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EXTENSION TO YOUNG AGES OF THE "92" SERIES TABLES FOR ASSURED LIVES

1. INTRODUCTION

The published rates of mortality in the "92" Series tables for assured lives were based on the graduated rates from age 17 upwards. Below that age, for the experiences of both permanent and temporary assurances, the available data were too sparse to provide a basis for realistic mortality rates for assured lives.

It is, however, convenient for certain purposes to have available mortality rates for assured lives at childhood ages. For this reason the Committee has therefore extended the assured lives tables down to age 0. These extensions have been carried out having regard to population mortality at young ages.

The "92" Series was the first set of tables produced by the Committee which included a table based on the experience of temporary assurances effected on female lives. It is interesting to note that, for each sex, from age 17 until the mid thirties the ultimate rates of mortality for the temporary assurance table are greater than those for the permanent assurance table. The differences in the rates of mortality at age 17 are illustrated in Table 1 below, which shows the value of 1,000,000 q_{17} for each of the assured lives tables.

Table 1.

Mortality Table	$10^6 \cdot q_{17}$
AM92	600
TM92	846
AF92	172
TF92	227

Although for each sex these differences are in absolute terms very small indeed, the Committee has produced separate extensions for the four assured lives tables – in order to ensure a reasonably smooth progression in the rates of mortality for each table.

Mortality rates for assured lives are generally lower than those for the general population. The extent of the current differences between the mortality of the two groups may be seen by comparing the "92" Series rates with those of the

ELT 15 tables. (The two sets of tables relate to approximately the same time period.) At age 17, however, for male temporary assurances the ultimate rate of mortality is 12.8% greater than the corresponding ELT 15 value. This may be seen from the following table, which (for each experience) expresses the value of q_{17} as a multiple of q_{17}^{ELT15} for the appropriate sex.

Table 2.

Experience	Males	Females
Permanent Assurances	0.8000	0.5548
Temporary Assurances	1.1280	0.7323

(The value shown is q_{17}/q_{17}^{ELT15} where q_{17} denotes the graduated rate of mortality for the relevant experience.)

2. DETERMINATION OF THE RATES OF MORTALITY FOR AGES 1 TO 16

For each of the extended tables the rate of mortality at age 1 was set equal to the ELT 15 value (for the appropriate sex). Between age 1 and age 17 the assured lives rates were blended into the population rates as follows.

For $x = 1, 2, 3, \ldots, 17$ the ratio of the mortality rate at age x in the extended assured lives table to the corresponding ELT15 rate of mortality is denoted by r_x. For each experience the value of r_1 was set equal to 1 while the value of r_{17} was obtained from Table 2 above. (Thus, for male permanent assurances, $r_{17} = 0.8$.) Then, for $x = 2, 3, 4, \ldots, 16$, the value of r_x was obtained by linear interpolation between the known values of r_1 and r_{17}. The 'extended' rate of mortality at age x was then calculated as $r_x \cdot q_x^{ELT15}$.

For females, in order to avoid minor irregularities in the progression of the mortality rates, a further very small adjustment was made to the results of the above calculations.

3. DETERMINATION OF THE RATES OF MORTALITY FOR AGE 0

For each of the extended assured lives tables the rate of mortality at age 0 is based on population mortality – adjusted, however, to remove the effect of relatively high mortality in the first 28 days of life.

Let $t = \frac{28}{365}$. To calculate q_0 an estimate was first made of the value of ${}_tq_0$ on the basis of population mortality. This estimate was then 'scaled up' by the

factor $\frac{365}{337}$ to obtain an annual rate for inclusion in the table. The procedure adopted is described below.

It is readily verified that for any mortality table

$$ {}_{m}q_{x+n} = \frac{{}_{n+m}q_x - {}_{n}q_x}{1 - {}_{n}q_x} $$

Thus

$$ {}_{1-t}q_{x+t} = \frac{q_x - {}_{t}q_x}{1 - {}_{t}q_x} $$

$$ = q_x \cdot \left(\frac{1 - \frac{{}_{t}q_x}{q_x}}{1 - \frac{{}_{t}q_x}{q_x} \cdot q_x} \right) $$

In particular,

$$ {}_{1-t}q_t = q_0 \cdot \left(\frac{1 - \frac{{}_{t}q_0}{q_0}}{1 - \frac{{}_{t}q_0}{q_0} \cdot q_0} \right) \qquad (1) $$

If both q_0 and $\frac{{}_{t}q_0}{q_0}$ are known, this last equation may be used to determine ${}_{1-t}q_t$. For the ELT 15 tables, which are based on the three-year period 1990-1992, the value of $\frac{{}_{t}q_0}{q_0}$ may be estimated as the proportion of infant deaths in these years which occur in the first 28 days of life. For males this proportion is 0.5938 (5213 deaths out of a total of 8779 infant deaths). For females the corresponding proportion is 0.6194 (i.e. 4015/6482). On the basis of the ELT15 values for q_0 of 0.00814 and 0.00632 (for males and females respectively) the values of ${}_{1-t}q_t$ (obtained from equation (1) above) are 0.003323 and 0.002415. When these are scaled up by the factor $\frac{365}{337}$, the resulting values of q_0 for the extended tables are obtained as 0.003599 (for males) and 0.002615 (for females).

The rates of mortality for the extension of the assured lives tables are shown below.

Table 3. Values of 1,000,000 q_x for the extended assured lives tables.

Age x	Mortality Table			
	AM92	AF92	TM92	TF92
0	3,599	2,615	3,599	2,615
1	620	550	620	550
2	375	292	383	295
3	293	208	305	213
4	231	165	246	171
5	209	142	227	149
6	188	129	208	137
7	176	117	199	126
8	164	113	190	124
9	162	101	192	113
10	160	101	193	110
11	158	101	194	117
12	164	101	207	118
13	196	101	252	120
14	243	115	320	141
15	330	134	445	168
16	423	151	582	195