ISSN 2044-3145

Continuous Mortality Investigation

Institute and Faculty of Actuaries

CMI Mortality Projections Committee

WORKING PAPER 114

Consultation on the value of the period smoothing parameter, S_κ

December 2018

Summary

The period smoothing parameter, S_κ, in the CMI Mortality Projections Model controls the amount of smoothing by calendar year when determining the level of initial mortality improvements. This parameter was introduced in CMI_2016 and a Core value of 7.5 was used for CMI_2016 and CMI_2017.

We propose to change the Core value of S_κ to 7 in CMI_2018. This would place more weight on recent low mortality improvements and lead to lower life expectancies.

We would like to receive responses to this proposal from users of the Model by 18 January 2019.

Contents

1. Introduction

This paper describes our proposal to use a Core value of 7 for the period smoothing parameter, S_κ, in CMI_2018, and seeks the views of users of the Model.

In a number of places we refer to Working Paper 115, due to be published by the end of this year. This will be an "interim update" containing a number of analyses intended to be helpful to users of the Model.

1.1 Plans for CMI_2018

We regularly update the CMI Mortality Projections Model (the "Model") to take account of recent mortality data. We expect to release the next version, CMI_2018, in February or March 2019, and will calibrate it to data for calendar years 1978-2018, rather than 1977-2017 as for CMI_2017.

As well as the routine update to the calibration data in CMI_2018, we also propose to make two further changes:

- Working Paper 106, produced by the CMI High Age Mortality Working Party, proposed modifications to the method used by the Office for National Statistics (ONS) to estimate the numbers of people in the general population at high ages. We intend to use this method in the production of CMI_2018. The impact is relatively small and will be shown in Working Paper 115.
- We intend to use a Core value of 7 for the period smoothing parameter, S_κ, in CMI_2018, rather than the value of 7.5 used in CMI_2016 and CMI_2017. The rest of this paper focusses on this proposed change and seeks views from users of the Model.

1.2 Contents

Section 2 provides background on the Model, and S_κ in particular, and includes summaries of earlier analyses.

Section 3 contains results from an indicative version of CMI_2018 in order to illustrate the impact of different values of S_κ.

Section 4 shows how different values of S_κ affect results from the Model, in the past and under different scenarios for mortality over the next ten years.

Section 5 describes our proposal for S_κ and the reason for it.

Section 6 seeks feedback on our proposal. We would like to receive comments by **18 January 2019**, to enable timely production of CMI_2018.

1.3 TAS compliance

This paper is intended to provide users of the Model with information on the impact of the choice of the period smoothing parameter, S_κ, so they can make an informed response to the Committee's proposal to change its Core value in CMI_2018. The paper complies with the principles of the Financial Reporting Council's Technical Actuarial Standard "TAS 100: Principles for Technical Actuarial Work". Any person using this paper should exercise judgement over its suitability and relevance for their purpose

1.4 Feedback

Section 6 seeks views on our proposal to change the Core value of S_κ. More general comments on the Model are welcome at any time and can be sent to projections@cmilimited.co.uk for our consideration.

1.5 Acknowledgements

The members of the Mortality Projections Committee involved in the production of this Working Paper are Tim Gordon (Chair), Steve Bale, Piero Cocevar, Cobus Daneel, Steven Rimmer, Neil Robjohns and Brian Sewell.

2. Existing work on S_κ

This section summarises existing CMI work on S_κ, including its role in the Model, and its impact on Model results.

2.1 The role of S_κ in the Model

The "CMI_2017 methods" supplement to Working Paper 105 describes the Model in detail. This section briefly summarises the Model, focussing on the role played by S_κ.

The Model projects rates of mortality improvement by interpolating between current rates, which are estimated from historical data, and assumed long-term rates, which are set by users of the Model. The current rates are determined by fitting an Age-Period-Cohort Improvement (APCI) model to historical mortality data.

The APCI model is defined by:

$$\log m_{x,t} = \alpha_x + \beta_x(t - \bar{t}) + \kappa_t + \gamma_{t-x}$$

where κ_t are parameter values for terms that vary by period (i.e. calendar year).

The period component of mortality improvements is then derived from κ_t as:

$$MI_t^{(Period)} = \kappa_{t-1} - \kappa_t$$

For the purpose of the Model, we want to extract the underlying trends in mortality improvement and smooth out short-term fluctuations and artefacts of the data. To achieve this we define an objective function that is a combination of the deviance (which measures goodness of fit) and penalty functions (to avoid overfitting and control the "smoothness" of each set of parameters).

The objective function is:

$$\text{Objective} = \text{Deviance} + \text{Penalty}(\alpha_x) + \text{Penalty}(\beta_x) + \text{Penalty}(\kappa_t) + \text{Penalty}(\gamma_{t-x})$$

and the period penalty can be expressed as:

$$\text{Penalty}(\kappa_t) = 10^{S_\kappa} \sum_{Y_{min+2}}^{Y_{max}} \left(MI_t^{(Period)} - MI_{t-1}^{(Period)}\right)^2$$

where Y_{min} and Y_{max} are the first and last years in the calibration data. For a given value of S_κ, the period penalty will be smaller when the difference between mortality improvements in successive years is smaller.

The value of S_κ controls the balance between goodness of fit and the smoothness of the period component of mortality improvements:

- A higher value of S_κ places more emphasis on smoothness and less on goodness of fit. This leads to a smaller variation in the period component of improvements from year to year, and a slower response to changing patterns of mortality improvements.
- A lower value of S_κ places less emphasis on smoothness and more on goodness of fit. This leads to a larger variation in the period component of improvements from year to year, and a faster response to changing patterns of mortality improvements.

2.2 Recent mortality improvements

Chart 2A shows Standardised Mortality Rates (SMRs) for England & Wales, compared to a trend line fitted to the period 2000-2011. Chart 2B shows the same information relative to the trend line.

We have calculated the SMRs as:

$$SMR_t = \sum\sum_{g,x} P(x)m(g,x,t) \div \sum\sum_{g,x} P(x)$$

where

- g is gender, x is age (20-100 inclusive) and t is calendar year
- $P(x)$ is taken from the 2013 European Standard Population[1] which does not vary by gender
- $m(x,t)$ is the central mortality rate.

Where we refer to "mortality" or "mortality improvement" in the context of SMRs in this paper, these should be understood for ages 20 to 100 for males and females combined. Mortality improvements vary by age and gender and results are likely to differ for different subsets of the population.

As we have not yet reached the end of 2018, we do not yet know what the mortality improvement for 2018 will be. The values shown for 2018 in Charts 2A and 2B are based on an indicative improvement of −1.5% p.a. for 2018. We describe the reason for this choice in Section 3.1.

The charts show a fairly steady fall in mortality between 2000 and 2011, with an average improvement of 2.5% p.a. Mortality improvements have been much lower since 2011. Based on the indicative improvement for 2018, the average improvement between 2011 and 2018 has been just 0.3% p.a.

Chart 2A: SMR and 2000-11 trend

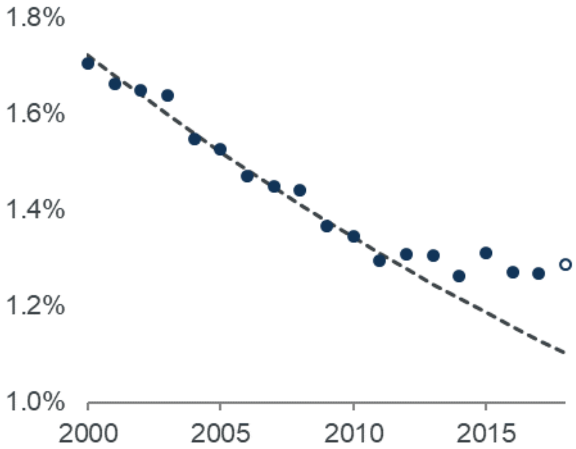
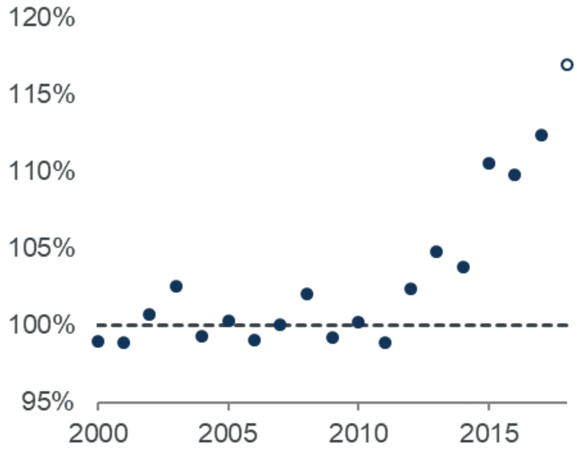


Chart 2B: SMR relative to 2000-11 trend



We noted in Section 2.1 that a lower value of S_κ leads to a faster response to changing patterns of mortality improvements. At the present time a lower value of S_κ leads to lower mortality improvements, placing more weight on the recent past.

[1] This is available from http://ec.europa.eu/eurostat/cache/metadata/Annexes/hlth_cdeath_esms_an1.pdf and is provided in age bands. We assume that the population within each five-year age band is split equally between its five ages and that the open age band 95+ is split equally between the six ages from 95 to 100 inclusive.

2.3 Existing analysis of S_κ

This section summarises analysis of the impact of S_κ in earlier CMI working papers.

CMI_2016 consultation

We first proposed the current Core value of the parameter S_κ in Working Paper 90. We based the value of 7.5 on analysis of data to 31 December 2015, considering the impact of different values of S_κ on smoothed mortality rates and resulting life expectancies.

In Section 9.3 of Working Paper 90 we noted that:

- "A value of 7 or less would give rise to a fall in life expectancy that is greater than the current CMI method. Our perception is that the majority of users think that CMI_2015 may have responded too strongly to recent data, so a value of 7 or less would seem to be unpopular as a default value"; and
- "… a value of 8 for S_κ would produce improvements for females that are marginally higher in 2015 than in 2011, despite the unprecedented low improvements of 2011-2015. That value seems to over-smooth the data."

We selected the value of 7.5 as a compromise between these two extremes and described it as "a broadly reasonable figure", taking into account the perceived wishes of users of the Model. We noted in Working Paper 90 that "other values are plausible and we encourage users to form their own views and adjust the model if they wish".

When we consulted on the value of S_κ in the summer of 2016, the majority of respondents were happy with our proposed value of 7.5, and dissenting responses were roughly evenly split between preferences for higher or lower values.

Response to "shock" and "trend" scenarios

In Section 7 of Working Paper 97, issued alongside CMI_2016, we considered the impact of two scenarios on the Model for different values of S_κ:

- The "shock" scenario increases the mortality rate in the final year of the calibration data by 5%.
- The "trend" scenario reduces the mortality improvement in the last five years of the calibration data by 1% p.a.

The purpose of comparing these two scenarios is that we would ideally like the Model to show little change in response to a single-year shock, but we would like it to respond to a persistent trend. There is a balance to be struck between a low value of S_κ which may respond too strongly to a shock, and a high value of S_κ, which may not respond strongly enough to the trend scenario.

Table 2.1 reproduces Table 7.2 of Working Paper 97. It shows the reduction in cohort life expectancy at age 65 under the two scenarios, with the Shock scenario having a smaller reduction in cohort life expectancy than the Trend scenario. Table 2.1 also shows the difference in reduction between them, which gives an indication of a Model's ability to discriminate between the two scenarios. The Committee considered the Core value of 7.5 to strike a reasonable balance, although a value of 7 leads to a similar difference.

Table 2.1: Percentage reduction in cohort life expectancy at age 65 (average of male and female reductions)

S_κ	6.5	7	7.5	8	8.5
Trend scenario	3.56%	3.05%	2.40%	1.76%	1.24%
Shock scenario	2.95%	2.01%	1.33%	0.87%	0.56%
Difference	0.60%	1.04%	1.06%	0.89%	0.68%

Likely progression of Model results

In Section 7 of Working Paper 105, issued alongside CMI_2017, we considered how results from CMI_2018 (assuming no change in method) might compare to those of CMI_2017 for different scenarios of mortality improvement in 2018.

Table 2.2 combines Tables 7.3 and 7.4 of that paper. It shows that, in the absence of any changes in method, CMI_2018 (with S_κ of 7.5) was expected to produce lower life expectancies at age 65 than the corresponding version of CMI_2017 unless mortality improvements in 2018 were unusually high by historical standards. Using a value of 6.5 for S_κ in CMI_2017 would have led to a more even chance of a corresponding version of CMI_2018 having given rise to higher or lower life expectancies.

Table 2.2: Percentage difference in life expectancy at age 65 between CMI_2017 and CMI_2018 (assuming no change in method) for different levels of mortality improvement in 2018 and different values of the period smoothing parameter. (“M” indicates males and “F” indicates females.)

Gender	M	F	M	F	M	F	M	F	M	F
S_κ	6.5	6.5	7.0	7.0	7.5	7.5	8.0	8.0	8.5	8.5
+6% improvement	+2.6%	+2.4%	+1.3%	+1.2%	**+0.4%**	**+0.4%**	−0.0%	+0.0%	−0.2%	−0.1%
+3% improvement	+0.9%	+0.9%	+0.1%	+0.2%	**−0.4%**	**−0.3%**	−0.5%	−0.5%	−0.5%	−0.4%
Nil improvement	−0.9%	−0.7%	−1.1%	−0.9%	**−1.2%**	**−1.0%**	−1.1%	−1.0%	−0.9%	−0.8%
−3% improvement	−2.8%	−2.3%	−2.4%	−2.0%	**−2.1%**	**−1.8%**	−1.7%	−1.5%	−1.3%	−1.1%

2.4 S_κ for other populations

We have chosen our proposed Core value of S_κ for CMI_2018 with the intention that it would be suitable for:

- analysis of lives-weighted mortality
- for the general population of England & Wales
- when calibrating to data for ages 20-100 and calendar years 1978-2018.

Populations of different sizes

A particular value of S_κ may not remain suitable if applied to a calibration dataset with a different range of ages or calendar years, or if applied to a population of a different size. The forthcoming Working Paper 115 will discuss our research on how smoothing parameters can be adjusted for populations of different sizes, in order to apply a consistent amount of smoothing.

Basis risk

We continue to encourage users of the Model to consider whether the Core Model, which is calibrated to the general population of England & Wales, is suitable for their specific purpose, which typically relates to a subset or a different population.

Working Paper 103 contains analyses of mortality improvements observed in the CMI's Self-Administered Pension Scheme (SAPS) and Annuities datasets, and analysis of variations in observed mortality improvements in the general population by Index of Multiple Deprivation (IMD). Over the limited periods analysed, it shows considerable variation in improvements, with improvements being highest for pension scheme members and people living in the least-deprived areas. We will update the analysis for SAPS and by IMD in the forthcoming Working Paper 115.

We are aware that some users of the Model make an adjustment to S_κ as a simple way to adjust the initial mortality improvements used for projections. For example, using a higher value of S_κ would currently lead to higher initial improvements, so some users of the Model set S_κ to be higher than its Core value in order to increase initial improvements, to reflect a belief that pension schemes or people living in the least-deprived areas will continue seeing higher rates of mortality improvements. Our proposed value is intended to be suitable for the general population of England and Wales, before any such adjustment.

3. Indicative impact of S_κ on CMI_2018

At this stage we do not yet have mortality data for the whole of 2018, so we are not in a position to produce CMI_2018. However, we have constructed an “indicative” version of CMI_2018 in order to analyse the impact of S_κ on it.

We stress that this is not a prediction of CMI_2018 and that the actual results of CMI_2018 could vary due to factors including, but not limited to, approximations in our indicative version and mortality in the final quarter of 2018.

3.1 Indicative version of CMI_2018

Our indicative version of CMI_2018 has been calibrated to a dataset for 1978-2018 constructed as follows:

- Deaths and exposures for 1978-2017 are taken directly from the CMI_2017 calibration data.
- Exposures for 2018 are set equal to exposures for 2017 from the CMI_2017 calibration data.
- Deaths for 2018 are based on deaths for 2017 from the CMI_2017 calibration data, but have been multiplied by $\exp(1.5\%)$ at all ages.

The method is similar to the method in Section 7 of Working Paper 105 and means that m-style mortality improvements in 2018 are −1.5% p.a. at all ages. This value is consistent with the analysis in Working Paper 111 to the end of week 39 of 2018, rounded to the nearer 0.5%. We do not take any explicit view on mortality in the final quarter of 2018.

Our indicative dataset has a number of simplifications:

- The indicative data for 1978-2017 has not been updated to use the latest data published by the ONS.
- The indicative data for 2018 does not allow for the ageing of specific cohorts from 2017 to 2018.
- The indicative data for 2018 does not allow for different levels of mortality improvement by age and gender.

We have calibrated versions of CMI_2018 to the indicative dataset. We vary the value of S_κ but all other parameters use the Core values from CMI_2017.

3.2 Results – standardised mortality

We have calculated standardised mortality rates (SMRs) using the method of Section 2.2.

We have also calculated annual and five-year average mortality improvement from the SMRs as:

$MI_t^{(1)} = \log(m_{t-1} - m_t)$ for annual improvements

$MI_t^{(5)} = \frac{1}{5}\log(m_{t-5} - m_t)$ for five-year average improvements

Chart 3A shows crude SMRs as well as smoothed SMRs from the indicative CMI_2018 for different values of S_κ. Chart 3B shows the same information but plots the ratio of crude SMRs to smoothed SMRs. The lower values of S_κ shown fit the crude rates most closely. A value of 8 for S_κ leads to differences of more than 4% between crude and smoothed SMRs in 2011 and 2018.

Chart 3A: SMRs for indicative CMI_2018

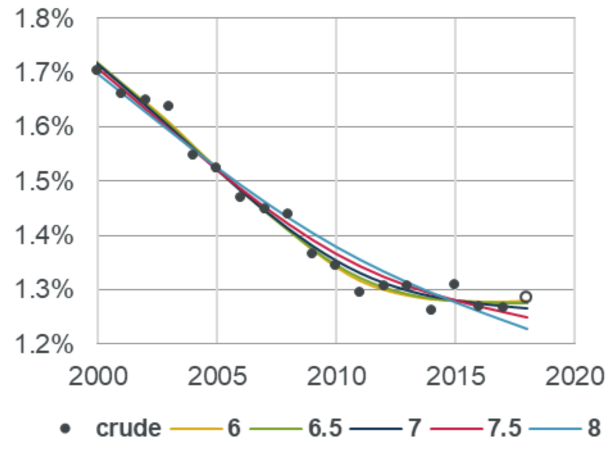


Chart 3B: "Crude/Smoothed" SMRs for indicative CMI_2018 (see text for details)

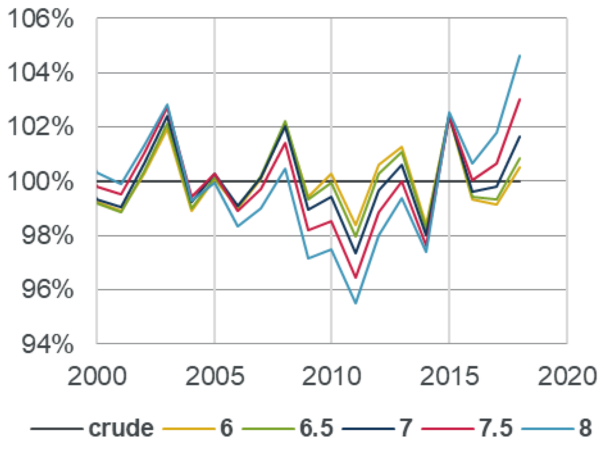


Chart 3C shows annual mortality improvements derived from the SMRs. Lower values of S_κ show the greatest variation in smoothed improvements, while higher values lead to a narrower range. Chart 3D shows five-year averages of mortality improvements. Smoothed results for the lower values of S_κ shown broadly follow the five-year average.

Chart 3C: Annual improvements for indicative CMI_2018

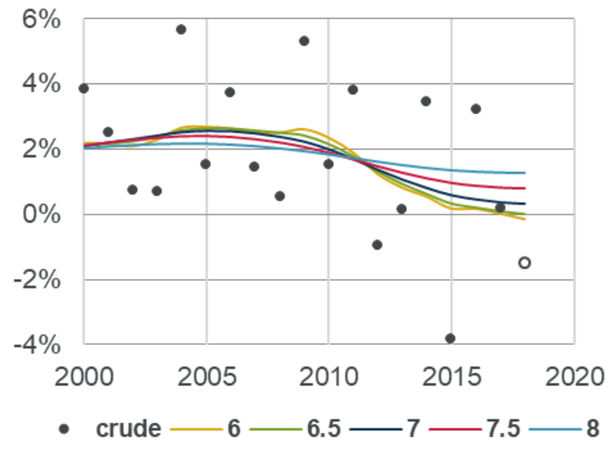
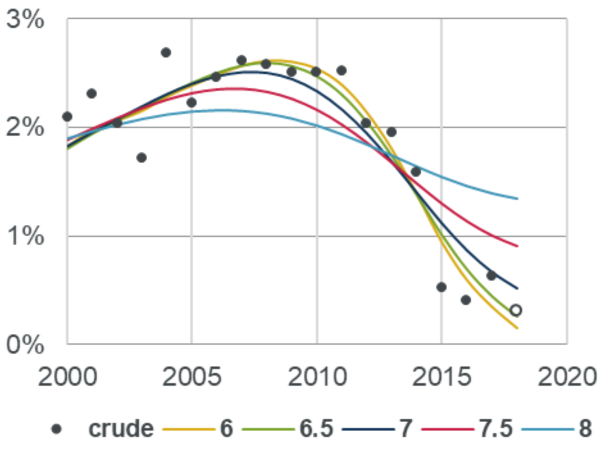


Chart 3D: 5-year average improvements for indicative CMI_2018



3.3 Results – Life expectancy

Table 3.1 shows life expectancies from CMI_2017 and variants of the indicative version of CMI_2018. These are all calculated at age 65 as at 1 January 2019, using S2PMA for males and S2PFA for females[2], and an illustrative long-term rate of 1.5% p.a.

Table 3.1: Life expectancies from CMI_2017 and indicative variants of CMI_2018

Method	Life expectancy at age 65					
	Absolute		Relative to CMI_2017 with S_κ=7.5		Relative to indicative CMI_2018 with S_κ=7.5	
	Male	Female	Male	Female	Male	Female
CMI_2017; $S_\kappa = 7.5$ (Core)	22.165	24.096				
Indicative CMI_2018; $S_\kappa = 6.0$	21.128	23.189	−4.7%	−3.8%	−3.1%	−2.4%
Indicative CMI_2018; $S_\kappa = 6.5$	21.244	23.258	−4.2%	−3.5%	−2.6%	−2.1%
Indicative CMI_2018; $S_\kappa = 7.0$	21.460	23.437	−3.2%	−2.7%	−1.6%	−1.3%
Indicative CMI_2018; $S_\kappa = 7.5$	21.805	23.754	−1.6%	−1.4%	-	-
Indicative CMI_2018; $S_\kappa = 8.0$	22.215	24.109	+0.2%	+0.1%	+1.9%	+1.5%

If S_κ is not changed then, based on the indicative dataset, we might expect CMI_2018 to give rise to a life expectancy that is 1.6% lower than CMI_2017 for males aged 65, and 1.4% lower than CMI_2017 for females aged 65.

Changing S_κ from 7.5 to 7 in the indicative version of CMI_2018 would further lower life expectancy by 1.6% for males aged 65 and by 1.3% for females aged 65.

Table 3.2 shows the percentage change in life expectancy at different ages of changing S_κ from 7.5 to 7 in the indicative version of CMI_2018.

Table 3.2: Change in life expectancy due to changing S_κ from 7.5 to 7 in indicative CMI_2018

Age	25	35	45	55	65	75	85	95
Male	−0.7%	−0.8%	−1.1%	−1.3%	−1.6%	−1.8%	−1.9%	−2.0%
Female	−0.6%	−0.7%	−0.9%	−1.1%	−1.3%	−1.5%	−1.7%	−1.9%

The proposed change to the value of S_κ would make a larger difference at older ages.

[2] The "S3" Series mortality tables have recently been published in Working Paper 113, but they were not finalised at the time of these calculations.

4. Impact of S_κ under different mortality scenarios

In this section we consider how initial mortality improvements (based on SMRs) change over time, for different values of S_κ. We show:

- how improvements would have developed if the APCI model had been applied since 2011; and
- how improvements would develop under three scenarios for future mortality.

4.1 Method

We construct three datasets for the period 1971-2028:

- Deaths and exposures for 1971-2017 are taken directly from the CMI_2017 software[3].
- Deaths and exposures for 2018 are as described in Section 3.1.
- Exposures for 2019-2028 are set equal to exposures for 2017.
- Deaths for 2019-2028 are calculated by adjusting deaths for the previous year, in order to achieve a desired mortality improvement. i.e. for $t > 2018$ deaths for scenario s are calculated by

$$D_{x,t}^{(s)} = D_{x,t-1}^{(s)} \exp\left(-i^{(s)}\right)$$

  where $i^{(s)}$ is the m-style crude mortality improvement for each scenario. We consider scenarios with $i^{(s)}$ of +3%, nil, and -3% in each year.

We calibrate the APCI model to 41-year datasets ending in 2011, 2012 … and 2028, and then calculate SMRs and mortality improvements as in Section 3.2.

4.2 Results

Charts 4A, 4B and 4C show how initial mortality improvements develop over time under different scenarios; i.e. the value shown for year Y corresponds to that version of the Model, calibrating the APCI model to years $Y - 40$ to Y inclusive and then calculating the SMR-based mortality improvement in the final year.

Note that:

- Charts 4A, 4B and 4C all show the same values up to and including 2018. They only differ after that point, based on the three scenarios for future improvements.
- Values shown for 2018 in Charts 4A, 4B and 4C correspond to those for 2018 in Chart 3C.
- Values shown for years earlier than 2017 in Charts 4A to 4C differ from those in Chart 3C, which are all based on calibrating the APCI model to a single 1978-2018 dataset.

Chart 4D shows results for all three scenarios on the same chart to aid comparison between them. The formats of each line do not distinguish between the +3%, nil and -3% scenarios, but in each case a higher crude mortality improvement corresponds to a higher smoothed improvement.

The charts show that:

- Initial improvements in 2011 are similar for all values of S_κ considered.
- Lower values of S_κ lead to faster changes in initial improvements.
- In recent years lower values of S_κ lead to lower initial improvements, but in the +3% scenario lower values of S_κ would lead to higher initial improvements.
- By the end of the projections, following ten years of steady crude improvements, initial improvements are similar for all values of S_κ considered for the nil and −3% scenarios, but not for the +3% scenario.

[3] The Core version of CMI_2017 is calibrated to data for 1977-2017, but the software also contains earlier data.

Chart 4A: Initial mortality improvements: scenario with +3% improvements for 2019-2028

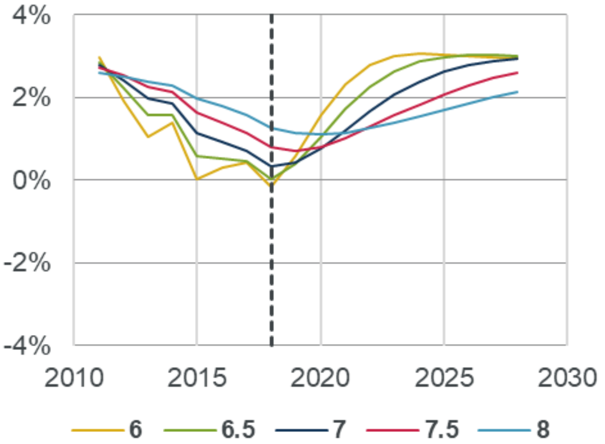


Chart 4B: Initial mortality improvements: scenario with nil improvements for 2019-2028

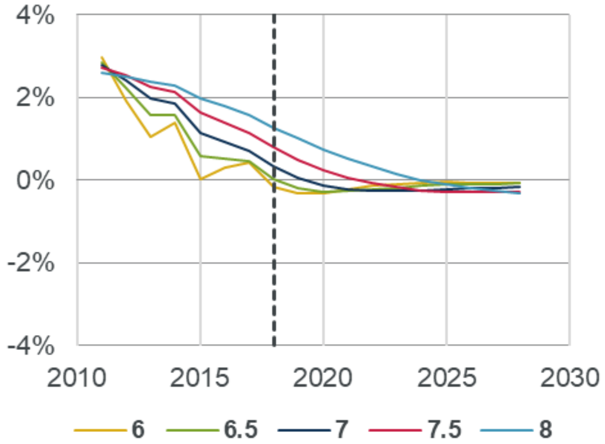


Chart 4C: Initial mortality improvements: scenario with −3% improvements for 2019-2028

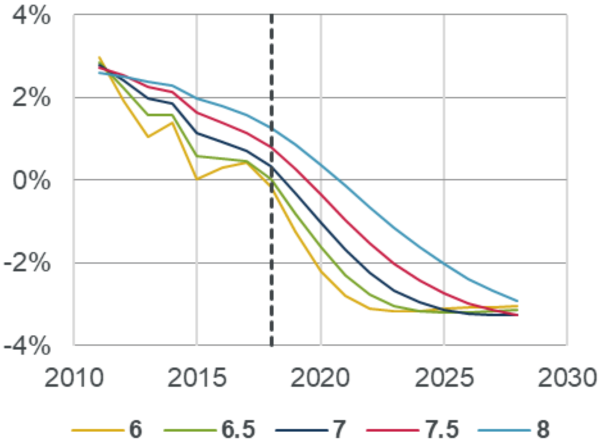
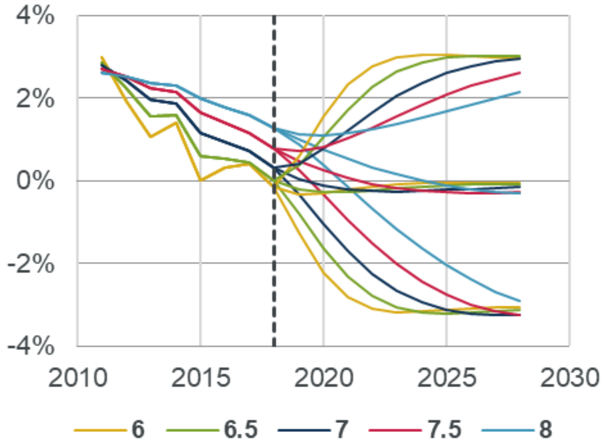


Chart 4D: Initial mortality improvements: all three scenarios overlaid



5. Proposal

Subject to the responses to this consultation, we intend to use a Core value of 7 for S_κ in CMI_2018.

We note that:

- the Model software allows the value of S_κ to be varied, so our preference does not preclude the use of another value; and
- repeating the message of Working Paper 90: “other values are plausible and we encourage users to form their own views and adjust the model if they wish”.

5.1 Reasons for our proposal

As noted in Section 2.3, the current Core value of S_κ of 7.5 proposed in Working Paper 90 reflected an appropriate balance between higher and lower values. At the time we thought that:

- a value of 8 would have led the Model to respond too slowly to emerging mortality data; and
- a value of 7 would have led to a larger change in life expectancy compared to CMI_2015 than what many users would have been comfortable with in the context of a sharp downturn in observed mortality improvements and uncertainty about what it represented.

Our proposal for a value of 7 for CMI_2018 also reflects an appropriate balance between being too slow or too quick to respond to new data:

- A value of 8 or higher would lead to the Model responding to new data too slowly:
  - Chart 3C shows that a value of 8 would lead to SMR-based initial improvements of 1.3% in indicative CMI_2018. This feels unduly high after a sustained period of low improvements, averaging 0.3% p.a. over the period from 2011 to 2018.
  - Table 2.2. shows that using a value of 8 for CMI_2017 and CMI_2018 would have led to life expectancies falling in most mortality scenarios for 2018. A value of 8 means that we are effectively “storing up” historical low improvements and recognising them gradually over a long period.
- Similar criticisms can be levelled at a value of 7.5:
  - Chart 3C shows initial improvements of 0.8% in 2018.
  - Table 2.2 shows that we expected life expectancies to fall in most mortality scenarios for 2018.
- A value of 6.5 leads to a more rapid response to new data:
  - This can be seen as beneficial, as Table 2.2 shows that the results from CMI_2018 would have had a more even chance of being higher or lower than CMI_2017.
  - However, Chart 4A shows that a Model with a value of 6.5 for S_κ would have had very volatile initial improvements from year to year. We think that this would be unpalatable to many users of the Model.
- We reject a value of 6 or lower for similar reasons to those given for a value of 6.5.

We feel that our proposed value of 7 strikes a reasonable balance in its responsiveness to new data. Although we rejected it in Working Paper 90 for leading to too large a change in life expectancy between CMI_2015 and CMI_2016, that was partly based on our perception of the views of users of the Model and in the context of a rapid change in observed mortality improvements. At the time of Working Paper 90, we analysed mortality data to the end of 2015 and there was uncertainty about whether the post-2011 experience represented a short-term blip or the start of a longer trend. Now that we have data for nearly three more years, we expect that a value of 7 and the associated lower initial rates of mortality improvement would be more palatable to users of the Model.

6. Consultation

We encourage you to respond to the consultation whether or not you agree with our proposals, so that the responses that we receive are representative of all users. We are particularly keen to hear from you as our proposal is based in part on our perception of what users of the Model would consider reasonable.

Please send your responses to projections@cmilimited.co.uk. The same address can be used for any other correspondence regarding the Model. We would like to receive responses by **18 January 2019**.

When responding, please assess the proposed value of S_κ by considering its suitability for lives-weighted analysis of the general population of England & Wales when calibrating to an age range of 20-100 for calendar years 1978-2018.

1. Do you agree with our proposal to use a value of 7 for S_κ?

2. If you disagree with our proposal:
   a. What is your preferred value for S_κ?
   b. Please give reasons for your preferred value.

3. If we do make a change to the value of S_κ, would you prefer this to be introduced in CMI_2018 or deferred until CMI_2019? Please give reasons.

With your response, please also include:

- Your name
- Your contact details, in case we wish to clarify a response
- The name of your organisation (if any)
- The type of your organisation (e.g. individual, insurer, reinsurer, pension fund, consultancy)

All responses will be shared with the Committee. A summary of responses and a list of respondents may then be made more widely available but we will not attribute comments to particular companies or individuals.

References

Working Paper 90: “CMI Mortality Projections Model consultation” (2016)

Working Paper 97: “CMI Mortality Projections Model: CMI_2016” (2017)

Working Paper 103: “CMI Mortality Projections Model: Mid-year update” (2017)

Working Paper 105: “CMI Mortality Projections Model: CMI_2017” (2018)

Working Paper 106: “A proposed approach to closing off CMI mortality tables” (2018)

Working Paper 111: “Regular monitoring of England & Wales population mortality” (2018)

Working Paper 113: “Final “S3” Series mortality tables” (2018)

Working Paper 115: “CMI Mortality Projections Model: Interim update” (forthcoming)

These papers may be accessed and downloaded from the “Mortality Projections” section of the Institute and Faculty of Actuaries’ website: https://www.actuaries.org.uk/learn-and-develop/continuous-mortality-investigation/cmi-working-papers/mortality-projections.

Some of these outputs are only accessible to Authorised Users (i.e. to employees of subscribers and to researchers, for non-commercial use).

Continuous Mortality Investigation Limited ("CMI") is registered in England & Wales
Company number: 8373631
Registered Office: 7th floor, Holborn Gate, 326-330 High Holborn, London, WC1V 7PP

Correspondence address: Two London Wall Place, 123 London Wall, London, EC2Y 5AU
Email: info@cmilimited.co.uk
Tel: 020 7776 3820

Website: www.cmilimited.co.uk (redirects to www.actuaries.org.uk)

Continuous Mortality Investigation Limited is wholly owned by the Institute and Faculty of Actuaries.