

CORRESPONDENCE.

To the Editors of the Journal of the Institute of Actuaries.

Whole Life Non-Profit Assurances.

DEAR SIRS,—In the discussion that followed the reading of Mr. Cameron's paper on 22 December, I gave short particulars of the mortality experienced in this class for the past eight years by an office transacting a considerable non-profit business, and it has been suggested that I should give the Institute a somewhat fuller account of the experience.

I was led to make the investigation by the fact that in the Office in question this class, in which there is a high average sum assured, generally shows a profit from mortality, and I expected to find some indication of a positive correlation between sum assured and longevity. Accordingly, the mortality was investigated on the basis of sums assured as well as policies. Nearest entry ages and nearest durations were employed, each policy in force in 1905 being followed from its renewal date in that year to its renewal date in 1913 or earlier withdrawal, the new business being treated similarly. Sums re-assured were deducted, so that in no case was there a larger net sum assured than £15,000 on any life. Policies on invalid lives (which constitute about 16 per-cent of the experience) were taken at their rated-up ages, but on the other hand policies at climatic or occupation extras were included at their true ages. The combined errors from these two sources, acting as they probably do in opposite directions, cannot, I think, vitiate the results as a whole to any serious extent.

The grand total of the Exposed to Risk gave 4,845 years of life for sums assured of £7,483,015, showing an average policy of £1,544 net.

Tables A, B, C, and D give the results of the investigation. They were worked out for each individual age and duration up to 10 years in force and thereafter for each attained age, but I have grouped them for conciseness.

The figures in heavy type refer to policies, those in ordinary type to sums assured.

TABLE A.
Exposed to Risk.

Years elapsed since date of Assurance	AGES AT ENTRY					
	Under 30	30 to 39	40 to 49	50 to 59	60 and over	All ages combined
0	78 154,680	121 217,192	107 201,292	86 171,245	28 39,833	420 784,242
1	61 96,380	115 176,592	99 196,717	78 137,385	27 35,233	380 642,307
2	58 77,430	104 139,992	96 183,273	76 116,210	24 32,633	358 549,538
3	56 73,330	101 131,181	97 188,223	63 77,125	17 16,175	334 486,034
4	42 49,000	91 110,441	88 151,911	44 51,225	8 8,905	278 371,482
5	38 45,500	80 91,842	77 128,811	43 45,945	7 16,250	245 328,348
6	33 38,300	72 87,892	71 111,100	38 32,015	6 12,750	220 282,057
7	36 38,434	69 89,480	68 116,300	37 23,915	6 12,750	216 280,879
8	27 24,334	56 71,105	60 101,930	33 26,365	5 12,250	181 235,984
9	24 21,450	49 58,405	54 90,003	28 21,365	5 9,750	160 200,973
Totals	453 618,838	858 1,174,122	817 1,469,560	526 702,795	133 196,529	2,787 4,161,844

TABLE B
Expected Deaths and Claims under the O^(M) Table.

Years elapsed since date of Assurance	AGES AT ENTRY					
	Under 30	30 to 39	40 to 49	50 to 59	60 and over	All ages combined
0	·21 447	·44 809	·59 1,057	·87 1,715	·56 810	2·67 4,838
1	·27 454	·66 1,041	·79 1,508	1·07 1,837	·75 936	3·54 5,776
2	·31 420	·69 943	·92 1,687	1·22 1,877	·76 1,048	3·90 5,975
3	·34 430	·74 970	1·03 1,962	1·16 1,408	·60 544	3·87 5,314
4	·28 309	·70 894	1·03 1,736	·92 1,118	·29 311	3·22 4,368
5	·27 305	·67 796	1·01 1,609	1·01 1,137	·29 645	3·25 4,492
6	·24 275	·66 826	1·00 1,583	·97 882	·40 622	3·27 4,188
7	·27 293	·68 896	1·07 1,800	1·02 677	·43 688	3·47 4,354
8	·24 193	·59 769	1·04 1,735	1·01 805	·28 667	3·16 4,169
9	·21 182	·54 640	1·02 1,718	·93 720	·47 734	3·17 3,994
Totals	2·64 3,308	6·37 8,584	9·50 16,395	10·18 12,176	4·83 7,005	33·52 47,468

TABLE C.

Actual Deaths and Claims.

Years elapsed since date of Assurance	AGES AT ENTRY						All ages combined
	Under 30	30 to 39	40 to 49	50 to 59	60 and over		
0	...	...	1 2,500	...	..	1 2,500
1	...	2 8,500	...	1 1,000	...	3 9,500	
2	...	...	...	1 15,000	2 2,408	3 17,408
3	...	...	...	...	...	...
4	...	...	2 3,500	...	..	2 3,500
5	1 200	...	...	1 100	1 3,000	3 3,300
6	...	...	...	1 5,000	...	1 5,000
7	...	...	...	...	1 500	1 500
8	...	...	...	1 1,500	...	1 1,500
9	1 3,534	...	...	...	...	1 3,534
Totals	2 3,734	2 8,500	3 6,000	5 22,600	4 5,908	16 46,742	

TABLE D.

Experience after the first 10 years' duration.

	AGES ATTAINED							
	Under 40	40 to 49	50 to 59	60 to 69	70 to 79	80 to 89	90 & over	All ages combined
Exposed to Risk . . .	78 68,819	311 500,408	630 1,196,549	557 805,403	380 540,892	90 199,400	12 10,200	2,058 3,321,171
Expected Deaths & Claims	6 610	3.8 6,191	13.2 24,448	22.1 32,558	32.3 45,219	17.1 37,089	4.0 3,464	93.1 149,579
Actual Deaths & Claims	...	4 6,400	6 11,830	16 20,700	28 29,483	10 16,300	...	64 84,713

The results are summarised in the following Table :

—	DURATION					
	Less than 10 years		10 years & upwards		All Durations combined	
	Policies	Sums Assured	Policies	Sums Assured	Policies	Sums Assured
Exposed to Risk ...	2,787	4,161,844	2,058	3,321,171	4,845	7,483,015
Expected Deaths ...	33·5	47,468	93·1	149,579	126·6	197,047
Actual Deaths	16	46,742	64	84,713	80	131,455
Ratio of Actual to Expected	·477	·985	·687	·566	·632	·667

Perhaps the most interesting feature is the lightness of the mortality experienced after the selection has worn off. This is specially noticeable among the largest assurances, for the deaths after 10 years amount to 68·7 per-cent of the expected and the claims to only 56·6 per-cent. For the first 10 years' duration the mortality among the larger policies appears to have been above that of the smaller ones, but I might add that here the figures were seriously affected by one claim for £15,000 (under an Estate Duty policy) which only escaped exclusion from the experience by a margin of three days.

It might be contended that the experience is rendered valueless by the inclusion of invalid lives at their rated-up ages. These lives might all have been included at their true ages, and the expected claims would have been about $7\frac{1}{2}$ per-cent less than those shown above. It would have been unsatisfactory to reduce the dimensions of the experience still further by excluding invalid lives altogether, and, allowing that $7\frac{1}{2}$ per-cent is perhaps rather too much to add for what is left of the initial invalidity, I think there is sufficient margin left over to establish a *prima facie* case that "financial lives" are not necessarily bad lives, and that an office basing its non-profit rates on the $O^{(M)}$ Table may still expect a substantial profit from mortality.

Yours faithfully,

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