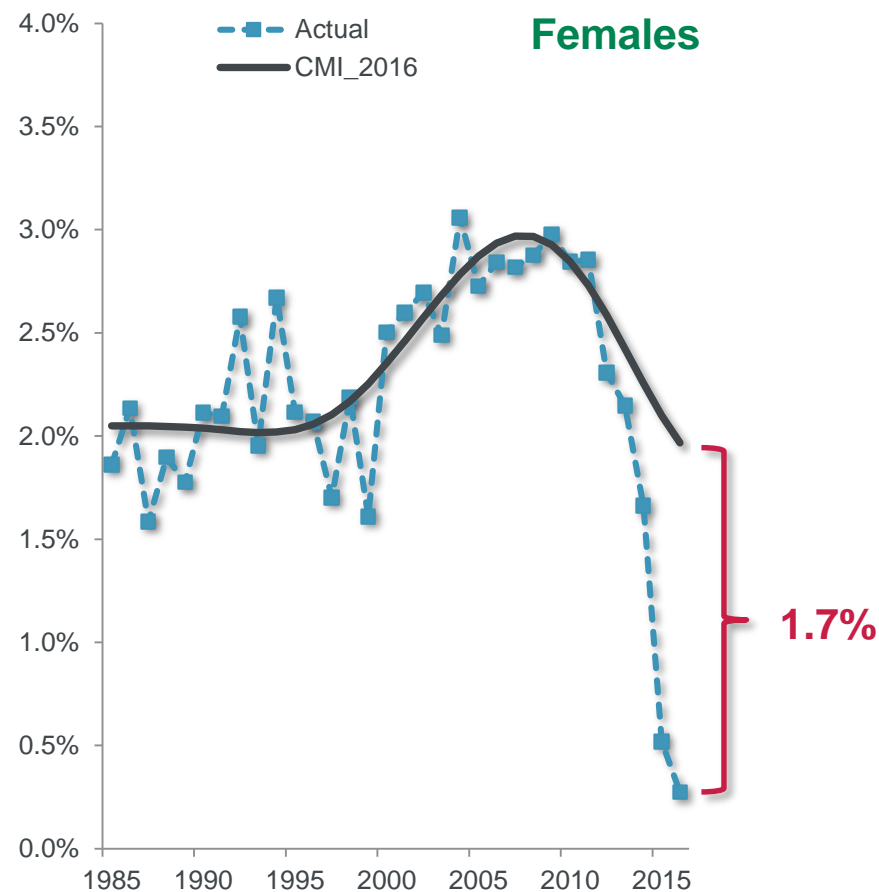
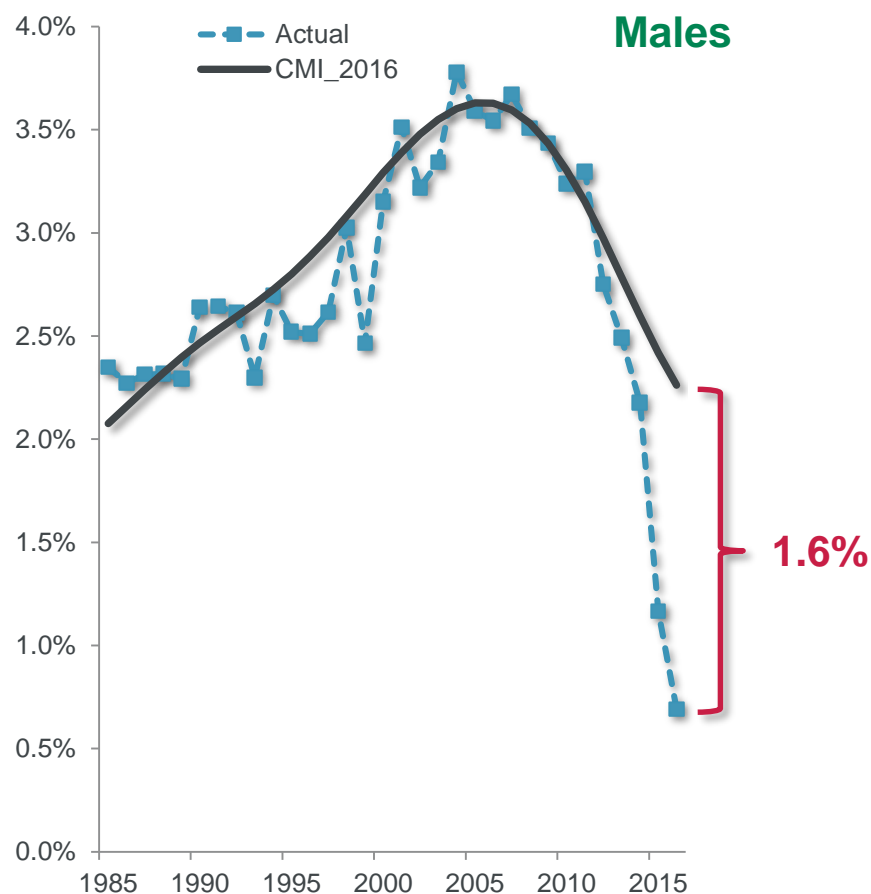
How CMI_2016 reflects the fall in improvements

Average annual improvement rate over previous 5 years, 1925-45 birth cohort, England & Wales

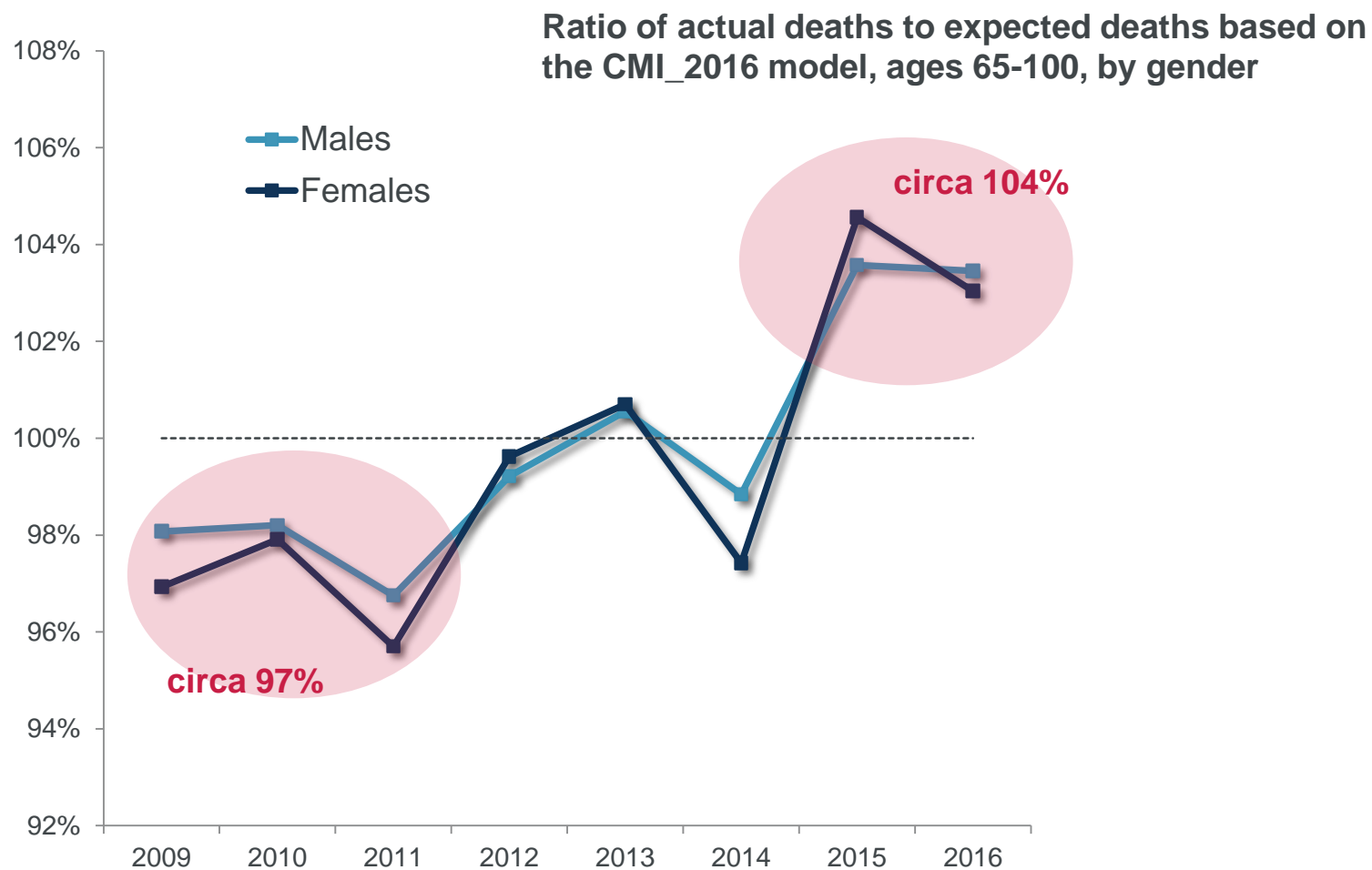


How CMI_2016 reflects the fall in improvements

Average annual improvement rate over previous 5 years, 1925-45 birth cohort, England & Wales

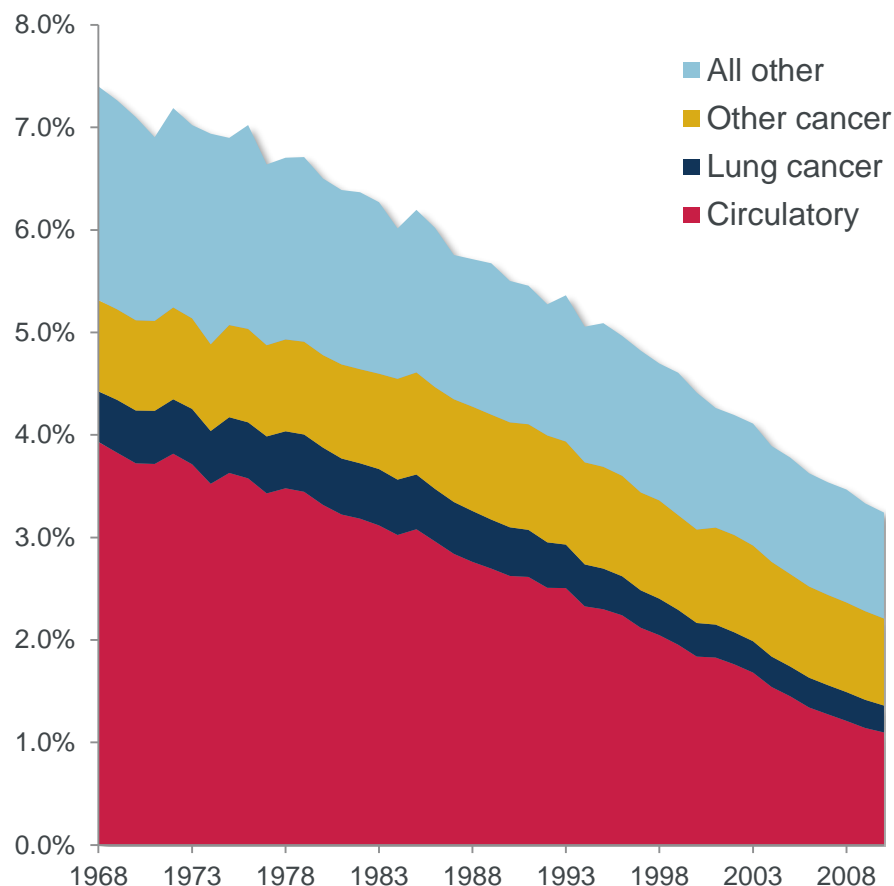


How CMI_2016 reflects the fall in improvements



Improvements by cause of death

Age-standardized mortality rate for ages 60-89, males in England & Wales, by cause of death group, 1968 to 2010

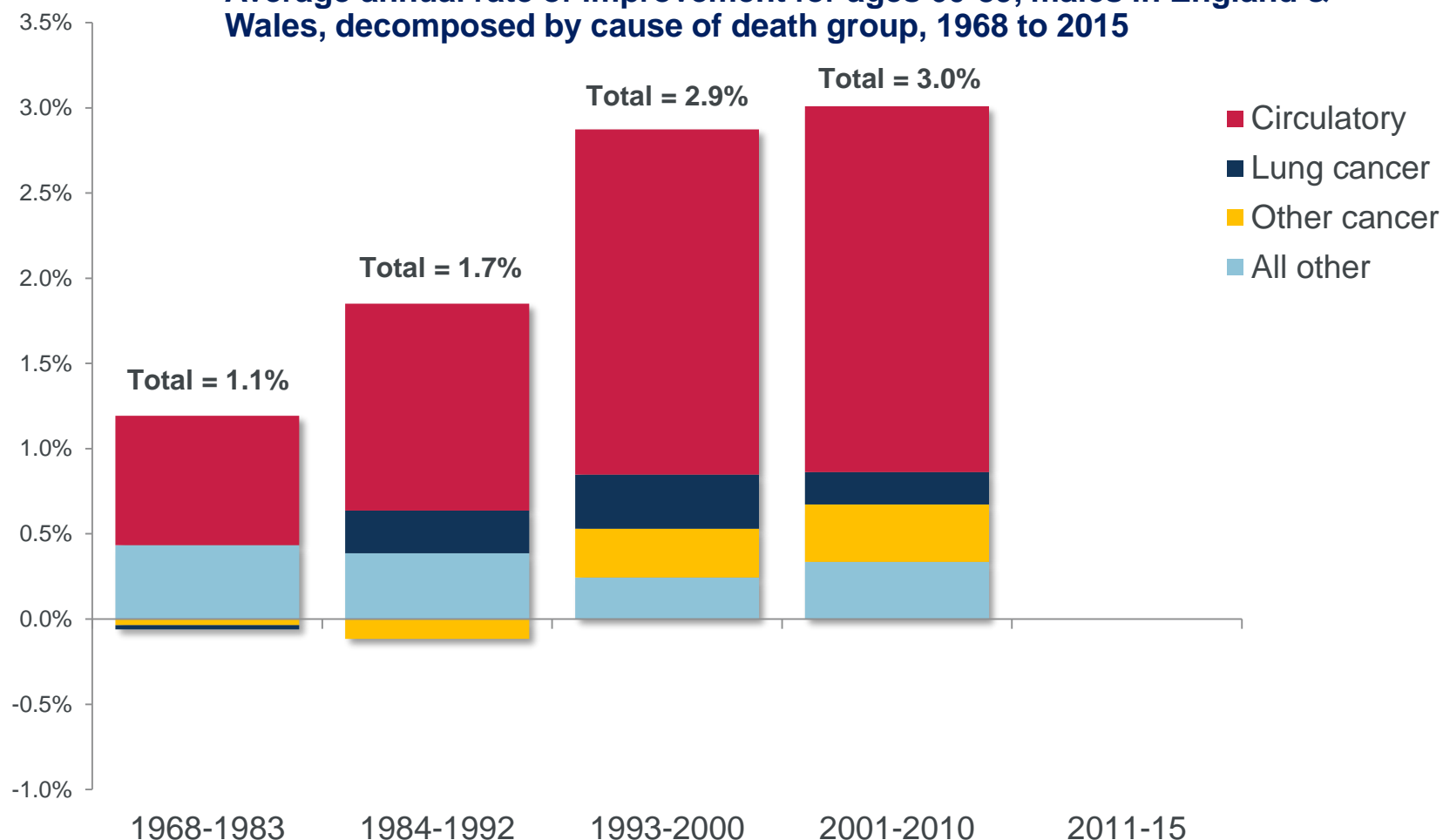


- In the period up to 2010 death rates from circulatory causes fell by up to 75%
- Around 70% of the total improvement was due to this
- The improvement was driven by a range of different factors, the most significant of which was reduced smoking
- The potential for future improvement in circulatory causes is more limited

Potential for future improvement

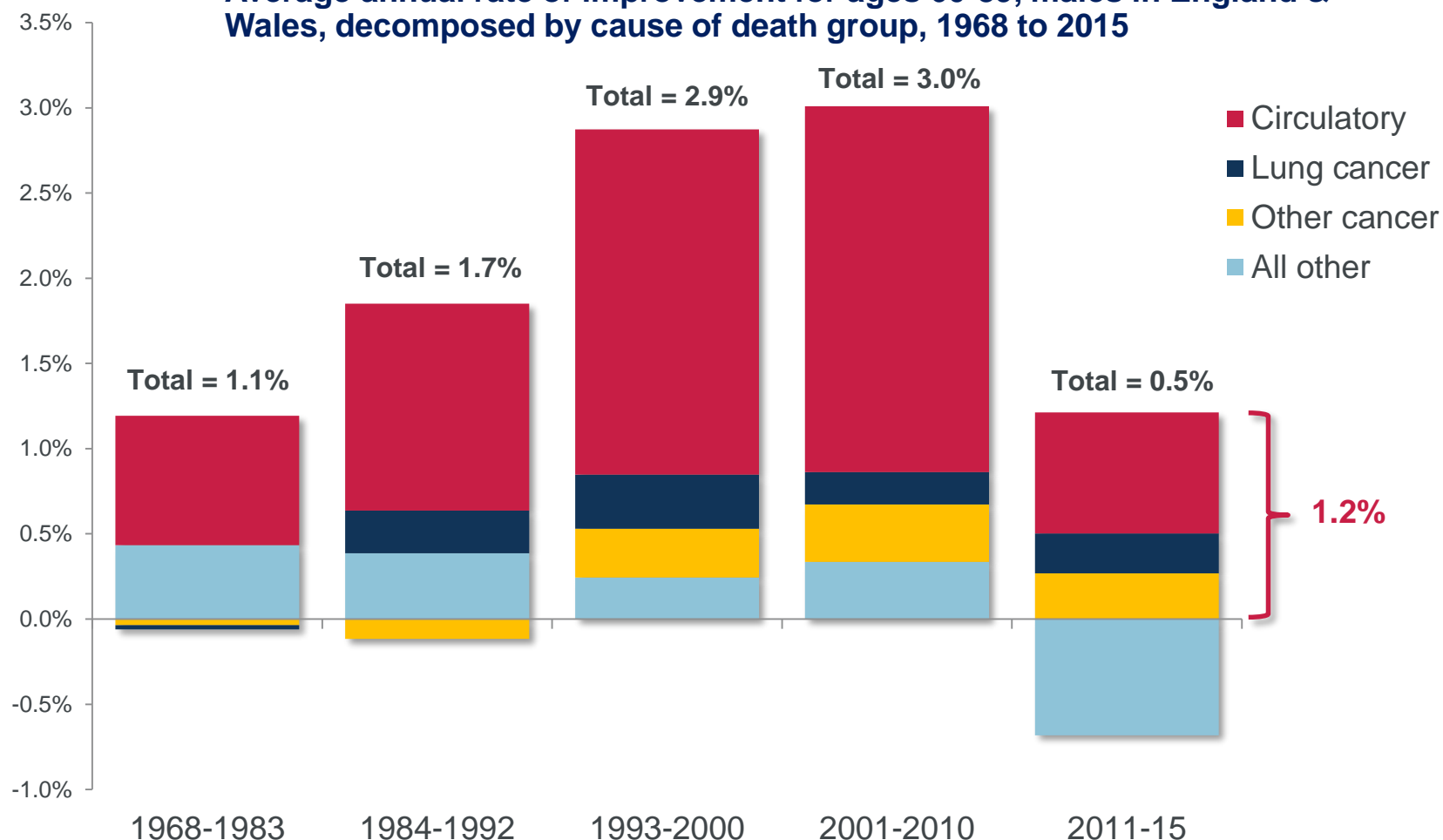
Improvements by cause of death

Average annual rate of improvement for ages 60-89, males in England & Wales, decomposed by cause of death group, 1968 to 2015



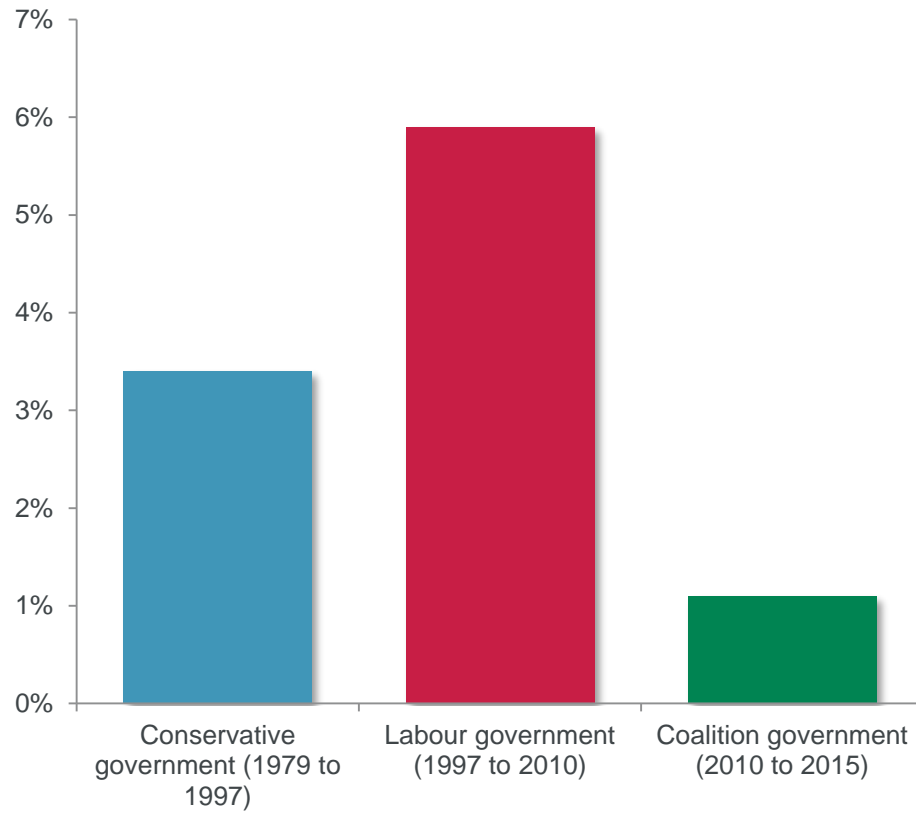
Improvements by cause of death

Average annual rate of improvement for ages 60-89, males in England & Wales, decomposed by cause of death group, 1968 to 2015



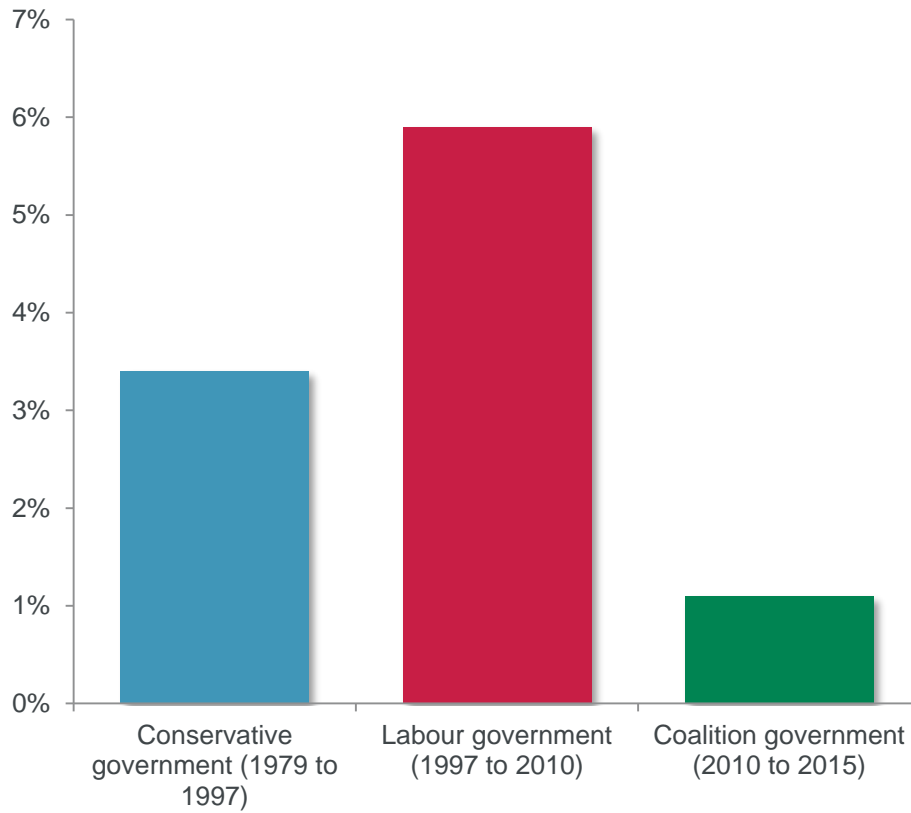
Correlation is not causation

Average annual increase in NHS expenditure (source: IFS)

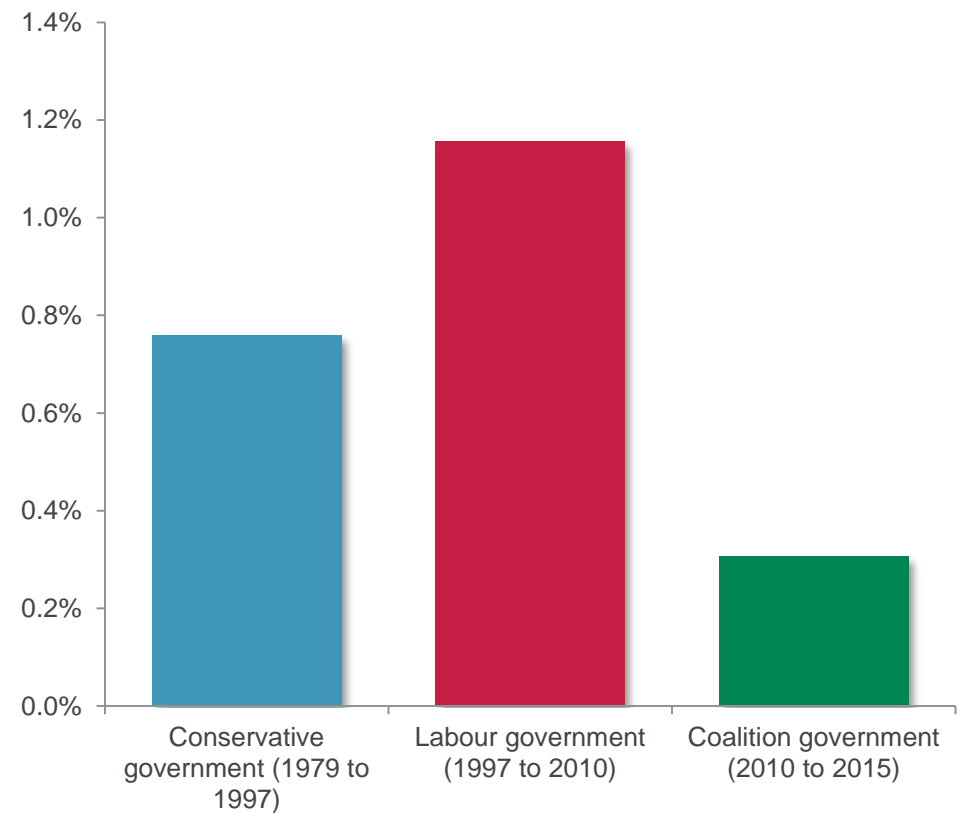


Correlation is not causation

Average annual increase in NHS expenditure (source: IFS)



Average annual increase in life expectancy at age 65, England & Wales



Concluding thoughts

- The deceleration can be partly explained by the reduced contribution to aggregate improvements from circulatory causes
- This has been exacerbated by mortality increases in a range of miscellaneous causes
- Therefore the fall in improvements can be seen as:-
 - a reversion to a more typical aggregate rate of change (following a period of unusually rapid improvement); plus
 - the impact of economic austerity (NHS & social care funding)
- Therefore lower improvements are not likely to be temporary (i.e. they are not a 'blip')
- There is a case to reduce the value of the 'smoothing parameter' when using CMI_2016

Stephen Courquin

Head of UK Actuarial Research
RGA Re

Discussion points

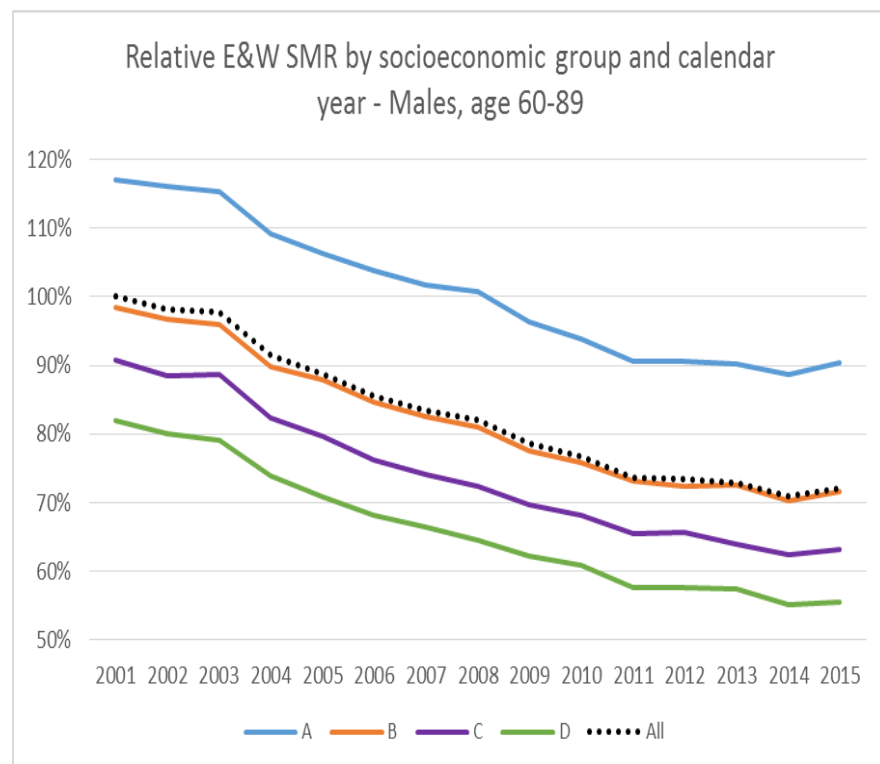
- Trends by socioeconomic group
- International comparisons

Trends by socioeconomic group

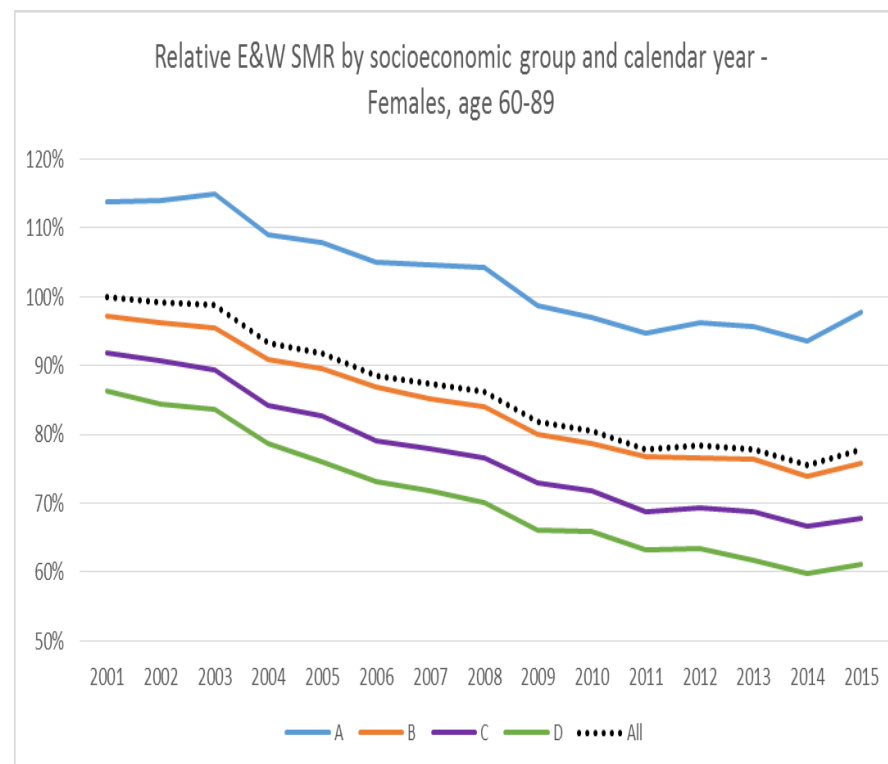
- Financial liabilities in pension schemes and insurance companies will tend to be skewed towards the higher socioeconomic groups
- Investigated trends by socioeconomic group in England & Wales using population data between 2001 and 2015
- Exposure & death data split by:
 - Single age (0-89)
 - Gender
 - Lower super output area (LSOA) – Approx 35,000 in E&W
- Mapped each LSOA to various indices linked to socioeconomic status
- Results shown are based on splitting data into four groups of increasing affluence (A – lower SEG, D – higher SEG)

Trends by socioeconomic group

Males



Females




Source: RGA analysis of ONS data

SMR calculated using 2013 European Standard Population

Trends by socioeconomic group

Annualised improvements by population subgroup: **Males**, age 60-89


	Sub - Group	Time period				% of Popn
		2001-05	2005-10	2010-14	2010-15	
Lower SEG  Higher SEG	A	2.4% ($\pm 0.6\%$)	2.4% ($\pm 0.5\%$)	1.4% ($\pm 0.6\%$)	0.8% ($\pm 0.5\%$)	27%
	B	2.8% ($\pm 0.7\%$)	2.9% ($\pm 0.6\%$)	1.9% ($\pm 0.7\%$)	1.1% ($\pm 0.6\%$)	29%
	C	3.2% ($\pm 0.7\%$)	3.1% ($\pm 0.7\%$)	2.2% ($\pm 0.7\%$)	1.5% ($\pm 0.7\%$)	26%
	D	3.6% ($\pm 0.9\%$)	3.0% ($\pm 0.8\%$)	2.4% ($\pm 0.9\%$)	1.8% ($\pm 0.8\%$)	18%
	All	3.0% ($\pm 0.3\%$)	2.9% ($\pm 0.3\%$)	1.9% ($\pm 0.3\%$)	1.2% ($\pm 0.3\%$)	100%

Improvement rates and confidence intervals calculated in a consistent method to that in CMI working paper 97

Source: RGA analysis of ONS data

Trends by socioeconomic group

Annualised improvements by population subgroup: **Females**, age 60-89

	Sub - Group	Time period				% of Popn
		2001-05	2005-10	2010-14	2010-15	
Lower SEG  Higher SEG	A	1.3% ($\pm 0.6\%$)	2.1% ($\pm 0.6\%$)	0.9% ($\pm 0.6\%$)	-0.1% ($\pm 0.6\%$)	27%
	B	2.0% ($\pm 0.6\%$)	2.5% ($\pm 0.6\%$)	1.6% ($\pm 0.7\%$)	0.7% ($\pm 0.6\%$)	29%
	C	2.6% ($\pm 0.7\%$)	2.8% ($\pm 0.7\%$)	1.8% ($\pm 0.8\%$)	1.2% ($\pm 0.7\%$)	26%
	D	3.1% ($\pm 0.9\%$)	2.8% ($\pm 0.9\%$)	2.4% ($\pm 1.0\%$)	1.5% ($\pm 0.9\%$)	18%
	All	2.1% ($\pm 0.3\%$)	2.6% ($\pm 0.3\%$)	1.6% ($\pm 0.3\%$)	0.7% ($\pm 0.3\%$)	100%

Results indicate material differences in trends between population subgroups and this should be a consideration when setting assumptions for specific portfolios

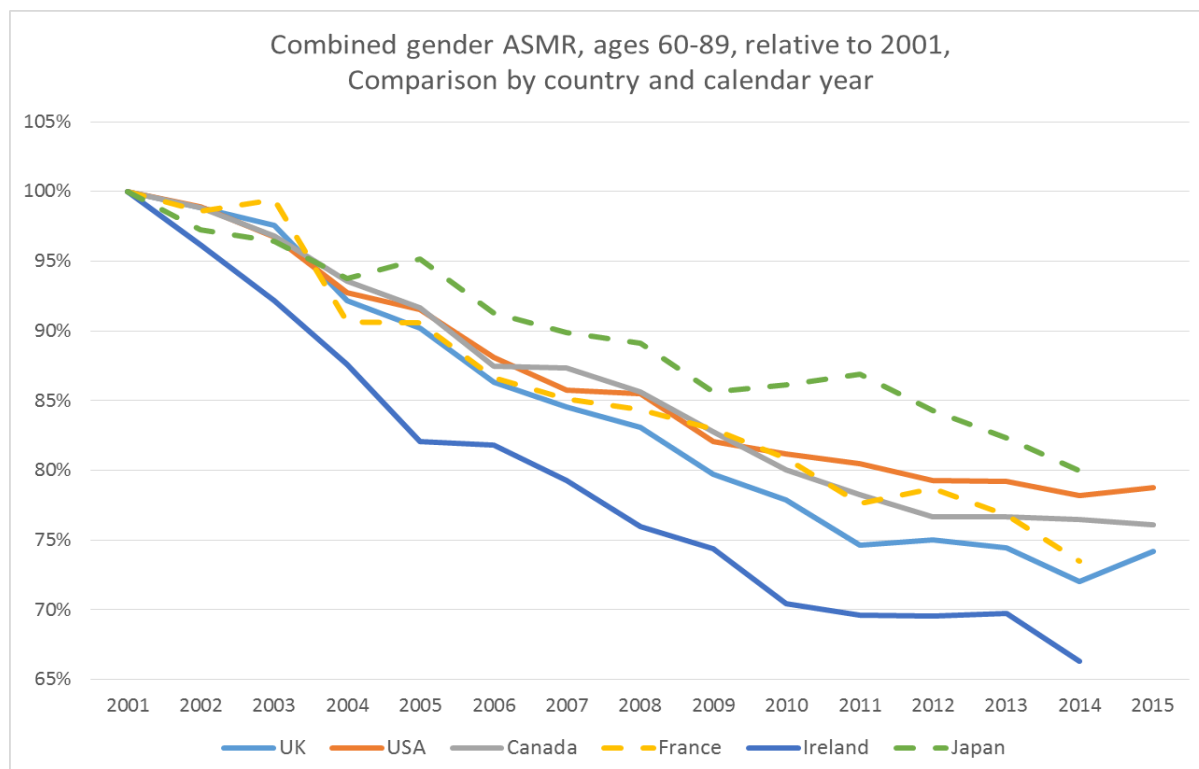
Source: RGA analysis of ONS data

International comparisons

- Are other countries in Europe and across the world also experiencing similar changes in trends?
- Understanding what has happened elsewhere may provide insight into the recent UK trends and their future path

International comparisons

Change in ASMR since 2001 – Comparison by country



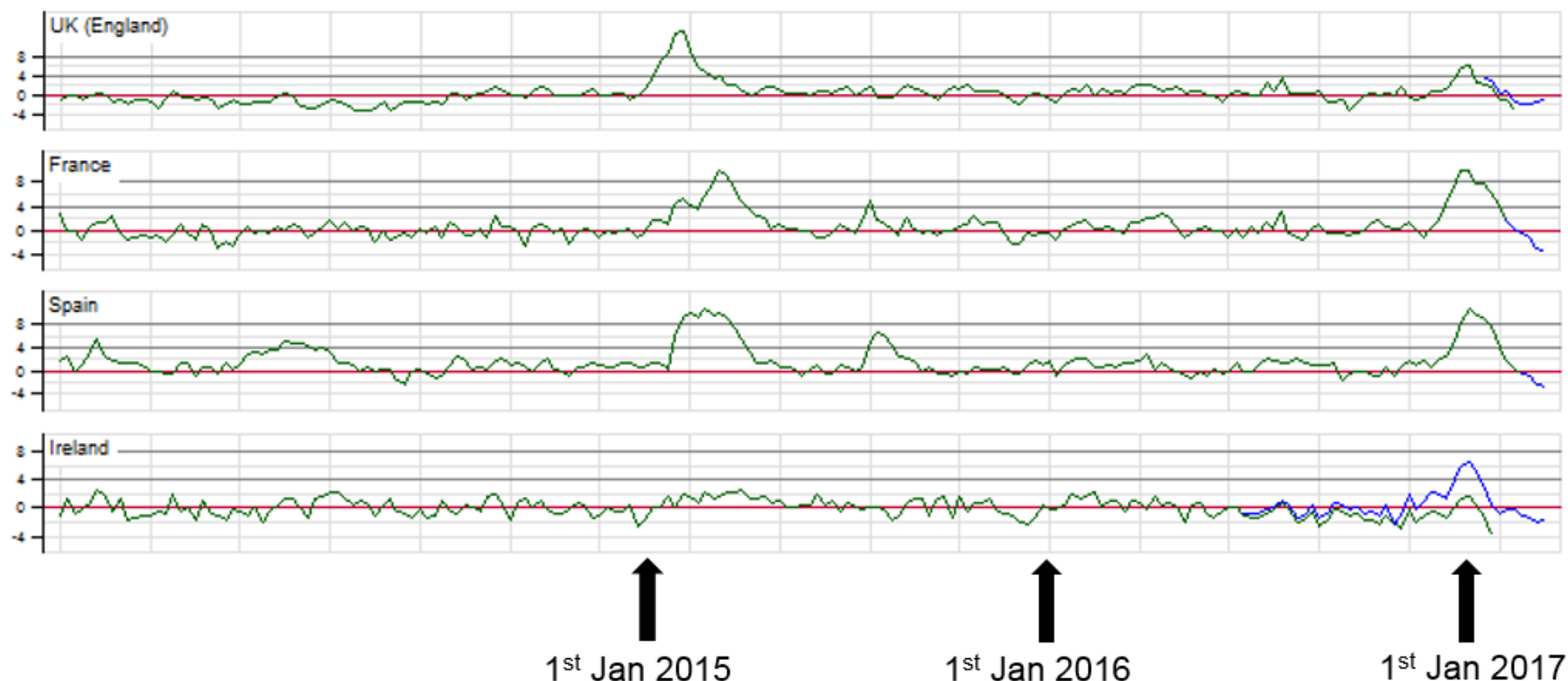
Country	Improvement Rate	
	2001-10	2010-14
E&W	2.7%	1.9%
USA	2.3%	0.9%
Canada	2.4%	1.1%
France	2.3%	2.3%
Ireland	3.8%	1.5%
Japan	1.6%	1.8%

SMR calculated using 2013 European Standard Population and assumed 50/50 split by gender

Source: ONS for UK, HMD for other countries

International comparisons

Weekly mortality as deviations from baseline – All ages



Source: European monitoring of excess mortality for public health action <http://www.euromomo.eu/>



Steven Baxter

Head of Longevity Innovation & Research
Hymans Robertson

Three key questions

1. Are the national trends mirrored in DB pension schemes?
2. Is the recent slowdown universal across the socio-economic spectrum?
3. What does this mean for projecting longevity?

Are national trends mirrored in DB schemes?

	Group	Annualised mortality improvement (age-standardised)		
		2000-2005	2005-2010	2010-2015
	England & Wales	2.8% ($\pm 0.1\%$)	2.8% ($\pm 0.1\%$)	1.1% ($\pm 0.1\%$)
	Club Vita	2.4% ($\pm 0.5\%$)	2.8% ($\pm 0.3\%$)	1.3% ($\pm 0.4\%$)
	England & Wales	1.6% ($\pm 0.1\%$)	2.4% ($\pm 0.1\%$)	0.3% ($\pm 0.1\%$)
	Club Vita	0.7% ($\pm 0.5\%$)	2.7% ($\pm 0.3\%$)	0.6% ($\pm 0.3\%$)

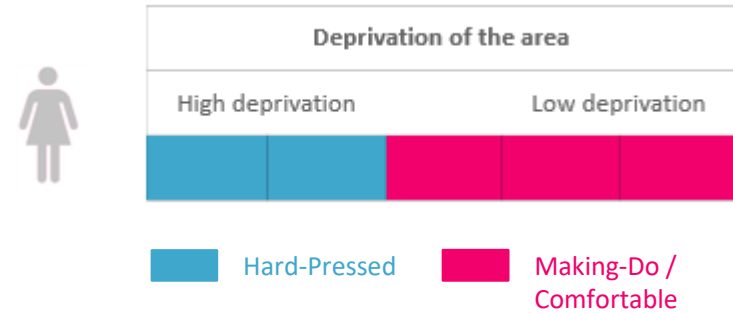
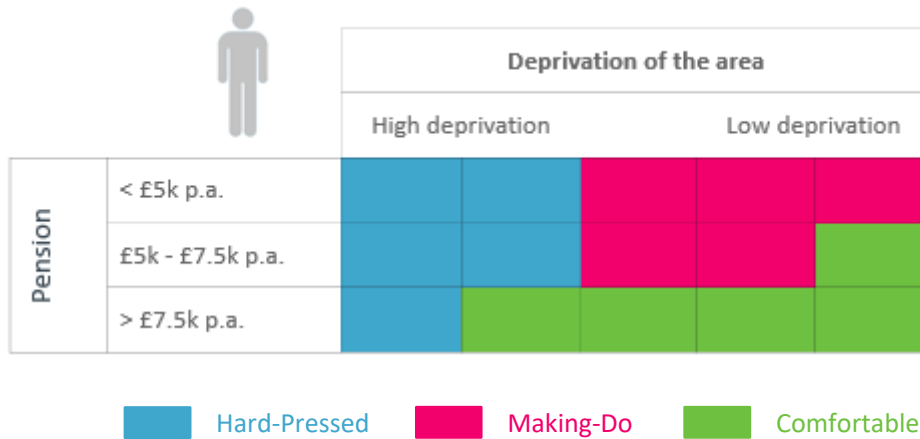
Source: Club Vita / Hymans Robertson

Notes on calculations:

- Annualised improvements calculated as $(\text{end mortality} / \text{start mortality})^{1/5}$ for age range 65-95
- Mortality is age-standardised using England & Wales 2010 population as reference.
- Confidence intervals on the annualised improvements shown at the 95% level and are estimated using methods consistent with those in CMI WP97 – but avoids (strong) assumption made in WP97 of independence between successive year-on-year improvements.
- Club Vita figures for men relate to pensioners only. Figures for women include pensioners and in-payment dependants.

Yes – on a lives basis

Is the recent slowdown universal?



VITASEGMENTS

Source: Club Vita

Comfortable (higher SEGs) **dominate** liabilities

Is the recent slowdown universal?



Group	Annualised mortality improvement (age-standardised)		
	2000-2005	2005-2010	2010-2015
England & Wales	2.8% (±0.1%)	2.8% (±0.1%)	1.1% (±0.1%)
Club Vita	2.4% (±0.5%)	2.8% (±0.3%)	1.3% (±0.4%)
Comfortable	2.4% (±1.1%)	2.1% (±0.8%)	2.1% (±0.7%)
Making-do	2.2% (±0.8%)	3.2% (±0.5%)	0.9% (±0.6%)
Hard-pressed	2.5% (±0.7%)	2.9% (±0.5%)	1.0% (±0.6%)

Source: Club Vita / Hymans Robertson

Notes on calculations:

- Annualised improvements calculated as $(\text{end mortality} / \text{start mortality})^{1/5}$ for age range 65-95
- Mortality is age-standardised using England & Wales 2010 population as reference.
- Confidence intervals on the annualised improvements shown at the 95% level and are estimated using methods consistent with those in CMI WP97 – but avoids (strong) assumption made in WP97 of independence between successive year-on-year improvements.

No slowdown in improvements amongst higher SEG men

Is the recent slowdown universal?



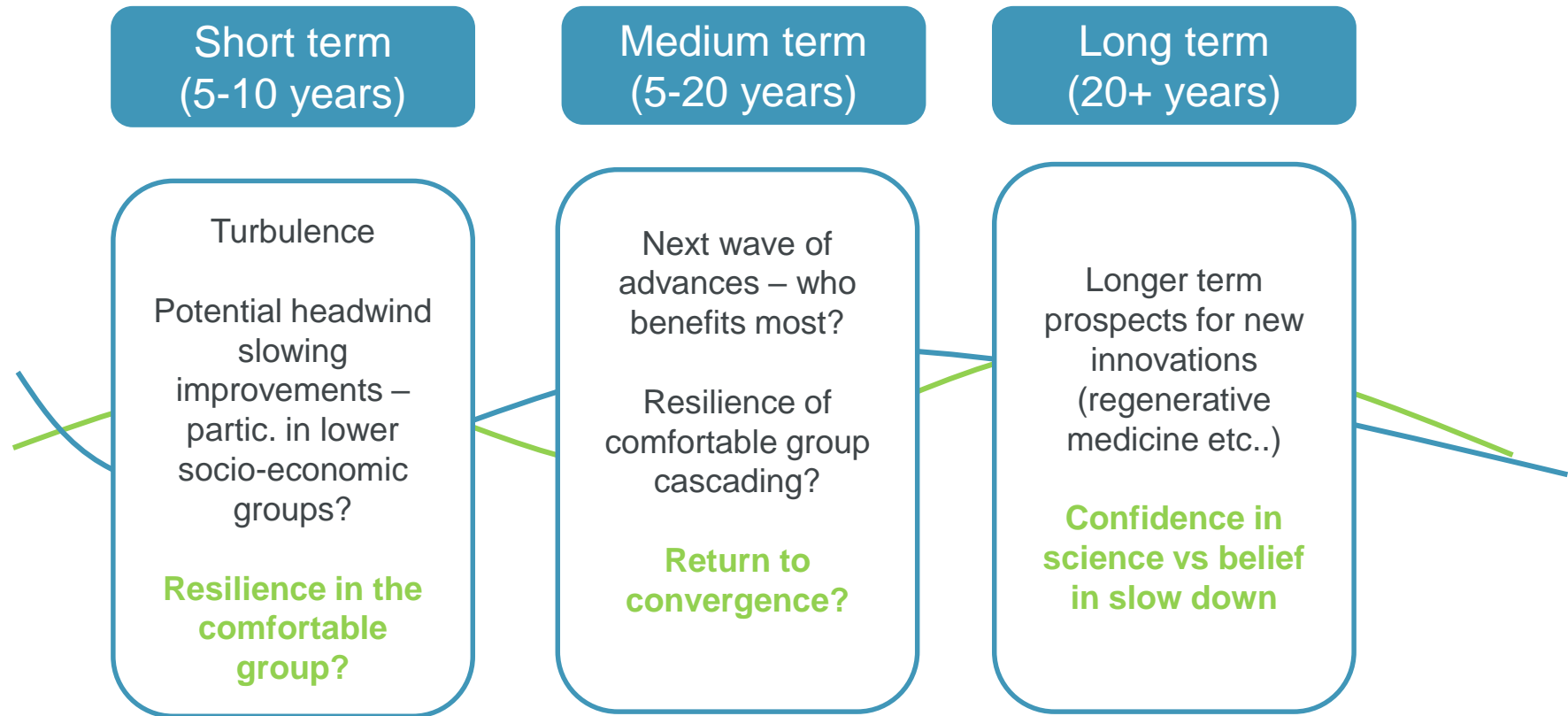
Group	Annualised mortality improvement (age-standardised)		
	2000-2005	2005-2010	2010-2015
England & Wales	1.6% ($\pm 0.1\%$)	2.4% ($\pm 0.1\%$)	0.3% ($\pm 0.1\%$)
Club Vita	0.7% ($\pm 0.5\%$)	2.7% ($\pm 0.3\%$)	0.6% ($\pm 0.3\%$)
Making-do/ Comfortable	0.7% ($\pm 0.7\%$)	2.1% ($\pm 0.5\%$)	0.5% ($\pm 0.5\%$)
Hard-pressed	0.6% ($\pm 0.8\%$)	3.2% ($\pm 0.5\%$)	0.7% ($\pm 0.6\%$)

Source: Club Vita / Hymans Robertson

Notes on calculations:

- Annualised improvements calculated as $(\text{end mortality} / \text{start mortality})^{1/5}$ for age range 65-95
- Mortality is age-standardised using England & Wales 2010 population as reference.
- Confidence intervals on the annualised improvements shown at the 95% level and are estimated using methods consistent with those in CMI WP97 – but avoids (strong) assumption made in WP97 of independence between successive year-on-year improvements.

What does this mean for projections?



Move away from one size all fits approach / Consider 'waves' of improvement

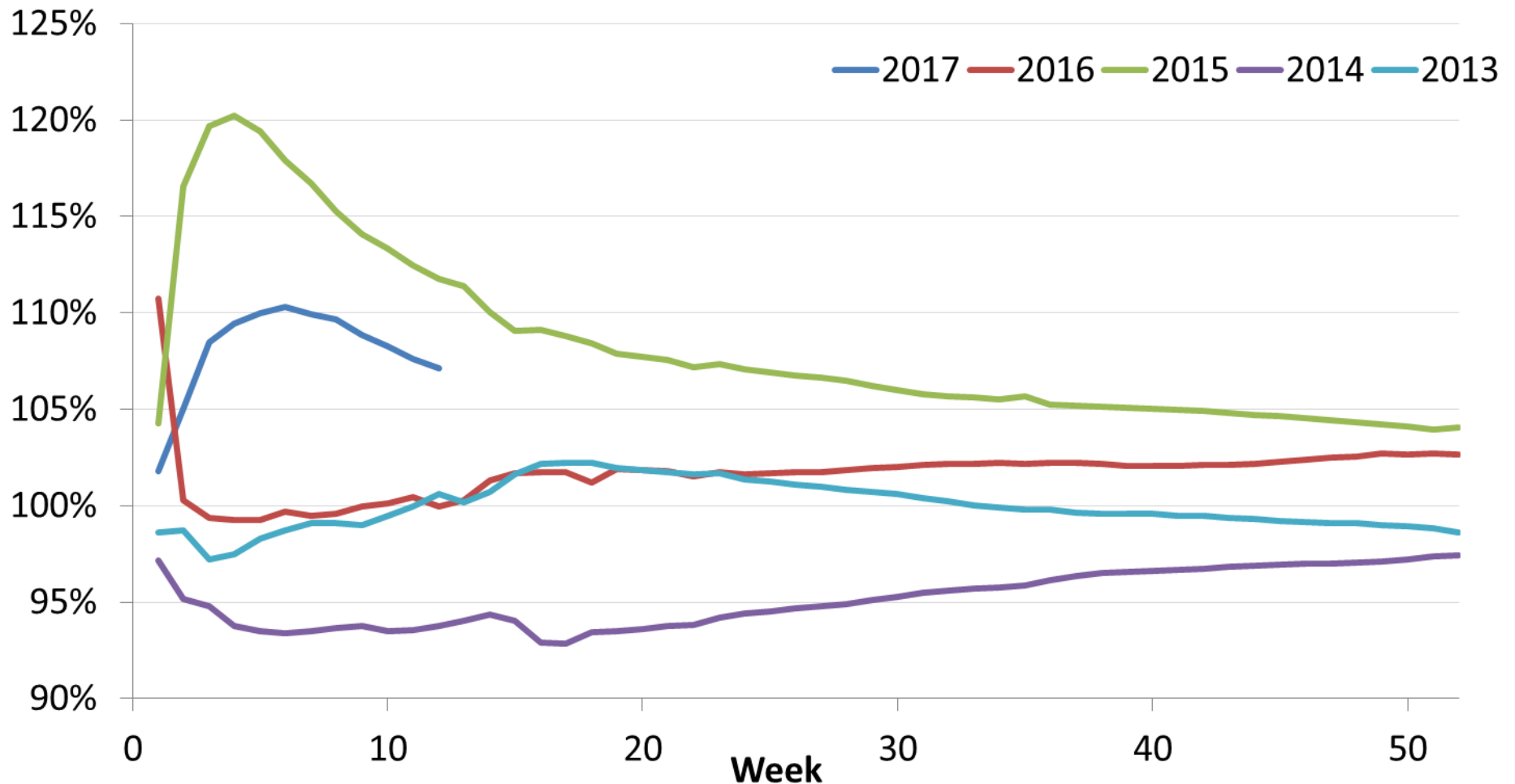
Three key questions

1. Are the national trends mirrored in DB pension schemes?
 - Yes, on a lives basis
2. Is the recent slowdown universal across the socio-economic spectrum?
 - No!
 - Higher socio-economic group men seeing stable improvements
3. What does this mean for projecting longevity?
 - Move away from a one size fits all
 - Within CMI2016 (E&W data) could proxy recent socio-economic trends?....
 - Liabilities skewed to **higher** SEG: more smoothing (higher $S_K > 7.5$)
 - Liabilities skewed to **lower** SEG: less smoothing (lower $S_K \leq 7.5$)
 - More broadly consider:
 - potential for waves of improvement
 - differential long term rates
 - other datasets

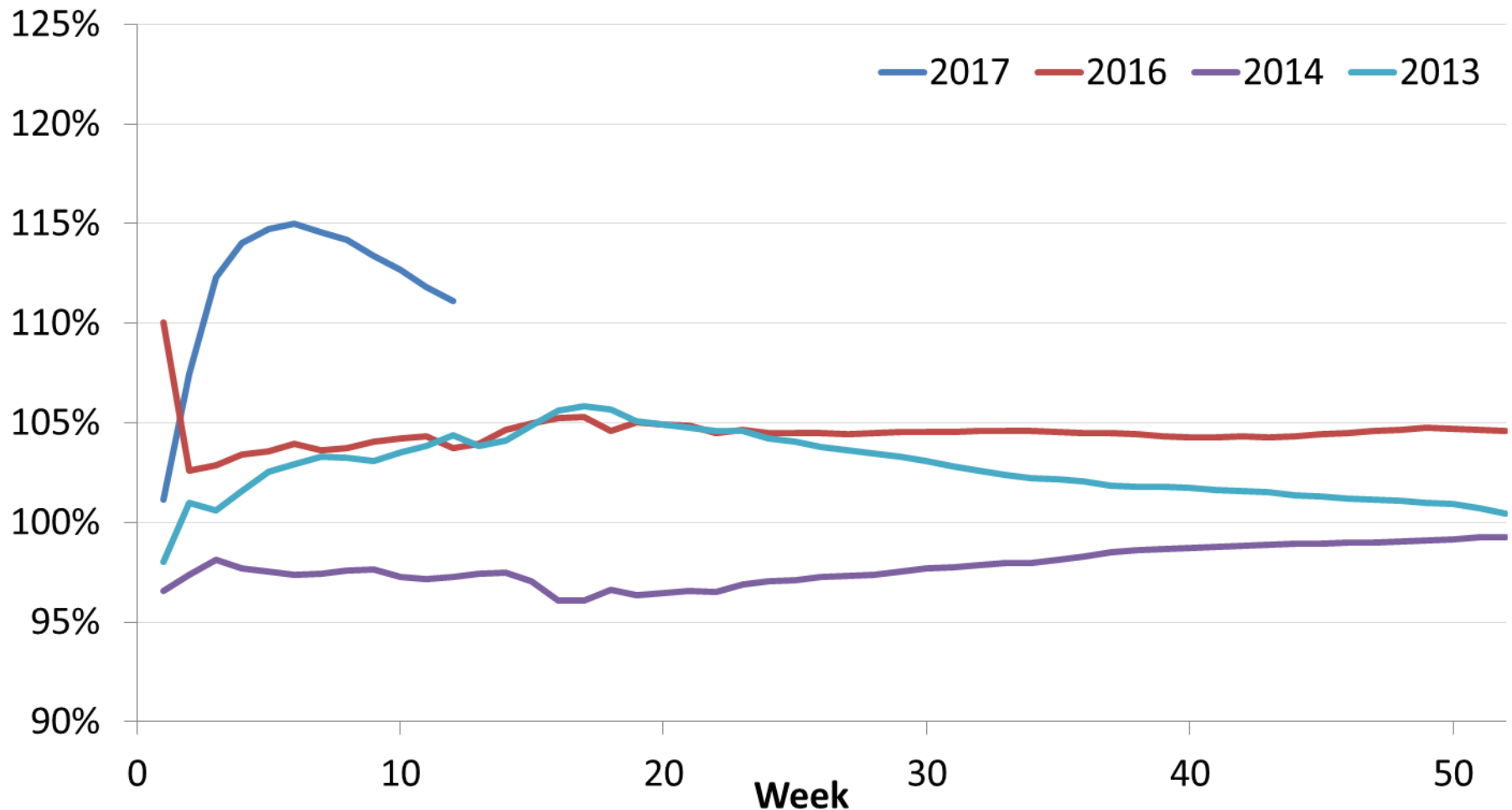
Stuart McDonald

Head of Longevity
Lloyds Banking Group

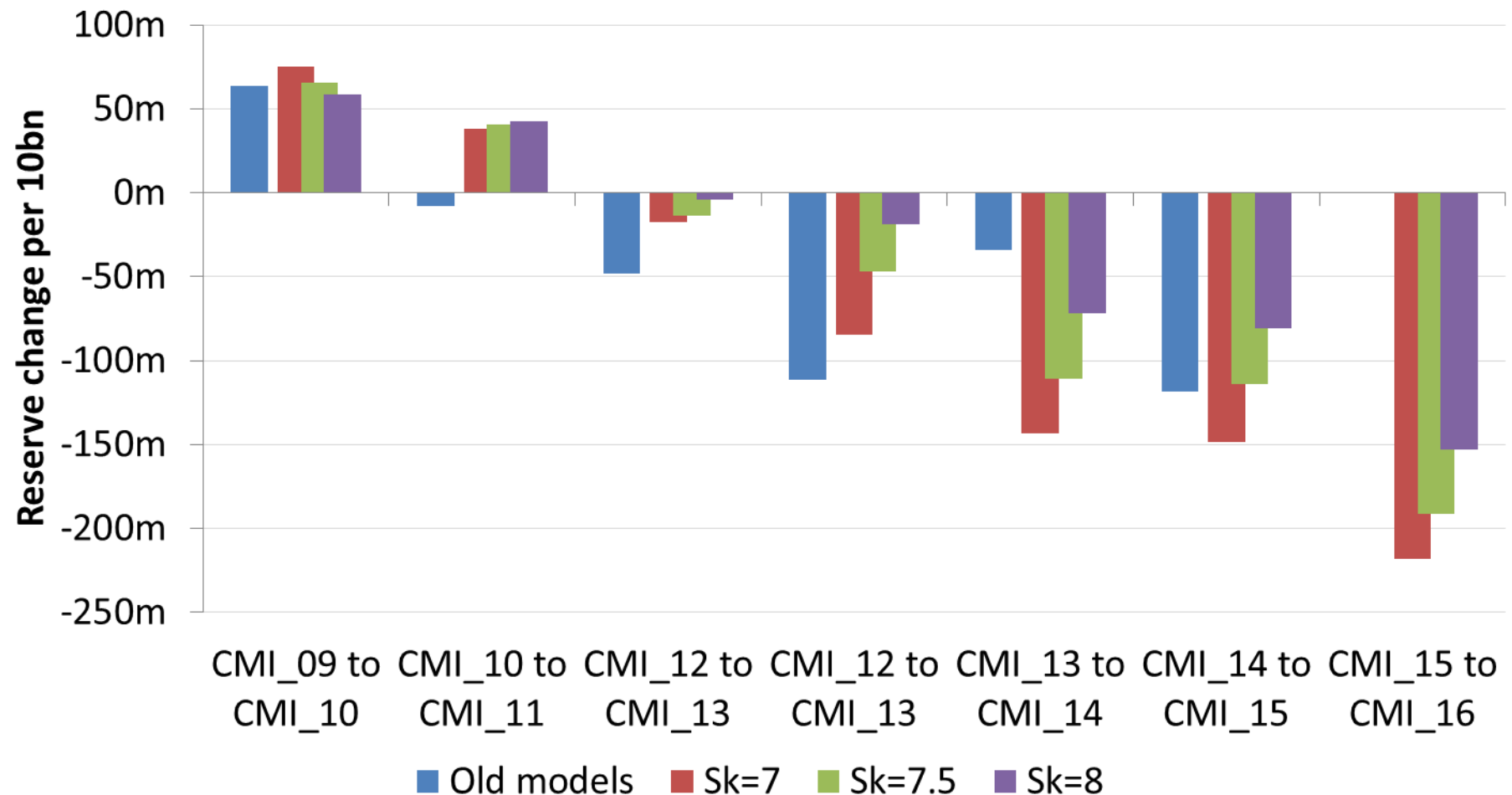
ONS weekly deaths vs 5 years average



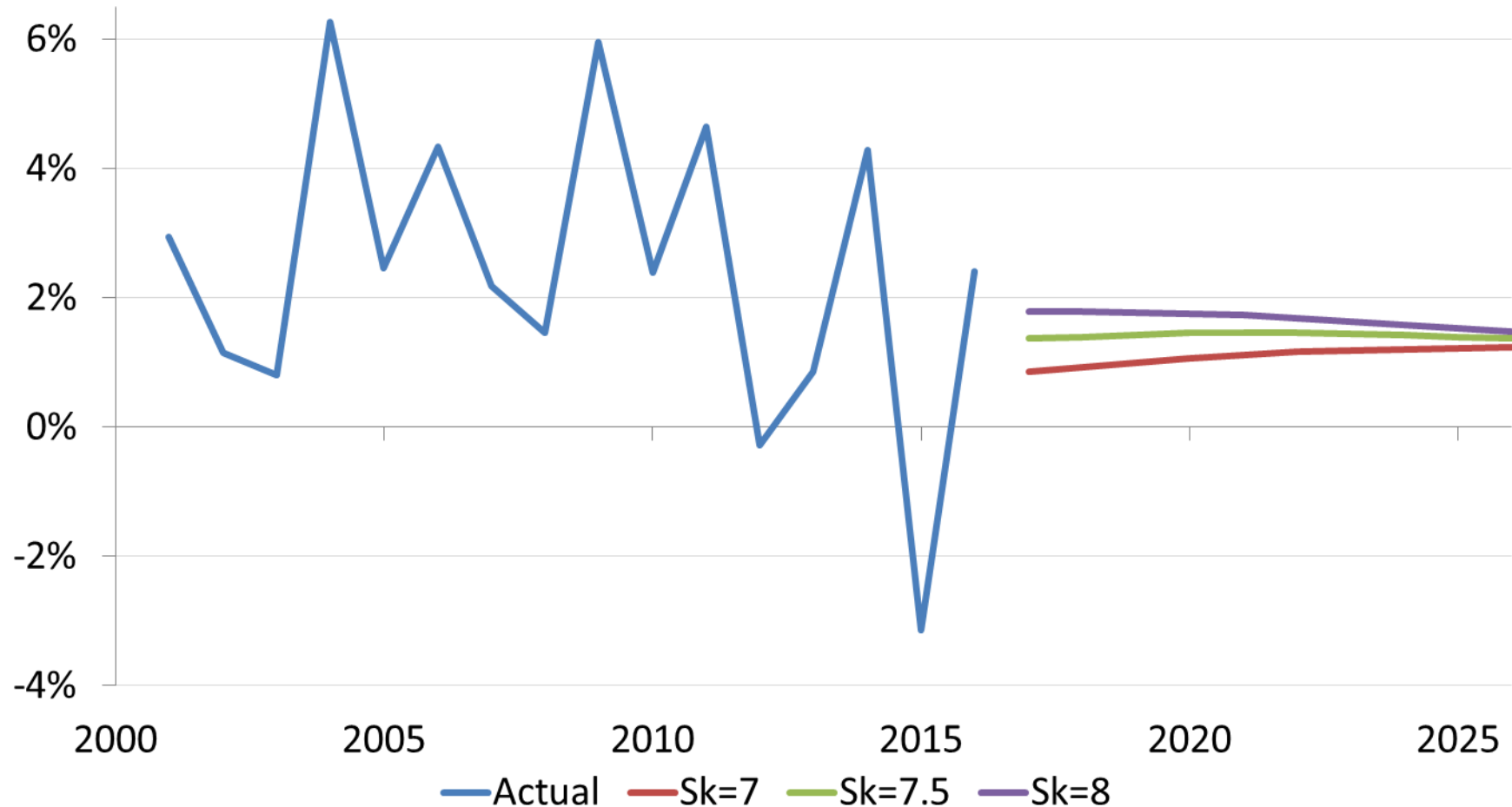
ONS weekly deaths vs 5 years avg (ex 2015)



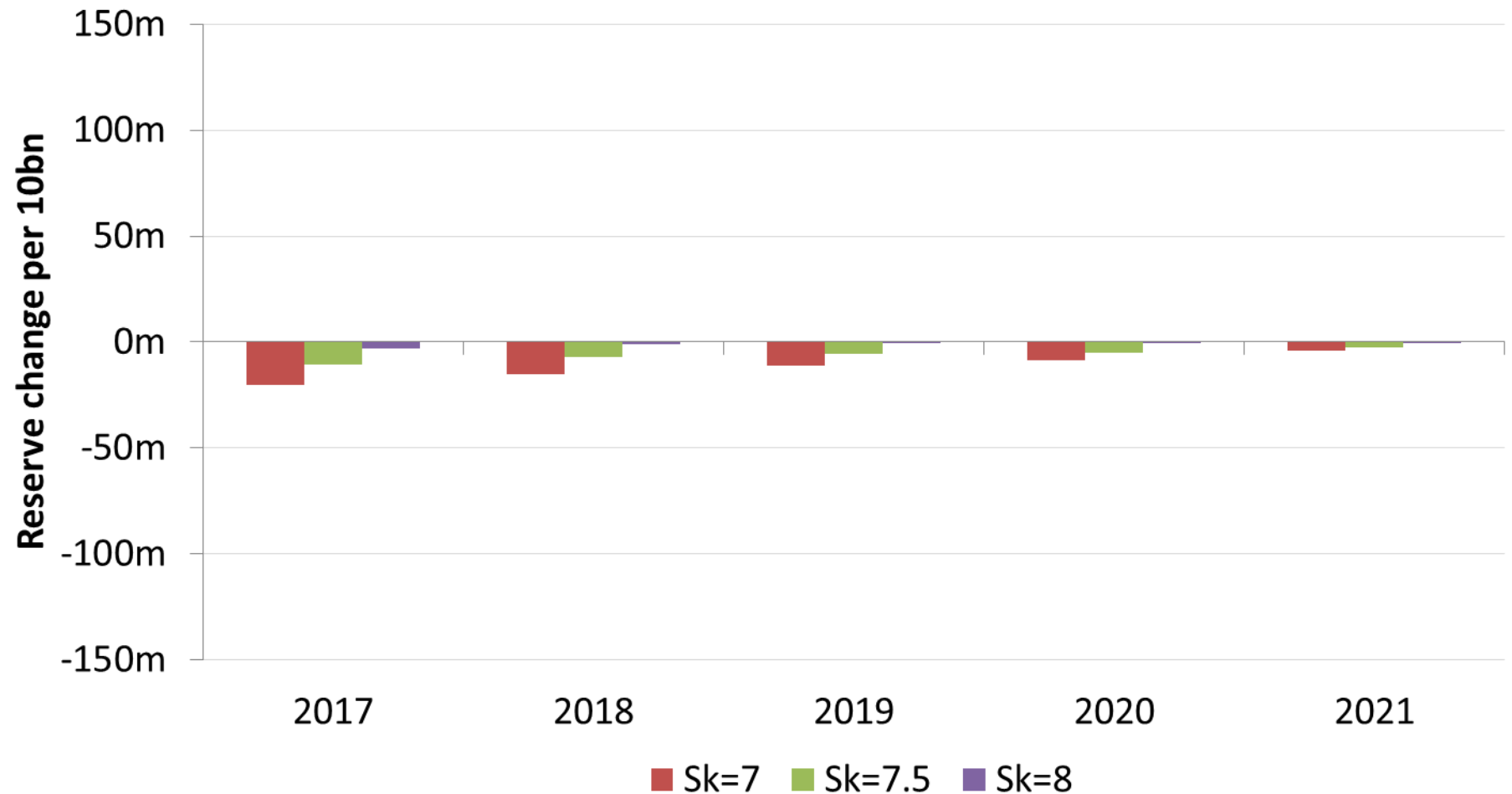
Reserve impact of past model releases



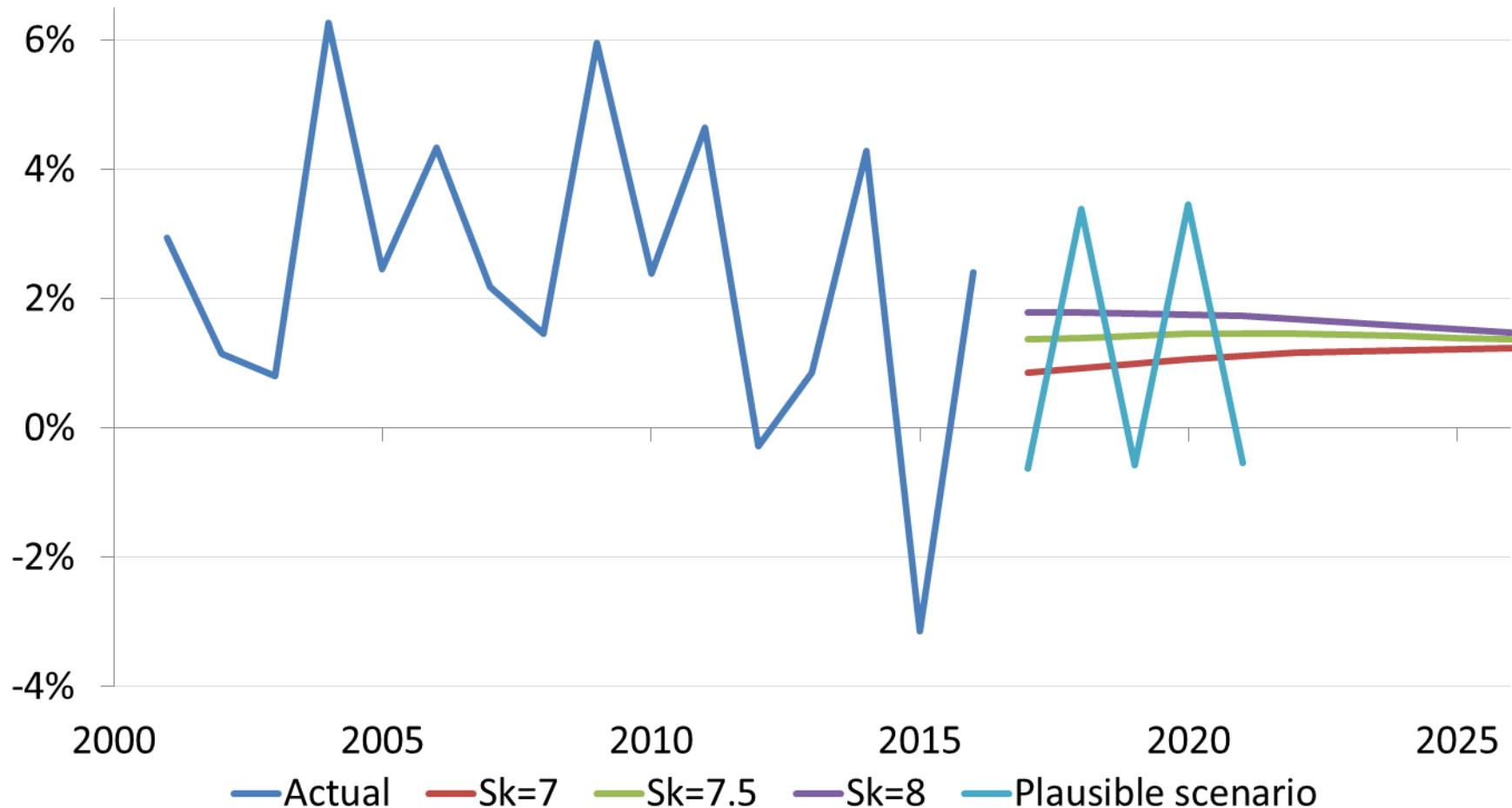
Forecasted improvements



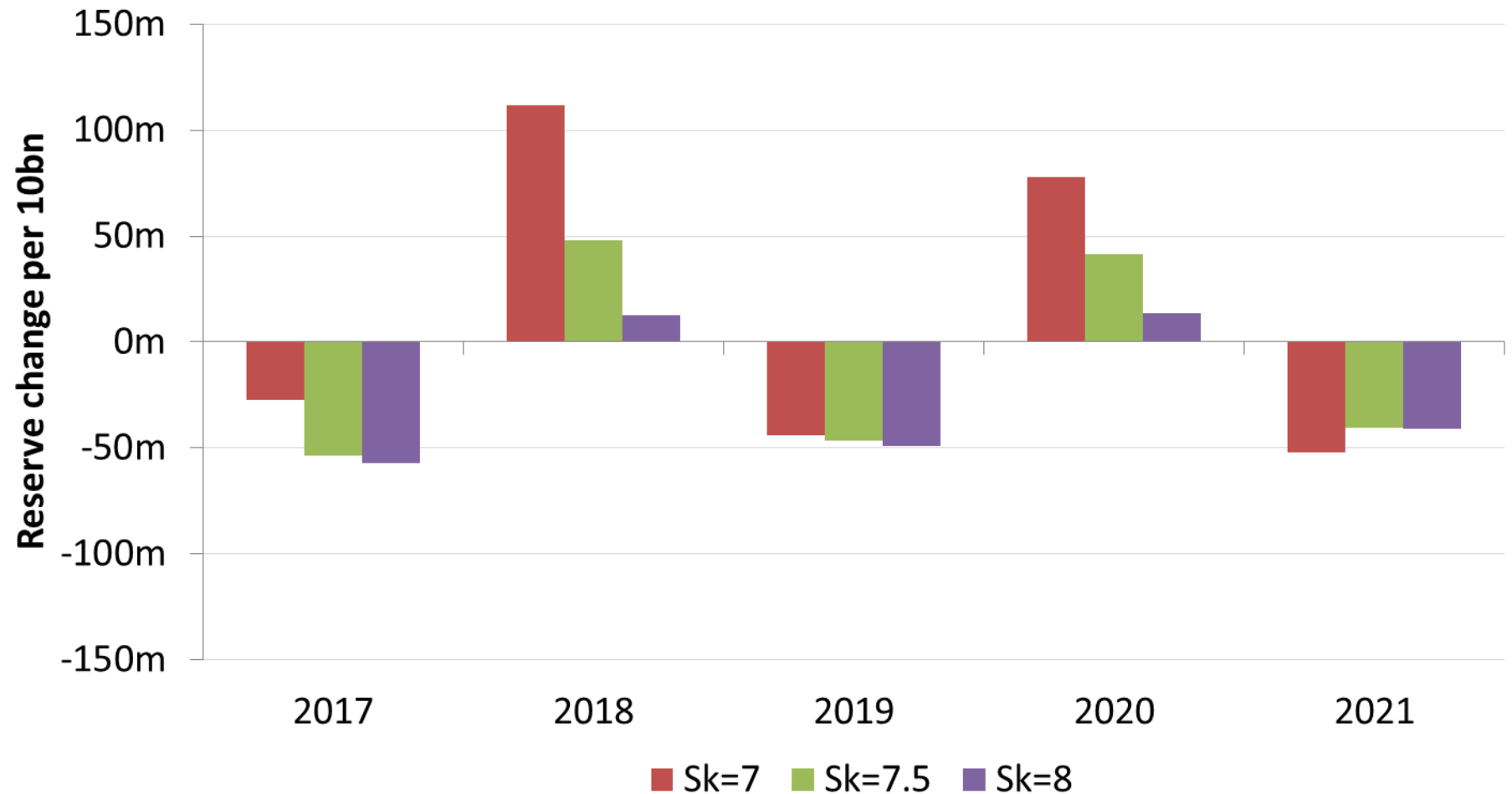
Reserve impact of future model releases



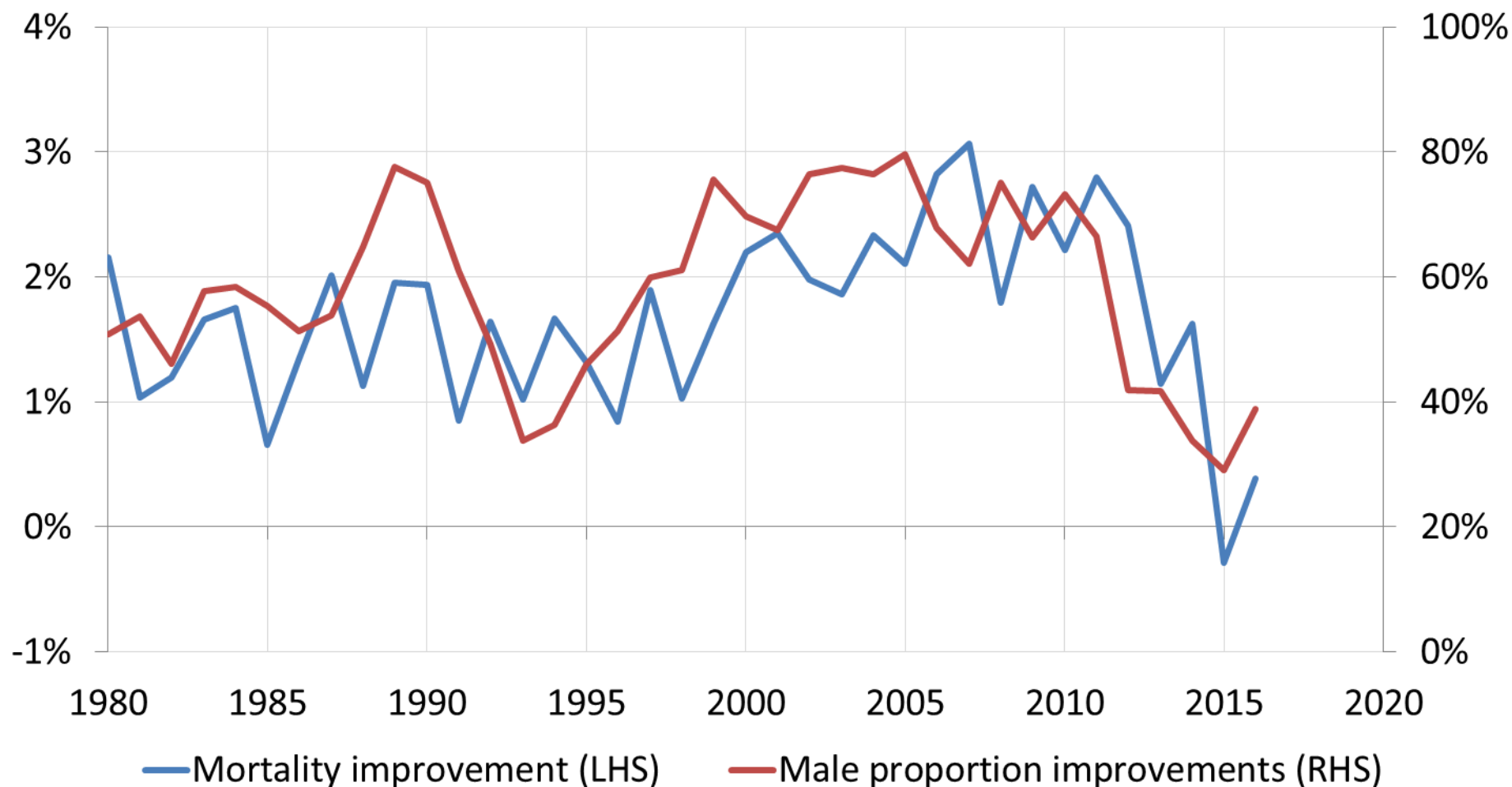
Forecasted improvements



How about volatile annual improvements?



Mortality convergence or divergence



Discussion

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

Continuous Mortality Investigation Limited
Registered in England & Wales (Company number: 8373631)
Registered Office: 7th 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
Tel: +44 20 7776 3820

Website: www.cmilimited.co.uk (redirects to 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

11 April 2017