

BOOK REVIEWS AND NOTICES

Richard B. Singer and Louis Levinson, *Medical Risks: Patterns of Mortality and Survival*, pp. 734, Lexington Books, D. C. Heath & Co., Lexington, Mass., 1976, \$27.50.

Medical Risks is more than a compilation of comparative mortality and survival data. This joint effort of the Association of Life Insurance Medical Directors of America and the Society of Actuaries is the culmination of twelve years of planning, thousands of hours of research, and an investment of over \$100,000, in order that the volume might come to fruition. The nine-member editorial committee was under the direction of Dr. Singer and Mr. Levinson, who served as chairman and project coordinator, respectively. The contributors numbered twenty-three. This publication will be of great value to medical directors, actuaries, and underwriters in the life insurance industry. It should also be a welcome addition to the reference library of other workers in the health sciences, including clinical investigators, physicians in a variety of specialties, epidemiologists, statisticians, and public health specialists. The two sponsoring organizations are to be commended for their combined efforts.

The bulk of the data presented in this book is drawn from sources outside the insured population. However, some studies of life insurance experience are included. Over 2,000 articles in the literature have been screened and evaluated; only those published since 1950 have been included. These were found by scanning approximately one hundred medical journals and cover studies performed in the United States, Great Britain, Canada, Australia, New Zealand, South Africa, the Scandinavian countries, and western Europe. Adequate follow-up was a prerequisite for inclusion. Experience, almost without exception, is reported in age groupings rather than by individual ages. The purpose of the publication is to make available, in a single volume, tables of comparative mortality and survival data for convenient reference. It is a most welcome addition to the Impairment Study of 1951 and the Build and Blood Pressure Study of 1959.

The book is divided into two parts. Part I consists of sixteen chapters. It is an interpretive text that reviews the mortality and survival data from the tabular abstracts in Part II. In addition, a wealth of interesting and valuable information is skillfully condensed in summary form to give bits of history, definitions, new advances, and the relationship of one disease to another. The first three chapters are titled "Plan and Scope of the Study," "Methodology," and "Interpretation of Comparative Mortality and Survival." These introductory chapters provide a brief résumé for those not familiar with the use of life tables and mortality studies. The other thirteen chapters deal with specific medical risk factors, including physical, toxic, and other

miscellaneous risk factors; cancer; neuropsychiatric disorders; coronary heart disease; hypertension; congenital and valvular heart disease; arrhythmias and ECG abnormalities; other cardiovascular diseases; respiratory diseases; digestive system diseases; genitourinary diseases; systemic disorders and endocrine and metabolic diseases. The authors of these monographs have done an excellent job in summarizing the characteristics of each disease or medical risk in language that is easily understood by all. Trends in mortality and how these may be affected by new treatment methods are frequently supplied. The major focus of each of these chapters is on the data contained in the tables. Much effort is made to supply these data in as simplified form as possible.

Part II of the volume contains the tabular abstracts, which are arranged in nine major categories of risk factors, as follows: physical, toxic, and other risks; cancer; neuropsychiatric disorders; cardiovascular diseases; respiratory diseases; digestive system diseases; genitourinary diseases; systemic disorders and metabolic diseases. Each major category is subdivided into a number of subcategories. The text dealing with each of the abstracts follows a uniform order, giving the reference, the definition of the subjects studied, the follow-up, and the results.

The tabular abstracts of Part II that pertain to physical, toxic, and other risks, contain fifty-five separate tables. The risks covered are addiction and intoxication, occupational hazards, environmental risks of smoking, family history, and postsurgical mortality. Tables presenting data on alcoholism in an industrial population show the observed data and comparative experience by drinking category, sex, occupation, and age group. Other tables relating to this subject show the experience by age groups for insured alcoholics, alcoholism in insured men, alcoholic patients in Ontario, treated chronic alcoholics in South Africa, and male residents of Oslo. The text portion points out that there were 140,000 deaths in the United States during 1970 caused by the physical risks listed. Over 90 percent of these were due to physical causes, including various types of accidents and homicide. Approximately 5,000 deaths (in the United States during 1970) were reported as caused by alcoholism, exclusive of alcoholic cirrhosis. There were 16,848 homicides during that same period. Six abstracts deal with the mortality among chronic alcoholics. This chapter also includes interesting statistics on cigarette smoking and its relationship to mortality and morbidity in both the male and female populations.

The section on cancer shows many tabular abstracts on mortality according to region, system, organ, and site. Cancer of the colon proves to be the leading site when both sexes are combined. Among men, cancer of the lung is the most common site, while cancer of the breast heads the list in females. The author indicates that more than one million persons in the United States are under care for cancer. There were 665,000 new cases reported in 1975. Malignant disease in the United States is compared with the experience in

other countries. Data taken from the end-results study of the National Cancer Institute compares the mortality of the treated cancer patient with that of the general population. Survival ratio data by sex, age, site, spread, and treatment are presented.

The chapters on neuropsychiatric disorders contain twenty-four abstracts, nine of which are follow-ups of cerebrovascular diseases; of these, eight are on organic brain disorders, including mental retardation, cerebral palsy, epilepsy, and multiple sclerosis. There are two studies on paraplegics and one on a long-term study of poliomyelitis. Stroke, the third leading cause of death in the United States, which accounts for 11 percent of all deaths, makes this a very important section of the book.

Cardiovascular diseases are covered at length. Almost eighty tables present statistics related to coronary artery disease. There are multiple studies on myocardial infarction and others on arteriography, coronary artery bypass, and ECG findings. The section on hypertension includes the experience from the Framingham heart study, as well as experience from several life insurance companies. Studies of congenital and valvular heart disease, arrhythmias, ECG abnormalities, cardiomyopathies, cardiac transplant, and valve replacement are also presented.

Asthma, pulmonary tuberculosis, bronchitis, emphysema, and chronic obstructive pulmonary disease are covered under the respiratory disease section.

Among nine reports on peptic ulcer disease is included a study on peptic ulcer in children. Chronic ulcerative colitis, cirrhosis, and gall bladder disease receive attention under the gastrointestinal disease section.

National Dialysis Registry and Renal Transplant Registry experience are included in the articles reviewed for the genitourinary chapter. Disorders of the prostate and albuminuria are included in this section.

Polycythemia, sarcoidosis, cystic fibrosis, rheumatoid arthritis, myasthenia gravis, and scleroderma are represented in studies under systemic disorders.

The endocrine and metabolism section presents thirty years' experience on diabetes mellitus from Joslin Clinic, as well as mortality studies from four life insurance companies, one industrial company, and the Scandinavian countries. Mortality studies related to serum cholesterol levels and hyperlipidemia end this section as well as the volume.

The authors are to be commended for this monumental contribution to medicine and to the life insurance industry. Not only have they provided the reader with a wealth of significant information, but they have presented it in an interesting and readable style and have provided an extensive current reference bibliography for further study. This volume is a must for all actuaries, medical directors, and underwriters in the life insurance industry.

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C. L. Trowbridge and C. E. Farr, *The Theory and Practice of Pension Funding*, pp. xvi, 154, Richard D. Irwin, Inc., Homewood, Ill., 1976, \$10.00.

This text is a part of the Society of Actuaries' continuing program for enlarging the literature of actuarial science. It is intended as a general text on pension funding and has already been adopted by the Education and Examination Committee as part of the Society's course of reading for actuarial students.

The authors indicate that the purpose of the book is to develop and set forth the theory of pension funding. They state that it is not their intention to attempt any formulation of generally accepted practice; however, it is difficult to see how a Society-sponsored text of this nature can avoid doing precisely that. As Joseph Conrad has written, "Of all the books produced since the remote ages by human talents and industry, those only that treat of cooking are, from a moral point of view, above suspicion."

The book is relatively short; the text itself consists of a mere 138 pages. It commences from ground zero in discussing pension benefit outgo, the budgeting of pension costs, the reasons for funding a pension plan, and the way in which funding affects the security of employee pension expectations. Pension benefit outgo is projected with illustrations based on both noninflationary and inflationary models. This discussion is followed by a chapter on the principles of funding and a chapter describing the pension funding models that are used. Then comes the heart of the matter: separate chapters on accrued benefit cost methods, entry age cost methods, aggregate cost methods, frozen initial liability methods, and other actuarial cost methods such as the individual level premium method and the open-group approaches.

The remainder of the text consists of eight short chapters covering, respectively, actuarial assumptions, actuarial gain or loss, valuation of pension fund assets, inflation, ancillary benefits, difficult practical problems, the regulatory environment, and actuarial reports. An appendix then sets forth a description of the populations used, the hypothetical pension plan, and the non-inflationary and inflationary models. This is followed by a list of pension funding terms and a list of references including forty-seven technical articles, textbooks, and other publications that expand on some of the specific problem areas lightly touched on in the text.

As might be expected in a work covering so extensive an area with such brevity, many important topics are not covered at all, and the discussion of some of the more important points is sharply limited. In the first few chapters there is heavy emphasis on the terminology that has been employed in the past, whereas actuaries can get by with the terms used in the pension reform act, the current regulations, and the reporting forms. There is also continued reference throughout the text to "with supplemental liability" methods, while the Society of Actuaries Committee on Terminology has elected to eliminate the word *liability* from all such definitions.

The discussion of the basic pension funding problem is set out in general terms, with substantial recourse to the valves, pipes, and tanks used in Mr. Trowbridge's *Harvard Business Review* article. This section would have been improved by some reference to the decline of certain industries and businesses, such as the railroad industry, where employment has dropped from 1,700,000 in 1944 to 600,000 in 1975.

There is considerable emphasis on immaturity of population and what results when the population approaches maturity—that is, a stationary population. This is quite helpful to student actuaries in enabling them to see the effect of such population changes on pension costs under various methods. Probably by reason of space limitation, however, there are no illustrations of or allusions to the problem of the “supermaturity” of a group, which may precede its going out of business. Anyway, the pension theory is constructed amid illustrations that suggest that organizations start up and eventually reach a stable maturity that lasts forever, and this excludes one of the most serious real life problems in the funding of pensions. Also, because of the book's concentration on this type of situation, it is natural for the reader to conclude erroneously that the “open-group approach” is the ideal actuarial method, whereas it really works out well only under a restricted set of future environments.

The illustrations of the effect of inflation are based on a model which assumes that inflation will run at a level annual rate each year in the future. While clearly some assumptions must be made in order to demonstrate the effect of inflation on pension funding, inflation that runs along at a uniform annual percentage forever is so contrary to the first 190 years of United States history as to raise questions as to the validity of any conclusions that might be drawn from such a model.

The basic pension plan used for the illustrative cost results has a benefit formula of $1\frac{1}{2}$ percent of final ten-year average pay per year of service and is payable on a straight life annuity basis with retirement at age 65 and with no early or disability retirement. The behavior of a nonintegrated final pay pension benefit under inflation cannot be assumed typical of the behavior of other benefits. If there should be generous early and disability retirement benefits, any fund in excess of the fund required under the accrued benefit cost method would probably not be superfluous. Where early retirement is available over a broad range of ages with unreduced benefits, for example, it can be demonstrated that even the past-service liability under the entry age normal cost method is inadequate to provide the benefits for those actually electing such early retirement. Thus, if plan termination should be accompanied by a substantial number of early retirements, some “excess” funds may be needed to cover the actuarial losses associated with the termination process. In any case, the text fails to suggest the reasons why or the circumstances in which experienced actuaries prefer to use the projected benefit cost method rather than the accrued benefit cost method.

As to some of the specific (though minor) flaws, first, there is some confusion in Chapter 5 between the determination of the amount of actuarial gains and losses and the manner in which those gains or losses are to be taken into the funding by adjustment of future contributions. Second, the authors fail to distinguish between the methods and assumptions that may be appropriate for a realistic estimate of future cash benefit payout and those that might be best suited for the development of an appropriate contribution; because of this, the text indicates that assumptions as to new hires would be more "realistic" for an actuarial valuation. Third, the basic methodology set forth in the text might have been easier to understand if commutation functions, rather than deferred annuity notation, had been employed, particularly since the printing of the text required that subscripts in some cases be set up on the same line as the annuity symbol itself. Finally, the authors introduce several theoretical cost methods, such as entry age aggregate, accrued benefit aggregate, and generalized aggregate, which are not really very helpful in discussing the theory and which are not used at all in practice, so that the space devoted to them in the text appears to serve no useful purpose.

Because of the brevity the text is at its weakest in the treatment of controversial items. In Chapter 2, considering the stream of cash benefit outgo from the pension fund, the authors conclude that the open-group approach is clearly the more realistic. The so-called closed-group approach develops a normal cost for the present active group that on average ought to be applicable not only to each employee in the closed group but also to any individual who might be hired in the future. The expression of such a normal pension cost as a level percentage of base pay indicates that it is assumed to apply to new hires as well. The text gives no indication that the only value in the open-group method is the possible deferral of amortization costs and interest on past-service liabilities by the use of increasing rather than level dollar payments.

The most misleading chapter of the book is Chapter 13, which sets forth the mathematical model for a mature pension fund operating under inflationary conditions. First, the assumption as to uniform annual inflation is artificial. Second, there is no reference to assets already held in the pension fund and what happens to the yield on them. Third, there is an implication that, with 5 percent inflation, 9 percent interest might be a realistic assumption, even though few funds have ever earned that much. Finally, there are no tables that show the impact of the different, more "realistic" assumptions on the contribution for a flat benefit plan or a career average plan.

The text does set forth for the first time in the literature a statement as to just what is meant by an "explicit" set of actuarial assumptions. To be explicit, assumptions should include as separate elements the rate of price inflation, the rate of wage inflation, the rate of investment earnings related to the assumed price inflation rate, and the noninflationary component of

future salary increases, consisting of the (separate) increases for promotion, merit, and longevity. Probably no one valuing pension plans today makes such complex assumptions, and, therefore, all actuarial valuation approaches must be deemed to be implicit to some degree. There are no comments as to the effect of adopting explicit assumptions on the factors used for joint and survivor options or early retirement where those values are actuarial equivalents.

In the chapter on death benefits the treatment of the joint and survivor option refers to the principle of actuarial equivalence, that is, that the mortality table used for the valuation of the group as a whole is indeed an appropriate table for the subgroup of covered participants who actually elect such an option. In the case of the preretirement spouse's option, it is suggested that the funding of such pensions on a one-year term basis will usually work out well, although it is not clear that this basis meets the minimum funding standards under ERISA.

The chapter on asset valuation is written from the viewpoint of determining the value to be placed on each specific security. In practice the consulting actuary is given statements by one or more trustees that show both the market value and the book value of each of the assets, as well as total values for the aggregate portfolio. Thus for trustee plans the practical asset valuation problem is the determination of the aggregate value of the assets by methods that minimize the effect of temporary market conditions on the contribution. Of course, the investment return that is assumed by the actuary must be representative of the prospective yields to be developed from the series of prospective asset values determined by the asset valuation method he is using; thus any asset valuation method other than one stemming from market value will develop an investment yield differing from the yield currently obtainable on new investments, so that the end results may seem peculiar to investment experts and plan sponsors.

Traditionally, actuarial theories and practices have been set forth in technical papers presented in the professional journals. Such papers customarily have focused on a single topic, which can thus be covered in depth. Moreover, such papers have been the subject of discussion presented by other actuaries, a process which has brought out not only shortcomings of proposed theories but also different points of view, applications to different types of business, descriptions concerning unusual situations, and so on. By way of contrast, *The Theory and Practice of Pension Funding* consists of a first section on pension cost methods and funding problems of the type that might have appeared in a professional actuarial journal, but with no discussion. The last half of the book sets forth myriad special and separate problems that must be treated in a very superficial manner owing to lack of space. Thus, such topics as valuation of assets, ancillary benefits, regulations, and annual reports are covered at breakneck speed in a manner comparable to the *Readers' Digest* treatment.

The end result is a text that will be useful in giving the new actuarial student some idea of what is involved in pension funding and some awareness of the practical problems. While incomplete, it is an interesting contribution to pension literature. It certainly cannot serve as the only official text on the pension funding subject, but its treatment of many items is sufficiently different from the Berin text and other sources that it should provide a good complementary text at an elemental level.

PAUL H. JACKSON

John A. Beekman, *Two Stochastic Processes*, pp. 170, Almqvist & Wiksell, Stockholm, 1974.

The two stochastic processes referred to in the title are the Gaussian Markov and the collective risk stochastic processes. Both theory and applications are examined. The applications include insurance, physics, electrical engineering, and statistics. Only applications in insurance and statistics will be of interest to actuaries. In fact, the author recommends that actuarial students of risk theory study chapters 1, 2, and 3, sections 4.0 and 4.7 of chapter 4, and chapter 6. These sections total 103 out of the book's 170 pages. Therefore, this review will consider mainly these 103 pages.

The book attempts to cover a lot of ground in very few pages. One of the ways this is accomplished is by merely stating the more difficult theorems without proofs (although references for the proof are given). This is probably an advantage for most actuarial readers, since it makes it possible to get a feel for the subject without getting bogged down in proofs. Another technique the author uses to cover a lot of material is to refer frequently to other sources in the literature. In fact, at points the book seems more like a guide to the literature than an expository text. The reference lists at the end of each chapter are long—chapters 1, 2, 3, 4, and 6 have, respectively, eleven, three, forty-five, thirty-seven and twenty-eight references each. The heavy use of references should make the book very valuable to researchers. In my own case, I became aware of many literature sources that bear on the collective risk problem but are to be found in general mathematical and statistical journals.

Most mathematical books these days totally neglect the historical aspects of the subject's development. Happily this is not the case with this book, which has ample historical information.

Mathematically, the book is not simple, nor, especially in parts, is it truly difficult. It is not easy to describe the mathematical maturity needed for any particular book. Perhaps my own experience is relevant. I first read this book in draft form about two years ago, just before I commenced a year of coursework that led to the M.S. degree in mathematics. At that time, much was not clear to me. Upon rereading the book recently, after receiving the M.S., I found it much easier than previously. I suspect this will be approximately the case for many; the more mathematical background the better.

The numerous problems at the end of each chapter are a very positive feature of the book. Most of the problems have detailed solutions at the end of the book, a great help to the reader.

Chapter 1, "Informal Remarks about Stochastic Processes," is an informal introduction to the subject of stochastic processes. The reader is motivated by three interesting examples: controlled fission in a nuclear reactor, statistical testing in the tobacco industry, and the noise or shot effect in vacuum tubes. (The applications relating to insurance are found in chap. 3.) A series expansion is introduced that solves the problems posed by the applications. Usually not very many terms of the expansion need to be calculated to give a fairly accurate answer. The accuracy of the expansion is explored in the exercises.

Chapter 2 is titled "Some Mathematical Preliminaries." The purpose of this chapter is to give the reader sufficient background in the Stieltjes integral and its application to probability theory and Laplace and Laplace-Stieltjes transforms, which are used later in the book. Many undergraduates are not familiar with these subjects, to which this chapter gives a brief but excellent introduction. There are many easy exercises that are instructive in developing an understanding, especially of the Stieltjes integral.

Chapter 3, "The Collective Risk Stochastic Process," which is the most important one for actuaries, is long—52 pages. Solution techniques are offered for such practical problems as net stop-loss premiums, individual policy retention limits, premium margins, and initial capital needs for a new line of business. Section 3.0, "An Overview of the Subject," first introduces the concept of operational time to the reader. Operational time may be understood as follows: one unit of operational time is that time period during which only one claim is expected. Thus, if a company normally expects 365 claims per year, one unit of operational time is one day. In this section and in the chapter as a whole, mathematics has its day in court: a Laplace transform technique leads to a closed form for the ruin probability $\psi(u)$ when the claim distribution is exponential; Lundberg's asymptotic approximation to $\psi(u)$ is introduced; and an approximate expression is presented for determining, when the moments (which depend on the incomplete gamma distribution) are known, the probability that aggregate claims exceed some specified amount.

Section 3.1 discusses various approximations to $F(x, t)$, the aggregate claim distribution for a period of time t . The normal asymptotic expansions of the normal Esscher approximations, and incomplete gamma functions, are used.

The next four sections discuss various methods of obtaining formulas or numerical solutions for $\psi(u)$ or $\psi(u, T)$ (the probability of ruin before T units of operational time have elapsed). The methods are (1) a convolution formula, (2) Monte Carlo, (3) moments, and (4) inverting transforms.

Section 3.6 discusses the loading of net stop-loss premiums, and section 3.7

discusses a measure for the collective risk process that was introduced by H. Cramér.

Section 4.0 introduces the reader to three Gaussian Markov processes: the Wiener process, the Doob-Kac process, and the Ornstein-Uhlenbeck family of processes. Section 4.7 lists various distributions related to Gaussian Markov processes.

Chapter 6 discusses two applications of stochastic processes to statistics. The first is the Kolmogorov statistic. It can be used to test equality of empirical and theoretical distributions. The second application is the Kac statistic, which is not limited by a fixed sample size as is the Kolmogorov statistic.

Finally, it seems to me that the Society of Actuaries is very lucky to have members such as Dr. Beekman who are working in difficult mathematical areas and whose partial objective it is to apply modern mathematics to the solution of insurance and pension actuarial problems.

In the United States the book is available thru the Halsted Press Division of John Wiley and Sons of New York.

RICHARD W. ZIOCK

Disability Income Insurance—Cost Differentials between Men and Women, pp. 59, New York Insurance Department, June, 1976.

Because of charges by various groups of discrimination in the underwriting and establishing of premium rates for individual disability income insurance, the results of this study have been eagerly awaited by many segments of the insurance industry. Fears of substantiating unisex rates were unfounded, since the results of the study generally conformed to those of the Society of Actuaries, on which the industry has relied on to a great extent in the past.

The study was initiated as a result of a suit filed by the New York Civil Liberties Union. The insurance department committed itself to an extensive review of available data to determine whether sex is a statistically valid characteristic of the disability income insurance risk. Twenty-one companies submitted experience, including 57,541 female claims, over the years 1968-73 inclusive.

Concluding that sex is a major factor affecting the cost of disability income insurance, the New York department provided overall statistics showing significantly different morbidity patterns. While the pattern was different for accident-only coverage, no variation was found in the age-specific ratios with changes in elimination periods, renewal guarantees, and benefit years, and no evidence was found of a shift during the years studied. Although there was some variation by occupational class, the basic pattern was very similar.

Comparisons are made in the booklet to other studies, published by the Society of Actuaries, that produced similar results. However, the most interesting and extensive discussion concerns social security disability income experience because this is often used to show that women should not be

charged higher premiums than men. Analysis of unpublished data furnished by the Office of the Actuary of the Social Security Administration indicated a pattern similar to that obtained by the department in its own study, but the differences were not as pronounced. This was due to the universal nature of social security coverage and the fact that social security disability experience is not distinguished by occupation. The department performed a special study of 1972 applicants for disability benefits, showing the effect of a far larger proportion of men engaged in hazardous occupations, which served to bring male claim costs up relative to female claim costs. In other words, an analysis of the exposure indicated that more men than women work at hazardous jobs and that most women working in hazardous industries hold nonhazardous jobs; the department concluded that the social security data would be consistent with insurance industry experience if homogeneous occupational groupings were used.

This well-written report merits the attention of every actuary because the question of alleged sex discrimination is not restricted to disability income insurance, and the insurance industry practices are being challenged on all sides.

The New York Insurance Department, and the contributing companies, are to be complimented on producing a study substituting facts for allegations. The conclusions are of paramount importance to the disability income business and the work of the health insurance actuary.

GARY N. SEE

Dan M. McGill (ed.), *Social Security and Private Pension Plans: Competitive or Complementary*, pp. xiii, 175, Ralph H. Blanchard Memorial Endowment Series, Vol. 1, published for the Pension Research Council by Richard D. Irwin, Inc., Homewood, Ill. 60430, 1977, \$9.50.

The Pension Research Council has published eight related papers that were commissioned as a first step toward assessing the dimension of a project that would attempt to delineate reasonable bounds for social security in the light of a changing economic, demographic, and cultural environment. The selected topics and a foreword are designed to provide a conceptual framework for further discussion of the respective roles of social security and private pension plans. Accordingly, this volume examines historical, social, and economic background and foreign perspectives before describing the general areas of current concern for both social security and private pension plans.

The quickest way to gain a sense of the utility of material and authority of authorship is to scan the following list of subjects and contributors: the philosophical bases of the social security system (J. Douglas Brown), philosophical bases of the private pension movement (Paul H. Jackson), a summary of international social security systems (John K. Dyer, Jr.), fiscal basis of the OASDI program (A. Haeworth Robertson), economic impact of OASDI and private pension plans (Geoffrey N. Calvert), two views of the concepts of balance be-

tween public and private pension benefits (Bert Seidman and Robert J. Myers), and current issues related to social security (Preston C. Bassett).

Valuably, especially for the nonspecialist, the editor, Dan M. McGill (chairman, Pension Research Council), has achieved a consistency of style and clarity of substance throughout this collection of papers. Six of the authors are actuaries who are well known at least to those members of the Society engaged in pension matters, and their credentials should not need repetition here. All the writers are well qualified in the design of pension plans—public, private, or both. Although the brief papers are their own best summaries, the remainder of this review can serve to locate for reference expressions of some of the basic premises and attitudes that often are not fully laid out during discussion of social security financing, coverage, and benefits.

Dr. Brown (who helped initiate the social security program, chaired the first Advisory Council on Social Security, and served on four of the five subsequent Advisory Councils) reminds the reader that, at the start, the philosophical basis of the social security system—including a social “right” to protection, independent of need—was perhaps its clearest characteristic. When the economic and social urgencies of the Great Depression inspired the commitment to initiate the social security system, specifics of benefit structure and sources of financing were left to evolve at a slower pace. Payouts were to be deferred until some contributions had accumulated, and it was the recommendation of the first Advisory Council that signaled acceptance of social adequacy over strict equity through extension of protection to the family unit (by dependents and survivors’ benefits). It is interesting to recall how the safety net of potential government revenues (rationalized at first by notions of accrued liabilities) may have helped ease the introduction of nonretirement benefits and liberated the system from an obligation to fund at levels that would accumulate significant reserves.

While others may debate whether private pensions stem from employee need or represent earned income, employers have maintained or modified their plans usually for pragmatic rather than philosophical reasons. Mr. Jackson, by specific illustration, makes the case that the accumulation of government mandates (social security benefit expansion, integration, ERISA) is apt to limit existing plans or potential new ones. Since less flexibility is allowed to the traditional defined benefit plan, defined contribution plans (or no plan at all, i.e., IRA’s) appear more attractive to many employers. Although the private pension system has been remarkably adaptive, the social and economic importance of its size needs emphasis, and an “environmental impact statement” ought to accompany proposed changes in related public programs and regulations.

Because of growing interdependence and maturation of economies throughout the world, developments abroad are perhaps more revealing now with respect to coordination of public and private pensions than ever before. Mr. Dyer’s survey of foreign private plan design indicates the prevalence of integration by excess types of benefit formulas, another signal that benefit formulas deducting social security as an offset may become less feasible to maintain in the United States. (A narrative history of United States integration rules is appended.)

Review of the foreign precedent of codeterminism or shared administration between private plan sponsors and plan beneficiaries perhaps can be accommodated in a later part of this project. While the statistical detail would have been inappropriate here, comparisons of replacement ratios and measurements of retirement income levels required or provided would also explore other useful dimensions of international experience.

The fiscal basis of the OASDI program and the results of the seventy-five-year cost projections of 1976 are laid out by Mr. Robertson. He summarizes the conclusions of the most recent trustees' reports, which express the deficit consequences of population trends and formula distortion since the notable expansion of social security benefit levels began in 1972. An appendix from the 1974 Advisory Council explains one of the ways formula excesses may be corrected ("decoupling"). The editor's foreword supplements the official reports in this paper by identifying other cost-saving benefit adjustments that have not yet been specifically proposed. These would, in general, widen scope for private supplementation. However, congressional reluctance to constrain social security benefits is well known (currently evident in deliberation over decoupling). Accordingly, it would be worthwhile to analyze the connection between higher taxes for social security, which Congress can impose in a variety of ways, and employer attitudes about the formation of new private plans and changes in existing plans.

It has been decided in the United States not to generate capital through a substantial reserve fund under the social security system. Mr. Calvert presents the position that expanding OASDI, as a consequence of fiscal basis and benefits taken as a whole, has actually lessened capital formation by the private sector. The consideration accompanying capital formation, in favor of people's capitalism via the equity investments held by private pension funds, invites reexamination of the traditional roles of plan sponsors and plan beneficiaries. This paper recognizes that the economic attributes of capital creation and ownership through private plans have often been underemphasized during the focus on transfer payments and levels of consumption.

The subject of "balance" refers to the extent to which it would be advisable to allow further expansion by social security. Mr. Seidman (director, Department of Social Security, AFL-CIO) argues that the nation must rely on the comprehensive social security program as the basic instrument to provide adequate income to the retired population. Furthermore, the demographic and inflationary problems troubling social security financing will not leave unscathed employer plans or personal savings. Mr. Seidman suggests a number of specific liberalizations (such as more flexible early retirement).

Mr. Myers asserts that an expansionist view of social security can mean excessive costs from the economy, especially if general revenues are committed, and that a healthy and reasonably restrained social security system permits helpful supplementation by private plans. He urges proponents of private plans to define the amount of OASDI's often-cited "floor of protection" and to en-

deavor to maintain the same relative positions of private pensions and social security.

Rounding out the survey of issues, Mr. Bassett looks beyond social security financing and identifies the benefit questions that appear most likely to be proposed soon after trust fund short-run solvency has been assured. Whether coverage for state and local government employees should be compulsory is examined with the help of an article by Mr. Myers, reprinted in the appendix, and remaining differences in social security for men and women are described by an extract from the report of the 1974 Advisory Council. Other subjects, such as normal retirement age and improved indexing for retirees, are at an early stage of consideration but can already be perceived as concerns shared by private and public plans.

Many scholarly institutions now are studying (and publishing) the possible directions social security might take. Social security is uniform and may appear more effective through its massive size and government authority than the numerous diverse private pension arrangements. Fortunately, the Pension Research Council has been enabled in this volume, through endowment funding by the National Health and Welfare Retirement Association, to initiate research that will increase understanding of how actions in regard to social security may also affect the response from voluntary private pension plans to national issues and problems.

SAMUEL E. SHAW II

William D. Hall and David L. Landsittel, *A New Look at Accounting for Pension Costs*, pp. xxiv, 184, Richard D. Irwin, Inc., Homewood, Ill. 60430, 1977, \$9.50.

The typical American pension plan has demonstrated very well its ability to adapt to change; it has taken in stride the recent substantial fluctuations in asset values and the uncertain division developing between private and social plans; it is adjusting fairly well to ERISA (many medium and smaller plans excepted); it has other possible changes to deal with in the future. One of these may be the Hall-Landsittel theory.

Messrs. Hall and Landsittel, practicing C.P.A.'s, present in a book published for the Pension Research Council a theory for the accounting of pension costs by the sponsoring employer which could be the basis for a Financial Accounting Standards Board replacement of *Accounting Principles Board Opinion No. 8*.

The Hall-Landsittel theory basically would modify a number of the present *APB Opinion No. 8* practices:

1. The *APB Opinion No. 8* minimax range would be replaced by a new single pension cost. Contributions different from the single pension cost would result in a deferred or prepaid pension expense. This single cost is a modified unit credit normal cost plus a past-service amortization cost determined by the assumptions used to report plan liabilities to participants (based upon the so-called symmetry concept). Assets are valued at market value, and gains and losses of the previous plan year are recognized immediately in full in the current plan year's normal cost.

2. The plan sponsor would recognize as a balance-sheet adjustment at the time the new accounting practice was adopted the unfunded accrued liability (using the same assumptions as above). This liability would be offset initially at least, by a deferred charge asset; as an ultimate solution, the deferred charge asset would not appear on the balance sheet. Future benefit and/or assumption changes would be reflected as plan gains or losses.

The authors present their theory and the rationale supporting it most creditably; the Pension Research Council permits several of its members to offer alternative viewpoints or amend what might be questionable conclusions, which complements the book's usefulness.

There are a number of substantive issues with which the "first remake of *APB Opinion No. 8*" will need to deal:

1. Symmetry issue. Should a plan participant and a stockholder of the employer see the same pension items, and should such items be calculated using the same assumptions?
2. "Balance sheet versus income statement" accounting issue.
 - a) If the plan is viewed as an ongoing entity, or one for which no direct employer liability exists, should not income accounting be emphasized?
 - (1) Costs determined as a level percentage of payroll.
 - (2) Gains or losses spread over future years.
 - (3) Long-range valuation of both assets and liabilities.
 - (4) Liability for unfunded past-service costs not recognized as a balance-sheet item.
 - b) If the plan is viewed as an entity that is terminable, for which there is a direct employer liability, and for which pension costs should match the pension benefits earned, should not balance-sheet accounting be emphasized?
 - (1) Costs determined by unit credit funding.
 - (2) Gains or losses both recognized immediately.
 - (3) Short-range valuation of both assets and liabilities.
 - (4) Liability for unfunded past-service costs recognized as a balance-sheet item.
 - c) The Hall-Landsittel theory follows item *b* above. The authors reason that the liability for unfunded past-service costs should be the unfunded accrued liability. Many observers feel that the "ERISA Title IV" liability would be more consistent with the authors' theory than the unfunded accrued liability.

That ERISA requires a change to *APB Opinion No. 8* appears doubtful. If changes are in fact required, we trust that plan sponsors will not be so discomfited by such changes that they look to alternatives—such as discontinuing their pension plans.

CARLTON HARKER

U.S. Congress, "1977 Annual Reports of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds, of the Federal Hospital Insurance Trust Fund, and of the Federal Supplementary Medical Insurance Trust Fund," pp. 82, 34, and 28, Government Printing Office, Washington, D.C., May, 1977.

An excellent introduction to these reports, in this reviewer's estimation, may be obtained by reading the "Commentary Prepared to Assist in the Reading and Interpretation of the Reports." The commentary was prepared by A. Haeworth Robertson, chief actuary of the Social Security Administration. This is the second year we have had the benefit of Mr. Robertson's commentary, which is easily readable and extremely helpful.

As in previous recent years, there are three 1977 trustees' reports: one for the federal old-age and survivors trust funds, one for the federal hospital insurance trust fund, and one for the federal supplementary medical insurance trust fund. The three reports are organized similarly. Major sections are devoted to highlights, an explanation of the nature of the trust funds, a summary of operations of the funds for the past fiscal year, projected operation and status of the funds, a statement of the actuarial status of the trust funds, conclusions, and appendixes. The appendixes contain assumptions, methodology, and other details.

OLD-AGE AND SURVIVORS INSURANCE AND DISABILITY INSURANCE TRUST FUNDS

Continuing the pattern of recent years' reports, this report calls attention to the need for additional financing for the old-age and survivors insurance and disability insurance trust funds in both the short and the long range. The excess of outgo over income is increasing, and in calendar year 1977 it is estimated that outgo will exceed income by \$5.6 billion.

Projections into future years are made on three sets of assumptions: an optimistic, an intermediate, and a pessimistic set—Alternatives I, II, and III, respectively. Under the optimistic set of assumptions the assets of the OASI Trust Fund are expected to be exhausted by 1984 and those of the DI Trust Fund by 1979, unless legislation is enacted to provide additional financing.

The report displays medium-range (twenty-five-year) cost estimates and long-range (seventy-five-year) cost estimates in terms of estimated percentages of taxable payroll. These estimates are compared with taxes as a percentage of taxable payroll to demonstrate the estimated shortfall of projected income compared with taxes. This information for the intermediate (Alternative II) assumptions is summarized in Table 1 of this review, taken from Mr. Robertson's commentary. Table 2 shows the extent to which these figures vary by alternative groups of assumptions.

An interesting feature of the report is the presentation of cost estimates based on "a more stable system." Apparently it is expected that Congress sometime soon will agree that benefit levels projected under the present law are too high and will take steps to reduce them.¹ Accordingly, "estimates of income and outgo . . . are presented in the report for a 'modified theoretical' system which would maintain through time, the relationship between average awarded benefits and average earnings at the beginning of 1979." Even under the modified

¹ EDITOR'S NOTE.—The review was written before enactment of the social security amendments of 1977.

theoretical approach, the projected outlays of the trust funds are estimated to exceed tax income in every calendar year for the next seventy-five years. However, the average annual excess (over seventy-five years) of expenditures over taxes is reduced from 8.20 percent of taxable payroll to 3.74 percent of taxable payroll by use of the modified theoretical approach.

A significant portion of the report (Appendix A) is devoted to a discussion

TABLE 1
COMPARISON OF ESTIMATED OASDI EXPENDITURES AND TAXES UNDER PRESENT LAW AS PERCENTAGE OF TAXABLE PAYROLL FOR SELECTED YEARS, 1977-2051, BASED ON INTERMEDIATE (ALTERNATIVE II) ASSUMPTIONS

Calendar Year	Expenditures	Tax Rate in Law	Excess of Expenditures over Taxes
1977.....	10.91%	9.90%	1.01%
1980.....	10.80	9.90	0.90
1990.....	12.39	9.90	2.49
2000.....	13.91	9.90	4.01
2010.....	16.57	9.90	6.67
2020.....	21.64	11.90	9.74
2030.....	26.02	11.90	14.12
2040.....	26.67	11.90	14.77
2050.....	26.93	11.90	15.03
25-year averages:			
1977-2001.....	12.24	9.90	2.34
2002-2026.....	18.85	11.18	7.67
2027-2051.....	26.47	11.90	14.57
75-year average:			
1977-2051.....	19.19	10.99	8.20

TABLE 2
COMPARISON OF AVERAGE EXCESS OF EXPENDITURES OVER TAXES FOR OASDI UNDER PRESENT LAW AS PERCENTAGE OF TAXABLE PAYROLL UNDER THE THREE ALTERNATIVE GROUPS OF ASSUMPTIONS

	EXCESS OF EXPENDITURES OVER TAXES		
	Alternative I	Alternative II	Alternative III
25-year averages:			
1977-2001.....	1.67%	2.34%	3.24%
2002-2026.....	3.94	7.67	13.33
2027-2051.....	6.03	14.57	31.71
75-year average:			
1977-2051.....	3.88	8.20	16.09

of the basic assumptions used in preparing the long-range cost estimates. For the actuary interested in these assumptions, Table 3, taken from the report, is provided.

FEDERAL HOSPITAL INSURANCE TRUST FUND

This report concludes that "the present financing schedule for the hospital insurance program is not adequate to provide for the expenditures anticipated over the entire 25-year valuation period, if the assumptions underlying the estimates prove to be realistic." The estimated average annual deficit for the twenty-five-year period is 1.16 percent of taxable payroll under the intermediate assumptions (Alternative II). Alternative II assumes that hospital costs during

TABLE 3
VALUES OF SELECTED ECONOMIC AND DEMOGRAPHIC FACTORS UNDER
THREE ALTERNATIVE SETS OF ASSUMPTIONS,
CALENDAR YEARS 1977-2051

CALENDAR YEAR	PERCENTAGE INCREASE IN AVERAGE ANNUAL			AVERAGE ANNUAL UNEMPLOYMENT RATE	TOTAL FERTILITY RATE†
	Wages	CPI	Real Wages*		
Alternative I:					
1977	8.4	6.0	2.4	7.1	1,709.9
1978	8.2	5.3	2.9	6.3	1,685.9
1979	7.9	4.6	3.3	5.6	1,662.0
1980	6.6	4.1	2.5	5.0	1,670.2
1981	5.8	3.4	2.4	4.5	1,710.5
1982	5.3	3.0	2.3	4.5	1,750.9
1983	5.25	3.0	2.25	4.5	1,791.2
1984 and later.	5.25	3.0	2.25	4.5	2,300.0‡
Alternative II:					
1977	8.4	6.0	2.4	7.1	1,709.9
1978	8.1	5.4	2.7	6.3	1,685.9
1979	7.8	5.3	2.5	5.7	1,662.0
1980	7.1	4.7	2.4	5.2	1,662.9
1981	6.4	4.1	2.3	5.0	1,688.8
1982	6.0	4.0	2.0	5.0	1,714.7
1983	5.75	4.0	1.75	5.0	1,740.5
1984 and later.	5.75	4.0	1.75	5.0	2,100.0‡
Alternative III:					
1977	8.4	6.0	2.4	7.1	1,709.9
1978	7.9	5.7	2.2	6.4	1,685.9
1979	8.1	7.6	0.5	6.6	1,662.0
1980	8.2	5.9	2.3	6.6	1,648.4
1981	7.0	5.1	1.9	6.3	1,645.2
1982	6.5	5.0	1.5	6.0	1,642.1
1983	6.25	5.0	1.25	5.6	1,638.9
1984 and later.	6.25	5.0	1.25	5.5	1,700.0‡

* Expressed as the difference between percentage increases in average annual wages and average annual consumer price index.

† Average number of children born per 1,000 women in their lifetime.

‡ This ultimate total fertility rate is not attained until after 1984. See Appendix A of the OASDI trustees' report for more detailed information.

the next five years will increase approximately 15 percent each year, grading to a 10 percent rate of increase after ten years.

It is noted in the report that this fund is in danger only in the long run. The current financing schedule of the program over the next five years is adequate to provide for anticipated program expenditures.

SUPPLEMENTARY MEDICAL INSURANCE

Supplementary medical insurance is essentially financed on a pay-as-you-go basis. It is intended to be self-supporting from premiums paid by participants and from general revenue contributions. The financing of the SMI program has been established through June 30, 1978, by the promulgation of standard monthly premium rates for participants (\$7.20/month for year ending June 30, 1977, and \$7.70/month for year ending June 30, 1978) and adequate actuarial rates that determine the amount to be contributed from general revenues for each enrollee.

REACTION TO THE REPORTS

Although the impending deficits in the social security system have received attention from several previous administrations and congresses, the 1977 reports—which advance the seriousness of the funding problem—have aroused considerable current interest in executive and legislative circles. The current administration has proposals now pending in Congress that call for widespread changes in financing the social security program, including general revenue financing and expansion in the earnings base. A group of Republican congressmen recently promoted extension of the normal retirement date to age 68 as a long-range solution to the financing problem. Members of the House Ways and Means Committee and the Senate Finance Committee have put forth other ideas, including increasing the wage base and levying additional taxes. The chairman of Ways and Means has recently expressed strong opposition to general revenue financing. The chief actuary of the social security system said earlier this year, “It seems unlikely that the traditional financing methods will continue to be the sole source of tax revenue for the program.” These positions are mentioned to point up the divergence of ideas and the complexity involved in reaching a solution to the funding problems pointed up in the 1977 reports.

This reviewer subscribes to the position initially adopted by the American Council of Life Insurance in response to the administration’s proposals. For interested readers, this position is outlined below:

A. Administration proposals to be supported.

1. Increasing the self-employment tax rate from its present level of 7 percent to 7.5 percent in order to restore the tax rate for the self-employed to its traditional ratio of one and one-half times the tax on employees.
2. Advancing the tax increase of 1 percent each on employers and employees that is scheduled for the year 2011 so that one-fourth of the increase would be imposed in 1985 and the remaining three-fourths in 1990. (However, this does not go far enough. The Council supports an immediate increase of 0.5 percent in the tax rate on both employees and employers.)

3. Providing a new test for dependents' benefits that would reduce the revenue loss resulting from recent Supreme Court decisions eliminating the requirements that a husband or widower had to be his wife's dependent in order to qualify for dependents' benefits under social security.
4. Providing for decoupling. Social Security Commissioner Cardwell indicated that the administration's current proposal is generally similar to the decoupling proposal made by the Ford administration last year and would generally stabilize replacement ratios at existing levels. As indicated above, the Council's policies call for the adoption of decoupling combined with stabilization of replacement ratios for future retirees at pre-1972 levels. The Council's Committee on Social Security and Health Care unanimously accepted a task force recommendation that the Council propose that there be no transition period for disability or survivor benefits when decoupling legislation is enacted, on the ground that this will rectify the overgenerous benefits now provided at the young ages. Also, if, as is understood, the administration proposals carry a similar recommendation, the Council should strongly support this recommendation.

In addition, in order to provide a further remedy for the present overgenerous disability benefits provided at the younger ages, the committee supplemented the task force recommendations by unanimously adopting a motion that a percentage-of-prior-earnings cap on disability benefits and dependents' benefits should be seriously considered by Congress.

B. Administration proposals to be opposed.

1. Enactment of a countercyclical general revenue financing procedure that would put general revenue into the social security system whenever unemployment exceeds 6 percent.
2. Reducing the reserve level of the trust funds to 33 percent of a year's outlay (the administration says this is made feasible by the assurance that general revenue will be put into the trust funds when unemployment rises above 6 percent).
3. Taxing employers on the entire earnings of employees (phased in over three years).
4. Increasing the amount of employee wages subject to tax by an additional \$600 in 1979, 1981, 1983 and 1985 (\$2,400 in all) in addition to automatic increases reflecting increases in average wages.
5. Shifting to OASDI one-half of the 0.2 percent increase in the medicare tax rate scheduled for 1978 and 40 percent of the 0.25 percent increase scheduled for 1981.

The 1977 reports and commentary make valuable reading for the actuary interested in the social security system and its problems. The importance of solving these problems with good sense and judgment is well known. Those who know the facts and other information in these reports will be well equipped to "speak up" and support their positions.

BENJAMIN R. WHITELEY

"Investigation of Sickness Statistics—Individual Policies, 1971 and 1973," *Continuous Mortality Investigation Reports, No. 2*, p. 1, Institute of Actuaries and Faculty of Actuaries, 1976.

The Continuous Mortality Investigation Bureau, at the request of the British Life Offices Association and the Associated Scottish Life Offices, has compiled experience data on individual disability insurance policies issued by companies in England and Scotland. In 1885 the Century Insurance Company

of Edinburgh, now part of the Friends Provident Group, issued the first policy of noncancelable disability insurance. In the eighty-eight years that had elapsed by the close of the experience period being reported upon, 1972-73, there was remarkably little change in the basic structure of these policies, which are now offered by most of the leading insurance companies of Great Britain.

Since disability experience data had not been collected previously on an intercompany basis, the publication of this report jointly by the Institute of Actuaries and the Faculty of Actuaries is a signal event in Great Britain and is of great interest on this side of the Atlantic as well. It is fortunate that the committee in charge of the investigation, chaired by Mr. J. Hamilton-Jones, reported on the experience during the years 1972 and 1973, since intercompany experience on the North American continent for the same two years has been reported both by the Society of Actuaries and by the New York Insurance Department in its report *Disability Income Insurance Cost Differentials between Men and Women*.

There are a few differences in the arrangement of the British data as compared with the North American. On this side of the Atlantic the reports present both disability rates, that is, frequency of claims, and annual claim costs, called claim rates in the British report, whereas only the latter are given extensive and detailed analysis in the report of Mr. Hamilton-Jones's committee. The British data are derived from numbers of claims and policies, while the data published by the Society (*TSA, 1974 Reports*) are based entirely on amounts of monthly indemnity. In the report published by the New York department all data are also based on amounts, but the department has made available to the public the underlying experience on the basis of both numbers and amounts. These detailed data are in the form of copies of summary printouts from the computer.

A third difference is that the North American data are in terms of the first year of benefit period and the second year of benefit period, these time spans being measured from the end of the elimination or deferment period. The term *benefit period* means the maximum period for which benefits are payable on any one continuous disability. The British data are all in terms of duration of *disablement*, that is, periods measured from the actual date of incurral of the disability. Therefore, in order to make specific comparisons of claim experience, it was necessary to divide the cost of disability in the second year of disablement between that for an initial period equivalent to the number of weeks of deferment and the remainder of that year. Since no actual experience was available as a basis for making this separation, the disability model described in *TSA, XXVI, 1* (Swiss Re disability model) was used. From this model it was possible to construct continuance tables, that is, rates of claim persistency through successive time intervals, from which an estimate could be made of the portion of second-year cost in each of the respective periods. Also, in order to place the experience on a comparable basis, it was necessary in the case of North America to use data based on numbers, available only from the computer printouts of the intercompany experience collected by the New York department. Comparisons of the two experiences with each other and with the model are presented in Table 1 of this review.

TABLE 1
 1972-73 DISABILITY EXPERIENCE ON MEN, BY NUMBER OF POLICIES: EXPERIENCE IN UNITED KINGDOM
 COMPARED WITH NORTH AMERICAN EXPERIENCE (NEW YORK STUDY) AND WITH DISABILITY MODEL*
 (Annual Claim Costs per \$1 a Week, First Year of Benefit Period and Subdivisions Thereof)

AGE GROUP	DEFERMENT (ELIMINATION) PERIOD (WEEKS)	EXPERIENCE	PERIOD OF DISABLEMENT†					TOTAL CLAIM COST (WEEKS)	RATIOS TO COST WITH 1-WEEK DEFERMENT		
			1/3	4/9	13/13	26/26	52/e‡		4/9	13/13	26/26
30-39	1	U.K.	.184	.105	.042	.029	.000	.360	100%	100%	100%
		Model	.145	.111	.048	.043	.001	.348	100	100	100
	4	N.A.						.370			
		U.K.		.099	.038	.021	.001	.159	94	90	72
	13	Model		.047	.025	.021	.003	.102	42	52	63
		N.A.						.089			
	26	U.K.			.019	.014	.005	.038		45	48
		Model			.017	.020	.008	.045		35	47
	26	N.A.						.043			
		U.K.				.014	.009	.023			48
	Model				.019	.013	.032			44	

* 1973 Swiss Re disability model, *TSA*, XXVI, 1.

† 1/3 refers to the 3 weeks following the first week of disablement; 4/9, 9 weeks after the first 4 weeks; etc.

‡ e = deferment period in weeks.

TABLE 1—Continued

AGE GROUP	DEFERMENT (ELIMINATION) PERIOD (WEEKS)	EXPERIENCE	PERIOD OF DISABLEMENT					TOTAL CLAIM COST (WEEKS)	RATIOS TO COST WITH 1-WEEK DEFERMENT		
			1/3	4/9	13/13	26/26	52/e1		4/9	13/13	26/26
40-49	1	U.K.	.217	.172	.075	.067	.002	.533	100	100	100
		Model	.186	.193	.112	.090	.003	.584	100	100	100
	4	U.K.		.163	.083	.065	.006	.317	95	111	97
		Model		.091	.058	.066	.008	.223	47	52	73
	13	U.K.			.035	.027	.005	.067		47	40
		Model			.040	.053	.022	.115		36	59
26	U.K.				.029	.018	.047			43	
	Model				.046	.038	.084			51	
50-59	1	U.K.	.271	.264	.120	.123	.005	.783	100	100	100
		Model	.258	.360	.262	.254	.008	1.142	100	100	100
	4	U.K.		.237	.154	.134	.013	.538	90	128	109
		Model		.210	.165	.217	.029	.621	58	63	85
	13	U.K.			.103	.126	.033	.262		86	102
		Model			.121	.180	.078	.379		46	71
	26	U.K.				.088	.060	.148			72
		Model				.169	.146	.315			67

The British report includes a comment with respect to the development of results in terms of numbers of policies rather than amounts of insurance, stating: "It has been noted that the investigation of sickness on the basis of amounts of benefit is liable to distort the experience. If the data provide adequate evidence, an early opportunity will be taken to investigate the effect; nevertheless it is not expected that results on an 'amounts' basis will be published for some time."

It will be interesting to see a comparison of the experience by amounts with that by numbers. In the North American data the differences are substantial. In the intercompany study of disability benefits incorporated in life insurance policies, which covered the years 1930-50 (*TSA, 1952 Reports*), all the tables developed for publication were based upon amounts of insurance, the monthly benefit being uniformly 1 percent of the face amount of insurance. The contributing companies, however, did provide data by number as well as by amount of insurance, and the committee that conducted the analysis made the following observation with respect to the experience by number of policies in relation to that by amount of insurance:

The resulting ratio of actual to expected was 88% for Benefits 2, 3 and 4 combined, and 91% for Benefit 5 (no data were available for Benefit 1). The ratios were remarkably uniform both by ages and by periods, and are therefore not presented in detail. Attention is called to the corresponding comparison (see Tables 13a and 13b) between number and amount experience as to termination rates; this also indicates more favorable experience by number than by amount, except for Benefit 5, where no differential appeared.

In the experience of disabled lives the experience by numbers showed both higher death rates and higher recovery rates than did the experience by amounts, except that on benefit 5, waiver of premium only, the recovery rates were slightly lower by number than by amount. For benefits 2 and 3 combined, the total terminations by number were 5 percent higher than those determined on the basis of amount of insurance. Thus the monetary cost was higher when computed on an amounts basis both with respect to incidence of disability and duration of claim (*TSA, 1952 Reports*, p. 128).

The combined impact of the higher claim rates by amount and lower termination rates results in an increase of the order of 15-20 percent in the premiums for disability insurance on the basis of the 1930-50 experience.

A comparison of the 1972-73 experience, as reported for the New York study, indicates, on the average, a somewhat higher relative increase when the experience is measured by amounts rather than by numbers. The relative increase, however, varies so much in the different subdivisions of the data, particularly according to the occupational classification, that a more definitive comparison will not be attempted.

With the exception of very limited experience of one company reported many years ago, nothing has been published, to my knowledge, that measures disability claim costs under individual policies according to the amount of in-

demnity payable. However, a more relevant measure is the ratio of indemnity for disability to the insured's earnings—a measure that has come to be referred to as the "replacement ratio." In recent years the reports on group long-term disability experience, published by the Society, have shown claim rates according to the ratio of group benefits (before deduction of social security benefits and other group insurance) to employee earnings. The latest report, covering the 1969-73 experience (*TSA, 1975 Reports*), reveals that claim costs rise dramatically with each increase in the percentage of earnings replaced by disability insurance.

Gross Benefit Ratio	Ratio of Actual to Tabular Claim Frequency
50% or less.....	87%
Over 50%.....	107
Over 60%.....	121
Over 70%.....	247

Comparisons of the 1972-73 intercompany claim costs on individual policies, according to the New York data, were previously mentioned. The corresponding experience for the biennium 1968-69 showed substantially less excess in the cost by amounts over that by numbers. This suggests that the rapidly rising social security benefits as well as higher benefits from other public systems—workmen's compensation, and state cash sickness plans, especially in California—may have had an influence.

It is apparent that the ratemaking procedure employed by many disability insurers has not recognized that costs may be significantly higher by amounts as compared with those by numbers. This may be inferred from the widespread use of the quantity discount, that is, the pricing of disability benefits as a rate per hundred dollars of monthly indemnity plus a flat expense charge or policy constant regardless of the size of the policy.

Evidence of higher costs by amounts over those by numbers may appear to be at odds with indications from experience by occupation or by occupational classification. For example, an insurer may find that high average amounts of indemnity on professionals are often accompanied by low claim costs. Also, it may find that its least hazardous class shows both the highest average indemnity and the best experience. How do we reconcile this with the comparison of experience by amounts and numbers? The explanation may lie in the comparative homogeneity of the categories being compared. If the experience within each occupation or each occupational class were subdivided according to amount of indemnity or, better yet, by total replacement ratio (aggregate coverage from all sources to earned income), it might be found that within each experience cell the larger policies, or the policyholders with higher replacement ratios, produce relatively higher claim costs, even though the cell in its entirety shows favorable experience.

The issue of overinsurance, inferred from the comparisons of experience by

amounts with that by numbers, has been examined at some length because it may provide at least one reason for the different character of the North American and United Kingdom experiences. Table 1 indicates, except for policies with four-week deferment, that the level of experience is higher in North America. This difference could result from less favorable experience on larger policies, since liberal or redundant benefit amounts tend to induce more and longer claims. The experience by amounts reflects the full financial effect of such a consequence, but the experience by numbers is not unaffected. Although not weighted by the amount of indemnity, the increased claim frequencies or durations by reason of overinsurance are nevertheless reflected in the claim frequencies and claim costs by numbers of policies.

Another valuable aspect of the new report from the Institute and Faculty committee is the confirmation of very substantial deferment period selection. This phenomenon was demonstrated by the Swedish experience¹ and again by the experience from the North American continent,² and was discussed in a 1971 paper presented to the Institute of Actuaries.³ It appears that the intensity of this selection in Great Britain is comparable to that in Sweden, the United States, and Canada. To demonstrate this, we have used the figures from Tables 1-4 (1972-73 experience) of the British study. These are presented in the last three columns of Table 1 of this review. A division, for like periods of disablement, of the disability cost for each deferment period by that for the one-week deferment shows that costs for theoretically identical risks diminish, in general, as the deferment increases. The resulting ratios, in comparison with those based on the model, are given in the last three columns of table 1.

It will be seen that, except for policies with four-week deferment, the pattern of deferment period selection is not dissimilar to that on this side of the Atlantic. Perhaps the divergencies are explained by the following quotation from the British report:

3.2.4. In studying the rates for the different periods it should be borne in mind that one cannot prejudge the effect of the deferred period on the experienced sickness. Few offices at present issue immediate benefit policies on a significant scale. If one compares the "after 26 weeks" rates of sickness for such policies with the "after 26 weeks" rates for 6-months deferred policies, it is not possible to attribute the differences to the effect of the deferred period. Subject to further evidence in the future, it seems more likely that the differences are largely due to other characteristics of the portfolios of contributing offices. For example, an office may contribute a high proportion of the data for policies with a short deferred period but a lower proportion of the data for longer deferred periods, because the data for longer deferred periods is submitted by a larger number of offices. Thus its claims experience would affect the overall rate of claim for short deferred periods more than the rate for long deferred periods.

¹ Carl-Gosta Dillner, "New Bases for Non-cancellable Sickness Insurance," *Skandinavisk Aktuarietidskrift*, Vol. XXV (1969).

² John H. Miller and Simon Courant, *A Mathematical Model of the Incidence of Disability*, *TSA*, XXVI (1974), 1.

³ J. Hamilton-Jones, "Actuarial Aspects of Long-Term Sickness Insurance" (paper presented to the Institute of Actuaries, November 22, 1971).

The British report also comments as follows on "claim inception rates" (claim rates, in North American terminology):

3.3.2. There are three features which seem worthy of comment. First for 1 week deferred benefits up to age group 55-59 the male claim inception rate is surprisingly constant. Secondly, there is a high inception rate for the age groups 20-24 for almost all deferred periods. It is probably premature to investigate why this should be, but recent mortality investigations have shown a similar feature. Thirdly, the overall inception rate for females is higher than for males. In view of the small numbers of females involved any breakdown of this comparison into age groups is probably superfluous this year.

The claim inception rates are reported only for the 1972 experience year. For policies with one week or four weeks' deferment they are substantially higher than the corresponding rates based on the model, but their relationship is reversed for the longer deferment periods.

The report mentions plans with respect to disability annuities: "3.3.3. The Sub-Committee plans to calculate disability annuities later on, but the data of several more years will be needed before a start can be made on this."

Actuaries and students interested in disability insurance will find the full report well worth their study.

The writer is indebted to Mr. Hamilton-Jones for his kindness in reviewing an earlier draft of these comments and offering helpful suggestions.

JOHN H. MILLER

"The Graduation of Pensioners' and of Annuitants' Mortality Experience, 1967-70," *Continuous Mortality Investigation Reports, No. 2*, p. 57, Institute of Actuaries and Faculty of Actuaries, 1976.

This report contains the graduation of pensioners' and annuitants' mortality experienced in the years 1967-70. Of greatest interest to North American actuaries is the method by which the graduation is carried out. After some experimentation with specific parametric forms of various mortality functions, it was decided to fit a curve of the form

$$q_x = \frac{\exp [F(x)]}{1 + \exp [F(x)]}$$

to the crude mortality rates, where $F(x)$ is a polynomial of whatever degree is appropriate for the data, namely,

$$F(x) = \sum_{r=0}^n a_r x^r .$$

The method of maximum likelihood is used to determine the values of the parameters $\{a_r\}$. They are chosen so as to maximize the natural logarithm of the likelihood function, that is, to maximize

$$\sum_x (A_x \log q_x + (ER_x - A_x) \log p_x) ,$$

where A_x is the number of actual deaths at age x and ER_x is the exposed to risk at that age. The degree of the polynomial $F(x)$ is determined by including all terms in the polynomial that add a value of 2.0 or more to the log likelihood. A value of 2.0 or more is significant at approximately the 5 percent level of significance.

Maximization of the log likelihood function results in the system of equations

$$\sum_x x^r (A_x - ER_x q_x) = 0, \quad r = 0, 1, \dots, n^*,$$

where n^* is the order of the polynomial being tested. This system of equations shows that at the values of the parameters selected, the actual and expected numbers of deaths are equal, as are the first n^* moments of actual and expected deaths.

Various graduations were carried out on the data that were divided by sex, by lives and amounts. A series of statistical tests was carried out to test the fit of each graduated curve. In most of the graduations of pensioners' data, it was found that a quadratic form of the function $F(x)$ provided a satisfactory fit. The second-degree term was found to represent the real decline during ages 50-60. As a result, for normal retirements only, a linear form was found to be not significantly worse. In only one of the eight graduations presented was a polynomial of order 3 required. That was in the case of female annuitants for durations 1 and over combined.

When one compares the results to the 1971 Group Annuity Mortality Table, one finds, as would be expected, that the graduated experience rates are uniformly higher. The values are typically from 10 to 50 percent higher, lower percentages applying to higher ages and higher percentages applying to lower ages.

All actuaries interested in statistical approaches to the graduation problem and those interested in an extremely flexible method will find the methodology most interesting.

HARRY H. PANJER

Geoffrey N. Calvert, *Pensions and Survival—the Coming Crisis of Money and Retirement*, pp. 167, Financial Post Books, 481 University Ave., Toronto, Ontario, Canada M5W 1A7, 1977, \$10.95.

Geoffrey Calvert, in his usual incisive and dramatic manner, sounds the alarm about the catastrophic situation facing the pension system, both public and private, in Canada over the long-range future. Too often actuaries, like modern-day Cassandras, are ignored by the general public when they discuss financial situations projected some decades hence. Mr. Calvert, however, clearly and forcefully makes the point that such long-range problems are inevitably coming and require action now, so that the general reader will be able to see this quite clearly. The value of this book is not limited to Canadian audiences but is equally applicable south of the border.

Mr. Calvert first demonstrates the demographic background of the problem for Canada (which is similar to that for the United States). Beginning shortly

after the turn of this century, the population at the retirement ages will represent a drastically and increasingly higher proportion of the population at the working ages. Although he recognizes that, at the same time, there will be fewer children to support in their dependency, he believes that this is not significant enough to offset the higher governmental costs for the retired, because expenditures for children are a personal matter. In this reviewer's opinion, there is a considerable offset here, because much tax money is now being spent for education and similar purposes for children that will eventually be greatly reduced (at least in relative terms).

Mr. Calvert next goes on to point out the fact (which should be obvious to all but often is not) that fundamentally the support for pensions must come from national productivity. Although the Canada Pension Plan and the Quebec Pension Plan (C/QPP) are accumulating sizable funds under present financing provisions, their balances will reach a peak in about fifteen years and will then rapidly decrease. Furthermore, under the CPP, the investments are being made in provincial government bonds and thus do not go directly toward strengthening the capital stock of the nation.

On the other hand, actuarially funded private pension plans are continuing to build up sizable funds that are vital for the development of the economy. Mr. Calvert accordingly strongly favors a strengthening of the private pension system, with C/QPP continued at its present relative level, but with redesigned financing. On the other hand, he sees great dangers if, as some advocate, C/QPP benefit levels are greatly expanded (which will be largely to the detriment of private pension plans).

In connection with the effect of nonfunded social security systems, Mr. Calvert quotes favorably the views of Martin Feldstein that the United States program has reduced capital formation. This reviewer cannot agree with the economic analysis made by Feldstein, because it does not consider what else would have happened if there had been no social security program (for more details see "The Role of Actuaries and Economists in Cost Analyses and Financing Aspects of Social Security Programs," *RSA* Vol. 2, No. 1, pp. 81 ff.).

Mr. Calvert, who was one of the earliest advocates of automatic adjustments in pension plans (see his classic paper "Cost-of-Living Pension Planning," *Harvard Business Review*, September-October, 1954), has had some second thoughts on the matter. Now he believes that it is necessary to adjust only a portion of the pension to reflect changes in the cost of living. He bases this approach on Canadian data on poverty limits that show that per capita needs decline somewhat with advancing age for persons aged 65 and over, being about 12 percent lower at ages 80 and over than at ages 64-69. Accordingly, he believes that desirable results can be obtained by indexing fully only the governmental benefits (which should not be expanded to provide a greater proportion of economic security needs), and then only part (or even none) of private pensions. Mr. Calvert is particularly concerned with the full indexing, without limit and without delay, of pensions for Canadian civil servants.

This reviewer cannot agree with Mr. Calvert's current position against full indexing of pensions. The expenditure figures by age that were considered might

reflect not lesser needs as age advances but rather less income to meet needs. It seems appropriate and equitable that the purchasing power of pensions should be protected and that individuals should be able to count on this for their future expenditure levels. If Mr. Calvert is correct in this respect, then should not pensions designed for static economic conditions be on a decreasing basis rather than level? And accordingly, then, if there is inflation, there should be full indexing.

This reviewer is thoroughly in accord with Mr. Calvert as to the necessity for higher retirement ages in the future (here meaning not necessarily next year or the year after, but eventually) and for fiscal soundness and cost recognition. Along with these views, Mr. Calvert also stresses the necessity for the public to take a closer (and changed) view as to work, so that there is the realization that pension security can be based only on productivity. Thus there should be longer productive lives for people, with a gradual phasing out from active work to retirement and with continual efforts being made to provide meaningful work.

There are a few factual matters on which this reviewer believes Mr. Calvert has gone somewhat astray. On page 50, in discussing the horrendous unfunded liabilities of the United States civil service retirement system, the reader should note that these are no longer so large (although they are still quite sizable), because of the repeal of the 1 percent "kicker" last fall. On the other hand, the unfunded liability of the United States social security program is currently being stated as \$4.2 trillion, not \$2.8 trillion. On page 121 it is said that four-fifths of men die before their wives. This figure should be more in the neighborhood of 70 percent (see *Statistical Bulletin*, Metropolitan Life Insurance Company, January, 1977).

Mr. Calvert's book is most thought-provoking and should be read by all who have an interest in the future—and in their own future, too (and who does not?).

ROBERT J. MYERS

Bruce F. Spencer, *Group Benefits in a Changing Society*, pp. 330, Charles D. Spencer & Associates, 222 West Adams St., Chicago, Ill. 60606, 1976, \$17.50.

As might be expected in a business as dynamic as group insurance, few textbooks have been available to the group insurance consultant that provide an up-to-date survey of the design and direction of employee benefit programs. Bruce Spencer, associate editor of *Employee Benefit Plan Review*, has set out to fill this void with *Group Benefits in a Changing Society*. This is a formidable task, and this reader judges the result to be only partially successful.

The book's greatest strength lies in its comprehensive description and an explanation of life, disability, and medical care benefits currently available in the marketplace. The material on ERISA and noninsured approaches also provides useful reviews and checklists for these subjects. In addition, although the text is punctuated with what appears to be a lifetime supply of exclamation points, the writing is generally clear and effective. Unfortunately, however, the book contains a significant number of errors and misinterpretations that detract from its credibility.

Two factual errors are offered as examples. In Chapter 2 the author indicates that section 79 of the Internal Revenue Code "prohibits the use of medical underwriting to determine benefits or rates for group term life coverage for cases under 10 lives." Rather than prohibiting medical underwriting below ten lives, section 79 withholds favorable tax treatment in such situations—a distinction of considerable importance to a benefits consultant, who might be tempted by the text's statement to tell his client that an insurer could not legally request such underwriting. In Chapter 3 the text states that Maine currently has a minimum first-year group term insurance rate law in effect. The law was repealed in 1975.

More seriously, the text also shows an incomplete understanding of the mechanics and objectives of premium setting and experience refund practices. An example of this is the concern expressed that "the risk that the older employee working for a small company may die might be greater than can be offset by reasonable premiums." Actually it is the existence of financial risks that cannot be safely absorbed by an individual or a small group that is the basis of the insurance enterprise. Also, a statement that "many insurance companies are happy" to have a claim ratio below 95 percent for small groups suggests a higher tolerance for suffering than one would believe exists in the industry.

There is also a surprising benefit omission in the text. In the description of major medical deductibles, there is no reference to medical care deductible accumulation periods of less than twelve months.

Considering the difficulty of the task that the author undertook, it is not surprising that he does not successfully negotiate all the pitfalls. Nevertheless, the book is welcome and, even though it has to be read critically, deserves the attention of those interested in the current state of employee benefit plans.

WILLIAM SCHREINER

Francisco Roberto Bayo and John C. Wilkin, *Experience of Disabled-Worker Benefits under OASDI, 1965-74*, pp. 44, Actuarial Study No. 74, Social Security Administration, Baltimore, Md., January, 1977.

In an age of uncertainty, the quest for security can become pernicious to the point where the members of a society no longer "want" individual responsibilities. And, as history teaches, freedom from individual responsibilities can be purchased only with the loss of individual freedoms. In an age gone by, the Hebrews sought insulation from individual responsibilities, as they became forgetful of their spiritual ordination, wanting to do away with the system of judges and wanting to have a king like other nations. Samuel said it all when he told them: "If you insist on having a king, he will conscript your sons and make them run before his chariots. . . . He will take away the best of your fields and vineyards and olive groves and give them to his friends. He will take a tenth of your harvest and distribute it to his favorites. He will demand . . . the finest of your youth. . . . He will demand a tenth of your flocks, and you shall be his

slave" (I Sam. 8: 11-17). Samuel's words are easily understood in terms of what can be seen happening in America today.

The statistics that authors Francisco Bayo and John Wilkin expertly set forth in *Experience of Disabled-Worker Benefits under OASDI, 1965-74* (Actuarial Study No. 74) chronicle what John H. Miller has referred to as "the proliferation of social security disability benefits." The statistics foretell in small part the ever growing dependency on government. Including disabled workers receiving benefits under OASDI, the proportion of "workers" on the public "payroll" has become nearly one in every four.

It has been over four decades since the social security system became law and over two decades since disability insurance was added thereto. In 1977 over \$90 billion should be paid under the system, of which about \$12 billion should be paid to disability insurance beneficiaries. Staggering amounts. The increase in the average number of disabled-worker beneficiaries has been rapid over the years, as is evidenced by the following figures:

Calendar Year	Average No. of Disabled Workers in Force
1957.....	81,149
1960.....	397,241
1965.....	948,294
1970.....	1,460,007
1975.....	2,376,680

Are these figures a portent of an even greater expansion of the disability insurance program? And is what we are witnessing the destruction of a private industry by its socialization? Bayo and Wilkin ably delineate the forces causing the increase in disabled-worker beneficiaries and argue persuasively against the "popular" causes attributed to the increase—such causes as an increasing public awareness of the program and an increasing number of claims being filed in these uncertain economic times.

Nowhere do Bayo and Wilkin tell us, however, that the "king has no clothes on"; that is, what has been chronicled is the increasing socialization of an industry. True, dates are given for each legislative liberalization of the program. True, also, the impact on incidence and termination rates of each liberalization is discussed. But nowhere is the political significance of this history and what it portends for the future discussed. We ask in earnest if their primary purpose has been met: "The primary purpose of this study is to present recent information on incidence and termination rates. These rates are an important basis for projection of the cost of the disability insurance program. In order to project the future cost of the program, some hypotheses as to the future course of the incidence and termination rates must be made. This in turn involves the adoption of some hypotheses as to the causes of past trends."

It can be argued that commentary on the impact of the political process on the number of disabled-worker beneficiaries is outside the scope of a study such as this. But when the political process has been the dominant force affecting

the number of beneficiaries, from a public viewpoint how can such a dominant force be ignored if we are to project the cost of the program realistically?

Bayo and Wilkin assert that the rapid and continuous increase since 1970 in the number of disabled-worker beneficiaries cannot be explained in terms of legislated changes in the program. They attribute the increase to rapid rise in benefit levels, particularly to young workers and low-income workers (especially when dependents are present), to high unemployment and the general weakening of the economy, to changes in attitude in the population, and to changes in administrative factors in the program itself. But how many of these are not, to at least some extent, in fact a consequence of government actions?

Bayo and Wilkin point out (1) that the definition of disability as contained in the Social Security Act is "inability to engage in any substantial gainful activity by reason of a medically determinable impairment," (2) that the two determinants to "inability to engage" are (i) impairment and (ii) vocational factors, and (3) that with heavy emphasis on the vocational factors the definition can change to "inability to engage in usual work by reason of age, education, and work experience." Can it be much longer before this definition found in private insurance is adopted de facto or de jure for OASDI? They believe that progressively healthier individuals have been granted benefits and that progressively healthier individuals have been allowed to stay on the rolls. They point out that the average ratio of benefits to after-tax earnings of disabled workers with median earnings increased from about 60 percent in 1967 to over 90 percent in 1975, while the recovery rate in 1975 was only 33 percent of what it was in 1967.

The reported disability incidence rates would be more useful if they had been separated into broad classes of occupational hazards in addition to age, sex, and year of disability. The graduated termination rates, which are five-year select and ultimate and which vary by cause, age, and sex, would be more useful if they had reflected the more recent experience rather than the combined experience for the period 1968-74.

An appendix is attached to the study that sets out the development of a two-dimensional Whittaker-Henderson Type B graduation formula by Steven F. McKay and John C. Wilkin. This development, from the reviewer's viewpoint, is a valuable contribution to actuarial literature. The formula has been applied in obtaining the graduated termination rates. A valuable addition to the appendix would have been the program source language for the formula.

The authors are to be commended for the professional and public service rendered in making this study. This reviewer found the study both educational and challenging. It is recommended reading to any actuary interested in disability income insurance or in social insurance programs. The study contains a large quantity of meaningful data as well as perceptive commentaries.

CLAYTON A. CARDINAL

Howard E. Winklevoss, *Pension Mathematics: With Numerical Illustrations*, pp. 243, published for the Pension Research Council by Richard D. Irwin, Inc., Homewood, Ill. 60430, 1977.

The stated objective of this book is to analyze pension costs in detail, including the manner in which such costs vary under *different* actuarial assumptions, *funding methods*, and *benefit provisions*.

In the opinion of the reviewers, the author has done an admirable job of illustrating through numerous tables and mathematical examples the manner in which pension costs and reserves vary over time and under various actuarial assumptions and funding methods. The book deals only with defined benefit pensions. The cost illustrations are based primarily upon one model plan, namely, a noncontributory final average plan.

A brief outline of the contents may be useful. Chapter 1 briefly outlines the various types of benefits, both pension and ancillary benefits, commonly found under defined benefit pension plans. Chapters 2 and 3 set down some of the many considerations underlying the selection of actuarial assumptions used in computing pension costs. They also include interesting statistical charts and tables setting out specimen survival probabilities for each of the contingencies of death, withdrawal, and disability, and monetary functions based on these probabilities in combination. These chapters provide considerable insight into the development of pension cost factors.

At the risk of repeating the author's remarks, it may be in order to caution the student reader that the results shown here and throughout the book reflect only the one, defined set of assumptions and that a change in just one of the assumptions would produce significantly different results. The author himself makes this fairly clear and later in the book devotes a chapter to illustrating the mathematical effect of varying the assumptions.

Chapter 4 sets down in detail how a pension plan population consisting of active members, retirees, and former employees with vested benefits develops and changes over the years.

Chapter 5 sets down general pension cost concepts relating to the present value of future benefits, and discusses how these might vary under (i) a plan windup situation and (ii) a continuation-of-plan situation. Chapters 6-9 develop costs under the principal funding methods, namely, the accrued benefit method, the projected benefit method, the aggregate method, and generalized cost methods. These chapters provide excellent information on the incidence of pension costs under the various funding methods.

Chapter 10 provides an insight into the relative cost of each of the ancillary benefits found in pension plans, such as vesting, disability benefits, and spouse's benefits.

Chapter 11 sets out total pension plan costs, including the various ancillary benefits under each of the principal funding methods.

Chapter 12 analyzes the cost of early retirement provisions. It is shown that under a final average plan, where a full actuarial reduction is applied to the accrued benefit in determining the early retirement pension, the plan actually saves money on early retirements. Chapter 13 analyzes the cost of early retirement under the various funding methods.

Chapter 14 investigates the cost of various plan provisions, such as more liberal early retirement provisions, indexing, different vesting provisions, disability benefits, and spouse's benefits.

Chapter 15 analyzes in detail the effect upon costs of varying the several actuarial assumptions, including the effect of varying the interest rate and salary scale together.

Finally, Chapters 16 and 17 explain and illustrate pension plan cost projections, sometimes referred to as "cash flow" projections, under which the costs and plan position are forecast for each of several years into the future. The purpose of these projections is to provide more insight into the incidence and level of costs than is provided under the traditional present-value actuarial valuation. Chapter 17 illustrates the application of the forecast technique to several benefit changes.

This book provides a considerable amount of insight into pension costs. Although the book is approached from a very mathematical viewpoint, and uses notation unfamiliar to most actuaries, it will be a valuable exercise to all pension actuaries to analyze the intricacies of pension cost relationships covered by the author.

The book should be instructive even to the established consulting actuary. Although he will, in most cases, already be familiar with most of the numerical conclusions and relationships, a study of the detailed tables and numerical illustrations can serve only to sharpen his tools. It is the feeling of the reviewers that in most cases this sharpening process will be quite valuable.

This book is likely to be of quite limited use to a nonactuary, who, unless well trained in mathematics, would not normally be able to follow the formulas and mathematical relationships. He might, however, find some interest in the tables and numerical conclusions. In any case, he must beware of treating the results as applicable to all pension plans and situations.

The book could be very useful as a part of the required reading for the actuarial student specializing in the pension side of the business. However, there are several minor errors in the formulas throughout the book that should first be corrected by means of a careful reading. Various places where the author is developing his ideas and inadvertently uses the wrong symbol may cause the reader inexperienced in pensions some frustration in understanding the presentation.

In the opinion of the reviewers, as a basic reference the book is probably most useful to those interested in pension cost relationships examined from a theoretical and mathematical viewpoint. This purpose the book fulfills very well. The book was presumably not intended to provide a practical look into pension consulting practice and related government regulations, or even to provide an insight into which funding method is appropriate under a given set of circumstances.

RONALD A. FLETCHER

OWEN O'NEIL

Ten years ago, Howard Winklevoss, while writing his doctoral thesis on pension costs, discovered that no comprehensive textbook on pension mathematics existed. Furthermore, the available papers and articles on pension mathematics had been written by actuaries for actuaries and thus were incomprehensible to anyone who lacked a basic actuarial education.

In his preface to *Pension Mathematics: With Numerical Illustrations*, Winklevoss describes the purpose and content of his book:

This book has been written to help fill the mathematical and numerical gap in the pension cost literature. The mathematical material presented in the book, while conforming to standard actuarial notation, begins with basic definitions and principles so that mathematicians in fields other than actuarial science, as well as actuaries, will have a comprehensive source on pension mathematics. Chapters 2 and 3 give the basic definitions of various actuarial functions, while Chapters 5 through 9 give the mathematics of various actuarial cost methods. Much of the material presented in Chapters 10 and 11 on the mathematics of ancillary benefits is new to the actuarial science literature, as is the mathematics on early retirement given in Chapters 11 and 12.

The usefulness of the book, however, is not restricted to mathematically oriented readers. Chapter 1 introduces the subject of pension costs; parts of Chapters 2 and 3 discuss various aspects of actuarial assumptions; Chapter 4 provides background on pension plan populations; and parts of Chapter 5 deal conceptually with basic pension cost concepts, all of which will be of interest to nonmathematically oriented readers. Chapters 14 through 16 consist entirely of numerical illustrations of pension costs and are almost entirely independent of the mathematics presented in earlier chapters. Chapter 14 investigates the sensitivity of pension costs to various pension plan designs; Chapter 15 shows the sensitivity of pension costs to different actuarial assumptions; Chapter 16 gives the results of using alternative actuarial cost methods on a hypothetical pension plan population simulated over a 50-year forecast period; and Chapter 17 presents the results of numerous pension cost forecasts, under different assumptions as to interest yields, salary increases, and so forth. Thus, a substantial portion of the book provides information which will be helpful to plan administrators, corporate treasurers, and other management personnel concerned with pension costs.

In spite of the publication of two excellent texts¹ on pension mathematics since Winklevoss' student days, this book does indeed achieve his goal of filling "the mathematical and numerical gap in the pension cost literature." A mathematically inclined layman can acquire a good understanding of pension funding and of its mathematical concepts by mastering *Pension Mathematics*. Furthermore, Winklevoss has written a well-organized, clear, and interesting book. Laymen will appreciate the relative ease with which they can move from simple basic principles to advanced pension mathematics.

Chapter 4, "Pension Plan Population Theory," is an illuminating addition to actuarial literature. Chapter 13, "Early Retirement under Actuarial Cost Methods," and Chapters 16 and 17 on pension cost forecasts are especially informative for laymen and actuaries alike.

While *Pension Mathematics: With Numerical Illustrations* seems nearly ideal

¹ B. N. Berin, *The Fundamentals of Pension Mathematics* (2d printing; Society of Actuaries, 1972); C. L. Trowbridge and C. E. Farr, *The Theory and Practice of Pension Funding* (Homewood, Ill.: Richard D. Irwin, Inc., 1976).

for educating nonactuaries painlessly, it can be considered to be lacking in some respects. Many actuaries may consider the treatment of explicit versus implicit assumptions to be one-sided, since Winklevoss has adopted explicit assumptions without reviewing the explicit and implicit arguments. A minor deficiency is the typographical errors. A choice example is on page 187: "The effect of female members is analyzed by replacing the *all-made* assumption with an all-female assumption."

The clarity of the book is enhanced by the omission of any reference to the standard commutation functions. This omission, however desirable for meeting the book's avowed purpose, means that the book is not sufficient in itself to provide a complete education in pension mathematics.

Winklevoss' notation seems optimal for its purpose, but it is not standard, despite his claim. Considered in isolation, it is easy to follow, but it still could confuse Society actuarial students who are learning another notation simultaneously. Conformity to standard notation should be a goal of every actuarial writer.

Winklevoss has avoided certain complications, probably in the interest of clarity and brevity. Three of these, however, should have been considered. First, to accompany the projections illustrating the costs of automatic cost-of-living increases (in Chapter 17, "Illustrative Pension Cost Forecasts"), at least a discussion, if not an illustration, of the alternative of periodically updating pensioners' benefits should be included. Second, the author ignores the new-money concept entirely, while in his pension cost forecasts he incorporates abrupt changes in investment yield without discussing how these changes might occur. Third, he does not cover the subject of asset valuation at all. These three matters could have been covered without increasing the length of the book if some concepts of lesser consequence had been deemphasized. For example, the profuse illustrations and discussions of two little-used modifications of the accrued benefit cost method (unit credit) could have been cut back substantially.

Although *Pension Mathematics: With Numerical Illustrations* could be improved in some respects, this reviewer recommends it highly not only for laymen but for experienced pension actuaries. This book can improve the understanding of pension funding even for F.S.A.'s because of its unique development of pension mathematical theory. In addition, it is a practical reference book for actuaries who are exploring the short- and long-term cost implications of plan changes, actuarial changes, and experience deviations.

E. ALLEN ARNOLD

SELECT CURRENT BIBLIOGRAPHY

In compiling this list, the Committee for the Review of Literature has digested only those papers that appear to be of direct interest to members of the Society of Actuaries; in doing so, the Committee offers no opinion on the views that the various articles express. The digested articles will be listed under the following subject-matter classifications: 1—"Life Insurance and Annuities"; 2—"Health Insurance"; 3—"Social Security."

LIFE INSURANCE AND ANNUITIES

U.S. National Center for Health Statistics, *United States Life Tables by Causes of Death: 1969-71*, pp. 67, U.S. Decennial Life Tables for 1969-71, Vol. 1, No. 5, U.S. Department of Health, Education, and Welfare, Rockville, Md., May, 1975.

This publication presents the most current tables in the series of U.S. Decennial Life Tables that are based on the United States censuses, and registered deaths during the three-year period surrounding the year of the particular census. It gives twenty tables, showing all combinations of five color categories (total, white males, white females, males other than white, and females other than white) and four causes-of-death topics (abridged life tables for all causes of death combined, eliminating specified causes of death; number of life table deaths from specified causes; probability of eventually dying from specified causes; and gain in expectation of life due to elimination of specified causes of death). The introduction adds verbal as well as mathematical meaning to the above concepts.

U.S. National Center for Health Statistics, *Methodology of the National and State Life Tables for the United States: 1969-71*, pp. 19, U.S. Decennial Life Tables for 1969-71, Vol. 1, No. 3, U.S. Department of Health, Education, and Welfare, Rockville, Md., May, 1975.

This publication describes the methodology used in the decennial life tables for 1969-71 for the United States. The topics discussed are (1) preliminary adjustment of data, (2) data used for calculation of life table values, (3) numbers of survivors at ages 2 and under, (4) mortality rates at ages 2-94 and 95 and over, (5) calculation of the remaining life table values, and (6) the special adjustments in the state life tables.

U.S. National Center for Health Statistics, *Actuarial Tables Based on United States Life Tables: 1969-71*, pp. 76, U.S. Decennial Life Tables for 1969-71, Vol. 1, No. 2, U.S. Department of Health, Education, and Welfare, Rockville, Md., May, 1975.

This publication presents the most current tables in the series of U.S. Decennial Life Tables that are based on the United States censuses, as well as registered deaths during the three-year period surrounding the year of the particular census. It presents sixty-six commutation function tables, showing all combinations of three color categories (total, white, and Negro), both sex categories, and eleven interest rate categories from 3 to 8 percent by $\frac{1}{2}$ percent increments.

Individual Retirement Accounts, pp. 6, Actuarial Note No. 1-77, U.S. Railroad Retirement Board, Chicago, Ill., January, 1977.

This note summarizes the principal eligibility conditions for individual retirement accounts under the Employee Retirement Income Security Act of 1974, including the liberalizations under the tax reform act of 1976.

All employees not eligible to participate in a qualified pension plan are eligible to set up an IRA. It is interesting to note that the railroad retirement system is not considered a qualified plan; therefore, railroad employees are eligible for IRA's except where an employee is participating in the private pension plan of an individual railroad or a pension plan from nonrailroad employment or self-employment.

HEALTH INSURANCE

The National Center for Health Statistics publishes "Vital and Health Statistics," which consists of several series of reports, some of the more recently published of which may be of interest to actuaries. Several are digested below. To be placed on the mailing list for items in this series, write to:

U.S. Department of Health, Education, and Welfare
Public Health Service
Health Resources Administration
National Center for Health Statistics
Center Building
3700 East-West Highway
Hyattsville, Maryland 20782

U.S. National Center for Health Statistics, *The Nation's Use of Health Resources—1976 Edition*, pp. x, 104, DHEW Publication No. (HRA) 77-1240, Government Printing Office, Washington, D.C., 1976.

This report includes "virtually the first effort of its kind to profile comprehensively the utilization of the Nation's Health Resources." The summary profile presented in the opening chapter is supported by subsequent chapters with more detail on the type of services studied. Statistics are presented on health care services rendered in ambulatory settings consisting of providers' offices, hospital outpatients, and other types of clinics; the care rendered to inpatients within short- and long-stay general and specialty hospitals; the care provided in institutional settings other than hospitals; and the care on an organized basis in patients' homes. Measures of utilization shown vary according to the setting in which the care is provided. Utilization data by selected characteristics of patients receiving care are also presented. Data sources include published and unpublished reports of governmental agencies as well as contributions of certain nongovernmental agencies. The data are generally applicable to 1973.

U.S. National Center for Health Statistics, *Hospital Discharges and Length of Stay: Short-Stay Hospitals, United States—1972*, pp. iv, 68, Data from the National Health Survey, Series 10, No. 107, Rockville, Md., September, 1976.

This study presents statistics on number of patients discharged from short-stay hospitals, number of days in hospital, and whether surgery was performed, by whether or not hospitalization was for a delivery and by selected demographic and other characteristics. The data were collected in health interview surveys during 1972 and refer to civilian, noninstitutionalized persons alive at the time of interview.

U.S. National Center for Health Statistics, *Acute Conditions: Incidence and Associated Disability, United States, July 1974—June 1975*, pp. iv, 68, Data from the National Health Survey, Series 10, No. 114, Rockville, Md., February, 1977.

Statistics are given on the incidence of acute conditions and the associated days of restricted activity, bed disability, and time lost from work and school, by age, sex, calendar quarter, place of residence, and geographic region. The data were collected in household interviews during the period July, 1974—June, 1975.

U.S. National Center for Health Statistics, *Utilization of Short-Stay Hospitals: Summary of Nonmedical Statistics, United States—1973*, pp. iv, 44, Data from the National Health Survey, Series 13, No. 23, Rockville, Md., July, 1976.

Statistics are presented on the utilization of short-stay hospitals, based on data collected in the Hospital Discharge Survey from a national sample of hospital records of discharged patients. Discharges, days of care, and average length of stay are distributed by each of the variables age, sex, and color of patient and by geographic region, bed size, and type of ownership (control) of hospital.

U.S. National Center for Health Statistics, *Inpatient Utilization of Short-Stay Hospitals by Diagnosis, United States—1973*, pp. iv, 76, Data from the National Health Survey, Series 13, No. 25, Rockville, Md., October, 1976.

Statistics are presented on the utilization of nonfederal short-stay hospitals, based on data abstracted by the Hospital Discharge Survey from a national sample of hospital records of discharged inpatients. The number of discharges, discharge rates, and average length of stay are shown for the classes and categories of first-listed diagnoses, by demographic characteristics of inpatients discharged, and by geographic region and bed size of the hospitals. For these patient and hospital characteristics, this report also presents the number and percent distribution of all listed diagnoses (up to five diagnoses per patient) reported for inpatients discharged.

U.S. National Center for Health Statistics, *Current Listing and Topical Index to the Vital and Health Statistics Series, 1962-1976*, pp. 24, Rockville, Md., May, 1977.

U.S. National Center for Health Statistics, *A Summary of Studies of Interviewing Methodology*, pp. viii, 80, Data Evaluation and Methods Research, Series 2, No. 69, Rockville, Md., March, 1977.

A summary is presented of methodological studies designed to test the effectiveness of certain questionnaire designs and interviewing techniques used in the collection of data on health events in household interviews and to investigate the role of behaviors, attitudes, perceptions, and information levels of both the respondent and the interviewer.

U.S. National Center for Health Statistics, *Multiplicity Study of Marriages and Births in Israel*, pp. vi, 64, Data Evaluation and Methods Research, Series 2, No. 70, Hyattsville, Md., June, 1977.

A description is given of an experimental study, the aims of which were to test the feasibility of conducting a multiplicity survey for marriages and births in Israel and to evaluate different counting rules. The study included an evaluation survey from which estimates of the components of mean-square error were obtained. The results indicate that an overall reduction of mean-square error was obtained by use of a multiplicity rule instead of a conventional rule. The substantial reduction in sampling error attained by the use of multiplicity was not offset by the slight increases in response bias and variance.

U.S. National Center for Health Statistics, *The Cooperative Health Statistics System: Its Mission and Program*, pp. vi, 16, Documents and Committee Reports, Series 4, No. 19, Rockville, Md., April, 1977.

U.S. National Center for Health Statistics, *Out-of-Pocket Cost and Acquisition of Prescribed Medicines, United States, 1973*, pp. iv, 48, Data from the National Health Survey, Series 10, No. 108, Rockville, Md., June, 1977.

Estimates are presented on the out-of-pocket cost and number of acquisitions of prescribed medicines per person per year by source of payments and selected demographic characteristics. Estimates are also presented on the conditions for which the medicines were used. The report is based on data collected in the Health Interview Survey during 1973.

U.S. National Center for Health Statistics, *Use of Selected Medical Procedures Associated With Preventive Care, United States—1973*, pp. vi, 52, Data from the National Health Survey, Series 10, No. 110, Rockville, Md., March, 1977.

Statistics are presented by selected demographic and health variables on proportion of specific population groups ever receiving electrocardiograms, glaucoma tests, chest X-rays, eye examinations, Pap smears, breast examinations, and routine physical examinations; the interval since the last examination; and patterns of prenatal and postnatal medical care. They are based on data collected in the Health Interview Survey during 1973.

U.S. National Center for Health Statistics, *Limitation of Activity Due to Chronic Conditions, United States, 1974*, pp. iv, 68, Data from the National Health Survey, Series 10, No. 111, Rockville, Md., June, 1977.

Statistics are given on persons limited in activity as a result of chronic conditions by age, sex, color, family income, educational attainment, usual activity status, living arrangements, geographic region, and place of residence. Statistics are also presented on chronic conditions reported as causing limitation of activity, by demographic characteristics. They are based on data collected in household interviews during 1974.

U.S. National Center for Health Statistics, *Goodenough-Harris Test Estimates of Intellectual Maturity of Youths 12-17 Years: Demographic and Socioeconomic Factors*, pp. iv, 44, Data from the National Health Survey, Series 11, No. 159, Rockville, Md., April, 1977.

Intellectual maturity of youths 12-17 years of age as measured by the Goodenough-Harris drawing test is discussed in terms of education of parent, family income, place of residence (size, type, and rate of population change), progress through school, race, and geographic region.

U.S. National Center for Health Statistics, *An Assessment of the Occlusion of the Teeth of Youths, 12-17 Years, United States*, pp. vi, 66, Data from the National Health Survey, Series 11, No. 162, Rockville, Md., February, 1977.

This report provides estimates of the distribution of selected major components of occlusion among youths; the prevalence of degrees of malocclusion; the average treatment priority index per youth by age, sex, race, family income, education of head of household, and region of residence; and a brief analysis of the relation of occlusal status to a reported need for orthodontic care.

U.S. National Center for Health Statistics, *Blood Pressure of Youths, 12-17 Years, United States*, pp. vi, 62, Data from the National Health Survey, Series 11, No. 163, Rockville, Md., March, 1977.

Systolic and diastolic blood pressure measurements of youths 12-17 years of age in the United States from the Health Examination Survey of 1966-70 are presented by age, sex, race, geographic region, urban or rural area of residence, family income, and education of head of household.

U.S. National Center for Health Statistics, *Monocular Visual Acuity of Persons 4-74 Years, United States—1971-1972*, pp. iv, 68, Data from the National Health Survey, Series 11, No. 201, Rockville, Md., March, 1977.

Herein are reported visual acuity levels with usual correction, if any, as determined in the ophthalmology examination before dilation, by race, geographic region, family income, and other selected demographic variables.

U.S. National Center for Health Statistics, *Dietary Intake Findings, United States, 1971-1974*, pp. iv, 76, Data from the National Health Survey, Series 11, No. 202, Hyattsville, Md., July, 1977.

This presents tables from the Health and Nutrition Examination Survey on the dietary intake of various nutrients in a probability sample of the United States population 1-74 years of age, by age, sex, race, and income level, 1971-74.

U.S. National Center for Health Statistics, *Tuberculin Skin Test Reaction among Adults 25-74 Years, United States, 1971-72*, pp. iv, 40, Data from the National Health Survey, Series 11, No. 204, Hyattsville, Md., July, 1977.

The prevalence of positive reaction to tuberculin skin tests, indicating exposure to and continuing hypersensitivity to tubercle bacilli, in the noninstitutionalized United States adult population, are shown by age, sex, race, geographic region, family income, education, marital status, and a measure of crowding in the household.

U.S. National Center for Health Statistics, *Characteristics, Social Contacts, and Activities of Nursing Home Residents, United States: 1973-74 National Nursing Home Survey*, pp. iv, 64, Data from the National Health Survey, Series 13, No. 27, Rockville, Md., May, 1977.

This report presents statistics on nursing home residents by sex, age, marital status, race or ethnicity, length of stay since current admission, prior living arrangements, outside leisure activities, overnight leave, and frequency of visitors. They are based on data collected in the 1973-74 National Nursing Home Survey.

U.S. National Center for Health Statistics, *Inpatient Utilization of Short-Stay Hospitals by Diagnosis, United States—1974*, pp. iv, 72, Data from the National Health Survey, Series 13, No. 30, Hyattsville, Md., July, 1977.

Statistics are presented on the utilization of nonfederal short-stay hospitals, based on data abstracted in the Hospital Discharge Survey from a national sample of hospital records of discharged inpatients. The number of discharges, discharge rates, and average length of stay are shown for the classes and categories of first-listed diagnoses, by demographic characteristics of inpatients discharged and by geographic region and bed size of the hospitals. For these patients and hospital characteristics, this report also presents the number and percentage distribution of all listed diagnoses (up to five diagnoses per patient) reported for inpatients discharged.

U.S. National Center for Health Statistics, *Utilization of Short-Stay Hospitals: Annual Summary for the United States, 1975*, pp. iv, 76, Data from the National Health Survey, Series 13, No. 31, Rockville, Md., April, 1977.

Statistics are presented in this report on the utilization of nonfederal short-stay hospitals, based on data collected by means of the Hospital Discharge Survey from a national sample of the hospital records of discharged inpatients. Estimates are provided by the demographic characteristics of patients discharged and by geographic region, bed size, and ownership of hospitals that provided inpatient care; conditions diagnosed; and surgical operations performed. Measurements of hospital utilization are given in terms of frequency, rate, percent, and average length of stay. Some comparisons of the nonmedical statistics for 1975 are made with those for 1965 and 1970 to identify trends.

SOCIAL SECURITY

Orlo R. Nichols and Steven F. McKay, *Social Security Benefits after the June 1976 Automatic Benefit Increase*, pp. 19, Actuarial Note No. 89, Social Security Administration, Baltimore, Md., July, 1976.

This note shows the social security benefit amounts payable to most individuals and family groups after the 6.4 percent automatic increase that became effective for June, 1976. Approximate formulas are given for the primary benefits and for the family maximum benefits. The maximum benefits payable for workers retiring at age 65 in all years from 1940 to the present are also shown. A brief description of the operation of the automatic adjustment provisions is included.

Orlo R. Nichols and Steven F. McKay, *The Effect of the 1976 Automatic Increase on Dynamic Projections of Benefits*, pp. 6, Actuarial Note No. 90, Social Security Administration, Baltimore, Md., August, 1976.

This note analyzes the effect that the social security automatic adjustment provisions enacted in 1973 will have on future benefits based on actual increases through 1976 and projected increases thereafter. Five alternative sets of economic assumptions are used regarding future increases in annual earnings and in the consumer price index. Projections are presented of future earnings, benefits, and replacement ratios (benefits at retirement compared with the previous year's earnings).

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S. W. Caffin, *A Technical Basis for General Insurance*, pp. ix, 203, The Law Book Company, Ltd., Australia, and Sweet and Maxwell, Ltd., London, £10.70.

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