



CMI Mortality Projections Committee

WORKING PAPER 116

The value of the period smoothing parameter, S_K , in CMI_2018

January 2019

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Summary

In Working Paper 114 we proposed changing the Core value of the period smoothing parameter, S_{κ} , in the CMI Mortality Projections Model from 7.5 (used in CMI_2016 and CMI_2017) to 7 in CMI_2018. We sought the views of users of the Model on the proposed value of S_{κ} and the timing of any change.

We received eighteen responses to the consultation; ten from consultancies, five from insurers, two from reinsurers, and one other. The majority of the responses were supportive of the proposed changes. As a result, we confirm that we will implement the proposals set out in Working Paper 114; i.e. we will:

- change the Core value of S_{κ} to 7; and
- make this change in CMI_2018.

In response to the consultation, we intend to add a new input to CMI_2018, an addition to the age-period component of initial mortality improvements. This will enable users to reflect historical differences in mortality improvements between populations, without needing to modify S_{κ} . This input will have a Core value of zero in CMI_2018.

We stress that the Core value of S_{κ} and the Core value of the addition to initial improvements are intended to be suitable for the general population of England & Wales, the dataset used to calibrate the Model. A number of respondents referred to evidence that members of pension schemes and higher socio-economic groups have had higher mortality improvements than the general population in recent years. We agree, and we urge users of the Model to ensure that they use values of S_{κ} and the addition to initial improvements that are appropriate for their specific populations.



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1. Introduction

The period smoothing parameter, S_{κ} , in the CMI Mortality Projections Model (the “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.

In Working Paper 114 we proposed a Core value of 7 in the next version of the Model, CMI_2018. That paper:

- described the role that S_{κ} plays in the Model;
- indicated the impact that different values of S_{κ} might have on CMI_2018 and later versions of the Model;
- gave reasons for our proposed change to the value of S_{κ} ; and
- sought the views of users of the Model.

The consultation closed on 18 January 2019. We were pleased to receive eighteen responses; ten from consultancies, five from insurers, two from reinsurers, and one other. We would like to thank all of those who responded to the consultation.

1.1 Contents

Section 2 concerns the Core value of S_{κ} and Section 3 concerns the timing of a change in its value. In each of these sections we describe the questions posed, summarise the responses received, and state our decisions.

Section 4 describes and discusses other comments made in response to the consultation, and actions that we will take as a result.

Section 5 summarises our decisions from all earlier sections.

1.2 TAS compliance

This paper summarises responses to the consultation on the value of the period smoothing parameter, S_{κ} , in CMI_2018, and describes our proposal. 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

1.3 Feedback

Comments on the Model are welcome at any time and can be sent to projections@cmilimited.co.uk for our consideration.

1.4 Vacancy

We are currently [advertising for a new Chair](#) of the Mortality Projections Committee; this is a key role within the CMI with a substantial time commitment. The deadline for applications is 28 February 2019.

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. Core value of S_{κ}

This section concerns the Core value of the period smoothing parameter in the CMI Model.

2.1 Questions

Working Paper 114 asked respondents to 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. It notes that:

- 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. Working Paper 115 describes how smoothing parameters can be adjusted for populations of different sizes, in order to apply a consistent amount of smoothing.
- 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 scheme members or people living in the least-deprived areas will continue to experience higher rates of mortality improvements.

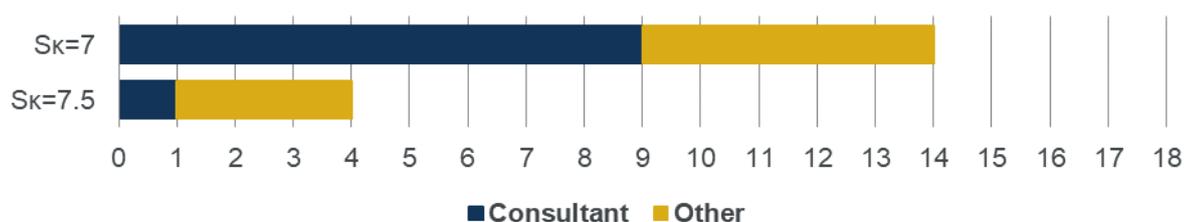
The two questions we asked regarding the value of S_{κ} were:

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.

2.2 Responses

Chart 2A summarises responses to questions 1 and 2a. The “Other” category includes five insurers, two reinsurers, and one other. Note that one respondent prefers S_{κ} to be “at least 7.5, potentially even higher”; its response has been included in Chart 2A as 7.5.

Chart 2A: Summary of responses regarding the value of S_{κ} , by type of respondent



The majority of respondents agree with our proposal to change S_{κ} to 7.

We note that all but one of the consultants prefer a value of 7, while views among others are more evenly split between 7 and 7.5.

Although we did not ask for reasons from those who supported our proposal to change S_{κ} to 7, some respondents provided comments:

- Several commented that a value of 7 strikes a reasonable balance between smoothing and responsiveness.
- Two respondents noted that a value of 7.5 meant that CMI_2018 was much more likely than not to lead to lower life expectancies than CMI_2017, so could not be considered a “best estimate”. Moving to a value of 7 for S_{κ} reduces this effect.



- One noted that using a value of 7.5 for S_{κ} risks over-smoothing historical improvements, and this could cause issues when estimating current mortality rates from a historical experience analysis. Moving to a value of 7 for S_{κ} reduces this effect.

Of those respondents that preferred a value of 7.5:

- One noted that reducing S_{κ} would lead to an increase in short-term fluctuations in the valuation of long-term liabilities, reversing some of the benefits of the revised method introduced in CMI_2016. It feared that short-term volatility would not aid long-term risk management.
- One commented that reducing S_{κ} to 7 would lead to a larger change in liabilities between CMI_2017 and CMI_2018 than many users would be comfortable with. It suggested that a significant fall in mortality improvements has only been seen since 2015, and the change in trend is not as clear as “generally agreed”.
- One noted the large impact from a shock scenario with S_{κ} of 7 in Table 2.1 of Working Paper 114, and considers this to over-responsive. It raised various concerns about adoption of such a model:
 - it could lead to an expectation among market analysts of a large release of reserves;
 - it could lead to expectations from pension schemes of lower transaction pricing, which the respondent feels would be premature; and
 - it could lead to significant scrutiny from regulators, which the respondent would not feel able to justify.
- One thinks that “the proposed change is too focused on short-term effects and recent volatile data”.

2.3 Decision

We will change the value of S_{κ} to 7, as proposed in Working Paper 114 and supported by the majority of respondents.

3. The timing of a change to S_{κ}

This section concerns the timing of any change to the Core value of the period smoothing parameter.

3.1 Question

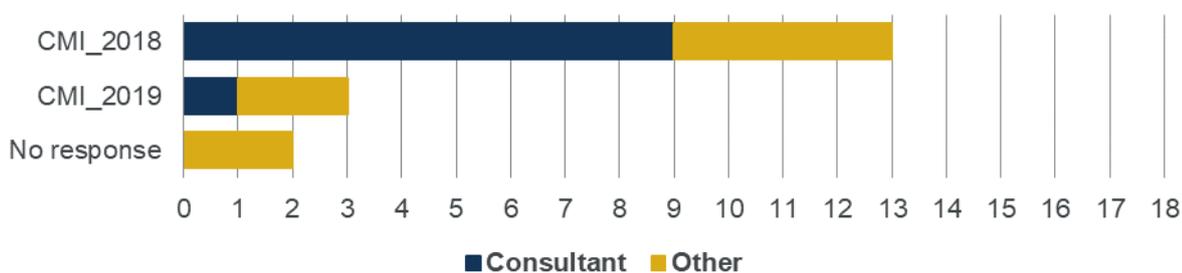
Regarding the timing of the implementation of the change we asked:

- 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.

3.2 Responses

Chart 3A summarises responses to these questions.

Chart 3A: Summary of responses regarding the timing of a change to S_{κ} , by type of respondent



The majority of respondents agreed with our proposal to make any change to S_{κ} in CMI_2018.

There is a link between a respondent's preferred value of S_{κ} and their preferred timing of any change.

- Of the fourteen respondents who prefer a value of S_{κ} of 7, twelve would like the change to be made in CMI_2018, one would prefer a delay until CMI_2019, and one did not express a preference.
- Of the four respondents who prefer a value of S_{κ} of 7.5, one would like the change to be made in CMI_2018, two would prefer a delay until CMI_2019, and one did not express a preference.

Those in favour of making the change in CMI_2018 saw no reason to delay, noting that a change in the Core value would not prevent users of the Model from continuing to use a value of 7.5 if they wish. One respondent expressed a concern that delaying the change could lead to some users implementing the change themselves in CMI_2018, while others waited for CMI_2019, effectively leading to "two Core versions of CMI_2018 for population-level mortality" and causing confusion.

Of those respondents that preferred a delay to CMI_2019:

- One suggested that Core assumptions should remain constant for at least a three year period. It would like more time to consider a suitable value of S_{κ} for its clients, particularly given the challenge of communicating this to clients alongside the additional consideration of the recently released SAPS "S3" Series mortality tables.
- One would prefer to wait for another year to see if the low improvements continue, to judge whether it is right to place more weight on the most recent years

3.3 Decision

We will change the value of S_{κ} to 7 in CMI_2018, as proposed in Working Paper 114 and supported by the majority of respondents.



4. Other comments

Respondents made a number of additional comments.

4.1 Appropriate value of S_{κ} for specific populations

Many of the respondents noted that while they were comfortable with a value of S_{κ} of 7 for the general population, this may not be suitable for specific populations of pension scheme members or annuitants. We consider these comments in groups, below.

Additional input to vary initial mortality improvements

One respondent noted that adjusting the value of S_{κ} to better model different mortality improvements for different populations is simple to implement, but says that “it is not ideal to misuse a parameter in this way”. It suggested adding additional functionality to the Model to explicitly adjust the initial rates of improvement, to enable users to do so directly, rather than by modifying S_{κ} .

We agree that using S_{κ} to reflect different levels of mortality improvement in different populations is not ideal, particularly as the impact on initial mortality improvements of a particular modification to S_{κ} can vary between Model versions, depending on the patterns of recent mortality.

We intend to add a new input to CMI_2018, an addition to the age-period component of initial mortality improvements, with a Core value of zero. This will enable users to allow for differences in mortality improvements between populations, without needing to modify S_{κ} .

Meaning of S_{κ} in CMI_2016

One respondent noted that while Working Paper 114 asked for views on the preferred value of S_{κ} for the general population, it had understood the value of S_{κ} first set in CMI_2016 to be appropriate for “the average user of the Model”.

The value of S_{κ} in CMI_2016 was intended to reflect the calibration dataset, the general population of England & Wales.

Stronger “health warning”

One respondent suggested that many users will assume or “argue for their benefit” that the Core Model is appropriate, without considering whether its projections are appropriate for the specific population that it is used for. It noted evidence, in CMI publications and elsewhere, of higher mortality improvements in recent years for higher socioeconomic groups and more affluent pensioners and suggests that the Core Model will understate short-term improvements in “the large majority” of uses of the Model. It asks the CMI to make the “health warning” in the working paper that accompanies the Model “much stronger”.

Another respondent asks the CMI to “consider providing stronger guidance to users on the need to allow for basis risk owing to socio-economic differences” if the value of the smoothing parameter is reduced.

We share the concern expressed. We have included a stronger “health warning” in the Summary section of this paper, and will give further thought to the wording in the working paper that accompanies CMI_2018.

No Core value for S_{κ}

One of the respondents noted a survey of pension accounting assumptions in which 97% of companies used the Core value of S_{κ} , and thought this might indicate adoption of the Core value without giving thought to other values. They suggested that this could be addressed by not having a Core value for S_{κ} , so that users would be required to make their own judgement, as for the long-term rate.

Question 10.4 of the Working Paper 90 consultation asked whether S_{κ} should be a Core or Advanced parameter. Based on responses to that question, we do not think there would be wide support for forcing users to form their own view of the value of S_{κ} .



Core value of S_{κ} based on pensioner and annuitant populations

One respondent questioned whether the Core value should be based on the general population and suggested that it should be chosen to be suitable for pensioner and annuitant populations, particularly as many users of the Model will use the Core value.

We will continue to base the Core value of S_{κ} on the general population as:

- The CMI's analysis of mortality improvements in its own datasets suggests that improvements may have differed between pensioners and annuitants, so it is not clear to us that a single value would be appropriate for both populations.
- Different users of the Model may have different views on the extent to which historical differences in mortality improvements should affect views of current improvements.
- The consultation specifically asked for views on the value of S_{κ} for the general population, so we do not know what values users may consider appropriate for other populations.

Illustrative values of S_{κ} for other populations

Two respondents suggested that, as well as the Core value for the general population, the CMI could also publish values of S_{κ} suitable for the valuation of pension schemes or annuity portfolios. The values of S_{κ} would be chosen so that they led to initial mortality improvements that were broadly consistent with improvements in the CMI's datasets; for example the mortality improvements for the SAPS population described in Working Paper 115.

As noted above, we intend to add a new input to CMI_2018, an addition to the age-period component of initial mortality improvements. This will enable users to allow for differences such as those shown in Working Paper 115 directly, without needing to modify S_{κ} .

4.2 Range of reasonable or illustrative values of S_{κ}

One respondent asked about the range of values of S_{κ} illustrated in our working papers:

- "Is this intended as a reasonable range, or simply for illustration?"; and
- "Would it still be from 6.5 to 8.5, or from 6.0 to 8.0?"

The range is primarily intended to be illustrative, but broadly reflects the Committee's view of a reasonable range for the England & Wales general population. We note that higher values may be considered reasonable for other populations, based on recent historical experience.

We will use a range of 6 to 8 in our working papers, so that the range continues to be centred on the Core value.

4.3 Compensating changes to projection parameters

Two respondents noted the importance of considering the combined effect of all of the Model's parameters, rather than a single parameter in isolation:

- One noted that reducing S_{κ} to 7 would increase the short-term volatility of the Model's results and suggested that such a change should be accompanied by a compensating change to a projection parameter, such as reducing the proportion remaining at midpoint from 50% to (say) 30%, to reduce the volatility of the Model's results.
- The other respondent suggested that users should be invited to consider whether the convergence parameters and long-term rate remain appropriate in light of the lower initial rates, so that the overall impact of the parameters is appropriate.

We expect that other respondents will have chosen their preferred value of S_{κ} based on the existing Core projection parameters in the Model. Because of this, and because the proposed reduction in the value of S_{κ} is intended to make the Model more responsive to new mortality data, we do not think it would be appropriate to make a change to the Core projection parameters with the aim of reversing the impact of the change in the value of S_{κ} .



We reviewed the convergence parameters as part of the consultation on CMI_2016. We do encourage users of the Model to consider whether they think the combined effect of the Model's parameters is suitable for the purpose for which they use the Model.

4.4 Review of the structure of the period penalty function

The parameter S_{κ} affects the fitted mortality rates through its use in the period penalty function. This can be expressed as:

$$10^{S_{\kappa}} \sum_t (MI_t^{P*} - MI_{t-1}^{P*})^2$$

where MI_t^{P*} is the m-style period component of the mortality improvement in year t . For a given value of S_{κ} , the penalty function has a lower value when mortality improvements change more slowly over time. A higher value of S_{κ} increases the importance of the penalty and leads to mortality improvements varying more slowly over time.

One respondent noted that there appear to have been distinct historical time periods, with relatively stable improvements within each period but different rates of improvement in different periods (e.g. materially lower improvements since 2011). It asks whether the structure of the penalty function could be amended so that it allows for such "regime shifts".

The current penalty function implicitly assumes that changes in mortality improvements from year to year follow a normal distribution. We acknowledge that this is a simple assumption, and that it would be possible to modify the penalty function to allow for regime shifts, or a "fat tailed" distribution. However, we consider the current approach to be pragmatic and we have no plans to make such a change in the short term.

4.5 Impact of historical improvements on illustrative life expectancies

One respondent noted that the impact of different mortality improvements (including changes in S_{κ}) on illustrative life expectancies will depend on the effective date of the base mortality table used. For example, the "S2" Series tables have an effective date in 2007, while the "S3" Series tables have an effective date in 2013. This means that differences in mortality improvements between the two tables between 2007 and 2013 would affect illustrative life expectancies that use the S2 tables, but not affect illustrative life expectancies that use the S3 tables. The respondent suggests that this point could be emphasised to readers of CMI working papers.

We note the suggestion, and we will consider how to emphasise this in future working papers.

4.6 Modelling assumptions

Two respondents asked about some of the assumptions used in calculations in Working Paper 114:

One noted:

- "The Committee's analysis seems to rely on the assumption that a five-year period creates a trend. We have not seen any analysis varying this assumption. Has the Committee considered analysing other periods, such as 7 years or 10 years, and what do they indicate as a suitable value for S_{κ} ?"
- "Table 2.1 appears to have been calculated using the CMI_2016 model. Can the Committee redo the shock-trend analysis based on the indicative CMI_2018 model, and what do the results show?"

Another noted that "The choice of those statistics and, in particular, their timeframe is not unique and other statistics would likely lead to different conclusions."

We agree that using a different time period or a different Model version could have led to different conclusions. However, as we based our view on a combination of several different analyses, we do not think that the assumptions would have made a material difference to our proposal.



4.7 Future changes to the Core value of S_K

One respondent asked about possible future changes to the Core value of S_K :

- “Assuming the change is made in CMI_2018, is the Committee’s intention to reassess the parameters biennially? Should we expect the same parameters for CMI_2019 and potentially new parameter values in CMI_2020?”
- “What sort of mortality improvement experience would be needed in the short term and/or medium term to reverse the proposal and set S_K to 7.5 again? What about the experience needed to move S_K to other values, such as 6.5 or 8?”

Another respondent expressed a preference for S_K to be kept relatively constant over time unless there was significant evidence that it was no longer appropriate. They expressed concern that “maintaining the logic applied in Working Paper 114 in future years might imply regular and material movements”.

We consider the appropriateness of the Model’s parameters in advance of the release of each version, and we will make changes if we think the previous parameters would lead to an undesirable Model. However, we understand that users value stability in the Model, and we have no specific plans for future changes to the Model.

4.8 Communications

One respondent asked what communications the Committee intends to issue around the suitability of the new parameter value.

As well as this working paper, we intend to comment on the change to S_K in the working paper that accompanies CMI_2018, and in the public CMI_2018 Briefing note.



5. Summary of our decisions

This section summarises decisions noted earlier.

Changing the value of S_{κ} in CMI_2018

We will implement the proposals set out in Working Paper 114, reflecting the generally supportive responses to the consultation; i.e. we will:

- change the Core value of S_{κ} to 7; and
- make this change in CMI_2018.

We note that our preference does not force users to change the value of S_{κ} that they use, as the Model software allows the value of S_{κ} to be varied.

Additional Model input

We intend to add a new input to CMI_2018, an addition to the age-period component of initial mortality improvements, with a Core value of zero. This will enable users to allow for differences in mortality improvements between populations, without needing to modify S_{κ} .



References

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

Working Paper 114: “Consultation on the value of the period smoothing parameter, S_k ” (2018)

Working Paper 115: “CMI Mortality Projections Model: Interim update” (2018)

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>.

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