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THE "ELAS" LIFE INCOME MORTALITY TABLE

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JOSEPH C. NOBACK:

Each one of us who has struggled with the problem of determining rates and drafting contractual provisions for guaranteed life income options is grateful to Mr. Harry Walker for having set down his solution to this problem. Mr. Walker's solution is a very good one, a very practical one, and a very competitive one.

The objective of this discussion is twofold. First, we shall discuss the spurious gains and losses revealed by Mr. Walker in his Table 3. Then, we shall try to catalogue several of the methods that are available for handling rates and contractual provisions for guaranteed life income options.

In his paper, Mr. Walker first analyzes the 1945-1950 intercompany experience to determine the current level of annuitant mortality and the class variation therein. He uses the *a*-1949 Table as a standard and demonstrates that the experience under certain *payee* elections follows that of the *a*-1949 Table. He also demonstrates that under certain *nonpayee* elections mortality tends to be heavier than that shown in the *a*-1949 Table. The class variations revealed by his Table 1 are not great. Consequently, the author leads us to the conclusion that the *a*-1949 Table with Projection B is an appropriate basis for all future life income rates. However, this is a double entry mortality system.

After a brief discussion, the author dismisses the *a*-1949 Table with Projection B because:

1. It is "a difficult tool to handle."
2. There are "elements of uncertainty in any forecasting of future mortality improvement."

In an effort to give some recognition to future mortality improvement, the ELAS Life Income Mortality Table evolves as a graduation of the 1915 Year-of-Birth tables from the *a*-1949 Table with Projection B. This is a practical solution to the variation of mortality by class and time as well as by attained age.

The author recognizes that there are gains and losses inherent in the use of the ELAS Life Income Mortality Table. He has described these gains and losses in Table 3. However, he has made no attempt to assign a

financial value to them. It seems to us that it would have been helpful if he had done so.

To satisfy our own curiosity, we have tried to make such a valuation. A number of assumptions had to be made:

1. A new series of policies is to be issued with the guaranteed settlement options computed on the basis of the ELAS Life Income Mortality Table.
2. Future annuitant mortality will follow the *a*-1949 Table with Projection B, subject to class variations as shown in Table 1 of Mr. Walker's paper.
3. The class distinction between maturity elections, payee death elections and nonpayee death elections may be expressed as five year setbacks in the year of birth.
4. All life income settlements are under the plan that provides for payment of the income for 10 years certain.
5. The life income settlements are entered upon in the age range 55 to 70.

On the basis of these assumptions the gains and losses shown in Table 1 emerge.

TABLE 1

GAIN OR LOSS IN DOLLARS PER \$1,000 SETTLED WHERE THE GUARANTEED LIFE INCOME OPTION IS ON THE ELAS LIFE INCOME MORTALITY TABLE AND THE EXPERIENCE MORTALITY IS ACCORDING TO THE *a*-1949 TABLE WITH PROJECTION B

SEX	AGE	TYPE OF SETTLEMENT	YEAR OF SETTLEMENT					
			1965	1975	1985	1995	2005	2015
Male.....	55	Maturity	+ 8	-10	-27	-43	-59	-75
Male.....	60	Maturity	+17	- 1	-19	-35	-51	-65
Male.....	65	Maturity	+22	+ 6	-10	-25	-39	-53
Male.....	70	Maturity	+24	+10	- 2	-14	-26	-38
Female....	55	Maturity	+ 9	- 3	-15	-25	-35	-45
Female....	60	Maturity	+17	+ 4	- 8	-20	-31	-41
Female....	65	Maturity	+23	+11	- 1	-13	-25	-35
Female....	70	Maturity	+29	+17	+ 7	- 3	-13	-21
Female....	55	Death—payee	+15	+ 3	- 9	-20	-30	-40
Female....	60	Death—payee	+24	+10	- 2	-14	-26	-36
Female....	65	Death—payee	+29	+17	+ 5	- 7	-19	-30
Female....	70	Death—payee	+35	+23	+12	+ 2	- 8	-17
Female....	55	Death—nonpayee	+22	+ 9	- 3	-15	-25	-35
Female....	60	Death—nonpayee	+31	+17	+ 4	- 8	-20	-31
Female....	65	Death—nonpayee	+35	+23	+11	- 1	-13	-25
Female....	70	Death—nonpayee	+41	+29	+17	+ 7	- 3	-13

In terms of the childhood fable, it would seem that the ELAS Bunny has taken one big hop and is now well ahead of the tortoise of mortality improvement. Bunny One-hop is resting in the luscious clover of mortality gains. However, the tortoise is an overpowering creature which toils laboriously and inexorably forward year by year.

Bunny One-hop may be able to rest contentedly in the clover of spurious gains for about twenty to twenty-five years but the time will come when Toilsome Tortoise will close the gap. Then dormant Bunny One-hop will suffer losses and these losses will grow larger and larger as time progresses. To meet these losses, Bunny One-hop will be able to draw upon the reserves he has accumulated.

It is difficult to forecast at this time which contestant will emerge victorious. Will it be ELAS' Bunny One-hop or Mortality's Toilsome Tortoise?

After reading Mr. Walker's paper it seems to us that someone should catalogue the various ways of handling the life income option problem. Here are some. Perhaps others may want to add to this list.

1. *The Broad Averaging Approach*

Under this approach a particular year-of-birth is adopted as the median group for future settlements. It is implied that the gains enjoyed in the early years will be held in surplus or in a special reserve liability to meet the losses in later years. This is a practical solution. It does not introduce any contractual problems. (At least three companies have already adopted this approach.)

2. *The Reader's Digest Approach*

Under this approach strict equity is the goal. The implication is that future mortality improvement can be forecast accurately. The text of the settlement option page would be unchanged. However, a separate table of values would have to be issued for each year-of-birth group. This would result in a hundred-page pamphlet which would accompany each policy. Only confusion would result.

3. *The Particular Beneficiary Approach*

To avoid issuing a separate volume, it has been suggested that the age of the beneficiary be determined at issue and that the table applicable to that particular beneficiary be incorporated in the policy. This has obvious limitations.

4. *The Grouped Year-of-Entry Approach*

Under this approach the Settlement Option Tables would be expanded. There would be one table for each decade in the future. The period adopted could be increased or decreased depending upon the degree of individual equity desired.

5. *The Grouped Year-of-Birth Approach*

Under this approach the year-of-birth groups differ by integral ages. For example, the 1925-1949 group guarantees may be found by entering the 1900-1924 Table at the attained age minus one. This method can be readily absorbed into our present contract. It is merely necessary to add a short age adjustment table and to define a "tabular" age. (This approach was first proposed in 1950. As yet no one has used it.)

Again we want to thank Mr. Harry Walker for having advanced his practical solution to this problem. Perhaps the history of the next few years will show that his solution is the only practical one and that therefore it is the best one.

JAMES E. HOSKINS:

The ELAS Table purports to give yields for life income settlements and deferred annuities which are on the average not greater than the equivalent of the policy proceeds, on the assumption of the *a*-1949 Table with Projection B. The construction of the table has the effect of assuming that incomes at attained ages 39 and under commence on the average in 1954, those at age 40 in 1955, at age 50 in 1965, at age 60 in 1975, etc. From general considerations it might perhaps have been expected that such incomes on policies currently issued would begin later on the average than is indicated by this scheme, except at the highest attained ages. Perhaps Mr. Walker in his review of the discussion will give some of the details as to the observed average duration at which incomes commence at various attained ages.

The assumption of *a*-1949 projected mortality appears at first glance to be conservative, from the showing in Mr. Walker's Table 1 that inter-company experience under life income settlements between 1945 and 1950 anniversaries exceeded 100% of the *a*-1949 Table in most classes. Part of the margin of conservatism, however, is used up by the fact that the experience was, on the average, at an earlier period than the year 1950 to which the *a*-1949 Table is assumed to apply. Another part is used up by the fact that all recipients of life incomes, except those under age 40, are assumed to have been born in 1915, while the calculated average calendar year of birth for beneficiaries of death claim settlements was 1921. This is equivalent to assuming that the average year of birth for all life income recipients was later than 1915 but that on the average their mortality will be slightly higher than *a*-1949 projected.

It will be recalled that the *a*-1949 Table is not an experience table but contains an arbitrary margin of conservatism when compared with the mortality which would have prevailed in 1950 if Projection B were ap-

plied to the 1943 Experience Table (*TSA I*, 462) which underlay the *a*-1949 Table. A measure of the conservatism in the *a*-1949 Table may be had by comparing its annuity values (*TSA I*, 386) with those on the 1943 Table (*TSA I*, 380), bearing in mind that part of the excess is due to assumed mortality improvement between 1943 and 1950 (which part can be estimated from the table in *TSA I*, 425). I believe many actuaries would consider that the leeway in the *a*-1949 Table is no greater than is proper to provide for contingencies and for the expenses of administering life income settlements.

The 1943 Experience Table, on which the *a*-1949 Table was based, was derived from the experience on nonrefund immediate annuities. For some

TABLE A
RATIOS TO *a*-1949 TABLE
DURATION 6 AND OVER—BY AMOUNTS

SEX	NONREFUND IMMEDIATE ANNUITIES 1946-1948	LIFE SETTLEMENTS— PAYEE ELECTIONS 1945-1950		TOTAL LIFE SETTLEMENTS 1945-1950	
	On Actual Age Distribution	On Actual Age Distribution	On Same Age Distribution as Nonrefund Immediate Annuities	On Actual Age Distribution	On Same Age Distribution as Nonrefund Immediate Annuities
Male	117%	110%	97%	113%	98%
Female	111	111	98	118	109

reason for which I have seen no satisfactory explanation, the experience on payee settlement options has been lighter than on nonrefund immediate annuities, even though most of such options are of a refund type. This was shown in the Jenkins-Lew paper (*TSA I*, 435-36) and is confirmed by more recent experience, namely, by a comparison of nonrefund immediate annuity mortality between 1946 and 1948 anniversaries (*TSA I*, 612-13) with payee settlement option mortality between 1945 and 1950 anniversaries (1951 Reports, 52-55 and 60-63)—periods which are comparable on the average. The immediate annuity experience cited is related only to the 1937 Standard Annuity Table, and the comparison might be influenced by differences in age distribution. However, Mr. James S. Elston has translated the experience at durations 6 and over to the *a*-1949 Table by making certain assumptions as to central ages in the respective age groups, with the results shown in Table A.

It will be seen that for payee settlements the observed mortality was as low as for nonrefund immediate annuities as a percentage of the a -1949 tabular, and that it was substantially lighter when the exposure was adjusted to a common age distribution. Even when the experience on non-payee elections is included, the average settlement mortality is lighter than that of nonrefund immediate annuities when allowance is made for differences in age distribution.

It is therefore questionable whether the a -1949 Table, when applied to life income settlements, contains even as much margin as is necessary to provide for expense and contingencies. Income yields derived from this assumption must be regarded as closely figured, even if the same yields are applied to both payee and nonpayee settlements.

There is further need for an element of conservatism in life income yields when they are based on an average year of birth or an average year of settlement, in that those who become entitled to an income at a time earlier than the assumed average date can in some cases purchase an original annuity on more favorable terms, so that the average commencement date for those who do take the option may be later than was originally assumed.

(AUTHOR'S REVIEW OF DISCUSSION)

HARRY WALKER:

I want to thank Mr. Noback and Mr. Hoskins for their discussions which I consider valuable additions to my paper.

Mr. Noback has provided us with another form for displaying the spurious gains and losses that are inherent in the assumption of an average year of birth in a mortality table used for life income settlements. The one reservation I would have with reference to his table arises from his having based his figures on an assumption of a five-year setback in the year of birth to provide for a class distinction between maturity elections, payee death claim elections, and nonpayee death claim elections. Reference to Table 1 in my paper shows that in the case of female lives the difference between the mortality ratios for maturity elections on the one hand, and for payee death claim elections on the other hand, is 11% by number of contracts and 15% by amount. This difference in mortality corresponds to a much greater difference than five years in year of birth, as is evident from the Projection B rates of mortality improvement.

Mr. Hoskins has asked for some of the details as to the observed average duration at which income commences at various attained ages. For the Retirement Income at 65 plan, our calculations indicated that the average duration at maturity for those policies reaching maturity would

be approximately 26 years. As for death claim settlements, based on our experience we had calculated the anticipated average policy duration at the time of settlement for each age at settlement of the payee-beneficiary (as stated on page 87 of my paper). Excluding settlements arising from death claims occurring more than 40 years after issue of the policy, the average duration at settlement was as follows for the indicated ages of the payee-beneficiary at time of settlement:

Age of payee-beneficiary	25	35	45	55	65	75	85
Average duration, after issue of policy, at settlement	20.1	20.1	21.5	21.5	25.3	29.0	32.2

In my paper I have explained how these figures were used in arriving at the calculated average calendar year of birth, 1921, for all payees under death claim life income settlements that would flow out of 1954 issues.