ISSN 0954-2388
CMIR **17** (1999)

Continuous Mortality Investigation Reports

Number 17

Institute of Actuaries

Faculty of Actuaries

Published by the Institute of Actuaries
and the Faculty of Actuaries
1999

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INTRODUCTION

The Executive Committee of the Continuous Mortality Investigation Bureau of the Institute of Actuaries and the Faculty of Actuaries has pleasure in presenting this, the seventeenth number of its reports.

This number is devoted entirely to the new range of standard tables based on the 1991–94 experience. This range, to be know as the "92" Series, is even more extensive than the "80" Series introduced by *C.M.I.R.* **10**, the innovations being standard tables for female temporary assurances, amounts tables for immediate annuitants, and tables based for the first time on the experience of retirement annuitants. Only the vested section of this last group warrants standard table status, but tables based on the deferred and on the combined vested and deferred experience are included in this volume for completeness. The official publication date of the new tables is 30 June 1999.

The proposed new standard tables were discussed by the profession at a special seminar held at Staple Inn in December 1998, and were further discussed at the Current Issues in Life Assurance seminar in April 1999. In the light of this, it is not proposed that further meetings be held to discuss this report.

The data upon which the tables were based was included in *C.M.I.R.* **16**, 1–82, and the base table for the life office pensioners' experience was published in *C.M.I.R.* **16**, 113–141.

A Working Party consisting of A D Wilkie, J J McCutcheon and D O Forfar, assisted by P A Leandro of the Bureau Secretariat, prepared the reports. The Committee is grateful to them for all the work undertaken, for which the Committee takes responsibility.

As on the previous occasion when a new suite of standard tables was produced, a computer package is being launched, and will be a Windows version of the Bureau's highly successful Standard Tables Program and will include all the new tables. A companion hardback volume will also be produced, and, as on the last time, will include mortality functions and a sample of monetary functions.

The committee structure of the Bureau was changed earlier this year and this is reflected in the details on the front inside cover. I retire from the Bureau on 1 July 1999, and will be succeeded by Peter Nowell, whom I wish well at this exciting time in the Bureau's history. Once again I would like to thank all those involved in the work of preparing these reports, including the contributing offices, the Secretariat of the Bureau, especially Tony Leandro who has had an exceptionally busy first year as Secretary, Alden Press, and, last but not least,

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STANDARD TABLES OF MORTALITY BASED ON THE 1991–94 EXPERIENCES

1. PERMANENT ASSURANCES, MALES AND FEMALES

1.1 *Introduction*

1.1.1 The investigations into the mortality of permanent assurances (i.e. whole of life and endowment assurances) are the oldest and largest carried out by the CMI Bureau. They are now carried out for both sexes, and are subdivided by select duration since entry. The data for durations 2, 3, 4 and 5 and over are available separately; however, they have been amalgamated to form a section for durations 2 and over (denoted "durations 2+"). Data for the United Kingdom and the Republic of Ireland are collected separately. Only the former is considered here. In recent years subdivisions by smoker and non-smoker status have been included, but these are not considered in this report.

1.2 *The data*

1.2.1 The experience is a large one. The total numbers of exposed to risk and of deaths are shown in Table 1.1, and compared with the corresponding numbers for the 1979–82 experience.

1.2.2 One can see that the male experience, as measured by the number of lives exposed to risk, has declined substantially since 1979–82, though the female experience has increased and at duration 0 is not far short of that of males. Presumably the reduction is the result of larger sales of unit linked or unitised with profits policies in recent years, which are not included in this investigation.

1.2.3 The data covers all adult ages, though there is a considerable reduction in the exposed to risk at around retirement ages, as endowment assurance policies mature. The age range of the data, and the continuous age range within which the central exposed to risk is greater than or equal to 100, and the continuous age range within which the number of deaths is greater than or equal to 10 are shown in Table 1.2. There are also isolated ages where the number of deaths exceeds nine. These are not noted.

1.2.4 The data at age 10 is clearly faulty, and there is very little exposed to risk between ages 11 and 16, so the graduations have been started at age 17. The select data effectively runs out at about age 80. The data for durations 2+ appears to have too few deaths recorded above age 90, so (as has been the practice for previous graduations) the graduation has been based only on data up to about age 90.

1.3 *Variance ratios*

1.3.1 The investigations are carried out on the basis of policies, rather than lives. Evidence of the distribution of policies per life is obtained from the cause of death investigation (though this is the last occasion on which this will be possible, because the cause of death investigation is to be discontinued). Investigations showed that it was only necessary to consider the distribution of policies per life for males, durations 2+. The available data in the cause of death investigation showed 41,478 deaths with 49,305 policies, an average of 1.189 policies per death. This is only a fraction, though a large one, of the total number of deaths, which amount to 68,963 policies, as noted above. For males, durations 0 and 1, there were only a few lives with duplicate policies. The corresponding information for females is not available.

1.3.2 For each age or group of ages "variance ratios" can be calculated from the distribution of policies per life, as m_2/m_1, where m_2 and m_1 are the second and first moments, respectively, of the distribution of policies among lives (or rather deaths). The variance ratio for all ages combined for males durations 2+ is 1.45, but the variance ratios are applied for each age separately. They are applied by dividing the exposed to risk and the actual deaths at each age by the ratio applicable to that age. Values of the variance ratios are shown in Table 1.15. In the discussion below certain values are quoted both without and with variance ratios, but the graduation has been carried out with variance ratios. This makes rather little difference to the fitted graduated rates, but a lot of difference to the values of χ^2.

1.4 *Comparison with AM80 and AF80*

1.4.1 The experience for 1991–94 has been compared with the AM80 and AF80 tables, which were based on the data for 1979–82. Table 1.3 shows the overall values of 100A/E, i.e. actual deaths as a percentage of expected deaths, for durations 0, 1 and 2+ separately, in each case the experience being compared with the corresponding rates from the AM80 and AF80 tables. For this calculation, initial exposures have been used, and the expected deaths have been calculated using values of q_x.

1.4.2 From this table one can see that the experience for females for 1991–94, at all durations, is much lighter than that in 1979–82. For males the experience at durations 2+ is also much lighter, though the experience for select durations has hardly improved. There is therefore a good reason to construct new tables for both sexes appropriate to the years 1991–94.

1.5 *Comparison with pensioners*

1.5.1 It is of interest to compare the experiences for durations 2+ with the graduated rates for pensioners, produced on the basis of the 1991–94 experience, and reported on in *C.M.I.R.* **16**. The overall comparisons are shown below; the full age range is used; the male experience is compared with the graduated rates for pensioners, males lives, and the female experience is compared with the corresponding experience for females (in this case using central exposures and μ_x).

	100 A/E
Males	84.6
	(83.6 with variance ratios)
Females	87.1

1.5.2 For both sexes the value of 100A/E is well below 100. The ratio is far from uniform over the ages, being well above 100 at younger ages, and well below at higher ages. It should be remembered that the great bulk of the pensioners data is for ages above 60, and the extension to lower ages has been somewhat speculative. In any case it is clear that a simple adjustment to the pensioners tables would not be appropriate for the permanent assurances, a not unexpected conclusion.

1.6 *Methodology*

1.6.1 As for the 1979–82 graduations, the methodology was to use central exposed to risk, fit a formula of the $\mu_x = \text{GM}(r, s)$ class, and in the first place choose the parameters by maximum likelihood, taking account also of the usual diagnostic tests (numbers of positive and negative deviations, runs, Kolmogorov-Smirnov, serial correlations and χ^2). However, as for the graduation of the life office pensioners experience, which has been considered in *C.M.I.R.* **16**, it was decided to adjust the parameters of the graduation formula so that the resulting mortality rates 'behaved properly', that is, the rates for the select durations rose with increasing duration, the rates for the highest and lowest ages were reasonable, and the rates for the two sexes were not unreasonable in relation to each other.

1.7 *The experience for males, durations 2+*

1.7.1 We consider first the experience for males, and start with durations 2+. The data for ages 17 to 91 inclusive is used, and variance ratios are applied. When the corresponding data for 1979–82, for both sexes, were graduated it was found that the formula $\mu_x = \text{GM}(2, 2)$ was the most satisfactory. This formula was also the best for the females experience for durations 2+. It was therefore reasonable to try this formula first on this occasion. However, it was also appropriate to consider alternative orders of formula, i.e. different values of r and s in the GM(r,s) formula. The following pairs of values were used: (0,2), (0,3), (1,2), (0,4), (1,3), (2,2), (0,5), (1,4), (2,3), (3,2), i.e. each combination for which $r+s \leq 5$ and $s \geq 2$. (There is no point in trying formulae with $s=0$ or 1 for a mortality graduation, because the underlying shape is always of Gompertz, GM(0,2), type, i.e. to a first approximation $\log \mu_x$ is linear in x.)

1.7.2 Note that, for example, the GM(2,3) formula is parameterised as:

$$a_1 + a_2 t + \exp\{b_1 + b_2 t + b_3(2t^2 - 1)\}$$

where $t = (x - 70)/50$. The first two terms of this formula can be described as the "r" part, with two terms, and the exponential can be described as the "s" part, with three terms inside the parentheses.

1.7.3 It was quickly clear that the lower order formulae, with $r+s \leq 3$, provided an unsatisfactory fit to the data; that all the formulae with $r+s=4$ and also (1,4) and (3,2) gave poorish fits, and that (0,4) gave a quite unsatisfactory shape. This left GM(0,5) and GM(2,3) as possible contenders, both with high values of the log likelihood (low values of the negative of the log likelihood) and the lowest values of χ^2. Although both had reasonable shapes, the values of q_x for the GM(0,5) formula rose above those for English Life Tables No. 15, Males at low and at high ages, whereas those for GM(2,3) did not. The latter was therefore preferred, without any further adjustments. Critical values for several formulae are shown in Table 1.4.

1.7.4 Values of q_x for ages from 10 to 120 are calculated by integrating μ_x using repeated Simpson's rule with successively shorter steps until the result converges. Note that the values of all the parameters are rounded to six decimal places before calculating μ_x, as quoted in the tables in this report.

1.7.5 The same graduation statistics as were shown for the 1979–82 graduations are shown in Table 1.6 (for all three durations, 0, 1 and 2+; the first two are described below). Specimen values of q_x, at decennial ages from 20 to 110, and percentage standard errors, are shown in Table 1.7. One can observe that for durations 2+ the T-ratio for the first serial correlation coefficient is just over 2.0, at 2.07 (note that these values should be compared with a unit normal distribution). Further, the value of χ^2 (at 105.8) is still outside what might be expected for 68 degrees of freedom.

1.7.6 Details of the exposed to risk, actual deaths, variance ratios, and adjusted exposure and deaths are shown in Table 1.15. Details of the graduation, with exposed to risk, actual deaths, expected deaths, deviations, and standardised deviations (z_x) are shown in Table 1.16.

1.8 *The experience for males, durations 0 and 1*

1.8.1 We consider next the experience for males for durations 0 and 1. First we compare the experience for the whole age range with the graduated rates for durations 2+, with the following results:

	100 A/E
Duration 0	76.5
Duration 1	93.0

1.8.2 The overall values of 100A/E are, as expected, below 100, and that for duration 0 is below that for duration 1. However, the pattern across the ages is not uniform, the values being somewhat lower at higher ages than at lower ages, again as might be expected.

1.8.3 We start again by fitting formulae of the GM(r,s) series to the data, omitting the data for the lowest ages and using an age range of 17 to 89 for duration 0 and 17 to 100 for duration 1. Note that variance ratios were not used for these durations. The results for various GM(r,s) formulae are shown in Table 1.5.

1.8.4 For neither duration do the low order formulae fit the data satisfactorily, and generally the higher order formulae produce a poor 'shape' of graduated rates, with the exception of the GM(2,2) formula. However, for both durations these have unsatisfactory features in relation to the rates for durations 2+, especially at the younger ages. An approach similar to that used for the pensioners was therefore adopted, to set some of the parameters to produce approximately the desired shape of curve, and then to optimise the rest, i.e. provide a conditional maximum likelihood fit, conditional on the values of the selected parameters.

1.8.5 For duration 1 many combinations of parameters were tried. Eventually it was decided to use for both durations a GM(2,3) formula, as for durations 2+, with in each case the values of three of the parameters fixed (a_1, a_2 and b_3 for duration 0; a_2, b_2 and b_3 for duration 1), allowing the other two (b_1 and b_2 for duration 0; $a_1$and b_1 for duration 1) to be fitted by optimisation. The fixed parameter values are as shown below.

	Duration 0	Duration 1
$100a_1$	0.02	
$100a_2$	−0.02	−0.03
b_2		5.0
b_3	−0.6	−1.2

1.8.6 The results appeared to be reasonably satisfactory, and the summary statistics for these constrained GM(2,3) graduations are shown in Table 1.5.

However, the values of q_x for duration 1 approach very close to those for durations 2+ in the 50s of age; this is a feature of the data, and has not been eliminated.

1.8.7 The same graduation statistics as for durations 2+ are shown in Table 1.6 and values of q_x at 10-year intervals are shown in Table 1.7. It should be noted that by fixing three of the parameters, the flexibility lies in the level and shape of the rates as affected by the free parameters, so the maximum percentage standard error in the value of q_x is not necessarily at the ends of the range. For duration 0, for example, the parameters have been chosen so that the values of q_x at the youngest ages are almost fixed.

1.8.8 Although the values of q_x for higher ages are shown in Table 1.7 (and also in Table 1.11 for females), the select rates for individual ages have been limited to age 90 for duration 0 and to age 91 for duration 1, as for the AM80 and AF80 tables.

1.8.9 A substantial part of the excess χ^2 in the data for duration 1 comes from three adjacent ages, 46, 47 and 48, where the actual deaths (135 for the three ages in total) are substantially higher than those expected (86.3 for the proposed graduation), whereas the experience for neighbouring ages is more normal. For duration 0 the excess χ^2 comes substantially from the youngest ages included, from 17 to 22 inclusive, where the actual deaths (90 in total) are also much higher than those expected (45.2 for the proposed graduation).

1.9 *The experience for females, durations 2+*

1.9.1 The experience for females, durations 2+, is now considered. The values of the log likelihood and of χ^2 for GM(r,s) formulae (1,2), (0,4), (1,3) and (2,2) are shown in Table 1.8. Although the GM(1,2) graduation (a Makeham formula) has rather poorer values of the statistics, its shape is rather better than that of any of the others, and it provides quite a satisfactory fit to the data, as seen from the statistics shown in Table 1.10. No adjustments needed to be made.

1.9.2 Details of the graduation, with exposed to risk, actual deaths, expected deaths, deviations, and standardised deviations (z_x) are shown in Table 1.17.

1.10 *The experience for females, durations 0 and 1*

1.10.1 The experience for females at durations 0 and 1 is now considered. One can see from the statistics in Table 1.9 that the differences in the log likelihood as between the GM formulae shown are not very large. However, for duration 0 only the GM(2,2) formula produces a reasonable shape, and for duration 1 only GM(1,2) and GM(2,2). Because a GM(1,2) formula had been found satisfactory for durations 2+, this form was chosen as the basis for modifications.

Both durations were refitted using a GM(1,2) formula, with a fixed value of $100a_1$ of 0.008 for each in order that the values of q_x at the youngest ages were conformable with those for durations 2+.

1.10.2 The usual graduation statistics and specimen values of q_x for all three durations are shown in Tables 1.10 and 1.11.

1.11 *Comparisons*

1.11.1 Several sets of comparative ratios are shown in Tables 1.12, 1.13 and 1.14, and graphs of these ratios are shown in Figures 1.2 to 1.6. Table 1.12 shows ratios of the values of q_x for duration 0 to those for duration 1 and the corresponding ratios for durations 1 and 2+, for both sexes. Figures 1.2 and 1.3 show the same ratios. It can be seen that none of these ratios exceeds 1.0. However, the rates for males duration 1 are much closer to those for durations 2+ at all except high ages than are those for females.

1.11.2 Table 1.13 and Figure 1.4 show a comparison between the rates for males and those for females. The female rates are all about half the male rates except at the very highest ages.

1.11.3 Table 1.14 and Figures 1.5 and 1.6 show a comparison of the graduated rates and those from the AM80 and AF80 tables. Many of the rates are much lower than in 1979–82. Others are higher. The shapes of the mortality experiences have changed substantially.

1.12 *The proposed tables*

1.12.1 Values of q_x for the proposed tables for permanent assurances are shown in Appendix A in Table A1 for males and in Table A2 for females. All six sets of rates are graphed in Figure 1.1.

Table 1.1. Permanent assurances, males and females: comparison of (central) exposed to risk and deaths for 1991–94 and for 1979–82, durations 0, 1 and 2+.

	1979–82	1991–94
Males		
Duration 0		
Central exposed	1,799,039.7	837,360.3
Deaths	1,795	1,345
Duration 1		
Central exposed	1,776,058.3	835,252.4
Deaths	2,287	1,774
Durations 2+		
Central exposed	22,239,148.0	15,139,004.8
Deaths	90,941	68,963
Females		
Duration 0		
Central exposed	719,974.5	765,376.5
Deaths	421	613
Duration 1		
Central exposed	664,893.5	733,713.3
Deaths	601	802
Durations 2+		
Central exposed	3,375,844.5	4,931,581.6
Deaths	6,368	12,214

Table 1.2. Permanent assurances, males and females: age ranges.

	Range of data	Exposed ≥ 100	Deaths ≥ 10
Males			
Duration 0	10–89	12–80	38–79
Duration 1	10–100*	13–81	35–81
Durations 2+	10–108	10–101	19–100
Females			
Duration 0	10–91	13–81	60–72
Duration 1	10–92	13–82	43–70
Durations 2+	10–108	10–94	25–95

*An isolated case at 100; the rest of the data ceases at age 89.

Table 1.3. Values of 100 A/E when the experience for 1991–94 is compared with the AM80 and AF80 tables (using initial exposures and q_x).

	Duration 0	Duration 1	Durations 2+
Males	98.7	96.2	72.2 (72.6 with variance ratios)
Females	87.1	68.8	79.9

Table 1.4. *Values of log likelihood and of χ^2 for graduation of males* durations 2+ (age range used: 17–91; with variance ratios).

	GM(0,4)	GM(1,3)	GM(2,2)	GM(0,5)	GM(1,4)	GM(2,3)	GM(3,2)
−Log likelihood	259,082.9	259,067.4	259,082.3	259,061.5	259,066.4	259,064.6	259,072.1
χ^2	144.7	114.1	139.0	100.4	110.9	105.8	120.8

Table 1.5. Values of log likelihood and of χ^2 for graduation of males duration 0 (ages 17 to 89) and duration1 (ages 17 to 100).

	GM(0,4)	GM(1,3)	GM(2,2)	GM(2,3) (unconstrained)	GM(2,3) (as fitted)
Duration 0:					
−Log likelihood	8,984.4	8,992.8	8,985.1	8,983.6	9,002.3
χ^2	48.7	67.7	52.5	49.1	100.9
Duration 1:					
−Log likelihood	11,164.5	11,165.5	11,162.7	11,162.7	11,168.0
χ^2	81.0	82.6	77.4	77.1	89.2

Table 1.6. Permanent assurances, males, durations 0, 1 and 2+: statistics for graduations of $\mu_x = \mathrm{GM}(r,s)$.

Duration: Formula	0 GM(2,3)	1 GM(2,3)	2+ GM(2,3)
Ages used	17–89	17–100	17–91
Values of parameters at optimum point:			
$100a_1$	0.02	0.022960	0.005887
T-ratio		7.0	0.3
$100a_2$	−0.02	−0.03	−0.049883
T-ratio			−2.2
b_1	−4.755647	−5.056244	−4.363378
T-ratio	−109.7	−173.1	−43.0
b_2	5.236521	5.0	5.544956
T-ratio	32.5		92.9
b_3	−0.6	−1.2	−0.620345
T-ratio			−6.3
Sign test: p(pos)	0.7338	0.3101	0.4076
Runs test: p(runs)	0.1962	0.4199	0.0800
K–S test: $p(KS)$	0.1320	0.6071	0.6833
Serial correlation test:			
T-ratio 1	2.85	1.23	2.07
T-ratio 2	1.80	0.39	−1.21
T-ratio 3	1.60	−0.94	0.35
χ^2 test:			
χ^2	100.87	89.24	105.79
Degrees of freedom	59	60	68
$p(\chi^2)$	0.000563	0.0085	0.0023

Table 1.7. Permanent assurances, males, durations 0, 1 and 2+: specimen values of q_x and percentage standard errors.

Duration: Formula	0 GM(2,3)	1 GM(2,3)	2+ GM(2,3)
Age 20	0.000425	0.000541	0.000582
Percentage s.e.	0.27	6.06	6.71
Age 30	0.000476	0.000558	0.000590
Percentage s.e.	1.04	5.88	2.77
Age 40	0.000788	0.000887	0.000937
Percentage s.e.	2.50	3.69	1.80
Age 50	0.001971	0.002434	0.002508
Percentage s.e.	3.59	1.34	0.85
Age 60	0.005774	0.007760	0.008022
Percentage s.e.	4.00	0.42	0.60
Age 70	0.016582	0.022210	0.024783
Percentage s.e.	4.10	0.14	0.75
Age 80	0.043833	0.053078	0.069303
Percentage s.e.	4.08	0.06	0.76
Age 90	0.103990	0.104031	0.170247
Percentage s.e.	3.96	0.03	1.88
Age 100	0.217127	0.167115	0.355505
Percentage s.e.	3.70	0.02	4.12
Age 110	0.391042	0.222233	0.607918
Percentage s.e.	3.23	0.01	5.93

Table 1.8. Values of log likelihood and of χ^2 for graduation of females durations 2+ (ages 17 to 89).

	GM(1,2)	GM(0,4)	GM(1,3)	GM(2,2)
−Log likelihood	74,402.5	74,394.8	74,394.9	74,397.4
χ^2	91.0	74.9	74.9	79.8

Table 1.9. Values of log likelihood and of χ^2 for graduation of females durations 0 and 1.

	GM(1,2)	GM(0,4)	GM(1,3)	GM(2,2)
Duration 0:				
−Log likelihood	4,516.7	4,509.2	4,512.5	4,509.3
χ^2	65.6	52.8	61.4	47.7
Duration 1:				
−Log likelihood	5,661.1	5,660.9	5,660.4	5,660.0
χ^2	62.4	63.2	66.0	59.1

Table 1.10. Permanent assurances, females, durations 0, 1 and 2+: statistics for graduations of $\mu_x = \mathrm{GM}(r, s)$.

Duration: Formula	0 GM(1,2)	1 GM(1,2)	2+ GM(1,2)
Values of parameters at optimum point:			
$100a_1$	0.008	0.008	0.011189
T-ratio			5.7
b_1	−4.978100	−4.763844	−4.331121
T-ratio	−81.5	−91.7	−384.6
b_2	5.078780	4.854450	5.135803
T-ratio	28.1	32.5	99.3
Sign test: p(pos)	0.2950	0.2175	0.5000
Runs test: p(runs)	0.5251	0.3365	0.6861
K–S test: $p(KS)$	0.7477	0.8805	0.4476
Serial correlation test:			
T-ratio 1	1.11	1.74	0.55
T-ratio 2	0.42	−0.74	1.62
T-ratio 3	0.67	−1.15	0.55
χ^2 test:			
χ^2	80.43	63.70	90.95
Degrees of freedom	51	55	66
$p(\chi^2)$	0.0053	0.20	0.0226

Table 1.11. Permanent assurances, females, durations 0, 1 and 2+: specimen values of q_x and percentage standard errors.

Duration: Formula	0 GM(1,2)	1 GM(1,2)	2+ GM(1,2)
Age 20	0.000125	0.000150	0.000193
Percentage s.e.	2.23	2.45	8.70
Age 30	0.000205	0.000264	0.000339
Percentage s.e.	3.77	3.66	4.07
Age 40	0.000424	0.000567	0.000747
Percentage s.e.	5.02	4.51	1.70
Age 50	0.001030	0.001364	0.001886
Percentage s.e.	5.70	4.94	1.33
Age 60	0.002701	0.003468	0.005058
Percentage s.e.	6.00	5.13	1.06
Age 70	0.007302	0.009000	0.013867
Percentage s.e.	6.10	5.18	1.10
Age 80	0.019897	0.023459	0.038059
Percentage s.e.	6.10	5.17	1.72
Age 90	0.053854	0.060631	0.102533
Percentage s.e.	6.01	5.08	2.52
Age 100	0.141638	0.152114	0.260630
Percentage s.e.	5.72	4.83	3.13
Age 110	0.344012	0.353086	0.569670
Percentage s.e.	4.95	4.18	2.98

Table 1.12. Permanent assurances: ratios of values of q_x in proposed tables: comparison of durations.

	Males		Females	
Age	Duration 0/ Duration 1	Duration 1/ Durations 2+	Duration 0/ Duration 1	Duration 1/ Durations 2+
20	0.7856	0.9296	0.8333	0.7772
25	0.8161	0.9417	0.8031	0.7782
30	0.8530	0.9458	0.7765	0.7788
35	0.8863	0.9448	0.7553	0.7724
40	0.8884	0.9466	0.7478	0.7590
45	0.8566	0.9570	0.7486	0.7419
50	0.8098	0.9705	0.7551	0.7232
55	0.7697	0.9763	0.7655	0.7044
60	0.7441	0.9673	0.7788	0.6856
65	0.7363	0.9405	0.7944	0.6669
70	0.7466	0.8962	0.8113	0.6490
75	0.7759	0.8366	0.8293	0.6321
80	0.8258	0.7659	0.8482	0.6164
85	0.8992	0.6890	0.8678	0.6025
90	0.9996	0.6111	0.8882	0.5913

Table 1.13. Permanent assurances: ratios of values of q_x in proposed tables: comparison of sexes.

Age	Duration 0 Females/Males	Duration 1 Females/Males	Durations 2+ Females/Males
20	0.2941	0.2773	0.3316
25	0.3563	0.3621	0.4382
30	0.4307	0.4731	0.5746
35	0.4974	0.5837	0.7141
40	0.5381	0.6392	0.7972
45	0.5429	0.6213	0.8014
50	0.5226	0.5604	0.7520
55	0.4937	0.4964	0.6881
60	0.4678	0.4469	0.6305
65	0.4493	0.4165	0.5873
70	0.4404	0.4052	0.5595
75	0.4416	0.4132	0.5469
80	0.4539	0.4420	0.5492
85	0.4786	0.4960	0.5671
90	0.5179	0.5828	0.6023
95			0.6570
100			0.7331
105			0.8296
110			0.9371
115			1.0322

Table 1.14. Ratios of values of q_x in proposed tables to those in corresponding AM80 and AF80 tables.

	Males			Females		
Age	Duration 0	Duration 1	Durations 2+	Duration 0	Duration 1	Durations 2+
20	0.6833	0.7483	0.7358	0.5631	0.5660	0.6725
25	0.9315	0.9621	0.9264	0.7908	0.7338	0.8702
30	1.1226	1.1318	1.0650	0.9234	0.8462	0.9391
35	1.0805	1.0416	0.9957	0.9054	0.8617	0.9028
40	0.9216	0.8512	0.8212	0.8314	0.8112	0.8616
45	0.8187	0.7595	0.7030	0.7780	0.7522	0.8297
50	0.7960	0.7678	0.6577	0.7618	0.7038	0.8060
55	0.8330	0.8394	0.6582	0.7810	0.6714	0.7915
60	0.9117	0.9495	0.6834	0.8313	0.6524	0.7836
65	1.0212	1.0784	0.7195	0.9112	0.6433	0.7808
70	1.1530	1.2085	0.7575	1.0205	0.6419	0.7816
75	1.2994	1.3217	0.7908	1.1493	0.6462	0.7852
80	1.4512	1.4011	0.8148	1.1869	0.6549	0.7909
85	1.5980	1.4335	0.8358	1.2303	0.6673	0.7987
90	1.7277	1.4123	0.8581	1.2773	0.6831	0.8088
95			0.8802			0.8217
100			0.9012			0.8387
105			0.9204			0.8611
110			0.9375			0.8904
115			0.9525			0.9264

Table 1.15. Permanent assurances, males, durations 2+: exposed to risk (R_x), actual deaths (A_x), variance ratios, adjusted R_x and A_x and crude μ_x.

Age x	R_x	A_x	Variance Ratio	Adjusted R_x	Adjusted A_x	Crude $\mu_x = A_x/R_x$
10	1,142.9	53	1.00	1,142.9	53.00	0.046373
11	431.3	1	1.00	431.3	1.00	0.002319
12	419.8	0	1.00	419.8	0.00	0.000000
13	455.5	0	1.00	455.5	0.00	0.000000
14	546.9	0	1.00	546.9	0.00	0.000000
15	785.8	0	1.00	785.8	0.00	0.000000
16	1,103.1	0	1.00	1,103.1	0.00	0.000000
17	1,669.1	0	1.00	1,669.1	0.00	0.000000
18	4,035.1	3	1.00	4,035.1	3.00	0.000743
19	11,732.6	13	1.00	11,732.6	13.00	0.001108
20	23,730.1	21	1.00	23,730.1	21.00	0.000885
21	37,068.9	25	1.15	32,233.8	21.74	0.000674
22	50,629.3	34	1.26	40,182.0	26.98	0.000672
23	65,520.4	51	1.29	50,791.0	39.53	0.000778
24	81,412.3	38	1.08	75,381.8	35.19	0.000467
25	98,035.3	49	1.00	98,035.3	49.00	0.000500
26	115,749.5	51	1.07	108,177.1	47.66	0.000441
27	133,482.3	85	1.28	104,283.1	66.41	0.000637
28	150,968.9	74	1.42	106,316.1	52.11	0.000490
29	167,686.6	76	1.58	106,130.8	48.10	0.000453
30	180,835.6	93	1.18	153,250.5	78.81	0.000514
31	191,086.2	105	1.13	169,102.8	92.92	0.000549
32	200,923.9	143	1.36	147,738.2	105.15	0.000712
33	212,018.3	127	1.40	151,441.6	90.71	0.000599
34	225,011.1	144	1.44	156,257.7	100.00	0.000640
35	240,211.3	167	1.47	163,409.1	113.61	0.000695
36	256,522.1	210	1.97	130,214.3	106.60	0.000819
37	275,553.1	201	1.42	194,051.5	141.55	0.000729
38	298,477.1	238	1.46	204,436.4	163.01	0.000797
39	323,673.6	307	1.62	199,798.5	189.51	0.000948
40	351,831.3	308	1.39	253,116.0	221.58	0.000875
41	384,724.8	357	1.36	282,885.9	262.50	0.000928
42	424,734.8	491	2.10	202,254.7	233.81	0.001156
43	475,237.6	525	1.56	304,639.5	336.54	0.001105
44	537,761.4	645	1.51	356,133.4	427.15	0.001199
45	580,177.6	825	1.70	341,280.9	485.29	0.001422
46	592,243.3	963	1.63	363,339.5	590.80	0.001626
47	593,139.6	1,001	1.60	370,712.3	625.63	0.001688
48	574,704.2	1,087	1.81	317,516.1	600.55	0.001891
49	548,810.1	1,134	1.75	313,605.8	648.00	0.002066
50	519,668.5	1,281	1.70	305,687.4	753.53	0.002465

Table 1.15. (Continued).

Age x	R_x	A_x	Variance Ratio	Adjusted R_x	Adjusted A_x	Crude $\mu_x = A_x/R_x$
51	487,844.6	1,333	1.72	283,630.6	775.00	0.002732
52	466,787.8	1,447	1.68	277,849.9	861.31	0.003100
53	458,539.4	1,634	1.73	265,051.7	944.51	0.003563
54	458,637.1	1,664	1.62	283,109.3	1,027.16	0.003628
55	450,022.4	1,765	1.59	283,033.0	1,110.06	0.003922
56	436,441.1	2,010	1.70	256,730.1	1,182.35	0.004605
57	423,193.6	2,187	1.60	264,496.0	1,366.88	0.005168
58	408,695.6	2,446	1.67	244,727.9	1,464.67	0.005985
59	390,958.6	2,532	1.60	244,349.1	1,582.50	0.006476
60	337,641.6	2,445	1.48	228,136.2	1,652.03	0.007241
61	301,243.3	2,662	1.57	191,874.7	1,695.54	0.008837
62	283,631.1	2,917	1.47	192,946.3	1,984.35	0.010284
63	263,928.9	2,982	1.54	171,382.4	1,936.36	0.011299
64	234,917.5	2,789	1.41	166,608.2	1,978.01	0.011872
65	135,496.6	1,866	1.28	105,856.7	1,457.81	0.013772
66	81,428.6	1,286	1.35	60,317.5	952.59	0.015793
67	69,644.6	1,149	1.19	58,524.9	965.55	0.016498
68	62,079.6	1,183	1.27	48,881.6	931.50	0.019056
69	55,106.3	1,156	1.16	47,505.4	996.55	0.020978
70	49,027.7	1,134	1.18	41,548.9	961.02	0.023130
71	44,957.6	1,110	1.15	39,093.6	965.22	0.024690
72	40,870.1	1,220	1.14	35,851.0	1,070.18	0.029851
73	35,189.3	1,194	1.33	26,458.1	897.74	0.033931
74	29,862.1	1,092	1.13	26,426.6	966.37	0.036568
75	24,832.1	1,034	1.31	18,955.8	789.31	0.041640
76	22,169.6	1,007	1.25	17,735.7	805.60	0.045423
77	21,344.8	1,024	1.26	16,940.3	812.70	0.047974
78	20,260.9	1,123	1.20	16,884.1	935.83	0.055427
79	18,463.3	1,115	1.23	15,010.8	906.50	0.060390
80	15,487.4	1,070	1.20	12,906.2	891.67	0.069088
81	13,436.6	1,036	1.16	11,583.3	893.10	0.077103
82	11,795.9	987	1.17	10,082.0	843.59	0.083673
83	10,273.6	988	1.31	7,842.4	754.20	0.096169
84	8,727.6	953	1.26	6,926.7	756.35	0.109194
85	6,880.7	744	1.18	5,831.1	630.51	0.108129
86	5,469.2	618	1.18	4,634.9	523.73	0.112996
87	4,422.1	627	1.18	3,747.5	531.36	0.141788
88	3,439.8	508	1.34	2,567.0	379.10	0.147683
89	2,730.0	406	1.34	2,037.3	302.99	0.148718
90	2,140.6	374	1.29	1,659.4	289.92	0.174717
91	1,625.3	331	1.42	1,144.6	233.10	0.203655
92	1,251.0	218	1.22	1,025.4	178.69	0.174261

Table 1.15. (Continued).

Age x	R_x	A_x	Variance Ratio	Adjusted R_x	Adjusted A_x	Crude $\mu_x = A_x/R_x$
93	946.0	178	1.19	795.0	149.58	0.188161
94	703.8	167	1.28	549.8	130.47	0.237283
95	516.5	106	1.13	457.1	93.81	0.205227
96	400.0	71	1.08	370.4	65.74	0.177500
97	297.5	47	1.21	245.9	38.84	0.157983
98	241.8	23	1.00	241.8	23.00	0.095120
99	194.3	27	2.70	72.0	10.00	0.138960
100	300.3	28	1.00	300.3	28.00	0.093240
101	113.5	9	1.00	113.5	9.00	0.079295
102	80.3	5	1.00	80.3	5.00	0.062267
103	64.0	1	1.40	45.7	0.71	0.015625
104	52.5	2	1.00	52.5	2.00	0.038095
105	46.0	2	1.00	46.0	2.00	0.043478
106	40.0	0	1.00	40.0	0.00	0.000000
107	34.0	2	1.00	34.0	2.00	0.058824
108	127.5	3	1.00	127.5	3.00	0.023529
Totals	15,139,004.8	68,963		9,853,930.8	48,591.64	

Table 1.16. Details of graduation for males durations 2+: exposed to risk and actual deaths adjusted by variance ratios.

Age x	Adjusted R_x	μ_x	Adjusted A_x	E_x	Dev_x	$(V_x)^{1/2}$	z_x	100A/E
17	1,669.1	0.000604	0.00	1.01				
18	4,035.1	0.000597	3.00	2.41				
19	11,732.6	0.000590	13.00	6.93				
17–19	17,436.8	0.000593	16.00	10.34	5.66	3.22	1.76	154.7
20	23,730.1	0.000584	21.00	13.87	7.13	3.72	1.91	151.4
21	32,233.8	0.000579	21.74	18.67	3.07	4.32	0.71	116.5
22	40,182.0	0.000575	26.98	23.09	3.90	4.80	0.81	116.9
23	50,791.0	0.000571	39.53	29.00	10.54	5.38	1.96	136.3
24	75,381.8	0.000568	35.19	42.84	−7.65	6.54	−1.17	82.1
25	98,035.3	0.000567	49.00	55.57	−6.57	7.45	−0.88	88.2
26	108,177.1	0.000567	47.66	61.30	−13.64	7.83	−1.74	77.7
27	104,283.1	0.000568	66.41	59.25	7.15	7.70	0.93	112.1
28	106,316.1	0.000572	52.11	60.76	−8.65	7.79	−1.11	85.8
29	106,130.8	0.000577	48.10	61.23	−13.13	7.82	−1.68	78.6
30	153,250.5	0.000585	78.81	89.61	−10.79	9.47	−1.14	88.0
31	169,102.8	0.000595	92.92	100.66	−7.74	10.03	−0.77	92.3
32	147,738.2	0.000609	105.15	89.97	15.18	9.49	1.60	116.9
33	151,441.6	0.000626	90.71	94.85	−4.14	9.74	−0.42	95.6
34	156,257.7	0.000648	100.00	101.22	−1.22	10.06	−0.12	98.8
35	163,409.1	0.000674	113.61	110.13	3.48	10.49	0.33	103.2
36	130,214.3	0.000705	106.60	91.87	14.73	9.58	1.54	116.0
37	194,051.5	0.000743	141.55	144.22	−2.67	12.01	−0.22	98.2
38	204,436.4	0.000788	163.01	161.07	1.95	12.69	0.15	101.2
39	199,798.5	0.000840	189.51	167.93	21.58	12.96	1.67	112.9
40	253,116.0	0.000902	221.58	228.34	−6.76	15.11	−0.45	97.0
41	282,885.9	0.000974	262.50	275.53	−13.03	16.60	−0.78	95.3
42	202,254.7	0.001057	233.81	213.88	19.93	14.62	1.36	109.3
43	304,639.5	0.001154	336.54	351.58	−15.04	18.75	−0.80	95.7
44	356,133.4	0.001266	427.15	450.71	−23.56	21.23	−1.11	94.8
45	341,280.9	0.001394	485.29	475.68	9.61	21.81	0.44	102.0
46	363,339.5	0.001541	590.80	559.91	30.89	23.66	1.31	105.5
47	370,712.3	0.001710	625.63	633.75	−8.13	25.17	−0.32	98.7
48	317,516.1	0.001902	600.55	603.95	−3.40	24.58	−0.14	99.4
49	313,605.8	0.002122	648.00	665.38	−17.38	25.80	−0.67	97.4
50	305,687.4	0.002372	753.53	724.99	28.54	26.93	1.06	103.9
51	283,630.6	0.002656	775.00	753.23	21.77	27.45	0.79	102.9
52	277,849.9	0.002978	861.31	827.40	33.91	28.76	1.18	104.1
53	265,051.7	0.003343	944.51	886.01	58.49	29.77	1.97	106.6
54	283,109.3	0.003756	1,027.16	1,063.23	−36.07	32.61	−1.11	96.6
55	283,033.0	0.004222	1,110.06	1,194.87	−84.81	34.57	−2.45	92.9

Table 1.16. (Continued).

Age x	Adjusted R_x	μ_x	Adjusted A_x	E_x	Dev_x	$(V_x)^{1/2}$	z_x	100A/E
56	256,730.1	0.004747	1,182.35	1,218.79	−36.43	34.91	−1.04	97.0
57	264,496.0	0.005339	1,366.88	1,412.26	−45.38	37.58	−1.21	96.8
58	244,727.9	0.006005	1,464.67	1,469.69	−5.02	38.34	−0.13	99.7
59	244,349.1	0.006754	1,582.50	1,650.22	−67.72	40.62	−1.67	95.9
60	228,136.2	0.007593	1,652.03	1,732.22	−80.20	41.62	−1.93	95.4
61	191,874.7	0.008534	1,695.54	1,637.37	58.17	40.46	1.44	103.6
62	192,946.3	0.009586	1,984.35	1,849.65	134.70	43.01	3.13	107.3
63	171,382.4	0.010763	1,936.36	1,844.64	91.73	42.95	2.14	105.0
64	166,608.2	0.012077	1,978.01	2,012.20	−34.19	44.86	−0.76	98.3
65	105,856.7	0.013543	1,457.81	1,433.64	24.18	37.86	0.64	101.7
66	60,317.5	0.015176	952.59	915.38	37.21	30.26	1.23	104.1
67	58,524.9	0.016993	965.55	994.51	−28.96	31.54	−0.92	97.1
68	48,881.6	0.019012	931.50	929.36	2.14	30.49	0.07	100.2
69	47,505.4	0.021255	996.55	1,009.71	−13.16	31.78	−0.41	98.7
70	41,548.9	0.023741	961.02	986.41	−25.40	31.41	−0.81	97.4
71	39,093.6	0.026495	965.22	1,035.80	−70.58	32.18	−2.19	93.2
72	35,851.0	0.029543	1,070.18	1,059.15	11.02	32.54	0.34	101.0
73	26,458.1	0.032912	897.74	870.79	26.96	29.51	0.91	103.1
74	26,426.6	0.036631	966.37	968.04	−1.66	31.11	−0.05	99.8
75	18,955.8	0.040733	789.31	772.12	17.19	27.79	0.62	102.2
76	17,735.7	0.045251	805.60	802.56	3.04	28.33	0.11	100.4
77	16,940.3	0.050223	812.70	850.80	−38.10	29.17	−1.31	95.5
78	16,884.1	0.055689	935.83	940.25	−4.42	30.66	−0.14	99.5
79	15,010.8	0.061690	906.50	926.01	−19.51	30.43	−0.64	97.9
80	12,906.2	0.068271	891.67	881.12	10.55	29.68	0.36	101.2
81	11,583.3	0.075482	893.10	874.32	18.78	29.57	0.64	102.1
82	10,082.0	0.083372	843.59	840.56	3.03	28.99	0.10	100.4
83	7,842.4	0.091998	754.20	721.49	32.71	26.86	1.22	104.5
84	6,926.7	0.101417	756.35	702.48	53.87	26.50	2.03	107.7
85	5,831.1	0.111691	630.51	651.28	−20.77	25.52	−0.81	96.8
86	4,634.9	0.122884	523.73	569.56	−45.83	23.87	−1.92	92.0
87	3,747.5	0.135066	531.36	506.17	25.19	22.50	1.12	105.0
88	2,567.0	0.148309	379.10	380.71	−1.61	19.51	−0.08	99.6
89	2,037.3	0.162690	302.99	331.45	−28.47	18.21	−1.56	91.4
90	1,659.4	0.178289	289.92	295.85	−5.93	17.20	−0.34	98.0
91	1,144.6	0.195190	233.10	223.41	9.69	14.95	0.65	104.3
Totals	9,844,448.3		47,795.80	47,795.82	−0.02			100.0

Table 1.17. Details of graduation for females durations 2+.

Age x	R_x	μ_x	A_x	E_x	Dev_x	$(V_x)^{1/2}$	z_x	100A/E
17	1,438.6	0.000169	1	0.24				
18	3,004.9	0.000175	1	0.53				
19	7,489.1	0.000182	1	1.36				
20	13,761.4	0.000189	3	2.60				
21	22,677.2	0.000198	5	4.48				
17–21	48,371.2	0.000191	11	9.22	1.78	3.04	0.59	119.4
22	32,217.1	0.000207	5	6.67	−1.67	2.58	−0.65	75.0
23	40,989.9	0.000217	7	8.90	−1.90	2.98	−0.64	78.6
24	48,532.7	0.000229	8	11.09	−3.09	3.33	−0.93	72.1
25	56,384.8	0.000241	16	13.60	2.40	3.69	0.65	117.7
26	65,565.9	0.000255	12	16.73	−4.73	4.09	−1.16	71.7
27	74,324.1	0.000271	21	20.12	0.88	4.49	0.20	104.4
28	82,633.1	0.000288	18	23.79	−5.79	4.88	−1.19	75.7
29	89,886.1	0.000307	24	27.59	−3.59	5.25	−0.68	87.0
30	94,863.0	0.000328	31	31.11	−0.11	5.58	−0.02	99.6
31	98,774.2	0.000351	27	34.71	−7.71	5.89	−1.31	77.8
32	102,439.6	0.000377	32	38.65	−6.65	6.22	−1.07	82.8
33	106,179.3	0.000406	44	43.11	0.89	6.57	0.14	102.1
34	110,276.6	0.000438	60	48.28	11.72	6.95	1.69	124.3
35	114,046.4	0.000473	46	53.95	−7.95	7.35	−1.08	85.3
36	118,249.1	0.000512	66	60.56	5.44	7.78	0.70	109.0
37	122,599.9	0.000555	56	68.09	−12.09	8.25	−1.47	82.2
38	128,432.3	0.000603	65	77.50	−12.50	8.80	−1.42	83.9
39	134,074.3	0.000657	98	88.03	9.97	9.38	1.06	111.3
40	139,153.1	0.000715	124	99.56	24.44	9.98	2.45	124.5
41	144,206.4	0.000781	122	112.59	9.41	10.61	0.89	108.4
42	149,323.3	0.000853	125	127.39	−2.39	11.29	−0.21	98.1
43	156,880.6	0.000933	155	146.42	8.58	12.10	0.71	105.9
44	165,740.6	0.001022	175	169.42	5.58	13.02	0.43	103.3
45	169,793.1	0.001121	216	190.28	25.72	13.79	1.86	113.5
46	167,221.0	0.001230	218	205.65	12.35	14.34	0.86	106.0
47	162,429.6	0.001351	268	219.40	48.60	14.81	3.28	122.2
48	153,393.6	0.001485	213	227.75	−14.75	15.09	−0.98	93.5
49	144,497.6	0.001633	249	236.00	13.00	15.36	0.85	105.5
50	137,280.5	0.001798	253	246.80	6.20	15.71	0.39	102.5
51	129,184.6	0.001980	242	255.81	−13.81	15.99	−0.86	94.6
52	123,498.6	0.002182	275	269.51	5.49	16.42	0.33	102.0
53	121,399.4	0.002406	307	292.12	14.88	17.09	0.87	105.1
54	120,374.6	0.002654	329	319.53	9.47	17.88	0.53	103.0
55	116,525.9	0.002930	333	341.36	−8.36	18.48	−0.45	97.6
56	110,757.9	0.003234	382	358.23	23.77	18.93	1.26	106.6
57	104,619.1	0.003572	340	373.71	−33.71	19.33	−1.74	91.0

Table 1.17. (Continued).

Age x	R_x	μ_x	A_x	E_x	Dev_x	$(V_x)^{1/2}$	z_x	100A/E
58	97,828.4	0.003946	368	386.07	−18.07	19.65	−0.92	95.3
59	89,950.8	0.004361	382	392.29	−10.29	19.81	−0.52	97.4
60	74,586.1	0.004821	330	359.57	−29.57	18.96	−1.56	91.8
61	62,276.8	0.005330	302	331.95	−29.95	18.22	−1.64	91.0
62	56,357.6	0.005895	332	332.22	−0.22	18.23	−0.01	99.9
63	50,300.6	0.006520	319	327.98	−8.98	18.11	−0.50	97.3
64	43,332.1	0.007214	299	312.58	−13.58	17.68	−0.77	95.7
65	34,219.1	0.007982	277	273.13	3.87	16.53	0.23	101.4
66	28,227.1	0.008833	237	249.34	−12.34	15.79	−0.78	95.1
67	25,149.6	0.009777	227	245.88	−18.88	15.68	−1.20	92.3
68	22,799.3	0.010822	208	246.74	−38.74	15.71	−2.47	84.3
69	20,595.0	0.011981	247	246.74	0.26	15.71	0.02	100.1
70	18,508.7	0.013265	237	245.51	−8.51	15.67	−0.54	96.5
71	16,937.3	0.014688	252	248.77	3.23	15.77	0.21	101.3
72	15,228.1	0.016264	245	247.67	−2.67	15.74	−0.17	98.9
73	12,948.4	0.018012	219	233.22	−14.22	15.27	−0.93	93.9
74	10,546.8	0.019948	220	210.39	9.61	14.50	0.66	104.6
75	8,372.3	0.022094	215	184.97	30.03	13.60	2.21	116.2
76	7,189.9	0.024472	162	175.95	−13.95	13.26	−1.05	92.1
77	6,841.7	0.027107	197	185.46	11.54	13.62	0.85	106.2
78	6,567.8	0.030027	197	197.21	−0.21	14.04	−0.02	99.9
79	6,099.6	0.033263	210	202.89	7.11	14.24	0.50	103.5
80	5,374.3	0.036849	174	198.04	−24.04	14.07	−1.71	87.9
81	4,723.1	0.040823	219	192.81	26.19	13.89	1.89	113.6
82	4,097.1	0.045227	192	185.30	6.70	13.61	0.49	103.6
83	3,405.6	0.050108	198	170.65	27.35	13.06	2.09	116.0
84	2,693.7	0.055516	160	149.54	10.46	12.23	0.86	107.0
85	1,832.8	0.061510	107	112.74	−5.74	10.62	−0.54	94.9
86	1,289.5	0.068152	95	87.88	7.12	9.37	0.76	108.1
87	1,007.4	0.075512	64	76.07	−12.07	8.72	−1.38	84.1
88	765.6	0.083668	74	64.06	9.94	8.00	1.24	115.5
89	573.6	0.092707	62	53.18	8.82	7.29	1.21	116.6
Totals	4,925,744.9		12,000	12,000.01	−0.01			100.0

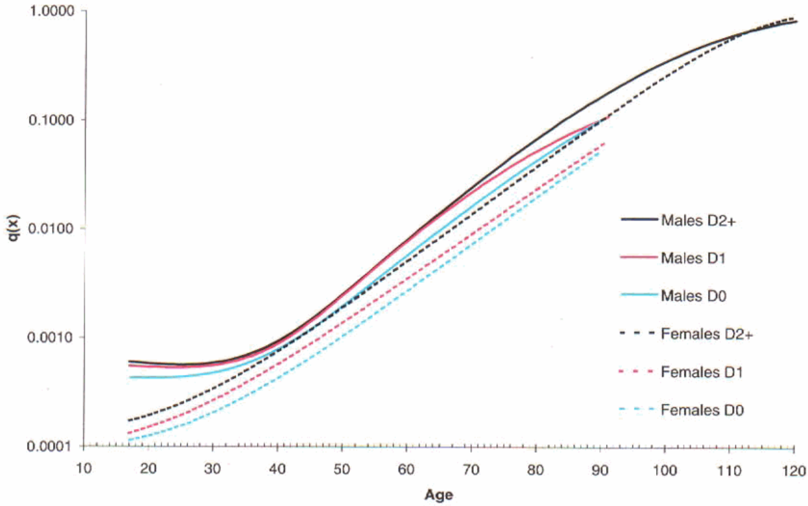

Figure 1.1. Permanent assurances, values of $q(x)$.

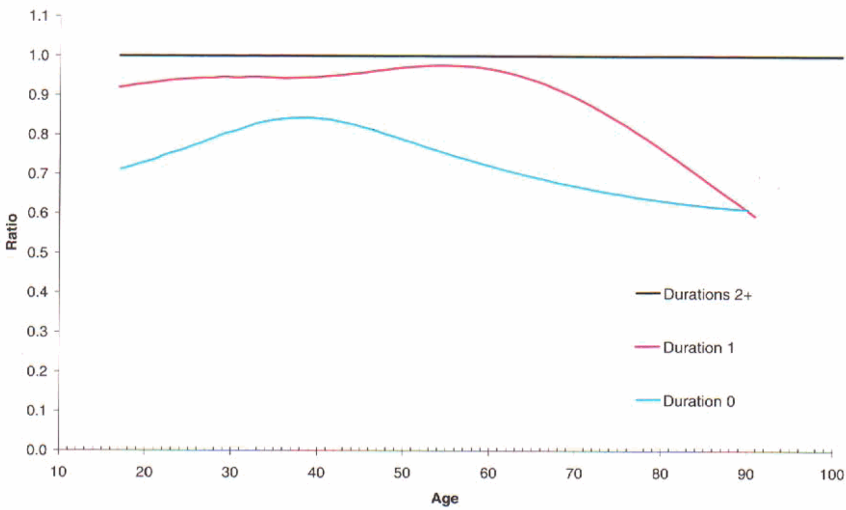

Figure 1.2. Ratios of $q(x)$ to those for durations 2+, males.

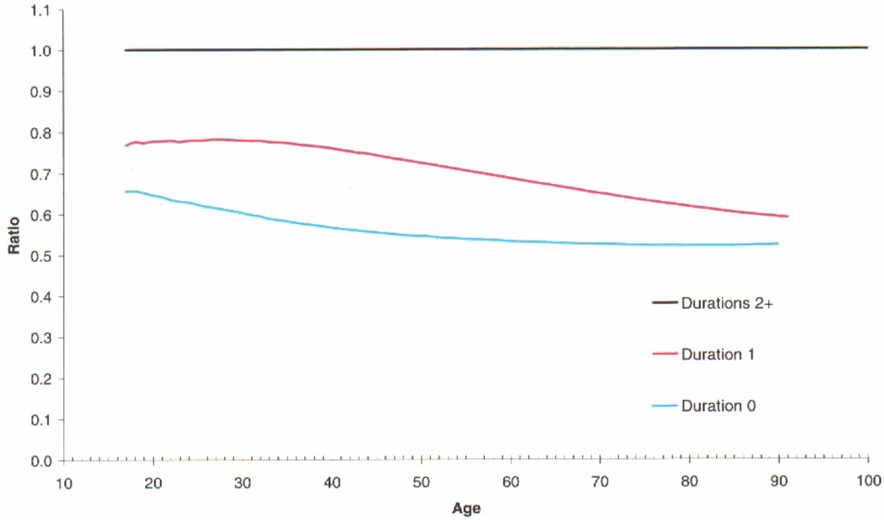

Figure 1.3. Ratios of $q(x)$ to those for durations 2+, females.

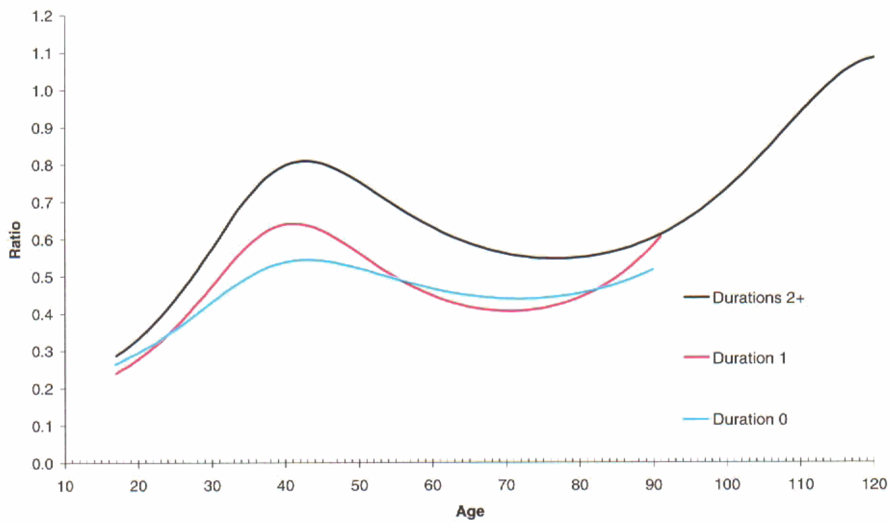

Figure 1.4. Ratios of $q(x)$ for females to those for males.

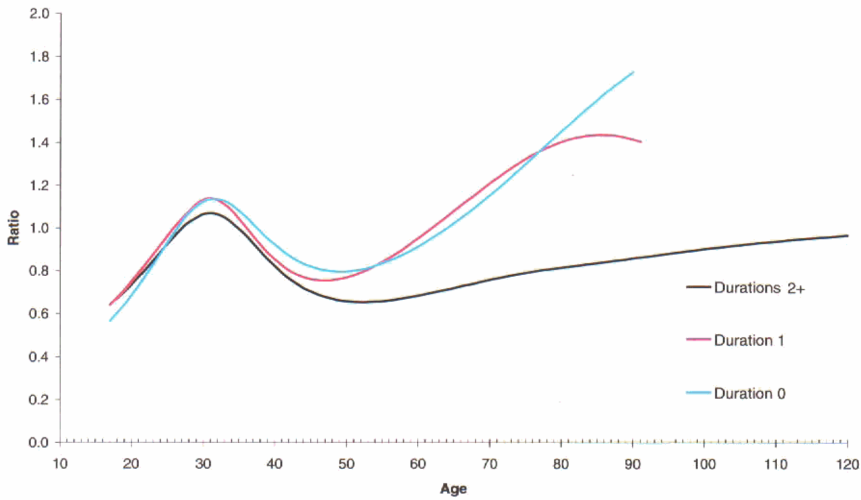

Figure 1.5. Ratios of $q(x)$ for males for 1991–94 to those of AM80.

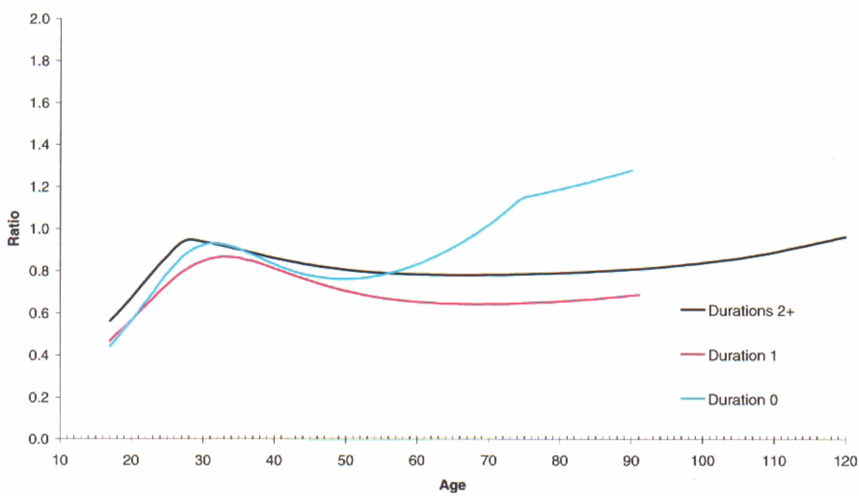

Figure 1.6. Ratios of $q(x)$ for females for 1991–94 to those of AF80.

2. IMMEDIATE ANNUITANTS, MALES AND FEMALES, LIVES AND AMOUNTS

2.1 *Introduction*

2.1.1 The investigations into the mortality of immediate annuitants, once one of the most important of the CMI Bureau's investigations, are now relatively small. The exposed to risk for both males and females has reduced since the last graduation exercise in 1979–82, as can be seen from Table 2.1, which also shows the corresponding figures (for lives only) for the five years 1921–25, the first experience published under the new permanent investigation. It can be seen that the experience for 1991–94 is smaller than that for 1921–25, even allowing for the extra year's exposure in the earlier investigation.

2.1.2 It will be seen below that the mortality of immediate annuitants (by lives) is no longer lower than that of permanent assurances, as it used to be. For males it is near enough the same, for females rather higher. Why this should be deserves some consideration of the class of person who nowadays buys a purchased life annuity, especially one with no guaranteed period. One might speculate that one of the possible reasons for the purchase of such an annuity is to provide for a lifetime income left as a legacy; the executors of a will with such a provision may prefer to purchase an annuity rather than to keep a trust alive for possibly many years, and, in these circumstances, the state of health of the beneficiary may not be taken into consideration.

2.1.3 The bulk of the data is of course at older ages, as shown in Table 2.2, and for both sexes it is concentrated into the ages 70 to 100, though there is a small amount of rather implausible data at very young ages. The experience for duration 0, for both sexes, is quite small, but the traditional method of using one year's selection has been maintained on this occasion. It will be seen that the graduation of the duration 0 data is necessarily rather tentative and relies heavily on the graduation for durations 1 and over (durations 1+).

2.1.4 The average amounts per life are much higher than in 1979–82 as might be expected. The increase is much the same for both males and females, as shown in Table 2.3.

2.2 *Males, lives*

2.2.1 We consider first the data for males, lives, durations 1+, for which there were 2,886 deaths. First, the data were graduated using a variety of GM(r,s) formulae, with the results as shown in Table 2.4. A GM(0,2) formula gives as good a fit as any higher order formula. However, the values of q_x at low ages were unreasonable, and it was desirable to try a different approach.

2.2.2 The experience was therefore compared with the graduated rates for permanent assurances, males, durations 2+, using the rates as fitted to the data without variance ratios. (These rates are very close to, but not identical with, the fitted rates for permanent assurances, males, durations 2+ with variance ratios, as shown in part 1 of this report.) The value of 100A/E was 98.59, and the fit was quite satisfactory. It was therefore decided to adopt these graduated rates as the rates for immediate annuitants, males, durations 1+. Details of the graduation statistics are shown in Table 2.5 and specimen values of q_x are shown in Table 2.6. Note that standard errors of the estimates of the parameter values and of the values of q_x are not available with this method of fitting the rates.

2.2.3 We now consider the data for males, lives, duration 0. With only 104 deaths it is difficult to fit an independent graduation. Various orders of GM(r,s) formula gave almost identical values of the log likelihood and of χ^2. When the data were compared with the rates adopted for durations 1+, the resulting value of 100A/E was 73.801. If a GM(r,s) formula is modified by multiplying all values of μ_x by a constant, k, the resulting parameters, denoted by *, are modified as follows: $a_i^* = k.a_i$ for all i; $b_1^* = b_1 + \ln k$; $b_i^* = b_i$ for $i \geq 2$. The graduated values of μ_x for duration 0 were therefore taken as 73.801% of those for durations 1+; the fit was reasonably satisfactory, although the value of χ^2 is rather on the high side. The usual details are given in Tables 2.5 and 2.6.

2.3 *Males, amounts*

2.3.1 We now consider the data for males amounts. As with the lives data, for durations 1+, the various GM(r,s) formulae tried show very similar values for the log likelihood and for χ^2, so the simplest formula, GM(0,2), would appear to be the best if we had no other information. However, when we compare the data for amounts, durations 1+ with the rates adopted for lives, durations 1+ (the same as those for permanent assurances, males, durations 2+, without variance ratios), we find a value of 100A/E of 95.344, and not a bad fit. However, the fit can be improved a little by taking the values of μ_x for amounts, durations 1+ as 95.344% of those for lives, durations 1+. The usual details are shown in Tables 2.5 and 2.6. Note that a high value of χ^2 is not unusual for amounts data.

2.3.2 For amounts, duration 0 a similar investigation led to the use of the values of μ_x for amounts, durations 1+ multiplied by 0.81786; this is equivalent to the lives, durations 1+ values multiplied by 0.77978. Note that the amounts data for duration 0 shows higher mortality than the lives data for duration 0, by about 5%, whereas for durations 1+ the experience by amounts is about 5%

lower than that for lives. There are no conspicuously large amounts at any one age that might account for this, but with only 104 deaths in the lives data, random fluctuations mean that such differences should not be taken as significant. Indeed the amounts data at neither duration is very significantly different from that of the lives, and separate tables would hardly be justified. The usual details of the graduations are shown in Tables 2.5 and 2.6.

2.4 *Females, lives*

2.4.1 We now consider the experience for females, starting with lives, durations 1+, which, with 5,857 deaths (omitting ages 10 to 16) is the largest part of the experience for immediate annuitants. When the data is compared with the graduated rates for permanent assurances, females, durations 2+, the value of 100A/E is 130.18, so there is no justification for using these rates, as was done for the males. But it is notable that the mortality rates for female immediate annuitants are now so much higher than those for permanent assurances.

2.4.2 A variety of GM(r, s) formulae were fitted. The results are shown in Table 2.7. The most satisfactory formula was GM(1,2), and this was an adequate fit. Higher order formulae showed better values of the log likelihood, but were of an unsuitable shape. However, with this GM(1,2) formula the mortality rates for females rose above those for males above age 100, so experiments with a GM(1,3) formula and various values of b_3 were tried, allowing the other parameters to be optimised. A negative value of b_3 reduces the values of μ_x at higher ages. However, it increased the values of μ_x at young ages unreasonably, so it was necessary also to fix the value of a_1 at a suitable level, optimising on b_1 and b_2. The chosen values were:

$100a_1$	0.03
b_3	−0.9

The resulting GM(1,3) formula gave a satisfactory fit, rather better than that for GM(1,2) alone. The usual statistics are shown in Tables 2.9 and 2.10.

2.4.3 The experience for females, lives, duration 0 proved difficult. There were only 146 deaths, and each GM(r, s) formula tried gave similar values for the log likelihood and for χ^2. However, none was a clearly good fit. When the graduated values of μ_x for durations 1+ are applied, the resulting value of 100A/E is 71.724, but this still gives a rather poor fit. Nevertheless it seemed to provide the most reasonable solution, so the values of μ_x for lives, durations 1+ were multiplied by 0.71724. This graduation is recommended. The mortality rates lie below those for males, duration 0 throughout. The usual statistics are shown in Tables 2.9 and 2.10.

2.5 *Females, amounts*

2.5.1 The experience for females, amounts, durations 1+ is considered next. A variety of GM(r,s) formulae were fitted, the statistics for which are shown in Table 2.8. A GM(1,2) formula fitted reasonably, but as for lives, the mortality rates rose above those for males at high ages. The same process as for lives was therefore used, fitting the values of a_1 and b_3 as:

$100a_1$	0.04
b_3	−1.5

The resulting rates are generally lower than for females, lives, durations 1+, but are higher at ages up to 39 and from 87 upwards. The usual statistics are shown in Tables 2.9 and 2.10. The overall level of mortality is almost the same as that of lives, durations 1+, but the fit of these rates would not be satisfactory.

2.5.2 For females, amounts, duration 0, the best procedure seemed to be, as before, to use a fixed multiple of the values of μ_x for amounts, durations 1+, in this case 82.226%. The fit is reasonable. The usual statistics are shown in Tables 2.9 and 2.10.

2.6 *Comparisons*

2.6.1 In Table 2.11 are shown ratios comparing the rates (q_x) for duration 0 with those for durations 1+. Note that, even when μ_x for duration 0 is taken as a fraction of μ_x for durations 1+, (*a*) the ratios of the values of q_x are slightly irregular, because the values of q_x are rounded to six decimal places, which at young ages is only three significant figures and (b) the ratios turn upwards at higher ages because, as the value of μ_x rises, the effect on q_x is not linear. These ratios are graphed in Figure 2.1.

2.6.2 In Table 2.12 are shown ratios comparing the rates for amounts and for lives. Note that, for males, the rates for amounts duration 0 are higher than those for lives throughout, whereas for females at low ages and high ages the rates for amounts are higher than those for lives, for both durations. These ratios are graphed in Figure 2.2.

2.6.3 In Table 2.13 are shown ratios comparing the rates for the sexes. Note that the rates for females durations 1+ rise above those for males, by a very small amount, for a few ages above 100. This result is a feature of the graduation rather than the data. These ratios are graphed in Figure 2.3. Note that the ratios for amounts, duration 0 and durations 1+ are very close, as can be seen on the graph, but are not identical.

2.6.4 In Table 2.14 are shown ratios comparing the rates for lives for 1991–94 with the corresponding rates for the IM80 and IF80 tables projected to calendar year 1992. Note that the new rates are neither consistently lower nor consistently higher than the projected rates. These ratios are graphed in Figure 2.4.

2.7 *The proposed tables*

2.7.1 Values of q_x for the proposed tables for immediate annuitants are shown in Appendix A in Table A6 for males and in Table A7 for females. As in the IM80 and IF80 tables, the rates for duration 0 are stopped at age 100.

Table 2.1. Immediate annuitants, males and females, lives and amounts, durations 0 and 1+: comparison of (central) exposed to risk and deaths for 1991–94, for 1979–82 and for the five years 1921–25 (lives only).

	1979–82	1991–94	1921–25
Males			
Lives			
Duration 0			
Central exposed	2,933.5	2,933.8	4,001.0
Deaths	122	104	123
Durations 1+			
Central exposed	61,503.5	35,689.5	49,121.5
Deaths	4,771	2,886	3,350
Amounts £			
Duration 0			
Central exposed	3,463,312.0	8,590,467.4	
Deaths	174,875	451,992	
Durations 1+			
Central exposed	45,392,287.5	52,612,320.8	
Deaths	3,857,585	4,181,932	
Females			
Lives			
Duration 0			
Central exposed	3,967.0	4,033.3	9,634.5
Deaths	154	146	205
Durations 1+			
Central exposed	142,137.5	66,470.3	153,625.0
Deaths	9,789	5,863	7,738
Amounts £			
Duration 0			
Central exposed	4,567,483.0	13,099,689.2	
Deaths	201,549	715,195	
Durations 1+			
Central exposed	79,089,613.0	97,571,461.7	
Deaths	5,342,282	8,150,260	

Table 2.2. Age ranges.

	Range of data	Exposed ≥ 100	Deaths ≥ 10
Males			
Duration 0	19–100	65–66	84
Durations 1+	22–107	61–96	67–100
Females			
Duration 0	32 107	71–89	None
Durations 1+	10–108	60–101	70–104

Table 2.3. Average amounts per life, 1979–82 and 1991–94.

	1979–82	1991–94
Males		
Duration 0	£1,180.61	£2,928.10
Durations 1+	£738.04	£1,474.17
Females		
Duration 0	£1,151.37	£3,247.88
Durations 1+	£556.43	£1,467.90

Table 2.4. Values of log likelihood and of χ^2 for graduation of males, lives, durations 1+ (age range used: 22–107).

	GM(0,2)	GM(0,3)	GM(1,2)	GM(0,4)	GM(1,3)	GM(2,2)	GM(2,3)
−Log likelihood	9,339.4	9,339.2	9,339.1	9,337.6	9,337.2	9,337.2	9,337.1
χ^2	34.4	34.0	34.5	34.2	33.6	32.8	33.2

Table 2.5. Immediate annuitants, males, lives and amounts, durations 0 and 1+: statistics for graduations of $\mu_x = \mathrm{GM}(r, s)$.

	Lives		Amounts	
Duration:	0	1–	0	1+
Formula	GM(2,3)	GM(2,3)	GM(2,3)	GM(2,3)
Basis: Permanent assurances, males, durations 2–, times a factor:				
$100a_1$	0.010649	0.014429	0.011251	0.013757
$100a_2$	−0.029980	−0.040629	−0.031682	−0.038737
b_1	−4.703659	−4.399861	−4.648604	−4.447540
b_2	5.568973	5.568973	5.568973	5.568973
b_3	−0.654909	−0.654909	−0.654909	−0.654909
Sign test: p(pos)	0.4018	0.3179	0.2517	0.2148
Runs test: p(runs)	0.9748	0.8081	0.2966	0.4928
K–S test: $p(KS)$	0.9996	0.8438	0.0303	0.0073
Serial correlation test:				
T-ratio 1	−2.10	−1.35	−0.63	1.01
T-ratio 2	0.38	0.68	1.17	−0.71
T-ratio 3	−0.56	0.22	−0.58	1.12
χ^2 test:				
χ^2	25.37	37.75	80.16	157.95
Degrees of freedom	11	35	15	35
$p(\chi^2)$	0.0080	0.34	0.000000	0.000000

Note that the method of graduation does not permit the calculation of the standard errors (and hence T-ratios) of estimates of the parameter values.

Table 2.6. Immediate annuitants, males, lives and amounts, durations 0 and 1+: specimen values of q_x.

	Lives		Amounts	
Duration:	0	1+	0	1+
Formula	GM(2,3)	GM(2,3)	GM(2,3)	GM(2,3)
Age 20	0.000423	0.000573	0.000447	0.000546
Age 30	0.000438	0.000593	0.000463	0.000566
Age 40	0.000697	0.000945	0.000737	0.000901
Age 50	0.001852	0.002508	0.001956	0.002392
Age 60	0.005925	0.008019	0.006259	0.007647
Age 70	0.018382	0.024826	0.019412	0.023684
Age 80	0.051702	0.069406	0.054547	0.066284
Age 90	0.128304	0.169777	0.135053	0.162554
Age 100	0.273933	0.351927	0.286970	0.338706
Age 110	0.489381	0.597771	0.508441	0.580348

Note that the method of graduation does not permit the calculation of the standard errors of estimates of the values of q_x.

Table 2.7. Values of log likelihood and of χ^2 for graduation of females, lives, durations 1+ (age range used: 17–108).

	GM(0,2)	GM(0,3)	GM(1,2)	GM(0,4)	GM(1,3)	GM(2,2)
−Log likelihood	18,359.1	18,354.6	18,359.0	18,344.7	18,345.6	18,354.1
χ^2	91.3	87.1	91.4	75.7	77.8	86.7

Table 2.8. Values of log likelihood and of χ^2 for graduation of females, amounts, durations 1+ (age range used: 17–108).

	GM(0,2)	GM(0,3)	GM(1,2)	GM(0,4)	GM(1,3)	GM(2,2)
−Log likelihood	17,567.6	17,560.6	17,567.3	17,549.6	17,550.3	17,556.4
χ^2	156.3	152.5	160.5	140.5	141.9	146.7

Table 2.9. Immediate annuitants, females, lives and amounts; durations 0 and 1+: statistics for graduations of $\mu_x = \text{GM}(r,s)$.

	Lives		Amounts	
Duration:	0	1+	0	1+
Formula	GM(1,3)	GM(1,3)	GM(1,3)	GM(1,3)
Factor	0.71724 times Lives		0.82226 times Amounts	
$100a_1$	0.021517	0.03	0.032890	0.04
T-ratio				
b_1	−5.597708	−5.265363	−6.378326	−6.182627
T-ratio		−128.9		−140.1
b_2	6.683129	6.683129	8.027676	8.027676
T-ratio		65.1		70.9
b_3	−0.9	−0.9	−1.5	−1.5
Sign test: p(pos)	0.3238	0.6742	0.2517	0.7388
Runs test: p(runs)	0.5467	0.0238	0.4800	0.9114
K–S test: $p(KS)$	0.1548	0.8126	0.2107	0.1718
Serial correlation test:				
T-ratio 1	0.14	1.06	−1.33	−0.08
T-ratio 2	1.51	−0.22	0.95	−1.18
T-ratio 3	−0.12	−0.14	−0.79	−1.27
χ^2 test:				
χ^2	33.94	87.37	64.71	153.81
Degrees of freedom	15	40	16	35
$p(\chi^2)$	0.0035	0.000022	0.000000	0.000000

Note that the method of graduation for duration 0 does not permit the calculation of the standard errors (and hence T-ratios) of estimates of the parameter values.

Table 2.10. Immediate annuitants, females, lives and amounts, durations 0 and 1+: specimen values of q_x and percentage standard errors.

	Lives		Amounts	
Duration:	0	1+	0	1+
Formula	GM(1,3)	GM(1,3)	GM(1,3)	GM(1,3)
Age 20	0.000217	0.000303	0.000329	0.000400
Percentage s.e.		0.04		0.00
Age 30	0.000230	0.000321	0.000331	0.000402
Percentage s.e.		0.27		0.03
Age 40	0.000310	0.000432	0.000352	0.000429
Percentage s.e.		1.25		0.30
Age 50	0.000727	0.001014	0.000540	0.000656
Percentage s.e.		2.89		1.73
Age 60	0.002613	0.003642	0.001815	0.002207
Percentage s.e.		3.76		3.63
Age 70	0.009917	0.013799	0.008543	0.010381
Percentage s.e.		3.99		4.24
Age 80	0.033910	0.046960	0.035680	0.043224
Percentage s.e.		3.98		4.30
Age 90	0.099302	0.135683	0.116540	0.139889
Percentage s.e.		3.80		4.10
Age 100	0.240692	0.318800	0.283964	0.333841
Percentage s.e.		3.36		3.59
Age 110	0.466470	0.583518	0.507942	0.577873
Percentage s.e.		2.56		2.78

Note that the method of graduation for duration 0 does not permit the calculation of the standard errors of estimates of the values of q_x.

Table 2.11. Immediate annuitants: ratios of values of q_x in proposed tables: comparison of duration 0 and durations 1+ (duration 0 divided by durations 1+).

	Males		Females	
Age	Lives	Amounts	Lives	Amounts
20	0.7382	0.8187	0.7162	0.8225
25	0.7381	0.8178	0.7175	0.8204
30	0.7386	0.8180	0.7165	0.8234
35	0.7385	0.8178	0.7175	0.8215
40	0.7376	0.8180	0.7176	0.8205
45	0.7381	0.8181	0.7173	0.8217
50	0.7384	0.8177	0.7170	0.8232
55	0.7385	0.8182	0.7170	0.8229
60	0.7389	0.8185	0.7175	0.8224
65	0.7394	0.8188	0.7179	0.8226
70	0.7404	0.8196	0.7187	0.8229
75	0.7421	0.8209	0.7199	0.8239
80	0.7449	0.8229	0.7221	0.8255
85	0.7492	0.8261	0.7258	0.8283
90	0.7557	0.8308	0.7319	0.8331
95	0.7652	0.8377	0.7412	0.8404
100	0.7784	0.8473	0.7550	0.8506

Table 2.12. Immediate annuitants ratios of values of q_x in proposed tables: comparison of rates for lives and amounts (amounts divided by lives).

	Males		Females	
Age	Duration 0	Durations 1+	Duration 0	Durations 1+
20	1.0567	0.9529	1.5161	1.3201
25	1.0552	0.9522	1.4887	1.3019
30	1.0571	0.9545	1.4391	1.2523
35	1.0564	0.9540	1.3228	1.1554
40	1.0574	0.9534	1.1355	0.9931
45	1.0571	0.9537	0.9134	0.7974
50	1.0562	0.9537	0.7428	0.6469
55	1.0564	0.9534	0.6746	0.5878
60	1.0564	0.9536	0.6946	0.6060
65	1.0563	0.9538	0.7664	0.6690
70	1.0560	0.9540	0.8615	0.7523
75	1.0557	0.9544	0.9610	0.8397
80	1.0550	0.9550	1.0522	0.9204
85	1.0541	0.9560	1.1255	0.9863
90	1.0526	0.9575	1.1736	1.0310
95	1.0505	0.9595	1.1918	1.0512
100	1.0476	0.9624	1.1798	1.0472
105		0.9662		1.0240
110		0.9709		0.9903
115		0.9762		0.9558

Table 2.13. Immediate annuitants ratios of values of q_x in proposed tables: comparison of rates for males and females (females divided by males).

	Lives		Amounts	
Age	Duration 0	Durations 1+	Duration 0	Durations 1+
20	0.5130	0.5288	0.7360	0.7326
25	0.5300	0.5451	0.7477	0.7454
30	0.5251	0.5413	0.7149	0.7102
35	0.4942	0.5086	0.6188	0.6160
40	0.4448	0.4571	0.4776	0.4761
45	0.4046	0.4163	0.3496	0.3481
50	0.3925	0.4043	0.2761	0.2742
55	0.4072	0.4194	0.2600	0.2586
60	0.4410	0.4542	0.2900	0.2886
65	0.4867	0.5012	0.3531	0.3515
70	0.5395	0.5558	0.4401	0.4383
75	0.5966	0.6150	0.5431	0.5411
80	0.6559	0.6766	0.6541	0.6521
85	0.7156	0.7387	0.7641	0.7620
90	0.7740	0.7992	0.8629	0.8606
95	0.8290	0.8558	0.9405	0.9375
100	0.8787	0.9059	0.9895	0.9856
105		0.9466		1.0033
110		0.9762		0.9957
115		0.9940		0.9732

Table 2.14. Ratios of values of q_x in proposed tables for lives to those in *corresponding IM80 and IF80 tables projected to calendar year 1992, i.e.* IM80C92 and IF80C92 (1991–94 divided by Ix80C92).

	Males		Females	
Age	Duration 0	Durations 1+	Duration 0	Durations 1+
20	0.6034	0.7860	1.2616	1.3407
25	0.7694	1.0036	1.2924	1.3689
30	0.8921	1.1627	1.0599	1.1263
35	0.8385	1.0909	0.7768	0.8213
40	0.6894	0.8991	0.5962	0.6316
45	0.5874	0.7652	0.5165	0.5479
50	0.5481	0.7137	0.5174	0.5493
55	0.5484	0.7141	0.5622	0.5997
60	0.5700	0.7420	0.6367	0.6842
65	0.5967	0.7687	0.7094	0.7676
70	0.7300	0.8517	0.7799	0.8500
75	0.8730	0.9232	0.8368	0.9183
80	1.0080	0.9770	0.8715	0.9627
85	1.0398	1.0085	0.8794	0.9773
90	1.0460	1.0156	0.8688	0.9684
95	1.0274	0.9995	0.9149	1.0153
100	0.9879	0.9653	0.9335	1.0293
105		0.9214		0.9945
110		0.8795		0.9349
115		0.8691		0.8984

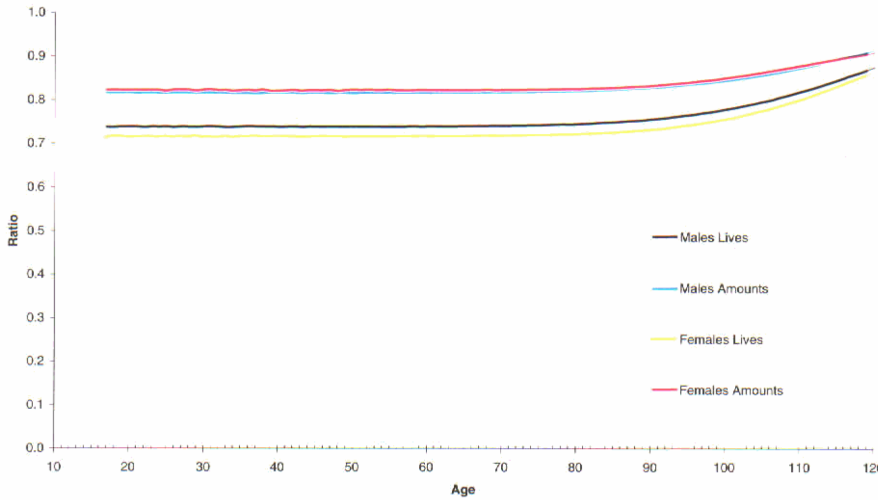

Figure 2.1. Immediate annuitants: ratios of values of $q(x)$ for duration 0 to those for durations 1+.

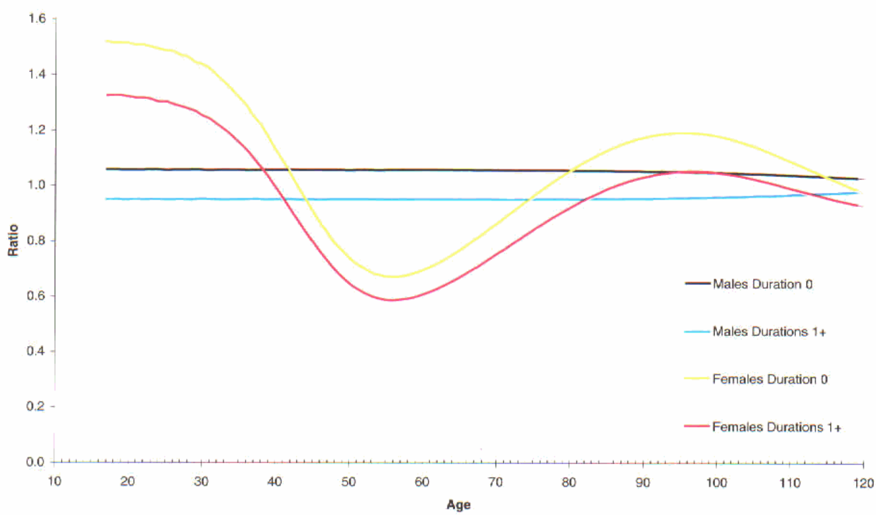

Figure 2.2. Immediate annuitants: ratios of values of $q(x)$ for amounts to those for lives.

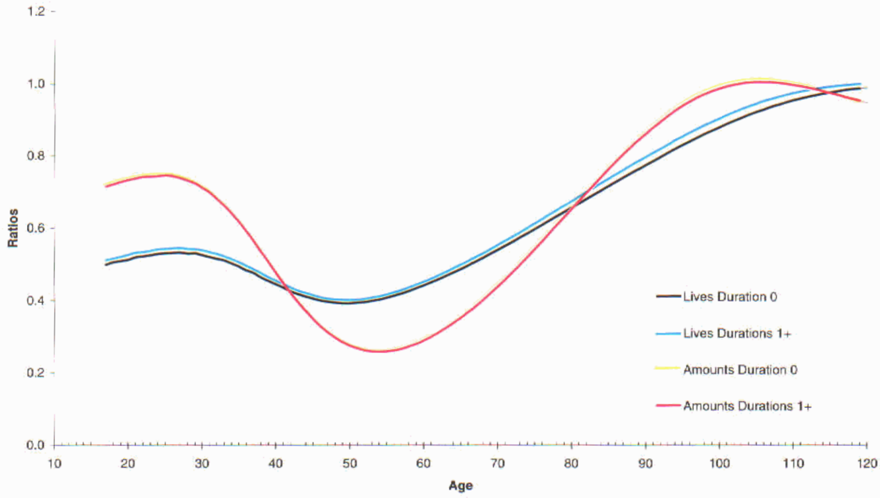

Figure 2.3. Immediate annuitants: ratios of values of $q(x)$ for females to those for males.

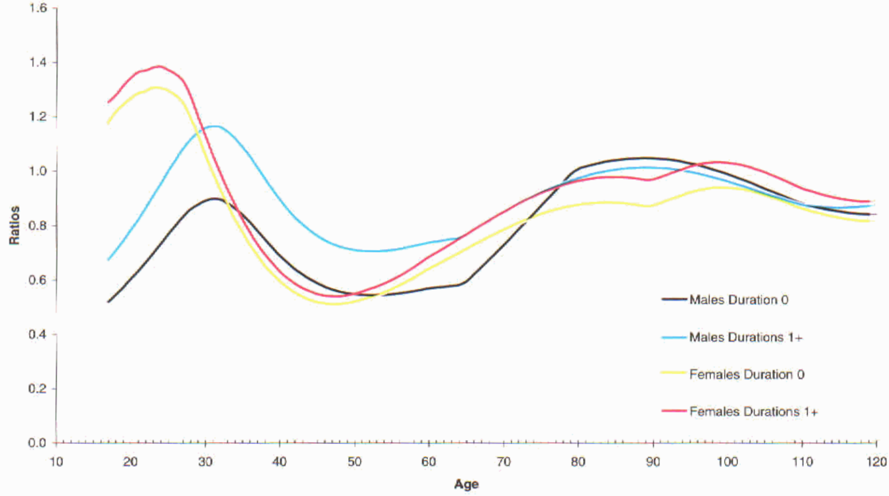

Figure 2.4. Immediate annuitants: ratios of values of $q(x)$ for 1991–94 to projected rates IM80C92 and IF80C92.

3. SELF-EMPLOYED RETIREMENT ANNUITANTS, MALES AND FEMALES

3.1 *Introduction*

3.1.1 The investigation into the mortality of those self-employed who have purchased retirement annuities has grown to be a large one. Data is gathered for both males and females, and is subdivided into two sections, deferred and vested, which together form the combined section.

3.1.2 For both sexes there has been a large increase in the exposure since 1979–82, as seen in Table 3.1, especially in the vested section. The experience for males remains much larger than that for females.

3.1.3 The age ranges for the deferred and vested sections overlap substantially in the age range 60–75, as would be expected, but there are many vested below 60 and a very few deferred above age 75, as shown in Table 3.2. In both sections there are small amounts of implausible data at the very youngest ages, below 16; and it might be questioned whether the data in the vested section at ages a little above 16 is plausible.

3.1.4 It is immediately apparent from inspection of the crude rates of mortality that the mortality in the vested sections, for both sexes, is much higher than that in the deferred at the youngest ages (below age 60), and is still rather higher between ages 60 and 75. Above 75 the combined sections are virtually all vested. The overall mortality of the combined section for both sexes has a 'normal' shape; the mortality for the deferred is almost the same as that for the combined at the youngest ages, and then runs below the combined; the mortality for the vested is well above that for the combined at the youngest ages, running into the combined at high ages. This is consistent with the self-employed choosing to retire when their health is impaired, and choosing to refrain from retiring while they are still healthy.

3.1.5 It is therefore appropriate to start by considering the graduation of the combined experiences, and then to fit the deferred and vested around the graduated rates for the combined. This procedure is based on an assumption that the combined experience contains deferred and vested in the correct proportions. If offices do not contribute correspondingly to both sections, or count lives differently in the two sections, or if many policyholders switch to non-contributing offices, or combine multiple policies in the deferred period to one policy at vesting, then these conditions may not be fulfilled. However, the mortality rates in the combined sections appear reasonably smooth, so it is at least plausible that the two sections are indeed appropriately weighted.

3.2 *Males, combined*

3.2.1 In total there are 37,456 deaths in the males combined experience. The very small amount of data below age 17 has been ignored.

3.2.2 The data is first compared with the graduated rates for permanent assurances, males, durations 2+. The value of 100A/E is 99.7, so the overall level is very similar. However, the detailed shape is different, so it is worth graduating the data separately.

3.2.3 A variety of different GM(r, s) formulae were used, including those with $r + s \leq 4$ and also GM(2,3). Details are given in Table 3.3. GM(2,3) gives the best value of the log likelihood, and provides both a good fit and a reasonable shape, so the GM(2,3) formula has been adopted. The usual details are given in Tables 3.4 and 3.5, which also show the details for the deferred and vested sections.

3.3 *Males, deferred*

3.3.1 The males deferred section is considered next. When the experience is compared with the newly graduated rates for the combined section the resulting value of 100A/E is 91.6. At low ages, where the deferred forms the vast bulk of the combined experience, the rates are necessarily very close. However, at rather higher ages, particularly from age 60 upwards, the deferred experience falls below the combined.

3.3.2 The rationale described in paragraph 3.1.4 suggests that the graduated rates for the deferred should be almost the same as those for the combined at the youngest ages, and in fact should be identical at age 17, should always lie below them, and should diverge further below at higher ages. The data effectively ceases at age 75, so rates above that age are superfluous (although details are shown to indicate where the graduated rates would go).

3.3.3 A further consideration is that it is possible, given the mortality rates for the combined, deferred and vested sections, to derive implied "forces of retirement" from the deferred section to the vested section. These must not be negative.

3.3.4 The procedure used to meet these constraints (while still fitting the experience data adequately) was as follows: the value of μ_x at age 17 in the graduated rates for the combined section is 0.00040096, and the rates for the deferred were adjusted so that the same value of μ_x at age 17 was obtained. This was done by "nudging" the rates by adjusting the value of a_1 in stages so that this equality was achieved. The value of a_2 was chosen to be the same as that for the combined section. Then, by a process of "trial and error", values for b_2 and b_3 were found so that the constraints could be met. Then the value of b_1 was found by optimising, subject to a repeated process of nudging and optimising. The resulting rates satisfied the criteria, and appear satisfactory. The implied retirement rates are positive at all ages and also increase with increasing age. The usual statistics for the mortality rates are shown in Tables 3.4, 3.5 and 3.6.

3.4 *Males, vested*

3.4.1 When the experience for the vested section for males is compared with the graduated rates for the combined section, the resulting value of 100A/E is 108.5, but the observed rates are exceptionally high at ages below 60. Since above age 75 the rates must in principle be the same as for the combined, the procedure described below was used.

3.4.2 At age 75 and above the values of μ_x (and hence of q_x) were taken as exactly the same as those for the combined section. The value of μ_x at age 75 on the combined rates was 0.038815. Only the data up to and including that for age 75 was used for the graduation of the rates below that age. The parameters were adjusted step by step by trial and error so that the value of μ_x at age 75 was reproduced exactly, and a satisfactory fit to the data below that age was achieved. The procedure was similar to that for the deferred section, with the values of a_2, b_2 and b_3 being chosen so that the constraints could be met; the value of b_1 was used for "nudging" and the value of a_1 was found by optimising.

3.4.3 The resulting rates at young ages are exceptionally high. The value of χ^2 is also high. A large part of this comes from the experience at ages 58 and 59, where the actual deaths total 156, as compared with an expected of 75.9. However, no smooth curve will accommodate such outliers. The minimum value of q_x is at age 60.

3.4.4 As noted above, the rates above age 75 were taken as exactly the same as those of the combined experience. When these are applied to the data for the vested section at ages 75 and above, they fit quite satisfactorily. Details are not shown.

3.5 *Females, combined*

3.5.1 The experience for females combined is compared with the graduated rates for females permanent assurances durations 2+, which shows 100A/E of 104.7. As with the males, the rates are broadly at the right level, but are not quite the right shape. The statistics for various GM(r,s) formulae are shown in Table 3.7. It is found that a GM(1,2) formula (a Makeham formula) fits satisfactorily. The rates from this formula rise above those for the males combined section above age 99; which might be considered an objection.

3.5.2 The usual statistics are shown in Tables 3.8 and 3.9, along with those for females deferred and vested.

3.6 *Females, deferred*

3.6.1 When the experience for the females deferred section is compared with the females combined we get a value for 100A/E of 90.2. As with the males, the experience rates run increasingly below those for the combined, but this starts at ages above about 50. In order to keep the rates consistent with those for the combined section, a procedure similar to that for males was used. A GM(1,3) formula was chosen. By trial and error suitable values of b_2 and b_3 were found. The value of a_1 was used to nudge the value of μ_{17} for the deferred so that it exactly equalled the value of μ_{17} for the combined (0.00018668). Then the value of b_1 was optimised so as to give the best fit to the data subject to the constraints. The resulting rates provide a satisfactory fit to the data, and also produce implied retirement rates that are positive at all ages (and also increase with increasing age). The usual statistics are shown in Tables 3.8 and 3.9.

3.7 *Females, vested*

3.7.1 When the experience for females vested is compared with the females combined rates, the resulting value of 100A/E is 108.5. The observed rates of mortality are, as for the males, extremely high at low ages. The same process as for males was adopted. From age 75 upwards the combined rates were used. Then the data for ages up to and including age 75 was analysed. A GM(2,3) formula was used. The parameters were adjusted step by step so that the value of μ_x at age 75 (0.024050) was reproduced exactly, and a satisfactory fit to the data below that age was achieved. Suitable values of a_2, b_2 and b_3 were chosen, the value of b_1 was nudged so that the desired value of μ_{75} was obtained and the value of a_1 was then optimised. The usual statistics are shown in Tables 3.8 and 3.9.

3.8 *Comparisons, tables and figures*

3.8.1 Various ratios are shown giving comparisons of the graduated rates for retirement annuitants among themselves and with other rates. Table 3.10 shows ratios of deferred to combined and vested to combined for both sexes. Table 3.11 shows ratios of females to males for each of the three sections. Table 3.12 shows ratios of the combined for each sex to the graduated rates for permanent assurances durations 2+.

3.8.2 Figures 3.1 and 3.2 show the values of q_x for each of the three sections, for males and females respectively. Figure 3.3 shows the ratios of the rates for females to those for males for each of the three sections. Figure 3.4 shows the ratios of the rates for the combined sections to those for the graduated tables for permanent assurances durations 2+.

3.8.3 Values of the graduated rates of mortality, q_x, at each age for the vested section are shown in Appendix A in Table A8. Rates of mortality for the deferred and combined sections have also been graduated, but these are not designated as standard tables, and are shown in Appendix B in Tables B1 for males and B2 for females.

3.9 *Age range of the table*

3.9.1 For both males and females, the amounts of exposed to risk and deaths below age 40 are small. Although values of q_x have been calculated down to age 17 it is doubtful if, in normal use, these tables should be used below age 40.

Table 3.1. Retirement annuitants, males and females, deferred and vested: comparison of (central) exposed to risk and deaths for 1991–94 and for 1979–82.

	1979 82	1991–94
Males		
Deferred		
Central exposed	2,997,376.5	5,335,263.0
Deaths	12,328	17,256
Vested		
Central exposed	221,898.0	630,827.0
Deaths	8,811	20,200
Combined		
Central exposed	3,219,274.5	5,966,090.0
Deaths	21,139	37,456
Females		
Deferred		
Central exposed	338,758.0	963,447.2
Deaths	860	1,958
Vested		
Central exposed	35,006.0	149,663.1
Deaths	692	2,695
Combined		
Central exposed	473,764.0	1,113,110.3
Deaths	1,552	4,653

Table 3.5. Retirement annuitants, males, combined, deferred and vested: statistics for graduations of $\mu_x = \mathrm{GM}(r, s)$.

Section	Combined	Deferred	Vested
Formula	GM(2,3)	GM(2,3)	GM(2,3)
Ages used	17–108	17–106	21–75*
Values of parameters at optimum point:			
$100a_1$	0.016470	0.017467	0.023761
T-ratio	0.50		1.13
$100a_2$	−0.020219	−0.020219	−5.0
T-ratio	−0.53		
b_1	−4.399325	−5.229113	−4.713208
T-ratio	−35.18	−634.9	
b_2	5.219980	4.3	6.0
T-ratio	62.12		
b_3	−0.637407	−1.24	−1.0
T-ratio	−5.48		
Sign test: p(pos)	0.5889	0.6061	0.8447
Runs test: p(runs)	0.2485	0.0512	0.1014
K–S test: $p(KS)$	0.9967	0.0533	0.0806
Serial correlation test:			
T-ratio 1	0.73	1.66	2.90
T-ratio 2	−0.67	1.27	1.29
T-ratio 3	1.46	1.88	0.65
χ^2 test:			
χ^2	118.60	64.96	162.61
Degrees of freedom	74	50	30
$p(\chi^2)$	0.000773	0.0759	0.0000

*Note that the graduated rates for vested above age 75 are assumed to be the same as the graduated rates for combined.

Table 3.2. Retirement annuitants: age ranges.

	Range of data	Exposed ≥ 100	Deaths ≥ 10
Males			
Deferred	10–106	19–76	25–75
Vested	10–108	42–94	50–95
Combined	10–108	19–94	25–95
Females			
Deferred	17–103	20–75	39 70
Vested	10–104	50–91	59–92
Combined	10–104	20–91	39–92

Table 3.3. Values of log likelihood and of χ^2 for graduation of retirement annuitants, males, combined.

	GM(0,2)	GM(0,3)	GM(1,2)	GM(0,4)	GM(1,3)	GM(2,2)	GM(2,3)
−Log likelihood	196,533.2	196,521.0	196,531.2	196,471.6	196,465.5	196,478.2	196,465.4
χ^2	258.7	256.1	245.9	141.0	119.6	140.1	118.6

Table 3.4. Values of log likelihood and of χ^2 for graduation of retirement annuitants, males, deferred.

	GM(0,3)	GM(1,2)	GM(0,4)	GM(1,3)	GM(2,2)	GM(2,3) (unconstrained)	GM(2,3) (as fitted)
−Log likelihood	109,368.8	109,364.0	109,345.5	109,342.3	109,342.4	109,341.1	109,349.1
χ^2	112.9	95.0	61.2	53.4	50.6	48.7	65.0

Table 3.6. Retirement annuitants, males, combined, deferred and vested: specimen values of q_x and percentage standard errors.

Section Formula	Combined GM(2,3)	Deferred GM(2,3)	Vested GM(2,3)
Age 20	0.000403	0.000398	0.048530
Percentage s.e.	17.92	0.05	0.41
Age 30	0.000494	0.000466	0.039017
Percentage s.e.	5.31	0.23	0.52
Age 40	0.000969	0.000912	0.029643
Percentage s.e.	2.43	0.54	0.69
Age 50	0.002741	0.002625	0.021244
Percentage s.e.	1.04	0.72	0.97
Age 60	0.008404	0.007665	0.016859
Percentage s.e.	0.69	0.77	1.23
Age 70	0.024353	0.019313	0.025328
Percentage s.e.	0.74	0.78	0.81
Age 80	0.063767	0.040250	0.066228
Percentage s.e.	0.85	0.78	0.30
Age 90	0.147491	0.068761	0.167927
Percentage s.e.	2.15	0.77	0.10
Age 100	0.294827	0.096448	0.343149
Percentage s.e.	4.81	0.76	0.04
Age 110	0.498787	0.111707	0.553955
Percentage s.e.	7.62	0.75	0.02

Table 3.7. Values of log likelihood and of χ^2 for graduation of retirement annuitants, females, combined.

	GM(0,2)	GM(0,3)	GM(1,2)	GM(0,4)	GM(1,3)	GM(2,2)
−Log likelihood	26,416.7	26,408.5	26,413.2	26,408.5	26,407.8	26,408.1
χ^2	121.8	107.3	114.6	107.0	103.7	104.5

Table 3.8. Retirement annuitants, females, combined, deferred and vested: statistics for graduations of $\mu_x = \mathrm{GM}(r,s)$.

Section	Combined	Deferred	Vested
Formula	GM(1,2)	GM(1,3)	GM(2,3)
Ages used	17–104	17–103	27–75*
Values of parameters at optimum point:			
$100a_1$	0.014000	0.016746	−0.943368
T-ratio	2.74		−31.4
$100a_2$			−5.0
T-ratio			
b_1	−4.271279	−5.497232	−4.737523
T-ratio	−244.21	−224.0	
b_2	5.378175	4.0	5.0
T-ratio	62.13		
b_3		−0.9	−1.0
T-ratio			
Sign test: p(pos)	0.5482	0.6170	0.7976
Runs test: p(runs)	0.0890	0.1135	0.5351
K–S test: $p(KS)$	0.3866	0.0400	0.2256
Serial correlation test:			
T-ratio 1	1.44	2.11	1.22
T-ratio 2	1.42	1.34	0.65
T-ratio 3	1.73	2.44	0.53
χ^2 test:			
χ^2	114.57	55.21	79.35
Degrees of freedom	65	40	18
$p(\chi^2)$	0.000146	0.0553	0.0000

*Note that the graduated rates for vested above age 75 are assumed to be the same as the graduated rates for combined.

Table 3.9. Retirement annuitants, females, combined, deferred and vested: specimen values of q_x and percentage standard errors.

Section Formula	Combined GM(1,2)	Deferred GM(1,3)	Vested GM(2,3)
Age 20	0.000208	0.000200	0.039297
Percentage s.e.	22.64	0.39	0.74
Age 30	0.000339	0.000307	0.029747
Percentage s.e.	12.19	1.08	0.98
Age 40	0.000725	0.000676	0.020476
Percentage s.e.	4.59	1.78	1.44
Age 50	0.001853	0.001777	0.012489
Percentage s.e.	2.37	2.15	2.39
Age 60	0.005155	0.004576	0.008601
Percentage s.e.	1.89	2.28	3.48
Age 70	0.014772	0.010602	0.014990
Percentage s.e.	1.58	2.32	1.98
Age 80	0.042436	0.021502	0.041499
Percentage s.e.	2.32	2.33	0.70
Age 90	0.119146	0.037831	0.097192
Percentage s.e.	3.58	2.32	0.28
Age 100	0.310422	0.057629	0.180428
Percentage s.e.	4.51	2.30	0.14
Age 110	0.663591	0.076119	0.272428
Percentage s.e.	3.94	2.28	0.08

Table 3.10. Retirement annuitants: ratios of values of q_x in proposed tables: comparison of sections.

	Males		Females	
Age	Deferred/Combined	Vested/Combined	Deferred/Combined	Vested/Combined
20	0.9876	120.4218	0.9615	188.9279
25	0.9648	102.7582	0.9219	134.8203
30	0.9433	78.9818	0.9056	87.7493
35	0.9338	52.7477	0.9087	51.9481
40	0.9412	30.5913	0.9324	28.2428
45	0.9534	15.8672	0.9544	14.2033
50	0.9577	7.7505	0.9590	6.7399
55	0.9449	3.7829	0.9375	3.1712
60	0.9121	2.0061	0.8877	1.6685
65	0.8603	1.2835	0.8121	1.1435
70	0.7930	1.0400	0.7177	1.0148
75	0.7149	1	0.6130	1
80	0.6312	1	0.5067	1
85	0.5469	1	0.4063	1
90	0.4662	1	0.3175	1
95	0.3923	1	0.2436	1
100	0.3271	1	0.1856	1
105	0.2711	1	0.1432	1
110	0.2240	1	0.1147	1
115	0.1845	1	0.0982	1

Table 3.11. Retirement annuitants: ratios of values of q_x in proposed tables: comparison of sexes.

Age	Combined Females/Males	Deferred Females/Males	Vested Females/Males
20	0.5161	0.5025	0.8097
25	0.6009	0.5742	0.7884
30	0.6862	0.6588	0.7624
35	0.7415	0.7216	0.7303
40	0.7482	0.7412	0.6908
45	0.7181	0.7188	0.6428
50	0.6760	0.6770	0.5879
55	0.6388	0.6338	0.5355
60	0.6134	0.5970	0.5102
65	0.6024	0.5686	0.5367
70	0.6066	0.5490	0.5918
75	0.6271	0.5376	0.6271
80	0.6655	0.5342	0.6655
85	0.7246	0.5384	0.7246
90	0.8078	0.5502	0.8078
95	0.9177	0.5697	0.9177
100	1.0529	0.5975	1.0529
105	1.2011	0.6343	1.2011
110	1.3304	0.6814	1.3304
115	1.3915	0.7407	1.3915

Table 3.12. Ratios of values of q_x for retirement annuitants, combined to those for permanent assurances, durations 2+.

Age	Males	Females
20	0.6924	1.0777
25	0.7527	1.0323
30	0.8373	1.0000
35	0.9434	0.9797
40	1.0342	0.9705
45	1.0846	0.9719
50	1.0929	0.9825
55	1.0761	0.9990
60	1.0476	1.0192
65	1.0154	1.0415
70	0.9826	1.0653
75	0.9506	1.0900
80	0.9201	1.1150
85	0.8917	1.1394
90	0.8663	1.1620
95	0.8451	1.1805
100	0.8293	1.1910
105	0.8206	1.1881
110	0.8205	1.1649
115	0.8297	1.1184

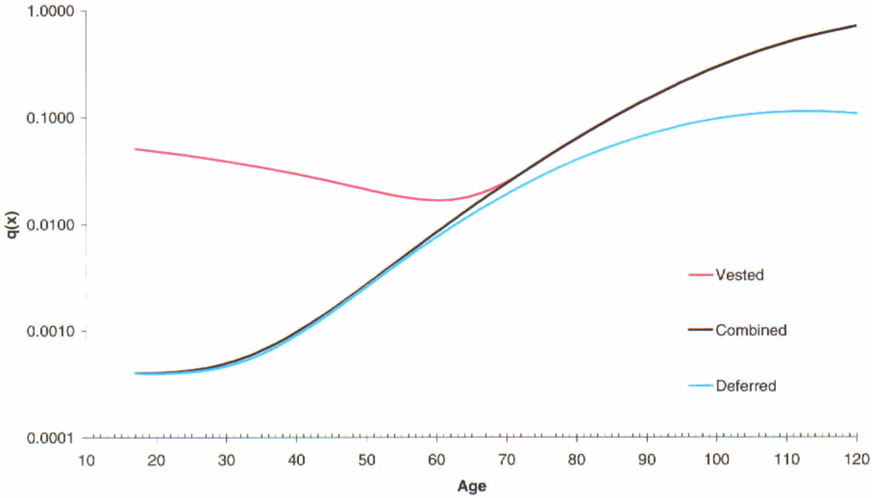

Figure 3.1. Retirement annuitants: values of $q(x)$ for males.

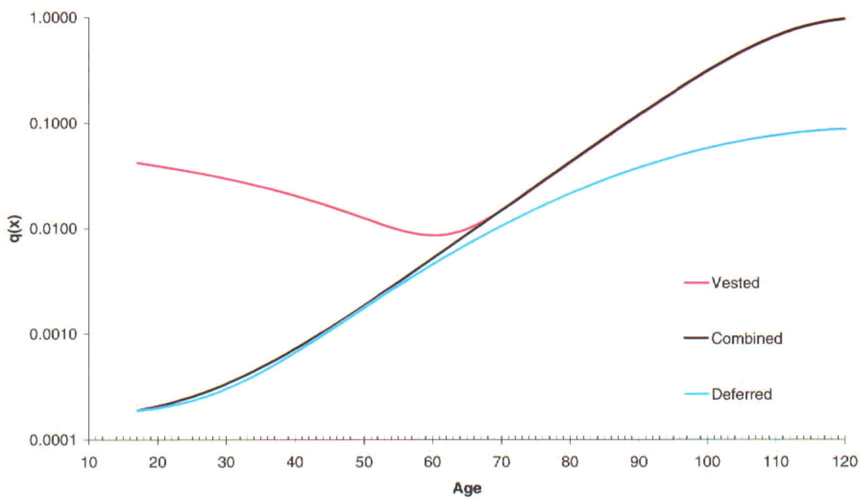

Figure 3.2. Retirement annuitants: values of $q(x)$ for females.

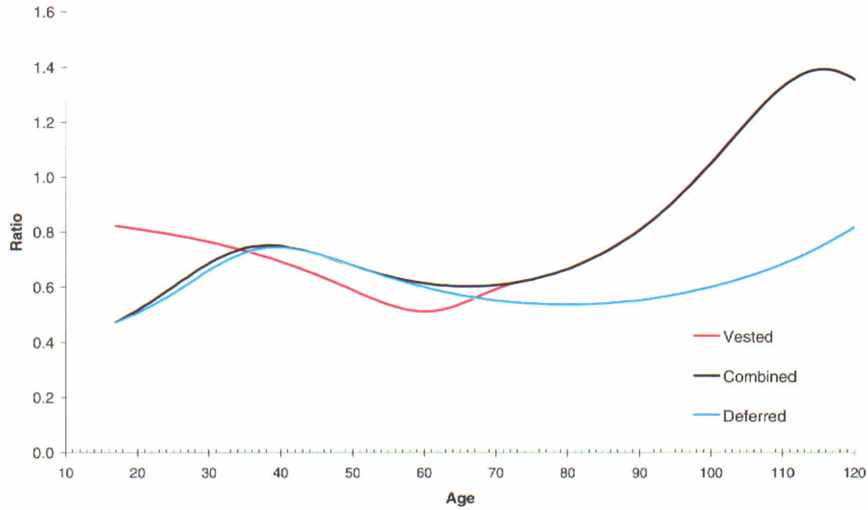

Figure 3.3. Retirement annuitants: ratios of $q(x)$ for females to those for males.

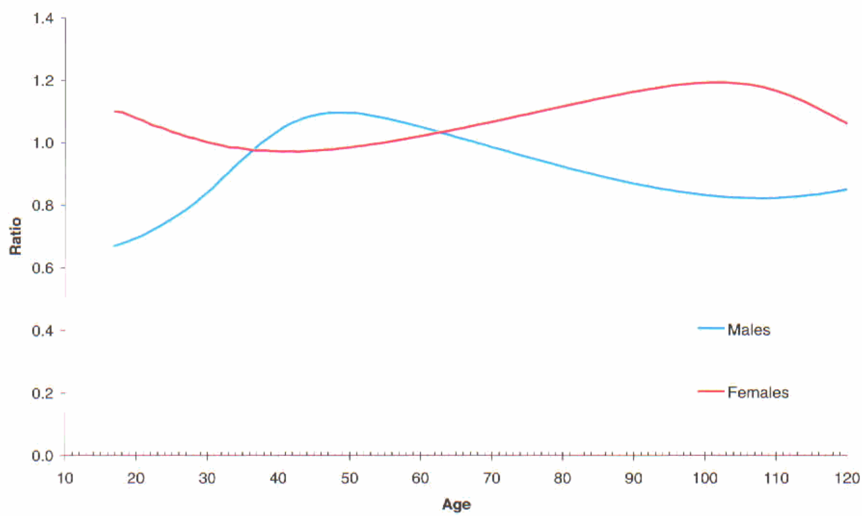

Figure 3.4. Retirement annuitants: ratios of $q(x)$ for combined to those for permanent assurances durations 2+.

4. WIDOWS OF LIFE OFFICE PENSIONERS

4.1 *Introduction*

4.1.1 The investigation into the mortality of widows of life office pensioners is one of the newer investigations carried out by the Bureau, and the experience in 1979–82 was quite small. It has increased many-fold since then, as shown in Table 4.1. There were previously only 692 deaths; this number has increased to 5,452. By contrast, the experience for widowers is still small and has not been considered in this report.

4.1.2 The bulk of the exposure is at older ages, as can be seen from Table 4.2, though there are also some younger widows. Those recorded at ages as young as 10 are presumably errors (possibly orphans), and only the data from age 17 has been used in the graduation process.

4.1.3 The investigation is carried out on an amounts basis as well as on a lives one. The average amounts per life in 1979–82 and 1991–94 are shown in Table 4.3. It can be seen that the average amount has almost doubled. This is a smaller proportionate increase than for pensioners. However, the experience was new in 1979–82, and therefore the average duration since the commencement of pension (though not necessarily the age of the pensioners) was less than in the pensioners investigation, but the impact of this on the experience is not clear.

4.2 *Comparison with pensioners' rates*

4.2.1 The experiences have been compared with the new female pensioners 1991–94 mortality rates. The results are as shown below. Although the overall level of the lives experience is similar to that of the pensioners, the overall shape is very different, with much higher rates for widows at lower ages as compared with the pensioners. The amounts experience is even further adrift.

	100A/E
Lives	101.9
Amounts	109.2

4.2.2 The experiences have also been compared with the mortality rates projected for 1992 (the centre of the 1991–94 experience quadrennium) from the tables for widows in the "80" Series tables, i.e. WL80C92 and WA80C92, using central exposures and q_x. The results are as shown below. Although the overall levels of both experiences are lower than projected, the rates for younger ages are generally higher, and a simple adjustment to the C92 rates would not be satisfactory.

	100A/E
Lives	88.0
Amounts	91.0

4.3 *The lives experience*

4.3.1 The values of the log likelihood and χ^2 for various GM(r,s) graduations are shown in Table 4.4. There is very little difference between all the formulae on this criterion. All are a tolerable shape, and all have some poor features when the fit is considered. All produce relatively high values of q_x in the 40s and 50s of age, running down to rather low values by age 20. This reflects the experience, but it would be more compatible with other tables for the values of q_x to be rather higher at age 20. This can be achieved by choosing the GM(1,2) formula with a value of $100a_1$ of 0.02, and then optimising for b_1 and b_2. The results in the usual form are shown in Tables 4.6 and 4.7.

4.4 *The amounts experience*

4.4.1 Before graduating the amounts experience the numbers of exposed to risk and actual deaths were divided by the average amount per life in the exposed to risk, £1,104.10, as noted in Table 4.3. The experience was then compared with the newly graduated rates for widows lives. The resulting value of 100A/E of 89.6 justified a separate graduation of the amounts experience.

4.4.2 The statistics for the widows amounts graduations by different GM(r,s) formulae are shown in Table 4.5. As with the lives, there is very little difference between them. All provide a reasonable fit (bearing in mind the assumption that the value of χ^2 is expected to be high), but the GM(1,3) and GM(2,2) formulae do not give a comfortable shape of curve. It was therefore decided to use the same method as for lives, i.e. to adopt a GM(1,2) formula, with a value of $100a_1$ of 0.018, and then optimising for b_1 and b_2. The results are shown in Tables 4.6 and 4.7.

4.5 *Comparisons, tables and figures*

4.5.1 Comparisons of the graduated amounts rates with the rates for lives, comparisons both with the projected rates for calendar year 1992 based on the WL80 and WA80 tables (WL80C92 and WA80C92), and comparisons of both with the graduated rates for female pensioners for 1991–94 are shown in Table 4.8.

4.5.2 The graduated rates for ages from 17 to 120 are shown in Appendix A in Table A9.

4.5.3 Graphs of the graduated rates are shown in Figure 4.1. The ratios of amounts to lives rates, for the widows and for male and female pensioners, are shown in Figure 4.2. Graphs of the rates as compared with the graduated rates for the projected rates WL80C92 and WA80C92 are shown in Figure 4.3, and ratios of the rates for widows to those for female pensioners are shown in Figure 4.4. The very high ratios of the rates for widows to those for female pensioners in the 30s and 40s of age suggest that possibly the graduated rates for the latter are too low.

Table 4.1. Widows, lives and amounts: comparison of (central) exposed to risk and deaths for 1991–94 and for 1979–82.

	1979–82	1991–94
Lives		
Central exposed	28,386.5	162,237.1
Deaths	692	5,452
Amounts £		
Central exposed	15,892,759.0	179,126,584.6
Deaths	238,438	4,279,423

Table 4.2. Widows: age ranges.

Range of data	Exposed ≥ 100	Deaths ≥ 10
10–108	33–95	56–97

Table 4.3. Widows: average amounts per life, 1979–82 and 1991–94.

1979–82	1991–94
£559.87	£1,104.10

Table 4.4. Values of log likelihood and of χ^2 for graduation of widows lives.

	GM(0,2)	GM(0,3)	GM(1,2)	GM(0,4)	GM(1,3)	GM(2,2)
−Log likelihood	22,380.0	22,379.8	22,380.0	22,379.2	22,379.7	22,379.9
χ^2	43.8	42.9	43.9	41.2	43.4	43.4

Table 4.5. Values of log likelihood and of χ^2 for graduation of widows amounts.

	GM(0,2)	GM(0,3)	GM(1,2)	GM(0,4)	GM(1,3)	GM(2,2)
−Log likelihood	16,999.3	16,998.7	16,999.3	16,997.3	16,996.9	16,998.1
χ^2	182.7	175.2	182.8	171.7	170.4	171.9

Table 4.6. Widows, lives and amounts: statistics for graduations of $\mu_x = \text{GM}(1,2)$.

Formula	Lives GM(1,2)	Amounts GM(1,2)
Values of parameters at optimum point:		
$100a_1$	0.02	0.018
T-ratio		
b_1	−3.795522	−3.921243
T-ratio	−201.02	−198.72
b_2	4.308854	4.444249
T-ratio	52.93	47.75
Sign test: p(pos)	0.7084	0.5000
Runs test: p(runs)	0.1374	0.9873
K–S test: $p(KS)$	0.9953	0.5214
Serial correlation test:		
T-ratio 1	2.13	−0.16
T-ratio 2	0.07	−0.46
T-ratio 3	−1.03	−1.29
χ^2 test:		
χ^2	43.9	181.44
Degrees of freedom	48	48
$p(\chi^2)$	0.6408	0.0000

Table 4.7. Widows, lives and amounts: specimen values of q_x and percentage standard errors.

Formula	Lives GM(1,2)	Amounts GM(1,2)
Age 20	0.000515	0.000423
Percentage s.e.	1.12	1.10
Age 30	0.000947	0.000772
Percentage s.e.	1.44	1.46
Age 40	0.001967	0.001619
Percentage s.e.	1.64	1.69
Age 50	0.004378	0.003676
Percentage s.e.	1.74	1.81
Age 60	0.010062	0.008662
Percentage s.e.	1.78	1.86
Age 70	0.023390	0.020687
Percentage s.e.	1.79	1.87
Age 80	0.054231	0.049329
Percentage s.e.	1.77	1.85
Age 90	0.123415	0.115548
Percentage s.e.	1.71	1.79
Age 100	0.267695	0.257996
Percentage s.e.	1.55	1.64
Age 110	0.521593	0.515942
Percentage s.e.	1.23	1.30

Table 4.8. Widows: ratios of values of q_x in proposed tables: comparison of lives and amounts (1991–94); comparison of both lives and amounts with the projected rates for 1992, WL80C92 and WA80C92; and comparison of both lives and amounts with the graduated rates for female pensioners 1991–94.

Age	Amounts/Lives 1991–94	1991–94/ WL80C92 Lives	1991–94/ WA80C92 Amounts	1991–94 Widows/ Pensioners Lives	1991–94 Widows/ Pensioners Amounts
20	0.8214	1.0553	1.2405	2.0276	2.0837
25	0.8161	1.4153	1.6538	2.7075	2.7537
30	0.8152	1.5423	1.7995	3.5074	3.5576
35	0.8176	1.4537	1.7048	4.0879	4.1939
40	0.8231	1.3336	1.5734	4.0809	4.2382
45	0.8306	1.2119	1.4423	3.5187	3.6601
50	0.8397	1.1086	1.3328	2.8010	2.8922
55	0.8499	1.0291	1.2438	2.1815	2.2294
60	0.8609	1.0179	1.1680	1.7203	1.7446
65	0.8724	0.9844	1.0728	1.3969	1.4118
70	0.8844	0.9554	0.9892	1.1763	1.1909
75	0.8968	0.9298	0.9153	1.0303	1.0508
80	0.9096	0.9072	0.8501	0.9400	0.9710
85	0.9228	0.8137	0.7932	0.8936	0.9397
90	0.9363	0.7725	0.7539	0.8846	0.9512
95	0.9500	0.7973	0.8428	0.9097	1.0039
100	0.9638	0.9062	0.9673	0.9672	1.0979
105	0.9771	0.9993	1.0749	1.0542	1.2317
110	0.9892	1.0648	1.1496	1.1624	1.3967
115	0.9986	1.1145	1.2010	1.2739	1.5702

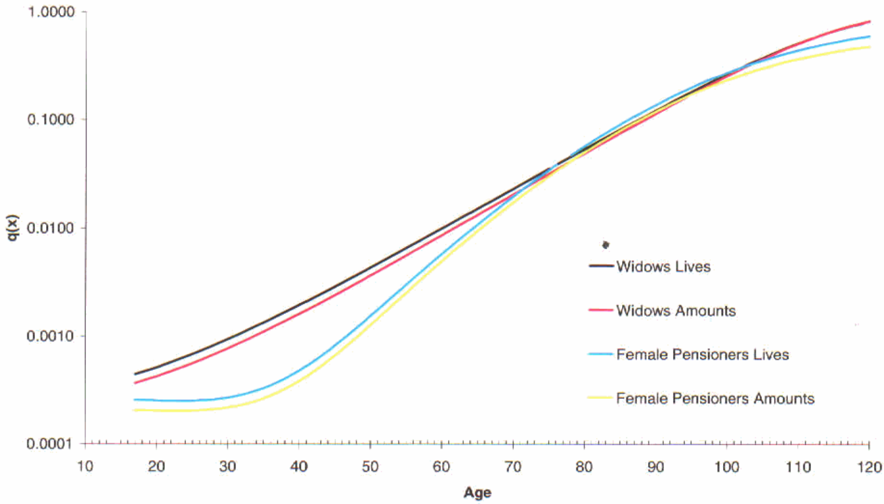

Figure 4.1. Values of $q(x)$ for widows (lives and amounts) and female pensioners.

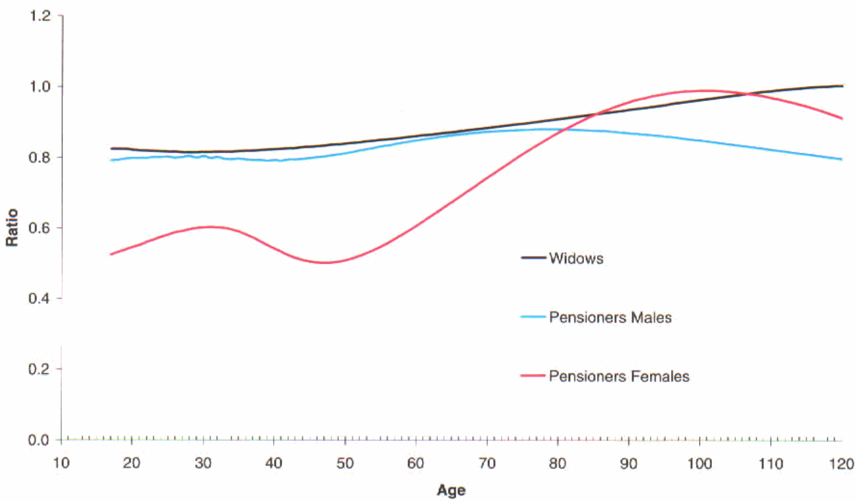

Figure 4.2. Ratios of values of $q(x)$ for amounts and lives tables for widows and pensioners.

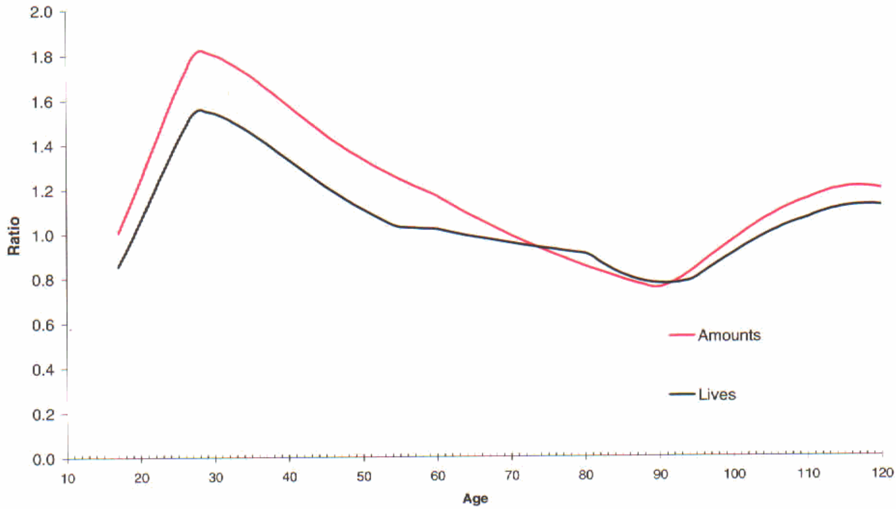

Figure 4.3. Ratios of values of $q(x)$ for widows 1991–94 to those for WL80C92 and WA80C92.

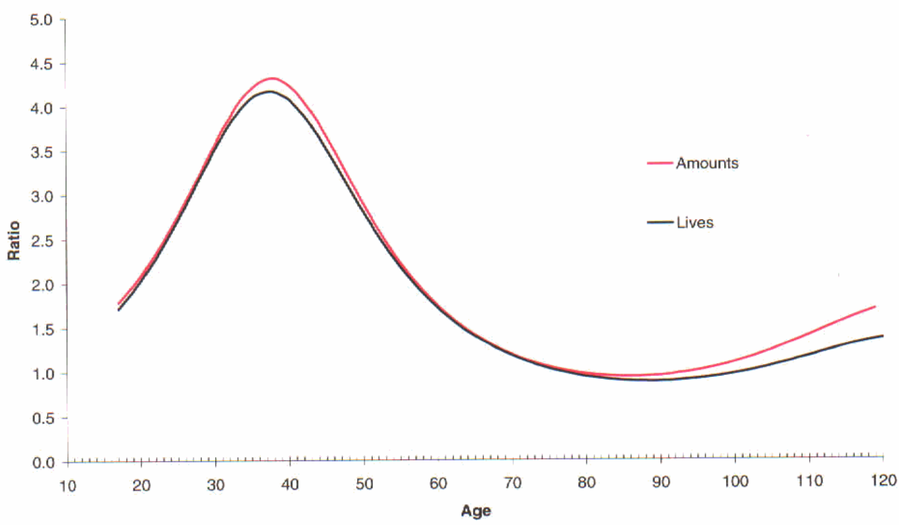

Figure 4.4. Ratios of values of $q(x)$ for widows 1991–94 to those for female pensioners.

5.1 *Introduction*

5.1.1 From 1971 to 1987 the Bureau carried out separate investigations into the mortality experience of level temporary and decreasing temporary assurances, but after the 1979–82 graduation these were combined into a single investigation for all temporary assurances. The investigation was originally only for male lives, and in 1979–82 the number of female lives included in the investigation was very small. The number of female lives is now significant and fully justifies a separate investigation. In 1979–82 the Committee aggregated the data for durations 1 to 4 (durations 1–4) and kept duration 0 and durations 5 and over (durations 5+) separate. The same has been done on this occasion.

5.1.2 Table 5.1 shows, for 1991–94, the central exposed to risk and the number of deaths for all ages for males and females, for durations 0, 1–4 and 5+, and, for comparison, the corresponding numbers for males for 1979–82. For males the exposure at durations 0 and 1–4 has fallen, though it has risen at durations 5+. The net effect is an overall fall in the exposure, though the number of deaths has risen. It may be that this is a feature of the data supplied by the contributing offices, rather than of the term assurance market as a whole. The size of the experience for females has now grown to a substantial fraction of that for males.

5.1.3 The data cover a wide range of adult ages, though with the peak exposure in the thirties and forties of age. For both sexes the normal data runs out at about age 90. However, for both sexes there are a few cases recorded, at all durations, from age 100 to 105. These may well be errors, and in any event they have been ignored in this graduation. The age range of the data (excluding the data at ages over 99), the continuous age range within which the central exposed to risk is greater than or equal to 100, and the continuous age range within which the number of deaths is greater than or equal to 10 are shown in Table 5.2. There are also isolated ages where the number of deaths exceeds nine. These are not noted.

5.1.4 As for other investigations, it seems as if the data at age 10 is faulty, and there is very little exposed to risk between ages 11 and 16, so the graduations have been started at age 17. Otherwise the full age ranges as shown in Table 5.2 have been used.

5.2 *Comparison with TM80 and with assured lives rates*

5.2.1 The experience for males has been compared with the TM80 table (which was based on the experience for 1979–82, and has rates for durations 0, 1–4 and 5+), and the experience for both sexes has been compared with the graduated rates for permanent assurances for 1991–94 (comparing the experience for durations 1–4 with the graduated rates for duration 1, and the experience for durations 5+ with the graduated rates for durations 2+). The results are as shown in Table 5.3.

5.2.2 It is clear that for males the mortality rates have reduced considerably since the 1979–82 experience, the period on the basis of which the TM80 rates were constructed. Inspection of the comparisons with the graduated rates for permanent assurances for 1991–94 shows that:

(i) whereas the rates for the ultimate durations (D2+ for permanent assurances) might be considered as fitting the experience for temporary assurances (D5+) for both sexes (100A/E = 97 and 96),
(ii) the experiences for duration 0 for temporary assurances, for both sexes, are distinctly lower than those for the permanent assurances, and
(iii) the experience for durations 1–4 is conflicting, with 100A/E = 88 for males and =120 for females, which may reflect more stringent underwriting criteria.

5.3 *The experience for males*

5.3.1 The experience for males, durations 5+, is considered first. The values of the log likelihood and χ^2 for selected GM(r,s) graduations are shown in Table 5.4. The results for all these formulae except GM(0,3) are fairly similar. The GM(2,3) formula has rather the best shape, but the value of a_2 is positive, so the values of q_x do not decrease in the early twenties of age as one might expect. A decision about which formula to use was therefore postponed until the other durations had been considered.

5.3.2 The values of the log likelihood and χ^2 for selected GM(r,s) graduations for males, durations 1–4, are shown in Table 5.5. There is little to choose in terms of the log likelihood between the higher-order formulae, but GM(2,3) has the best overall shape. For example, although GM(0,4) has the 'best' values of the statistics shown, the values of q_x are quite unsuitable at higher ages, reaching a peak at too low a level of 0.042185 at age 87 and then falling sharply.

5.3.3 The values of the log likelihood and χ^2 for selected GM(r,s) graduations for males, duration 0, are shown in Table 5.6. Again, there is little to choose between the higher-order formulae, but for consistency with the other durations a GM(2,3) formula was considered further.

5.3.4 When the graduated rates for the three durations, using the GM(2,3) formulae for each, are compared, one can see uncomfortable features. These are features of the graduation rather than the data. The values of q_x cross over at extreme ages; the rates for durations 1–4 are higher than those for durations 5+ below age 35; the rates for duration 0 are higher than those for durations 5+ below age 23 and higher than those for durations 1–4 above age 87. These are extreme ages, but there is no reason to suppose that these cross-overs represent reality any better than the assumption that the rates lie conformably with one another.

5.3.5 The experience at young ages needs to be considered in detail. Table 5.7 shows a summary of the experience for ages 17–24 and 25–29 at all three duration groups. One can see that, although for all ages combined the exposed to risk for durations 5+ is larger in total than that for durations 1–4 (see Table 5.1), at young ages the experience for durations 5+ is relatively small, so the experience for durations 0 and 1–4 is more 'credible'. For these lower durations the crude death rates for ages 25–29 are smaller than those for ages 17–24. This indicates that falling mortality rates in the early twenties of age, as are found in many other investigations, are more plausible than rising mortality rates.

5.3.6 The graduation for durations 1–4 was therefore chosen as the 'datum', and those for durations 0 and 5+ were 'arranged' around it, by choosing suitable values of certain parameters, and then optimising for the others. The parameters found before modification and after modification in this way are shown in Table 5.8. For both durations the values of $100a_1$, $100a_2$ and b_3 were fixed, and the values of b_1 and b_2 were optimised. This brought the values of q_x at low ages and high ages for all three durations into conformity. The high value of χ^2 for durations 1–4 is unavoidable, since there are high values of z $(=(\text{A} - \text{E})/\sqrt{\text{E}})$ at ages 35 and 56 (negative) and 36, 63, 67 and 68 (positive), which no smooth graduation can get rid of.

5.3.7 Details of the usual statistics for the three graduations are shown in Table 5.9 and values of q_x at decennial ages are shown in Table 5.10.

5.4 *The experience for females*

5.4.1 We now consider the experience for females, looking first at durations 5+. The values of the log likelihood and of χ^2 for various GM(r,s) formulae are shown in Table 5.11. There is not a great deal of difference between the different formulae, but the GM(1,2) graduation provides a satisfactory shape, and satisfactory statistics. However, it produces rather low rates at low ages, as discussed below.

5.4.2 The values of the log likelihood and of χ^2 for various GM(r,s) formulae for durations 1–4 are shown in Table 5.12. Excluding GM(0,2), the remainder show rather similar statistics, and again GM(1,2) provides a satisfactory shape, although the rates at low ages are also rather low. The values of q_x for this formula are generally around 90% of those for durations 2+, so this formula gives a good starting point. However, the value of χ^2 is rather high. This can be attributed to two ages, 50 and 65, for which the actual deaths are high relative to those expected, and also relative to the actual deaths at neighbouring ages. It is possible that these can be accounted for by the presence of duplicates, but this has not been investigated.

5.4.3 The values of the log likelihood and of χ^2 for various GM(r,s) formulae for duration 0 are shown in Table 5.13. There were only 86 deaths and all formulae from GM(0,2) upwards show similar results. This time the shape produced by a GM(1,2) formula is not satisfactory; the value of a_1 is negative, and this makes the values of q_x unreasonably low at lower ages. The values of χ^2 are remarkably low; although the sparse data fall into rather few cells, there are still usually 14 cells; however, typically none of the values of z exceeds 1; the experience conforms almost too closely with the graduation; this is unusual.

5.4.4 Although the GM(1,2) graduations for durations 5+ and 1–4 would have seemed satisfactory if they had stood alone, the values of q_x at low ages were low relative to those for the males, the female permanent assurances, and ELT 15 females. Whilst this may be a genuine feature of the data, the number of deaths is small and it seemed more satisfactory to adjust the parameters to increase the rates. This was done by choosing values of $100a_1$ as shown in Table 5.14, and then optimising the values of the other two parameters. Duration 0 was treated similarly.

5.4.5 Values of the parameters and selected statistics for the original and the modified graduations for the three durations for females are shown in Table 5.14.

5.4.6 The usual graduation statistics and specimen values of q_x for all three durations are shown in Tables 5.15 and 5.16.

5.5 *Comparisons*

5.5.1 Comparisons of the values of q_x in various ways are shown in Tables 5.17 to 5.20 and Figures 5.1 to 5.4.

5.5.2 Table 5.17 and Figure 5.1 show the ratios of the rates for successive durations. Note that the rates "conform" in the sense that the rates for duration 0 are below those for durations 1–4, which in turn are below those for durations 5+, for both sexes. However, the ratios are not constant. The relatively low level of duration 0 for females might suggest that selection is more effective for them than for males, but the data on which this observation is based are very few. It is also possible that this feature is a reflection of fewer suicides and accidental deaths or, perhaps, more mortgage related cases.

5.5.3 Table 5.18 and Figure 5.2 show the ratios of the rates for females to those for males. Note that the rates for females duration 0 are noticeably low compared with those for males. Note also that the rates for females are well below those for males at young ages. Had the rates for females not been increased, as described in 5.4.4, this effect would have been even more pronounced.

5.5.4 Table 5.19 and Figure 5.3 show the ratios of the graduated rates for temporary assurances for 1991–94 to those for permanent assurances, as discussed in section 1 of this report (comparing durations 1–4 and 5+ for the former with durations 1 and 2+ for the latter). Note that, in general, the rates for temporary assurances are a little below those for permanent assurances, except at young ages (say below age 40) and at high ages (say above 70). However, the rates for temporary assurances females duration 0 are relatively low throughout, and those for females durations 1–4 are relatively high.

5.5.5 Table 5.20 and Figure 5.4 show the ratios of the graduated rates for 1991–94 for temporary assurances, for males only, to the rates in the TM80 tables for temporary assurances based on the 1979–82 experience. Note that the rates for 1991–94 are higher than those based on the data for 1979–82 at younger ages (say below 35) and at higher ages (say above 65), but are lower in between these ages.

5.6 *The proposed tables*

5.6.1 Values of q_x for the proposed tables for temporary assurances are shown in Appendix A in Table A3 for males and in Table A4 for females. All six sets of rates are graphed in Figure 5.5.

Table 5.1. Temporary assurances, males and females: comparison of (central) exposed to risk and deaths for 1991–94 and for 1979–82, durations 0, 1–4 and 5+.

	1979–82	1991–94
Males		
Duration 0		
Central exposed	530,080.0	343,230.2
Deaths	507	397
Durations 1–4		
Central exposed	1,679,654.0	1,076,950.8
Deaths	2,180	1,816
Durations 5+		
Central exposed	2,038,825.5	2,629,063.5
Deaths	4,968	6,831
Females		
Duration 0		
Central exposed		233,720.8
Deaths		86
Durations 1–4		
Central exposed		702,119.7
Deaths		614
Durations 5+		
Central exposed		2,004,000.2
Deaths		1,299

Table 5.2. Temporary assurances, males and females: age ranges.

	Range of data	Exposed ≥ 100	Deaths ≥ 10
Males			
Duration 0	10–85	17–72	46–57
Durations 1–4	10–87	18–79	25–74
Durations 5–	10–91	21–80	31–77
Females			
Duration 0	10–95*	17–70	none
Durations 1–4	10–90	18–80	34–55
Durations 5+	10–91	22–78	34–69

*An isolated case at 95; the rest of the data ceases at age 87.

Table 5.3. Temporary assurances: values of 100A/E when experiences are compared with mortality tables shown.

	TM80 (for males only)	1991–94 graduated rates for permanent assurances (males and females) for durations 0, 1 and 2+ respectively.
Males		
Duration 0	86	87
Durations 1–4	82	88
Durations 5+	70	97
Females		
Duration 0		78
Durations 1–4		120
Durations 5+		96

Table 5.4. Temporary assurances, males: values of log likelihood and of χ^2 for graduation of experience for durations 5+.

	GM(0,3)	GM(1,2)	GM(0,4)	GM(1,3)	GM(2,2)	GM(2,3)
−Log likelihood	44,493.9	44,488.1	44,487.0	44,487.5	44,487.7	44,487.4
χ^2	74.3	59.3	60.9	61.1	58.7	61.3

Table 5.5. Temporary assurances, males: values of log likelihood and of χ^2 for graduation of experience for durations 1–4.

	GM(0,3)	GM(1,2)	GM(0,4)	GM(1,3)	GM(2,2)	GM(2,3)
−Log likelihood	12,565.1	12,557.1	12,550.1	12,553.2	12,552.3	12,552.3
χ^2	96.3	82.1	68.9	72.8	72.3	72.1

Table 5.6. Temporary assurances, males: values of log likelihood and of χ^2 for graduation of experience for duration 0.

	GM(0,3)	GM(1,2)	GM(0,4)	GM(1,3)	GM(2,2)	GM(2,3)
−Log likelihood	2,909.8	2,909.1	2,908.9	2,909.0	2,908.7	2,908.4
χ^2	40.2	39.5	38.5	39.1	36.7	36.0

Table 5.7. Temporary assurances, males: basic data for ages 17–29, durations 0, 1–4 and 5+.

	Duration 0	Durations 1–4	Durations 5+
Ages 17–24			
Exposed to risk	20,281	29,095.9	2,624.1
Deaths	10	20	0
Crude μ_x	0.000493	0.000687	0.0
Ages 25–29			
Exposed to risk	43,703	103,943.7	29,974.1
Deaths	15	61	16
Crude μ_x	0.000343	0.000587	0.000534

Table 5.8. Temporary assurances, males: values of parameters for graduations using GM(2,3) formulae before and after modification, durations 0, 1–4 and 5+.

	Duration 0	Durations 1–4	Durations 5+
Before modification			
$100a_1$	−0.121308	−0.113910	0.058200
$100a_2$	0.057816	−0.173839	0.023011
b_1	−2.937319	−4.170362	−4.262635
b_2	4.579830	4.745634	5.970317
b_3	1.429532	−0.119740	−0.490863
−Log likelihood	2,908.36	12,552.3	44,487.44
χ^2	36.00	72.07	61.25
After modification			
$100a_1$	−0.12	unchanged	−0.10
$100a_2$	−0.17		−0.17
b_1	−4.415430		−3.851692
b_2	4.486721		5.433870
b_3	−0.12		−0.12
−Log likelihood	2,911.73		44,490.43
χ^2	43.40		67.57

Table 5.9. Temporary assurances, males, durations 0, 1–4 and 5+: statistics for graduations of μ_x = GM(2,3).

Duration:	0	1–4	5+
Ages used	17–85	17–87	17–91
Values of parameters at optimum point:			
$100a_1$	−0.12	−0.113910	−0.10
T-ratio		−0.54	
$100a_2$	−0.17	−0.173839	−0.17
T-ratio		−0.90	
b_1	−4.415430	−4.170362	−3.851692
T-ratio	−48.00	−3.45	−166.20
b_2	4.486721	4.745634	5.433870
T-ratio	20.83	11.06	81.24
b_3	−0.12	−0.119740	−0.12
T-ratio		−0.11	
Sign test: p(pos)	0.6170	0.7478	0.8251
Runs test: p(runs)	0.6209	0.4620	0.4806
K–S test: $p(KS)$	0.8322	0.9902	0.9462
Serial correlation test:			
T-ratio 1	0.18	−0.16	−1.27
T-ratio 2	1.14	−0.68	−0.61
T-ratio 3	−0.86	−0.54	1.18
χ^2 test:			
χ^2	43.40	72.07	67.57
Degrees of freedom	40	51	51
$p(\chi^2)$	0.3284	0.0276	0.0600

Table 5.10. Temporary assurances, males, durations 0, 1–4 and 5+: specimen values of q_x and percentage standard errors for graduations of $\mu_x = \text{GM}(2,3)$.

Duration:	0	1–4	5+
Age 20	0.000610	0.000707	0.000770
Percentage s.e.	1.85	473.33	0.25
Age 30	0.000482	0.000587	0.000625
Percentage s.e.	6.27	246.14	1.01
Age 40	0.000691	0.000861	0.000896
Percentage s.e.	11.45	92.57	2.23
Age 50	0.001746	0.002175	0.002436
Percentage s.e.	11.64	22.68	2.55
Age 60	0.004874	0.006181	0.007754
Percentage s.e.	10.49	6.08	2.43
Age 70	0.012959	0.016962	0.023992
Percentage s.e.	9.68	5.34	2.31
Age 80	0.032517	0.044179	0.070274
Percentage s.e.	9.18	16.99	2.20
Age 90	0.077367	0.108844	0.190948
Percentage s.e.	8.76	45.01	2.03
Age 100	0.173276	0.248635	0.451695
Percentage s.e.	8.17	76.38	1.64
Age 110	0.355042	0.499781	0.811264
Percentage s.e.	7.12	66.09	0.87

Table 5.11. Temporary assurances, females: values of log likelihood and of χ^2 for graduation of experience for durations 5+.

	GM(0,2)	GM(0,3)	GM(1,2)	GM(0,4)	GM(1,3)	GM(2,2)
−Log likelihood	9,464.9	9,464.8	9,464.7	9,462.0	9,462.4	9,463.4
χ^2	51.9	52.1	52.7	47.6	48.5	50.1

Table 5.12. Temporary assurances, females: values of log likelihood and of χ^2 for graduation of experience for durations 1–4.

	GM(0,2)	GM(0,3)	GM(1,2)	GM(0,4)	GM(1,3)	GM(2,2)
−Log likelihood	4,526.7	4,526.6	4,526.5	4,526.2	4,526.4	4,526.5
χ^2	87.5	75.1	74.3	73.6	74.1	74.1

Table 5.13. Temporary assurances, females: values of log likelihood and of χ^2 for graduation of experience for duration 0.

	GM(0,2)	GM(0,3)	GM(1,2)	GM(0,4)	GM(1,3)	GM(2,2)
−Log likelihood	709.1	709.1	709.1	709.1	709.1	709.1
χ^2	4.1	4.1	4.2	4.2	4.2	4.1

Table 5.14. Temporary assurances, females: values of parameters for graduations using GM(1,2) formulae before and after modification, durations 0, 1–4 and 5+.

	Duration 0	Durations 1–4	Durations 5+
Before modification			
$100a_1$	−0.001102	0.002597	0.003781
b_1	−5.171077	−4.489519	−4.390281
b_2	4.700423	4.876527	4.922720
−Log likelihood	709.1	4,526.5	9,464.7
χ^2	4.2	74.3	52.7
After modification			
$100a_1$	0.008	0.012	0.018
b_1	−5.082158	−4.462904	−4.352028
b_2	5.493452	5.240908	5.347124
−Log likelihood	710.4	4,528.4	9,467.4
χ^2	7.9	85.4	56.9

Table 5.15. Temporary assurances, females, durations 0, 1–4 and 5+: statistics for graduations of $\mu_x = \text{GM}(1,2)$.

Duration:	0	1–4	5+
Ages used	17–95	17–91	17–91
Values of parameters at optimum point:			
$100a_1$	0.008	0.012	0.018
T-ratio			
b_1	−5.082158	−4.462904	−4.352028
T-ratio	−23.6	−61.7	−71.8
b_2	5.493452	5.240908	5.347124
T-ratio	10.9	30.56	36.0
Sign test: p(pos)	0.1509	0.2950	0.7121
Runs test: p(runs)	0.0949	0.5251	0.7238
K–S test: $p(KS)$	0.9373	0.9206	0.7738
Serial correlation test:			
T-ratio 1	1.61	1.09	−0.54
T-ratio 2	−0.91	0.14	−0.44
T-ratio 3	−1.46	0.88	1.52
χ^2 test:			
χ^2	7.86	85.44	56.89
Degrees of freedom	11	51	47
$p(\chi^2)$	0.7261	0.0018	0.1529

Table 5.16. Temporary assurances, females, durations 0, 1–4 and 5+: specimen values of q_x and percentage standard errors for graduations of $\mu_x = \mathrm{GM}(1,2)$.

Duration:	0	1 4	5–
Age 20	0.000107	0.000184	0.000245
Percentage s.e.	5.73	2.56	1.62
Age 30	0.000161	0.000304	0.000369
Percentage s.e.	11.43	4.44	3.14
Age 40	0.000323	0.000643	0.000729
Percentage s.e.	17.09	5.97	4.62
Age 50	0.000808	0.001613	0.001780
Percentage s.e.	20.46	6.79	5.51
Age 60	0.002264	0.004372	0.004834
Percentage s.e.	21.89	7.12	5.89
Age 70	0.006618	0.012200	0.013680
Percentage s.e.	22.36	7.22	6.01
Age 80	0.019568	0.034193	0.039009
Percentage s.e.	22.36	7.18	5.99
Age 90	0.057417	0.094273	0.109163
Percentage s.e.	21.89	6.96	5.77
Age 100	0.162429	0.245893	0.285707
Percentage s.e.	20.40	6.33	5.14
Age 110	0.412353	0.552823	0.624691
Percentage s.e.	16.46	4.74	3.59

Table 5.17. Temporary assurances: ratios of values of q_x in proposed tables: comparison of durations.

Age	Males		Females	
	Duration 0/ Durations 1–4	Durations 1–4/ Durations 5+	Duration 0/ Durations 1–4	Durations 1–4/ Durations 5+
20	0.8628	0.9182	0.5815	0.7510
25	0.8417	0.9239	0.5546	0.7897
30	0.8211	0.9392	0.5296	0.8238
35	0.8071	0.9586	0.5116	0.8566
40	0.8026	0.9609	0.5023	0.8820
45	0.8044	0.9355	0.4990	0.8988
50	0.8028	0.8929	0.5009	0.9062
55	0.7975	0.8452	0.5080	0.9075
60	0.7885	0.7971	0.5178	0.9044
65	0.7771	0.7509	0.5295	0.8988
70	0.7640	0.7070	0.5425	0.8918
75	0.7501	0.6660	0.5567	0.8842
80	0.7360	0.6287	0.5723	0.8765
85	0.7226	0.5961	0.5895	0.8694
90	0.7108	0.5700	0.6091	0.8636

Table 5.18. Temporary assurances: ratios of values of q_x in proposed tables: comparison of sexes.

Age	Duration 0 Females/Males	Durations 1 4 Females/Males	Durations 5+ Females/Males
20	0.1754	0.2603	0.3182
25	0.2438	0.3700	0.4328
30	0.3340	0.5179	0.5904
35	0.4207	0.6636	0.7426
40	0.4674	0.7468	0.8136
45	0.4722	0.7612	0.7922
50	0.4628	0.7416	0.7307
55	0.4583	0.7195	0.6701
60	0.4645	0.7073	0.6234
65	0.4820	0.7074	0.5910
70	0.5107	0.7193	0.5702
75	0.5505	0.7417	0.5587
80	0.6018	0.7740	0.5551
85	0.6653	0.8156	0.5592
90	0.7421	0.8661	0.5717
95			0.5949
100			0.6325
105			0.6896
110			0.7700
115			0.8674

Table 5.19. Ratios of values of q_x in proposed tables for temporary assurances to those in corresponding tables for permanent assurances for 1991–94.

	Males			Females		
Age	Duration 0	Durations 1–4/ Duration 1	Durations 5+/ Durations 2+	Duration 0	Durations 1–4/ Duration 1	Durations 5+/ Durations 2+
20	1.4353	1.3068	1.3230	0.8560	1.2267	1.2694
25	1.1977	1.1614	1.1837	0.8194	1.1865	1.1694
30	1.0126	1.0520	1.0593	0.7854	1.1515	1.0885
35	0.9064	0.9954	0.9811	0.7666	1.1316	1.0203
40	0.8769	0.9707	0.9562	0.7618	1.1340	0.9759
45	0.8834	0.9408	0.9625	0.7684	1.1527	0.9514
50	0.8858	0.8936	0.9713	0.7845	1.1826	0.9438
55	0.8714	0.8409	0.9714	0.8088	1.2188	0.9460
60	0.8441	0.7965	0.9666	0.8382	1.2607	0.9557
65	0.8118	0.7693	0.9636	0.8709	1.3067	0.9696
70	0.7815	0.7637	0.9681	0.9063	1.3556	0.9865
75	0.7572	0.7833	0.9840	0.9440	1.4062	1.0052
80	0.7418	0.8323	1.0140	0.9835	1.4576	1.0250
85	0.7370	0.9170	1.0599	1.0244	1.5080	1.0451
90	0.7440	1.0463	1.1216	1.0662	1.5549	1.0647
95			1.1954			1.0824
100			1.2706			1.0962
105			1.3263			1.1025
110			1.3345			1.0966
115			1.2793			1.0749

Table 5.20. Ratios of values of q_x in proposed tables for temporary assurances 1991–94, for males, to those in the TM80 tables.

Age	Males		
	Duration 0	Durations 1–4	Durations 5+
20	1.1402	1.0584	0.9935
25	1.3223	1.2581	1.1185
30	1.3098	1.2789	1.1510
35	1.0806	1.1002	1.0903
40	0.8158	0.8849	0.8750
45	0.7174	0.7251	0.7168
50	0.7287	0.7066	0.6554
55	0.8094	0.7357	0.6509
60	0.9455	0.7949	0.6793
65	1.1258	0.8772	0.7292
70	1.2349	0.9798	0.7957
75	1.3611	1.1017	0.8762
80	1.5033	1.2426	0.9684
85	1.6594	1.4012	1.0694
90	1.8267	1.5744	1.1736
95			1.2710
100			1.3451
105			1.3740
110			1.3385
115			1.2420

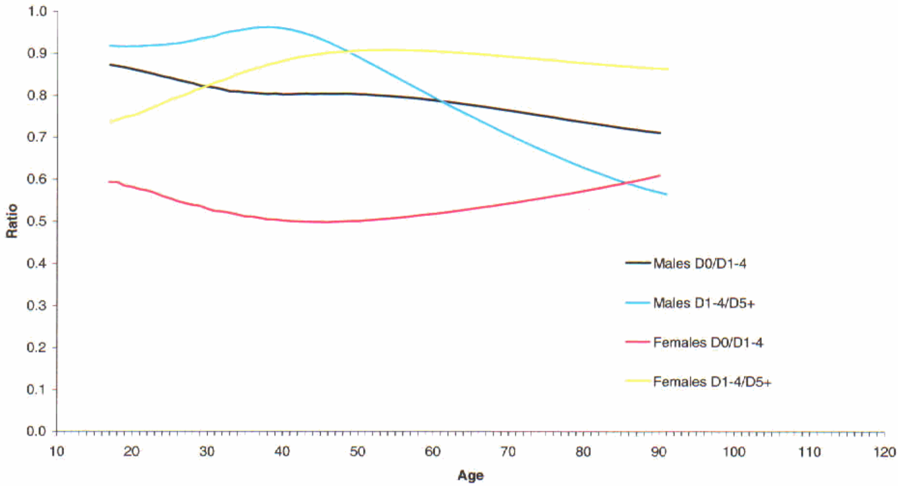

Figure 5.1. Ratios comparing values of q_x by durations.

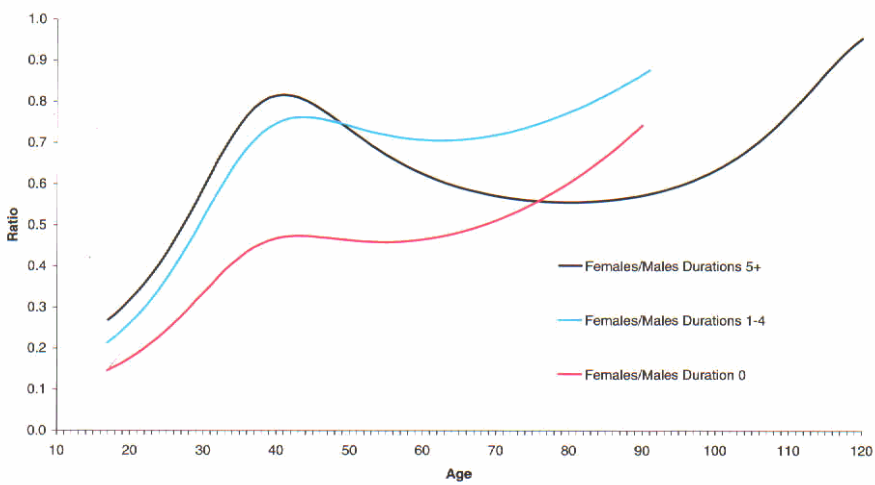

Figure 5.2. Ratios comparing values of q_x for females and males.

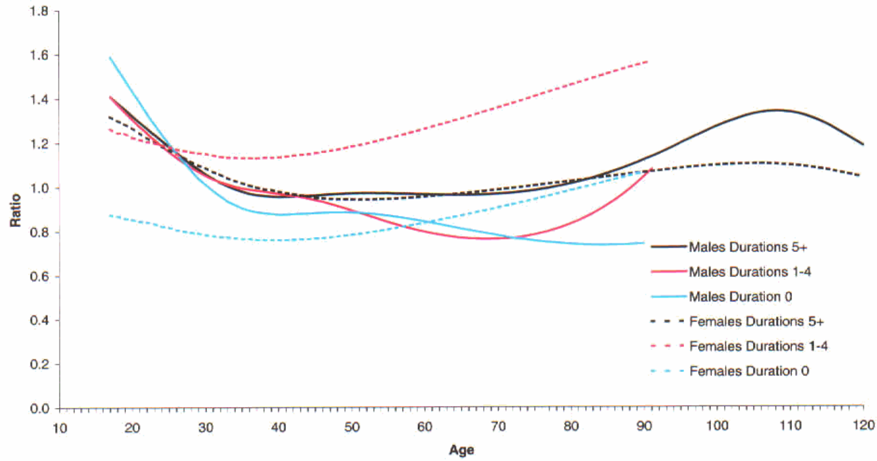

Figure 5.3. Ratios comparing values of q_x for temporary assurances 1991–94 with those for permanent assurances 1991–94.

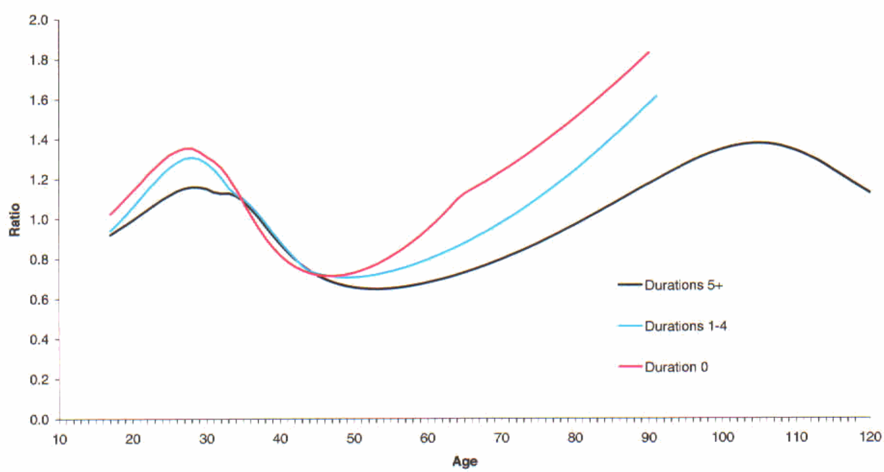

Figure 5.4. Ratios comparing values of q_x for temporary assurances, males, 1991–94 with TM80.

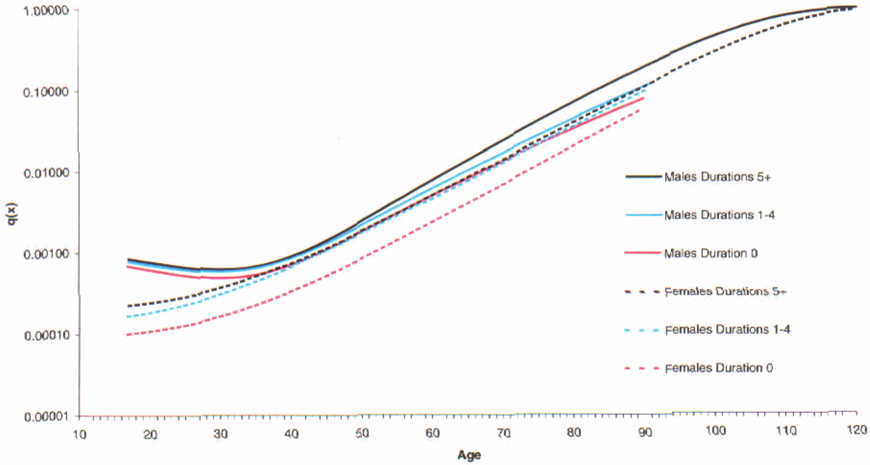

Figure 5.5. Temporary assurances, 1991–94, values of q_x for males and females, durations 0, 1–4 and 5+.

6. PROJECTION FACTORS FOR MORTALITY IMPROVEMENT

6.1 *Introduction*

6.1.1 In *C.M.I.R.* **16**, 127–129 (1998), the Committee published details of its proposed new tables for life office pensioners. These tables are based on the experiences of normal retirals (i.e. persons who retired at or after the normal retirement age for their scheme) during the 1991–94 quadrennium. For each sex there are separate tables based on the experiences of lives and of amounts. For each of the lives tables the value of q_x applies on average to a life attaining age x in the middle of 1992 and gives the probability of death before the attainment of age $x+1$ in the middle of 1993. The 'base' year for these tables is thus 1992. Accordingly, the tables for male lives and female lives are denoted by PML92Base and PFL92Base respectively. The corresponding tables based on the amounts experiences are denoted by PMA92Base and PFA92Base.

6.1.2 When publishing the "80" Series of tables, based on the experiences of the 1979–82 quadrennium, the Committee was of the view that it would be imprudent not to incorporate into the new tables for pensioners, annuitants, and widows an allowance for projected improvements in mortality with the passage of time. Analysis of recent trends in the mortality of pensioners confirms that such an allowance is again essential for most practical purposes.

6.2 *Observed improvements in the mortality of life office pensioners*

6.2.1 It is of interest to consider the trends in pensioners' mortality since the setting up by the Bureau of the relevant investigations. For the lives investigations the first quadrennium for which data are available is 1955–58; for amounts it is 1959–62. Tables 6.4, 6.5, 6.6, and 6.7 show the values of the 100A/E ratios (i.e. actual deaths as a percentage of those expected), where for each sex a single comparison is used throughout a 40-year period (1955–1994). For males (both lives and amounts) the comparison basis is the PMA80C10 table. For females (both lives and amounts) it is the PFA80C10 table. Over the years, of course, different comparison bases have been used by the Committee. When, however, a comparison basis was changed, for at least one quadrennium the values of 100A/E were always given both on the previous basis and on the new basis. These two sets of ratios relating to a single quadrennium permit the calculation of 'bridging factors' which in turn allow all the earlier comparisons to be revised to the most recent basis. (Although an element of approximation is necessarily inherent in the use of bridging factors, any errors are likely to be very small and of little practical consequence.)

6.2.2 For the first two quadrennia of the pensioners' investigations the data were insufficient to permit meaningful analyses over the age range 91 to 95, even for males alone. In addition, the initial smallness of the relevant experiences meant that for females analyses above age 85 were feasible only for the 1975–78 and subsequent quadrennia.

6.2.3 The existence of a single comparison basis for each experience enables the crude rates of mortality (for each quinary age group) in the 1967–70 and subsequent quadrennia to be expressed as a percentage of the corresponding rate in the 1963–66 quadrennium. The results of these calculations are shown in Tables 6.8, 6.9, 6.10 and 6.11.

6.2.4 From these tables we may derive the values shown in Table 6.1. Thus, for example, we see that for the 61–65 age group in the male lives experience the crude mortality rate in the 1975–78 quadrennium was 79% of the corresponding rate in the 1959–62 quadrennium. Similarly, for the same age group the crude rate for the 1991–94 quadrennium was 65% of that for the period 16 years previously. By combining these figures we see that for the age group 61–65 the crude rate of mortality over the period 1991–94 was 51% of the corresponding crude rate for the period 1959–62.

6.2.5 Table 6.2 shows the corresponding ratios for the female investigations.

6.2.6 For males a clear pattern emerges from these figures. Within each age group a more rapid rate of improvement in mortality has occurred in recent years than in the more distant past. Improvements in mortality for amounts are significantly greater than for lives. For both lives and amounts the rate of mortality improvement decreases as age increases.

6.2.7 For females, in contrast, no clear pattern can be seen. In general, for both lives and amounts, a slower rate of improvement in mortality has occurred in recent years, but this is not true at all ages. Some age groups show a more rapid mortality improvement for amounts than for lives, but for other age groups the opposite is true.

6.2.8 Figure 6.1 illustrates the reductions in overall mortality for each of the four experiences since the 1963–66 quadrennium. (For male amounts, for example, the total number of deaths in 1963–66 was 162% of the number expected and in 1991–94 it was 98% of the number expected (on the same basis – see Table 6.5). Thus, the overall rate of mortality in 1991–94 was in some sense 60.5% of its value 28 years previously.) This comparison is, of course, influenced by differences in the age distributions of the two experiences. Accordingly, it is desirable to consider the trends in mortality improvement for specific age groups. Figure 6.2 illustrates the position for the male amounts experience. It shows, for example, that over the 28 year period the mortality rate for the 66–70 age group fell by more than 50%, while for the 76–80 age group it fell by more than 30%.

6.2.9 Figure 6.3 illustrates the corresponding reductions in mortality for the female amounts experience.

6.2.10 For males the improvements in mortality in recent years have been greater than those implied by the reduction factors recommended by the Committee in conjunction with the "80" Series of tables. That this is so is demonstrated by Figure 6.4, which for each year of the period 1983–94 expresses the actual number of deaths as a percentage of the number expected using the "80" Series projected mortality rates. For the female experiences, in contrast, significant "swings" occur from year to year and there is no clear pattern. This suggests that the female experiences are in some way unusual.

6.2.11 The experiences for the six most recent years for which data are available are illustrated in Table 6.13. Although not as marked as in previous years, this experience illustrates the fluctuating nature of the female experience.

6.3 *Allowance for improving mortality*

6.3.1 In the light of the above observations, the Committee considers it essential when publishing its new tables for pensioners, immediate annuitants, retirement annuitants, and widows also to publish projection factors to allow for improvements in mortality with the passage of time. As far as possible, the factors should reflect recent trends. In practice the rates at which mortality is improving vary from one experience to another. The Committee has given some thought as to the extent to which this feature should be reflected in its proposed projection factors. On the one hand it is desirable to reflect as far as possible the likely trends in the observed experiences. On the other hand it is desirable to adopt a relatively simple model which avoids obvious anomalies. (For example, it is questionable whether one could justify a mortality improvement model which leads at some future time to lower rates of mortality for males than for females or for lives than for amounts.) Taking all factors into consideration, the Committee is now of the view that for practical purposes the same set of projection factors should be used in conjunction with each of the new tables for pensioners, immediate annuitants, retirement annuitants, and widows.

6.3.2 The Committee's initial thoughts on this matter were presented to the profession at a seminar in London in December 1998. Some speakers agreed with the Committee's proposals while others pointed to the experience of recent years and suggested that more rapid improvements in mortality should be assumed. Having considered both these comments and subsequently available data relating to the period 1992–97, the Committee has decided to issue revised projection factors, which incorporate more rapid improvement in the early years than was previously envisaged. The revised factors are based on the experiences of the five most recent quadrennia (i.e. 1975–78 to 1991–94). In recommending that a single set of improvement factors be used for all experiences (and, in each case, for males and females, lives and amounts, where relevant) the Committee recognises that it may possibly be overstating the future improvement in female mortality. Given, however, that the female experience has such unusual features, that it is difficult to know how much weight to give to it, and that one should probably err on the side of caution, the Committee feels that the recommended projection factors are reasonable for most practical purposes.

6.3.3 The model adopted to allow for mortality improvement is essentially the same as that described in §4.3 of *C.M.I.R.* **10** (1990). At each age the rate of mortality is assumed to decrease exponentially to a limiting value. With the new factors, however, the speed of convergence to the limit depends on age (in contrast to the projection factors adopted for the "80" Series).

6.3.4 Measure time in years from 1992, and for $t = 0, 1, 2, \ldots$ for each experience let $q_{x,t}$ denote the rate of mortality (i.e. "q_x") for a life attaining age x in calendar year $1992 + t$. (Similarly for the immediate annuitants let $q_{[x],t}$ be the select rate of mortality (i.e. "$q_{[x]}$") for a life newly selected at exact age x in year $1992 + t$.) For each experience $q_{x,0}$ is the value of q_x in the relevant new 'base' table while $q_{[x],0}$ is the value of $q_{[x]}$ in the new annuitants table.

6.3.5 It is assumed that

$$q_{x,t} = q_{x,0}.RF(x,t)$$

where

$$RF(x,t) = \frac{q_{x,t}}{q_{x,0}}$$

is the "reduction factor" for age x and time t.

For immediate annuitants the select rate of mortality in calendar year $1992 + t$ is

$$q_{[x],t} = q_{[x],0}.RF(x,t)$$

6.3.6 The reduction factor $RF(x, t)$ is defined in terms of two subsidiary functions, $\alpha(x)$ and $f(x)$. It is assumed that $q_{x,\infty}$, the long-term rate of mortality at age x, will be $\alpha(x)$ times the base rate (i.e. the rate in 1992). In addition, it is assumed that a fraction $f(x)$ of the total fall in the rate of mortality at age x (i.e. $q_{x,0} - q_{x,\infty}$) will occur in the first 20 years.

6.3.7 Both $\alpha(x)$ and $f(x)$ are linear functions of age for $60 \le x \le 110$. For $x < 60$ and for $x > 110$ each function is constant, taking the appropriate values to ensure continuity.

6.3.8 Somewhat arbitrarily the value of $\alpha(110)$ is taken as 1. (The financial consequences of this choice are of very little significance.) Subject to this single constraint the linear functions $\alpha(x)$ and $f(x)$ were determined to provide a clearly-defined 'best fit' to the observed mortality improvements over the 20-year period 1975–94. A further technical adjustment was made so that the finally-adopted projection factors have 1992 as their base year.

6.3.9 The reduction factor recommended for all experiences is

$$RF(x,t) = \alpha(x) + [1 - \alpha(x)].[1 - f(x)]^{\frac{t}{20}}$$

with

$$\alpha(x) = \begin{cases} c & x < 60 \\ 1 + (1-c).\dfrac{(x-110)}{50} & 60 \le x \le 110 \\ 1 & x > 110 \end{cases}$$

and

$$f(x) = \begin{cases} h & x < 60 \\ \dfrac{(110-x).h + (x-60).k}{50} & 60 \le x \le 110 \\ k & x > 110 \end{cases}$$

where $c = 0.13$, $h = 0.55$, and $k = 0.29$.

These values of c, h, and k are derived from the adjusted 'best fit' procedure described in outline above.

6.3.10 Specimen reduction factors are given in Table 6.12.

6.3.11 One simple measure of the effect of improving mortality is obtained by considering how the expectation of life at a given age increases with the passage of time. Table 6.3 shows the values of $\mathring{e}_x$ (for $x = 60, 70, 80$) on the PMA92Base and PFA92Base tables and at various future times on both a 'true' and a calendar year basis.

6.3.12 It is important to appreciate that the expectations of life reflected in Table 6.3 apply to no one individual, but simply reflect 1992 levels of mortality. For the amounts tables, Figures 6.5 and 6.6 show how, when allowance is made for improving mortality, the 'true' expectation of life at any age increases as the time of attainment of that age moves into the future. Thus, for example, for the male amounts table the 'true' value of $\mathring{e}_{60}$ for a life attaining age 60 in 1992 is around 1.8 years more than the value of 21.2 derived from the base table while for a life attaining age 60 in the year 2000 (i.e. time $t = 8$) the value of $\mathring{e}_{60}$ is nearly 2.5 years more than the corresponding base table value. These simple observations are not without financial significance!

Table 6.1. Life office pensioners, males: ratios of crude mortality rates in two sets of quadrennia, each 16 years apart.

	1975–78 / 1959–62		1991–94 / 1975–78	
Age group	Lives	Amounts	Lives	Amounts
61–65	.79	.82	.65	.49
66–70	.88	.83	.65	.56
71–75	.99	.94	.69	.63
76–80	.99	.97	.75	.69
81–85			.83	.74
All ages	.94	.92	.73	.65

Note: The ratios for 'all ages' relate to the age range 51–100. At the oldest ages ratios are not available for the 1975–78 / 1959–62 comparison.

Table 6.2. Life office pensioners, females: ratios of crude mortality rates in two sets of quadrennia, each 16 years apart.

	1975–78 / 1959–62		1991–94 / 1975–78	
Age group	Lives	Amounts	Lives	Amounts
61–65	.76	.58	.84	.91
66–70	.88	.87	.85	.71
71–75	.78	.84	.84	.89
76–80			.86	.70
81–85			.83	.75
All ages	.81	.78	.81	.77

Note: The ratios for 'all ages' relate to the age range 51–100. At the oldest ages ratios are not available for the 1975–78 / 1959–62 comparison.

Table 6.3a. Expectation of life ($\mathring{e}_x$), males: calendar year bases.

Age x	PMA92Base	PMA92C2010	PMA92C2030
60	21.2	23.5	25.2
70	13.2	14.9	16.2
80	7.4	8.4	9.1

Table 6.3b. Expectation of life ($\mathring{e}_x$), females: calendar year bases.

Age x	PFA92Base	PFA92C2010	PFA92C2030
60	24.2	26.5	28.1
70	16.0	17.7	19.0
80	9.7	10.7	11.5

Table 6.3c. Expectation of life ($\mathring{e}_x$), males: 'true' (i.e. year of use) bases.

Age x	PMA92U1992	PMA92U2000	PMA92U2010
60	23.0	23.9	24.8
70	14.0	14.7	15.5
80	7.7	8.1	8.5

Table 6.3d. Expectation of life ($\mathring{e}_x$), females: 'true' (i.e. year of use) bases.

Age x	PFA92U1992	PFA92U2000	PFA92U2010
60	26.1	26.9	27.8
70	16.9	17.7	18.5
80	10.0	10.5	11.0

Table 6.4. Life office pensioners, male lives, retirements at or after normal pension age: 100 A/E ratios where for each quadrennium the comparison basis is PMA80C10.

	Quadrennium									
Age group	1955–58	1959–62	1963–66	1967–70	1971–74	1975–78	1979–82	1983–86	1987–90	1991–94
51–55								289[*]	333	203
56–60								226	197	181
61–65	350	271	289	257	235	213	206	175	166	138
66–70	241	222	217	211	202	196	176	156	140	127
71–75	196	183	181	183	181	181	165	145	138	124
76–80	165	161	161	153	157	159	151	137	129	120
81–85			147	135	143	139	137	130	122	116
86–90			139	124	128	132	126	123	114	111
91–95			114	126	124	115	115	112	109	106
96–100								109	96	88
All ages	184	172	168	162	162	161	151	138	127	118
Total deaths	11,320[†]	18,941[†]	30,969[†]	45,863[†]	63,481[†]	76,907[†]	85,426[†]	84,267	74,842	63,558

Notes:

[*] denotes an age group with fewer than 10 actual deaths.

[†] indicates that the total deaths and the "all ages" 100 A/E ratios include a small number of cases outwith the 51–100 age group.

Table 6.5. Life office pensioners, male amounts, retirements at or after normal pension age: 100 A/E ratios where for each quadrennium the comparison basis is PMA80C10.

	Quadrennium								
Age group	1959–62	1963–66	1967–70	1971–74	1975–78	1979–82	1983–86	1987–90	1991–94
51–55							210	207	80
56–60							259	66	101
61–65	233	250	227	218	190	159	153	117	94
66–70	201	198	179	174	167	143	125	107	93
71–75	163	159	160	159	154	140	117	111	97
76–80	145	139	137	141	141	127	117	106	97
81–85		140	129	133	136	127	119	103	100
86–90		139	119	120	125	125	116	110	118
91–95		114	122	229	111	114	117	105	106
96–100							114	104	89
All ages	164	162	155	154	151	135	121	108	98
Total deaths	1,809†	3,382†	5,758†	9,094†	13,595†	20,021†	28,672	37,372	46,096

Notes:
The total deaths are shown in units of £1,000.
† indicates that the total deaths and the "all ages" 100 A/E ratios include a small number of cases outwith the 51–100 age group.

Table 6.6. Life office pensioners, female lives, retirements at or after normal pension age: 100 A/E ratios where for each quadrennium the comparison basis is PFA80C10.

	Quadrennium									
Age group	1955–58	1959–62	1963–66	1967–70	1971–74	1975–78	1979–82	1983–86	1987–90	1991–94
51–55								357*	267*	321*
56–60	356	224	194	278	313	278	269	177	201	218
61–65	270	253	231	207	205	193	189	191	179	162
66–70	199	211	203	205	185	185	175	164	168	158
71–75	185	216	184	181	170	168	156	143	152	141
76–80			163	147	157	144	139	130	128	124
81–85			139	135	137	141	137	122	117	117
86–90						134	132	118	115	108
91–95						138	134	134	120	117
96–100								120	127	121
All ages	187	191	169	162	157	154	148	136	132	124
Total deaths	588	1,324†	2,322†	3,828†	5,791†	8,086†	10,536†	12,266	13,124	13,246

Notes:

* denotes an age group with fewer than 10 actual deaths.

† indicates that the total deaths and the "all ages" 100 A/E ratios include a small number of cases outwith the 51–100 age group.

Table 6.7. Life office pensioners, female amounts, retirements at or after normal pension age: *100 A/E ratios where for each quadrennium the comparison basis is PFA80C10.*

Age group	Quadrennium 1959–62	1963–66	1967–70	1971–74	1975–78	1979–82	1983–86	1987–90	1991–94
51–55							221	926	306
56–60	199	163	288	260	288	224	132	130	123
61–65	273	194	180	199	158	168	171	166	143
66–70	199	188	189	173	173	148	135	132	123
71–75	179	180	153	178	151	140	127	123	134
76–80		151	153	148	141	126	114	121	99
81–85		147	142	149	139	126	103	110	104
86–90					153	133	119	113	101
91–95					144	124	138	130	117
96–100							142	128	129
All ages	193	162	159	162	151	140	127	127	117
Total deaths	67†	130†	255†	490†	840†	1,446†	2,470	4,177	5,598

Notes:
The total deaths are shown in units of £1,000.
† indicates that the total deaths and the "all ages" 100 A/E ratios include a small number of cases outwith the 51–100 age group.

Table 6.8. Life office pensioners, male lives: mortality rates as a percentage of values in the quadrennium 1963–66.

Age group	Quadrennium							
	1963–66	1967–70	1971–74	1975–78	1979–82	1983–86	1987–90	1991–94
61 65	100	89	81	74	71	61	57	48
66–70	100	97	93	90	81	72	65	59
71–75	100	101	100	100	91	80	76	69
76 80	100	95	98	99	94	85	80	75
81–85	100	92	98	95	93	89	83	79
86–90	100	90	92	95	91	89	82	80
91–95	100	111	108	101	101	98	96	93

Table 6.9. Life office pensioners, male amounts: mortality rates as a percentage of values in the quadrennium 1963–66.

Age group	Quadrennium							
	1963–66	1967–70	1971–74	1975–78	1979–82	1983–86	1987–90	1991–94
61–65	100	91	88	76	64	61	47	38
66–70	100	91	88	84	72	63	54	47
71–75	100	101	100	97	88	74	70	61
76–80	100	98	101	101	91	84	76	70
81–85	100	92	95	97	91	85	74	72
86–90	100	86	87	90	90	84	79	85
91–95	100	*107*	*201*	98	*100*	103	92	93

Table 6.10. Life office pensioners, female lives: mortality rates as a percentage of values in the quadrennium 1963–66.

	Quadrennium							
Age group	1963–66	1967–70	1971–74	1975–78	1979–82	1983–86	1987–90	1991–94
61–65	100	90	89	83	82	83	78	70
66–70	100	101	92	92	87	81	83	78
71–75	100	98	93	92	85	78	83	77
76–80	100	91	96	89	86	80	79	76
81–85	100	98	99	102	99	88	84	84

Table 6.11. Life office pensioners, female amounts: mortality rates as a percentage of values in the quadrennium 1963–66.

Age group	Quadrennium							
	1963–66	1967–70	1971–74	1975–78	1979–82	1983–86	1987–90	1991–94
61–65	100	93	103	81	87	88	86	74
66–70	100	101	92	92	79	72	70	66
71–75	100	85	99	84	78	71	68	74
76–80	100	102	99	94	84	76	80	66
81–85	100	97	101	95	86	70	75	71

Table 6.12. Reduction factors ×1000 with 1992 as the base year: males and females, lives and amounts.

Age x	Time t in years, measured from 1992									
	4	8	12	16	20	24	28	32	36	40
60	872	762	669	589	522	464	414	372	337	306
65	892	799	719	649	590	538	494	456	423	394
70	910	832	764	705	653	608	569	535	505	479
75	927	863	806	756	713	674	640	610	584	561
80	942	890	844	803	767	735	706	681	658	638
85	955	915	879	846	817	791	768	747	728	711
90	967	937	910	885	863	843	825	808	793	780
95	977	956	937	920	904	889	876	864	853	843
100	986	973	961	950	940	931	923	915	908	901

Table 6.13. Life office pensioners, all ages: values of 100 A/E for calendar years 1992 to 1997 using the base mortality tables published in *C.M.I.R.* **16**, projected to the relevant year using the reduction factors described in 6.3.6, as the comparison basis.

Year	Male Amounts	Males Lives	Female Amounts	Female Lives
1992	101	101	109	107
1993	99	102	93	95
1994	97	98	100	95
1995	104	98	94	100
1996	98	95	96	96
1997	96	93	93	99

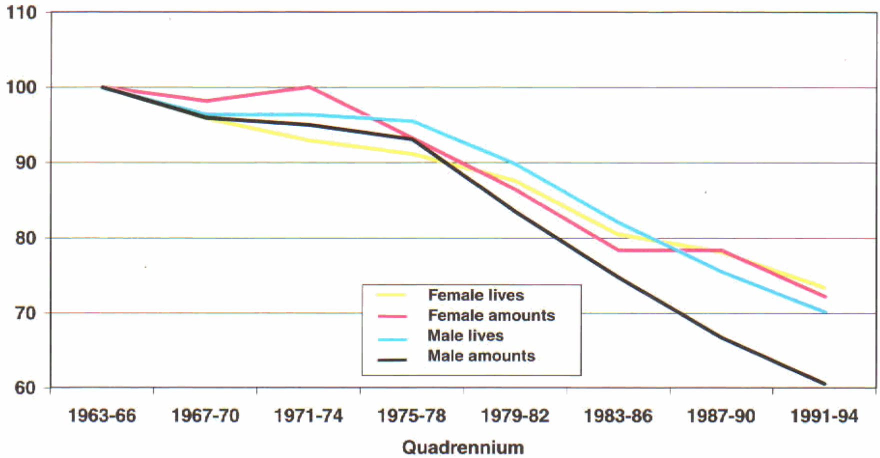

Figure 6.1. Life office pensioners, all ages: 100A/E as a percentage of the value for 1963–66: comparison basis PMA80C10 for males, PFA80C10 for females: compare with Tables 6.4, 6.5, 6.6 and 6.7.

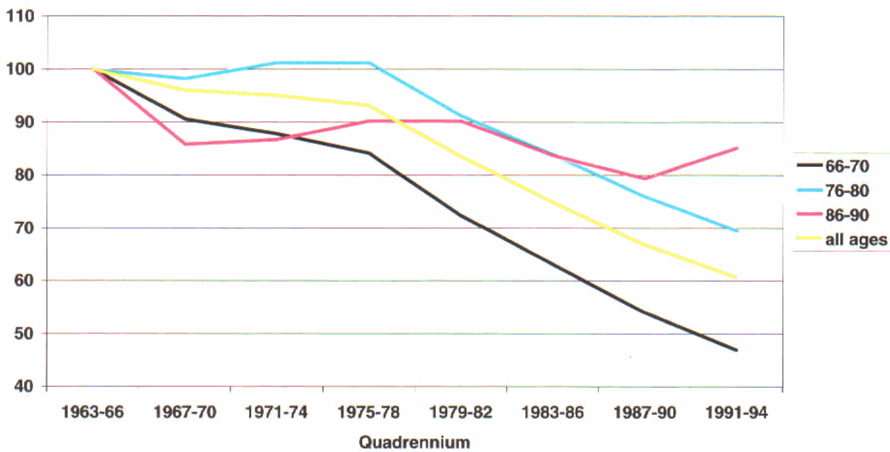

Figure 6.2. Life office pensioners, male amounts: 100A/E as a percentage of the value for 1963–66: comparison basis PMA80C10.

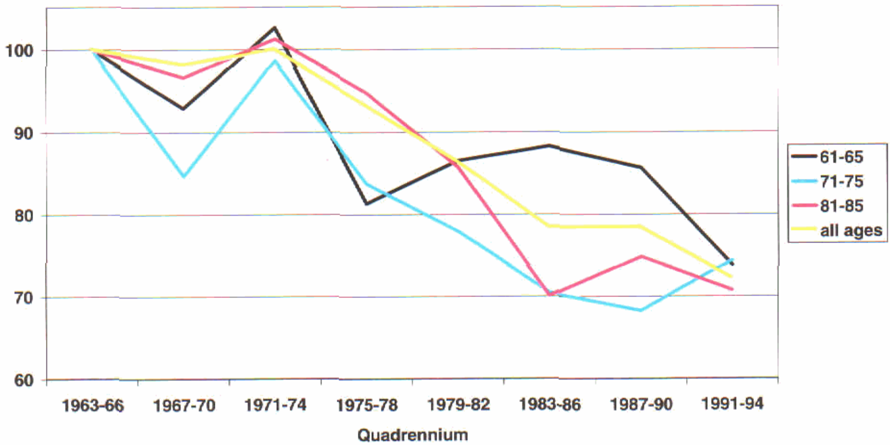

Figure 6.3. Life office pensioners, female amounts: 100A/E as a percentage of the value for 1963–66: comparison basis PFA80C10.

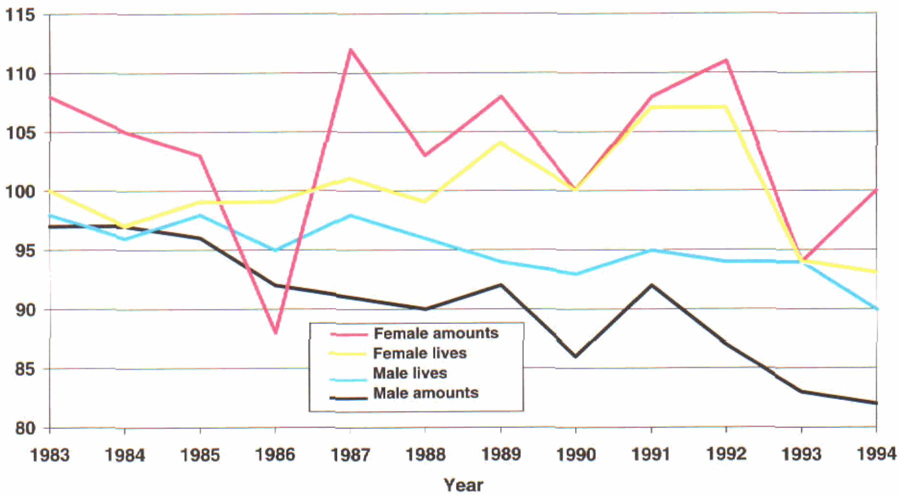

Figure 6.4. Life office pensioners, all ages: actual deaths as a percentage of expected deaths using the "80" Series projected mortality rates.

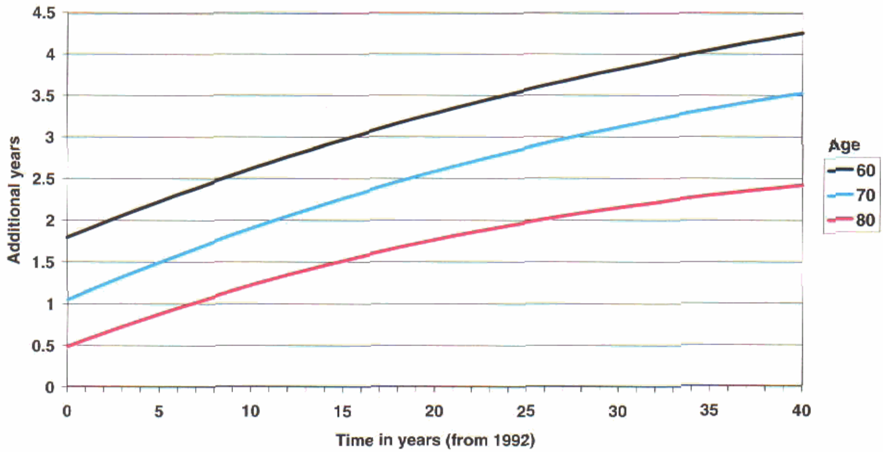

Figure 6.5. Life office pensioners, male amounts: increase in 'true' (i.e. year of use) expectation of life over 'base' value (see Table 6.3) with the passing of time.

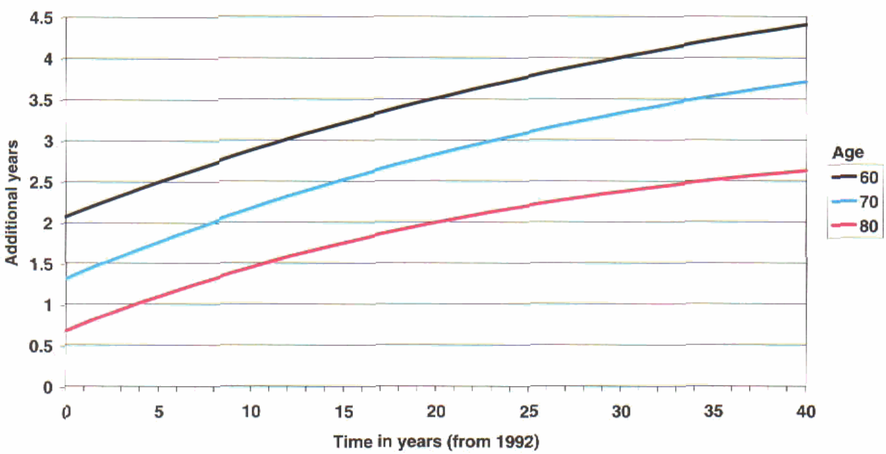

Figure 6.6. Life office pensioners, female amounts: increase in 'true' (i.e. year of use) expectation of life over 'base' value (see Table 6.3) with the passing of time.

7. SPECIMEN MONETARY VALUES AND COMPARISONS WITH OTHER TABLES

7.1 *Introduction*

7.1.1 The tables which follow show specimen monetary functions derived from the new tables and compare these with the corresponding functions from the equivalent "80" Series tables (or with the 'least different' "80" Series table where a direct equivalent does not exist). The layouts of the tables follow the layouts of the tables in Section 5 of *C.M.I.R.* **10**, 59–85 where the "80" Series tables were compared with earlier tables.

7.2 *Assurances*

7.2.1 Tables 7.1 and 7.2 cover permanent (whole life and endowment) assurances and Tables 7.3 and 7.4 cover temporary assurances. For female temporary assurances there is no direct equivalent table in the "80" Series, so the AF80 table has been used as the comparison basis. A range of premium rates and policy values are shown.

7.3 *Pensioners*

7.3.1 Tables 7.5 to 7.8 show annuity values on the three projection bases (calendar year, year of birth and year of use) for a variety of years. These are then compared with the annuity values calculated using the corresponding "80" Series table. All "92" Series tables are projected using the factors described in Section 6 of this report; all "80" Series tables are projected using the factors described in Section 4 of *C.M.I.R.* **10**, 44–58.

7.3.2 The section headed Year of Use gives specimen annuity values for cohorts reaching the designated ages in 2000 and 2010. Those values can be picked out from the Year of Birth section where the values appropriate for the year 2010 are highlighted in bold.

7.4 *Immediate annuitants*

7.4.1 Tables 7.9 to 7.16 show specimen annuity values for the new immediate annuitant tables. The format is similar to that used for pensioners. For the new tables based on amounts, the comparison basis is the immediate annuitants "80" Series table (based on lives) for males or females and select duration as appropriate.

7.5 *Retirement annuitants*

7.5.1 Tables 7.17 and 7.18 show specimen annuity values for the new vested retirement annuitant tables. The format is similar to that used for pensioners. The comparison basis is the pensioner, lives (males and females respectively) from the "80" Series since no exact equivalent was previously produced.

7.6 *Widows*

7.6.1 Tables 7.19 and 7.20 show specimen annuity values for the new widows tables. The format is similar to that used for pensioners.

Table 7.1. Comparison of monetary values on AM92 and AM80: rate of interest 4%.

Sample AM92 monetary functions

Premium rates per £1,000 sum assured				Policy values				
x	$P_{[x]}$	$P_{[x]:\overline{15}\rceil}$	$P_{[x]:\overline{25}\rceil}$	t	${}_tV_{25}$	${}_tV_{45}$	t	${}_tV_{25:\overline{25}\rceil}$
				5	0.0304	0.0732	5	0.1296
20	4.86	48.32	23.45	10	0.0673	0.1567	10	0.2875
25	5.94	48.33	23.51	15	0.1116	0.2491	15	0.4798
30	7.33	48.39	23.64	20	0.1642	0.3478	20	0.7139
35	9.14	48.52	23.93	25	0.2254	0.4488		
40	11.52	48.79	24.48	30	0.2951	0.5471		
45	14.65	49.34	25.52	35	0.3724	0.6378	t	${}_tV_{45:\overline{25}\rceil}$
50	18.83	50.35	27.38	40	0.4549	0.7167		
55	24.47	52.19	30.60	45	0.5393		5	0.1349
60	32.12	55.41	35.96	50	0.6215		10	0.2948
65	42.60	60.90	44.56	55	0.6972		15	0.4844
				60	0.7632		20	0.7126

AM92 monetary functions as a percentage of the equivalent AM80 functions

Premium rates per £1,000 sum assured				Policy values				
x	$P_{[x]}$	$P_{[x]:\overline{15}\rceil}$	$P_{[x]:\overline{25}\rceil}$	t	${}_tV_{25}$	${}_tV_{45}$	t	${}_tV_{25:\overline{25}\rceil}$
				5	88	90	5	100
20	89	100	100	10	88	91	10	100
25	89	100	100	15	88	92	15	100
30	89	100	100	20	89	94	20	100
35	88	100	99	25	89	95		
40	87	99	97	30	91	96		
45	87	99	96	35	92	97	t	${}_tV_{45:\overline{25}\rceil}$
50	87	98	94	40	93	98		
55	87	97	92	45	95		5	98
60	87	96	91	50	96		10	99
65	88	95	90	55	97		15	100
				60	98		20	100

Table 7.2. Comparison of monetary values on AF92 and AF80: rate of interest 4%.

Sample AF92 monetary functions

Premium rates per £1,000 sum assured					Policy values					
x	$P_{[x]}$	$P^1_{[x]:\overline{10}\rvert}$	$P^1_{[x]:\overline{20}\rvert}$	$P_{[x]:\overline{25}\rvert}$	t	${}_tV_{25}$	${}_tV_{45}$	t	${}_tV_{25:\overline{25}\rvert}$	${}_tV^1_{25:\overline{25}\rvert}$
					5	0.0256	0.0577	5	0.1302	0.0018
20	3.89	0.22	0.32	23.27	10	0.0561	0.1242	10	0.2884	0.0033
25	4.79	0.30	0.46	23.35	15	0.0924	0.1993	15	0.4806	0.0042
30	5.93	0.43	0.70	23.49	20	0.1352	0.2825	20	0.7145	0.0036
35	7.36	0.66	1.09	23.71	25	0.1851	0.3720			
40	9.18	1.03	1.75	24.09	30	0.2426	0.4652			
45	11.52	1.65	2.84	24.71	35	0.3076	0.5584	t	${}_tV_{45:\overline{25}\rvert}$	${}_tV^1_{45:\overline{25}\rvert}$
50	14.56	2.67	4.63	25.75	40	0.3795	0.6472			
55	18.53	4.38	7.56	27.47	45	0.4569		5	0.1324	0.0135
60	23.78	7.20	12.28	30.31	50	0.5375		10	0.2910	0.0253
65	30.81	11.84	19.68	34.97	55	0.6181		15	0.4814	0.0322
					60	0.6949		20	0.7125	0.0277

AF92 monetary functions as a percentage of the equivalent AF80 functions

Premium rates per £1,000 sum assured					Policy values					
x	$P_{[x]}$	$P^1_{[x]:\overline{10}\rvert}$	$P^1_{[x]:\overline{20}\rvert}$	$P_{[x]:\overline{25}}$	t	${}_tV_{25}$	${}_tV_{45}$	t	${}_tV_{25:\overline{25}\rvert}$	${}_tV^1_{25:\overline{25}\rvert}$
					5	91	91	5	100	82
20	91	81	86	100	10	91	91	10	100	81
25	91	91	88	100	15	91	92	15	100	79
30	91	89	85	100	20	91	92	20	100	79
35	90	86	83	99	25	91	93			
40	90	82	80	99	30	92	94			
45	90	80	79	98	35	92	95	t	${}_tV_{45:\overline{25}\rvert}$	${}_tV^1_{45:\overline{25}}$
50	89	78	79	97	40	93	96			
55	89	78	79	96	45	94		5	99	78
60	88	78	79	94	50	94		10	100	78
65	88	78	80	92	55	95		15	100	78
					60	96		20	100	78

Table 7.3. Comparison of monetary values on TM92 and TM80: rate of interest 4%.

Sample TM92 monetary functions

Premium rates per £1,000 sum assured					Policy values					
x	$P_{[x]}$	$P^1_{[x]:\overline{10}\vert}$	$P^1_{[x]:\overline{25}\vert}$	$P^1_{[x]:\overline{n}\vert}$ $x+n=65$	t	${}_tV_{25}$	${}_tV^1_{30:\overline{35}\vert}$	t	${}_tV^1_{25:\overline{25}\vert}$	${}_tV^1_{45:\overline{25}\vert}$
					5	0.0300	0.0084	5	0.0012	0.0223
20	4.87	0.62	0.69	1.52	10	0.0666	0.0182	10	0.0028	0.0428
25	5.92	0.58	0.82	1.75	15	0.1109	0.0284	15	0.0041	0.0555
30	7.30	0.63	1.17	2.09	20	0.1534	0.0372	20	0.0039	0.0490
35	9.09	0.82	1.89	2.57	25	0.2246	0.0411			
40	11.45	1.27	3.22	3.22	30	0.2945	0.0332			
45	14.56	2.15	5.57	4.10	35	0.3721		t	$1000\ {}_tV^1_{25:\overline{10}\vert}$	${}_tV^1_{45:\overline{10}\vert}$
50	18.68	3.74	9.49	5.22	40	0.4557				
55	24.17	6.50	15.71	6.50	45	0.5420		2	−0.0441	0.0018
60	31.55	11.18	24.97	7.03	50	0.6273		4	−0.0427	0.0029
65	41.48	18.91	37.62		55	0.7070		6	−0.0156	0.0033
					60	0.7772		8	0.0109	0.0025

TM92 monetary functions as a percentage of the equivalent TM80 functions

Premium rates per £1,000 sum assured					Policy values					
x	$P_{[x]}$	$P^1_{[x]:\overline{10}\vert}$	$P^1_{[x]:\overline{25}\vert}$	$P^1_{[x]:\overline{n}\vert}$ $x+n=65$	t	${}_tV_{25}$	${}_tV^1_{30:\overline{35}\vert}$	t	${}_tV^1_{25:\overline{25}\vert}$	${}_tV^1_{45:\overline{25}\vert}$
					5	90	64	5	54	72
20	93	115	103	78	10	90	64	10	56	74
25	92	122	90	75	15	90	65	15	55	76
30	91	109	77	73	20	91	66	20	56	79
35	91	88	71	71	25	92	68			
40	90	72	69	69	30	94	70			
45	90	67	72	68	35	95		t	$1000\ {}_tV^1_{25:\overline{10}\vert}$	${}_tV^1_{45:\overline{10}\vert}$
50	90	68	76	69	40	97				
55	92	73	83	73	45	99		2	89	60
60	94	79	90	85	50	101		4	132	61
65	97	87	96		55	102		6	−197	61
					60	103		8	44	62

Table 7.4. Comparison of monetary values on TF92 and AF80: rate of interest 4%.

Sample TF92 monetary functions

Premium rates per £1,000 sum assured					Policy values					
x	$P_{[x]}$	$P^1_{[x]:\overline{10}\rvert}$	$P^1_{[x]:\overline{25}\rvert}$	$P^1_{[x]:\overline{n}\rvert}$ $x+n=65$	t	${}_tV_{25}$	${}_tV^1_{30:\overline{35}\rvert}$	t	${}_tV^1_{25:\overline{25}\rvert}$	${}_tV^1_{45:\overline{25}\rvert}$
					5	0.0254	0.0059	5	0.0016	0.0131
20	3.90	0.23	0.39	0.96	10	0.0558	0.0122	10	0.0030	0.0247
25	4.79	0.30	0.56	1.16	15	0.0921	0.0183	15	0.0038	0.0316
30	5.91	0.42	0.85	1.42	20	0.1350	0.0233	20	0.0033	0.0274
35	7.34	0.62	1.33	1.74	25	0.1852	0.0250			
40	9.16	0.95	2.16	2.16	30	0.2432	0.0196			
45	11.50	1.52	3.53	2.68	35	0.3092		t	$1000\ {}_tV^1_{25:\overline{10}\rvert}$	${}_tV^1_{45:\overline{10}\rvert}$
50	14.55	2.49	5.82	3.34	40	0.3824				
55	18.56	4.12	9.55	4.12	45	0.4615		2	0.1318	0.0011
60	23.90	6.89	15.43	4.72	50	0.5439		4	0.2173	0.0018
65	31.08	11.53	24.28		55	0.6262		6	0.2395	0.0020
					60	0.7043		8	0.1759	0.0015

TF92 monetary functions as a percentage of the equivalent AF80 functions

Premium rates per £1,000 sum assured					Policy values					
x	$P_{[x]}$	$P^1_{[x]:\overline{10}\rvert}$	$P^1_{[x]:\overline{25}\rvert}$	$P^1_{[x]:\overline{n}\rvert}$ $x+n=65$	t	${}_tV_{25}$	${}_tV^1_{30:\overline{35}\rvert}$	t	${}_tV^1_{25:\overline{25}\rvert}$	${}_tV^1_{45:\overline{25}\rvert}$
					5	90	73	5	73	75
20	91	86	87	79	10	90	73	10	72	76
25	91	91	84	79	15	91	73	15	72	76
30	90	86	80	78	20	91	74	20	71	77
35	90	81	77	77	25	91	74			
40	90	76	76	76	30	92	74			
45	89	74	76	75	35	93		t	$1000\ {}_tV^1_{25:\overline{10}\rvert}$	${}_tV^1_{45:\overline{10}\rvert}$
50	89	73	77	74	40	94				
55	89	73	78	73	45	94		2	92	72
60	89	74	81	71	50	95		4	83	72
65	89	76	83		55	96		6	79	72
					60	97		8	77	72

Table 7.5. Pensioners, Males, Lives, PML92.

Sample annuity values using different types of projected table

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	23.159	24.556	26.012	27.172			26.719	**27.790**	26.719	**27.790**
	65	14.977	16.049	17.187	18.111		17.169	**18.139**	18.897	17.169	**18.139**
	75	8.721	9.375	10.082	10.668	9.803	**10.455**	10.985	11.407	9.803	**10.455**
	85	4.708	5.019	5.358	5.642	**5.462**	5.732	5.953	6.131	5.137	**5.462**
5	55	12.778	13.250	13.721	14.080			13.835	**14.184**	13.835	**14.184**
	65	9.616	10.113	10.624	11.026		10.538	**10.975**	11.308	10.538	**10.975**
	75	6.387	6.776	7.186	7.519	6.990	**7.369**	7.672	7.910	6.990	**7.369**
	85	3.812	4.033	4.270	4.467	**4.335**	4.522	4.674	4.797	4.107	**4.335**
10	55	8.322	8.520	8.712	8.852			8.716	**8.862**	8.716	**8.862**
	65	6.842	7.108	7.375	7.579		7.295	**7.525**	7.697	7.295	**7.525**
	75	4.960	5.211	5.471	5.679	5.329	**5.571**	5.761	5.909	5.329	**5.571**
	85	3.184	3.349	3.524	3.668	**3.566**	3.704	3.814	3.903	3.398	**3.566**

Sample annuity values expressed as a percentage of PML80

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	104	107	110	113			112	115	112	115
	65	104	108	112	115		112	116	119	112	116
	75	104	108	112	116	110	114	118	121	110	114
	85	104	106	110	113	111	114	117	120	107	111
5	55	103	104	106	108			107	109	107	109
	65	103	106	108	111		108	111	113	108	111
	75	104	106	110	113	108	111	114	116	108	111
	85	103	105	108	111	109	112	115	117	106	109
10	55	102	103	104	105			104	105	104	105
	65	102	104	106	108		106	108	109	106	108
	75	103	105	108	110	106	109	111	113	106	109
	85	103	105	107	110	108	111	113	115	106	108

Table 7.6. Pensioners, Males, Amounts, PMA92.

Sample annuity values using different types of projected table

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	25.233	26.452	27.717	28.722			28.512	**29.395**	28.512	**29.395**
	65	16.443	17.438	18.485	19.332		18.566	**19.434**	20.110	18.566	**19.434**
	75	9.459	10.100	10.789	11.359	10.547	**11.176**	11.685	12.089	10.547	**11.176**
	85	4.941	5.254	5.592	5.876	**5.700**	5.969	6.189	6.367	5.376	**5.700**
5	55	13.514	13.894	14.272	14.561			14.417	**14.684**	14.417	**14.684**
	65	10.325	10.764	11.212	11.563		11.175	**11.548**	11.832	11.175	**11.548**
	75	6.841	7.213	7.603	7.919	7.432	**7.789**	8.073	8.296	7.432	**7.789**
	85	3.982	4.202	4.438	4.633	**4.503**	4.689	4.839	4.960	4.278	**4.503**
10	55	8.644	8.792	8.934	9.040			8.956	**9.060**	8.956	**9.060**
	65	7.234	7.459	7.683	7.854		7.633	**7.822**	7.963	7.633	**7.822**
	75	5.261	5.497	5.740	5.933	5.616	**5.839**	6.014	6.150	5.616	**5.839**
	85	3.314	3.477	3.649	3.791	**3.692**	3.827	3.935	4.022	3.526	**3.692**

Sample annuity values expressed as a percentage of PMA80

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	107	109	111	113			113	115	113	115
	65	107	109	113	115		113	116	119	113	116
	75	106	109	112	116	111	115	118	121	111	115
	85	105	108	111	114	112	115	118	121	109	112
5	55	104	106	107	108			108	109	108	109
	65	105	107	109	111		109	111	113	109	111
	75	105	107	110	113	109	112	114	116	109	112
	85	104	106	109	112	110	113	116	118	107	110
10	55	103	104	104	105			105	105	105	105
	65	104	105	107	108		106	108	109	106	108
	75	104	106	108	110	107	109	111	113	107	109
	85	104	106	108	111	109	111	113	115	106	109

Table 7.7. Pensioners, Females, Lives, PFL92.

Sample annuity values using different types of projected table

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	26.968	28.224	29.513	30.528			30.338	**31.221**	30.338	**31.221**
	65	18.264	19.275	20.330	21.174		20.467	**21.320**	21.979	20.467	**21.320**
	75	11.124	11.785	12.486	13.060	12.288	**12.916**	13.419	13.816	12.288	**12.916**
	85	6.114	6.446	6.802	7.098	**6.931**	7.208	7.432	7.614	6.595	**6.931**
5	55	13.918	14.292	14.660	14.939			14.797	**15.055**	14.797	**15.055**
	65	11.013	11.434	11.859	12.190		11.839	**12.188**	12.451	11.839	**12.188**
	75	7.735	8.095	8.470	8.771	8.327	**8.664**	8.930	9.137	8.327	**8.664**
	85	4.778	5.000	5.237	5.431	**5.312**	5.494	5.641	5.759	5.088	**5.312**
10	55	8.756	8.899	9.036	9.136			9.052	**9.152**	9.052	**9.152**
	65	7.539	7.747	7.952	8.108		7.910	**8.081**	8.208	7.910	**8.081**
	75	5.793	6.011	6.234	6.411	6.130	**6.332**	6.490	6.611	6.130	**6.332**
	85	3.885	4.044	4.210	4.346	**4.257**	4.385	4.488	4.569	4.098	**4.257**

Sample annuity values expressed as a percentage of PFL80

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	100	102	105	107			107	109	107	109
	65	99	102	105	108		106	108	111	106	108
	75	102	104	108	111	107	110	113	115	107	110
	85	108	110	113	115	114	117	119	121	111	114
5	55	100	101	103	104			103	104	103	104
	65	99	101	103	105		103	105	106	103	105
	75	101	103	105	108	104	107	109	111	104	107
	85	106	108	110	113	111	114	116	118	109	111
10	55	100	101	102	102			102	102	102	102
	65	99	100	102	103		102	103	104	102	103
	75	100	102	104	106	103	105	106	108	103	105
	85	105	107	109	111	110	112	113	115	107	110

Table 7.8. Pensioners, Females, Amounts, PFA92.

Sample annuity values using different types of projected table

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	28.227	29.456	30.714	31.703			31.589	**32.431**	31.589	**32.431**
	65	19.386	20.393	21.440	22.276		21.628	**22.461**	23.103	21.628	**22.461**
	75	12.055	12.729	13.442	14.024	13.270	**13.901**	14.405	14.802	13.270	**13.901**
	85	6.847	7.195	7.567	7.876	**7.712**	7.998	8.230	8.417	7.363	**7.712**
5	55	14.243	14.591	14.934	15.193			15.077	**15.313**	15.077	**15.313**
	65	11.425	11.827	12.233	12.547		12.229	**12.556**	12.804	12.229	**12.556**
	75	8.195	8.550	8.917	9.211	8.788	**9.116**	9.373	9.574	8.788	**9.116**
	85	5.237	5.463	5.702	5.898	**5.782**	5.965	6.112	6.230	5.558	**5.782**
10	55	8.868	8.997	9.120	9.210			9.140	**9.228**	9.140	**9.228**
	65	7.725	7.918	8.108	8.251		8.074	**8.231**	8.347	8.074	**8.231**
	75	6.052	6.261	6.474	6.642	6.380	**6.571**	6.720	6.835	6.380	**6.571**
	85	4.194	4.351	4.516	4.649	**4.565**	4.690	4.790	4.869	4.409	**4.565**

Sample annuity values expressed as a percentage of PFA80

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	101	103	105	107			107	109	107	109
	65	101	103	106	109		107	109	112	107	109
	75	104	107	110	112	109	112	115	117	109	112
	85	110	112	114	117	116	118	120	122	113	116
5	55	100	101	103	104			103	104	103	104
	65	100	101	103	105		103	105	107	103	105
	75	102	104	107	109	106	108	110	112	106	108
	85	108	110	112	114	113	115	117	119	111	113
10	55	100	101	101	102			102	102	102	102
	65	99	101	102	103		102	103	104	102	103
	75	101	103	105	106	104	106	107	109	104	106
	85	107	108	110	112	111	113	114	116	109	111

Table 7.9. Immediate Annuitants, Males, Lives, IML92 Ultimate.

Sample annuity values using different types of projected table

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	25.002	26.332	27.701	28.781			28.431	**29.407**	28.431	**29.407**
	65	16.640	17.667	18.743	19.608		18.797	**19.689**	20.381	18.797	**19.689**
	75	9.879	10.520	11.205	11.768	10.971	**11.593**	12.094	12.491	10.971	**11.593**
	85	5.185	5.493	5.825	6.103	**5.933**	6.195	6.409	6.581	5.616	**5.933**
5	55	13.342	13.770	14.192	14.512			14.309	**14.616**	14.309	**14.616**
	65	10.361	10.815	11.276	11.636		11.224	**11.610**	11.903	11.224	**11.610**
	75	7.078	7.446	7.831	8.141	7.666	**8.016**	8.294	8.512	7.666	**8.016**
	85	4.166	4.382	4.613	4.803	**4.679**	4.859	5.005	5.122	4.459	**4.679**
10	55	8.534	8.708	8.875	8.996			8.882	**9.007**	8.882	**9.007**
	65	7.225	7.459	7.692	7.868		7.632	**7.829**	7.976	7.632	**7.829**
	75	5.406	5.637	5.875	6.063	5.755	**5.973**	6.143	6.275	5.755	**5.973**
	85	3.456	3.616	3.784	3.922	**3.827**	3.958	4.063	4.147	3.666	**3.827**

Sample annuity values expressed as a percentage of IM80

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	105	107	110	112			112	114	112	114
	65	104	107	110	113		110	113	116	110	113
	75	101	104	107	111	106	110	113	115	106	110
	85	99	102	105	108	106	109	111	114	103	106
5	55	103	105	106	108			107	108	107	108
	65	103	105	107	109		107	109	111	107	109
	75	101	103	106	109	105	108	110	112	105	108
	85	99	101	104	107	105	107	110	112	102	105
10	55	102	103	104	105			104	105	104	105
	65	103	104	106	107		105	107	108	105	107
	75	101	103	105	107	104	106	108	110	104	106
	85	99	101	104	106	104	106	108	110	102	104

Table 7.10. Immediate Annuitants, Males, Lives, IML92 Select.

Sample annuity values using different types of projected table

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	25.031	26.355	27.719	28.795			28.457	**29.426**	28.457	**29.426**
	65	16.703	17.720	18.786	19.644		18.853	**19.735**	20.419	18.853	**19.735**
	75	9.991	10.622	11.297	11.852	11.078	**11.689**	12.181	12.571	11.078	**11.689**
	85	5.347	5.648	5.973	6.245	**6.084**	6.339	6.548	6.716	5.775	**6.084**
5	55	13.357	13.782	14.202	14.519			14.322	**14.626**	14.322	**14.626**
	65	10.400	10.847	11.302	11.658		11.258	**11.637**	11.925	11.258	**11.637**
	75	7.159	7.518	7.895	8.199	7.740	**8.082**	8.354	8.566	7.740	**8.082**
	85	4.296	4.506	4.730	4.915	**4.798**	4.972	5.114	5.227	4.585	**4.798**
10	55	8.544	8.716	8.880	9.001			8.890	**9.013**	8.890	**9.013**
	65	7.252	7.482	7.709	7.883		7.655	**7.847**	7.991	7.655	**7.847**
	75	5.467	5.692	5.923	6.107	5.811	**6.022**	6.187	6.315	5.811	**6.022**
	85	3.564	3.718	3.880	4.013	**3.924**	4.050	4.151	4.232	3.769	**3.924**

Sample annuity values expressed as a percentage of IM80

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	105	107	110	112			112	114	112	114
	65	104	107	110	113		110	113	116	110	113
	75	101	104	107	110	106	110	113	115	106	110
	85	99	101	104	107	105	108	111	113	102	105
5	55	103	105	106	108			107	108	107	108
	65	104	105	108	109		108	110	111	108	110
	75	101	103	106	108	105	108	110	112	105	108
	85	99	101	103	106	104	107	109	111	102	104
10	55	103	103	104	105			104	105	104	105
	65	103	104	106	107		106	107	108	106	107
	75	101	103	105	107	104	106	108	110	104	106
	85	99	101	103	105	104	106	108	109	101	104

Table 7.11. Immediate Annuitants, Males, Amounts, IMA92 Ultimate.

Sample annuity values using different types of projected table

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	25.409	26.729	28.086	29.155			28.831	**29.791**	28.831	**29.791**
	65	17.000	18.024	19.095	19.956		19.166	**20.049**	20.734	19.166	**20.049**
	75	10.163	10.807	11.494	12.058	11.269	**11.891**	12.390	12.786	11.269	**11.891**
	85	5.379	5.691	6.027	6.308	**6.139**	6.403	6.619	6.792	5.820	**6.139**
5	55	13.459	13.878	14.291	14.604			14.411	**14.709**	14.411	**14.709**
	65	10.508	10.955	11.409	11.763		11.363	**11.741**	12.028	11.363	**11.741**
	75	7.234	7.599	7.981	8.289	7.821	**8.168**	8.443	8.658	7.821	**8.168**
	85	4.299	4.516	4.747	4.938	**4.815**	4.996	5.141	5.258	4.595	**4.815**
10	55	8.577	8.746	8.907	9.025			8.916	**9.036**	8.916	**9.036**
	65	7.296	7.525	7.751	7.923		7.696	**7.887**	8.030	7.696	**7.887**
	75	5.500	5.728	5.962	6.147	5.846	**6.060**	6.227	6.356	5.846	**6.060**
	85	3.552	3.711	3.879	4.016	**3.922**	4.052	4.157	4.240	3.762	**3.922**

Sample annuity values expressed as a percentage of IM80

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	106	109	111	113			113	115	113	115
	65	106	109	112	115		112	115	118	112	115
	75	104	107	110	113	109	113	116	118	109	113
	85	103	105	108	111	109	112	115	117	106	109
5	55	104	106	107	108			108	109	108	109
	65	105	107	109	110		109	111	112	109	111
	75	103	106	108	111	107	110	112	114	107	110
	85	102	104	107	110	108	110	113	115	105	108
10	55	103	104	105	105			105	105	105	105
	65	104	105	107	108		106	108	109	106	108
	75	103	105	107	109	106	108	110	111	106	108
	85	102	104	106	108	107	109	111	113	105	107

Table 7.12. Immediate Annuitants, Males, Amounts, IMA92 Select.

Sample annuity values using different types of projected table

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	25.429	26.745	28.098	29.164			28.848	**29.803**	28.848	**29.803**
	65	17.042	18.059	19.124	19.980		19.204	**20.080**	20.759	19.204	**20.080**
	75	10.239	10.877	11.557	12.116	11.341	**11.955**	12.449	12.840	11.341	**11.955**
	85	5.490	5.797	6.128	6.405	**6.242**	6.502	6.713	6.884	5.928	**6.242**
5	55	13.469	13.886	14.297	14.608			14.419	**14.715**	14.419	**14.715**
	65	10.534	10.977	11.427	11.777		11.386	**11.759**	12.043	11.386	**11.759**
	75	7.288	7.648	8.025	8.328	7.872	**8.213**	8.483	8.694	7.872	**8.213**
	85	4.387	4.600	4.827	5.014	**4.896**	5.072	5.215	5.329	4.680	**4.896**
10	55	8.584	8.752	8.911	9.028			8.921	**9.040**	8.921	**9.040**
	65	7.315	7.540	7.763	7.933		7.711	**7.899**	8.039	7.711	**7.899**
	75	5.541	5.765	5.995	6.176	5.884	**6.093**	6.256	6.383	5.884	**6.093**
	85	3.625	3.780	3.944	4.078	**3.988**	4.115	4.216	4.297	3.832	**3.988**

Sample annuity values expressed as a percentage of IM80

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	106	109	111	113			113	115	113	115
	65	106	109	112	115		113	115	118	113	115
	75	104	107	110	113	109	112	115	118	109	112
	85	102	104	107	110	108	111	113	116	105	108
5	55	104	106	107	108			108	109	108	109
	65	105	107	109	111		109	111	112	109	111
	75	103	105	108	110	107	109	112	114	107	109
	85	101	103	106	108	107	109	111	113	104	107
10	55	103	104	105	105			105	105	105	105
	65	104	105	107	108		106	108	109	106	108
	75	103	104	106	108	105	107	109	111	105	107
	85	101	102	105	107	105	107	109	111	103	105

Table 7.13. Immediate Annuitants, Females, Lives, IFL92 Ultimate.

Sample annuity values using different types of projected table

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	28.981	30.042	31.124	31.972			31.944	**32.649**	31.944	**32.649**
	65	19.859	20.747	21.667	22.399		21.875	**22.594**	23.148	21.875	**22.594**
	75	12.009	12.620	13.264	13.789	13.115	**13.683**	14.136	14.492	13.115	**13.683**
	85	6.251	6.566	6.902	7.181	**7.026**	7.287	7.498	7.668	6.710	**7.026**
5	55	14.546	14.841	15.130	15.349			15.272	**15.466**	15.272	**15.466**
	65	11.723	12.076	12.431	12.705		12.446	**12.728**	12.941	12.446	**12.728**
	75	8.267	8.593	8.931	9.201	8.819	**9.119**	9.355	9.538	8.819	**9.119**
	85	4.903	5.116	5.340	5.525	**5.413**	5.586	5.725	5.836	5.201	**5.413**
10	55	9.000	9.106	9.207	9.280			9.229	**9.300**	9.229	**9.300**
	65	7.903	8.069	8.233	8.356		8.213	**8.346**	8.444	8.213	**8.346**
	75	6.136	6.330	6.527	6.682	6.444	**6.620**	6.757	6.863	6.444	**6.620**
	85	3.993	4.144	4.303	4.432	**4.349**	4.470	4.567	4.645	4.198	**4.349**

Sample annuity values expressed as a percentage of IF80

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	103	105	107	108			108	110	108	110
	65	103	105	107	109		108	110	112	108	110
	75	102	104	107	109	106	109	111	113	106	109
	85	101	103	106	108	107	109	111	113	104	107
5	55	102	103	104	105			105	105	105	105
	65	102	103	105	106		105	107	108	105	107
	75	102	103	105	107	105	107	108	110	105	107
	85	101	103	105	107	106	108	110	111	104	106
10	55	102	102	103	103			103	103	103	103
	65	102	103	104	105		104	105	105	104	105
	75	101	103	104	106	104	105	106	108	104	105
	85	101	103	104	106	105	107	109	110	103	105

Table 7.14. Immediate Annuitants, Females, Lives, IFL92 Select.

Sample annuity values using different types of projected table

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	28.997	30.055	31.133	31.979			31.957	**32.659**	31.957	**32.659**
	65	19.899	20.781	21.694	22.421		21.910	**22.622**	23.171	21.910	**22.622**
	75	12.098	12.700	13.336	13.854	13.199	**13.757**	14.202	14.554	13.199	**13.757**
	85	6.404	6.711	7.040	7.313	**7.167**	7.420	7.626	7.792	6.858	**7.167**
5	55	14.554	14.847	15.135	15.353			15.278	**15.471**	15.278	**15.471**
	65	11.747	12.095	12.446	12.718		12.466	**12.744**	12.954	12.466	**12.744**
	75	8.328	8.648	8.980	9.245	8.875	**9.168**	9.399	9.578	8.875	**9.168**
	85	5.023	5.229	5.447	5.626	**5.522**	5.689	5.823	5.931	5.316	**5.522**
10	55	9.005	9.110	9.209	9.282			9.233	**9.303**	9.233	**9.303**
	65	7.919	8.082	8.243	8.365		8.226	**8.356**	8.453	8.226	**8.356**
	75	6.182	6.370	6.563	6.714	6.485	**6.656**	6.789	6.892	6.485	**6.656**
	85	4.090	4.236	4.389	4.514	**4.436**	4.552	4.646	4.720	4.291	**4.436**

Sample annuity values expressed as a percentage of IF80

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	103	105	107	108			108	110	108	110
	65	103	105	107	109		108	110	112	108	110
	75	102	104	107	109	106	109	111	113	106	109
	85	102	104	106	109	107	110	112	114	105	107
5	55	102	103	104	105			105	105	105	105
	65	102	103	105	106		105	106	108	105	106
	75	102	103	105	107	105	107	108	110	105	107
	85	102	103	105	107	106	108	110	112	104	106
10	55	102	102	102	103			103	103	103	103
	65	102	103	104	104		104	104	105	104	104
	75	101	103	104	106	104	105	106	108	104	105
	85	102	103	105	107	106	107	109	110	104	106

Table 7.15. Immediate Annuitants, Females, Amounts, IFA92 Ultimate.

Sample annuity values using different types of projected table

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	30.029	30.942	31.876	32.611			32.700	**33.284**	32.700	**33.284**
	65	20.589	21.390	22.218	22.879		22.474	**23.108**	23.597	22.474	**23.108**
	75	12.256	12.838	13.452	13.951	13.327	**13.865**	14.293	14.630	13.327	**13.865**
	85	6.146	6.454	6.784	7.058	**6.905**	7.160	7.368	7.535	6.595	**6.905**
5	55	14.901	15.140	15.375	15.555			15.523	**15.674**	15.523	**15.674**
	65	12.076	12.384	12.694	12.935		12.734	**12.975**	13.157	12.734	**12.975**
	75	8.438	8.747	9.066	9.322	8.969	**9.251**	9.472	9.644	8.969	**9.251**
	85	4.844	5.053	5.274	5.456	**5.346**	5.517	5.654	5.764	5.137	**5.346**
10	55	9.146	9.227	9.303	9.360			9.331	**9.382**	9.331	**9.382**
	65	8.094	8.235	8.373	8.477		8.367	**8.477**	8.558	8.367	**8.477**
	75	6.257	6.439	6.623	6.769	6.551	**6.715**	6.842	6.941	6.551	**6.715**
	85	3.958	4.107	4.264	4.392	**4.310**	4.430	4.526	4.603	4.161	**4.310**

Sample annuity values expressed as a percentage of IF80

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	107	108	109	110			111	112	111	112
	65	107	108	110	111		111	112	114	111	112
	75	104	106	108	110	108	110	112	114	108	110
	85	100	101	104	106	105	107	110	111	102	105
5	55	105	105	106	106			106	107	106	107
	65	105	106	107	108		108	109	109	108	109
	75	104	105	107	108	106	108	110	111	106	108
	85	100	102	104	106	105	107	108	110	102	105
10	55	103	103	104	104			104	104	104	104
	65	104	105	105	106		106	106	107	106	106
	75	103	104	106	107	105	107	108	109	105	107
	85	100	102	104	105	104	106	108	109	102	104

Table 7.16. Immediate Annuitants, Females, Amounts, IFA92 Select.

Sample annuity values using different types of projected table

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	30.035	30.947	31.879	32.613			32.705	**33.288**	32.705	**33.288**
	65	20.606	21.404	22.230	22.889		22.489	**23.120**	23.607	22.489	**23.120**
	75	12.304	12.882	13.490	13.986	13.372	**13.904**	14.328	14.663	13.372	**13.904**
	85	6.239	6.542	6.868	7.138	**6.990**	7.242	7.446	7.610	6.685	**6.990**
5	55	14.904	15.142	15.377	15.556			15.525	**15.676**	15.525	**15.676**
	65	12.086	12.392	12.701	12.940		12.742	**12.981**	13.162	12.742	**12.981**
	75	8.471	8.776	9.092	9.345	8.999	**9.277**	9.496	9.666	8.999	**9.277**
	85	4.917	5.122	5.339	5.518	**5.412**	5.579	5.714	5.821	5.207	**5.412**
10	55	9.148	9.228	9.304	9.360			9.332	**9.383**	9.332	**9.383**
	65	8.101	8.240	8.377	8.481		8.373	**8.481**	8.562	8.373	**8.481**
	75	6.282	6.460	6.642	6.786	6.573	**6.734**	6.860	6.956	6.573	**6.734**
	85	4.017	4.163	4.317	4.442	**4.363**	4.480	4.574	4.649	4.218	**4.363**

Sample annuity values expressed as a percentage of IF80

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	107	108	109	110			111	112	111	112
	65	106	108	110	111		111	112	114	111	112
	75	104	105	108	110	108	110	112	114	108	110
	85	99	101	104	106	105	107	109	111	102	105
5	55	105	105	106	106			106	107	106	107
	65	105	106	107	108		107	108	109	107	108
	75	103	105	107	108	106	108	109	111	106	108
	85	100	101	103	105	104	106	108	109	102	104
10	55	103	103	104	104			104	104	104	104
	65	104	105	105	106		105	106	107	105	106
	75	103	104	106	107	105	106	108	109	105	106
	85	100	101	103	105	104	106	107	108	102	104

Table 7.17. Retirement Annuitants, Males, Vested, RMV92.

Sample annuity values using different types of projected table

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	23.328	25.082	26.877	28.277			27.303	**28.695**	27.303	**28.695**
	65	16.962	18.059	19.206	20.126		19.237	**20.192**	20.931	19.237	**20.192**
	75	10.528	11.195	11.905	12.488	11.681	**12.322**	12.837	13.244	11.681	**12.322**
	85	5.818	6.144	6.495	6.788	**6.618**	6.892	7.115	7.295	6.286	**6.618**
5	55	12.429	13.058	13.673	14.132			13.646	**14.137**	13.646	**14.137**
	65	10.403	10.885	11.372	11.751		11.300	**11.711**	12.021	11.300	**11.711**
	75	7.403	7.775	8.163	8.474	8.003	**8.355**	8.633	8.849	8.003	**8.355**
	85	4.582	4.805	5.041	5.235	**5.113**	5.296	5.444	5.563	4.889	**5.113**
10	55	7.991	8.282	8.557	8.756			8.484	**8.711**	8.484	**8.711**
	65	7.203	7.452	7.698	7.885		7.625	**7.836**	7.992	7.625	**7.836**
	75	5.588	5.817	6.052	6.238	5.936	**6.151**	6.318	6.447	5.936	**6.151**
	85	3.748	3.908	4.076	4.213	**4.121**	4.251	4.355	4.438	3.961	**4.121**

Sample annuity values expressed as a percentage of PML80

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	105	109	114	118			115	119	115	119
	65	118	121	125	128		125	129	131	125	129
	75	126	129	132	135	131	135	138	141	131	135
	85	128	130	133	136	135	138	140	143	131	135
5	55	100	103	106	108			106	108	106	108
	65	112	114	116	118		116	118	120	116	118
	75	120	122	124	127	124	126	128	130	124	126
	85	124	126	128	130	129	131	134	136	127	129
10	55	98	100	102	104			102	103	102	103
	65	108	109	111	112		111	112	113	111	112
	75	116	118	119	121	119	120	122	124	119	120
	85	121	122	124	126	125	127	129	131	123	125

Table 7.18. Retirement Annuitants, Females, Vested, RFV92.

Sample annuity values using different types of projected table

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	27.977	29.357	30.742	31.808			31.350	**32.338**	31.350	**32.338**
	65	20.213	21.154	22.122	22.889		22.295	**23.057**	23.642	22.295	**23.057**
	75	12.689	13.305	13.951	14.474	13.811	**14.377**	14.826	15.178	13.811	**14.377**
	85	6.817	7.132	7.468	7.745	**7.598**	7.855	8.063	8.230	7.284	**7.598**
5	55	13.972	14.408	14.827	15.137			14.877	**15.191**	14.877	**15.191**
	65	11.769	12.145	12.520	12.809		12.515	**12.817**	13.043	12.515	**12.817**
	75	8.596	8.918	9.251	9.516	9.144	**9.438**	9.668	9.846	9.144	**9.438**
	85	5.281	5.490	5.711	5.891	**5.786**	5.954	6.089	6.196	5.579	**5.786**
10	55	8.662	8.845	9.016	9.138			8.989	**9.124**	8.989	**9.124**
	65	7.881	8.061	8.237	8.369		8.204	**8.349**	8.455	8.204	**8.349**
	75	6.312	6.501	6.692	6.842	6.613	**6.784**	6.916	7.017	6.613	**6.784**
	85	4.259	4.406	4.560	4.684	**4.606**	4.722	4.815	4.889	4.461	**4.606**

Sample annuity values expressed as a percentage of PFL80

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	103	106	109	111			110	113	110	113
	65	110	112	114	117		115	117	119	115	117
	75	116	118	120	123	120	122	124	126	120	122
	85	120	121	124	126	125	127	129	131	122	125
5	55	100	102	104	105			104	105	104	105
	65	106	107	109	110		109	110	111	109	110
	75	112	113	115	117	114	116	118	119	114	116
	85	117	119	120	122	121	123	125	126	119	121
10	55	99	100	101	102			101	102	101	102
	65	103	104	106	106		105	106	107	105	106
	75	109	110	111	113	111	112	113	115	111	112
	85	115	116	118	119	119	120	122	123	117	119

Table 7.19. Widows, Lives, WL92.

Sample annuity values using different types of projected table

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	25.968	27.477	29.019	30.223			29.733	**30.841**	29.733	**30.841**
	65	18.159	19.264	20.412	21.328		20.486	**21.426**	22.151	20.486	**21.426**
	75	11.622	12.302	13.020	13.606	12.819	**13.460**	13.971	14.375	12.819	**13.460**
	85	6.664	6.999	7.357	7.653	**7.492**	7.768	7.991	8.170	7.156	**7.492**
5	55	13.422	13.902	14.371	14.724			14.459	**14.806**	14.459	**14.806**
	65	10.853	11.318	11.788	12.151		11.733	**12.123**	12.417	11.733	**12.123**
	75	7.960	8.326	8.705	9.007	8.559	**8.899**	9.167	9.375	8.559	**8.899**
	85	5.140	5.362	5.596	5.787	**5.673**	5.852	5.996	6.111	5.453	**5.673**
10	55	8.490	8.688	8.877	9.013			8.866	**9.011**	8.866	**9.011**
	65	7.408	7.643	7.873	8.048		7.811	**8.006**	8.151	7.811	**8.006**
	75	5.905	6.124	6.348	6.524	6.242	**6.445**	6.602	6.723	6.242	**6.445**
	85	4.139	4.294	4.456	4.588	**4.504**	4.628	4.727	4.805	4.350	**4.504**

Sample annuity values expressed as a percentage of WL80

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	103	106	110	112			112	114	112	114
	65	106	109	112	115		112	116	118	112	116
	75	110	113	116	119	115	118	121	124	115	118
	85	120	122	125	127	126	129	131	133	123	126
5	55	101	103	105	107			105	107	105	107
	65	103	105	107	109		107	109	111	107	109
	75	107	109	111	114	110	113	115	117	110	113
	85	117	118	120	123	121	124	125	127	119	121
10	55	100	102	103	104			103	104	103	104
	65	102	103	105	106		104	106	107	104	106
	75	105	106	108	110	107	109	111	112	107	109
	85	114	115	117	119	118	120	121	123	116	118

Table 7.20. Widows, Amounts, WA92.

Sample annuity values using different types of projected table

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	27.040	28.484	29.952	31.096			30.698	**31.733**	30.698	**31.733**
	65	19.006	20.080	21.193	22.077		21.305	**22.204**	22.895	21.305	**22.204**
	75	12.208	12.881	13.590	14.166	13.410	**14.037**	14.536	14.929	13.410	**14.037**
	85	7.000	7.336	7.694	7.991	**7.834**	8.109	8.331	8.509	7.499	**7.834**
5	55	13.746	14.190	14.624	14.948			14.721	**15.036**	14.721	**15.036**
	65	11.196	11.638	12.081	12.424		12.043	**12.408**	12.682	12.043	**12.408**
	75	8.268	8.623	8.990	9.283	8.858	**9.185**	9.442	9.641	8.858	**9.185**
	85	5.359	5.579	5.810	5.999	**5.889**	6.065	6.207	6.320	5.672	**5.889**
10	55	8.619	8.798	8.968	9.091			8.963	**9.092**	8.963	**9.092**
	65	7.576	7.794	8.008	8.169		7.955	**8.134**	8.267	7.955	**8.134**
	75	6.086	6.296	6.510	6.677	6.413	**6.605**	6.754	6.869	6.413	**6.605**
	85	4.290	4.443	4.602	4.732	**4.650**	4.771	4.868	4.944	4.500	**4.650**

Sample annuity values expressed as a percentage of WA80

Rate of interest %	Age	Calendar year				Year of birth				Year of use	
		1992	2000	2010	2020	1925	1935	1945	1955	2000	2010
0	55	103	105	109	111			110	113	110	113
	65	106	109	112	115		112	115	118	112	115
	75	112	114	117	120	116	119	122	124	116	119
	85	120	122	124	126	125	128	130	132	123	125
5	55	100	102	104	105			104	106	104	106
	65	103	105	107	109		107	109	110	107	109
	75	108	110	112	114	111	114	116	117	111	114
	85	117	118	120	122	121	123	125	126	119	121
10	55	100	101	102	103			102	103	102	103
	65	101	103	104	106		104	105	106	104	105
	75	106	107	109	111	108	110	111	113	108	110
	85	114	115	117	119	118	119	121	122	116	118

8. PUBLICATION OF THE NEW TABLES

8.1 *Introduction*

8.1.1 Prior to the "80" Series, new tables had traditionally been published by means of a number of printed volumes containing commutation and monetary functions over a wide range of interest rates, in addition to mortality functions.

8.1.2 When the "80" Series of tables was published the Committee, supported by comments received from members of the profession, broke with tradition and decided that due to the widespread use of personal computers the publication of printed volumes of commutation and monetary functions was no longer necessary. Instead, it was decided that a computer package should be made available which would allow the user to generate the basic mortality functions and a wide range of commutation and monetary functions, at any reasonable rate of interest, for any of the new standard tables or, in the case of joint-life functions, a combination of any two of the new standard tables. This computer package is known as the Standard Tables Program.

8.2 *The "92" Series*

8.2.1 Following the favourable reception of the Standard Tables Program and bearing in mind the other information needs of the profession, the Committee is of the view that the new tables should be published by means of:

(a) a single printed volume that contains the basic mortality functions (q, μ and l) for each of the new standard tables for assurances and the base tables for pensioners, immediate annuitants, retirement annuitants and widows, together with corresponding values of q for selected projected tables, as well as examples of monetary functions at only one or two rates of interest for each of the tables;

(b) an updated Windows version of the Standard Tables Program, Version 3.0, containing the new "92" Series tables (as well as the "80" Series and earlier tables); and

(c) placing the word-processing files that comprise this edition of *C.M.I.R.* onto the Faculty of Actuaries and Institute of Actuaries web site (www.actuaries.org.uk).

8.2.2 It is the intention of the Committee that future publications will also be put onto the web site so that information can be quickly made available to the profession and other interested parties.

8.2.3 The reader unfamiliar with the Standard Tables Program is referred to *C.M.I.R.* **10**, 86 where a full description of its capabilities is given.

8.3 *Publication date*

8.3.1 The official launch date of the new standard tables was 30 June 1999 when the values of q were put onto the web site. The printed volume, entitled "Standard Tables of Mortality – The "92" Series", and Version 3.0 of the Standard Tables Program were available for purchase from July 1999.

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APPENDIX A

VALUES OF MORTALITY RATES FOR THE NEW STANDARD TABLES

Basic tables for 1991–94 experience, and projected tables for calendar year 2020 and years of birth 1945 and 1972.

Table A1. Permanent assurances, males – AM92 two years select: values of $q_{[x-t]+t}$

Age x	Duration 0	Duration 1	Durations 2+
17	0.000427	0.000552	0.000600
18	0.000426	0.000548	0.000594
19	0.000425	0.000544	0.000587
20	0.000425	0.000541	0.000582
21	0.000425	0.000538	0.000577
22	0.000427	0.000535	0.000572
23	0.000429	0.000534	0.000569
24	0.000431	0.000533	0.000567
25	0.000435	0.000533	0.000566
26	0.000440	0.000535	0.000567
27	0.000447	0.000538	0.000570
28	0.000455	0.000542	0.000574
29	0.000465	0.000549	0.000580
30	0.000476	0.000558	0.000590
31	0.000490	0.000569	0.000602
32	0.000507	0.000584	0.000617
33	0.000527	0.000602	0.000636
34	0.000550	0.000624	0.000660
35	0.000577	0.000651	0.000689
36	0.000608	0.000683	0.000724
37	0.000644	0.000722	0.000765
38	0.000685	0.000768	0.000813
39	0.000733	0.000823	0.000870
40	0.000788	0.000887	0.000937
41	0.000851	0.000962	0.001014
42	0.000922	0.001049	0.001104
43	0.001003	0.001150	0.001208
44	0.001096	0.001267	0.001327
45	0.001201	0.001402	0.001465
46	0.001320	0.001557	0.001622
47	0.001455	0.001735	0.001802
48	0.001607	0.001938	0.002008
49	0.001778	0.002170	0.002241
50	0.001971	0.002434	0.002508
51	0.002189	0.002732	0.002809
52	0.002433	0.003070	0.003152
53	0.002707	0.003452	0.003539
54	0.003014	0.003881	0.003976

Table A1. (Continued).

Age x	Duration 0	Duration 1	Durations 2+
55	0.003358	0.004363	0.004469
56	0.003742	0.004903	0.005025
57	0.004171	0.005507	0.005650
58	0.004649	0.006180	0.006352
59	0.005182	0.006929	0.007140
60	0.005774	0.007760	0.008022
61	0.006433	0.008680	0.009009
62	0.007164	0.009696	0.010112
63	0.007974	0.010815	0.011344
64	0.008871	0.012046	0.012716
65	0.009864	0.013396	0.014243
66	0.010960	0.014873	0.015940
67	0.012169	0.016484	0.017824
68	0.013502	0.018239	0.019913
69	0.014969	0.020145	0.022226
70	0.016582	0.022210	0.024783
71	0.018353	0.024441	0.027606
72	0.020296	0.026847	0.030718
73	0.022423	θ.029434	0.034144
74	0.024750	0.032208	0.037911
75	0.027293	0.035176	0.042046
76	0.030067	0.038344	0.046578
77	0.033090	0.041715	0.051538
78	0.036379	0.045292	0.056956
79	0.039954	0.049080	0.062867
80	0.043833	0.053078	0.069303
81	0.048037	0.057288	0.076300
82	0.052586	0.061709	0.083893
83	0.057501	0.066337	0.092117
84	0.062804	0.071169	0.101007
85	0.068516	0.076199	0.110600
86	0.074661	0.081422	0.120929
87	0.081258	0.086827	0.132028
88	0.088331	0.092405	0.143929
89	0.095902	0.098144	0.156660
90	0.103990	0.104031	0.170247
91		0.110052	0.184714
92			0.200079
93			0.216354
94			0.233548

Table A1. (Continued).

Age x	Duration 0	Duration 1	Durations 2+
95			0.251662
96			0.270688
97			0.290613
98			0.311414
99			0.333058
100			0.355505
101			0.378702
102			0.402588
103			0.427090
104			0.452127
105			0.477608
106			0.503432
107			0.529493
108			0.555674
109			0.581857
110			0.607918
111			0.633731
112			0.659171
113			0.684114
114			0.708442
115			0.732042
116			0.754809
117			0.776648
118			0.797477
119			0.817225
120			1.000000

Table A2. Permanent assurances, females – AF92 two years select: values of $q_{[x-t]+t}$

Age x	Duration 0	Duration 1	Durations 2+
17	0.000113	0.000132	0.000172
18	0.000117	0.000138	0.000178
19	0.000121	0.000143	0.000185
20	0.000125	0.000150	0.000193
21	0.000130	0.000157	0.000202
22	0.000135	0.000165	0.000212
23	0.000141	0.000173	0.000223
24	0.000148	0.000183	0.000235
25	0.000155	0.000193	0.000248
26	0.000163	0.000205	0.000263
27	0.000172	0.000218	0.000279
28	0.000182	0.000232	0.000297
29	0.000193	0.000247	0.000317
30	0.000205	0.000264	0.000339
31	0.000218	0.000283	0.000364
32	0.000233	0.000304	0.000391
33	0.000249	0.000327	0.000422
34	0.000267	0.000352	0.000455
35	0.000287	0.000380	0.000492
36	0.000309	0.000410	0.000533
37	0.000334	0.000444	0.000579
38	0.000361	0.000481	0.000629
39	0.000391	0.000522	0.000685
40	0.000424	0.000567	0.000747
41	0.000461	0.000616	0.000816
42	0.000502	0.000671	0.000892
43	0.000547	0.000731	0.000977
44	0.000597	0.000798	0.001070
45	0.000652	0.000871	0.001174
46	0.000713	0.000951	0.001288
47	0.000781	0.001040	0.001416
48	0.000855	0.001138	0.001556
49	0.000938	0.001246	0.001713
50	0.001030	0.001364	0.001886
51	0.001132	0.001495	0.002077
52	0.001244	0.001640	0.002290
53	0.001368	0.001798	0.002525
54	0.001506	0.001973	0.002786

Table A2. (Continued).

Age x	Duration 0	Duration 1	Durations 2+
55	0.001658	0.002166	0.003075
56	0.001827	0.002379	0.003395
57	0.002014	0.002613	0.003749
58	0.002220	0.002871	0.004142
59	0.002449	0.003155	0.004577
60	0.002701	0.003468	0.005058
61	0.002981	0.003813	0.005592
62	0.003291	0.004192	0.006183
63	0.003634	0.004611	0.006838
64	0.004013	0.005071	0.007562
65	0.004432	0.005579	0.008365
66	0.004897	0.006138	0.009254
67	0.005410	0.006754	0.010238
68	0.005978	0.007431	0.011327
69	0.006607	0.008178	0.012533
70	0.007302	0.009000	0.013867
71	0.008071	0.009905	0.015343
72	0.008922	0.010901	0.016977
73	0.009863	0.011998	0.018784
74	0.010903	0.013205	0.020783
75	0.012053	0.014534	0.022994
76	0.013325	0.015995	0.025438
77	0.014730	0.017604	0.028138
78	0.016284	0.019373	0.031123
79	0.018000	0.021319	0.034419
80	0.019897	0.023459	0.038059
81	0.021993	0.025812	0.042077
82	0.024307	0.028398	0.046510
83	0.026862	0.031240	0.051398
84	0.029683	0.034362	0.056786
85	0.032795	0.037791	0.062721
86	0.036229	0.041555	0.069254
87	0.040016	0.045686	0.076441
88	0.044190	0.050217	0.084340
89	0.048789	0.055186	0.093016
90	0.053854	0.060631	0.102533
91		0.066594	0.112964
92			0.124381
93			0.136862
94			0.150486

Table A2. (Continued).

Age x	Duration 0	Duration 1	Durations 2+
95			0.165332
96			0.181481
97			0.199012
98			0.218002
99			0.238520
100			0.260630
101			0.284383
102			0.309814
103			0.336943
104			0.365762
105			0.396238
106			0.428303
107			0.461851
108			0.496734
109			0.532756
110			0.569670
111			0.607181
112			0.644942
113			0.682563
114			0.719616
115			0.755647
116			0.790192
117			0.822800
118			0.853050
119			0.880579
120			1.000000

Table A3. Temporary assurances, males – TM92 five years select: values of $q_{[x-t]+t}$

Age x	Duration 0	Durations 1–4	Durations 5+
17	0.000679	0.000778	0.000846
18	0.000655	0.000753	0.000820
19	0.000632	0.000729	0.000794
20	0.000610	0.000707	0.000770
21	0.000589	0.000686	0.000747
22	0.000570	0.000667	0.000725
23	0.000552	0.000649	0.000705
24	0.000535	0.000633	0.000687
25	0.000521	0.000619	0.000670
26	0.000508	0.000607	0.000656
27	0.000498	0.000598	0.000644
28	0.000490	0.000591	0.000634
29	0.000484	0.000588	0.000628
30	0.000482	0.000587	0.000625
31	0.000483	0.000590	0.000626
32	0.000487	0.000598	0.000630
33	0.000494	0.000610	0.000640
34	0.000507	0.000626	0.000655
35	0.000523	0.000648	0.000676
36	0.000545	0.000676	0.000703
37	0.000572	0.000711	0.000738
38	0.000605	0.000753	0.000781
39	0.000645	0.000802	0.000833
40	0.000691	0.000861	0.000896
41	0.000746	0.000929	0.000970
42	0.000810	0.001008	0.001057
43	0.000883	0.001098	0.001158
44	0.000966	0.001202	0.001275
45	0.001061	0.001319	0.001410
46	0.001168	0.001453	0.001565
47	0.001289	0.001603	0.001743
48	0.001425	0.001772	0.001945
49	0.001577	0.001962	0.002175
50	0.001746	0.002175	0.002436
51	0.001936	0.002413	0.002731
52	0.002146	0.002679	0.003064
53	0.002380	0.002975	0.003441
54	0.002639	0.003304	0.003864

Table A3. (Continued).

Age x	Duration 0	Durations 1–4	Durations 5+
55	0.002926	0.003669	0.004341
56	0.003244	0.004075	0.004877
57	0.003594	0.004524	0.005478
58	0.003980	0.005022	0.006153
59	0.004406	0.005573	0.006908
60	0.004874	0.006181	0.007754
61	0.005390	0.006853	0.008700
62	0.005956	0.007594	0.009757
63	0.006578	0.008412	0.010937
64	0.007260	0.009313	0.012255
65	0.008008	0.010305	0.013724
66	0.008828	0.011397	0.015363
67	0.009726	0.012598	0.017187
68	0.010709	0.013919	0.019219
69	0.011784	0.015369	0.021479
70	0.012959	0.016962	0.023992
71	0.014243	0.018710	0.026784
72	0.015645	0.020627	0.029885
73	0.017176	0.022729	0.033327
74	0.018846	0.025032	0.037143
75	0.020667	0.027554	0.041372
76	0.022652	0.030315	0.046055
77	0.024814	0.033334	0.051236
78	0.027169	0.036635	0.056965
79	0.029730	0.040241	0.063292
80	0.032517	0.044179	0.070273
81	0.035546	0.048476	0.077969
82	0.038837	0.053161	0.086443
83	0.042410	0.058267	0.095763
84	0.046289	0.063826	0.105998
85	0.050495	0.069875	0.117224
86	0.055054	0.076451	0.129518
87	0.059992	0.083593	0.142957
88	0.065337	0.091343	0.157622
89	0.071118	0.099745	0.173593
90	0.077367	0.108844	0.190948
91		0.118686	0.209761
92		0.129320	0.230102
93		0.140793	0.252030
94		0.153155	0.275595

Table A3. (Continued).

Age x	Duration 0	Durations 1–4	Durations 5+
95			0.300831
96			0.327753
97			0.356353
98			0.386594
99			0.418410
100			0.451695
101			0.486303
102			0.522043
103			0.558677
104			0.595921
105			0.633445
106			0.670875
107			0.707804
108			0.743804
109			0.778435
110			0.811264
111			0.841891
112			0.869961
113			0.895193
114			0.917393
115			0.936470
116			0.952446
117			0.965448
118			0.975704
119			0.983521
120			1.000000

Table A4. Temporary assurances, females – TF92 five years select: values of $q_{[x-t]+t}$

Age x	Duration 0	Durations 1–4	Durations 5+
17	0.000099	0.000167	0.000227
18	0.000102	0.000172	0.000232
19	0.000104	0.000178	0.000238
20	0.000107	0.000184	0.000245
21	0.000110	0.000191	0.000252
22	0.000114	0.000199	0.000260
23	0.000118	0.000208	0.000269
24	0.000122	0.000218	0.000279
25	0.000127	0.000229	0.000290
26	0.000132	0.000241	0.000303
27	0.000138	0.000254	0.000317
28	0.000145	0.000269	0.000332
29	0.000153	0.000285	0.000349
30	0.000161	0.000304	0.000369
31	0.000170	0.000324	0.000390
32	0.000181	0.000346	0.000414
33	0.000193	0.000371	0.000440
34	0.000206	0.000399	0.000469
35	0.000220	0.000430	0.000502
36	0.000237	0.000464	0.000538
37	0.000255	0.000502	0.000579
38	0.000275	0.000545	0.000624
39	0.000298	0.000591	0.000674
40	0.000323	0.000643	0.000729
41	0.000351	0.000701	0.000791
42	0.000383	0.000766	0.000860
43	0.000418	0.000837	0.000937
44	0.000457	0.000916	0.001022
45	0.000501	0.001004	0.001117
46	0.000549	0.001102	0.001223
47	0.000604	0.001210	0.001341
48	0.000665	0.001330	0.001472
49	0.000733	0.001464	0.001618
50	0.000808	0.001613	0.001780
51	0.000893	0.001777	0.001960
52	0.000987	0.001960	0.002161
53	0.001093	0.002163	0.002384
54	0.001210	0.002389	0.002633

Table A4. (Continued).

Age x	Duration 0	Durations 1–4	Durations 5+
55	0.001341	0.002640	0.002909
56	0.001488	0.002918	0.003217
57	0.001651	0.003226	0.003559
58	0.001834	0.003569	0.003940
59	0.002037	0.003949	0.004363
60	0.002264	0.004372	0.004834
61	0.002517	0.004840	0.005358
62	0.002800	0.005361	0.005941
63	0.003115	0.005938	0.006589
64	0.003467	0.006579	0.007310
65	0.003860	0.007290	0.008111
66	0.004298	0.008079	0.009002
67	0.004787	0.008955	0.009993
68	0.005332	0.009926	0.011095
69	0.005940	0.011004	0.012319
70	0.006618	0.012200	0.013680
71	0.007375	0.013526	0.015192
72	0.008219	0.014996	0.016873
73	0.009159	0.016626	0.018739
74	0.010208	0.018434	0.020812
75	0.011378	0.020437	0.023114
76	0.012682	0.022656	0.025669
77	0.014135	0.025115	0.028505
78	0.015754	0.027839	0.031652
79	0.017559	0.030855	0.035141
80	0.019568	0.034193	0.039009
81	0.021807	0.037886	0.043296
82	0.024299	0.041971	0.048045
83	0.027074	0.046487	0.053301
84	0.030161	0.051477	0.059117
85	0.033595	0.056988	0.065547
86	0.037414	0.063071	0.072651
87	0.041658	0.069779	0.080494
88	0.046373	0.077173	0.089144
89	0.051608	0.085315	0.098674
90	0.057417	0.094273	0.109163
91		0.104118	0.120693
92		0.114925	0.133348
93		0.126774	0.147218
94		0.139747	0.162392

Table A4. (Continued).

Age x	Duration 0	Durations 1–4	Durations 5+
95			0.178963
96			0.197018
97			0.216645
98			0.237923
99			0.260924
100			0.285707
101			0.312311
102			0.340754
103			0.371027
104			0.403085
105			0.436844
106			0.472174
107			0.508892
108			0.546759
109			0.585478
110			0.624691
111			0.663985
112			0.702896
113			0.740926
114			0.777553
115			0.812260
116			0.844557
117			0.874011
118			0.900277
119			0.923123
120			1.000000

Table A5. Pensioners – PML92Base, PMA92Base, PFL92Base and PFA92Base values of q_x

	Males		Females	
Age x	Lives PML92Base	Amounts PMA92Base	Lives PFL92Base	Amounts PFA92Base
20	0.000623	0.000340	0.000254	0.000203
21	0.000612	0.000338	0.000253	0.000202
22	0.000601	0.000337	0.000253	0.000202
23	0.000591	0.000335	0.000252	0.000202
24	0.000581	0.000334	0.000252	0.000202
25	0.000573	0.000333	0.000253	0.000203
26	0.000565	0.000332	0.000255	0.000204
27	0.000560	0.000331	0.000257	0.000206
28	0.000555	0.000331	0.000260	0.000209
29	0.000553	0.000332	0.000265	0.000212
30	0.000553	0.000333	0.000270	0.000217
31	0.000556	0.000335	0.000278	0.000222
32	0.000562	0.000338	0.000287	0.000230
33	0.000572	0.000343	0.000299	0.000238
34	0.000586	0.000349	0.000313	0.000249
35	0.000605	0.000357	0.000330	0.000263
36	0.000631	0.000367	0.000351	0.000279
37	0.000663	0.000380	0.000376	0.000298
38	0.000704	0.000396	0.000405	0.000321
39	0.000755	0.000417	0.000441	0.000349
40	0.000817	0.000443	0.000482	0.000382
41	0.000892	0.000475	0.000532	0.000421
42	0.000982	0.000514	0.000589	0.000468
43	0.001089	0.000561	0.000657	0.000522
44	0.001216	0.000619	0.000736	0.000586
45	0.001365	0.000689	0.000829	0.000662
46	0.001541	0.000774	0.000936	0.000750
47	0.001746	0.000876	0.001061	0.000852
48	0.001985	0.000997	0.001205	0.000972
49	0.002262	0.001142	0.001371	0.001110
50	0.002583	0.001315	0.001563	0.001271
51	0.002953	0.001519	0.001783	0.001456
52	0.003378	0.001761	0.002036	0.001670
53	0.003865	0.002045	0.002326	0.001917
54	0.004422	0.002379	0.002657	0.002200

Table A5. (Continued).

Age x	Males		Females	
	Lives PML92Base	Amounts PMA92Base	Lives PFL92Base	Amounts PFA92Base
55	0.005058	0.002771	0.003035	0.002524
56	0.005780	0.003228	0.003466	0.002894
57	0.006600	0.003759	0.003955	0.003317
58	0.007527	0.004376	0.004510	0.003799
59	0.008574	0.005090	0.005139	0.004345
60	0.009753	0.005914	0.005849	0.004965
61	0.011076	0.006861	0.006650	0.005667
62	0.012559	0.007947	0.007553	0.006458
63	0.014217	0.009189	0.008567	0.007350
64	0.016065	0.010604	0.009704	0.008352
65	0.018120	0.012211	0.010977	0.009476
66	0.020400	0.014032	0.012399	0.010734
67	0.022923	0.016088	0.013985	0.012138
68	0.025708	0.018402	0.015751	0.013703
69	0.028775	0.020998	0.017711	0.015442
70	0.032142	0.023901	0.019885	0.017371
71	0.035831	0.027137	0.022289	0.019505
72	0.039862	0.030732	0.024943	0.021861
73	0.044253	0.034713	0.027867	0.024455
74	0.049025	0.039105	0.031081	0.027306
75	0.054197	0.043935	0.034607	0.030432
76	0.059787	0.049227	0.038467	0.033849
77	0.065811	0.055006	0.042682	0.037577
78	0.072286	0.061292	0.047276	0.041632
79	0.079225	0.068106	0.052271	0.046035
80	0.086639	0.075464	0.057690	0.050800
81	0.094538	0.083379	0.063554	0.055946
82	0.102929	0.091862	0.069886	0.061488
83	0.111815	0.100917	0.076705	0.067441
84	0.121196	0.110544	0.084032	0.073817
85	0.131071	0.120739	0.091884	0.080629
86	0.141431	0.131492	0.100278	0.087885
87	0.152267	0.142786	0.109228	0.095594
88	0.163563	0.154599	0.118745	0.103761
89	0.175302	0.166903	0.128838	0.112386

Table A5. (Continued).

Age x	Males: Lives PML92Base	Males: Amounts PMA92Base	Females: Lives PFL92Base	Females: Amounts PFA92Base
90	0.187460	0.179664	0.139514	0.121470
91	0.200011	0.192841	0.150773	0.131009
92	0.212925	0.206389	0.162615	0.140996
93	0.226167	0.220257	0.175034	0.151420
94	0.239700	0.234389	0.188021	0.162267
95	0.253482	0.248727	0.201561	0.173519
96	0.267471	0.263206	0.215636	0.185155
97	0.281620	0.277762	0.230224	0.197150
98	0.295880	0.292327	0.245296	0.209477
99	0.310203	0.306832	0.260821	0.222103
100	0.324539	0.321209	0.276762	0.234995
101	0.338835	0.335389	0.293080	0.248115
102	0.353042	0.349305	0.309730	0.261424
103	0.367107	0.362893	0.326664	0.274879
104	0.380983	0.376091	0.343834	0.288437
105	0.394621	0.388838	0.361186	0.302054
106	0.407973	0.401079	0.378665	0.315684
107	0.420997	0.412763	0.396216	0.329280
108	0.433649	0.423842	0.413781	0.342795
109	0.445890	0.434272	0.431304	0.356185
110	0.457684	0.444014	0.448729	0.369403
111	0.468997	0.453033	0.466001	0.382406
112	0.479798	0.461297	0.483064	0.395150
113	0.490060	0.468780	0.499869	0.407594
114	0.499756	0.475459	0.516366	0.419700
115	0.508865	0.481313	0.532508	0.431431
116	0.517368	0.486326	0.548254	0.442752
117	0.525248	0.490484	0.563564	0.453630
118	0.532489	0.493776	0.578402	0.464038
119	0.539080	0.496194	0.592739	0.473947
120	1.000000	1.000000	1.000000	1.000000

Table A6. Immediate annuitants, males – IML92Base and IMA92Base one year select: values of $q_{[x-t]+t}$

	Lives		Amounts	
Age x	Duration 0	Durations 1+	Duration 0	Durations 1+
17	0.000433	0.000587	0.000458	0.000560
18	0.000429	0.000582	0.000454	0.000555
19	0.000426	0.000577	0.000450	0.000550
20	0.000423	0.000573	0.000447	0.000546
21	0.000420	0.000569	0.000444	0.000543
22	0.000418	0.000567	0.000442	0.000540
23	0.000417	0.000565	0.000441	0.000539
24	0.000416	0.000564	0.000440	0.000538
25	0.000417	0.000565	0.000440	0.000538
26	0.000418	0.000567	0.000442	0.000540
27	0.000421	0.000570	0.000445	0.000544
28	0.000425	0.000576	0.000449	0.000549
29	0.000430	0.000583	0.000455	0.000556
30	0.000438	0.000593	0.000463	0.000566
31	0.000448	0.000606	0.000473	0.000578
32	0.000460	0.000623	0.000486	0.000594
33	0.000474	0.000643	0.000501	0.000613
34	0.000492	0.000667	0.000520	0.000636
35	0.000514	0.000696	0.000543	0.000664
36	0.000540	0.000731	0.000570	0.000697
37	0.000570	0.000772	0.000602	0.000736
38	0.000606	0.000821	0.000640	0.000783
39	0.000648	0.000878	0.000685	0.000837
40	0.000697	0.000945	0.000737	0.000901
41	0.000754	0.001022	0.000797	0.000974
42	0.000820	0.001111	0.000867	0.001060
43	0.000896	0.001215	0.000947	0.001158
44	0.000984	0.001333	0.001040	0.001271
45	0.001085	0.001470	0.001147	0.001402
46	0.001201	0.001627	0.001269	0.001551
47	0.001333	0.001806	0.001408	0.001722
48	0.001484	0.002010	0.001568	0.001917
49	0.001656	0.002243	0.001750	0.002139
50	0.001852	0.002508	0.001956	0.002392
51	0.002074	0.002809	0.002191	0.002678
52	0.002326	0.003150	0.002457	0.003004
53	0.002611	0.003536	0.002759	0.003372
54	0.002934	0.003973	0.003099	0.003788

Table A6. (Continued).

	Lives		Amounts	
Age x	Duration 0	Durations 1+	Duration 0	Durations 1+
55	0.003298	0.004466	0.003484	0.004258
56	0.003708	0.005021	0.003917	0.004787
57	0.004170	0.005646	0.004405	0.005383
58	0.004689	0.006348	0.004953	0.006053
59	0.005271	0.007136	0.005569	0.006805
60	0.005925	0.008019	0.006259	0.007647
61	0.006656	0.009008	0.007031	0.008590
62	0.007474	0.010113	0.007895	0.009645
63	0.008387	0.011347	0.008859	0.010822
64	0.009405	0.012722	0.009935	0.012134
65	0.010539	0.014254	0.011132	0.013595
66	0.011800	0.015956	0.012464	0.015219
67	0.013201	0.017846	0.013943	0.017022
68	0.014756	0.019941	0.015584	0.019022
69	0.016477	0.022261	0.017402	0.021236
70	0.018382	0.024826	0.019412	0.023684
71	0.020486	0.027657	0.021633	0.026387
72	0.022807	0.030778	0.024083	0.029367
73	0.025365	0.034214	0.026781	0.032647
74	0.028179	0.037990	0.029749	0.036253
75	0.031269	0.042133	0.033010	0.040211
76	0.034660	0.046673	0.036585	0.044549
77	0.038373	0.051638	0.040500	0.049294
78	0.042434	0.057061	0.044781	0.054478
79	0.046868	0.062972	0.049454	0.060130
80	0.051702	0.069406	0.054547	0.066284
81	0.056963	0.076395	0.060088	0.072971
82	0.062680	0.083973	0.066108	0.080224
83	0.068881	0.092175	0.072634	0.088078
84	0.075596	0.101034	0.079699	0.096565
85	0.082853	0.110584	0.087332	0.105718
86	0.090684	0.120858	0.095563	0.115570
87	0.099116	0.131886	0.104422	0.126151
88	0.108179	0.143698	0.113939	0.137491
89	0.117899	0.156321	0.124140	0.149617
90	0.128304	0.169777	0.135053	0.162554
91	0.139418	0.184088	0.146701	0.176322
92	0.151264	0.199268	0.159106	0.190940
93	0.163861	0.215328	0.172287	0.206419
94	0.177225	0.232274	0.186259	0.222767

Table A6. (Continued).

	Lives		Amounts	
Age x	Duration 0	Durations 1+	Duration 0	Durations 1+
95	0.191370	0.250103	0.201033	0.239986
96	0.206304	0.268807	0.216616	0.258070
97	0.222031	0.288370	0.233008	0.277008
98	0.238551	0.308768	0.250206	0.296780
99	0.255856	0.329968	0.268199	0.317358
100	0.273933	0.351927	0.286970	0.338706
101		0.374596		0.360778
102		0.397913		0.383521
103		0.421809		0.406871
104		0.446206		0.430756
105		0.471017		0.455098
106		0.496148		0.479808
107		0.521498		0.504791
108		0.546959		0.529946
109		0.572422		0.555169
110		0.597771		0.580348
111		0.622892		0.605374
112		0.647670		0.630135
113		0.671993		0.654519
114		0.695751		0.678419
115		0.718842		0.701731
116		0.741170		0.724359
117		0.762651		0.746213
118		0.783207		0.767212
119		0.802773		0.787288
120		1.000000		1.000000

Table A7. Immediate annuitants, females – IFL92Base and IFA92Base one year select: values of $q_{[x-t]+t}$

	Lives		Amounts	
Age x	Duration 0	Durations 1+	Duration 0	Durations 1+
17	0.000216	0.000302	0.000329	0.000400
18	0.000217	0.000302	0.000329	0.000400
19	0.000217	0.000302	0.000329	0.000400
20	0.000217	0.000303	0.000329	0.000400
21	0.000218	0.000304	0.000329	0.000400
22	0.000218	0.000304	0.000329	0.000400
23	0.000219	0.000305	0.000329	0.000400
24	0.000220	0.000307	0.000329	0.000400
25	0.000221	0.000308	0.000329	0.000401
26	0.000222	0.000310	0.000330	0.000401
27	0.000224	0.000312	0.000330	0.000401
28	0.000225	0.000314	0.000330	0.000401
29	0.000228	0.000317	0.000330	0.000402
30	0.000230	0.000321	0.000331	0.000402
31	0.000233	0.000325	0.000332	0.000403
32	0.000237	0.000331	0.000332	0.000404
33	0.000242	0.000337	0.000333	0.000405
34	0.000247	0.000345	0.000334	0.000407
35	0.000254	0.000354	0.000336	0.000409
36	0.000261	0.000364	0.000338	0.000411
37	0.000271	0.000377	0.000340	0.000414
38	0.000281	0.000392	0.000344	0.000418
39	0.000294	0.000410	0.000347	0.000423
40	0.000310	0.000432	0.000352	0.000429
41	0.000328	0.000457	0.000358	0.000436
42	0.000349	0.000487	0.000366	0.000445
43	0.000374	0.000522	0.000375	0.000457
44	0.000404	0.000564	0.000387	0.000471
45	0.000439	0.000612	0.000401	0.000488
46	0.000480	0.000669	0.000419	0.000510
47	0.000528	0.000736	0.000441	0.000536
48	0.000585	0.000815	0.000467	0.000569
49	0.000650	0.000907	0.000500	0.000608
50	0.000727	0.001014	0.000540	0.000656
51	0.000816	0.001138	0.000588	0.000715
52	0.000920	0.001283	0.000647	0.000786
53	0.001041	0.001451	0.000717	0.000872
54	0.001181	0.001647	0.000803	0.000976

Table A7. (Continued).

	Lives		Amounts	
Age x	Duration 0	Durations 1+	Duration 0	Durations 1+
55	0.001343	0.001873	0.000906	0.001101
56	0.001531	0.002134	0.001029	0.001252
57	0.001747	0.002435	0.001177	0.001432
58	0.001997	0.002783	0.001354	0.001647
59	0.002284	0.003183	0.001565	0.001903
60	0.002613	0.003642	0.001815	0.002207
61	0.002991	0.004168	0.002111	0.002567
62	0.003424	0.004771	0.002462	0.002993
63	0.003920	0.005461	0.002875	0.003496
64	0.004485	0.006247	0.003361	0.004086
65	0.005129	0.007144	0.003931	0.004779
66	0.005862	0.008164	0.004598	0.005589
67	0.006695	0.009322	0.005376	0.006534
68	0.007639	0.010635	0.006280	0.007632
69	0.008708	0.012120	0.007329	0.008907
70	0.009917	0.013799	0.008543	0.010381
71	0.011280	0.015692	0.009944	0.012080
72	0.012816	0.017824	0.011555	0.014035
73	0.014544	0.020219	0.013403	0.016276
74	0.016482	0.022905	0.015516	0.018839
75	0.018655	0.025913	0.017927	0.021759
76	0.021084	0.029274	0.020667	0.025078
77	0.023797	0.033022	0.023774	0.028838
78	0.026819	0.037193	0.027284	0.033084
79	0.030180	0.041826	0.031239	0.037862
80	0.033910	0.046960	0.035680	0.043224
81	0.038042	0.052639	0.040650	0.049218
82	0.042610	0.058905	0.046195	0.055897
83	0.047649	0.065804	0.052360	0.063313
84	0.053196	0.073381	0.059191	0.071518
85	0.059289	0.081684	0.066732	0.080561
86	0.065966	0.090759	0.075028	0.090491
87	0.073266	0.100653	0.084120	0.101351
88	0.081230	0.111409	0.094047	0.113183
89	0.089896	0.123073	0.104843	0.126020
90	0.099302	0.135683	0.116540	0.139889
91	0.109485	0.149278	0.129160	0.154808
92	0.120482	0.163888	0.142720	0.170787
93	0.132322	0.179541	0.157229	0.187822
94	0.145037	0.196255	0.172685	0.205901

Table A7. (Continued).

	Lives		Amounts	
Age x	Duration 0	Durations 1+	Duration 0	Durations 1+
95	0.158651	0.214043	0.189079	0.224997
96	0.173184	0.232906	0.206388	0.245069
97	0.188651	0.252839	0.224581	0.266063
98	0.205059	0.273821	0.243613	0.287913
99	0.222408	0.295822	0.263430	0.310537
100	0.240692	0.318799	0.283964	0.333841
101		0.342696		0.357722
102		0.367443		0.382063
103		0.392956		0.406741
104		0.419139		0.431627
105		0.445883		0.456587
106		0.473069		0.481486
107		0.500566		0.506192
108		0.528237		0.530573
109		0.555937		0.554505
110		0.583518		0.577873
111		0.610832		0.600570
112		0.637731		0.622502
113		0.664072		0.643586
114		0.689719		0.663752
115		0.714545		0.682946
116		0.738437		0.701125
117		0.761294		0.718260
118		0.783030		0.734334
119		0.803579		0.749341
120		1.000000		1.000000

Table A8. Retirement annuitants – RMV92Base and RFV92Base values of q_x

Age x	Males RMV92Base	Females RFV92Base
17	0.051376	0.042165
18	0.050428	0.041210
19	0.049479	0.040254
20	0.048530	0.039297
21	0.047580	0.038340
22	0.046629	0.037384
23	0.045678	0.036427
24	0.044726	0.035470
25	0.043775	0.034514
26	0.042823	0.033558
27	0.041871	0.032603
28	0.040919	0.031649
29	0.039968	0.030697
30	0.039017	0.029747
31	0.038068	0.028798
32	0.037119	0.027853
33	0.036173	0.026911
34	0.035228	0.025973
35	0.034286	0.025039
36	0.033348	0.024112
37	0.032413	0.023190
38	0.031483	0.022276
39	0.030560	0.021371
40	0.029643	0.020476
41	0.028734	0.019592
42	0.027835	0.018721
43	0.026947	0.017865
44	0.026072	0.017026
45	0.025213	0.016206
46	0.024372	0.015407
47	0.023551	0.014633
48	0.022753	0.013887
49	0.021983	0.013171
50	0.021244	0.012489
51	0.020541	0.011845
52	0.019878	0.011244
53	0.019261	0.010689
54	0.018697	0.010187

Table A8. (Continued).

Age x	Males RMV92Base	Females RFV92Base
55	0.018192	0.009742
56	0.017755	0.009361
57	0.017393	0.009049
58	0.017116	0.008814
59	0.016934	0.008662
60	0.016859	0.008601
61	0.016903	0.008640
62	0.017080	0.008786
63	0.017404	0.009049
64	0.017892	0.009438
65	0.018562	0.009962
66	0.019431	0.010633
67	0.020520	0.011460
68	0.021850	0.012455
69	0.023444	0.013628
70	0.025328	0.014990
71	0.027525	0.016554
72	0.030064	0.018330
73	0.032972	0.020330
74	0.036279	0.022565
75	0.039971	0.025064
76	0.043988	0.027855
77	0.048353	0.030953
78	0.053089	0.034391
79	0.058219	0.038206
80	0.063767	0.042436
81	0.069756	0.047125
82	0.076213	0.052319
83	0.083160	0.058070
84	0.090623	0.064432
85	0.098625	0.071467
86	0.107189	0.079238
87	0.116337	0.087816
88	0.126091	0.097273
89	0.136470	0.107689
90	0.147491	0.119146
91	0.159170	0.131732
92	0.171520	0.145535
93	0.184549	0.160648
94	0.198265	0.177163

Table A8. (Continued).

Age x	Males RMV92Base	Females RFV92Base
95	0.212671	0.195171
96	0.227764	0.214760
97	0.243539	0.236014
98	0.259986	0.259005
99	0.277089	0.283793
100	0.294827	0.310422
101	0.313175	0.338912
102	0.332100	0.369254
103	0.351567	0.401405
104	0.371532	0.435283
105	0.391947	0.470757
106	0.412761	0.507643
107	0.433916	0.545701
108	0.455349	0.584630
109	0.476996	0.624066
110	0.498787	0.663591
111	0.520651	0.702735
112	0.542516	0.740987
113	0.564306	0.777821
114	0.585948	0.812707
115	0.607369	0.845149
116	0.628496	0.874707
117	0.649259	0.901033
118	0.669594	0.923893
119	0.689438	0.943192
120	1.000000	1.000000

Table A9. Widows – WL92Base and WA92Base values of q_x

Age x	Lives WL92Base	Amounts WA92Base
17	0.000444	0.000366
18	0.000466	0.000384
19	0.000489	0.000403
20	0.000515	0.000423
21	0.000544	0.000446
22	0.000575	0.000471
23	0.000609	0.000498
24	0.000645	0.000527
25	0.000685	0.000559
26	0.000729	0.000595
27	0.000777	0.000633
28	0.000829	0.000675
29	0.000885	0.000721
30	0.000947	0.000772
31	0.001014	0.000827
32	0.001087	0.000887
33	0.001167	0.000953
34	0.001254	0.001024
35	0.001349	0.001103
36	0.001452	0.001189
37	0.001565	0.001282
38	0.001687	0.001385
39	0.001821	0.001497
40	0.001967	0.001619
41	0.002126	0.001752
42	0.002299	0.001899
43	0.002488	0.002058
44	0.002693	0.002233
45	0.002917	0.002423
46	0.003161	0.002631
47	0.003428	0.002859
48	0.003718	0.003108
49	0.004034	0.003379
50	0.004378	0.003676
51	0.004753	0.004000
52	0.005162	0.004355
53	0.005607	0.004742
54	0.006092	0.005165

Table A9. (Continued).

Age x	Lives WL92Base	Amounts WA92Base
55	0.006621	0.005627
56	0.007197	0.006132
57	0.007824	0.006683
58	0.008507	0.007286
59	0.009252	0.007944
60	0.010062	0.008662
61	0.010945	0.009447
62	0.011906	0.010304
63	0.012953	0.011240
64	0.014093	0.012262
65	0.015334	0.013378
66	0.016685	0.014596
67	0.018155	0.015925
68	0.019755	0.017376
69	0.021496	0.018959
70	0.023390	0.020687
71	0.025450	0.022572
72	0.027691	0.024627
73	0.030128	0.026869
74	0.032777	0.029314
75	0.035657	0.031978
76	0.038786	0.034882
77	0.042184	0.038046
78	0.045875	0.041492
79	0.049882	0.045245
80	0.054231	0.049329
81	0.058948	0.053773
82	0.064063	0.058606
83	0.069606	0.063861
84	0.075611	0.069570
85	0.082112	0.075770
86	0.089147	0.082500
87	0.096753	0.089798
88	0.104971	0.097709
89	0.113844	0.106277
90	0.123415	0.115548
91	0.133730	0.125571
92	0.144835	0.136395
93	0.156777	0.148073
94	0.169605	0.160656

Table A9. (Continued).

Age x	Lives WL92Base	Amounts WA92Base
95	0.183364	0.174195
96	0.198102	0.188744
97	0.213864	0.204352
98	0.230692	0.221067
99	0.248625	0.238935
100	0.267695	0.257996
101	0.287931	0.278283
102	0.309351	0.299821
103	0.331967	0.322627
104	0.355774	0.346705
105	0.380759	0.372042
106	0.406891	0.398613
107	0.434119	0.426369
108	0.462377	0.455242
109	0.491573	0.485139
110	0.521593	0.515942
111	0.552300	0.547505
112	0.583529	0.579652
113	0.615094	0.612181
114	0.646780	0.644862
115	0.678355	0.677439
116	0.709565	0.709637
117	0.740144	0.741163
118	0.769821	0.771718
119	0.798321	0.801003
120	1.000000	1.000000

Table A10. Pensioners – PML92, PMA92, PFL92 and PFA92 ($C = 2020$) values of q_x for calendar year 2020

	Males		Females	
Age x	Lives PML92C20	Amounts PMA92C20	Lives PFL92C20	Amounts PFA92C20
20	0.000258	0.000141	0.000105	0.000084
21	0.000254	0.000140	0.000105	0.000084
22	0.000249	0.000140	0.000105	0.000084
23	0.000245	0.000139	0.000104	0.000084
24	0.000241	0.000138	0.000104	0.000084
25	0.000237	0.000138	0.000105	0.000084
26	0.000234	0.000138	0.000106	0.000085
27	0.000232	0.000137	0.000107	0.000085
28	0.000230	0.000137	0.000108	0.000087
29	0.000229	0.000138	0.000110	0.000088
30	0.000229	0.000138	0.000112	0.000090
31	0.000230	0.000139	0.000115	0.000092
32	0.000233	0.000140	0.000119	0.000095
33	0.000237	0.000142	0.000124	0.000099
34	0.000243	0.000145	0.000130	0.000103
35	0.000251	0.000148	0.000137	0.000109
36	0.000262	0.000152	0.000145	0.000116
37	0.000275	0.000157	0.000156	0.000124
38	0.000292	0.000164	0.000168	0.000133
39	0.000313	0.000173	0.000183	0.000145
40	0.000339	0.000184	0.000200	0.000158
41	0.000370	0.000197	0.000220	0.000174
42	0.000407	0.000213	0.000244	0.000194
43	0.000451	0.000233	0.000272	0.000216
44	0.000504	0.000257	0.000305	0.000243
45	0.000566	0.000286	0.000344	0.000274
46	0.000639	0.000321	0.000388	0.000311
47	0.000724	0.000363	0.000440	0.000353
48	0.000823	0.000413	0.000499	0.000403
49	0.000938	0.000473	0.000568	0.000460
50	0.001071	0.000545	0.000648	0.000527
51	0.001224	0.000630	0.000739	0.000603
52	0.001400	0.000730	0.000844	0.000692
53	0.001602	0.000848	0.000964	0.000795
54	0.001833	0.000986	0.001101	0.000912

Table A10. (Continued).

Age x	Males: Lives PML92C20	Males: Amounts PMA92C20	Females: Lives PFL92C20	Females: Amounts PFA92C20
55	0.002096	0.001148	0.001258	0.001046
56	0.002396	0.001338	0.001437	0.001199
57	0.002735	0.001558	0.001639	0.001375
58	0.003120	0.001814	0.001869	0.001575
59	0.003554	0.002110	0.002130	0.001801
60	0.004042	0.002451	0.002424	0.002058
61	0.004770	0.002955	0.002864	0.002441
62	0.005611	0.003550	0.003374	0.002885
63	0.006578	0.004251	0.003964	0.003401
64	0.007685	0.005073	0.004642	0.003996
65	0.008950	0.006032	0.005422	0.004681
66	0.010391	0.007147	0.006315	0.005467
67	0.012025	0.008439	0.007336	0.006367
68	0.013873	0.009930	0.008500	0.007395
69	0.015956	0.011644	0.009821	0.008563
70	0.018296	0.013605	0.011319	0.009888
71	0.020916	0.015841	0.013011	0.011386
72	0.023841	0.018380	0.014918	0.013075
73	0.027094	0.021253	0.017062	0.014973
74	0.030702	0.024490	0.019465	0.017100
75	0.034689	0.028121	0.022151	0.019478
76	0.039082	0.032179	0.025145	0.022127
77	0.043904	0.036696	0.028474	0.025069
78	0.049182	0.041702	0.032166	0.028326
79	0.054939	0.047229	0.036248	0.031923
80	0.061197	0.053303	0.040749	0.035882
81	0.067976	0.059952	0.045698	0.040227
82	0.075297	0.067201	0.051124	0.044981
83	0.083174	0.075068	0.057057	0.050166
84	0.091621	0.083569	0.063526	0.055804
85	0.100650	0.092716	0.070558	0.061915
86	0.110265	0.102516	0.078180	0.068518
87	0.120470	0.112969	0.086418	0.075631
88	0.131262	0.124068	0.095295	0.083270
89	0.142636	0.135802	0.104830	0.091444

Table A10. (Continued).

	Males		Females	
Age x	Lives PML92C20	Amounts PMA92C20	Lives PFL92C20	Amounts PFA92C20
90	0.154580	0.148151	0.115043	0.100164
91	0.167078	0.161088	0.125947	0.109437
92	0.180110	0.174581	0.137554	0.119266
93	0.193650	0.188589	0.149868	0.129650
94	0.207667	0.203065	0.162894	0.140582
95	0.222124	0.217957	0.176626	0.152053
96	0.236984	0.233205	0.191057	0.164051
97	0.252201	0.248746	0.206174	0.176555
98	0.267726	0.264511	0.221955	0.189545
99	0.283510	0.280429	0.238377	0.202991
100	0.299498	0.296425	0.255408	0.216863
101	0.315633	0.312423	0.273011	0.231125
102	0.331857	0.328344	0.291144	0.245737
103	0.348109	0.344113	0.309759	0.260654
104	0.364331	0.359653	0.328806	0.275830
105	0.380462	0.374887	0.348227	0.291217
106	0.396441	0.389742	0.367961	0.306760
107	0.412210	0.404148	0.387946	0.322407
108	0.427710	0.418037	0.408114	0.338100
109	0.442886	0.431346	0.428398	0.353785
110	0.457684	0.444014	0.448729	0.369403
111	0.468997	0.453033	0.466001	0.382406
112	0.479798	0.461297	0.483064	0.395150
113	0.490060	0.468780	0.499869	0.407594
114	0.499756	0.475459	0.516366	0.419700
115	0.508865	0.481313	0.532508	0.431431
116	0.517368	0.486326	0.548254	0.442752
117	0.525248	0.490484	0.563564	0.453630
118	0.532489	0.493776	0.578402	0.464038
119	0.539080	0.496194	0.592739	0.473947
120	1.000000	1.000000	1.000000	1.000000

Table A11. Immediate annuitants, males – IML92 and IMA92 ($C = 2020$) one year select: values of $q_{[x-t]+t}$ for calendar year 2020

	Lives – IML92C20		Amounts – IMA92C20	
Age x	Duration 0	Durations 1+	Duration 0	Durations 1+
17	0.000179	0.000243	0.000190	0.000232
18	0.000178	0.000241	0.000188	0.000230
19	0.000177	0.000239	0.000187	0.000228
20	0.000175	0.000237	0.000185	0.000226
21	0.000174	0.000236	0.000184	0.000225
22	0.000173	0.000235	0.000183	0.000224
23	0.000173	0.000234	0.000183	0.000223
24	0.000172	0.000234	0.000182	0.000223
25	0.000173	0.000234	0.000182	0.000223
26	0.000173	0.000235	0.000183	0.000224
27	0.000174	0.000236	0.000184	0.000225
28	0.000176	0.000239	0.000186	0.000228
29	0.000178	0.000242	0.000189	0.000230
30	0.000182	0.000246	0.000192	0.000235
31	0.000186	0.000251	0.000196	0.000240
32	0.000191	0.000258	0.000201	0.000246
33	0.000196	0.000266	0.000208	0.000254
34	0.000204	0.000276	0.000216	0.000264
35	0.000213	0.000288	0.000225	0.000275
36	0.000224	0.000303	0.000236	0.000289
37	0.000236	0.000320	0.000250	0.000305
38	0.000251	0.000340	0.000265	0.000325
39	0.000269	0.000364	0.000284	0.000347
40	0.000289	0.000392	0.000305	0.000373
41	0.000313	0.000424	0.000330	0.000404
42	0.000340	0.000460	0.000359	0.000439
43	0.000371	0.000504	0.000392	0.000480
44	0.000408	0.000552	0.000431	0.000527
45	0.000450	0.000609	0.000475	0.000581
46	0.000498	0.000674	0.000526	0.000643
47	0.000552	0.000749	0.000584	0.000714
48	0.000615	0.000833	0.000650	0.000795
49	0.000686	0.000930	0.000725	0.000887
50	0.000768	0.001039	0.000811	0.000991
51	0.000860	0.001164	0.000908	0.001110
52	0.000964	0.001306	0.001018	0.001245
53	0.001082	0.001466	0.001143	0.001398
54	0.001216	0.001647	0.001284	0.001570

Table A11. (Continued).

	Lives – IML92C20		Amounts – IMA92C20	
Age x	Duration 0	Durations 1+	Duration 0	Durations 1+
55	0.001367	0.001851	0.001444	0.001765
56	0.001537	0.002081	0.001623	0.001984
57	0.001728	0.002340	0.001826	0.002231
58	0.001943	0.002631	0.002053	0.002509
59	0.002185	0.002958	0.002308	0.002820
60	0.002456	0.003324	0.002594	0.003169
61	0.002867	0.003880	0.003028	0.003700
62	0.003339	0.004518	0.003527	0.004309
63	0.003880	0.005250	0.004099	0.005007
64	0.004499	0.006086	0.004753	0.005805
65	0.005206	0.007041	0.005499	0.006715
66	0.006010	0.008127	0.006349	0.007752
67	0.006925	0.009362	0.007314	0.008929
68	0.007963	0.010761	0.008410	0.010265
69	0.009137	0.012344	0.009650	0.011776
70	0.010463	0.014131	0.011050	0.013481
71	0.011959	0.016145	0.012628	0.015403
72	0.013641	0.018408	0.014404	0.017564
73	0.015530	0.020948	0.016397	0.019988
74	0.017647	0.023791	0.018630	0.022703
75	0.020014	0.026968	0.021128	0.025737
76	0.022657	0.030510	0.023915	0.029121
77	0.025600	0.034449	0.027019	0.032885
78	0.028872	0.038824	0.030468	0.037066
79	0.032501	0.043668	0.034294	0.041698
80	0.036519	0.049024	0.038529	0.046819
81	0.040958	0.054931	0.043205	0.052469
82	0.045853	0.061430	0.048361	0.058687
83	0.051237	0.068565	0.054029	0.065517
84	0.057149	0.076379	0.060250	0.073001
85	0.063623	0.084918	0.067063	0.081181
86	0.070701	0.094225	0.074504	0.090103
87	0.078418	0.104345	0.082616	0.099807
88	0.086815	0.115320	0.091438	0.110338
89	0.095929	0.127192	0.101007	0.121737
90	0.105799	0.139998	0.111365	0.134042
91	0.116462	0.153777	0.122546	0.147289
92	0.127952	0.168558	0.134585	0.161513
93	0.140302	0.184369	0.147516	0.176741
94	0.153541	0.201233	0.161367	0.192997

Table A11. (Continued).

	Lives – IML92C20		*Amounts – IMA92C20*	
Age x	Duration 0	Durations 1+	Duration 0	Durations 1+
95	0.167696	0.219163	0.176164	0.210298
96	0.182789	0.238168	0.191926	0.228655
97	0.198837	0.258246	0.208667	0.248071
98	0.215852	0.279388	0.226398	0.268541
99	0.233840	0.301574	0.245120	0.290049
100	0.252797	0.324773	0.264828	0.312572
101		0.348945		0.336073
102		0.374036		0.360507
103		0.399981		0.385816
104		0.426704		0.411929
105		0.454117		0.438769
106		0.482123		0.466245
107		0.510613		0.494255
108		0.539468		0.522688
109		0.568565		0.551428
110		0.597771		0.580348
111		0.622892		0.605374
112		0.647670		0.630135
113		0.671993		0.654519
114		0.695751		0.678419
115		0.718842		0.701731
116		0.741170		0.724359
117		0.762651		0.746213
118		0.783207		0.767212
119		0.802773		0.787288
120		1.000000		1.000000

Table A12. Immediate annuitants, females – IFL92 and IFA92 ($C = 2020$) one year select: values of $q_{[x-t]+t}$ for calendar year 2020

	Lives – IFL92C20		Amounts – IFA92C20	
Age x	Duration 0	Durations 1+	Duration 0	Durations 1+
17	0.000090	0.000125	0.000136	0.000166
18	0.000090	0.000125	0.000136	0.000166
19	0.000090	0.000125	0.000136	0.000166
20	0.000090	0.000126	0.000136	0.000166
21	0.000090	0.000126	0.000136	0.000166
22	0.000090	0.000126	0.000136	0.000166
23	0.000091	0.000126	0.000136	0.000166
24	0.000091	0.000127	0.000136	0.000166
25	0.000092	0.000128	0.000136	0.000166
26	0.000092	0.000128	0.000137	0.000166
27	0.000093	0.000129	0.000137	0.000166
28	0.000093	0.000130	0.000137	0.000166
29	0.000094	0.000131	0.000137	0.000167
30	0.000095	0.000133	0.000137	0.000167
31	0.000097	0.000135	0.000138	0.000167
32	0.000098	0.000137	0.000138	0.000167
33	0.000100	0.000140	0.000138	0.000168
34	0.000102	0.000143	0.000138	0.000169
35	0.000105	0.000147	0.000139	0.000170
36	0.000108	0.000151	0.000140	0.000170
37	0.000112	0.000156	0.000141	0.000172
38	0.000116	0.000162	0.000143	0.000173
39	0.000122	0.000170	0.000144	0.000175
40	0.000128	0.000179	0.000146	0.000178
41	0.000136	0.000189	0.000148	0.000181
42	0.000145	0.000202	0.000152	0.000184
43	0.000155	0.000216	0.000155	0.000189
44	0.000167	0.000234	0.000160	0.000195
45	0.000182	0.000254	0.000166	0.000202
46	0.000199	0.000277	0.000174	0.000211
47	0.000219	0.000305	0.000183	0.000222
48	0.000242	0.000338	0.000194	0.000236
49	0.000269	0.000376	0.000207	0.000252
50	0.000301	0.000420	0.000224	0.000272
51	0.000338	0.000472	0.000244	0.000296
52	0.000381	0.000532	0.000268	0.000326
53	0.000431	0.000601	0.000297	0.000361
54	0.000489	0.000683	0.000333	0.000405

Table A12. (Continued).

	Lives – IFL92C20		Amounts – IFA92C20	
Age x	Duration 0	Durations 1+	Duration 0	Durations 1+
55	0.000557	0.000776	0.000375	0.000456
56	0.000635	0.000884	0.000426	0.000519
57	0.000724	0.001009	0.000488	0.000594
58	0.000828	0.001153	0.000561	0.000683
59	0.000947	0.001319	0.000649	0.000789
60	0.001083	0.001509	0.000752	0.000915
61	0.001288	0.001795	0.000909	0.001106
62	0.001530	0.002131	0.001100	0.001337
63	0.001814	0.002527	0.001330	0.001617
64	0.002146	0.002989	0.001608	0.001955
65	0.002534	0.003529	0.001942	0.002361
66	0.002986	0.004158	0.002342	0.002847
67	0.003512	0.004890	0.002820	0.003428
68	0.004122	0.005739	0.003389	0.004118
69	0.004829	0.006721	0.004064	0.004939
70	0.005645	0.007855	0.004863	0.005909
71	0.006585	0.009160	0.005805	0.007052
72	0.007665	0.010660	0.006911	0.008394
73	0.008905	0.012379	0.008206	0.009965
74	0.010322	0.014344	0.009717	0.011798
75	0.011940	0.016586	0.011474	0.013927
76	0.013782	0.019136	0.013510	0.016393
77	0.015876	0.022030	0.015860	0.019239
78	0.018247	0.025306	0.018564	0.022510
79	0.020929	0.029005	0.021663	0.026256
80	0.023952	0.033170	0.025202	0.030531
81	0.027354	0.037849	0.029229	0.035390
82	0.031171	0.043091	0.033794	0.040891
83	0.035444	0.048949	0.038948	0.047096
84	0.040215	0.055474	0.044747	0.054066
85	0.045528	0.062725	0.051244	0.061863
86	0.051429	0.070759	0.058495	0.070550
87	0.057966	0.079634	0.066554	0.080186
88	0.065188	0.089407	0.075474	0.090831
89	0.073144	0.100139	0.085306	0.102537
90	0.081884	0.111884	0.096099	0.115352
91	0.091458	0.124698	0.107893	0.129318
92	0.101914	0.138630	0.120725	0.144466
93	0.113297	0.153727	0.134623	0.160818
94	0.125654	0.170028	0.149607	0.178384

Table A12. (Continued).

	Lives – IFL92C20		Amounts – IFA92C20	
Age x	Duration 0	Durations 1+	Duration 0	Durations 1+
95	0.139025	0.187564	0.165688	0.197163
96	0.153444	0.206359	0.182863	0.217135
97	0.168944	0.226427	0.201120	0.238269
98	0.185547	0.247766	0.220433	0.260517
99	0.203270	0.270366	0.240762	0.283815
100	0.222121	0.294201	0.262054	0.308083
101		0.319230		0.333227
102		0.345394		0.359137
103		0.372621		0.385692
104		0.400820		0.412762
105		0.429885		0.440205
106		0.459697		0.467876
107		0.490118		0.495626
108		0.521002		0.523306
109		0.552191		0.550769
110		0.583518		0.577873
111		0.610832		0.600570
112		0.637731		0.622502
113		0.664072		0.643586
114		0.689719		0.663752
115		0.714545		0.682946
116		0.738437		0.701125
117		0.761294		0.718260
118		0.783030		0.734334
119		0.803579		0.749341
120		1.000000		1.000000

Table A13. Retirement annuitants – RMV92 and RFV92 ($C = 2020$) values of q_x for calendar year 2020

Age x	Males RMV92C20	Females RFV92C20
17	0.021293	0.017476
18	0.020900	0.017080
19	0.020507	0.016684
20	*0.020114*	*0.016287*
21	0.019720	0.015890
22	0.019326	0.015494
23	0.018932	0.015097
24	0.018537	0.014701
25	*0.018143*	*0.014305*
26	0.017748	0.013908
27	0.017354	0.013513
28	0.016959	0.013117
29	0.016565	0.012723
30	*0.016171*	*0.012329*
31	0.015778	0.011936
32	0.015384	0.011544
33	0.014992	0.011153
34	0.014600	0.010765
35	*0.014210*	*0.010378*
36	0.013821	0.009993
37	0.013434	0.009611
38	0.013048	0.009232
39	0.012666	0.008857
40	*0.012286*	*0.008486*
41	0.011909	0.008120
42	0.011536	0.007759
43	0.011168	0.007404
44	0.010806	0.007057
45	0.010450	0.006717
46	0.010101	0.006386
47	0.009761	0.006065
48	0.009430	0.005756
49	0.009111	0.005459
50	0.008805	0.005176
51	0.008513	0.004909
52	0.008239	0.004660
53	0.007983	0.004430
54	0.007749	0.004222

Table A13. (Continued).

Age x	Males RMV92C20	Females RFV92C20
55	0.007540	0.004038
56	0.007359	0.003880
57	0.007209	0.003750
58	0.007094	0.003653
59	0.007018	0.003590
60	0.006987	0.003565
61	0.007280	0.003721
62	0.007631	0.003925
63	0.008052	0.004187
64	0.008559	0.004515
65	0.009169	0.004921
66	0.009897	0.005416
67	0.010764	0.006012
68	0.011791	0.006721
69	0.013000	0.007557
70	0.014417	0.008532
71	0.016067	0.009663
72	0.017981	0.010963
73	0.020187	0.012447
74	0.022720	0.014131
75	0.025584	0.016042
76	0.028754	0.018208
77	0.032258	0.020650
78	0.036121	0.023399
79	0.040372	0.026494
80	0.045041	0.029974
81	0.050157	0.033885
82	0.055753	0.038273
83	0.061859	0.043196
84	0.068509	0.048709
85	0.075734	0.054880
86	0.083568	0.061777
87	0.092043	0.069478
88	0.101190	0.078063
89	0.111040	0.087622
90	0.121621	0.098248
91	0.132962	0.110041
92	0.145086	0.123106
93	0.158015	0.137551
94	0.171769	0.153487

Table A13. (Continued).

Age x	Males RMV92C20	Females RFV92C20
95	0.186362	0.171027
96	0.201803	0.190281
97	0.218098	0.211359
98	0.235248	0.234360
99	0.253245	0.259373
100	0.272079	0.286471
101	0.291730	0.315705
102	0.312172	0.347096
103	0.333374	0.380632
104	0.355293	0.416258
105	0.377884	0.453867
106	0.401093	0.493293
107	0.424859	0.534311
108	0.449113	0.576623
109	0.473782	0.619861
110	0.498787	0.663591
111	0.520651	0.702735
112	0.542516	0.740987
113	0.564306	0.777821
114	0.585948	0.812707
115	0.607369	0.845149
116	0.628496	0.874707
117	0.649259	0.901033
118	0.669594	0.923893
119	0.689438	0.943192
120	1.000000	1.000000

Table A14. Widows – WL92 and WA92 ($C = 2020$) values of q_x for calendar year 2020

Age x	Lives WL92C20	Amounts WA92C20
17	0.000184	0.000152
18	0.000193	0.000159
19	0.000203	0.000167
20	0.000213	0.000175
21	0.000225	0.000185
22	0.000238	0.000195
23	0.000252	0.000206
24	0.000267	0.000218
25	0.000284	0.000232
26	0.000302	0.000247
27	0.000322	0.000262
28	0.000344	0.000280
29	0.000367	0.000299
30	0.000392	0.000320
31	0.000420	0.000343
32	0.000451	0.000368
33	0.000484	0.000395
34	0.000520	0.000424
35	0.000559	0.000457
36	0.000602	0.000493
37	0.000649	0.000531
38	0.000699	0.000574
39	0.000755	0.000620
40	0.000815	0.000671
41	0.000881	0.000726
42	0.000953	0.000787
43	0.001031	0.000853
44	0.001116	0.000925
45	0.001209	0.001004
46	0.001310	0.001090
47	0.001421	0.001185
48	0.001541	0.001288
49	0.001672	0.001400
50	0.001814	0.001524
51	0.001970	0.001658
52	0.002139	0.001805
53	0.002324	0.001965
54	0.002525	0.002141

Table A14. (Continued).

Age x	Lives WL92C20	Amounts WA92C20
55	0.002744	0.002332
56	0.002983	0.002541
57	0.003243	0.002770
58	0.003526	0.003020
59	0.003835	0.003292
60	0.004170	0.003590
61	0.004714	0.004069
62	0.005319	0.004603
63	0.005993	0.005200
64	0.006742	0.005866
65	0.007574	0.006608
66	0.008499	0.007435
67	0.009524	0.008354
68	0.010660	0.009377
69	0.011920	0.010513
70	0.013314	0.011775
71	0.014856	0.013176
72	0.016562	0.014729
73	0.018446	0.016451
74	0.020527	0.018358
75	0.022823	0.020468
76	0.025354	0.022802
77	0.028142	0.025382
78	0.031213	0.028231
79	0.034591	0.031375
80	0.038306	0.034843
81	0.042386	0.038665
82	0.046865	0.042873
83	0.051777	0.047503
84	0.057160	0.052593
85	0.063054	0.058184
86	0.069502	0.064320
87	0.076548	0.071046
88	0.084241	0.078413
89	0.092630	0.086473
90	0.101768	0.095281
91	0.111710	0.104895
92	0.122514	0.115374
93	0.134236	0.126784
94	0.146939	0.139186

Table A14. (Continued).

Age x	Lives WL92C20	Amounts WA92C20
95	0.160680	0.152646
96	0.175522	0.167230
97	0.191523	0.183005
98	0.208741	0.200032
99	0.227231	0.218375
100	0.247040	0.238090
101	0.268215	0.259227
102	0.290788	0.281830
103	0.314788	0.305931
104	0.340224	0.331552
105	0.367098	0.358693
106	0.395389	0.387345
107	0.425058	0.417470
108	0.456044	0.449007
109	0.488261	0.481870
110	0.521593	0.515942
111	0.552300	0.547505
112	0.583529	0.579652
113	0.615094	0.612181
114	0.646780	0.644862
115	0.678355	0.677439
116	0.709565	0.709637
117	0.740144	0.741163
118	0.769821	0.771718
119	0.798321	0.801003
120	1.000000	1.000000

Table A15. Pensioners – PML92, PMA92, PFL92 and PFA92 ($B = 1945$) values of q_x for year of birth 1945

Age x	Males: Lives PML92B45	Males: Amounts PMA92B45	Females: Lives PFL92B45	Females: Amounts PFA92B45
47	0.001746	0.000876	0.001061	0.000852
48	0.001917	0.000963	0.001164	0.000939
49	0.002111	0.001066	0.001279	0.001036
50	0.002329	0.001186	0.001410	0.001146
51	0.002574	0.001324	0.001554	0.001269
52	0.002846	0.001484	0.001715	0.001407
53	0.003149	0.001666	0.001895	0.001562
54	0.003484	0.001874	0.002093	0.001733
55	0.003855	0.002112	0.002313	0.001924
56	0.004262	0.002380	0.002556	0.002134
57	0.004710	0.002682	0.002822	0.002367
58	0.005199	0.003023	0.003115	0.002624
59	0.005734	0.003404	0.003437	0.002906
60	0.006317	0.003831	0.003789	0.003216
61	0.007076	0.004383	0.004248	0.003620
62	0.007932	0.005019	0.004771	0.004079
63	0.008898	0.005751	0.005362	0.004600
64	0.009985	0.006590	0.006031	0.005191
65	0.011206	0.007552	0.006788	0.005860
66	0.012577	0.008651	0.007644	0.006618
67	0.014114	0.009906	0.008611	0.007474
68	0.015834	0.011334	0.009702	0.008440
69	0.017756	0.012957	0.010929	0.009529
70	0.019898	0.014797	0.012310	0.010754
71	0.022283	0.016876	0.013861	0.012130
72	0.024931	0.019221	0.015600	0.013673
73	0.027866	0.021858	0.017548	0.015399
74	0.031110	0.024815	0.019723	0.017328
75	0.034689	0.028121	0.022151	0.019478
76	0.038628	0.031805	0.024853	0.021870
77	0.042951	0.035899	0.027856	0.024524
78	0.047684	0.040432	0.031186	0.027463
79	0.052853	0.045435	0.034871	0.030711
80	0.058481	0.050938	0.038941	0.034290
81	0.064593	0.056969	0.043423	0.038225
82	0.071212	0.063555	0.048351	0.042541
83	0.078358	0.070721	0.053754	0.047262
84	0.086051	0.078488	0.059664	0.052411

Table A15. (Continued).

	Males		Females	
Age x	Lives PML92B45	Amounts PMA92B45	Lives PFL92B45	Amounts PFA92B45
85	0.094309	0.086875	0.066113	0.058015
86	0.103145	0.095896	0.073132	0.064094
87	0.112571	0.105561	0.080752	0.070673
88	0.122594	0.115875	0.089002	0.077771
89	0.133220	0.126837	0.097910	0.085407
90	0.144447	0.138440	0.107502	0.093599
91	0.156273	0.150670	0.117802	0.102360
92	0.168688	0.163510	0.128830	0.111703
93	0.181680	0.176932	0.140605	0.121636
94	0.195231	0.190905	0.153139	0.132163
95	0.209317	0.205391	0.166443	0.143287
96	0.223914	0.220343	0.180520	0.155003
97	0.238988	0.235714	0.195372	0.167305
98	0.254503	0.251446	0.210992	0.180183
99	0.270419	0.267481	0.227371	0.193618
100	0.286695	0.283753	0.244489	0.207593
101	0.303281	0.300196	0.262327	0.222080
102	0.320128	0.316740	0.280854	0.237052
103	0.337183	0.333313	0.300037	0.252473
104	0.354393	0.349843	0.319837	0.268306
105	0.371701	0.366254	0.340208	0.284510
106	0.389048	0.382474	0.361100	0.301040
107	0.406379	0.398431	0.382459	0.317847
108	0.423634	0.414053	0.404225	0.334878
109	0.440754	0.429270	0.426336	0.352083
110	0.457684	0.444014	0.448729	0.369403
111	0.468997	0.453033	0.466001	0.382406
112	0.479798	0.461297	0.483064	0.395150
113	0.490060	0.468780	0.499869	0.407594
114	0.499756	0.475459	0.516366	0.419700
115	0.508865	0.481313	0.532508	0.431431
116	0.517368	0.486326	0.548254	0.442752
117	0.525248	0.490484	0.563564	0.453630
118	0.532489	0.493776	0.578402	0.464038
119	0.539080	0.496194	0.592739	0.473947
120	1.000000	1.000000	1.000000	1.000000

Table A16. Immediate annuitants, males – IML92 and IMA92 (B = 1945) one year select: values of $q_{[x-t]+t}$ for year of birth 1945

	Lives – IML92B45		Amounts – IMA92B45	
Age x	Duration 0	Durations 1+	Duration 0	Durations 1+
47	0.001333	0.001806	0.001408	0.001722
48	0.001433	0.001942	0.001515	0.001852
49	0.001545	0.002093	0.001633	0.001996
50	0.001670	0.002262	0.001764	0.002157
51	0.001808	0.002448	0.001910	0.002334
52	0.001960	0.002654	0.002070	0.002531
53	0.002127	0.002881	0.002248	0.002747
54	0.002312	0.003130	0.002442	0.002984
55	0.002513	0.003404	0.002655	0.003245
56	0.002734	0.003702	0.002888	0.003531
57	0.002976	0.004029	0.003143	0.003841
58	0.003239	0.004385	0.003421	0.004181
59	0.003525	0.004773	0.003725	0.004551
60	0.003838	0.005194	0.004054	0.004953
61	0.004252	0.005755	0.004492	0.005488
62	0.004721	0.006387	0.004987	0.006092
63	0.005249	0.007102	0.005545	0.006773
64	0.005845	0.007907	0.006175	0.007541
65	0.006518	0.008815	0.006884	0.008408
66	0.007275	0.009837	0.007684	0.009383
67	0.008128	0.010988	0.008585	0.010481
68	0.009089	0.012282	0.009599	0.011716
69	0.010167	0.013737	0.010738	0.013104
70	0.011380	0.015369	0.012018	0.014662
71	0.012740	0.017200	0.013453	0.016410
72	0.014265	0.019250	0.015063	0.018367
73	0.015972	0.021544	0.016864	0.020558
74	0.017882	0.024108	0.018878	0.023005
75	0.020014	0.026968	0.021128	0.025737
76	0.022394	0.030155	0.023637	0.028783
77	0.025044	0.033701	0.026432	0.032171
78	0.027992	0.037641	0.029540	0.035937
79	0.031267	0.042010	0.032992	0.040114
80	0.034899	0.046849	0.036819	0.044742
81	0.038920	0.052197	0.041055	0.049857
82	0.043365	0.058097	0.045737	0.055503
83	0.048271	0.064595	0.050901	0.061724
84	0.053674	0.071736	0.056588	0.068563

Table A16. (Continued).

	Lives – IML92B45		Amounts - IMA92B45	
Age x	Duration 0	Durations 1+	Duration 0	Durations 1+
85	0.059615	0.079568	0.062838	0.076067
86	0.066135	0.088141	0.069694	0.084285
87	0.073276	0.097503	0.077199	0.093263
88	0.081082	0.107705	0.085400	0.103052
89	0.089597	0.118795	0.094339	0.113700
90	0.098864	0.130821	0.104065	0.125256
91	0.108930	0.143832	0.114620	0.137764
92	0.119838	0.157868	0.126050	0.151271
93	0.131630	0.172973	0.138398	0.165816
94	0.144346	0.189183	0.151704	0.181439
95	0.158027	0.206527	0.166007	0.198173
96	0.172708	0.225032	0.181341	0.216044
97	0.188420	0.244716	0.197735	0.235074
98	0.205191	0.265588	0.215216	0.255277
99	0.223042	0.287649	0.233802	0.276657
100	0.241990	0.310889	0.253507	0.299210
101		0.335289		0.322921
102		0.360816		0.347766
103		0.387426		0.373706
104		0.415064		0.400692
105		0.443660		0.428665
106		0.473133		0.457551
107		0.503391		0.487264
108		0.534327		0.517707
109		0.565829		0.548775
110		0.597771		0.580348
111		0.622892		0.605374
112		0.647670		0.630135
113		0.671993		0.654519
114		0.695751		0.678419
115		0.718842		0.701731
116		0.741170		0.724359
117		0.762651		0.746213
118		0.783207		0.767212
119		0.802773		0.787288
120		1.000000		1.000000

Table A17. Immediate annuitants, females – IFL92 and IFA92 ($B = 1945$) one year select: values of $q_{[x-t]+t}$ for year of birth 1945

	Lives – IFL92B45		Amounts – IFA92B45	
Age x	Duration 0	Durations 1+	Duration 0	Durations 1+
47	0.000528	0.000736	0.000441	0.000536
48	0.000565	0.000787	0.000451	0.000550
49	0.000607	0.000846	0.000467	0.000567
50	0.000656	0.000914	0.000487	0.000592
51	0.000711	0.000992	0.000512	0.000623
52	0.000775	0.001081	0.000545	0.000662
53	0.000848	0.001182	0.000584	0.000710
54	0.000930	0.001298	0.000633	0.000769
55	0.001024	0.001427	0.000690	0.000839
56	0.001129	0.001574	0.000759	0.000923
57	0.001247	0.001738	0.000840	0.001022
58	0.001379	0.001922	0.000935	0.001138
59	0.001528	0.002129	0.001047	0.001273
60	0.001693	0.002359	0.001176	0.001430
61	0.001911	0.002663	0.001349	0.001640
62	0.002163	0.003013	0.001555	0.001890
63	0.002453	0.003418	0.001799	0.002188
64	0.002787	0.003883	0.002089	0.002539
65	0.003172	0.004418	0.002431	0.002955
66	0.003614	0.005033	0.002835	0.003446
67	0.004122	0.005740	0.003310	0.004023
68	0.004705	0.006550	0.003868	0.004701
69	0.005373	0.007479	0.004523	0.005496
70	0.006139	0.008543	0.005289	0.006427
71	0.007015	0.009759	0.006184	0.007512
72	0.008016	0.011148	0.007227	0.008778
73	0.009158	0.012732	0.008440	0.010249
74	0.010459	0.014535	0.009846	0.011955
75	0.011940	0.016586	0.011474	0.013927
76	0.013622	0.018914	0.013353	0.016203
77	0.015531	0.021551	0.015516	0.018821
78	0.017691	0.024535	0.017998	0.021824
79	0.020134	0.027903	0.020840	0.025259
80	0.022889	0.031698	0.024084	0.029176
81	0.025992	0.035966	0.027774	0.033628
82	0.029480	0.040754	0.031960	0.038673
83	0.033392	0.046114	0.036693	0.044369
84	0.037770	0.052102	0.042027	0.050779

Table A17. (Continued).

	Lives – IFL92B45		Amounts – IFA92B45	
Age x	Duration 0	Durations 1+	Duration 0	Durations 1+
85	0.042660	0.058774	0.048015	0.057966
86	0.048109	0.066190	0.054717	0.065995
87	0.054165	0.074413	0.062190	0.074929
88	0.060884	0.083503	0.070490	0.084833
89	0.068316	0.093529	0.079675	0.095768
90	0.076517	0.104550	0.089800	0.107791
91	0.085543	0.116634	0.100915	0.120955
92	0.095451	0.129839	0.113069	0.135305
93	0.106294	0.144225	0.126302	0.150877
94	0.118130	0.159846	0.140648	0.167702
95	0.131009	0.176750	0.156135	0.185795
96	0.144981	0.194978	0.172778	0.205160
97	0.160093	0.214564	0.190583	0.225786
98	0.176382	0.235528	0.209545	0.247650
99	0.193884	0.257883	0.229645	0.270710
100	0.212625	0.281624	0.250851	0.294912
101		0.306737		0.320186
102		0.333187		0.346444
103		0.360925		0.373587
104		0.389886		0.401502
105		0.419986		0.430068
106		0.451125		0.459151
107		0.483186		0.488616
108		0.516037		0.518319
109		0.549534		0.548118
110		0.583518		0.577873
111		0.610832		0.600570
112		0.637731		0.622502
113		0.664072		0.643586
114		0.689719		0.663752
115		0.714545		0.682946
116		0.738437		0.701125
117		0.761294		0.718260
118		0.783030		0.734334
119		0.803579		0.749341
120		1.000000		1.000000

Table A18. Retirement annuitants – RMV92 and RFV92 ($B = 1945$) values of q_x for year of birth 1945

Age x	Males RMV92B45	Females RFV92B45
47	0.023551	0.014633
48	0.021978	0.013414
49	0.020515	0.012292
50	0.019158	0.011262
51	0.017903	0.010324
52	0.016748	0.009474
53	0.015691	0.008708
54	0.014731	0.008026
55	0.013865	0.007425
56	0.013092	0.006903
57	0.012412	0.006457
58	0.011823	0.006088
59	0.011326	0.005793
60	0.010920	0.005571
61	0.010799	0.005520
62	0.010788	0.005549
63	0.010893	0.005663
64	0.011120	0.005866
65	0.011479	0.006161
66	0.011980	0.006556
67	0.012635	0.007056
68	0.013458	0.007671
69	0.014467	0.008409
70	0.015680	0.009280
71	0.017118	0.010295
72	0.018803	0.011464
73	0.020762	0.012802
74	0.023022	0.014319
75	0.025584	0.016042
76	0.028420	0.017997
77	0.031557	0.020201
78	0.035021	0.022686
79	0.038839	0.025488
80	0.043043	0.028644
81	0.047661	0.032198
82	0.052728	0.036197
83	0.058277	0.040695
84	0.064344	0.045748

Table A18. (Continued).

Age x	Males RMV92B45	Females RFV92B45
85	0.070963	0.051422
86	0.078172	0.057788
87	0.086008	0.064922
88	0.094508	0.072908
89	0.103709	0.081838
90	0.113649	0.091808
91	0.124363	0.102925
92	0.135885	0.115299
93	0.148248	0.129049
94	0.161483	0.144296
95	0.175617	0.161166
96	0.190673	0.179787
97	0.206672	0.200286
98	0.223628	0.222784
99	0.241552	0.247396
100	0.260448	0.274224
101	0.280313	0.303350
102	0.301139	0.334829
103	0.322910	0.368686
104	0.345602	0.404903
105	0.369182	0.443415
106	0.393614	0.484095
107	0.418850	0.526753
108	0.444833	0.571128
109	0.471502	0.616878
110	0.498787	0.663591
111	0.520651	0.702735
112	0.542516	0.740987
113	0.564306	0.777821
114	0.585948	0.812707
115	0.607369	0.845149
116	0.628496	0.874707
117	0.649259	0.901033
118	0.669594	0.923893
119	0.689438	0.943192
120	1.000000	1.000000

Table A19. Widows – WL92 and WA92 ($B = 1945$) values of q_x for year of birth 1945

Age x	Lives WL92B45	Amounts WA92B45
47	0.003428	0.002859
48	0.003591	0.003002
49	0.003765	0.003153
50	0.003948	0.003315
51	0.004143	0.003486
52	0.004349	0.003669
53	0.004568	0.003863
54	0.004800	0.004069
55	0.005046	0.004288
56	0.005307	0.004522
57	0.005583	0.004769
58	0.005876	0.005033
59	0.006188	0.005313
60	0.006518	0.005611
61	0.006992	0.006035
62	0.007520	0.006508
63	0.008107	0.007035
64	0.008759	0.007621
65	0.009483	0.008273
66	0.010287	0.008999
67	0.011178	0.009805
68	0.012168	0.010702
69	0.013265	0.011699
70	0.014480	0.012807
71	0.015827	0.014037
72	0.017319	0.015403
73	0.018971	0.016919
74	0.020800	0.018602
75	0.022823	0.020468
76	0.025059	0.022537
77	0.027531	0.024830
78	0.030262	0.027371
79	0.033278	0.030184
80	0.036606	0.033297
81	0.040276	0.036740
82	0.044322	0.040547
83	0.048779	0.044753
84	0.053685	0.049396

Table A19. (Continued).

Age x	Lives WL92B45	Amounts WA92B45
85	0.059082	0.054519
86	0.065014	0.060167
87	0.071529	0.066388
88	0.078678	0.073235
89	0.086515	0.080765
90	0.095097	0.089035
91	0.104486	0.098111
92	0.114744	0.108058
93	0.125939	0.118947
94	0.138140	0.130851
95	0.151416	0.143845
96	0.165841	0.158007
97	0.181489	0.173417
98	0.198431	0.190152
99	0.216739	0.208291
100	0.236479	0.227911
101	0.257718	0.249083
102	0.280511	0.271869
103	0.304908	0.296329
104	0.330943	0.322507
105	0.358644	0.350433
106	0.388016	0.380122
107	0.419046	0.411565
108	0.451698	0.444728
109	0.485911	0.479551
110	0.521593	0.515942
111	0.552300	0.547505
112	0.583529	0.579652
113	0.615094	0.612181
114	0.646780	0.644862
115	0.678355	0.677439
116	0.709565	0.709637
117	0.740144	0.741163
118	0.769821	0.771718
119	0.798321	0.801003
120	1.000000	1.000000

Table A20. Pensioners – PML92, PMA92, PFL92 and PFA92 ($B = 1972$) values of q_x for year of birth 1972

Age x	Males: Lives PML92B72	Males: Amounts PMA92B72	Females: Lives PFL92B72	Females: Amounts PFA92B72
20	0.000623	0.000340	0.000254	0.000203
21	0.000591	0.000326	0.000244	0.000195
22	0.000561	0.000314	0.000236	0.000189
23	0.000533	0.000302	0.000227	0.000182
24	0.000506	0.000291	0.000220	0.000176
25	0.000483	0.000281	0.000213	0.000171
26	0.000460	0.000270	0.000208	0.000166
27	0.000441	0.000261	0.000202	0.000162
28	0.000423	0.000252	0.000198	0.000159
29	0.000408	0.000245	0.000195	0.000156
30	0.000395	0.000238	0.000193	0.000155
31	0.000384	0.000231	0.000192	0.000153
32	0.000376	0.000226	0.000192	0.000154
33	0.000371	0.000222	0.000194	0.000154
34	0.000368	0.000219	0.000196	0.000156
35	0.000368	0.000217	0.000201	0.000160
36	0.000372	0.000216	0.000207	0.000164
37	0.000379	0.000217	0.000215	0.000170
38	0.000390	0.000219	0.000224	0.000178
39	0.000406	0.000224	0.000237	0.000188
40	0.000426	0.000231	0.000251	0.000199
41	0.000452	0.000240	0.000269	0.000213
42	0.000483	0.000253	0.000289	0.000230
43	0.000520	0.000268	0.000314	0.000249
44	0.000564	0.000287	0.000341	0.000272
45	0.000615	0.000310	0.000374	0.000298
46	0.000675	0.000339	0.000410	0.000329
47	0.000744	0.000373	0.000452	0.000363
48	0.000823	0.000413	0.000499	0.000403
49	0.000912	0.000461	0.000553	0.000448
50	0.001014	0.000516	0.000614	0.000499
51	0.001129	0.000581	0.000682	0.000557
52	0.001258	0.000656	0.000758	0.000622
53	0.001403	0.000742	0.000844	0.000696
54	0.001565	0.000842	0.000940	0.000778

Table A20. (Continued).

Age x	Males		Females	
	Lives PML92B72	Amounts PMA92B72	Lives PFL92B72	Amounts PFA92B72
55	0.001746	0.000956	0.001047	0.000871
56	0.001946	0.001087	0.001167	0.000974
57	0.002169	0.001235	0.001300	0.001090
58	0.002415	0.001404	0.001447	0.001219
59	0.002687	0.001595	0.001610	0.001362
60	0.002986	0.001811	0.001791	0.001520
61	0.003514	0.002177	0.002110	0.001798
62	0.004127	0.002612	0.002482	0.002122
63	0.004838	0.003127	0.002915	0.002501
64	0.005658	0.003735	0.003418	0.002942
65	0.006602	0.004449	0.004000	0.003453
66	0.007686	0.005287	0.004671	0.004044
67	0.008925	0.006264	0.005445	0.004726
68	0.010338	0.007400	0.006334	0.005511
69	0.011945	0.008717	0.007352	0.006410
70	0.013765	0.010236	0.008516	0.007439
71	0.015822	0.011983	0.009842	0.008613
72	0.018138	0.013984	0.011350	0.009947
73	0.020738	0.016267	0.013059	0.011460
74	0.023646	0.018862	0.014991	0.013171
75	0.026891	0.021799	0.017171	0.015099
76	0.030497	0.025111	0.019622	0.017266
77	0.034494	0.028831	0.022371	0.019695
78	0.038909	0.032991	0.025447	0.022409
79	0.043770	0.037627	0.028878	0.025433
80	0.049103	0.042770	0.032696	0.028791
81	0.054937	0.048452	0.036932	0.032511
82	0.061297	0.054706	0.041619	0.036618
83	0.068206	0.061559	0.046789	0.041138
84	0.075688	0.069036	0.052479	0.046099
85	0.083763	0.077160	0.058720	0.051527
86	0.092448	0.085951	0.065548	0.057447
87	0.101758	0.095422	0.072996	0.063884
88	0.111703	0.105582	0.081095	0.070862
89	0.122292	0.116433	0.089878	0.078401

Table A20. (Continued).

Age x	Males: Lives PML92B72	Males: Amounts PMA92B72	Females: Lives PFL92B72	Females: Amounts PFA92B72
90	0.133526	0.127973	0.099374	0.086522
91	0.145404	0.140191	0.109609	0.095241
92	0.157920	0.153072	0.120607	0.104572
93	0.171063	0.166593	0.132388	0.114528
94	0.184817	0.180722	0.144971	0.125114
95	0.199161	0.195425	0.158367	0.136334
96	0.214070	0.210656	0.172584	0.148188
97	0.229511	0.226367	0.187625	0.160671
98	0.245449	0.242501	0.203487	0.173773
99	0.261845	0.258999	0.220161	0.187479
100	0.278655	0.275796	0.237633	0.201771
101	0.295830	0.292821	0.255882	0.216624
102	0.313320	0.310003	0.274881	0.232010
103	0.331069	0.327269	0.294596	0.247895
104	0.349023	0.344542	0.314991	0.264241
105	0.367123	0.361743	0.336018	0.281006
106	0.385308	0.378797	0.357628	0.298146
107	0.403518	0.395626	0.379766	0.315609
108	0.421692	0.412155	0.402372	0.333343
109	0.439767	0.428309	0.425381	0.351294
110	0.457684	0.444014	0.448729	0.369403
111	0.468997	0.453033	0.466001	0.382406
112	0.479798	0.461297	0.483064	0.395150
113	0.490060	0.468780	0.499869	0.407594
114	0.499756	0.475459	0.516366	0.419700
115	0.508865	0.481313	0.532508	0.431431
116	0.517368	0.486326	0.548254	0.442752
117	0.525248	0.490484	0.563564	0.453630
118	0.532489	0.493776	0.578402	0.464038
119	0.539080	0.496194	0.592739	0.473947
120	1.000000	1.000000	1.000000	1.000000

Table A21. Immediate annuitants, males – IML92 and IMA92 ($B = 1972$) one year select: values of $q_{[x-t]+t}$ for year of birth 1972

	Lives – IML92B72		Amounts – IMA92B72	
Age x	Duration 0	Durations 1+	Duration 0	Durations 1+
20	0.000423	0.000573	0.000447	0.000546
21	0.000406	0.000550	0.000429	0.000525
22	0.000390	0.000529	0.000412	0.000504
23	0.000376	0.000510	0.000398	0.000486
24	0.000363	0.000492	0.000383	0.000469
25	0.000351	0.000476	0.000371	0.000453
26	0.000341	0.000462	0.000360	0.000440
27	0.000332	0.000449	0.000351	0.000429
28	0.000324	0.000439	0.000342	0.000418
29	0.000317	0.000430	0.000336	0.000410
30	0.000313	0.000423	0.000330	0.000404
31	0.000309	0.000419	0.000327	0.000399
32	0.000308	0.000417	0.000325	0.000397
33	0.000307	0.000416	0.000325	0.000397
34	0.000309	0.000419	0.000326	0.000399
35	0.000313	0.000423	0.000330	0.000404
36	0.000318	0.000431	0.000336	0.000411
37	0.000326	0.000441	0.000344	0.000421
38	0.000336	0.000455	0.000355	0.000434
39	0.000348	0.000472	0.000368	0.000450
40	0.000363	0.000493	0.000384	0.000470
41	0.000382	0.000517	0.000403	0.000493
42	0.000403	0.000546	0.000426	0.000521
43	0.000428	0.000580	0.000452	0.000553
44	0.000456	0.000618	0.000482	0.000589
45	0.000489	0.000662	0.000517	0.000632
46	0.000526	0.000713	0.000556	0.000679
47	0.000568	0.000769	0.000600	0.000734
48	0.000615	0.000833	0.000650	0.000795
49	0.000668	0.000905	0.000706	0.000863
50	0.000727	0.000985	0.000768	0.000939
51	0.000793	0.001074	0.000838	0.001024
52	0.000866	0.001173	0.000915	0.001119
53	0.000948	0.001283	0.001001	0.001224
54	0.001038	0.001406	0.001097	0.001340

Table A21. (Continued).

	Lives – IML92B72		Amounts – IMA92B72	
Age x	Duration 0	Durations 1+	Duration 0	Durations 1+
55	0.001138	0.001541	0.001202	0.001469
56	0.001248	0.001690	0.001319	0.001612
57	0.001370	0.001855	0.001447	0.001769
58	0.001504	0.002037	0.001589	0.001942
59	0.001652	0.002236	0.001745	0.002132
60	0.001814	0.002455	0.001916	0.002341
61	0.002112	0.002858	0.002231	0.002725
62	0.002456	0.003323	0.002594	0.003170
63	0.002854	0.003861	0.003015	0.003683
64	0.003312	0.004481	0.003499	0.004274
65	0.003840	0.005194	0.004056	0.004953
66	0.004446	0.006011	0.004696	0.005734
67	0.005140	0.006948	0.005429	0.006627
68	0.005934	0.008019	0.006267	0.007650
69	0.006840	0.009241	0.007224	0.008816
70	0.007872	0.010632	0.008314	0.010143
71	0.009046	0.012213	0.009553	0.011652
72	0.010378	0.014005	0.010958	0.013363
73	0.011886	0.016033	0.012550	0.015299
74	0.013592	0.018324	0.014349	0.017486
75	0.015515	0.020905	0.016378	0.019951
76	0.017680	0.023808	0.018662	0.022724
77	0.020113	0.027065	0.021228	0.025837
78	0.022841	0.030714	0.024104	0.029323
79	0.025893	0.034790	0.027322	0.033220
80	0.029302	0.039336	0.030915	0.037567
81	0.033102	0.044394	0.034918	0.042404
82	0.037327	0.050008	0.039369	0.047775
83	0.042017	0.056226	0.044306	0.053727
84	0.047210	0.063097	0.049773	0.060306
85	0.052949	0.070671	0.055811	0.067561
86	0.059277	0.079000	0.062466	0.075544
87	0.066238	0.088138	0.069784	0.084305
88	0.073880	0.098137	0.077813	0.093898
89	0.082247	0.109051	0.086601	0.104374

Table A21. (Continued).

	Lives – IML92B72		Amounts – IMA92B72	
Age x	Duration 0	Durations 1+	Duration 0	Durations 1+
90	0.091389	0.120930	0.096197	0.115785
91	0.101354	0.133828	0.106648	0.128182
92	0.112188	0.147791	0.118004	0.141614
93	0.123937	0.162865	0.130310	0.156126
94	0.136647	0.179092	0.143612	0.171761
95	0.150360	0.196506	0.157952	0.188557
96	0.165115	0.215139	0.173368	0.206545
97	0.180948	0.235012	0.189894	0.225752
98	0.197891	0.256140	0.207560	0.246195
99	0.215970	0.278529	0.226389	0.267884
100	0.235204	0.302171	0.246398	0.290819
101		0.327052		0.314988
102		0.353142		0.340370
103		0.380401		0.366930
104		0.408775		0.394621
105		0.438196		0.423386
106		0.468584		0.453152
107		0.499847		0.483833
108		0.531877		0.515333
109		0.564562		0.547545
110		0.597771		0.580348
111		0.622892		0.605374
112		0.647670		0.630135
113		0.671993		0.654519
114		0.695751		0.678419
115		0.718842		0.701731
116		0.741170		0.724359
117		0.762651		0.746213
118		0.783207		0.767212
119		0.802773		0.787288
120		1.000000		1.000000

Table A22. Immediate annuitants, females – IFL92 and IFA92 ($B = 1972$) one year select: values of $q_{[x-t]+t}$ for year of birth 1972

	Lives – IFL92B72		*Amounts – IFA92B72*	
Age x	Duration 0	Durations 1+	Duration 0	Durations 1+
20	0.000217	0.000303	0.000329	0.000400
21	0.000211	0.000294	0.000318	0.000386
22	0.000203	0.000284	0.000307	0.000373
23	0.000197	0.000275	0.000297	0.000361
24	0.000192	0.000268	0.000287	0.000349
25	0.000186	0.000260	0.000277	0.000338
26	0.000181	0.000253	0.000269	0.000327
27	0.000176	0.000246	0.000260	0.000316
28	0.000171	0.000239	0.000252	0.000306
29	0.000168	0.000234	0.000243	0.000296
30	0.000164	0.000229	0.000236	0.000287
31	0.000161	0.000225	0.000229	0.000278
32	0.000159	0.000221	0.000222	0.000270
33	0.000157	0.000218	0.000216	0.000262
34	0.000155	0.000216	0.000210	0.000255
35	0.000154	0.000215	0.000204	0.000249
36	0.000154	0.000215	0.000199	0.000242
37	0.000155	0.000215	0.000194	0.000237
38	0.000156	0.000217	0.000191	0.000232
39	0.000158	0.000220	0.000186	0.000227
40	0.000162	0.000225	0.000184	0.000224
41	0.000166	0.000231	0.000181	0.000221
42	0.000172	0.000239	0.000180	0.000219
43	0.000179	0.000249	0.000179	0.000218
44	0.000187	0.000262	0.000179	0.000218
45	0.000198	0.000276	0.000181	0.000220
46	0.000210	0.000293	0.000184	0.000223
47	0.000225	0.000314	0.000188	0.000228
48	0.000242	0.000338	0.000194	0.000236
49	0.000262	0.000366	0.000202	0.000245
50	0.000285	0.000398	0.000212	0.000258
51	0.000312	0.000435	0.000225	0.000273
52	0.000343	0.000478	0.000241	0.000293
53	0.000378	0.000527	0.000260	0.000317
54	0.000418	0.000583	0.000284	0.000345

Table A22. (Continued).

	Lives – IFL92B72		Amounts – IFA92B72	
Age x	Duration 0	Durations 1+	Duration 0	Durations 1+
55	0.000463	0.000646	0.000313	0.000380
56	0.000515	0.000718	0.000346	0.000422
57	0.000574	0.000800	0.000387	0.000471
58	0.000641	0.000893	0.000434	0.000528
59	0.000716	0.000997	0.000490	0.000596
60	0.000800	0.001115	0.000556	0.000676
61	0.000949	0.001322	0.000670	0.000814
62	0.001125	0.001568	0.000809	0.000984
63	0.001334	0.001858	0.000978	0.001190
64	0.001580	0.002200	0.001184	0.001439
65	0.001869	0.002603	0.001432	0.001741
66	0.002208	0.003076	0.001732	0.002106
67	0.002607	0.003629	0.002093	0.002544
68	0.003072	0.004277	0.002525	0.003069
69	0.003615	0.005031	0.003042	0.003697
70	0.004247	0.005910	0.003659	0.004446
71	0.004981	0.006929	0.004391	0.005334
72	0.005832	0.008110	0.005258	0.006386
73	0.006816	0.009475	0.006281	0.007627
74	0.007950	0.011048	0.007484	0.009087
75	0.009256	0.012857	0.008895	0.010796
76	0.010755	0.014933	0.010542	0.012792
77	0.012473	0.017308	0.012461	0.015115
78	0.014436	0.020020	0.014686	0.017808
79	0.016674	0.023108	0.017259	0.020918
80	0.019219	0.026615	0.020222	0.024497
81	0.022107	0.030589	0.023622	0.028601
82	0.025375	0.035079	0.027510	0.033288
83	0.029066	0.040140	0.031939	0.038620
84	0.033221	0.045827	0.036965	0.044664
85	0.037890	0.052202	0.042646	0.051484
86	0.043120	0.059326	0.049043	0.059151
87	0.048963	0.067265	0.056216	0.067732
88	0.055475	0.076085	0.064228	0.077297
89	0.062712	0.085857	0.073139	0.087912

Table A22. (Continued).

	Lives – IFL92B72		Amounts – IFA92B72	
Age x	Duration 0	Durations 1+	Duration 0	Durations 1+
90	0.070732	0.096645	0.083010	0.099641
91	0.079593	0.108522	0.093896	0.112542
92	0.089358	0.121551	0.105851	0.126667
93	0.100083	0.135797	0.118921	0.142061
94	0.111829	0.151320	0.133146	0.158757
95	0.124652	0.168174	0.148560	0.176780
96	0.138607	0.186406	0.165182	0.196140
97	0.153744	0.206055	0.183026	0.216832
98	0.170108	0.227150	0.202090	0.238840
99	0.187736	0.249706	0.222363	0.262127
100	0.206662	0.273726	0.243817	0.286642
101		0.299201		0.312320
102		0.326101		0.339076
103		0.354381		0.366812
104		0.383978		0.395419
105		0.414813		0.424771
106		0.446787		0.454737
107		0.479784		0.485176
108		0.513672		0.515943
109		0.548303		0.546891
110		0.583518		0.577873
111		0.610832		0.600570
112		0.637731		0.622502
113		0.664072		0.643586
114		0.689719		0.663752
115		0.714545		0.682946
116		0.738437		0.701125
117		0.761294		0.718260
118		0.783030		0.734334
119		0.803579		0.749341
120		1.000000		1.000000

Table A23. Retirement annuitants – RMV92 and RFV92 ($B = 1972$) values of q_x for year of birth 1972

Age x	Males RMV92B72	Females RFV92B72
20	0.048530	0.039297
21	0.045960	0.037034
22	0.043516	0.034888
23	0.041192	0.032850
24	0.038983	0.030915
25	0.036883	0.029080
26	0.034887	0.027339
27	0.032989	0.025687
28	0.031185	0.024121
29	0.029472	0.022636
30	0.027843	0.021228
31	0.026296	0.019893
32	0.024826	0.018629
33	0.023431	0.017431
34	0.022105	0.016297
35	0.020846	0.015224
36	0.019652	0.014209
37	0.018518	0.013249
38	0.017443	0.012342
39	0.016424	0.011486
40	0.015459	0.010678
41	0.014544	0.009917
42	0.013680	0.009201
43	0.012862	0.008527
44	0.012090	0.007895
45	0.011362	0.007303
46	0.010677	0.006750
47	0.010034	0.006234
48	0.009430	0.005756
49	0.008866	0.005312
50	0.008341	0.004904
51	0.007854	0.004529
52	0.007404	0.004188
53	0.006991	0.003880
54	0.006616	0.003605

Table A23. (Continued).

Age *x*	Males RMV92B72	Females RFV92B72
55	0.006278	0.003362
56	0.005978	0.003152
57	0.005715	0.002973
58	0.005491	0.002828
59	0.005306	0.002714
60	0.005162	0.002633
61	0.005362	0.002741
62	0.005613	0.002887
63	0.005922	0.003079
64	0.006302	0.003324
65	0.006763	0.003630
66	0.007321	0.004006
67	0.007989	0.004462
68	0.008787	0.005009
69	0.009732	0.005657
70	0.010847	0.006420
71	0.012154	0.007310
72	0.013680	0.008341
73	0.015451	0.009527
74	0.017499	0.010884
75	0.019832	0.012436
76	0.022438	0.014209
77	0.025344	0.016224
78	0.028576	0.018511
79	0.032164	0.021108
80	0.036140	0.024051
81	0.040536	0.027385
82	0.045387	0.031157
83	0.050727	0.035422
84	0.056595	0.040238
85	0.063028	0.045672
86	0.070065	0.051795
87	0.077747	0.058686
88	0.086112	0.066431
89	0.095202	0.075125
90	0.105056	0.084866
91	0.115713	0.095766
92	0.127211	0.107939
93	0.139585	0.121507
94	0.152870	0.136599

Table A23. (Continued).

Age x	Males RMV92B72	Females RFV92B72
95	0.167096	0.153346
96	0.182290	0.171882
97	0.198476	0.192344
98	0.215673	0.214859
99	0.233893	0.239552
100	0.253144	0.266534
101	0.273427	0.295897
102	0.294734	0.327708
103	0.317055	0.362000
104	0.340365	0.398768
105	0.364636	0.437954
106	0.389830	0.479440
107	0.415901	0.523045
108	0.442793	0.568510
109	0.470446	0.615496
110	0.498787	0.663591
111	0.520651	0.702735
112	0.542516	0.740987
113	0.564306	0.777821
114	0.585948	0.812707
115	0.607369	0.845149
116	0.628496	0.874707
117	0.649259	0.901033
118	0.669594	0.923893
119	0.689438	0.943192
120	1.000000	1.000000

Table A24. Widows – WL92 and WA92 ($B = 1972$) values of q_x for year of birth 1972

Age x	Lives WL92B72	Amounts WA92B72
20	0.000515	0.000423
21	0.000525	0.000431
22	0.000537	0.000440
23	0.000549	0.000449
24	0.000562	0.000459
25	0.000577	0.000471
26	0.000594	0.000485
27	0.000612	0.000499
28	0.000632	0.000514
29	0.000653	0.000532
30	0.000676	0.000551
31	0.000700	0.000571
32	0.000727	0.000593
33	0.000756	0.000617
34	0.000787	0.000643
35	0.000820	0.000671
36	0.000856	0.000701
37	0.000894	0.000732
38	0.000935	0.000767
39	0.000979	0.000805
40	0.001026	0.000844
41	0.001076	0.000887
42	0.001130	0.000933
43	0.001188	0.000982
44	0.001249	0.001035
45	0.001315	0.001092
46	0.001385	0.001153
47	0.001460	0.001218
48	0.001541	0.001288
49	0.001627	0.001363
50	0.001719	0.001443
51	0.001817	0.001529
52	0.001923	0.001622
53	0.002035	0.001721
54	0.002156	0.001828

Table A24. (Continued).

Age x	Lives WL92B72	Amounts WA92B72
55	0.002285	0.001942
56	0.002423	0.002065
57	0.002571	0.002196
58	0.002729	0.002337
59	0.002899	0.002489
60	0.003081	0.002652
61	0.003472	0.002997
62	0.003913	0.003386
63	0.004408	0.003825
64	0.004964	0.004319
65	0.005587	0.004874
66	0.006286	0.005499
67	0.007069	0.006200
68	0.007944	0.006988
69	0.008923	0.007870
70	0.010017	0.008860
71	0.011238	0.009967
72	0.012600	0.011206
73	0.014119	0.012591
74	0.015809	0.014139
75	0.017692	0.015866
76	0.019785	0.017793
77	0.022110	0.019941
78	0.024693	0.022334
79	0.027558	0.024997
80	0.030736	0.027958
81	0.034255	0.031248
82	0.038151	0.034901
83	0.042459	0.038955
84	0.047220	0.043447
85	0.052475	0.048422
86	0.058272	0.053927
87	0.064659	0.060011
88	0.071689	0.066729
89	0.079418	0.074140
90	0.087907	0.082303
91	0.097219	0.091287
92	0.107420	0.101160
93	0.118579	0.111996
94	0.130772	0.123872

Table A24. (Continued).

Age x	Lives WL92B72	Amounts WA92B72
95	0.144069	0.136865
96	0.158550	0.151061
97	0.174292	0.166540
98	0.191372	0.183387
99	0.209866	0.201687
100	0.229848	0.221520
101	0.251387	0.242963
102	0.274545	0.266087
103	0.299379	0.290956
104	0.325929	0.317621
105	0.354227	0.346118
106	0.384286	0.376468
107	0.416095	0.408667
108	0.449628	0.442689
109	0.484823	0.478477
110	0.521593	0.515942
111	0.552300	0.547505
112	0.583529	0.579652
113	0.615094	0.612181
114	0.646780	0.644862
115	0.678355	0.677439
116	0.709565	0.709637
117	0.740144	0.741163
118	0.769821	0.771718
119	0.798321	0.801003
120	1.000000	1.000000

Table B1. Retirement annuitants, males – RMD92 and RMC92 values of q_x

Age x	Deferred RMD92	Combined RMC92
17	0.000393	0.000401
18	0.000392	0.000401
19	0.000392	0.000401
20	0.000392	0.000403
21	0.000394	0.000405
22	0.000396	0.000408
23	0.000400	0.000413
24	0.000404	0.000419
25	0.000411	0.000426
26	0.000419	0.000435
27	0.000429	0.000446
28	0.000442	0.000459
29	0.000457	0.000475
30	0.000475	0.000494
31	0.000497	0.000516
32	0.000523	0.000543
33	0.000553	0.000573
34	0.000589	0.000609
35	0.000630	0.000650
36	0.000679	0.000697
37	0.000734	0.000752
38	0.000799	0.000815
39	0.000872	0.000887
40	0.000957	0.000969
41	0.001053	0.001064
42	0.001162	0.001171
43	0.001285	0.001293
44	0.001425	0.001432
45	0.001583	0.001589
46	0.001760	0.001767
47	0.001959	0.001969
48	0.002181	0.002196
49	0.002429	0.002452
50	0.002705	0.002741
51	0.003011	0.003065
52	0.003351	0.003430
53	0.003725	0.003839
54	0.004138	0.004296

Table B1. (Continued).

Age x	Deferred RMD92	Combined RMC92
55	0.004592	0.004809
56	0.005090	0.005381
57	0.005635	0.006019
58	0.006230	0.006731
59	0.006877	0.007523
60	0.007580	0.008404
61	0.008341	0.009381
62	0.009164	0.010466
63	0.010050	0.011666
64	0.011004	0.012995
65	0.012026	0.014462
66	0.013119	0.016081
67	0.014286	0.017865
68	0.015528	0.019828
69	0.016846	0.021985
70	0.018241	0.024353
71	0.019714	0.026947
72	0.021264	0.029787
73	0.022892	0.032891
74	0.024597	0.036279
75	0.026378	0.039971
76		0.043988
77		0.048353
78		0.053089
79		0.058219
80		0.063767
81		0.069756
82		0.076213
83		0.083160
84		0.090623
85		0.098625
86		0.107189
87		0.116337
88		0.126091
89		0.136470
90		0.147491
91		0.159170
92		0.171520
93		0.184549
94		0.198265

Table B1. (Continued).

Age x	Deferred RMD92	Combined RMC92
95		0.212671
96		0.227764
97		0.243539
98		0.259986
99		0.277089
100		0.294827
101		0.313175
102		0.332100
103		0.351567
104		0.371532
105		0.391947
106		0.412761
107		0.433916
108		0.455349
109		0.476996
110		0.498787
111		0.520651
112		0.542516
113		0.564306
114		0.585948
115		0.607369
116		0.628496
117		0.649259
118		0.669594
119		0.689438
120		1.000000

Table B2. Retirement annuitants, females – RFD92 and RFC92 values of q_x

Age x	Deferred RFD92	Combined RFC92
17	0.000176	0.000189
18	0.000180	0.000195
19	0.000185	0.000201
20	0.000190	0.000208
21	0.000196	0.000216
22	0.000203	0.000224
23	0.000211	0.000234
24	0.000220	0.000245
25	0.000231	0.000256
26	0.000242	0.000270
27	0.000256	0.000284
28	0.000271	0.000301
29	0.000288	0.000319
30	0.000307	0.000339
31	0.000329	0.000362
32	0.000354	0.000387
33	0.000382	0.000415
34	0.000413	0.000447
35	0.000449	0.000482
36	0.000488	0.000520
37	0.000532	0.000563
38	0.000582	0.000612
39	0.000637	0.000665
40	0.000698	0.000725
41	0.000766	0.000791
42	0.000842	0.000865
43	0.000926	0.000947
44	0.001019	0.001039
45	0.001122	0.001141
46	0.001235	0.001255
47	0.001360	0.001381
48	0.001497	0.001522
49	0.001648	0.001679
50	0.001813	0.001853
51	0.001994	0.002048
52	0.002191	0.002264
53	0.002406	0.002505
54	0.002641	0.002773

Table B2. (Continued).

Age x	Deferred RFD92	Combined RFC92
55	0.002895	0.003072
56	0.003172	0.003404
57	0.003471	0.003774
58	0.003795	0.004186
59	0.004145	0.004645
60	0.004522	0.005155
61	0.004927	0.005723
62	0.005363	0.006355
63	0.005830	0.007058
64	0.006330	0.007841
65	0.006864	0.008712
66	0.007434	0.009681
67	0.008040	0.010758
68	0.008685	0.011957
69	0.009368	0.013290
70	0.010092	0.014772
71	0.010858	0.016420
72	0.011665	0.018252
73	0.012515	0.020288
74	0.013409	0.022551
75	0.014346	0.025064
76		0.027855
77		0.030953
78		0.034391
79		0.038206
80		0.042436
81		0.047125
82		0.052319
83		0.058070
84		0.064432
85		0.071467
86		0.079238
87		0.087816
88		0.097273
89		0.107689
90		0.119146
91		0.131732
92		0.145535
93		0.160648
94		0.177163

Table B2. (Continued).

Age x	Deferred RFD92	Combined RFC92
95		0.195171
96		0.214760
97		0.236014
98		0.259005
99		0.283793
100		0.310422
101		0.338912
102		0.369254
103		0.401405
104		0.435283
105		0.470757
106		0.507643
107		0.545701
108		0.584630
109		0.624066
110		0.663591
111		0.702735
112		0.740987
113		0.777821
114		0.812707
115		0.845149
116		0.874707
117		0.901033
118		0.923893
119		0.943192
120		1.000000

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APPENDIX C

FORMULAE FOR THE NEW STANDARD TABLES

In this appendix the parameters used for the calculation of the adjusted values of μ_x are described. The formulae apply over all ages of the standard tables apart from the self employed retirement annuitants, males and females, where separate formulae are applied up to age 74 and 75 and over, as shown.

It should be noted that the formulae described in this appendix are used to calculate values of μ_x for the various experiences into which the data are classified. Using a numerical integration technique, these values of μ_x can then be used to calculate the values of $q_{[x]}$, $q_{[x]-1}$, q_x etc, shown in Appendices A and B. The values of $q_{[x]}$, $q_{[x]+1}$, q_x etc, rounded to six decimal places, are then used to calculate values of $\mu_{[x]}$, $\mu_{[x]-1}$, μ_x etc as described in section 2.6 of *C.M.I.R.* **10**.

Table C1. Graduation formulae and their parameter values.

		Parameters					
		GM(*r*,*s*)	$100a_0$	$100a_1$	b_0	b_1	b_2
Permanent assurances, males							
	Duration 0	GM(2,3)	0.02	−0.02	−4.755647	5.236521	−0.6
	Duration 1	GM(2,3)	0.02296	−0.03	−5.056244	5.0	−1.2
	Durations 2+	GM(2,3)	0.005887	−0.049883	−4.363378	5.544956	−0.620345
Permanent assurances, females							
	Duration 0	GM(1,2)	0.008	–	−4.978100	5.07878	–
	Duration 1	GM(1,2)	0.008	–	−4.763844	4.85445	–
	Durations 2+	GM(1,2)	0.011189	–	−4.331121	5.135803	–
Temporary assurances, males							
	Duration 0	GM(2,3)	−0.12	−0.17	−4.415430	4.486721	−0.12
	Durations 1–4	GM(2,3)	−0.113910	−0.173839	−4.170362	4.745634	−0.119740
	Durations 5+	GM(2,3)	−0.10	−0.17	−3.851692	5.43387	−0.12
Temporary assurances, females							
	Duration 0	GM(1,2)	0.008	–	−5.082158	5.493452	–
	Durations 1–4	GM(1,2)	0.012	–	−4.462904	5.240908	–
	Durations 5+	GM(1,2)	0.018	–	−4.352028	5.347124	–
Pensioners, males							
	Lives	GM(2,3)	−0.0081	−0.07	−4.67509	5.629188	−1.2
	Amounts	GM(2,3)	0.023	−0.011	−5.39778	6.622746	−1.6
Pensioners, females							
	Lives	GM(2,3)	0.0108	−0.014	−4.97225	5.884075	−1.0
	Amounts	GM(2,3)	0.0119	−0.008	−5.26110	5.982521	−1.15
Immediate annuitants, males							
Lives	Duration 0	GM(2,3)	0.010649	−0.029980	−4.703659	5.568973	−0.654909
	Durations 1+	GM(2,3)	0.014429	−0.040629	−4.399861	5.568973	−0.654909
Amounts	Duration 0	GM(2,3)	0.011251	−0.031682	−4.648604	5.568973	−0.654909
	Durations 1+	GM(2,3)	0.013757	−0.038737	−4.447540	5.568973	−0.654909
Immediate annuitants, females							
Lives	Duration 0	GM(1,3)	0.021517	–	−5.597708	6.683129	−0.9
	Durations 1+	GM(1,3)	0.03	–	−5.265363	6.683129	−0.9
Amounts	Duration 0	GM(1,3)	0.03289	–	−6.378326	8.027676	−1.5
	Durations 1+	GM(1,3)	0.04	–	−6.182627	8.027676	−1.5

Table C1. (Continued).

		Parameters					
		GM(*r*,*s*)	$100a_0$	$100a_1$	b_0	b_1	b_2
Widows							
	Lives	GM(1,2)	0.02	–	−3.795522	4.308854	–
	Amounts	GM(1,2)	0.018	–	−3.921243	4.444249	–
Retirement annuitants, males							
Vested	Pre age 75	GM(2,3)	0.023761	−5.0	−4.713208	6.0	−1.0
Vested	Post age 74	GM(2,3)	0.01647	−0.02022	−4.39933	5.21998	−0.63741
Retirement annuitants, females							
Vested	Pre age 75	GM(2,3)	−0.943368	−5.0	−4.737523	5.0	−1.0
Vested	Post age 74	GM(1,2)	0.014	–	−4.27128	5.378175	–

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AN INVESTIGATION INTO THE DISTRIBUTION OF POLICIES PER LIFE ASSURED IN THE CAUSE OF DEATH INVESTIGATION 1991–94

The continuous investigation into the mortality of assured lives is based on policies and not lives. Consequently the death of a policyholder carrying n policies appears as n deaths in the data. In order to estimate the standard deviations needed to test differences between actual and expected deaths, information is required about the distribution of policies per life assured. This information is not contained in the data submitted to the main assured lives investigations but is included in the data for deaths in the cause of death investigation. This data has been used as a proxy for direct information about the distribution of duplicates in the assured lives investigations, for the purpose of the graduations described elsewhere in this edition of *C.M.I.R.*

The last report by the C.M.I. Committee into the distribution of duplicates amongst deaths in the cause of death investigation was contained in *C.M.I.R.* **8**, 49–58 (1986). The work described in that report to analyse the cause of death experience was repeated for the 1991–94 experience. Table 1 shows for U.K. males, at durations 2 and over, the 'variance ratios' in quinary age groups and at all ages combined. This is the ratio of the variance of a distribution where there are duplicates to that of a straightforward binomial variance. As previously reported, this can be approximated by m_1/m_2 where m_1 and m_2 are the first and second moments about zero of the duplicates' distribution.

Table 2 shows the number of deaths with n policies contained in the data. The values of m_1 and m_2 shown in Table 1 can be calculated directly from this table.

The total number of policies held by lives who died in the period, as reported in Table 1, is 49,353. This compares with 68,963 deaths in the assured lives investigation in the same period. The difference is represented by offices who did not contribute data to the cause of death investigation and by offices who were not able to provide death certificates for all deaths.

Table 1 shows values that are, in all cases except the two indicated, lower than those reported in *C.M.I.R.* **8** for the investigation period 1981–82. The reason for the decline in the number of duplicate policies per life is not clear. It does not seem to accord with the perception that the insured population takes out more policies as inflation erodes the value of their existing contracts. The number of lives in both the cause of death and assured lives investigation has been declining and it is not known how this has affected the results shown in Table 2.

Table 1. First and second moments about zero together with the variance ratios of the distribution of duplicates in the cause of death investigation: assured lives (whole-life and endowment), males, U.K., durations 2 and over, 1991–94.

Age group	m_1	m_2	m_1/m_2	Number of lives	Number of policies
Under 25	1.080	1.277*	1.18*	112	121
25–29	1.113	1.466	1.32	204	227
30–34	1.155	1.532	1.33	361	417
35–39	1.230	1.979	1.61	662	814
40–44	1.263	2.100	1.66	1,304	1,647
45–49	1.312	2.292	1.75	2,754	3,612
50–54	1.301	2.195	1.69	4,012	5,219
55–59	1.281	2.107	1.65	6,079	7,785
60–64	1.216	1.814	1.49	8,220	9,995
65–69	1.113	1.399	1.26	4,274	4,755
70–74	1.079	1.284	1.19	3,695	3,988
75–79	1.106	1.402	1.27	3,407	3,768
80–84	1.088	1.326	1.22	3,472	3,776
85–89	1.103	1.356	1.23	1,875	2,068
90 and over	1.104	1.429	1.29	1,052	1,161
All ages	1.190	1.736	1.46	41,483	49,353

Values marked with * are bigger than the equivalent calculated from the 1981–82 data.

Table 2. Numbers of deaths with *n* policies in the 1991–94 cause of death investigation: assured lives (whole-life and endowment), males, U.K., durations 2 and over.

	Number of policies per life (n)									
	1	2	3	4	5	6	7	8	9	10+
Under 25	105	5	2	–	–	–	–	–	–	–
25–29	189	11	1	2	1	–	–	–	–	–
30–34	315	38	6	2	–	–	–	–	–	–
35–39	556	79	20	4	–	–	1	1	1	–
40–44	1,066	176	40	15	3	–	1	1	1	1
45–49	2,173	404	125	35	4	6	1	3	1	2
50–54	3,176	594	165	45	20	8	2	1	–	1
55–59	4,871	879	230	63	21	6	4	2	1	2
60–64	6,897	1,010	228	54	17	8	5	–	–	1
65–69	3,873	346	42	8	2	1	1	–	1	–
70–74	3,455	203	28	6	2	–	–	–	1	–
75–79	3,133	216	43	8	3	3	–	–	1	–
80–84	3,235	197	24	9	4	2	1	–	–	–
85–89	1,717	131	20	6	1	–	–	–	–	–
90 and over	975	61	8	4	2	–	2	–	–	–
All ages	35,736	4,350	982	261	80	34	18	8	7	7

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