Continuous Mortality Investigation

Life Office Mortality Committee

Working Paper 26

Extensions to Younger Ages of the "00" Series Pensioner Tables of Mortality

April 2007

CMI Mortality Graduation Working Party
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Introduction

In 2003 the CMI Mortality Committee set up a Working Party to carry out the graduation of a new set of mortality tables, to be based on the 1999-2002 experience. The members of the Mortality Graduation Working Party ("MGWP") are Angus Macdonald (Chairman), John Ellam, Adrian Gallop, Simon Spencer, Joanne Wells, David Wilkie and Richard Willets.

The previous work has been exposed to the Profession in a series of Working Papers:
— Working Paper 8, first published in draft form in May 2004 with the final version made available in August 2004, contained initial findings of the Working Party and proposals on which tables to graduate.
— Working Paper 12, published in April 2005, contained proposed graduations for the assured lives tables.
— Working Paper 16, published in September 2005, contained proposed graduations for the annuitant and pensioner tables.
— Working Paper 21, published in July 2006, contained the final "00" Series tables for assured lives, which were adopted by the Actuarial Profession with an effective date of 1 September 2006.
— Working Paper 22, published in July 2006 contained the final "00" Series tables for annuitants and pensioners, which were adopted by the Actuarial Profession with an effective date of 1 September 2006.

In Working Paper 16, the proposed mortality rates for the life office pensioner tables started at age 50 due to low data volumes at the younger ages. However, feedback received suggested that practitioners would find it useful for the pensioner tables to be extended down to younger ages.

The MGWP therefore revised the tables for Normal retirements so that they started at age 20, and these were published in Working Paper 22. The rates for the Early and Combined retirements were left unchanged and commenced at age 50. However, there was also a demand for extending these tables and so in this Working Paper the MGWP suggests possible extensions down to age 20. There are a number of approaches that could have been adopted and we believe those set out in this Working Paper are reasonable, but other approaches may also be equally appropriate.

The CMI is not seeking approval for these rates from the Actuarial Profession. **It is the responsibility of any actuary or other person using a base table to ensure that it is appropriate for the particular purpose to which it is put.**

This paper is not intended as a consultation document, but feedback is welcomed. Any comments on the Working Paper should be submitted to:
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Background

The CMI collects insured pension scheme data in two separate categories: those retiring at or after normal retirement age ("Normals") and those retiring before the normal retirement date ("Earlies"). The coding guide provided to data contributors states the following for each of these categories:

Normals

"Normal and late retirements of pensioners insured under life office pension schemes. (Any cases where retirement occurs after age 65 (males) or 60 (females) should be included in this group even if there is no fixed retirement age.) Schemes include those written under a group contract providing deferred annuities for employees; and pensions purchased by Trustees of Managed Funds or Deposit Administration Schemes, even if they were purchased from offices other than those writing contracts or giving investment services during the period of deferment."

Earlies

"Early retirements, including ill-health retirements, of pensioners insured under life office pension schemes (i.e. retirements taking place before the normal retirement date)."

It has long been assumed that the Early experience contains ill-health retirements as well as those who choose to retire early – and the consistently heavier mortality of the Early experience would seem to bear this out. However, there is a suspicion that some mis-coding by offices (particularly at younger ages) might mean that some ill-health retirements are also finding their way into the Normal experience.

While each of these categories is regularly analysed and 'all office results' provided to member offices, the "92" Series tables (based on the 1991-1994 experience and published in 1999) only contained tables based on Normals – the PMA92, PML92, PFA92 and PFL92 tables.

The "00" Series tables, by contrast, contained separate tables based on each of these sections as well as tables based on the "Combined" (i.e. Normals plus Earlies) experience. These are summarised below:

Table	Pensioner Type	Sex	Lives/Amounts	Age Range
PNML00	Normal	Male	Lives	20-120
PNMA00	Normal	Male	Amounts	20-120
PNFL00	Normal	Female	Lives	20-120
PNFA00	Normal	Female	Amounts	20-120
PEML00	Early	Male	Lives	50-120
PEMA00	Early	Male	Amounts	50-120
PEFL00	Early	Female	Lives	50-120
PEFA00	Early	Female	Amounts	50-120
PCML00	Combined	Male	Lives	50-120
PCMA00	Combined	Male	Amounts	50-120
PCFL00	Combined	Female	Lives	50-120
PCFA00	Combined	Female	Amounts	50-120

WP 22 approach and problems encountered

The main problem the MGWP encountered when constructing the "00" Series Normal, Early and Combined pensioner tables was the very low volume of data at younger ages. Compounded to this was an apparent flattening of the crude rates of mortality in the 50s of age – and for some sections of the data this was in fact more of a U-shape, with crude rates at the younger ages decreasing as age rises before increasing again at the older ages.

The original approach of the MGWP, as set out in the draft tables in Working Paper 16, was simply to start the tables at age 50. This allowed the resulting rates to fit the data reasonably closely. However, following feedback, it was decided that rates for the age range 20-50 should indeed be produced for the Normal tables. This entailed changing the proposed rates between ages 50 and 65 to reflect assumptions regarding the experience of "healthy" lives rather than the actual experience, using assured lives data. The assured lives rates at age 20 were then blended into the originally graduated Normal pensioner rates at age 65 (this is described in more detail in Working Paper 22).

This approach was also adopted for the construction of the "92" Series pensioner tables.

The Early and Combined tables remained as originally graduated – i.e. they started at age 50 and reflected the underlying data reasonably closely, retaining the flat or U-shape feature in the 50s of age.

Extending the Early and Combined tables

Given the paucity of data, it is not obvious how the Early and Combined tables should be extended down to younger ages. The MGWP has considered a number of possible methods.

The simplest option is to assume that the age 50 mortality rate for each table applies to all ages down to age 20. This approach has its merits: it is not unreasonable that the mortality rates at young ages, particularly for ill-health retirements, are constant by age since it is their illness more than their age that affects their mortality, until normal age mortality 'catches up' (in this case in the 60s of age or so).

Another approach would be to target an appropriate mortality rate at age 20 and then blend it into the age 50 graduated rate for the relevant table, in much the same way that the Normal tables were extended. It is not obvious what a suitable starting point would be, though the assured lives rates as used for the Normals could be considered particularly unrealistic.

On consideration, the MGWP has decided to offer the following approach.

Males, Combined

For both lives and amounts, the shape of the original graduation looks reasonably sensible, reducing very slightly as age reduces. (Note that this is based on the Combined data, not the Normal and Early graduated rates.) The MGWP therefore proposes that this is simply extended down to age 20.

The parameter values for the GM formulae used to calculate values of μ are summarised below.

Parameter	Lives	Amounts
GM formula	GM(1,4)	GM(1,3)
$100 \times a_1$	0.735863	0.536403
b_1	–9.258547	–6.688640
b_2	13.714773	8.359170
b_3	–5.064792	–2.286393
b_4	1.565239	

Males, Earlies

In Working Paper 22, the rates for Earlies, both lives and amounts, were constrained not to fall below those for the relevant Combined rates. This happens at a little over age 60 for lives and a little below age 60 for amounts. Thus, below about age 60, the Early rates were set equal to the Combined rates for males (i.e. q_x(PEML00) = q_x(PCML00) and q_x(PEMA00) = q_x(PCMA00) for x < about 60). The MGWP suggests that these equalities be extended down to age 20.

Females, Combined

The original graduation formula for Combined females contained a U-shape with a minimum value at about age 57. In Working Paper 22, this was partially removed by an adjustment whereby the rates were blended from arbitrary values of μ_{16} into the graduated values of μ_{54} for lives and μ_{57} for amounts. The arbitrary values of μ_{16} were 0.00347646 for lives and 0.00332832 for amounts. Further details of these adjustments are given in Working Paper 16.

As this again gives a reasonable shape, the MGWP proposes that the resulting rates be continued down to age 20.

Females, Earlies

In contrast to the Combined females, the U-shape is much more pronounced, and was left in as part of the Working Paper 22 final mortality rates. This presents more of a problem, as it is not possible simply to extend the formula down to younger ages – this would lead to rapidly increasing mortality rates as age reduces.

The MGWP therefore suggests using a similar adjustment to that already applied to the Combined females, but taking effect from age 50. Thus for both lives and amounts the graduated rate of μ_{50} (which for amounts is itself constrained not to be greater than the equivalent graduated lives rate) is blended into the values of μ_{16} assumed for Combined females.

This necessarily creates a significant discontinuity at age 50, but given the arbitrary nature of any rates produced the MGWP is comfortable with this and feels that on balance the resulting rates are sensible compared to the other sections of the data.

The proposed rates

The final proposed rates are represented graphically below, and are set out in the Appendix.

Figures 1 and 2 show the existing rates of q_x and the proposed extensions to younger ages for males and females respectively.

Figure 3 to 6 show the rates of q_x over the entire age range separately for the four sections of males and females, lives and amounts, together with the corresponding Normals table rates.

Figure 1. Males, Earlies and Combined - "00" Series tables and proposed extensions to younger ages
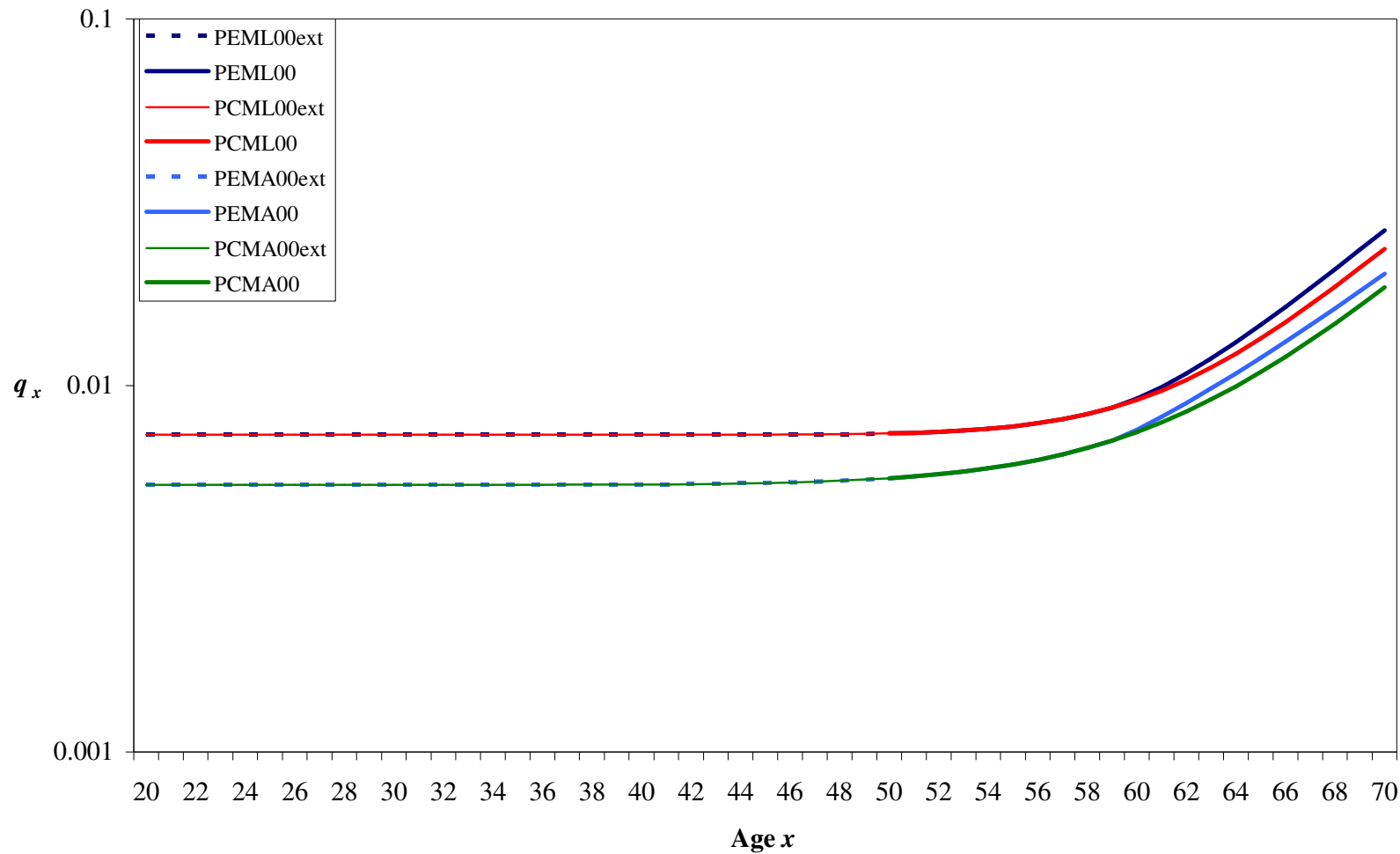
Figure 2. Females, Earlies and Combined - "00" Series tables and proposed extensions to younger ages
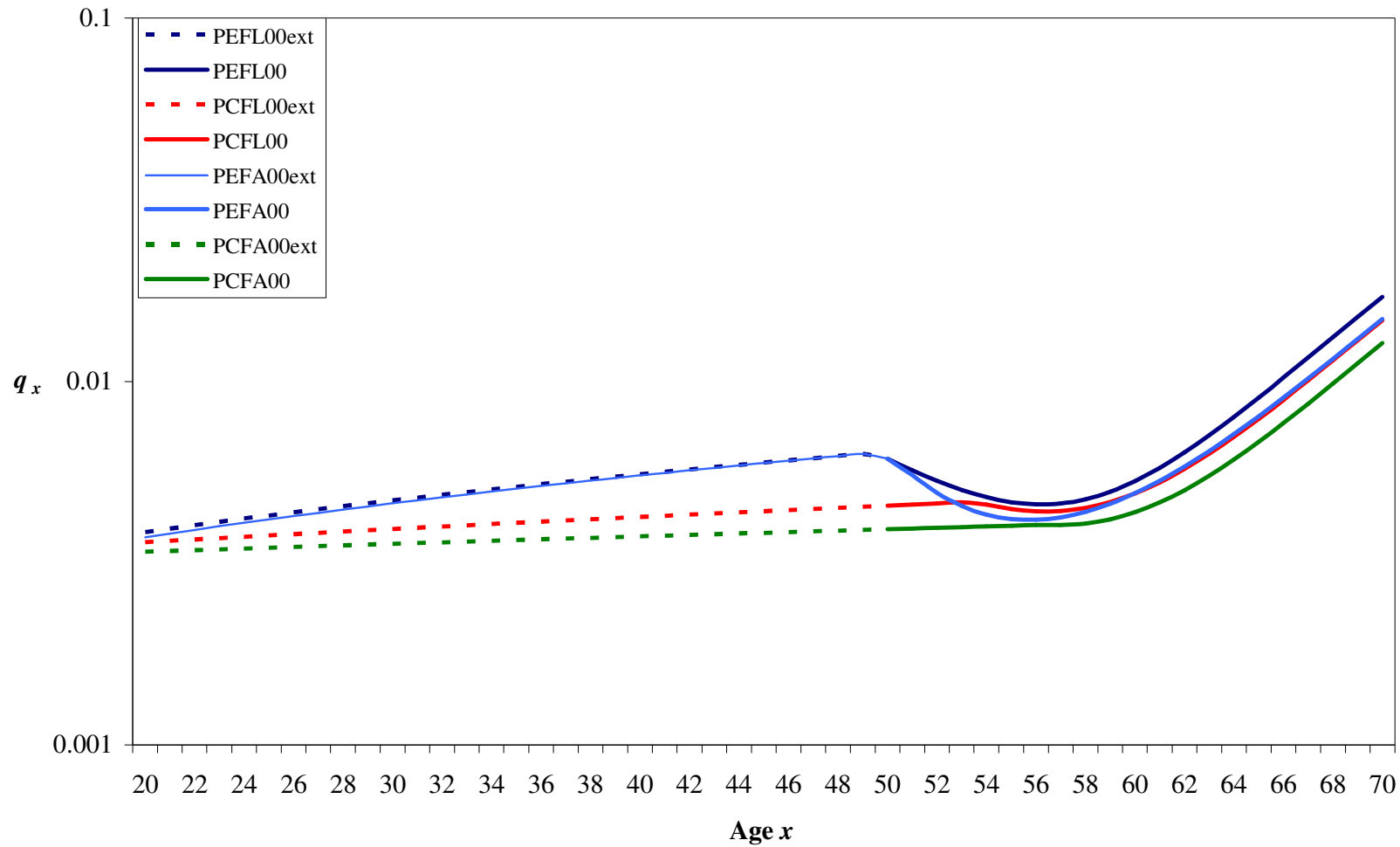
Figure 3. Males, Lives - "00" Series tables and proposed extensions to younger ages
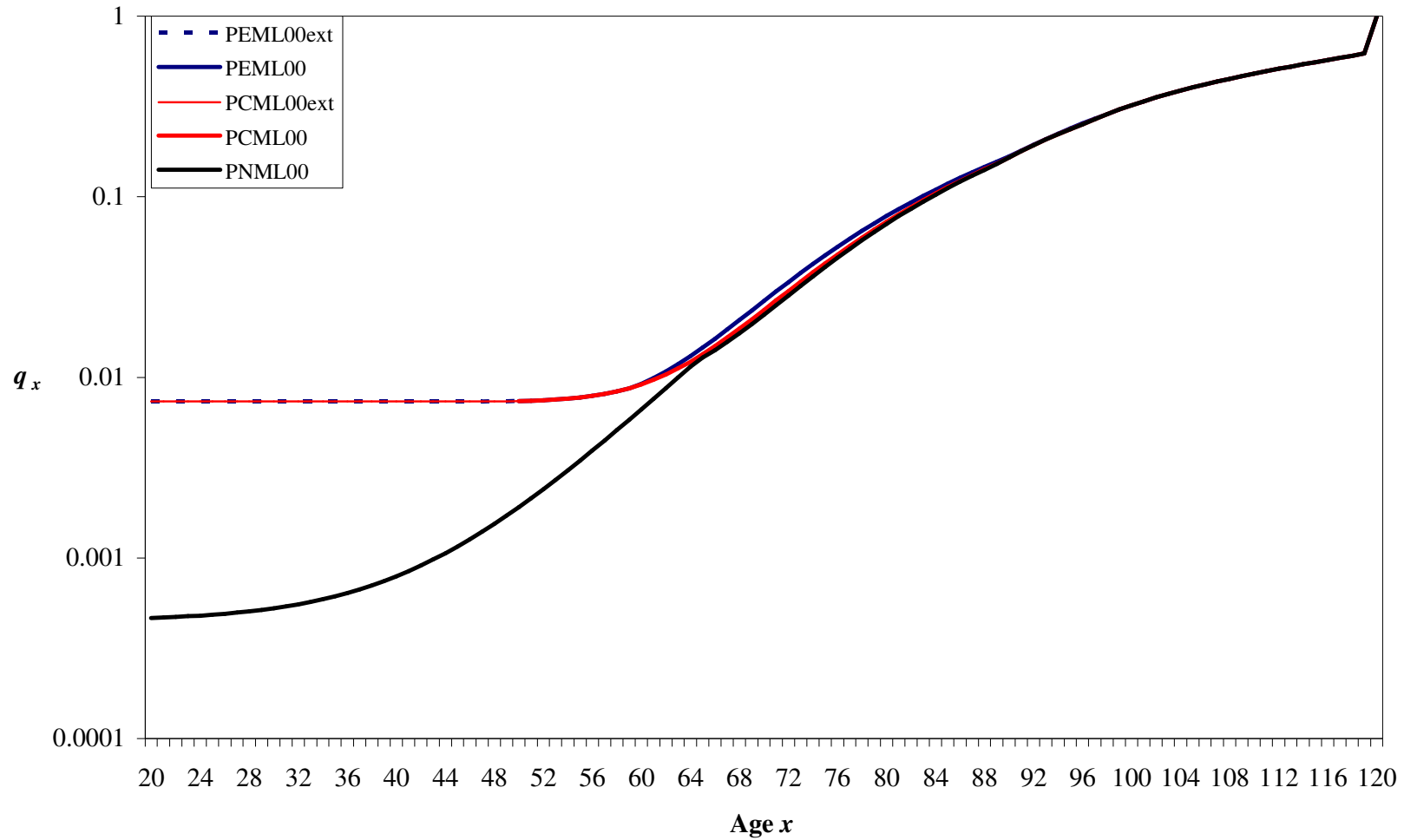
Figure 4. Females, Lives - "00" Series tables and proposed extensions to younger ages
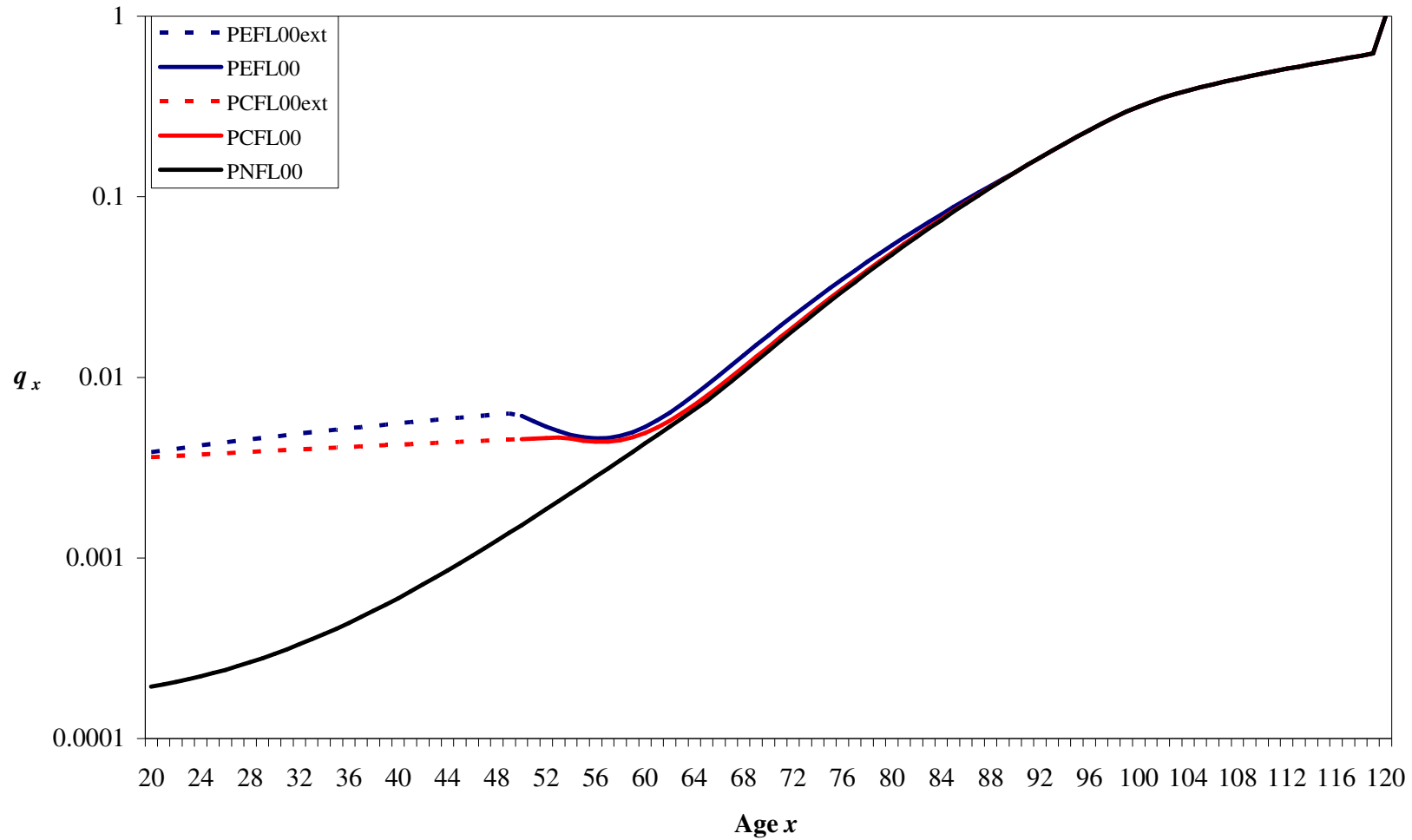
Figure 5. Males, Amounts - "00" Series tables and proposed extensions to younger ages
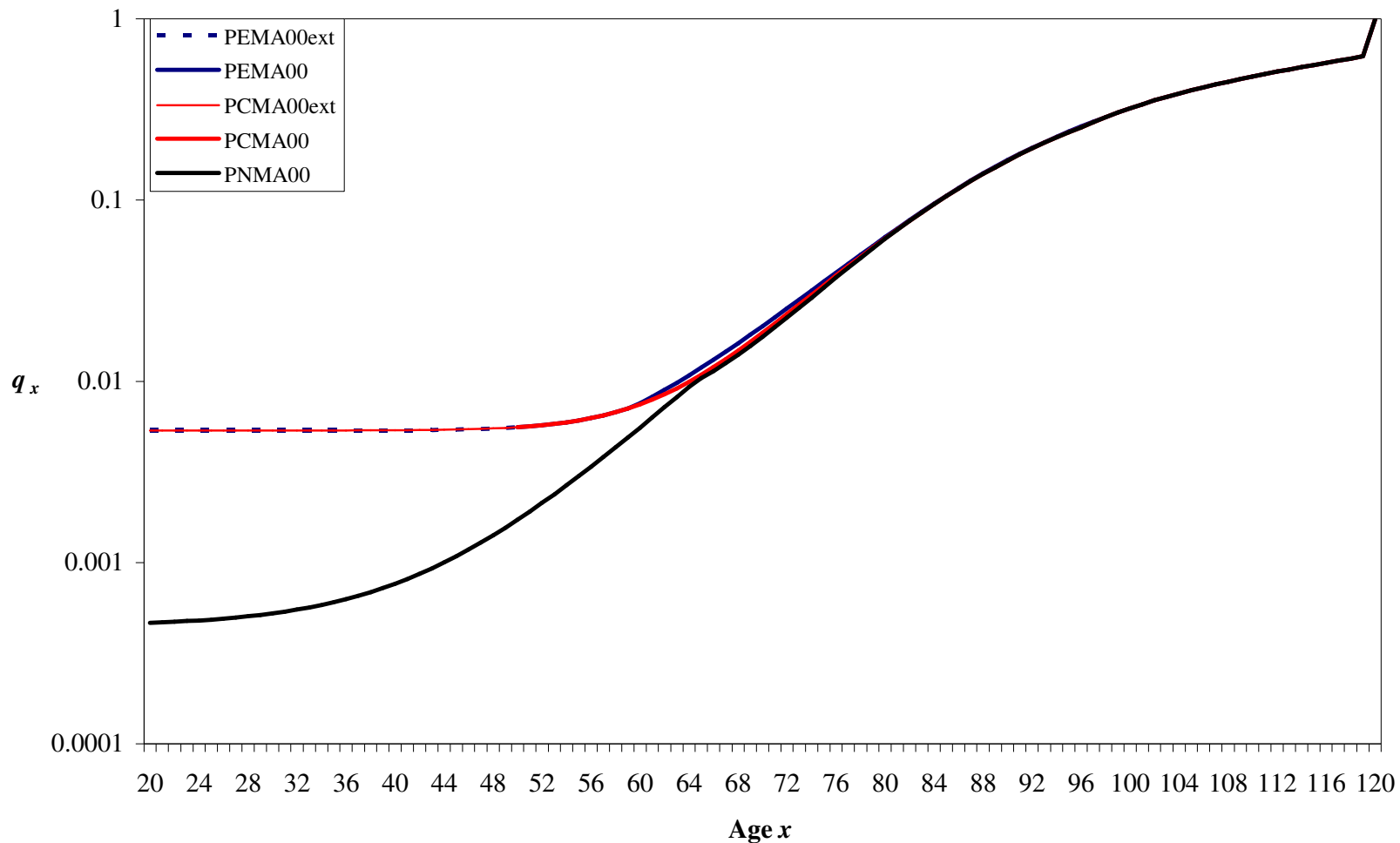
Figure 6. Females, Amounts - "00" Series tables and proposed extensions to younger ages
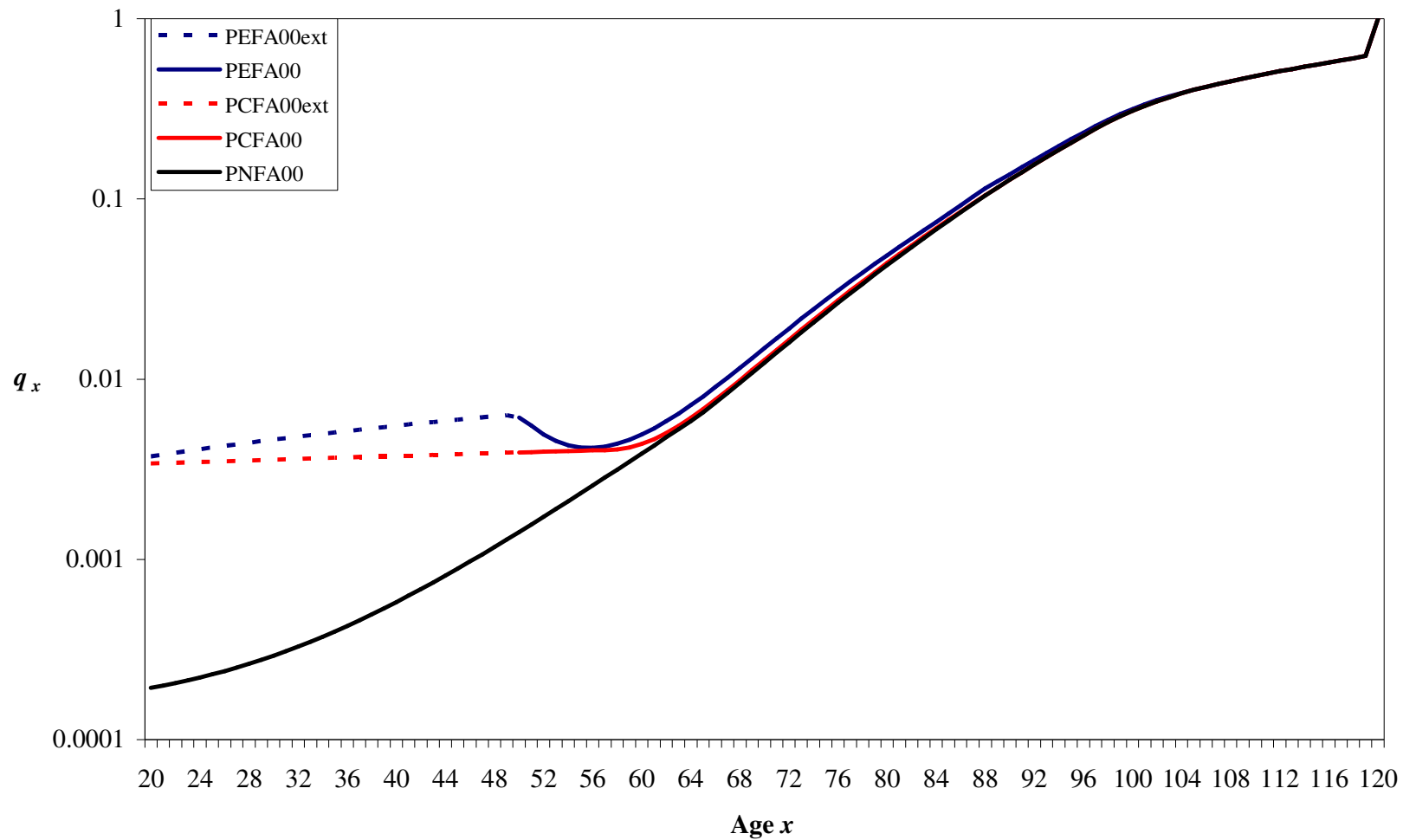
Comparison with the 1999-2002 experience

The following tables show how the actual 1999-2002 pensioner experience compares with the graduated tables – the officially adopted "00" Series tables plus the extensions to younger ages for the Early and Combined tables set out in this Working Paper.

These tables show how little data there is at the younger ages compared with what might be considered more traditional pensioner ages. They also show that, whilst not perfect, the proposed tables in this Working Paper do reflect the underlying data more closely than the Normal tables – reinforcing the MGWP's view that care should always be taken in choosing the most suitable mortality table (adjusted as necessary) for the particular purpose to which it is put.

Table 1. Pensioners, Males, Lives: comparison of 1999-2002 experience with relevant "00" Series tables and WP26 extensions.

Age Group	Normals – Comparison PNML00			Earlies – Comparison PEML00			Combined – Comparison PCML00		
	Actual Deaths	Expected Deaths	100 A/E	Actual Deaths	Expected Deaths	100 A/E	Actual Deaths	Expected Deaths	100 A/E
21-25	-	-	-	3	0	3,031	3	0	3,031
26-30	-	0	-	1	0	593	1	0	329
31-35	1	0	1,569	2	2	98	3	3	105
36-40	2	1	338	3	6	47	5	12	40
41-45	12	1	1,009	16	11	146	28	20	139
46-50	21	4	599	30	24	125	51	40	126
51-55	115	42	272	195	230	85	310	349	89
56-60	256	136	188	507	511	99	763	737	104
61-65	1,110	965	115	1,234	1,247	99	2,344	2,260	104
66-70	4,124	4,253	97	2,069	2,073	100	6,193	6,367	97
71-75	6,590	6,489	102	3,341	3,375	99	9,931	9,870	101
76-80	10,921	10,982	99	5,056	4,975	102	15,977	15,931	100
81-85	12,351	12,295	100	4,217	4,243	99	16,568	16,528	100
86-90	11,823	11,870	100	2,580	2,581	100	14,403	14,465	100
91-95	5,088	5,211	98	861	880	98	5,949	6,084	98
96-100	1,072	1,274	84	121	128	94	1,193	1,401	85
21-50	36	5	672	55	44	126	91	76	119
51-100	53,450	53,517	100	20,181	20,243	100	73,631	73,992	100
21-100	53,486	53,523	100	20,236	20,287	100	73,722	74,069	100

Table 2. Pensioners, Males, Amounts: comparison of 1999-2002 experience with relevant "00" Series tables and WP26 extensions.

Age Group	Normals – Comparison PNMA00			Earlies – Comparison PEMA00			Combined – Comparison PCMA00		
	Actual Deaths	Expected Deaths	100 A/E	Actual Deaths	Expected Deaths	100 A/E	Actual Deaths	Expected Deaths	100 A/E
21-25	-	-	-	1,808	59	3,047	1,808	59	3,047
26-30	1,624	8	20,469	4	99	4	1,628	182	896
31-35	1,544	78	1,978	297	1,999	15	1,841	2,729	67
36-40	285	1,163	25	694	5,914	12	979	14,942	7
41-45	14,276	2,009	711	8,993	8,194	110	23,269	20,376	114
46-50	22,994	4,175	551	22,968	21,813	105	45,962	37,708	122
51-55	155,175	68,991	225	238,185	264,328	90	393,360	431,006	91
56-60	701,882	301,975	232	921,321	869,556	106	1,623,203	1,341,890	121
61-65	2,541,136	2,494,177	102	2,462,718	2,805,578	88	5,003,854	5,418,685	92
66-70	8,800,258	8,955,665	98	5,515,119	5,414,272	102	14,315,377	14,361,902	100
71-75	14,184,787	14,058,491	101	8,785,840	8,560,777	103	22,970,627	22,659,853	101
76-80	23,389,320	23,355,966	100	8,733,054	8,732,201	100	32,122,374	32,215,124	100
81-85	19,067,230	19,286,012	99	5,126,229	5,323,427	96	24,193,459	24,569,365	98
86-90	12,687,426	12,385,284	102	2,440,653	2,284,344	107	15,128,079	14,650,850	103
91-95	3,584,702	3,651,509	98	434,167	478,236	91	4,018,869	4,126,115	97
96-100	568,351	593,765	96	52,339	50,384	104	620,690	643,693	96
21-50	40,723	7,433	548	34,764	38,078	91	75,487	75,996	99
51-100	85,680,267	85,151,835	101	34,709,625	34,783,104	100	120,389,892	120,418,483	100
21-100	85,720,990	85,159,268	101	34,744,389	34,821,182	100	120,465,379	120,494,479	100

Table 3. Pensioners, Females, Lives: comparison of 1999-2002 experience with relevant "00" Series tables and WP26 extensions.

Age Group	Normals – Comparison PNFL00			Earlies – Comparison PEFL00			Combined – Comparison PCFL00		
	Actual Deaths	Expected Deaths	100 A/E	Actual Deaths	Expected Deaths	100 A/E	Actual Deaths	Expected Deaths	100 A/E
21-25	-	0	-	-	0	-	-	0	-
26-30	1	0	7,023	1	0	896	2	0	1,795
31-35	-	0	-	1	1	111	1	2	118
36-40	3	0	1,061	6	4	136	9	5	234
41-45	6	1	646	10	7	110	16	10	167
46-50	11	3	323	22	16	124	33	24	140
51-55	58	27	214	89	85	105	147	137	107
56-60	152	102	149	174	188	93	326	311	105
61-65	549	589	93	346	326	106	895	927	97
66-70	837	843	99	378	411	92	1,215	1,248	97
71-75	1,470	1,423	103	610	588	104	2,080	1,999	104
76-80	2,678	2,651	101	801	810	99	3,479	3,460	101
81-85	2,873	2,974	97	583	572	102	3,456	3,564	97
86-90	2,912	2,900	100	377	389	97	3,289	3,297	100
91-95	2,038	1,954	104	183	176	104	2,221	2,130	104
96-100	657	756	87	37	50	74	694	806	86
21-50	21	5	446	40	28	144	61	41	147
51-100	14,224	14,219	100	3,578	3,594	100	17,802	17,879	100
21-100	14,245	14,224	100	3,618	3,622	100	17,863	17,921	100

Table 4. Pensioners, Females, Amounts: comparison of 1999-2002 experience with relevant "00" Series tables and WP26 extensions.

Age Group	Normals – Comparison PNFA00			Earlies – Comparison PEFA00			Combined – Comparison PCFA00		
	Actual Deaths	Expected Deaths	100 A/E	Actual Deaths	Expected Deaths	100 A/E	Actual Deaths	Expected Deaths	100 A/E
21-25	-	1	-	-	211	-	-	197	-
26-30	50	24	208	11	131	8	61	417	15
31-35	-	98	-	3,022	1,062	284	3,022	1,801	168
36-40	2,534	373	679	1,824	2,431	75	4,358	4,503	97
41-45	3,203	1,288	249	10,540	6,046	174	13,743	10,599	130
46-50	3,723	4,293	87	21,323	13,892	153	25,046	22,907	109
51-55	51,176	27,315	187	92,446	71,643	129	143,622	118,111	122
56-60	167,781	106,710	157	174,457	182,956	95	342,238	309,106	111
61-65	615,343	677,191	91	346,588	370,792	93	961,931	1,035,549	93
66-70	1,075,761	1,153,656	93	485,831	482,182	101	1,561,592	1,608,440	97
71-75	2,078,528	2,040,153	102	638,984	595,756	107	2,717,512	2,628,495	103
76-80	3,277,955	3,083,824	106	518,140	546,514	95	3,796,095	3,665,874	104
81-85	2,344,710	2,368,641	99	260,333	251,657	103	2,605,043	2,650,034	98
86-90	1,314,292	1,512,324	87	101,361	107,768	94	1,415,653	1,620,756	87
91-95	843,201	745,124	113	49,468	39,419	125	892,669	782,303	114
96-100	212,388	220,100	96	2,593	4,408	59	214,981	224,346	96
21-50	9,510	6,077	156	36,720	23,774	154	46,230	40,423	114
51-100	11,981,135	11,935,039	100	2,670,201	2,653,094	101	14,651,336	14,643,015	100
21-100	11,990,645	11,941,116	100	2,706,921	2,676,868	101	14,697,566	14,683,438	100

Use of the tables

As stated earlier, the CMI is not seeking formal approval from the Actuarial Profession of the rates contained in this Working Paper. They are not part of the "00" Series suite of mortality tables, but have been produced in the light of an apparent demand for rates at younger ages for these tables.

However, the MGWP does believe that the rates contained in these tables may have a role to play. The younger age Normal rates previously published do assume a healthy population, which may not always be appropriate. In particular, the MGWP feels that the extended Combined tables may be more suited than the Normal tables for valuing pensioners where the assumption of healthy lives at young ages is not appropriate.

Illustrative annuity values

The tables below set out illustrative expectations of life (e^{o}_{x}) and annuity (a_x) values at 5% over a range of ages for the "00" Series pensioner tables extended, where relevant, below age 50 with the rates proposed in this Working Paper.

Table 5. Pensioners, Males, Lives: sample expectations of life and annuity values.

Age	Normals PNML00 e^{o}_{x}	a_x 5%	Earlies PEML00 e^{o}_{x}	a_x 5%	Combined PCML00 e^{o}_{x}	a_x 5%
20	59.75	18.62	49.88	16.71	50.33	16.74
30	50.02	17.86	43.31	16.26	43.80	16.30
40	40.29	16.66	36.24	15.46	36.77	15.54
50	30.70	14.79	28.63	14.07	29.20	14.20
60	21.58	12.11	20.56	11.70	21.17	11.93
70	13.68	8.81	12.94	8.41	13.47	8.69

Table 6. Pensioners, Males, Amounts: sample expectations of life and annuity values.

Age	Normals PNMA00 e^{o}_{x}	a_x 5%	Earlies PEMA00 e^{o}_{x}	a_x 5%	Combined PCMA00 e^{o}_{x}	a_x 5%
20	61.05	18.69	53.73	17.30	53.99	17.32
30	51.32	17.99	46.42	16.82	46.69	16.85
40	41.60	16.86	38.71	16.00	38.99	16.05
50	31.99	15.11	30.59	14.60	30.89	14.68
60	22.79	12.57	22.21	12.31	22.52	12.44
70	14.60	9.30	14.31	9.14	14.50	9.25

Table 7. Pensioners, Females, Lives: sample expectations of life and annuity values.

Age	Normals PNFL00		Earlies PEFL00		Combined PCFL00	
	e^{o}_{x}	a_x 5%	e^{o}_{x}	a_x 5%	e^{o}_{x}	a_x 5%
20	63.26	18.85	55.69	17.55	57.60	17.80
30	53.39	18.18	47.88	16.97	49.61	17.29
40	43.58	17.13	40.12	16.18	41.47	16.50
50	33.94	15.53	32.27	15.00	33.10	15.22
60	24.66	13.18	23.70	12.83	24.41	13.08
70	16.13	10.00	15.42	9.63	15.98	9.92

Table 8. Pensioners, Females, Amounts: sample expectations of life and annuity values.

Age	Normals PNFA00		Earlies PEFA00		Combined PCFA00	
	e^{o}_{x}	a_x 5%	e^{o}_{x}	a_x 5%	e^{o}_{x}	a_x 5%
20	64.11	18.89	56.43	17.60	58.98	17.94
30	54.24	18.25	48.59	17.04	50.90	17.46
40	44.44	17.25	40.84	16.28	42.61	16.70
50	34.78	15.70	33.03	15.18	34.07	15.45
60	25.46	13.43	24.39	13.07	25.26	13.36
70	16.81	10.31	15.98	9.92	16.68	10.24

References

C.M.I. (2004) Working Paper 8: Considerations for the Graduation of the CMI 1999-2002 Mortality Experience.

C.M.I. (2005) Working Paper 12: The Graduation of the CMI 1999-2002 Mortality Experience: Feedback on Working Paper 8 and Proposed Assured Lives Graduations.

C.M.I. (2005) Working Paper 16: The Graduation of the CMI 1999-2002 Mortality Experience: Proposed Annuitant and Pensioner Graduations.

C.M.I. (2006) Working Paper 21: The Graduation of the CMI 1999-2002 Mortality Experience: Final "00" Series Mortality Tables – Assured Lives

C.M.I. (2006) Working Paper 22: The Graduation of the CMI 1999-2002 Mortality Experience: Final "00" Series Mortality Tables – Annuitants and Pensioners

The MGWP's proposed extensions to younger ages of the pensioner Early and Combined tables are shown on the following pages. The original Working Paper 22 table names are shown as an aid to readers, but the rates presented here below age 50 are not officially adopted extensions to those tables.

Table A1. Pensioners, Males, Lives and Amounts: values of q_x at ages 20 to 50

| | Proposed q_x – Males, Amounts | | | Proposed q_x – Males, Lives | |
| | Combined PCMA00 | Early PEMA00 | | Combined PCML00 | Early PEML00 |
Age			Age		
20	0.005350	0.005350	20	0.007332	0.007332
21	0.005350	0.005350	21	0.007332	0.007332
22	0.005350	0.005350	22	0.007332	0.007332
23	0.005350	0.005350	23	0.007332	0.007332
24	0.005350	0.005350	24	0.007332	0.007332
25	0.005350	0.005350	25	0.007332	0.007332
26	0.005350	0.005350	26	0.007332	0.007332
27	0.005350	0.005350	27	0.007332	0.007332
28	0.005350	0.005350	28	0.007332	0.007332
29	0.005350	0.005350	29	0.007332	0.007332
30	0.005351	0.005351	30	0.007332	0.007332
31	0.005351	0.005351	31	0.007332	0.007332
32	0.005351	0.005351	32	0.007332	0.007332
33	0.005352	0.005352	33	0.007332	0.007332
34	0.005353	0.005353	34	0.007332	0.007332
35	0.005354	0.005354	35	0.007332	0.007332
36	0.005355	0.005355	36	0.007332	0.007332
37	0.005357	0.005357	37	0.007332	0.007332
38	0.005360	0.005360	38	0.007332	0.007332
39	0.005363	0.005363	39	0.007332	0.007332
40	0.005368	0.005368	40	0.007332	0.007332
41	0.005373	0.005373	41	0.007333	0.007333
42	0.005381	0.005381	42	0.007333	0.007333
43	0.005390	0.005390	43	0.007335	0.007335
44	0.005402	0.005402	44	0.007336	0.007336
45	0.005417	0.005417	45	0.007339	0.007339
46	0.005437	0.005437	46	0.007344	0.007344
47	0.005462	0.005462	47	0.007351	0.007351
48	0.005494	0.005494	48	0.007361	0.007361
49	0.005534	0.005534	49	0.007376	0.007376
50	0.005583	0.005583	50	0.007398	0.007398

Table A2. Pensioners, Males, Lives and Amounts: values of μ_x at ages 20 to 50

| Age | Proposed μ_x – Males, Amounts | | Age | Proposed μ_x – Males, Lives | |
	Combined PCMA00	Early PEMA00		Combined PCML00	Early PEML00
20	0.005364	0.005364	20	0.007359	0.007359
21	0.005364	0.005364	21	0.007359	0.007359
22	0.005364	0.005364	22	0.007359	0.007359
23	0.005364	0.005364	23	0.007359	0.007359
24	0.005364	0.005364	24	0.007359	0.007359
25	0.005364	0.005364	25	0.007359	0.007359
26	0.005364	0.005364	26	0.007359	0.007359
27	0.005364	0.005364	27	0.007359	0.007359
28	0.005364	0.005364	28	0.007359	0.007359
29	0.005365	0.005365	29	0.007359	0.007359
30	0.005365	0.005365	30	0.007359	0.007359
31	0.005365	0.005365	31	0.007359	0.007359
32	0.005366	0.005366	32	0.007359	0.007359
33	0.005366	0.005366	33	0.007359	0.007359
34	0.005367	0.005367	34	0.007359	0.007359
35	0.005368	0.005368	35	0.007359	0.007359
36	0.005369	0.005369	36	0.007359	0.007359
37	0.005371	0.005371	37	0.007359	0.007359
38	0.005373	0.005373	38	0.007359	0.007359
39	0.005376	0.005376	39	0.007359	0.007359
40	0.005380	0.005380	40	0.007359	0.007359
41	0.005385	0.005385	41	0.007359	0.007359
42	0.005391	0.005391	42	0.007360	0.007360
43	0.005399	0.005399	43	0.007361	0.007361
44	0.005410	0.005410	44	0.007362	0.007362
45	0.005424	0.005424	45	0.007365	0.007365
46	0.005441	0.005441	46	0.007368	0.007368
47	0.005464	0.005464	47	0.007374	0.007374
48	0.005492	0.005492	48	0.007382	0.007382
49	0.005527	0.005527	49	0.007395	0.007395
50	0.005572	0.005572	50	0.007413	0.007413

Table A3. Pensioners, Females, Lives and Amounts: values of q_x at ages 20 to 50

| | Proposed q_x – Females, Amounts | | | Proposed q_x – Females, Lives | |
| | Combined | Early | | Combined | Early |
Age	PCFA00	PEFA00	Age	PCFL00	PEFL00
20	0.003401	0.003726	20	0.003612	0.003854
21	0.003418	0.003815	21	0.003643	0.003939
22	0.003435	0.003905	22	0.003674	0.004024
23	0.003453	0.003994	23	0.003706	0.004109
24	0.003470	0.004083	24	0.003737	0.004194
25	0.003487	0.004173	25	0.003768	0.004279
26	0.003505	0.004262	26	0.003800	0.004364
27	0.003522	0.004352	27	0.003831	0.004449
28	0.003539	0.004441	28	0.003862	0.004534
29	0.003556	0.004531	29	0.003894	0.004620
30	0.003574	0.004620	30	0.003925	0.004705
31	0.003591	0.004709	31	0.003956	0.004790
32	0.003608	0.004799	32	0.003988	0.004875
33	0.003626	0.004888	33	0.004019	0.004960
34	0.003643	0.004978	34	0.004051	0.005045
35	0.003660	0.005067	35	0.004082	0.005130
36	0.003678	0.005156	36	0.004113	0.005215
37	0.003695	0.005246	37	0.004145	0.005300
38	0.003712	0.005335	38	0.004176	0.005385
39	0.003729	0.005424	39	0.004207	0.005470
40	0.003747	0.005514	40	0.004239	0.005555
41	0.003764	0.005603	41	0.004270	0.005640
42	0.003781	0.005692	42	0.004301	0.005725
43	0.003799	0.005782	43	0.004333	0.005810
44	0.003816	0.005871	44	0.004364	0.005895
45	0.003833	0.005960	45	0.004395	0.005980
46	0.003851	0.006049	46	0.004427	0.006065
47	0.003868	0.006139	47	0.004458	0.006150
48	0.003885	0.006228	48	0.004489	0.006235
49	0.003902	0.006317	49	0.004521	0.006319
50	0.003920	0.006126	50	0.004552	0.006126

Table A4. Pensioners, Females, Lives and Amounts: values of μ_x at ages 20 to 50

| | Proposed μ_x – Females, Amounts | | | Proposed μ_x – Females, Lives | |
| | Combined | Early | | Combined | Early |
Age	PCFA00	PEFA00	Age	PCFL00	PEFL00
20	0.003398	0.003688	20	0.003602	0.003818
21	0.003415	0.003777	21	0.003634	0.003904
22	0.003433	0.003867	22	0.003665	0.003989
23	0.003450	0.003957	23	0.003697	0.004075
24	0.003467	0.004047	24	0.003728	0.004160
25	0.003485	0.004137	25	0.003760	0.004246
26	0.003502	0.004227	26	0.003791	0.004331
27	0.003519	0.004316	27	0.003823	0.004417
28	0.003537	0.004406	28	0.003854	0.004502
29	0.003554	0.004496	29	0.003886	0.004587
30	0.003571	0.004586	30	0.003917	0.004673
31	0.003589	0.004676	31	0.003949	0.004758
32	0.003606	0.004765	32	0.003980	0.004844
33	0.003624	0.004855	33	0.004012	0.004929
34	0.003641	0.004945	34	0.004043	0.005015
35	0.003658	0.005035	35	0.004075	0.005100
36	0.003676	0.005125	36	0.004106	0.005186
37	0.003693	0.005215	37	0.004137	0.005271
38	0.003710	0.005304	38	0.004169	0.005357
39	0.003728	0.005394	39	0.004200	0.005442
40	0.003745	0.005484	40	0.004232	0.005528
41	0.003762	0.005574	41	0.004263	0.005613
42	0.003780	0.005664	42	0.004295	0.005699
43	0.003797	0.005753	43	0.004326	0.005784
44	0.003815	0.005843	44	0.004358	0.005869
45	0.003832	0.005933	45	0.004389	0.005955
46	0.003849	0.006023	46	0.004421	0.006040
47	0.003867	0.006113	47	0.004452	0.006126
48	0.003884	0.006203	48	0.004484	0.006211
49	0.003901	0.006292	49	0.004515	0.006297
50	0.003919	0.006382	50	0.004547	0.006382