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ACTUARIAL EDUCATION OVERSEAS

by Linden Cole

The Society of Actuaries has special committees working now to try to identify ways of improving actuarial education in North America. We have discovered that similar efforts are underway in both the United Kingdom and Australia.

In the U.K., the Institute of Actuaries has its examinations broken into an "A" group and a "B" group, similar to our Associateship and Fellowship examinations. The Institute relies heavily on a tutorial program to teach the students, rather than leaving them entirely on their own. In the tutorial program, students are given drill problems and quizzes, and get feedback on their performance.

In Australia, the Institute of Actuaries in Australia requires the British "A" group, but an Australian "B" group, for Fellowship in the Australian Institute. They offer formal classes for the "B" group exams in both Sydney and Melbourne, where the vast majority of students are located. For the "A" group, however, the students in the Sydney area receive credit by means of the undergraduate courses at Macquarie University, without any further testing by either the Australian or the British Institute.

The concerns which the two Institutes have addressed are somewhat different from concerns being addressed by the Society of Actuaries. The first concern is that the system is putting too much strain on the available volunteers, because of the emphasis on tutorial courses and classes. They construct and grade quizzes and sets of drill problems, as well as the final examination. A second major concern is the average length of time to reach Fellowship,

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PARTICIPATING IN ACTUARIAL MEETINGS

by Bob Likins

One of the ways we can continue our professional development and contribute to our profession is to get involved in a Society of Actuaries or other actuarial organization meeting. We, of the Society's Committee on Professional Development, offer readers a reminder of how they can become participants in actuarial meetings.

Actuarial Meetings

There are many actuarial meetings to choose from. Besides the Society's four yearly meetings, there are also Section Meetings and Continuing Education Seminars. The American Academy of Actuaries sponsors meetings, including the Enrolled Actuaries meeting, and the Canadian Institute of Actuaries holds three meetings annually. The Conference of Actuaries in Public Practice has an annual meeting and the Casualty Actuarial Society has two meetings each year. Remember your local Actuarial Clubs — they are good places to share your expertise with a smaller group of people.

Meeting Forms

The Society meeting formats change to meet the needs of the subject matter and audience.

- *Panel Discussions* present specific topics with limited audience participation. Participants include the moderator, the panelists and a recorder. The moderator enlists the panelists who make presentations on the specific topic and the recorder who edits the remarks for inclusion in the *Record*.

- *Open Forums* are used when broad discussion of a topic is appropriate.

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WHY NOT RANDOM INTEREST?

by James C. Hickman

Instead of building on the assumption that time until death is a random variable, why doesn't *Actuarial Mathematics* start with the premise that the rate of investment income is a random process? During the past 20 years, it has been the uncertainty in the rate of investment earnings that has produced the greatest inconvenience in managing pension and insurance systems.

This question and statement are typical of many made to the authors of *Actuarial Mathematics*. The question deserves an answer. However, like most important questions, the response can be made at several levels, each deeper than its predecessor.

Tradition

The first answer is based on tradition. Life tables and actuarial science started together. A life table provides an estimate of the distribution of time until death. For many years methods of constructing life tables have been a topic in actuarial education. The same cannot be said for models of the rate of investment earnings.

Scenarios

A second response is motivated by the current popularity of developing interest rate scenarios. These scenarios are used in building models to estimate surplus requirements related to interest rate risk. Can these scenarios be used with a life table in a model that will combine the random nature of both time until death and the rate of investment income? The answer is a qualified yes. The qualification is that a probability distribution must be defined on the set of scenarios.

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EDITORIAL

We have recently been exposed to a semi-serious debate on the following subject: Resolved, that the supply of Type I actuaries exceeds the demand, while there are numerous opportunities for the too few of Type II. Type I includes those with strong mathematical, technical, and problem solving abilities; but weak in people skills. In Type II these strengths and weaknesses are reversed.

In this discussion the affirmative side appeared to have more support. Selection techniques used in the hiring of actuaries, emphasizing qualifications other than the strictly technical, were described. There was some implication that success in actuarial endeavor depends less on the ability to assimilate a specific body of knowledge than on the personal qualities needed for success in general business. Does it then follow that the Society's selection process emphasizes too much of the technical and the specialized? Might we do better to include more of the subjects taught today in business schools—communication, management, marketing?

But the point was also made that actuaries, like engineers, are problem-oriented by definition; and that persons without a flair for problem-solving can never be actuaries, no matter how advanced their people skills. This viewpoint clearly puts technical skills first, considering them a necessary, though not necessarily sufficient, attribute for actuarial success. Those who see it this way are presumably satisfied with our present system, requiring that an actuary demonstrate problem-solving abilities long before he has much opportunity to exhibit people skills.

We got the strong impression that participants like to think of successful actuaries as 'well-rounded'—that no matter how good one might be with *problems* or with *people,* he or she must not be too lacking as to the other. Such a requirement raises a new set of questions. Can a good personnel manager be a strong technician? Can a good problem solver be adept with people? Is there such a thing as a salesman-actuary? or an actuary-salesman? Can we expect to find an actuary skilled with all types of problems, including the not-uncommon type where *people* are the problem?

Readers will have noticed some drift in the interests of our profession away from the purely actuarial and toward other knowledge or skill that an actuary is likely to need. The continuing education effort of the Society is offering seminars on investment, management, communication, and other 'less actuarial' areas. Our current President, seconded in this issue by a past-president, used these pages (November) to encourage actuaries to develop communication skills. It may well be that the ability to speak and to write clearly and effectively, a skill that *we* include within *both* the problem-oriented and the people-oriented categories, is more important than any.

Clearly these few straws-in-the-wind are no indication of reduced emphasis on the unique characteristics of our profession; but they may be an indication that, in this day and age, technical know-how is simply not enough.

C.L.T.

Actuarial Education Overseas

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which they would like to see sharply reduced.

In the U.K., the Institute's committee in this area is recommending that the responsibility for the "A" group of examinations be given to two universities, one in England and one in Scotland. Students would pass their courses to receive credit for the "A" group exams. Overseas candidates would still take Institute "A" group examinations. There would thus be a sharp reduction in the number of correspondence courses and exams to grade.

To meet the second concern, it is proposed to hire FIAs to administer the tutorial program for the B examinations.

This proposal assumes that the universities will do a faster and equally effective job of education on fundamental principles than the present system, reducing the time required to get credit for the "A" group of examinations without lowering standards. A student studying full-time would be expected to have credit for all of the "A" group of examinations in one year.

In Australia, the Institute has observed that the group of students who completes the classes (including doing all of the homework and taking all of the quizzes) have far higher passing percentages than the group of dropouts. Their proposal, following up from that observation, is that after a first unsuccessful attempt on an examination, students will be required to complete all classwork before that examination can even be taken again.

Reducing the number of poor papers and the number of failing students would ease the strain on the volunteer system, and (assuming that students presently dropping out would do much better if they are forced to continue with the classes) reduce the time to Fellowship.

The proposals are now being circulated to members of both Institutes for discussion. It appears that they are likely to be accepted and implemented. □

Why Not Random Interest?

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Those who construct interest rate scenarios often do so based on their view of the future rather than on an analysis of data. A statistical model of interest rate experience would automatically provide an estimate of the distribution of forecast errors. In the case of interest rate scenarios, the assignment of a probability to each scenario will involve an application of subjective probability elicitation methods. For example, the actuary making the assignment might think of a standard urn containing B black balls and 100-B white balls. The composition of the hypothetical urn can be changed by mentally changing B. When the actuary is indifferent between two small bets, one in which he wins if a black ball is drawn and one in which he wins if the interest rate scenario under consideration is realized, he has assigned probability B/100 to the scenario. Iteration of the elicitation process may be needed to guarantee that the assignments satisfy the axioms of probability.

The next steps follow a path used in *Actuarial Mathematics.* (1) Formulate a loss variable which measures the loss to the insurer, recognizing that the value of the loss will depend on the random variables time until death and the interest rate scenario. (2) Determine the net premium by invoking the equivalence principle. This principle requires that expected losses be zero. If we assume that time until death and the interest rate scenario have independent distributions, the variance of the loss on each policy is easy to compute. The variance helps measure the risk assumed by the insurance company in issuing the policy and it can be used to make approximate probability statements about the present value of future cash flows.

For those seeking greater precision, a set of notes tracing the development for a whole life insurance follows on page 4.

Insight into the scenario approach comes from considering identical policies issued at one time to n lives all at the same age x. It is reasonable to assume that the n time until death random variables are mutually independent and have the same distribution, defined by a life table. However, under the scenario model all of the policies will have their cash flows valued under the same interest rate scenario, selected in accord with the probability distribution defined on the set of scenarios.

Because of the independence among the time until death random variables and the operation of the central limit theorem, one can expect that average loss due to mortality will be more stable for large groups. The set of annual rates of investment earnings will be the same for each policy. Therefore, the impact of interest rate variability on the average present value of cash flows will not necessarily be reduced for larger groups. This effect has been observed by insurance managers during the recent roller coaster path of interest rates. The mathematical notes that follow develop this point.

Time Series Models

The persistent questioner may respond that he does not have in mind a probability distribution on a set of interest rate scenarios. He prefers a more data centered model or at least one that provides more flexibility than the fixed sample paths of the scenario approach. Is it possible to integrate time series models for interest rates with probability based life contingencies models? The answer, which constitutes the third response, is yes. It comes in three parts.

(1) A great deal of effort has gone into building statistical models for interest rates. These models provide point estimates of future interest rates and estimates of forecast error distributions. Much of this modeling activity has not been entirely satisfactory to actuaries. Actuaries tend to be interested in interest rates over the long term. Changes in the economic environment such as wars, oil embargoes, shifts in fiscal and monetary policy are reflected in unanticipated changes in the time series forecasting models and their parameters.

(2) Combining time series models for interest rates with life contingency models has been the subject of several recent papers. As might be expected, letting each annual rate of interest be a realization of a time series model can result in marked increases in the variances of future insurance losses. A bibliography of some of the papers follows.

(3) Suppose you have a multivariate distribution of future interest rates. The distribution could be obtained by fitting a time series model to past data or by more subjective methods. Then by simulation a realization of the interest rate in each year can be generated and used to create sample paths of interest rates. These randomly generated interest scenarios can be used with times of death, also produced by simulation, to build an empirical distribution of future losses.

Management of Risk

Whenever a conversation on the desirability of introducing random interest rates occurs, someone usually takes a management view. This position, which is the fourth and most comprehensive response, can be summarized as follows. It is true that interest rates have been more volatile in recent years than in earlier periods in the history of insurance and pensions. It is also true that the volatility is reflected in financial results. However, the goal should be to educate actuaries on how to manage interest rate risk, not just to model it. By careful risk classification, product design and reinsurance, mortality risk can be managed. A combination of product design and investment strategy, such as Redington's immunization laws, can reduce interest rate risk and moderate the financial impact of interest rate variation.

Summary

Interest rate variation and resulting risk is a fact of business life. There is a variety of methods for incorporating estimates of the distribution of future interest rates into life contingency models. As yet, there is no consensus on which of these mthods should be introduced into basic actuarial education.

Bibliography

Boyle, P.P., "Rates of Return as Random Variables," *Journal of Risk and Insurance,* Vol. 43, 693-713 (1976).

Panjer, H.H. and Bellhouse, D.R., "Stochastic Modelling of Interest Rates with Applications to Life Contingencies," *Journal of Risk and Insurance,* Vol. 47, 91-110 (1980).

Panjer, H.H. and Bellhouse, D.R., "Stochastic Modelling of Interest Rates with Applications to Life Contingencies—Part II," *Journal of Risk and Insurance,* Vol. 48, 628-637 (1981).

Pollard, J.H., "Premium Loadings for Non-Participating Business," *Journal of the Institute of Actuaries,* Vol. 103, 205-212 (1976).

INTERNATIONAL SUMMER SCHOOL

The Association of Swiss Actuaries is organizing its fourth Summer School on the topic, "Stochastic Models for Life Contingencies."

The time: September 2-6, 1985. *The place:* University of Lausanne, Lausanne-Dorigny.

Application forms, which must be submitted by April 30, may be obtained by writing to:

René Held
c/o Swiss Reinsurance Company
PO Box CH-8022 Zurich

DOG LIFE INSURANCE IN SOCIETY ANNALS

It was startling to discover that life insurance on dogs, which has been discussed as a new enterprise in this newsletter's columns, came up in the *Transactions* nearly 60 years ago.

That subject entered into the discussion by Canadian actuary A.D. Watson (T.A.S.A. XXVIII, 297) of Walter G. Bowerman's paper in the same volume, "Blood Pressure By Build When Build is Measured from Best Weight Rather than Average Weight". Mr. Watson was arguing by analogy, not proposing that dog life insurance be undertaken; the excerpt reads thus:

> If a "Dog Life Insurance Company" were formed, insuring dogs of all breeds, as well as mongrels, it is quite possible the different build-types, i.e., different breeds, would show important differences in mortality. The average build-type would, of course, depend on the proportions in which the several breeds became insured, but there is no reason to expect that it would in any "dog-company" bear any relation to the best build-type. It might in fact correspond to no breed of dogs at all. Having ascertained the best build-type, what Actuary would counsel other dogs to try to approximate to that type? Any dog following the routine of the regimen necessary to that end would certainly "lead a dog's life" and would likely find the natural span too short to accomplish much.... □

E.J.M.

NOTES ON RANDOM INTEREST

Notation

Interest rate scenarios

$$r_j = \{i_{j1}, i_{j2}, \ldots\}$$

where i_{jk} = interest rate in policy year k, interest rate scenario j. Probability distribution for random variable, R, interest rate scenario

$$P[R = r_j] = p(r_j)$$

Present values

$$v(r_j)^k = \prod_{u=1}^{k} (1 + i_{ju})^{-1}$$

$$\ddot{a}_{\overline{k}|}\, r_j = \sum_{u=0}^{k-1} v(r_j)^u$$

Actuarial present values, given interest rate scenario r_j

Insurance

$$A(r_j)_x = \sum_{k=0}^{\infty} v(r_j)^{k+1}\, {}_kp_x q_{x+k}$$

Annuity

$$\ddot{a}(r_j)_x = \sum_{k=0}^{\infty} \ddot{a}_{\overline{k+1}|}\, r_j\; {}_kp_x q_{x+k}$$

Loss Variable — whole life insurance, fully discrete model

$$L(K,R) = v(R)^{K+1} - \pi \ddot{a}_{\overline{K+1}|}\, R$$

= (present value of benefits) − (present value of net premiums)

Net Premium — by the equivalence principle

$$E_R\left[E_{K|R}\, L(K,R)\right] = 0$$

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MEET ME IN ST. LOUIS

by Richard K. Kischuk

Plan now to be in St. Louis on May 23-24, 1985 for the Society's special topic meeting on Life Company Financial Reporting. This meeting is being cosponsored by the Financial Reporting Section.

The meeting will open with the general session which will include a debate on the role of the valuation actuary in the U.S. Sessions throughout the meeting will examine the emerging role of the valuation actuary in areas such as defining investment policy, product development and signing required statements of actuarial opinion. Another session will compare the role of the valuation actuary in the United States, Canada and the United Kingdom.

A double session will examine the topic: "Has the NAIC Annual Statement Blank Outlived Its Usefulness?" In part, this session will be used to gather input for possible sweeping revisions in the NAIC annual statement blank. John Montgomery introduced some of the ideas that will be discussed in St. Louis during the "Current Topics" panel at the annual meeting in Toronto.

Actuaries who are interested in management reporting won't want to miss sessions devoted to topics such as management reporting for mutual companies, product line capital allocation, financial performance "yardsticks," earnings analysis by product and source, accounting for segmented portfolios, capital budgeting, investment income allocation, and expense allocation.

Many actuaries will want to take the opportunity to catch up on today's "hot topics" in financial reporting. These will include sessions on accounting for new products, demutualization, federal income tax, reinsurance, accounting for nontraditional distribution systems, and accounting for internal replacement programs.

Finally, plans are underway for one or more seminars to be held on May 22, the day before the Society meeting. Preliminary plans call for a seminar devoted to practical approaches to evaluating interest rate risks. Society members have indicated a lot of interest in a seminar covering practical tools that actuaries can use in evaluating these risks.

All in all, this will be an exciting three days. □

BROCHURE

The Preliminary Actuarial Exams brochure has had a recent update. More recent exams have replaced the older exams in the former edition. Copies of the 1984 version of this popular recruiting piece can be obtained from the Society's office.

Notes on Random Interest

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This implies

$$\pi = \sum_j A(r_j)_x \, p(r_j) \; / \; \sum_j \ddot{a}(r_j)_x \, p(r_j).$$

Variance — assuming independent distributions for K and R

$$\mathrm{Var}(L(K,R)) = \sum_{j=1} \sum_{k=0} (v(r_j)^{k+1} - \pi \, \ddot{a}_{\overline{k+1}|r_j})^2 \, {}_{k|}q_x \, p(r_j)$$

Variance for a Group — n policies all issued at age x

$$\mathrm{Var}\left(\sum_1^n L(K_i,R)\right) = n\mathrm{Var}(L(K,R)) + n(n-1) \sum_j (A(r_j)_x - \pi \, \ddot{a}(r_j)_x)^2 \, p(r_j).$$

LETTERS

Cost Comparisons

Sir:

Mr. Koppikar's letter (October issue) about yearly prices per $1,000 of protection (YPPs) prompts several comments.

First, he says the YPPs are interest sensitive, which they are. I hope he is not implying there is something wrong with them. They are interest sensitive because interest is a significant factor in a cash-value life insurance policy. Any price measure that is not interest sensitive is meaningless.

Second, he says the YPPs are high in the first year, which they typically are. I hope he is not implying there is something wrong with them. They are high in the first year because they reveal the front-end load in the typical cash-value life insurance policy. Any price measure that does not reveal the high first-year price does not provide rigorous disclosure to the consumer.

Third, he says the YPPs combine expenses with mortality costs, which they do. The comment is hardly a novel one. More than twenty years ago, E. J. Moorhead (a person well known to readers of this newsletter) suggested separating expenses from mortality costs. He made the suggestion in a comment published in the September 1962 issue of the *Journal of Insurance* (now the *Journal of Risk and Insurance*). The comment was concerning my first article on YPPs, which was published in the December 1961 issue of the same journal.

Fourth, Mr. Koppikar says that what we need is a method of separating expenses from mortality costs and showing their discounted values at issue. My first major article on that very subject was published in the March 1969 issue of the *Journal of Risk and Insurance.* The technique described in the article has come to be known as the "retention method."

We do not need discussion about disclosure methods, because the methods already exist or can be developed readily. What we need are courageous regulators willing to adopt rigorous disclosure requirements that are adamantly opposed by the life insurance industry. I know of no such

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