CORRESPONDENCE.

HOW FAR CAN WE RELY ON THE ESTIMATED LIABILITY OF A LIFE OFFICE, CALCULATED BY MEANS OF A MODEL OFFICE?

To the Editor of the Journal of the Institute of Actuaries.

SIR,—On reading Mr. King's paper in the July number of the *Journal*, it struck me that it would be interesting to try the effect of applying the results given in his Table V, to the case of an actual office. Fortunately, through the kindness of Mr. M. A. Black, Actuary of the Australian Mutual Provident Society, who has placed at my disposal for this purpose the figures quoted in the first column of the subjoined table, I am enabled to give a comparison of the reserves by various tables of mortality and rates of interest, as resulting from an actual valuation according to the formula $A_{x+n} - P_x(1 + a_{x+n})$, of the whole-life policies existing in that office at 31st December 1873. Alongside of the actual reserves, I have placed those which result from the application of Mr. King's figures relating to an office of 25 years' standing, that being the age of the Mutual Provident Society at 31st December 1873. In the third column I have shown the relative reserves resulting from the application of the method which Mr. King recommends when greater exactness is desired, as detailed by him on p. 254. In order to apply this method, it is

necessary to know the average annual amounts of new business tran-
sacted by the company in each quinquennium of its existence, and
these are given below for the *whole-life* policies of the Mutual Provident
Society.

1st	Quinquennium	.	£20,990
2nd	,,	.	93,490
3rd	,,	.	231,482
4th	,,	.	349,599
5th	,,	.	505,400

It will be seen that, for policies of over five years' duration, I have
taken the 4 per-cent reserve by the H^M and $H^{M(5)}$ tables combined as
the standard of comparison.

Prior to the appearance of Mr. King's paper, I had tried the effect
of a comparison of the reserves of the actual office, with those brought
out by Mr. Valentine (see vol. xviii, p. 233) for Mr. Manly's hypo-
thetical office of *five* years' duration (in which it will be recollected
all the policies have endured for exactly five years), and found the
results by most of the tables to run very close indeed to his figures,
as will be seen by the 4th column of the table given below. In this
case the 4 per-cent reserve by the H^M and $H^{M(5)}$ tables combined, for
policies of *all* durations, has been taken as the standard of comparison,
that being the course which has been followed by Mr. Valentine in
his table above referred to.

			Actual Reserve.	Reserves according to Mr. King's two methods.		Reserve according to Mr. Valentine's table.
			£	£	£	£
H^M and $H^{M(5)}$ combined	3 p. c.		486,063	. .		487,897
for policies of all	$3\frac{1}{2}$,,		460,069		. .	460,989
durations	4 ,,		435,883*			435,883
H^M and $H^{M(5)}$ combined	3 ,,		455,608	454,082	459,437	. .
for policies of over	$3\frac{1}{2}$,,		430,725	429,625	432,599	.
5 years' duration .	4 ,,		407,614	407,614	407,614	.
H^M	.	3 ,,	435,172	438,593	439,773	437,548
,,	.	$3\frac{1}{2}$,,	410,794	415,359	413,420	412,175
,,	.	4 ,,	388,185	392,940	388,934	388,551
Seventeen Offices		3 ,,	434,432	435,739	435,801	438,284
,,	.	$3\frac{1}{2}$,,	409,871	412,515	409,541	411,897
,,	.	4 ,,	387,231	390,902	385,377	388,367
Davies's Equitable		3 ,,	388,021	395,793	396,865	386,933
,,	.	$3\frac{1}{2}$,,	365,219	373,374	372,269	363,587
,,	.	4 ,,	344,078	352,586	349,368	341,680
Carlisle	. .	3 ,,	400,017	406,391	404,980	401,775
,,	. .	$3\frac{1}{2}$,,	376,004	383,565	379,514	377,165
,,	. .	4 ,,	354,009	361,961	355,831	354,320
English No. 2	.	4 ,,	375,607	381,119	376,421	375,744
Northampton	.	3 ,,	370,222	379,489	379,278	367,336

* The reserve actually made for the liabilities under the whole-life policies,
exclusive of the bonuses thereon, according to the last quinquennial report of the
Society, was £489,424; the difference between the two amounts being due to the
" Proportion of Premium" in hand at the date of valuation.

On examining the above figures, it will be observed that, while the results given by the model office run tolerably close to the real reserves by the Institute Experience and by the 17 Offices' Experience, yet when we come to the remaining tables, particularly Davies's Equitable and the Northampton, there is a considerable divergence. It will be noticed that the method described by Mr. King as the more exact, does not in all cases give the most accurate results, and also that it makes too great a difference between the reserves required at different rates of interest. This is evidently due to the fact that much the largest proportion of the policies were in their first quinquennium of insurance, this being the point at which the difference is greatest between the reserves at different rates of interest. In the case of an office whose new business was small in proportion to the old, a contrary effect would be produced. The following facts in connection with the subject are also worth noting:—in Mr. King's model office the average age at entry, as stated by himself, is 35·3, the average duration of the policies in force when the office is 25 years old may be found from his Table S to be about 11 years, and the proportion discontinued during that time 40 per-cent. In the Mutual Provident Society the average office age at entry of the whole-life policies was $38\frac{1}{2}$, the average duration about $5\frac{1}{2}$ years, and the proportion discontinued only 25 per-cent.

In conclusion, I would remark that it seems to me that when any great degree of accuracy is required, we can hardly trust the results brought out by means of the model office at least until some investigations have been made as to the limits of the possible error involved in such approximations. Meantime, in the hope that the figures quoted above may conduce towards the further elucidation of this interesting subject,

I remain, Sir,
Your obedient servant,
D. CARMENT.

Sydney, N.S.W.
24th November 1877.