The Actuary

The Newsletter of the Society of Actuaries

VOLUME 7, No. 5 — MAY, 1973

COMMITTEES

Editor's Note: This is another report on the operations of the Society's Committees. Mr. Biggs is Chairman of the Committee on Review.

Committee on Review

by John H. Biggs

A good scholarly journal is characterized first by its excellent papers and discussions. An important secondary characteristic of such a journal is the material included in its book review section. In this material the members of the profession have the chance to comment on the various new texts in their field and on a broad ranging variety of texts that impinge on their subject. The principal job of the Committee on Review is to make sure that the *Transactions* includes a complete and lively series of book reviews on actuarial and other mathematical texts. Responsibility for the Society's library is also vested in this committee.

We recently defined for the Society's Board of Governors the following purposes for our committee:

1. We should be sure to obtain competent reviews of all significant actuarial texts.
2. We should identify texts which are not of an actuarial character but of interest to a significant number of actuaries. We should obtain reviews or digests of these texts.

   (The underlying purpose of both (1) and (2) is to make the book review section of the *Transactions* useful, educational, and interesting to the members of the Society.)
3. Since the *Transactions* is a part of every actuary's "research data base" we should make sure that reviews, references, and digests form a complete and comprehensive source.

(Continued on page 6)

The Board of Governors has received numerous enquiries about the Society's position in the Equity Funding situation. The Board has appointed an investigating Committee to keep in touch with developments and with the various authorities conducting investigations. The Committee will report back to the Board when the final results of the various investigations are available. Because of the many complexities in the situation it will likely be some time before these investigations are completed.

Thomas P. Bowles, Jr.
President

PENSIONS

Congressman John N. Erlenborn of Illinois, ranking Republican on the General Subcommittee on Labor of the House Education and Labor Committee, is pleased to announce appointment of

RUSSELL J. MUELLER, F.S.A.

Actuary and Minority Legislative Associate for the Pension Task Force.

Mr. Mueller is interested in receiving individual comments from concerned actuaries on any of the pension reform bills now pending before Congress. These comments will be considered as the Task Force continues its studies into the vesting, funding, and plan termination insurance areas. Copies of the Subcommittee Report, *Estimates of the Cost of Vesting in Pension Plans*, by Professor Howard E. Winklevoss of the Wharton School, are available upon written request to Mr. Mueller at: House Pension Task Force, 112 Cannon House Office Building, Washington, D. C. 20515.

DISABILITY AND PROBABILITY

by Robert L. Whitney

Jack Moorhead has urged me, partly in my capacity as Chairman of the Committee on Experience under Individual Health Insurance, to comment on the sales promotion statements that follow the format of:

> "For a man age 35 there is a 50-50 chance that he will be disabled for at least 90 days continuously before he reaches age 60."

With the help of many members of the Committee, particularly Jim Olsen and Ben Helphand, the following is what I have learned.

An early use of the above type of probability statement appeared in an article by Robert A. Brown, Volume III (1953), of the *CLU Journal*:

> "A further study of the hazard of disability based on the 1952 Society of Actuaries report reveals that, of a thousand persons who are age 35, 33% of them will suffer a long term disability (three months or longer) before 65."

The methodology used to determine the 33% involved starting with a radix of 10,000 individuals at age 35 and applying q_x and r_x to obtain the numbers dying and the numbers becoming disabled during each of the years of ages between 35 and 65. The mortality basis for this double decrement table was the 1946-49 Ultimate Basic Table. The disability rates were the Benefit 2 rates shown on page 94 of the 1952 Report of Mortality and Morbidity Experience. The methodology used here is quite reasonable and practical. Refinements might have been introduced in applying the r_x to reflect the effect of multiple disabilities. I am inclined to agree with Ben Helphand, who was responsible for the

(Continued on page 7)

The Actuary

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EDITORIAL

IN the President's message in the November 1972 issue Mr. Bowles told the members of the Society that the actuary could no longer lead a cloistered existence, that actua ies had to take their place in the outside world and, in effect, had to be prepared to stand up and be counted.

The speed of events is sometimes faster than the prophet expects and in the six months that have elapsed since the Editorial was written, the profession has surely become aware of the world outside, sometimes not in the pleasantest way. These may be times that test the soundness of our structure as a profession.

As professionals we must look at all these current happenings in their proper perspective and must not let ourselves be hurried into a position of either attack or defense merely for the sake of doing something. On the other hand we must avoid complacency and the Society must continue to be vigilant in the protection of the professional standing and standards of its members.

The problems that involve the Society are varied. These cover our relations with the public, with the regulatory authorities both Federal and State, and with other professions. The important point is that they affect all members of the Society. We will be judged and held accountable as actuaries irrespective of the field in which we may specialize and we might well remember Benjamin Franklin's comments on "togetherness."

There is little or nothing in the Syllabus of Reading (or even in the field of Continuing Education) to help in the solution of the many problems that confront us. The solutions will have to come from the members of the Society individually aware of their professional responsibilities.

A.C.W.

TO BE CONTINUED

Editor's Note: This is another in the series of articles from the Committee on Continuing Education. Comments will be welcomed by the Committee and by the Editor.

New York Insurance Department Report on Regulation

by Manuel R. Cueto

In January of this year, the New York Insurance Department issued a draft report on "Regulation of Financial Condition of Insurance Companies." Copies were made available to the Insurance Departments of other states and to the insurance industry.

Suggestions made at the public hearing held on March 5, (where comments were, in general, most favorable) and any proposed modifications subsequently submitted, will be considered for inclusion in the final report.

The report is the product of a two-year study and comprehensive critique of the Department's basic regulatory activity the cost of which accounts for more than half of the annual budget. The study was prompted by a number of important considerations and developments which, of themselves, demand changes in philosophy and practice. Included among these considerations are the following:

(1) The special appropriateness of a systematic review and re-evaluation of regulation of financial condition because the present system has become so complex and so steeped in tradition built over the years.

(2) The impact upon the regulatory system of the rise of consumerism and the need to review the effectiveness of the Department's insurance consumer protection activities.

(3) The desirability of a thorough analysis of the adequacy and relevance of present regulatory practices concerning financial conditions in the light of the increasing complexity of the insurance business and changes in the ownership and control of insurance companies.

(4) The broad implications that the creation and expansion of insurer insolvency guarantee funds have upon the regulation of financial condition of insurance companies and the desirability of filling the gaps that currently exist in this protection.

(Continued on page 8)

LETTERS

Notation

Sir:

Howard Kayton's creative suggestion in the March issue of *The Actuary* to call males "M_x" and females "M_{x3}" reminds me of the Women's Libber in our actuarial department who reported that certain companies used a 3-year set-forward for male rates.

To confuse the situation still more, if the next CSO Table preserves the hump in mortality in the early 20's instead of smoothing it out as did the 1958 CSO Table, it may be necessary on term policies of short durations to use a 3-year set-forward for female rates.

John S. Moyse

* * * *

Sir:

The caption, "Male Chauvinist Actuarial Notation," used in the March 197? issue reflects keen analytical powers applied to the words of one Mr. H. H. Kayton [illegible] these would seem to be definitely [illegible]ed along chauvinistic lines. He evidently would want us to use a male age x symbol for a reference point of comparison. We should not be deceived by his expression "a delightful difference" since he undoubtedly has been charmed by a local perturbance of undeniably elegant pulchritude.

Mr. Kayton should be advised before he makes any more suggestions to consider the implications of adopting the title M_{xt} in recognition of a mixed up situation. Here, x would represent the true age of a person (no distinction as to sex) and t would represent the life table appropriate for the person being addressed. Under this mixed-up address notation, one could discreetly enter a two-dimensional table to determine if the person might be considered to be r years younger or older than the value of x (i.e., 3 years younger for insurance purposes; 6 years younger for annuity purposes, or perhaps even 10 years older for certain old nannies and goats who have led lives of debauchery).

[illegible]nk you for calling this situation to my attention. We must be careful of how we make "demonstrations for impression[illegible]

John M. Boermeester

* * * *

Examinations

Sir:

The current restructuring of the Fellowship Examinations simply continues the practice of laying the groundwork for the next revision which may not be long delayed.

Apparently the "Pentagon" of the Society's Education Examination and Allied Committees fails to realize why revisions have to be made so frequently. Perhaps the "Pentagon" does not appreciate the turmoil into which the student body is thrown at each revision of the syllabus.

The reason for these many revisions is quite simple; the syllabus is a framework of parts, it should be a framework of topics. If the examination parts were arranged according to topics, future revisions would simply be adding or deleting material to suit changes in our knowledge of the topic. This would put an end to the shunting of topics from Part to Part.

I have various ideas on the syllabus and the allocation of topics but I will content myself with suggesting that the syllabus for the Associateship Examination is rather inadequate. Computer analysis could be added to the existing Part 1 (or Part 3). Furthermore, a fuller coverage of Finance in Part 3 could be achieved by the addition of Economics, Theory of Money and Banking (including Federal Reserve System.)

The educational aim of the Society should be to qualify those students who have a wide yet general grasp of the topics which an actuary encounters in everyday life without emphasis and [illegible]cialization in any one field. Such [illegible]cialization can be left to each individual according to his own interests and choice.

G. B. Saksena

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Work and the Quality of Life

Sir:

Mr. Pedoe's otherwise excellent review of "Work in America . . ." in the April issue is marred by his gratuitous observation that ". . . life without health is a tragedy and longevity without health a disaster." That statement is philosophical, not actuarial, and is certainly subject to challenge on philosophical grounds.

I do not argue that illness is better than health, and I certainly concede that the existence of large numbers of human beings who require permanent and complete custodial care poses difficult ethical problems for society at large. On the other hand, history is so studded with examples of people who made outstanding contributions to society while enduring "longevity without health" that Mr. Pedoe's sweeping statement is well off the mark (as well as being unrelated, as far as I can tell, to the remainder of his article).

A bibliography could be compiled to support the above. I have not done so, but one might start with the Autobiography of Helen Keller and, perhaps, Milton's *On His Blindness*.

Daniel J. McCarthy

* * * *

Sir:

Despite having, at least, my full share of effrontery, I have some trepidation in offering comments on Mr. Pedoe's review of "Work in America."

1. It seems to me that too many persons are too much concerned with those who "are dissatisfied with the quality of their working lives. Dull, repetitive, seemingly meaningless tasks, offering little challenge or autonomy are causing discontent among workers at all occupational levels . . .". During at least the first 10-12 years of my employment, I spent a very large part of my time doing dull, repetitive tasks. I realised that they were necessary and built up little discontent; there must be very few people indeed capable and able to spend most of their time doing original work and making important decisions; certainly this must be true of their earlier years of employment. And I would like to point out that even in the most deadly of dull, repetitive work, the individual can still take pride in doing his work well and can still let his mind run free to contemplate grander things. (Didn't some one invent the spinning jenny under such circumstances—and Edison the telegraph relay?).

   Perhaps the most fortunate people are those who can feel they are performing important work while doing things you or I might not care for.

(Continued on page 4)

Letters

(Continued from page 3)

Many years ago, many offices had spittoons as many people chewed tobacco—in my Company, "they" convinced one janitorial employee that he was expert at cleaning spittoons and gave him a full-time job doing so. He was reportedly quite happy.

On a somewhat higher plane, consider teaching in the public schools. Presumably a reasonably high proportion of teachers have above-average intelligence and sensitivity. My wife tells me that in several years of teaching High School mathematics and science she had only two students who were able enough and interested enough for her to have any real satisfaction teaching. For the most part the work must be "dull, repetitive, seemingly meaningless" if one wants to consider it so. And so it goes for almost all useful work.

As a side view, I might compare work with diet. I understand and believe that an individual can get perfectly accustomed to a monotonous diet—I know, and you probably do, people who for breakfast invariably have orange juice, soft-boiled eggs toast and Coffee. Voluntary monotony!

2. I, too, read about the many people at advanced ages in the Caucasus. Maybe so. I can't lay my hands on supporting data which I have seen, but Actuarial Study No. 3 by Wolfenden, page 46, refers to the correlation between illiteracy and the numbers claiming to be 100 or more years of age, and to supporting data in the 1910 U.S. Census reports. Since there is wide-spread veneration of old age, there is certainly a temptation to overstate when there is little or no evidence to contradict. It seems unfortunate that neither Benet nor Leaf considered this likely possibility. If some one 80 wishes to claim 100 there are few to contradict him and the more primitive the area the fewer and less accessible they are.

Edwin L. Bartleson

* * * *

Sir:

Dr. Arthur Pedoe's interesting review of "Work in America" mentions the article "Search for the Oldest People" by Dr. Alexander Leaf in *National Geographic* (later capsulated in *Reader's Digest*).

After a trip to the Soviet Union in 1958, I made an analysis of centenarians in the USSR. I found that there were far more persons aged 100 and over than would be expected as the survivors of the same year-of-birth cohort from a previous period. The same holds true in the United States, but not to nearly as great an extent (*see TSA, XI*, p. 723, *and XVI*, p. 309).

I am convinced that there are not nearly as many centenarians as Dr. Leaf believes. I am especially dubious of the ages of those discussed as being well beyond age 110 (*see TSA, VII, p.* 63). Certainly, these people are quite old, and their habits and medical aspects are interesting and significant. However, the proofs of age are suspect. For example, the oldest case seems very questionable since, among other things, she was supposed to have borne a child after age 50.

A statistic that casts doubts on the authenticity of the advanced ages cited by his cases, is that the majority were men, whereas, with the superior longevity of women, the sex ratio of true centenarians is heavily weighted in the female direction.

Individuals' statements about their ages and what they remember of past events when they were a certain age are virtually worthless from a scientific standpoint. I once investigated the case of the alleged oldest Social Security beneficiary, stated to be about 129 years old. The proof of this, as accepted by our public information people, was that he remembered standing on the docks in Liberia in 1840!

I do not doubt the veracity of these alleged oldest living human beings. Likely, they have fooled themselves and now believe what is patently untrue.

Robert J. Myers

* * * *

Papers

Sir:

As Chairman of the Committee on Papers I would like to supplement the references to the Committee in Mr. Bragg's report on *Actuarial Literature* in the April issue.

Apparently the basic complaint is that there are too many highly technical papers published.

I have stated that the Committee on Papers can only review the papers submitted to them, and Jo Beers explained this in *The Actuary* of February 1969 as follows:

> "The Committee on Papers is charged with evaluating the papers submitted. We can do nothing about papers which are needed but which have not been written."

It was also suggested that the Committee on Papers tended to accept technical papers and reject non-technical ones and this discouraged potential authors of non-technical papers. My impression is that the degree to which the content of a paper is technical is not a major factor in acceptance or rejection.

I looked up the records of the last 46 papers reviewed by the Committee to see if this were true. I found that I immediately had difficulty in deciding which papers were highly technical. The presence of a few formulas would not make a paper technical since almost every paper had some formulas. I finally adopted the definition that I deemed a paper to be highly technical where (a) a considerable proportion of the paper was formulas or (b) the formulas were of a highly technical level or (c) the point of the paper depended on the manipulation of the formulas.

Using this definition I concluded that 22 of the 46 papers were highly technical and 24 were not. Half of the highly technical papers submitted were accepted, and 60% of the not highly technical were accepted.

We cannot draw many firm conclusions from statistics such as these. My review was of course very subjective and someone else would get a different split into the two types. However, the figures do reinforce my opinion that a paper is *not* more likely to be accepted just because its content is highly technical.

Personally I would like to see more non-technical papers published; these might include "state of the art" papers and others which would present new ideas of interest to the profession. When I wrote the actuarial examinations years ago most references were to papers or actuarial books published by the Society. Today most of the references in the syllabus are to Study Notes. I believe that many fine papers could be written based on the Study Note material, and I hope the authors of the Study Notes are not deterred from writing papers because they think only highly technical papers are accepted by the Committee on Papers.

W. B. Waugh

ACTUARIAL TECHNIQUES IN APL

*by D. W. F. Crossley**

APL is both a unique form of mathematical notation and a programming language. As a notation it has intrinsic appeal and gives rise to many elegant and ingenious definitions of mathematical concepts. As a programming language, or system, it also provides the user with instant evaluation of these concepts. The combination is extremely powerful, and some interesting applications may be demonstrated with respect to annuities.

Consider the annuity $\ddot{a}_x$, defined by

$$\ddot{a}_x = \sum_{t=1}^{\omega-x-1} v^t \, {}_tp_x .$$

The quantities $1, v, v^2, \ldots,$ and $1, p_x, {}_2p_x, \ldots,$ are two vectors of equal length, which may be denoted by V and TPX, respectively. The above summation is then expressed in APL by the symbols $+/V\times TPX$, where "$+/$" is the APL equivalent of Σ. There are no summation limits—these are implicitly defined by the length and content of the vectors V and TPX. There is insufficient space to describe how these two vectors may be represented in APL, but neither is difficult or involves more than a short line of coding. The appropriate expressions may be substituted for V and TPX, and $\ddot{a}_x$ may then be evaluated at an APL terminal.

This is a simple enough concept, but at this point it does not have any advantage over the much easier calculation: N_x/D_x. The vector method, however, is capable of much greater flexibility.

Consider a vector of payments $p_1, p_2, \ldots,$ denoted by P, having the same number of terms as TPX. The present value of an annuity returning these amounts each year is $+/P\times V\times TPX$, and P can be specified at will to represent any kind of payment pattern. Missing payments, as in the case of deferred or temporary annuities, are equivalent to payments of zero. Thus annuities of any nature—increasing, decreasing, temporary, deferred, reducing after a given age, or any combination—may all be evaluated by respecifying P, and it is interesting that by generating a vector of payments increasing by, say, 5 per cent one could evaluate an annuity that offsets inflation.

* Mr. Crossley is a student of the Society.

Joint-life annuities such as $\ddot{a}_{xy}$ are represented by

$$+/V\times TPX\times TPY ,$$

where TPY is the vector $1, p_y, {}_2p_y, \ldots$. In this case the mortality basis for (x) and (y) need not be the same, implying that TPY might refer to probabilities taken either from another mortality table or from another type of decrement table. This expression need not be limited to two lives; thus joint n-life annuities may be evaluated without using joint-life commutation columns or tables of uniform seniority.

The vector V has so far been assumed to involve only one interest rate, but this is an unnecessary restriction. It is a trivial problem to create discount factors based on rates i_1 for ten years, i_2 for the next five years, and i_3 thereafter, for example; then all the foregoing expressions become much more powerful because they have the ability to utilize varying interest rates.

Last, there is the problem of annuities payable m times per year. Given a period interest rate $i^{(m)}/m$, and a mortality table of m entries per year, the year loses its fundamental significance and is replaced by the period defined by $1/m$. A mortality table can be expanded by inserting intermediate values based on arithmetic or geometric means, or according to the Balducci hypothesis, for example. The age and all periods should now be made m times greater, and the identical APL expression will evaluate an annuity of any fundamental period. Moreover, this table may be entered at nonannual points, thereby allowing for calculations at fractional ages.

The above expressions do not rely on commutation columns, but it should be emphasized that they are by no means made redundant by this approach. APL can utilize commutation functions very effectively, and standard calculations should still be performed with them. Beyond the scope of this method is the vector or first-principles approach, which undoubtedly has great merit, and, through these combined procedures, APL will become, or already is, an invaluable aid for many actuaries.

For further information concerning the use of APL please write to D. Crossley, I. P. Sharp Associates, P.O. Box 71, Toronto Dominion Centre, Toronto, Ontario M5K 1E7.

Letters *(Continued from page 4)*

Youth

Sir:

While visiting the cancer center at the National Institutes of Health in Bethesda, Md., where unbelievable breakthroughs in medical research are being developed, I was surprised at the youth of the doctors. Most of the doctors seemed to be under 35. Also, I seem to recall a statement by a math professor of mine that most of the brilliant breakthroughs in math have been made by mathematicians who were under 25.

What about our younger actuaries? What brilliant breakthroughs are they developing? — The actuarial exams? — Repetitive clerical work? I wonder if actuaries really need to memorize material or do they just need to know where to find that material? What would happen to our profession and to our industry if the actuarial exam syllabus were cut in half and companies were encouraged to contribute two years of their new F.S.A.s' time to centers of research? Perhaps our profession could contribute to objectives higher than larger corporate profits or larger policyholder dividends.

Jim Lewis

* * * *

Study Manuals

Sir:

I would appreciate the courtesy of your columns to advise users of the Northeastern study manuals of the following.

To expedite production of the manuals, Northeastern will prepare the basic manual without the later study notes, and then send additional pages to manual purchasers if the later notes constitute a significant part of the exam material. Because of the extra clerical work involved in this subsequent mailing, it will be imperative that order forms for the

(Continued on page 6)

Letters

(Continued from page 5)

manual be accurately and completely filled out.

Specific information will be sent to all members of the Society preceding each exam period. We expect to be mailing this information by July 1 this year, with order forms, price, and availability date for all of our publications.

Richard L. London
Assistant Professor
Northeastern
University

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Survivor Benefits for the Uniformed Services

Sir:

Mr. Kriss Cloniger, III, gives an interesting description of the new legislation on Survivor Benefits for the Uniformed Services in the April issue. This plan, replaces the previous Retired Serviceman's Family Protection Plan. This last was intended to be on an actuarial-equivalent basis, fully paid for by the retired members, but was not widely used—probably because of the lack of a "bargain" to the participants. The cost of the new plan is more than implied by the Survivor Benefits since the Government has, in addition, to pay for non-contributory retirement and disability pensions and for the employer's share of Social Security.

The new SBP closely parallels the provisions for survivor benefits for pensioners under the Civil Service Retirement Act. Mr. Cloniger cites the reason for the automatic adjustment of benefits, the CPI increase plus 1%, as being "meant to recognize the lag time in the adjustment process." Careful analysis indicates that this is not so. To accomplish this result would require such an increase to be made for each pensioner only the first time that an adjustment is applicable to him.

The same fallacious reasoning was given by the House of Representatives when it enacted this provision for Civil Service Retirement. When the error was pointed out in the Senate consideration of the legislation, the same basis was retained, but the "rationale" was changed—the 1% supplement was "justified" as letting the pensioners have a share in the increased productivity of the nation (as reflected by wages generally rising more rapidly than prices).

Robert J. Myers

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Committee on Review

(Continued from page 1)

4. We should coordinate closely with the editor of *The Actuary*, in providing good book review coverage, on a more timely basis in *The Actuary* and of a more permanent comprehensive character in the *Transactions*.
5. Another important objective is to extend the usefulness of the Society's library. Hopefully the recent addition of the computer bibliography prepared by the Society's Committee on Computer Science will further this aim.

The committee includes ten members who each follow a category of actuarial interest for new texts and for good reviewers. One member of the Committee is responsible for liaison with the Society library. It is not necessarily the job of a member of the Committee to prepare a review himself; a more usual procedure is for him to find an able reviewer with a special interest in the text. We want to share the burdens and pleasures of reviewing among as many members of our Society as possible.

One of the more difficult tasks of the Chairman of the committee is to define the kinds of books for which we will prepare reviews. Several examples may illustrate the kind of judgment that is involved.

1. We have decided in general not to review the vast outpouring of texts on consumer issues in life insurance. This decision was reached with some reluctance since clearly an actuarial viewpoint might be useful in evaluating some of the more radical statements and proposals. Nevertheless, we felt that we would overwhelm the *Transactions* if all texts related to life insurance and in particular to the price disclosure and other consumer issues were covered.
2. We did decide to review a few carefully chosen books in the literature on ecology. In the Fall 1972 *Transactions* we included two reviews on books related to pollution and population. They were the Club of Rome book, *Limits to Growth* and the important text of the Presidential Commission on *Population and the American Future*.

The Editor of *The Actuary* has also included some texts on the environment and has also reviewed some consumerist items. We hope through the combination of our two publications we will satisfy the tastes of most actuaries.

The Chairman of the Committee on Review welcomes suggestions of texts from all members of the Society and also welcomes any volunteers who wish to prepare reviews. Assignments can easily be made to the proper individual on the Committee on Review. We hope our work provides an important service to the Society's membership, and we think broad participation in reviewing can best assure fulfillment of that hope. □

ARCH

The list of contents for the latest issues (1973.2 and 1973.3) is given below.

Issue 1973.2

Comments: on G. Berger's "*Asset Shares and Anderson's Concept* Richard W. Ziock

Financial Projections and the Pricing of Life Insurance Frank Irish

A Stochastic Model of Bond Prices, Richard W. Ziock

Transcripts from the Waterloo Actuarial Research Conference on Time Series Analysis, 1972 September 28-30

(a) *On the Relevance to Actuaries of Research on the Long Term Interest Rate*, James C. Hickman

(b) *Discussion of Fama's paper, Risk Return, and Equilibrium Empirical Tests*, Paul M. Kahn

(c) *Box-Jenkins Models for Hospital Insurance*, Donald A. Jones

(d) Overview, J. L. Lewis, Jr.

(e) Overview, Newton L. Bowers, Jr.

Issue 1973.3

This is a Special Issue of the written material for Hilary Seal's *SHORT COURSE IN RISK THEORY* for the Actuaries' Club of New York, March, 1973.

Contents

I. Risk Theory: Input
II. Risk Theory: Output
III. Practical forms for $p_n(t)$ and $B(\cdot)$
IV. Numerical Calculation of $F(x,t)$
 (a) Computer Output
V. Numerical Calculation of $U(w,t)$
 (a) Computer Output
Annotated Bibliography

Subscriptions can still be sent to David G. Halmstad, Area 222, Metropolitan Life Insurance Company, One Madison Avenue, New York, N. Y. 10010. □

Deaths

Larry T. Steele
David P. Eakins
Julian A. S. Lamb
Lloyd G. Current

Disability and Probability

(*Continued from page* 1)

calculation, that the effect of this refinement would have been negligible.

(At one time, I thought of running a series of calculations on a computer which essentially would check this assertion. It is now questionable whether I will follow through on this . . . and I believe this article will be of interest, without such a theoretical check).

A few years later, another actuary made an independent calculation with the same rates of disability, but with the 1958 CSO Mortality Table being used for rates of mortality. This resulted in a probability of 25.4% for an insured age 35 becoming disabled for at least 90 days before age 60. This is consistent with the nearly 33% probability for disability before age 65.

When the 1964 Commissioners Disability Table came along, other actuaries went through their own calculations following the above outlined methodology. When table X_{18} was used for mortality rates, the probability for an age 35 person being disabled at least 90 days before age 65 came out to 46%. When the 1958 CSO Mortality Table was used, the probability was reduced slightly to 45%. When Prudential Ordinary Male Mortality Rates were used, the probability derived was 45.5% for disability before age 65; for a person age 35 being disabled at least 90 days before age 60, the probability is 35.3%.

There have been a number of publications that have referred to a probability in the order of 68% or 69% for one person age 35 becoming disabled for at least 90 days before age 65. It has been determined that the basis for this assertion is the information shown on page 13 of Volume III of the Commissioners Disability Table. The information shown there is the number of lives disabled from date of disablement per 100,000 active lives exposed at each quinquennial age. This is fundamentally incorrect because if you start with a radix of 100,000 lives at the beginning age, you obviously will have fewer lives exposed at each succeeding age. In any event, the arithmetic for this erroneous method works out as follows:

$$\frac{5\,[i_{37} + i_{42} + i_{47} + i_{52} + i_{57} + i_{62}]}{100{,}000}$$

$$= \frac{5\,[981+1257+1676+2239+3110+4427]}{100{,}000}$$

$$= \frac{5\,[13690]}{100{,}000} = 68\% \text{ (ages 35 to 65)}$$

$$\text{or } \frac{5\,[13690-4427]}{100{,}000} = 46\% \text{ (ages 35 to 60)}$$

The 46% "answer" shown above may well be the basis for the 50-50 chance stated at the outset of this letter.

The probabilities derived from the above incorrect method have also been carried over to use in multiple life situations. For example, a number of disability buy-out promotional statements refer to the probabilities of at least one individual among two businessmen or among three businessmen becoming disabled. Obviously, any error involved in a one life basis would be compounded if carried over to multiple life situations.

Beyond the methodology, it is important to consider whether the 1964 Commissioners Disability Table is appropriate. The data used in this table for the first year of disability comes directly from 1957-61 inter-company experience. This includes experience from *all* occupational classes with a heavy proportion with elimination periods of zero or seven days. However, the sales literature using these probability type statements is generally aimed at the better occupational classes and frequently at professionals who usually purchase a longer elimination period. Special studies have shown that the frequency of disabilities lasting 90 days or more is higher under policies with short elimination periods than under policies with long elimination periods. With the above in mind, suggestions for appropriate disability rates for the population to which the sales promotion statements are being made have ranged from a factor in the range of 30% to 40% to a factor in the range of 50% to 60% of the 1964 CDT. In addition, it was noted that current experience at higher attained ages may not have matured and could have a high proportion of select experience. This relates not only to the traditional better health from approved applicants but also to the possibility of limited exposure to the temptations of early retirement, which could be a function of the length of time a policy has been in force as well as attained age.

Considering these suggestions, a series of calculations were made, two of which are reported here. The first used a multiple of the 1964 CDT which was 40% up to age 50 and increasing by 2% thereafter. The second used a factor of 55% increasing by 1.5% after age 50. In both calculations, the 1955-60 Basic Select and Ultimate Tables were used for mortality rates.

The first basis ("low") resulted in probabilities of 27.3% and 18.3% for a person age 35 being disabled at least 90 days before ages 65 and 60, respectively. The second basis ("high") resulted in corresponding probabilities of 32.7% and 23.1%. The 18.3% and 23.1% probabilities are a far cry from the 50-50 chance quoted at the outset with regard to a lengthy disability before age 60. It is interesting that the 32.7% matches the "nearly 33%" calculation made by Ben Helphand over 20 years ago.

I hope this article will be of interest to those who have occasion to deal with statements about the probability of lengthy disabilities. □

1973 YEAR BOOK

The names of the following individuals were inadvertently omitted from the lists in the Year Book.

Committee on Continuing Education and Research

Committee on Retirement Plans

Donald F. Campbell*
Richard C. Keating*

**Liaison Representatives from the Conference of Actuaries in Public Practice*

Committee on the Alternate Route (Special)

Ernest R. Vogt

Actuarial Meetings

June 4-5, Middle Atlantic Actuarial Club (Spring Meeting)

June 14, Baltimore Actuaries Club

June 21-22, Actuaries Club of Southwest (Spring Meeting)

July 12, Baltimore Actuaries Club

To Be Continued

(Continued from page 2)

The critique has particular significance since it comes from within the New York Insurance Department regulatory system and its practitioners. The report identifies a number of deficiencies in the present system for regulating the financial condition of insurance companies. It also includes a recognition of emerging developments which may accentuate those deficiencies or promote new stresses in the regulatory system and the insurance business. Finally, the report recommends fundamental and sweeping changes to modernize the insurance regulatory system.

The conclusions and recommendations set forth are stated largely in general terms, since, as the Department points out, the full implementation of many of their recommendations will require further detailed study, consideration, and the use of pilot programs. Some recommendations can be adopted immediately. While a number of the proposals are purely administrative or operational in character, the various parts of the program are related to each other, and many recommendations are contingent upon the implementation of others.

The proposed program represents a significant departure from the usual regulatory pattern of the past and affects all forms of insurance.

Some of the major recommendations concerning regulation of financial condition, are as follows:

(1) In order to provide full protection to all New York policyholders and claimants against the consequences of insolvency, the Life Insurance Guaranty Corporation should be broadened to include New York policyholders of nondomestic insurers, irrespective of the time any company has been in existence. The Property and Liability Insurance Security Fund should be extended to cover all New York insurance obligations of defunct property-liability companies by including claims arising under accident and health coverages written by property companies and unearned premiums due policyholders.

(2) The development of full insolvency protection outlined above places new emphasis on the detection and early seizure of control of insurance companies in hazardous financial condition, in order to minimize the possible drain on the funds of the company. This change in emphasis requires the improved ability to detect such companies speedily, and three specific statutory changes:

(i) the "impairment" level under the present law should be rationalized and modernized to provide a consistent margin to absorb errors in measurement;

(ii) the liability for participating in a "fraudulent" insolvency should be expanded to include the penalties for knowingly continuing to operate a company in an impaired or even insolvent condition;

(iii) the Insurance Department should have statutory authority to seize an impaired insurer immediately, without the prolonged litigation engendered by current law.

(3) In the interest of enforcing rules to promote solidity, the Insurance Department, after necessary study, should develop a more systematic and explicit set of rules for insurer conduct and enforce these rules by imposing penalties for violations. The adoption of such a regulatory system would largely replace the present practice of case-by-case discussion and prior approval for large numbers of specific acts.

(4) The Department recommends that it be given explicit statutory authority to require, after notice and hearing, changes in company accounting, control systems, and practices, to reflect more accurately the company's financial condition or preserve its solidity.

(5) The techniques of surveillance would be restructured to achieve the objectives above by redesigning the auditing and field examinations procedures. One of the major proposals is that most of the auditing and examination work now performed manually, would be done by EDP techniques, thereby permitting speedier and more efficient determination of financial condition. Examinations would be "tailor made" to meet the circumstances of the particular company being examined. One of the types of streamlined examination would largely consist of ascertaining, by computer methods, the validity of a company's accounting and control systems through audit of records, transactions, and the resulting accounting procedures to assure that they are producing reasonably accurate financial data for annual statement reporting purposes. Along these lines the Department is currently planning a monitoring system of key indices and ratios of major balance sheet items as a supplement to the "early warning system" of solidity tests and profitability ratios of the NAIC central reporting program.

Such a monitoring system will necessitate, in many cases, the formatting of company records according to the Department's specifications. This data will be used, on a sampling basis, in subsequent processing, employing the Department's EDP programs in performing its regulatory responsibilities.

(6) It is also proposed that, to the extent practicable, the financial and non-financial concerns of field examinations be separated on the grounds that the treatment of policyholders and claimants and the examination of other non-financial areas involve separate and distinct procedures and disciplines.

(7) The present practice of enumerating in the examination reports all of the examination findings in great detail would be unnecessary. The examination report would, therefore, be substantially streamlined, focused only on significant findings as to financial condition and would be produced on a much more timely basis. The emphasis on quick information-gathering methods, should therefore lead to a short and simple document as the report of the examiner. Since most examinations would be less all-inclusive and time-consuming, they would in many instances, be conducted more frequently than they are today, especially in the case of companies in distress.

(8) It is planned that the proposed shift in regulatory priorities will make available some resources for expanded insurance consumer protection activities. This would include such matters as treatment of policyholders and claimants, market conduct, and institutional behavior, and would involve new techniques including consumer surveys in the form of questionnaires or interviews, and in-depth market surveys in specific lines of insurance.

The Department concludes its 252-page report with the realistic statement that the implementation of the proposed changes in philosophy and practice will require the understanding of the general public, the receptivity of the insurance industry, and the advice and assistance of such state bodies as the legislature and the judiciary. Such implementation will also have to be coordinated with the activities and initiatives of insurance departments of other states. □