



Assurances Committee

Summary of Working Paper 92: “Proposed “08” Series term mortality tables”

October 2016

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Introduction

This document provides a brief synopsis of Working Paper 92, which describes proposed “08” Series tables for mortality under term assurance policies. At the ages where data volumes are credible, the tables are based on experience in 2007-2010 of business written in 2001 or later and are presented for consultation before they will be formalised, in early 2017.

For more detail, readers are encouraged to refer to the full Working Paper¹.

The paper is very similar to Working Paper 89, released in May, that sets out proposed rates for accelerated critical illness. We have however revised some terminology in Section 5 of the latest paper, as we recognised that the previous terminology was potentially misleading; the revised terminology is also used in an updated version of Working Paper 89, issued simultaneously to this paper.

The underlying data

Much of the data underlying the proposed tables was collected in a special exercise in 2012 to 2014 in which insurance companies could submit data in a wide variety of formats. Data was collected for the years 2007-2011; we sought data for all five years to capture claims incurred in 2007-2010 that were settled by the end of 2011.

The proposed tables are based on term assurance data only; whereas the previous “00” Series tables also used data for endowment and whole life assurances. The latter are generally older products, with different underwriting and distribution practices and the Committee decided that the new tables would be more coherent if based only on the term data. The paper does, though, include a high-level comparison of the experience under endowment and whole life assurances in 2007-2010 with the graduated rates.

The dataset has two principal differences from that underlying the All-Offices results for 2007-2010 presented in Working Paper 75:

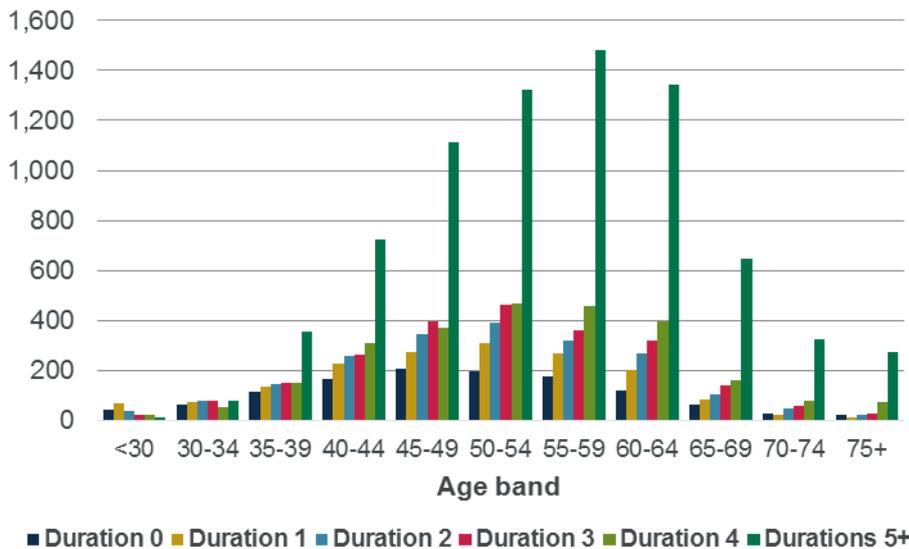
- First, we have included an adjustment for claims incurred in 2007-2010 but settled after 2011.
- Second – and more materially – we found a marked difference in experience between older term assurance business and policies issued more recently. Consequently we chose to base the proposed graduated rates on data for business written in 2001 and later. The rationale for this is detailed in the paper together with an illustration of its impact.

The tables are based on a more extensive dataset of term assurance policies than the predecessor “00” Series tables, with over 17,000 incurred claims. Chart 1 shows the claims in the graduations dataset, sub-divided by age band and by duration. It will be apparent that there is a limited volume of data below age 35 or above age 75.

¹ Most of the CMI’s research is only available to employees of subscribers and to researchers, for non-commercial use. Details of how to access the full paper and the CMI’s other research can be found on the [CMI’s web pages](#).



Chart 1: Numbers of incurred claims by age band and curtate duration



“...there is a limited volume of data below age 35 or above age 75.”

Factors reflected in the proposed tables

Our approach to the graduations was guided by analysis of the 2007-2010 dataset using a generalised linear model (GLM). This analysis confirmed that:

- The factors that were reflected in the “00” Series tables – age, gender, smoker status and duration – were all important factors that should again be reflected in the graduations.
- It was reasonable to graduate the “All-Offices” data – i.e. it was not the case that any office had rates with a substantially different age or durational shape to the preliminary rates.

The analysis also led us to question whether there is a material difference in experience between older business and that written more recently, which resulted in us graduating only the post-2000 business. The analysis did not produce clear evidence that the shape of claim rates by age or by duration varied by other factors – distribution channel, sum assured band, product type and year of commencement (within the post-2000 dataset). As a result, we decided not to reflect any of these factors in the proposed tables.

The proposed graduations

Based on our analysis of the data, we decided to:

- graduate the ultimate experience only, and then consider experience at short durations;
- consider the four gender/smoker datasets independently;
- graduate data over the age range 35-75, to avoid including ages where the number of claims is small; and
- graduate the data on a lives-weighted basis only.

A number of different graduation formulae were tested for each dataset using the CMI Graduation Software (available alongside Working Paper 77). We used the Akaike Information Criterion (AIC) as the principal test statistic in selecting the graduation formulae, but also considered other tests. We also favoured a simpler model, with fewer parameters, where graduations were materially the same. This approach generally led us to a simple Gompertz formula although for male non-smokers we preferred a Gompertz-Makeham formula. The results of statistical tests and results graphs for the proposed graduations from the software are included in the paper.



The table below summarises the key features of each graduation:

	Male non-smokers	Male smokers	Female non-smokers	Female smokers
Formula	GM(1,2)	G(3)	G(3)	G(2)
Durations	5+	4+	5+	5+
Age range	35-75	36-75	35-75	35-75

Note: the age range for male smoker data was restricted to ages 36-75 as the crude mortality rates at younger ages are particularly volatile.

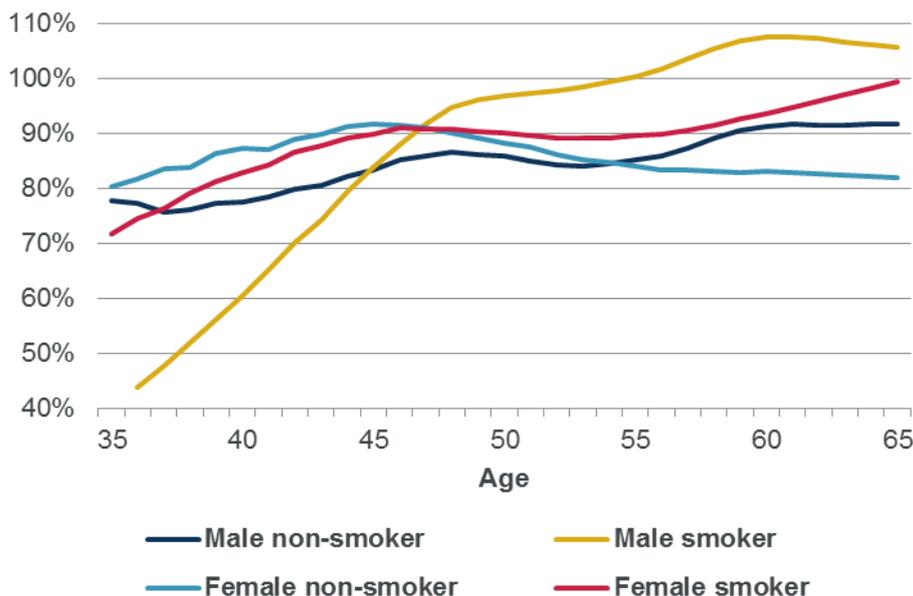
Select rates

Given the data volumes, we did not graduate the data at short durations. Instead, we set the selection discounts by considering the experience at ages 35-70 at each duration, relative to the graduated rates for each gender/smoker category. For three of the categories, we found that it was reasonable to express the select rates as a flat percentage of the ultimate rates. For male smokers there was evidence that selection discounts increase with increasing age; however for simplicity and consistency with the other rates, we propose also using a level percentage adjustment to the ultimate rates. This means that the male smoker rates fit the experience less well than the other sets of rates.

Comparison of the proposed rates with existing tables

The paper includes comparisons of the proposed rates with several existing mortality tables, including the predecessor “00” Series tables, produced by the CMI based on experience in 1999-2002. A comparison of the ultimate rates from the two sets of tables is shown in Chart 2.

Chart 2: Comparison of the proposed T08 rates with the “00” Series rates, by age



“... the male smoker rates ... increase rapidly relative to the TMS00 rates (and also relative to population mortality) ...”

Note: the “00” Series rates have been projected to a consistent date using the smoothed improvement rates from CMI_2015.

For three of the gender/smoker categories, the new ultimate rates generally lie between 80% and 90% of the projected, earlier rates. The exception is the male smoker rates, which increase rapidly



relative to the TMS00 rates (and also relative to population mortality) between ages 36 and 50; whilst we are comfortable that the graduated rates are a suitable reflection of the underlying experience we did modify the rates below age 40 as part of the extension to younger ages.

There are also differences between the proposed tables and the “00” Series tables with regard to the selection discounts; in particular these varied by age in the “00” Series tables whereas we propose using uniform discounts by age.

Extensions to younger and older ages

The data has only been graduated within the age range 35-75, where we were confident of the credibility of the data; however actuaries may need tables that apply across a wider age range and the proposed tables provide rates at ages 18 to 90.

The paper describes our proposed approach to deriving rates at younger and older ages. As with the younger and older age extensions to the proposed AC08 tables, we have sought a pragmatic means of extending the rates but other approaches may be equally valid.

GLM analysis

Working Paper 92 also includes the results of our analysis of the experience in 2007-2010, compared with the graduated rates, using generalised linear models (GLMs). This analysis helped to corroborate a number of aspects of the proposed tables but we also used it to investigate the significance of other factors available within the dataset – distribution channel, sum assured band, product type, year of commencement and calendar year.

There were limitations within the dataset that restricted the value of the GLM analysis; in particular the high proportion of data for which some of these factors were unknown and the limited number of offices that supplied data with multiple, identified distribution channels so the GLM has limited data from which to infer the impact of channel on experience. Despite these barriers, the paper details a number of interesting findings, including:

- There are significant variations by office – beyond those arising from statistical volatility – that are not explained by the other factors in the model. The analysis suggests that even a large office may need to adjust the rates by up to +/- 20%.
- High sums assured (over £125,000) exhibit lighter experience than the graduated rates.

The GLM analysis also suggests a significant trend of improving experience over the four-year period; however whilst this appears to be true for some offices it is not for others and we do not think a general trend of improving experience should be inferred from this analysis. We are very keen to collect the outstanding data for the years 2011-2015 to report on experience in the subsequent years and, in particular, to better assess this apparent trend.

Whole life and endowment assurances

Working Paper 92 concentrates on mortality under term assurance policies, but we also collected data for whole life and endowment assurances. We do not intend producing tables for either; because of the low volume of data for endowment assurances and considerable heterogeneity within the whole life dataset (described in the paper).

Recognising this, the paper includes a high-level comparison of the experience of the 2007-2010 whole life data and endowment assurances data with the graduated rates.



Associated outputs

Alongside the paper, the Committee has also released:

- A spreadsheet containing the proposed rates, including the extensions to younger and older ages;
- A set of All-Offices results for 2007-2010, restated to compare the experience of the dataset with the proposed rates; and
- The datasets that underlie the graduations, reformatted to enable easier use in the CMI Graduation Software; allowing users to assess our choice of age range, grouping of durations and graduation formulae.

Both the All-Offices results and the dataset are also available for the entire dataset – i.e. including both pre-2001 business and post-2000 data – to allow users to assess the implications of our decision to only use the data for the more recent business.

What next?

The paper concludes with a list of areas where the Committee is keen to receive feedback from potential users of the tables. The Committee is requesting feedback on these tables and the corresponding accelerated critical illness tables, described in Working Paper 89, by **30 November 2016**.

We are hosting a discussion forum in London on Friday October 28 at which we will provide an overview of the key points of both sets of proposed tables with time for questions and discussion. More details are available at:

<https://www.actuaries.org.uk/learn-develop/attend-event/cmi-discussion-forum-proposed-08-series-accelerated-critical-illness-and-term-mortality-tables>.

Please register interest in attending this meeting by email to meetings@cmilimited.co.uk.

Responses can be sent to assurances@cmilimited.co.uk or submitted via an online survey at: <https://www.surveymonkey.co.uk/r/CMI-AC08andT08rates>. Comments that support our proposals are also requested, to ensure that changes are not made in the final tables reflecting a minority view.

Depending on the extent and nature of the feedback we receive on the proposed tables, we will finalise both sets of tables early in 2017.

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