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GROUP ANNUITY ILL-HEALTH TERMINATIONS

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THE "CLASSICAL" THEORY

EMPLOYER contributions under conventional deferred group annuity contracts are usually "discounted for mortality" prior to retirement. That is, employer annuity purchase rates are computed to provide an annuity, with or without a guarantee or refund period, commencing at normal retirement; however, if the annuitant should die before normal retirement, no refund is made. Cash values on termination of employment are usually defined as a stated percentage (constant, or graded according to years of participation) of all contributions made by or on behalf of the employee, with compound interest thereon. Employer credits are usually defined as the total cash value less the cash termination benefit paid to the employee or less the value of the paid-up annuity retained by the employee.

It is well known that selection against the insurance company is possible where the total value available on termination of employment substantially exceeds that payable on death. For this reason, such contracts specify that the employer credit shall be allowed only on presentation to the insurance company of satisfactory evidence of the good health of the terminating employee. Mr. H. J. Stark, after examining the 1937–38 Group Annuity Mortality Investigation figures,[1] concluded that "the condition of health at termination of employment cannot be overlooked if a satisfactory mortality experience on deferred annuities is to be maintained" and that "the very substantial differences between the mortality ratios based on deaths alone and those based on deaths including terminations in ill-health indicate the necessity for continued care in determination of the condition of health of employees whose employment is terminated."

Mr. R. M. Peterson,[2] in discussing this question said:

> Assuming that the mortality assumption at ages under 60 in the group annuity premium structure is satisfactory, the financial benefit which the insurance company needs to obtain from the administration of the "ill-health" contract provision is measured by the reserves released from the extra mortality which would have been experienced had all terminated lives remained in the

[1] "Group Annuity Mortality Investigation," by Herbert J. Stark, *RAIA* XXIX, 37.

[2] "Group Annuity Mortality," by Ray M. Peterson, *TSA* IV, 246.

experience, as would be the case where all annuities are vested and none are cancelled. . . . The contract provision requiring evidence of good health of the terminating employee as a condition to the payment of a return to the employer is for the general protection of the insurance company with respect to its mortality guarantees and, by its language, the "ill-health" cases contemplated are not necessarily limited to true total and permanent disability cases. From the legal point of view, the writer believes that the insurance company is on firm grounds in refusing to allow a return to the employer where there is evidence that the ex-employee (i) is in such physical condition that he will be unable to work for an extended period of time or (ii) has a physical impairment, established by medical evidence, that definitely decreases his prospective longevity but does not necessarily meet the usual test of qualification for total and permanent disability benefits under an insurance contract.

PROVISION FOR ILL-HEALTH TERMINATIONS IN EXISTING ANNUITY TABLES

It is of some interest to examine the construction of mortality tables which are being used, or have been used, for the calculation of group annuity rates and reserves.

The American Annuitants' Mortality Tables[3] were based on individual immediate annuity experience, with little exposure at preretirement ages. Since very little business was issued at the younger ages, the rates of mortality reflect, to a considerable extent, the mathematical smoothness characteristic of the Makeham graduation rather than the limited experience available. The mortality rates of the Combined Annuity Table[4] at preretirement ages were based on Mr. Cammack's Group Life Clerical Mortality Table, the mortality rates being a weighted average of the rates of mortality among active and disabled lives.

The 1937 Standard Annuity Table mortality rates at the younger ages were based on the 1932–36 Group (Life) Mortality Experience (Clerical Group) with an empirical adjustment to allow for deaths among disabled lives.

The *a*–1949 Table[5] was the first major American annuity table to be constructed, at the younger ages, from active life group annuity experience. The 1943 Experience Table, the rates of which were projected to 1949 to obtain the *a*–1949 Table, was based on group annuity experience at the younger ages. A percentage (graded by age and derived

[3] "Mortality among American Annuitants and Premiums Based Thereon," by Arthur Hunter, *TASA* XXI, 157.

[4] J. D. Craig, Discussion ("Mortality Tables Constructed Upon the Experience Under Group Policies," by E. E. Cammack, *TASA* XXVIII, 247), *TASA* XXIX, 120.

[5] "A New Mortality Basis for Annuities," by W. A. Jenkins and E. A. Lew, *TSA* I, 369.

from a study of Metropolitan Life group life conversion mortality) of "ill-health" terminations was added to the active life deaths in order to obtain total deaths.

Since 1949 a number of tables have been used or considered for use in this area. Among these are The Progressive Annuity Mortality Table,[6] the Prudential 1950 Group Annuity Valuation Table,[7] and the Group Annuity Table for 1951.[8] Each of these tables, at the younger ages, is based on some modification of the a-1949 Table.

CONVENTIONAL PRACTICE

In order to stay within its mortality guarantees, a company must administer its "ill-health" clause in such a fashion that the reserves released on death and on "ill-health" termination should at least equal the "expected" release according to the mortality table used in its premium calculations on the assumption that no annuities are canceled on termination of employment.

It is obvious that the practice of the employer with respect to terminating the employment of disabled employees will affect the number of terminations and the proportion of those who are in "ill-health." The existence of other employee benefits (*e.g.*, group life insurance, sick leave, severance pay, accident and health insurance, etc.) will also be of importance. The practice of the insurer in administering the clause will also affect the proportion of terminations that are considered to be in "ill-health."

Conventionally the insurance company would attempt to "draw the line" at some arbitrary point in an individual case, allowing either the full credit to the employer or nothing at all. In computing dividends on group annuity contracts equity between policyholders is all that is desired; and provided a contract is sufficiently large, the dividend formula would soon tend to correct any inequities due to the arbitrary practice in handling "ill-health" terminations.

PROBLEMS IN CANADA

In recent years the number of registered employer-employee pension plans established each year in Canada has grown considerably. Much of this growth has taken place in the area of employers employing a

[6] "The Progressive Annuity Mortality Table—A Gompertz Adaptation of the Annuity Table for 1949 (with Projection)," by E. G. Fassel and J. C. Noback, *TSA* II, 279.

[7] "Actuarial Note: A New Mortality Basis for Group Annuities," by Henry E. Blagden, *TSA* II, 322.

[8] "Group Annuity Mortality," by Ray M. Peterson, *TSA* IV, 246.

small staff. Group annuity contracts have been found suitable for this type of plan by many insurers. This is borne out by the fact that the average group annuity contract issued in Canada in 1957 insured 29 employees.[9] Some companies have ceased to underwrite new individual policy pension trusts and now write "group" annuity contracts insuring one life. Although many of these small contracts provide for a return of employer contributions, with or without interest, on death before retirement, there are many advantages of having employer contributions applied at rates discounted for mortality.

1. The initial cost to the employer of a given benefit is lower or, alternatively, higher pension benefits can be purchased with the same contribution.
2. If the plan is written on a "with return" basis and part or all of the employer death benefit vests in the employee, the vested proceeds are subject to both income tax and estate tax. A group life insurance plan, the proceeds of which are taxable only in respect of estate tax, would normally provide death benefits which are more reasonable with regard to the employees' needs.
3. If the plan is written on a "with return" basis and the proceeds on death are applied to reduce the employer's cost for the current year, the fluctuations in the employer's net annual cost are likely to be greater than if the employer contributions are "discounted for mortality." Thus the employer's attempts at budgeting for the future are hindered.

One problem encountered in actual cases and often discussed in sales interviews is the "ill-health" termination clause. Basically the small employer is not happy with a practice whereby it is possible to "forfeit" a $10,000 credit, in a seemingly arbitrary fashion, "while the body is still warm." We cannot look to the dividend formula, since (*a*) much of the group annuity business in Canada is written on a nonparticipating basis, (*b*) many of the contracts that provide for participation contemplate profits arising only from excess interest and possibly expense savings, (*c*) those contracts that provide for participation in mortality profits can give little credibility to the actual experience under a small contract.

SOME PRACTICAL SOLUTIONS

An informal survey of some Canadian companies has revealed considerable diversity of practice. All companies questioned investigate the health of terminating employees to some extent. These investigations

[9] *Report of the Superintendent of Insurance for Canada*, 1957, Vol. I, 75A.

range from a simple statement by the employer that the employee is or is not in good health to a detailed questionnaire completed by the employee regarding recent weight changes, illnesses, medical attention, etc. Inspection reports and attending physicians' reports are obtained in some cases. Evidence on file under group accident and sickness or group life (disability) plans carried by the insurer for the same employer is useful. Most companies specify a minimum dollar amount and credits falling below this amount are allowed, regardless of health or on the basis of a simple statement by the employer.

In cases where evidence of health is unsatisfactory to the insurer, one company offers the employer the choice of

a) 60% of the employer credit with interest at the end of one year if the employee is then alive, the burden of proof resting with the insurer, or

b) 100% of the employer credit with interest at the end of five years, if the employee is then alive, the burden of proof resting with the employer.

Another company makes an immediate and final settlement of 50% of the "formula" employer credit. A third company refuses to make an immediate settlement and leaves the paid-up annuity in force. At normal retirement, if the employer can supply evidence of the employee's survival, the commuted value of the annuity is credited to the employer. The first method described above suffers on two counts. The employer must choose the settlement most advantageous to himself, taking into account his need for funds and the expected longevity of the employee. Assuming that his need for funds is not pressing, (*b*) is more advantageous except where the employee has an extremely high mortality rating. The delay in final settlement in either case creates problems in tracing the employee, especially since the employee has no financial interest at stake. The second method is somewhat arbitrary and is open to employer criticism and possible selection against the insurance company. The long delay in final settlement, as well as associated problems in tracing former employees and the expense of maintenance of paid-up annuities, are disadvantages of the third method.

A SUGGESTED METHOD

It would seem that an administrative procedure for "ill-health" terminations in the field of small group annuity contracts should ideally:

1. Provide an immediate, final settlement to the employer wherever possible.

2. Provide a credit which bears some reasonable relationship to the "formula" credit taking into account the state of health of the employee.
3. Enable the insurance company to achieve the aggregate financial experience desired on its mortality guarantees.

It should be noted that the determination of the amount of credit to be allowed in any case is a process in which a mutually satisfactory figure must be reached in the range \$0 to the full "formula" credit, say \$10,000, and not a process in which a precise scientific answer in a range such as \$5,275.67 to \$5,284.11 is calculated.

Suppose the full formula credit is $\$C$ in the case of an employee, normally expected to retire at age z, who terminates employment at age x $(x < z)$. If the employee is in reasonably good health such that the mortality class into which he fell would be expected to experience mortality no worse than that expected in the premium calculations, then the full credit of $\$C$ would be allowed. On the other hand, if the employee's future prospects of longevity were such that it was virtually certain that he would not survive to normal retirement date, then no credit would be allowed.

If we assume that the impaired life is subject to mortality rates q'_x, then the ratio of the substandard and standard annuity values is

$$\frac{{}_{z-x|}\ddot{a}_x'^{(12)}}{{}_{z-x|}\ddot{a}_x^{(12)}}$$

(assuming the annuity is on a life only basis), where the numerator is calculated on the premium basis of interest and the q'_x mortality basis, and the denominator is calculated on the premium bases of interest and mortality.

It is suggested that the employer credit to be allowed be set equal to

$$\$C \cdot \frac{{}_{z-x|}\ddot{a}_x'^{(12)}}{{}_{z-x|}\ddot{a}_x^{(12)}}.$$

The function

$$\frac{{}_{z-x|}\ddot{a}_x'^{(12)}}{{}_{z-x|}\ddot{a}_x^{(12)}}$$

will have a value ranging from 0 to 1 inclusive, the value varying inversely with the degree of impairment of the life involved. Defining

$${}_n\alpha_x = \frac{{}_np'_x}{{}_np_x} \quad \text{and} \quad \beta_z = \frac{\ddot{a}_z'^{(12)}}{\ddot{a}_z^{(12)}},$$

where

$$n = z - x ,$$

we note that

$${}_n a_x \cdot \beta_x = \frac{{}_{z-x|}\ddot{a}_x'^{(12)}}{{}_{z-x|}\ddot{a}_x^{(12)}} .$$

METHODS OF EVALUATING ${}_n a_x$

If we assume that the mortality experienced by the impaired life will be equal to a constant percentage of standard mortality, *i.e.*, $q_x' = (1 + b)\, q_x$, then a good approximation, in the age range involved, is

$$\mu_x' \doteqdot (1 + b)\, \mu_x$$

or[10]

$$-\frac{d \log l_x'}{dx} \doteqdot -(1 + b)\frac{d \log l_x}{dx}$$

$$\therefore \log {}_n p_x' \doteqdot (1 + b) \log {}_n p_x = \log {}_n p_x\, ({}_n p_x)^b$$

$$\therefore {}_n a_x = \frac{{}_n p_x'}{{}_n p_x} \doteqdot ({}_n p_x)^b .$$

The result is interesting in that ${}_n a_x$ can be easily determined for any mortality level simply by reference to a table of ${}_n p_x$ on the standard table. Thus, at the level of 300% *extra* mortality, ${}_n a_x \doteqdot ({}_n p_x)^3$. If the mortality basis involves projection, ${}_n p_x$ can be taken from the appropriate generation table, if available. If Sternhell functions[11] are available, the approximation

$${}^{1950+k}_{\ n}p_x \doteqdot {}_n p_x\, (1 + {}^{1950+k}_{\ n}I_x)$$

is sufficiently accurate for our purposes, where ${}^{1950+k}_{\ n}p_x$ is the probability that a life aged x in $1950 + k$ will survive to age $x + n$ in $1950 + k + n$, and

$${}^{1950+k}_{\ n}I_x = G_x - G_{x+n} - {}_n F_{x+n} + k\,(F_x - F_{x+n}) .$$

If the extra mortality can be represented by a constant number of extra deaths per thousand, *i.e.*, $q_x' = A + q_x$, then a good approximation, in the age range involved, is

$$\mu_x' \doteqdot A + \mu_x ;$$

[10] Society of Actuaries' Textbook on *Life Contingencies*, by C. W. Jordan, Chap. 1. The logarithmic base e is omitted in the notation.

[11] "Calculation of Approximate Annuity Values on a Mortality Basis that Provides for Future Improvements in Mortality," by Charles M. Sternhell, *TSA* II, June, 30.

since[12]

$$ {}_np_x = e^{-\int_0^n \mu_{x+t}dt}, $$

$$ \therefore {}_na_x = \frac{{}_np'_x}{{}_np_x} \doteqdot \frac{e^{-\int_0^n (\mu_{x+t}+A)dt}}{e^{-\int_0^n \mu_{x+t}dt}} = e^{-An}, $$

which can be computed easily from a table of the powers of e. It is interesting to see that, in this case, ${}_na_x$ depends on the level of extra mortality and not on the level of the standard or substandard tables.

METHODS OF EVALUATING β_z

Since the number of values of z that will occur in practice is relatively small, values of β_z can be calculated exactly with little difficulty for various levels of extra mortality. Interpolation can be used for intermediate levels of extra mortality. However, certain shortcuts are available. In the case of constant percentage extra mortality, the reader is referred to Brett's note[13] and the discussion thereof by Lidstone.[14]

If the standard table follows a Gompertz curve, we note that[15]

$$ \begin{aligned} a'_x &= \sum_{t=1}^{\infty} {}_tE'_x \\ &= \sum_{t=1}^{\infty} e^{-\int_0^t (\mu'_{x+s}+\delta)ds} \\ &\doteqdot \sum_{t=1}^{\infty} e^{-\int_0^t [(1+b)Bc^{x+s}+\delta]ds} \\ &\doteqdot \sum_{t=1}^{\infty} e^{-\int_0^t (Bc^{x+s}c^r+\delta)ds} \\ &\doteqdot a_{x+r}, \end{aligned} $$

where

$$ r = \frac{\log (1+b)}{\log c}. $$

Similarly it can be shown that substandard annuity values can be computed on a standard Makehamized table by rating the age and changing the rate of interest.

[12] Jordan, *loc. cit.*

[13] "Actuarial Note: Annuities on the Basis of Constant Multiples of the Mortality of a Standard Table," by J. H. Brett, *TASA* XXXIX, 318.

[14] *TASA* XL, 194.

[15] Jordan, *loc. cit.*, Chap. 2.

In the case of extra mortality represented by a constant number of extra deaths per thousand, it can be shown that substandard annuity values can be computed on the standard table by changing the rate of interest.

PRACTICAL PROBLEMS

It is obvious that the suggested method requires sufficient information as to the state of health of the terminating employee to allow a reasonable assessment to be made of the mortality class into which he would fall. In some cases inspection reports and attending physicians' statements will be necessary. Evidence under other group plans is often useful. While the underwriting department of the insurer can be responsible for assigning mortality ratings to cases of this type, the following differences from the usual individual life insurance policy underwriting should be noted:

1. The usual impairment ratings refer to a percentage of standard *ordinary life insurance* mortality and not standard *group annuity* mortality. A simple adjustment can usually be found to take account of this.
2. Numerical measurement of the extra mortality involved must be determined for individuals who would be declined outright for ordinary insurance. Reinsurance opinions would not be available normally.
3. Plan restrictions (*e.g.*, restriction to short term endowments at standard rates in cases where extra mortality is expected to be deferred) would not be applicable.

Some companies compute premium rates on a physical basis which is designed to reproduce approximately the theoretical basis desired. The individual mortality, interest and expense rates might differ considerably between the two bases. If the actuary feels that the values of ${}_n a_x$ and β_x produced by the physical basis are unrealistic, the theoretical basis should be used.

Certain impairments produce extra mortality of a temporary nature and it is often feasible to set $\beta_x = 1$ in such cases.

Since the formulas for ${}_n a_x$ are easy to evaluate, more complicated expressions for the extra mortality involved can be handled. For example, if

$$q'_{x+t} = (1+b)\, q_{x+t} \qquad (0 \le t \le f)$$

$$= (1+h)\, q_{x+t} \qquad (f < t \le n)$$

then

$${}_n a_x \doteq ({}_f p_x)^b \, ({}_{n-f} p_{x+f})^h .$$

If

$$q'_{x+t} = q_{x+t} + A \qquad (0 \leq t \leq f)$$

$$= q_{x+t} + M \qquad (f < t \leq n)$$

then

$${}_n a_x \doteq e^{-Af-(n-f)M}.$$

The method suggested above cannot be expected to produce a final, immediate, equitable and satisfactory settlement in every case, and occasionally a case may arise whereby deferred settlement alone is acceptable.

In the opinion of the author, the standard contract provision with respect to "ill-health" terminations should not be changed, except, if felt desirable from a sales standpoint, by adding a phrase of the type "the employer credit to be allowed in the case of an employee who terminates employment, and in respect to whom the evidence of health submitted is not satisfactory to the insurance company, shall be of such amount as the insurance company shall decide."

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