SOCIETY OF ACTUARIES

Article from:

The Actuary

September 1969 – volume 3 - Issue 7

SOCIAL SECURITY NOTES

Robert J. Myers, *Distribution of SMI Bills and Reimbursements by Type of Service*, Actuarial Note No. 54, pp. 2, Social Security Administration, Washington, July 1969.

This note examines data on numbers of bills and amounts of reimbursements under the Supplementary Medical Insurance program, by type of service, allocated by recording periods. Through December 31, 1968, 92.5% of the reimbursements were for physicians' bills, 1.5% for home health bills, 2.7% for outpatient hospital bills, .5% for independent laboratory bills, and 2.7% for all other bills. These percentages could be distorted somewhat due to the lack of available data on an accrual basis and the fact that the data does not include bills (or reimbursements) that went toward satisfying the deductible.

—o—

Charles R. Owen, *The Farmington, West Virginia, Mine Disaster: An Actuarial Analysis of Survivor Benefits Payable*, Actuarial Note No. 53, pp. 4, Social Security Administration, Washington, June 1969.

This note presents an analysis of the benefits awarded to the survivors of the 78 men who lost their lives in the mine disaster near Farmington, W. Va. in November 1968. Assuming an interest rate of 4¼%, the present value of all estimated payments (including benefits which will be awarded to the widows in the future) amounts to $1.9 million.

—o—

Robert J. Myers and Margaret A. Lannen, *Comparison of Actual Experience under OASDHI System with Short-Range Cost Estimates*, Actuarial Note No. 52, pp. 3, Social Security Administration, Washington, June 1969.

This note compares actual experience for calendar year 1968 under the OASDHI system with the short-range cost estimates given in the 1968 Trustees Reports. The balance in each of the trust funds at the end of calendar years 1960-68 is compared with the estimate made at the beginning of each of the same years. The actual balances in the OASI and DI Trust Funds on December 31, 1968 were slightly higher than estimated. The balance in the SMI Trust Fund was about 25% higher than estimated due primarily to a greater lag in filing and adjudicating claims than anticipated.

Because the General Fund of the Treasury did not totally reimburse the HI Trust Fund during the calendar year for costs relating to uninsured persons, the actual experience under HI during calendar year 1968 could not be compared with the estimates (which assumed total reimbursement).

—o—

Copies of these notes may be obtained gratis from Robert J. Myers, Chief Actuary, Social Security Administration, Washington, D. C. 20201. □

University of Nebraska

(*Continued from page* 1)

Booklets describing the actuarial profession and the University program are distributed to high schools and colleges in the state of Nebraska in an effort to inform students of opportunities in actuarial science. In addition, the Bankers Life Insurance Company of Nebraska has instituted a scholarship program at the high school level which has proven successful (see John Fibiger's letter, *The Actuary*, September 1968.)

The enrollment in the actuarial courses in recent years has been encouraging as has been the examination record of the students. On the May 1969 examinations, there were 43 passes in Parts 1-4 by University of Nebraska students. Almost all these students are native Nebraskans. It is hoped that in the future more out-of-state students will be attracted into the program.

The actuarial program at Nebraska receives significant support from the Nebraska Actuaries Club and the insurance industry. Industry support is a key factor in the success and the continued growth of the program. □

A SIMPLIFIED ILLUSTRATION OF LIDSTONE'S THEOREM

by Richard W. Zink

The following illustration of the validity of Lidstone's Theorem is different from that given in the Part 4 textbook *Life Contingencies* 2nd Ed., by C. Wallace Jordan, on pg. 119, and for some students may be simpler. This illustration is not tailor-made for Part 4 students because knowledge of the 3-factor dividend formula, first covered extensively on Part 7, is a prerequisite. However, a quick explanation of the gain from interest, gain from loading and gain from mortality elements of the 3-factor dividend formula will usually suffice for most Part 4 students.

Consider a participating insurance of uniform amount 1 with level annual premiums.

Let P = Net annual premium based on i and q

L = e = Level annual expense provision and expense, respectively, due or incurred at the beginning of each policy year. In this illustration they will always be considered level by duration and equal to each other.

GP = Gross premium

= P + L (i.e. the net premium plus loading)

${}_tD$ = t—th year dividend payable at the end of every year if the insured paid the premium for the t—th year at the beginning of that year.

i′ = experience rate of interest

q′ = experience rate of mortality

$(GP-v'{}_tD)$ = Net payment by policyholder at beginning of t—th year.

It can be shown (see page 24 *Distribution of Surplus* by Joseph B. Maclean) that the contribution to surplus at the end of the t—th policy year for the plan under discussion which will leave the terminal reserve unchanged is

$$({}_{t-1}V + P)(i' - i) + (L - e)(1 + i') + (q - q')(1 - {}_tV),$$

the familiar 3-factor contribution formula. Since L=e, the gain from loading will equal zero, but is included for completeness.

Let the company pay out the entire contribution to surplus as a dividend. Now if the dividend increases with duration, then the net payments of $(GP-v'{}_tD)$ made by the policyholder will decrease. What we have in effect is a decreasing premium plan with decreasing net premiums of $(P-v'{}_tD)$ and a level amount of insurance.

Now consider a non-participating insurance of uniform amount 1 with level annual premiums.

Let P′ = Net annual premium based on i′ and q′.

GP′ = P′ + L (i.e. the experience net premium plus loading)

Comparison of Reserves

Let us compare various reserves on the participating and non-participating contracts respectively. On the participating contract the reserve on the decreasing premium plan based on experience interest and mortality is always equal to the reserve on the participating level premium plan based on valuation interest and mortality because of the nature of the 3-factor dividends. On the non-participating level premium plan let the reserve be based on experience assumptions.

Now it should be obvious that if the benefits on two policies are the same, the reserves on the one with decreasing premiums will be higher than the reserves on the one with level premiums, if both are based on the same assumptions. An extreme example is the reserves on single premium Whole Life, compared to the reserves on annual premium Whole Life.

Since the experience par reserves have decreasing net premiums, these reserves will be greater than the non-par experience reserves. But the par experience reserves are equal to the par valuation reserves. Hence the non-par reserves on experience assumptions are lower than the par reserves on valuation assumptions if the 3-factor dividends increase with duration. The opposite will be true if the 3-factor dividends decrease with duration.

We can now generalize these results to say that the reserves on a level premium, level benefit plan based on i and q will be higher (lower) than those based on i′ and q′ if

$$({}_{t-1}V + P)(i' - i) + (q - q')(1 - {}_tV)$$

increases (decreases) with duration, which result is Lidstone's theorem and completes the example. □

Continuing Education

(*Continued from page* 1)

Subcommittee 2 —

To investigate the best means of

a. accomplishing a literature search as to each of the subject areas identified by Subcommittee 1.

b. developing an appropriate bibliography or reading list for each subject area.

c. identifying places where the literature is weak.

Subcommittee 3 —

a. To investigate the best means of developing new literature to fill in the weak places (assuming that weak places can be identified through means recommended by Subcommittee 2.)

b. To make a recommendation as to how we might make available to Society membership the Study Notes developed by the education side of E&E committee.

Subcommittee 4 —

a. To investigate how other professions, with similar needs, have faced up to the matter of continuing education.

b. To investigate the possibilities of continuing education through the resources of some educational institution(s).

The Committee hopes to have some recommendations to make to the Society's Fall Board of Governors meeting. Meantime the Chairman will be glad to hear from any members with their suggestions within or without the areas delineated above. □

PROGRAMMING LANGUAGE

by Manuel R. Cueto

The article "Developing an Actuarial Programming Language" by Russell J. Mueller (*The Actuary*, April) suggests that "a study should be undertaken to determine the feasibility of developing" such a language. In this connection, I feel it to be appropriate to draw attention to some practical considerations which should form part of such a study.

In his article, Mr. Mueller refers to "IBM's support of APL—a computer language for statisticians." This language was devised by Dr. Kenneth Iverson, who is presently with the Research Division of IBM. Nevertheless, IBM has made this program author-supported only and not of a type which is supported by the IBM Corporation as are such high-level languages as COBOL, FORTRAN and PL/I. Moreover, APL is really a "time-sharing" language and not just a language for statisticians.

The question of "support" is concerned with the problems of compilers for, and maintenance of, high-level languages. Because such languages are not completely computer-independent, it is necessary for each manufacturer of computing equipment, if such language is to be supported and made available to the user to provide "compiler programs" for their respective computers. A compiler program translates the instructions written in the high-level language of the source program into machine language.

With respect to the maintenance of such languages, it should be noted that in today's computer environment it is also necessary to obtain the support of each operating system whether an electronic installation uses a tape, disk or full operating system. Briefly, operating systems which are generally furnished by the manufacturer of equipment consist of a comprehensive set of service programs and high-level language translators under the supervisory control and coordination of an integrated set of control routines. Furthermore, each version or "release" of an operating system, which incorporates certain improvements and advances over prior versions, must also include support of the high-level language. It follows, therefore, that modifications and improvements have also to be made in high-level

(*Continued on page* 6)

VALUATION OF COMMON STOCKS IN A NON-INSURED PENSION PLAN

by Charles C. McLeod

At a recent workshop of the Canadian Institute of Actuaries on pension plan investments, there was considerable discussion about adjusted book values of common stocks. The practice of valuing common stocks at market was discussed as being subject to too many fluctuations. These sentiments are echoed in the Society's Study Notes which describe in detail eight different methods of deriving adjusted book values.

What are we to do, however, if we do not know the book or cost value of the assets? This would be the case, for example, if units were bought in a mutual fund where dividends are invested in buying further units. When payments are being made into and out of the fund at random points during the year, it may be hard, if not impossible, to calculate what part of the assets represents dividend income and what part represents unrealized capital gains. This leads one to consider whether to use market value of assets in such a case, or to go one step further, to use market value in all cases even if the book value of the assets is known.

Let us distinguish at this stage between conservative valuation and undervaluation. Actuarial liabilities are usually valued conservatively. These liabilities relate to events in the future which we frequently cannot evaluate with any great accuracy. We therefore use a turnover scale, a valuation interest rate, etc., less than that which we expect. On the other hand we are usually certain of the value of the stocks in the portfolio. The prices are quoted daily and if we sold the portfolio, we know how much we would realize. (The only possible exception would be the sale of a block of shares so large that the size of the sale would depress the market value.) If the market value of our assets is $100,000 and we choose to value them at $80,000, this is not conservative valuation but *undervaluation.*

One reason given for undervaluing the assets is to allow for possible depreciation. This can be rebutted in a number of ways. First, if it is thought that the stocks will go down in value, then they should be sold. Second, the stocks were bought presumably in expectation of growth, so why should this growth (which has taken place) not be reflected in the valuation balance sheet? However, if one feels that the assets are not likely to go down in value but wishes to take precautions in case they do, one can hold an investment reserve liability equal to x% of the market value of assets. The value of x would vary with the possibility of loss. This could be done for each stock separately or for the portfolio as a whole.

It sometimes seems that many actuaries are apprehensive about common stock valuation in a pension plan and this may arise from historical actuarial background with life insurance companies. The situations however are different. If a life company's liabilities exceed the market value of its assets, then the company is insolvent. There is thus the tendency not to take a capital gain into account until the asset is sold and to use cost value until that time. With pension plans, the liabilities will frequently exceed the assets; for example a new plan providing past service benefits. If market values are depressed below cost value (assuming we know the latter), this will rarely mean that the plan must be terminated.

This short article has not considered the practical aspects in detail, nor the special problems which may occur—e.g., fixed-cost Taft-Hartley plans. Nevertheless, I hope it indicates that market value, or at least adjusted market value, of common stocks would give a better picture of the financial status of a pension plan than book or adjusted book (sometimes called "phony") values. □

ACTUARIAL MEETINGS

Oct. 7, Canadian Institute of Actuaries—Toronto

Oct. 8, Nebraska Actuaries Club—Omaha

Oct. 8, Actuaries Club of Indiana, Kentucky and Ohio—Columbus, Ohio

Oct. 9, Baltimore Actuaries Club

Oct. 14, Actuaries Club of New York, Joint Meeting—Tarrytown

Oct. 16, 17, Actuarial Club of the Pacific States—Pebble Beach

Oct. 24, Middle Atlantic Actuarial Club—Washington, D. C.

Oct. 30, 31, Southeastern Actuaries Club, Louisville

Programming Language

(*Continued from page 5*)

language programs so that they may be properly accommodated in the new version, particularly where multiple variable task techniques are being employed as a matter of more efficient operations.

Of necessity, the following questions naturally occur:

(a) Who will write the compiler for the actuarial programming language and set forth and enforce the standards for the various compilers, which experience has shown to be absolutely essential?

(b) Who will provide the maintenance of such language?

(c) Will the manufacturers or actuaries undertake such responsibilities?

When we consider the different types by the same manufacturer — currently ment produced by various manufacturers and different computers produced by the same manufacturers — currently in use among insurance companies it becomes a formidable problem. We should not lose sight of the fact that the cost of developing a programming language and the associated compilers is very high in both time and money.

There has indeed been a trend toward a "multiplicity of these computing languages." However, it may be a serious mistake to interpret this as "increasing evidence of the case for deciding that an actuarial programming language is not only feasible but appropriate" as Mr. Mueller states. On the contrary, many professional persons and systems and programming personnel deplore this multiplicity of languages and feel we need fewer but better languages.

From a practical viewpoint, the actuaries should focus attention on the current compilers, FORTRAN and PL/I. This method would be more feasible, obtain quicker results, and achieve through the manufacturer the support of the functions, notations and symbols typical of our actuarial mathematics.

Following this, the next step for facilitating computer usage by and for actuaries could be the establishment of a central library of actuarial programs written in existing standard high-level languages such as FORTRAN and PL/I. In the long run it would be far better and less costly to follow this kind of approach than to construct a purely actuarial programming language and its associated compilers. □