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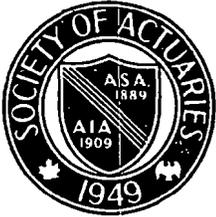
ON LEVEL PREMIUM POLICY LOSS RATIOS

by Clayton A. Cardinal

With the recent increases in frequency and severity rates in health insurance, many insurers have filed or are filing premium increases on their individual policies. Understanding the need for a premium increase on guaranteed renewable level premium policies is difficult for many regulators because of the "confusion" caused by the active life policy reserve. The purpose of this essay is to present a perspective on loss ratios for level premium policies which may be helpful to an insurer in reflecting a regulator's or consumer's viewpoint.

Three classes of loss ratios may be established, which when taken in a predetermined order constitute an important pattern. This pattern can be used to explain the need for a premium increase and also to demonstrate that the amount of any increase is not excessive.

First Class

Past premiums through any point of time on any increasing risk level premium contract must be sufficient to fund benefits incurred since inception and also to fund the policy reserve resulting from the level premium funding mechanism. Said differently, since the policy reserve is an estimation of the excess of the present value of future benefits over that of the future funding for future benefits, it follows that the policy reserve must be added to the present value of past benefits when relating (1) the total funds set aside for benefits (past and future) out of past premiums to (2) the past premiums. Accordingly, the first class of ratios represents the relationship between (1) the present value of the sum of past benefits and the present policy reserve (here, and elsewhere, adjusted to net level premi-

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M. D. R. Brown
and
K. H. Cooper

The first public conference of the Canadian Association of Pension Supervisory Authorities was held in Quebec, June 11-12, 1975. The Association is composed of representatives of government bodies which administer legislation governing private pension plans in Canada. To date, this legislation operates in four provinces and for certain plans under federal jurisdiction. Similar legislation will come into effect, probably in 1976, in three other provinces.

The organizers of the conference solicited submissions from employer and labour groups and professional and trade organizations. The fourteen briefs submitted were the basis for discussions at the conference. Each session dealt with a particular aspect of pension benefits legislation, and was presided over by the senior person responsible for pension regulation in one of the jurisdictions.

The topics discussed covered a wide range: the need for stricter standards of mandatory vesting and/or locking-in of employee contributions (the present minimum standard is age 45 and 10 years' service); the need for greater public awareness and understanding of existing legislation; pressure for more disclosure in the areas of financing and administration (Canadian legislation lags far behind the U.S. here, though far in advance in other respects); the impact on pension benefits legislation of the growing thrust of "Human Rights" (anti-discrimination) legislation; and the concerns of legislators in the investment area, including the fiduciary responsibility of various parties and the need for professional standards of conduct, among pension fund investment managers.

ADVISORY COUNCIL ON SOCIAL SECURITY

Reports of the Quadrennial Advisory Council on Social Security, pp. 239, Superintendent of Documents, U.S. Govt. Printing Office, Washington, D.C. 20402, $1.95.

by K. Arne Eide

Gigantic size and awesome complexity are two of the characteristics that impress most people who study the social security system in the United States. To analyze its many programs and emerge with a clear conception of the system's intricately interwoven structure and multitudinous operations is not an easy mental exercise. Even when consideration is restricted to the old-age, survivors, disability, and health insurance (OASDHI) programs which commonly, but mistakenly, are thought to constitute the social security system, the task of analyzing the programs is a formidable one. Yet making such analyses and coming up with recommendations for improvement in the programs was the assignment of the 1975 Advisory Council on Social Security. All in all, this reader of the Reports believes the Council completed its assignment in a most commendable manner.

The statutory authority for the Advisory Council states that it shall be appointed "for the purpose of reviewing the status of the Federal Old-Age and Survivors Insurance Trust Fund, the Federal Disability Insurance Trust Fund, the Federal Hospital Insurance Trust Fund and the Federal Supplementary Medical Insurance Trust Fund in relation to the long-term commitments of the old-age, survivors, and disability insurance program and the programs under parts A & B of Title XVIII, and of reviewing the scope of coverage and the adequacy of benefits under, and all other aspects of, these programs, including

Letters

reserve and the *separation* of the unified reserve between the portion which is to be presented on the lefthand as opposed to the righthand side of the balance sheet. The fundamentals for *determination* of the unified reserve are addressed by Recommendation 1 and Interpretation 1-c; and in fact, Interpretation 1-c states in paragraph (2) that ". . . To be consistent with actuarial principles the difference between the amount carried on the balance sheet as reserve liability and the amount carried as deferred charge on account of unamortized acquisition expense must be substantially equal to the present value of future costs less the present value of future valuation premiums, based on actuarial assumptions determined in accordance with Recommendation 1. . . ."

The Committee is unanimous in its opinion that interest should be taken into account in the computation of the unified reserve. Hence, where the "expense" portion of the reserve and the remainder of the reserve are calculated separately, the Committee is likewise unanimous in its opinion that each calculation should take interest into account.

Financial Reporting Principles Committee, American Academy of Actuaries

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Professional Structure

Sir:

I would like to suggest one additional alternative which I believe should be considered in the ongoing discussion about the institutional structure of the actuarial profession, particularly the relationship between the American Academy of Actuaries and its sponsoring organizations.

I am a member of the Operations Research Society of America, although somewhat inactive. While ORSA does not have a highly formalized examination system such as that of the Society of Actuaries, nevertheless membership is granted only upon demonstration of competency in the field of operations research. Membership in ORSA therefore represents a mark of professional qualification, perhaps the only one in that field.

Under the umbrella of ORSA exists a number of "colleges" of areas of interest, such as a college of transportation

applications, a college of health applications, a college of military applications, etc. A member of ORSA can affiliate himself with one or more of these colleges as he chooses. Each of the colleges sponsors education and research activities within its area of interest. It sponsors meetings and develops literature.

It seems to me that the diverse institutional structure of the actuarial profession in the United States has produced a public relations problem in confusion which has not been entirely overcome by the formation of the American Academy of Actuaries. This is true even with members of our own profession as evidenced by the slow growth in the membership of the American Academy of Actuaries in the last several years compared with the potential membership. Furthermore, I believe the continuing education and research efforts of our profession have been hampered by our present structure.

I believe that the existence of a single professional organization in this country, membership in which would convey the distinction of professional status, would overcome some of the public relations problems and the existence of "colleges" sponsored by that single organization would be more productive of continuing education and research.

Dwight K. Bartlett, 3rd

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Issue 1975.2

Conversation on Stirling Numbers, Ralph Garfield & Cecil Nesbitt.

Alternative Matrix Proof of $M_x = D_x - dN_x$, T.N.E. Greville.

Varying Annuities Verbalized, Graham Lord.

How Accurate Are Linear Approximations of Mean Reserves?, Gottfried Berger.

Direct Calculations of Contingency Margins for Gross Premiums & Contingency Reserves Resulting from those Margins, Dennis L. Carlson.

Credibility Theory & Privileged Frames of Reference, Myron H. Margolin.

Commutation Function Package, W. C. Scheel.

Subscriptions may still be sent to David G. Halmstad, P. O. Box 124, Ridgefield, Conn. 06877.

No back numbers prior to 1974 are available.   □

Social Security Note

Mr. Robert J. Myers has prepared a pamphlet on *The Case for Indexing of Social Security Benefits for Changes in Wage Levels.* This pamphlet was submitted to the Committee on Ways and Means.

A copy may be obtained from Mr. Myers on request. His address is 9610 Wire Ave., Silver Spring, Md. 20901. □

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The discussions of greatest interest to actuaries were those related to legislated standards of funding and solvency. The submission of the Canadian Institute of Actuaries put forward the position that the regulators should recognize a duality in their objectives in this area: a "solvency" test, predicated on a plan termination valuation (no turnover or salary projections, assets at market value) and an "adequacy" test to ensure that the continuing financial stability of the plan is adequately protected by the level of contributions determined on an acceptable actuarial basis, with no reference to specific limits on the amortization periods for unfunded liabilities. It

Multiple Decrement Probabilities

by *Walter B. Lowrie*

In the textbook for Life Contingencies by C. W. Jordan, formulas are given to obtain probabilities for a multiple decrement table from the rates from associated single decrement tables as follows:

$$q_x^{(1)} = \frac{q_x'^{(1)}\left(1 - \frac{1}{2} q_x'^{(2)}\right)}{1 - \frac{1}{4} q_x'^{(1)} q_x'^{(2)}} \qquad (14.38)$$

This, and the companion formula, appear on page 281. It is assumed that there are only two decrements. Formula 14.38 is derived by the simultaneous solution of formula 14.32 (page 279).

We are warned by Mr. Jordan that $q_x^{(1)}$ and $q_x^{(2)}$, found by using equation 14.38, may not add up to the theoretically proper total and should be pro-rated.

On the other hand, the approximation

$$q_x^{(1)} \doteq q_x'^{(1)}\left(1 - \frac{1}{2} q_x'^{(2)}\right)$$

and its companion can be derived as follows:

$$q_x^{(1)} = \int_0^1 {}_t p_x^{(\tau)} \, \mu_{x+t}^{(1)} \, dt = \int_0^1 {}_t p_x'^{(1)} \, \mu_{x+t}^{(1)} \, {}_t p_x'^{(2)} \, dt$$

$$= q_x'^{(1)} \int_0^1 {}_t p_x'^{(2)} \, dt = q_x'^{(1)} \int_0^1 \left(1 - {}_t q_x'^{(2)}\right) dt$$

$$= q_x'^{(1)}\left(1 - \frac{1}{2} q_x'^{(2)}\right)$$

using a uniform distribution of decrement assumption for causes (1) and (2) separately.

The valuable aspect of this second approximation is that $q_x^{(1)}$ and $q_x^{(2)}$ add up to the theoretically proper amount, namely $q_x^{(\tau)}$ ⦁ this is proved as follows (assuming two decrements):

$$p_x^{(\tau)} = p_x'^{(1)} \cdot p_x'^{(2)}$$

so

$$q_x^{(\tau)} = 1 - p_x^{(\tau)} = 1 - p_x'^{(1)} \cdot p_x'^{(2)} = 1 - \left(1 - q_x'^{(1)}\right)\left(1 - q_x'^{(2)}\right)$$

$$= q_x'^{(1)} + q_x'^{(2)} - q_x'^{(1)} \cdot q_x'^{(2)}$$

But, using the second approximation:

$$q_x^{(\tau)} = q_x^{(1)} + q_x^{(2)} \doteq q_x'^{(1)}\left(1 - \frac{1}{2}q_x'^{(2)}\right) + q_x'^{(2)}\left(1 - \frac{1}{2}q_x'^{(1)}\right)$$

$$= q_x'^{(1)} + q_x'^{(2)} - q_x'^{(1)} \cdot q_x'^{(2)}$$

Note that the second approximation utilizes only the numerators of formula 14.38.

This formula was brought to my attention by Bruce Macleish, one of my part 4 students.   □

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appeared that there was substantial support at the conference for the position that it would be legitimate for regulators to distinguish between these alternative tests and to require as the minimum required contribution the greater of (a) the amount required to maintain "solvency" under the first approach, or (b) the amount required for "adequacy" under the second approach. In any event, the minimum contribution so determined should be treated as tax-deductible by the federal revenue authorities without further question.

Some actuaries present also urged that the recognition by the regulators of the duality in the approaches to funding would permit them to be less rigid in such matters as prescribing asset valuation bases, which has been under study by the Pension Commission of Ontario.

In the context of funding, there seemed to be little enthusiasm for a plan of termination insurance similar to that in the U.S., at least until such time as the American experience reveals some of the advantages and pitfalls of such a scheme, and until there is a clearer basis for coordinating and allocating responsibilities for such arrangements among the various jurisdictions in Canada.

The general mood of the conference reflected the unresolved tension between those (especially among labor spokesmen) who believe the private pension system cannot provide an adequate solution to the retirement income problem (because of insufficient coverage, lack of sufficient portability/vesting for those covered, and economic inefficiency of the funding mechanisms, given current investment vehicles) and those who fear further expansion of the government role through "social insurance" and general welfare programs (insufficient recognition of eventual real costs, preemption of capital formation from the private to the public sectors). Not surprisingly, the conference did not resolve this fundamental question but did give the interested parties a forum for the more complete ventilation of the issue. The likelihood that the conference w be repeated regularly in the future is a good omen for the eventual rational resolution of this and other basic questions affecting retirement income arrangements in Canada.   □