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The Actuary

SOCIETY'S SPECIAL SESSION ON MORTALITY

by James C. Hickman

The study of mortality is a basic concern of actuaries. At the time of the Annual Meeting on November 1, 1967, the Society's Committee on Research, under the chairmanship of E. A. Lew, devoted a special session to Mortality Estimation and Risk Theory Aspects of Mortality. The four papers presented are outlined briefly below.

John Mereu's paper "Measurement of Mortality" was introductory in nature and reviewed the history of actuarial approaches. Much of the earlier literature on this subject was concerned with methods of grouping data into age blocks for use with exposure formulas rather than with the underlying concepts. With modern computers it is now feasible to obtain exposures on a seriatim basis, and actuaries may concentrate on the problem of finding the best way to allow for partial contributions to exposure in the year of termination. In the past, actuaries have used a particular method of counting exposure and have assumed that the probability that a life aged $x + k$ ($k<1$) will die before age $x + 1$ is proportional to the period remaining.

H. L. Seal has shown that the usual actuarial estimate of the mortality rate has a bias because the exposed to risk depends on the actual mortality of the "existing" or "enders." The correction formula for this bias results in exposing deaths to the earlier of the end of the year of age or the end of their prospective exposure period. Expressions comparable to those developed in discrete form for the correction are also derived for the continuous versions with analagous formulas for the assumptions of uniform distribution of deaths, and of constant force of mortality.

IN DEFENCE OF CARTER

by Laurence E. Coward

The actuarial profession, so closely linked with the insurance industry, can hardly be expected to welcome with open arms any proposals (such as those in the Carter Report) for additional taxation on insurance companies and their policyholders. However, the present system of life insurance taxation is so indefensible that a major reorganization appears to be inevitable. In such event, actuaries will have the opportunity and responsibility to help develop the new tax system on a sound and constructive basis.

The answer to H. Edward Harland's question "whether any substantial change in taxation is necessary or desirable?" can only be in the affirmative. It is true that "the life insurance industry has made, and is continuing to make, a substantial contribution to Canada's growth and social well-being." But this is no reason why the industry should not bear its proper share of income tax. Tax incentives for social reasons should be directed at specific objectives and not take the form of tax exemption for a major industry.

At present, mutual life insurance companies are exempt from income tax and stock companies are taxed only on amounts paid to or set aside for the shareholders. The Canadian income tax paid by stock insurance companies is about $2 million per year. The interest income of the companies is about $700 million a year, of which roughly one-third will eventually be taxed at a low rate when it comes into the hands of individuals as annuity or pension income. The assets in excess of statutory reserves increase by over $50 million a year and these are untaxed. Canadian companies pay $15 million a year in foreign in-

TREASURY AIDE VIEWS FUNDING, REINSURANCE OF PRIVATE PENSIONS

by E. F. Boynton

The latest thinking of the Interagency Task Force which is investigating the need for regulation of private pension funds was revealed in a recent speech by William Gibb, Deputy Legislative Counsel for the Treasury Department. The comments were made at a meeting of the American Finance Association as a follow-up to the basic proposals outlined by Assistant Secretary Stanley S. Surrey at the American Pension Conference in May, 1967.

The basic objective of the Task Force proposals is to provide a means to protect vested benefits and, according to Mr. Gibb, this would be accomplished by a two-prong approach: (1) new minimum funding standards, plus (2) participation in a "termination protection fund," heretofore called "reinsurance."

The funding standards now being considered would require that a progressively increasing percentage of the vested liabilities of the plan be funded each year. Specifically, the vesting percentage "target" would increase by 4% per year so that all vested benefits would have to be funded within at least 25 years. The target for existing plans would increase by only 3% per year for the first 5 years as a transitional arrangement, and an unspecified adjustment would be made in the funding target to handle substantive plan amendments.

Assumptions and methods to test the degree of funding of vested liabilities would apparently be prescribed by a Government agency. The contributions to the plan would also have to meet the present normal cost-plus interest minimum now required by the IRS.

TRUTH IN LENDING — COMPUTING INTEREST ON A CREDIT TRANSACTION

by Robert J. Myers

(Reproduced with permission from The New York Statistician, September-October, 1967, vol. 19, no. 1)

In the April 1967 issue of the *New York Statistician,* Dr. M. R. Neifeld cites a problem of determining the true interest rate on a short-term credit transaction. He then states that computations thereof were made by several marketing professors and government economists, with the results ranging from 80% to 130% per annum and not having any computational errors. This is impossible. There can be only one answer for a discrete problem such as was posed. Dr. Neifeld should have consulted an actuary, not a marketing professor or a government economist!

The problem was to find the true annual interest rate involved when an immediate payment of $20 is to be financed by four $5 payments made 4, 18, 32, and 46 days later and a $2 payment made 60 days later.

The way to solve the problem is first to set up the exact equation in terms of the daily interest rate, as in the following Equation of Value:

$$5\left(v^4 + v^{18} + v^{32} + v^{46}\right) + 2v^{60} = 20 \qquad (1)$$

where $v = (1 + i)^{-1}$ and i is the daily rate of interest.

Next, we use the Method of Equated Time to find a first approximation to "i". The following expression gives the weighted average time (in days):

$$\frac{5(4 + 18 + 32 + 46) + 2\ (60)}{22} = 28.1818 \qquad (2)$$

Using this value, we determine the first approximation to "i" from the equation:

$$22(1 + i)^{-28.1818} = 20 \qquad (3)$$

By the use of logarithms, we find that "i" is .0034 (i.e. .34% per day). Then, by trial and error, through direct computation in Formula (1), we find that the exact true interest rate "i" can be bracketed by "i" equals .003456 and "i" equals .003457 (since the former results in the left side of the equation equalling 20.00008, while the latter produces a value of 19.99953). Therefore, the true daily rate of interest, correct to four decimal places is .3456%

Finally, we may obtain the true annual rate of interest, "j", from the following formula:

$$1 + j = (1.003456)^{365\frac{1}{4}} \qquad (4)$$

Using logarithms, we find that for "i" equal to .3456% "j" equals 2.526, or a rate of 252.6%. If we wish to bracket "j", we find that for "i" equal to .3457%, "j" equals 252.7%. Therefore, the correct precise answer for the true annual rate of interest — to the nearest percent, is 253%.

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come taxes, but foreign companies pay no Canadian income tax. It seems clear that the life insurance company is not carrying its weight in comparison with other financial institutions.

Premium Tax Cited

The standard reply is that insurers pay a special premium tax which produces rather more than $16 million a year. This, however, is a provincial tax, in the general nature of a sales tax on services, and is no substitute for income tax. I fully agree of course that in order to avoid over-taxation, the premium tax should be taken into account when the basis of income tax on life insurance is formulated.

The critics of the Carter Report take exception to the recommendation that no deduction be allowed for free surplus and contingency reserves in calculating an insurance company's taxable gain from operations, and have suggested that this seriously impairs the solvency of the companies. They apparently overlook the fact that if it were ever necessary to draw on the surplus and contingency reserves, in order to maintain

statutory reserves, a tax credit would arise which would be equivalent to repayment of the tax previously imposed. It appears that the solvency of the company would not be affected, except perhaps to the extent of the interest on the income tax paid.

With respect to the taxation of the policyholder, I hold no brief for the particular method recommended by the Royal Commission. In fact, I believe it would be appallingly complicated to tax the income element in each life insurance policy each year on an accrual basis — and that if income tax is imposed on the policyholder it should be payable only when the policy matures. The Commission was certainly conscious of these problems and two alternative methods are set out in an Appendix to the Report. Moreover the Report states:

"The recommendations we have made in this chapter are set out in general terms. It will be necessary for the tax authorities to work out, in association with the representatives of the life insurers and the Department of Insurance, detailed regulations that would apply."

In brief, the proposals in the Carter Report are considerably more reason-

able and realistic than they have been made to appear. If actuaries are to play a constructive part they should not automatically oppose any changes in life insurance taxation but should seriously consider how to apply the Report's principles in a fair and practical manner. □

REVIEW

by Karl M. Davies

J. Truett, J. Cornfield, and W. Kannel, "A Multivariate Analysis of the Risk of Coronary Heart Disease in Framingham," *Journal of Chronic Diseases,* vol. 20, p. 511, July 1967.

Various aspects of the Framingham Study, which has received considerable attention in medical and insurance circles, have been reported in several journals. The purpose of this Study, which is being conducted by the National Heart Institute, is to learn more of the epidemiology of coronary heart disease.

The Study started in 1949 with a group of 2,187 men and 2,669 women, age 30 to 62, who were free of coronary disease at that time. Seven risk factors were measured on the initial examination and the incidence of coronary heart disease in relation to these factors has been observed and analyzed.