

**TRANSACTIONS OF SOCIETY OF ACTUARIES
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BOOK REVIEWS

Kenneth Black, Jr. and Harold D. Skipper, Jr., *Life Insurance* Eleventh Edition, pp. 590, published by Prentice Hall, Englewood Cliffs, N.J., 07632, 1987.

Life Insurance is the most comprehensive text ever written on this subject. The authors of this eleventh edition have updated and expanded the work of their predecessors, which goes back to the first edition in 1915 by Professor Solomon S. Heubner of the University of Pennsylvania Wharton School. This edition contains the most substantive changes to the volume since the fifth edition in 1958.

The authors go into extensive detail on all aspects of individual life insurance, including such actuarial topics as net premiums, reserves and asset shares. Of the 33 chapters, 26 deal with some aspect of life insurance; of the remaining seven, three are devoted to individual health insurance (including one on the mathematics of health insurance), two to group insurance (life, health and long-term disability), one to Social Security, and one to retirement plans.

Persons who already have some knowledge of life insurance but who wish for deeper knowledge will probably not benefit from the first three chapters ("Life and Health Insurance in Personal Planning," "Life and Health Insurance Fundamentals" and "The Role and Importance of Life Insurance"). Such persons might prefer to begin with Chapter 4 ("Introduction to Life Insurance Products and Their Environment"), in which the authors go into detail about types of life insurance, benefit features and the effects of the recent economic environment on the industry. (One interesting point is made about term life insurance sales: They were 34 percent of total life insurance sales in 1955, as measured in face amount. They reached 50 percent of sales in 1977 and peaked at 60 percent in 1982.)

Chapter 5 is devoted to "whole life" insurance, a term broad enough to include limited pay life, endowments, variable life, and various forms of current assumption whole life. (There is even a brief section on second-to-die policies). Chapter 6 describes flexible-premium life insurance (adjustable life and universal life). Chapter 7 is on annuities and "special-purpose" benefits (accidental death benefit, waiver of premium and guaranteed insurability options). Numerical examples, such as the effect of differing payment levels on cash values under a flexible premium deferred annuity, are provided liberally throughout the text.

Chapters 8 and 9 deal with the life insurance contract itself. The treatment is thorough and comparable to that in the Society of Actuaries Study Notes. Chapter 10, which deals with life insurance cost analysis (for example, interest-adjusted net cost), has more formulas and numerical examples than even the chapters on life insurance mathematics (and that's really saying something) and is effective in explaining this relatively complex subject.

Chapter 11 describes the different types of insurers (commercial, savings banks, fraternal, and so on) and provides benchmarks on evaluating insurance company financial strength (for example, A.M. Best ratings), fairness to policyowners, service, product

availability, and operational performance. Chapter 12 delivers a cookbook approach to the life insurance planning process (basically, deciding how much life insurance a person really needs); the reviewer found this chapter to be of limited value, compared to other chapters.

Chapter 13 provides an excellent summary of the tax aspects of life insurance, starting with IRC Section 101(a)(i), which excludes life insurance death proceeds from the beneficiary's gross income for federal income tax purposes. Of special interest is the thorough explanation, with tax rate schedules, of federal estate and gift taxation. Unfortunately, this edition was not published in time to incorporate the provisions of the Tax Reform Act of 1986 (it still refers to policy loan interest as tax-deductible). In other respects, however, the material on taxation is still current (as of 1990). The reviewer found Chapter 14, on the principles of estate and retirement planning, to be of less interest overall than Chapter 13.

Chapter 15, "Business Uses of Life Insurance," is recommended to those who wish to learn about, or broaden their knowledge of, this area of growing importance. In addition to an exhaustive description of the different uses of split dollar plans, there are descriptions of buy-sell agreements, nonqualified deferral compensation plans, and even such items as the accumulated earnings tax and Section 303 redemptions.

Chapters 16 and 17 are devoted to individual health insurance (medical expense insurance and disability income insurance). However, Chapter 16 includes a lengthy section on the providers of such coverage, which includes both individual and group insurance mechanisms, as well as health maintenance organizations, preferred provider organizations, plus the various governmental plans (Social Security, workers compensation). A description of individual medical expense and disability income contracts follows. The disability income portion includes most, but not all, of the benefit innovations of the late 1970s and 1980s—residual disability, social insurance supplements and cost-of-living benefits.

Chapter 18–22 are the "actuarial" chapters. Chapter 18, "Fundamentals of Life Insurance Mathematics," takes a bricks-and-mortar approach to the subject, beginning literally at the beginning. For example, in "The Laws of Probability" section are included the following sentences:

1. "Certainty may be expressed by unity, or 1."
2. "Simple probability, or the chance that an event will happen, may be expressed by a fraction, which may take a value of from 0 to 1."

After explaining the law of large numbers, the authors proceed in Chapter 18 to probabilities and mortality table construction, including select and ultimate rates. Then, using interest and mortality rates, they provide tabular examples of how to calculate the present value of the benefit payable on the death of an insured. [This is done without the use of traditional actuarial notations, such as D_x , M_x , and so on, although v is used to represent $1/(1+i)$.] In Chapter 19, the same approach is used to explain the calculation of net level premiums.

The mathematics of reserves are set forth in Chapter 20, including a section on deficiency reserves. A section on surrender values includes an explanation of why such values are less than the corresponding asset share in early durations. The section on nonforfeiture and valuation laws includes a good explanation of the dynamic valuation law adopted in the 1980s. Chapter 21 describes the process of developing gross premiums and asset share testing. A section on the distribution of surplus includes a detailed description of the contribution principle and the familiar three-factor contribution method used to determine dividends (in addition to other methods).

The material in these four Chapters (18–21) is presented in such a clear and logical way that it is possible for a layperson to achieve a serviceable knowledge of basic actuarial mathematics with relatively little effort and time.

Chapter 22 is devoted to the mathematics of health insurance (unit benefit cost, continuance tables, and so on), but does not go into the step-by-step approach used to develop mathematical values as in the previous chapters on life insurance.

Chapter 23 and 24 deal with the underwriting of life and health insurance. The discussion is thorough, and the section on reinsurance in Chapter 24 even includes a brief discussion of modified coinsurance. There are also sections on the Fair Credit Reporting Act, the NAIC Model Privacy Act, and laws and regulations relating to unfair discrimination (for example, the Montana unisex law).

Chapter 25 is devoted entirely to social insurance, with Social Security being the dominant item. The chapter contains a detailed description of how to calculate primary insurance amounts and average indexed monthly earnings, as well as a description of the various Medicare benefits. There are also short sections on unemployment insurance and workers compensation.

Chapter 26 is on the subject of group life insurance. The fundamentals of group insurance are explained, and examples of different schedules of group term life insurance are given. There is also a sample calculation of a monthly group term life average annual premium per \$1,000, based on a hypothetical group of employees. The taxable economic benefit from employer contributions in excess of \$50,000 of group term life insurance is demonstrated from the P.S. 58 Table in a numerical example. There is also a discussion of retired lives reserve, cash value group life insurance, and other group life coverages.

Chapter 27 deals with group disability and medical expense insurance. The section on group disability is very short and includes no numerical examples. The section on group medical expense insurance goes into details on coverages, policy provisions and financing arrangements (retrospective premiums, cost-plus, and so on) but again includes no examples of premium rate development.

Chapter 28, on retirement plans, begins with the impact of federal legislation (especially ERISA) and then goes into detail on pension plan design and benefit formulas. The actuarial cost allocation methods are described verbally (for example, entry age normal, unit benefit, and so on). There is a description of insured pension plans (deposit administration, immediate participation guarantees, and so on) and of the investment year method of crediting interest. Also included are descriptions of Keogh plans, IRAs, SEPs, and Section 403(b) plans.

Chapter 29 describes how life insurance companies are organized and managed. One interesting point is that the “difficulties of organization of a new mutual life insurance company are so great that none has been organized for many years, and no new mutual company is likely to be formed.” A discussion of upstream and downstream holding companies, and how they interact with stock and mutual companies, is interesting and informative, as is a description of the demutualization process. In discussing the entry of life insurance companies into the financial services industries, the authors quote opposing viewpoints on whether these efforts will ultimately be successful.

Chapter 30, “Marketing Life and Health Insurance,” describes distribution systems, spelling out in detail the distinctions between agency-building and brokerage systems. (A brief section on direct response marketing points out that this method accounts “for only 2 percent of life insurance sales and slightly more of health insurance.”) There are sections on management compensation, agent compensation, product development (including a graph of the typical product life cycle), and statistics about the retention of new agents, which make the following interesting points:

- Three years after contracting 100 new agents, a company with moderate agent retention and high productivity will have 25 of its recruits remaining, at a net investment of about \$120,000 each. (By 1990, this amount has risen to closer to \$150,000.)
- For a company with low agent retention, the net investment per recruit remaining increases by 60 percent.
- For a company with high agent retention, the net investment decreases by 25 percent.
- The time period to recover these investments ranges from nine years for high retention to 21 years for low retention.

Chapter 31, on life insurance company investment management, begins by describing the various types of investment risk (business, interest rate, credit, liquidity, and control). The “inverted yield curve” of the early 1980s is discussed, as are the principles of asset/liability management. There is also a description of the types of assets typically held by life insurance companies. (Interestingly, policy loans, which peaked historically as a percentage of assets at 18 percent, in 1932, and which were 9.3 percent of assets in 1981, had dropped to 6.6 percent in 1985.)

Chapter 32 deals with life insurance agency financial statements. The difference between statutory accounting principles and GAAP is discussed. Samples of the balance sheet, summary of operations, and charges in surplus account are shown for a hypothetical company. The treatment is not exhaustive, but it is sufficient to provide a good working knowledge of the statutory annual statement.

The final chapter, on regulation and taxation, goes into the history of insurance regulation (the first state insurance department was formed in Massachusetts in 1852). Background is given on the continuing question of whether the industry will be subject to federal or state regulation (or both). The mechanism of state regulation, and the scope of insurance department authority, is examined in detail. In a discussion of state taxation, the point is made that only 5 percent of state premium taxes are used to defray the costs of operating state insurance departments. The section on federal income taxation gives

an excellent discussion of the current tax law, including an easy-to-understand description of the theory and operations of the controversial "equity base tax."

The authors are to be commended for the quantity and quality of their efforts in bringing this comprehensive and authoritative text up-to-date. They have done a service to anyone interested in furthering his or her knowledge of the complex and fascinating business of life insurance.

ANTHONY B. RICHTER

John M. Bragg, *Protecting Against Inflation—And Maximizing Yield*, pp. xv, 174, published by College of Business Administration, Georgia State University, Atlanta, 1986; \$19.95.

Before the 1960s, inflation at the consumer level in the U.S. above a 2 percent per annum level was almost solely a wartime phenomenon. Consequently, its place in actuarial literature was slim; the first substantial paper in the *Transactions* was Fergus J. McDiarmid's "Inflation and Life Insurance" in 1958 (*TSA*, Vol. X, p. 576). Geoffrey N. Calvert in the same decade was exploring the subject of cost-of-living pension plans.

John Bragg's book, an important contribution to the material on this complex subject, reflects his work, started in 1968 when he designed for his company a life policy with benefits tied to the consumer price index. But the book's scope is far broader than just an account of that enterprise.

Chapter 1, "The Challenge of Inflation," summarizes inflation's history back to the first millenium B.C. and then embarks upon one of the book's chief purposes: consideration of how an individual saver may choose among the available instruments so as to achieve greatest protection from inflation's ravages. Chapter 2 then reveals the author's own "Theory of the Economic Series," a pattern of successively pessimism, movement to optimism, prevalent optimism, and move to pessimism that together embrace each business cycle. He makes a strong case for the validity of this form of analysis.

Four chapters describe the financial services industry and several inflation-resistant products marketed in the U.S. and elsewhere. Then in the final three chapters the subject changes from the past to the future; two concepts, "The Model Yield-Based Response" (by the investor to the inflation menace) and "The Model Index-Based Response" are presented. The book closes with appendixes, a bibliography and a useful index.

Mr. Bragg is an expert at bringing his readers into the process of understanding his prescription and then of applying his ideas to their personal needs. His service even includes a system through which those interested can for a nominal fee keep current with the Bragg analysis of economic conditions year by year into the future.

This book and the author's subscriber services are highly recommended.

E.J. MOORHEAD

Steven P. Schnaars, *Megamistakes: Forecasting and the Myth of Technological Change*, pp. 224, published by Free Press, New York, N.Y., 1988.

While the purpose of this delightful and stimulating book is the identification of new products for the marketplace, anyone interested in predicting the future should read it.

The book surveys the batting average of futurists, which is amazingly low. About 20 years ago, Herman Kahn predicted 100 changes that would occur by the end of the century. Of these, 15 have occurred, and 10 others were vague enough that, if you are charitable, can be considered to have happened. Other futurists have not been as successful.

Predictions are a function of their times. In the heyday of the Apollo missions, colonization of the solar system was predicted. Such predictions vanished with the end of the manned space program. Another frequent mistake is to assume that because the technology exists, it will be used, regardless of whether the end product is useful, wanted, or cost-effective. An example of this is a proposal to replace the rearview mirror on cars with a combination of a backward aiming video camera and a TV screen on the dash. While it makes sense for fighter planes, does it make sense for automobiles?

Many case histories are examined. Although they existed for many years, microwave ovens and VCRs were not successful until social changes evolved or the right marketing ploy was developed. For microwaves, the dramatic increase in the number of the two-income families was the key. For VCRs, the key to success was the shift in emphasis from looking at videos, then few in number, to recording TV programs for later viewing. Even then, the design had to be changed from a VCR built into the TV set (the original concept) to an independent VCR. And then the market for videos developed exponentially!

Another case history examined is the market for CB radios, which suddenly went flat and then declined. Will the demand for cellular telephones follow suit or keep expanding? Schnaars thinks a significant difference exists between the social image of these two products.

Actuaries should be pleased that Schnaars believes demographic forecasts, and deductions made from them, have been very good—as long as we limit them to people already born. Predictions about the birthrate have not been successful. I wonder if changing immigration patterns will have an effect. Up to now, we have pretty well been able to ignore them. Schnaars does not, however, mention the debate about OASDI projections.

He suggests a common-sense approach to evaluating predictions. First, the basic underlying assumptions should be evaluated; this should appeal to actuaries. Futurists should ask, is the new product really an improvement on existing products, and will anybody want it? Assuming the answer is “yes,” they should ask, can it be produced at a price that will make it marketable? Schnaars does not believe in elaborate mathematical models and suggests they often distract from a hard-headed analysis of erroneous underlying assumptions.

A long time has passed since I recommended a book so enthusiastically to my friends and colleagues.

J. BRUCE MACDONALD

Marvin Snyder, *The Value of Pensions in Divorce: What It Is and How To Use It*, pp. 132, published by Professional Education Systems, Inc., Eau Claire, Wisc., 1989.

Mr. Snyder's experience in preparing "valuations in more than one thousand marital pension cases" and service as an expert witness in several cases of "equitable distribution of pension values" has ably qualified him to treat the subject that is the title of this book. Although Donald R. Anderson's important book *Actuarial Evidence* dealt summarily with the role of the actuary as an "expert on employment income," in Mr. Snyder's book we find a very complete and helpful treatment of the valuation and distribution of pension benefits that are determined to be marital property and subject to a QDRO (Qualified Domestic Relations Order, a sample of which is given in an appendix).

The book begins with an excellent summary of the theory of pension plans and a discussion of pension plan terminology and reporting requirements. Separate chapters are devoted to the different valuation considerations for defined benefit and defined contribution plans.

Other chapters discuss the appropriate treatment of inflation and taxation in making pension valuations. The concept of actuarial equivalence is developed in connection with the various forms of retirement benefits. Another chapter enumerates all the basic information required to make a proper valuation of a pension benefit.

A particularly helpful chapter discusses the format of the PBGC Tables. The author makes a strong case for the use of these tables in valuing pensions in a divorce case. A handy detached "Pension Value Calculator" (slide rule) included with the book is based on the PBGC tables (separate scales for male and female).

The chapter on "hiring an expert" primarily comprises unanswered questions that convincingly make the case for a qualified expert (probably an actuary) to make the pension valuation.

Other chapters cover present value vs. deferred vesting, non-ERISA plans, valuation dates and coverture, and postdivorce contingencies.

The book has several brief but useful appendixes. One, entitled "Examination of Pension Expert Witness," lists 75 questions that an expert witness might expect to be asked in the course of the examination of his/her expertise. This list would be most helpful to both the novice and the experienced expert witness. Others include a list of pension acronyms, a sample pension benefit questionnaire, a sample pension valuation report, and an illustration of coverture.

Mr. Snyder's work is an important contribution to the growing body of literature that identifies and supports the actuary in his/her role as an expert witness. This book is both

a good review for the experienced divorce case pension valuation expert witness as well as a foundation for the beginner.

EDWARD F. COWMAN

William Porter Kellam, *Episodes in the Life of Charles Francis McCay—Academic, Actuary, Author and Businessman*, privately published, Athens, Georgia, 1983.

If you were to ask a group of actuaries to name some actuaries who practiced in the U.S. during the third quarter of the nineteenth century, those who didn't quickly change the subject might come up with Elizur Wright, Charles Gill and Sheppard Homans. Canadians might think of Hugh C. Baker. Few would name Charles F. McCay; even fewer would pronounce his name—as if spelled McCoy—as he did.

Charles F. McCay was well-known during and since his lifetime. He was born March 8, 1810, in Pennsylvania and died March 13, 1889, in Baltimore, Maryland. During his early career, McCay taught mathematics, philosophy and astronomy. From 1833 and 1853, he was at the University of Georgia in Athens, teaching astronomy and mathematics and writing a textbook on calculus. While in Athens, he also acted as agent for the Mutual Life Insurance Company of New York and served as actuary of the Southern Mutual Life Insurance Company. McCay later went to South Carolina where he was president of the University of South Carolina and involved in the insurance and banking businesses. During his career, he devised various mortality tables including possibly the first select and ultimate table of life insurance mortality on this continent.

McCay was almost as well-known to British as to American actuaries. This was because the Actuarial Society didn't exist during McCay's lifetime; he died just a few weeks before the Society was organized. During McCay's time, American actuarial authors submitted their papers for publication in the *Journal of the Institute of Actuaries*.

The author, Porter Kellam, was director of libraries at the University of Georgia until his retirement in 1973. His interest in Charles F. McCay sprang from McCay's connection to the university, not from McCay's being an actuary. I learned of this book while looking for information on McCay for the book *Our Yesterdays*, by E.J. Moorhead. McCay, a strong supporter of Elizur Wright's views on life insurance supervision, published many articles in American trade papers during the years 1870–1880. Mr. Kellam, during his research for his book, collected copies of these articles; they, as well as the book itself, are available in the Society of Actuaries library.

Mr. Kellam's excellent book should be of interest to actuaries, especially those in the South. Because the material on McCay's actuarial career appears in its own section of the book entitled "Part III, Businessman: The Augusta Years: 1857–1869," reading of the other sections is optional.

SHIELA I. KELLEY

D. Stiers, M. J. Goovaerts, and J. De Kerf, *APL The Language and Its Actuarial Applications*. pp. viii, 223, published by North-Holland, New York, N.Y., 1987.

This slim book has a very rapid introduction to APL and some applications to nonlife insurance and general mathematics. The applications are to loss reserving methods, credibility theory, probability functions, elements of numerical analysis, and forecasting.

The applications are supported by a diskette with workspaces saved under IBM APL/PC Version 1.0. A version with IBM APL/PC Version 2.0 is also available. The workspace names are IBNR, CREDI, PROBABIL, NUMANAL, and FORECAST. There is an extensive listing in the book of the programs from the diskette.

For North American readers the book's language may be awkward, but the actuarial work is proper. For a more gradual introduction to APL, I recommend the following:

1. *APL: An Interactive Approach*. Third Edition. Gilman and Rose. Wiley, 1983.
2. The manuals that come with STSC's and I. P. Sharp's *APL for the PC*.
3. For practice and learning on a PC, there is a disk and manual available for \$9 from I-APL Ltd., 6611 Linville Drive, Weed, CA 96094. Once obtained, this may be freely copied for educational use. It is not available for commercial use.
4. Jamieson, D. R. W., "ACT: An Actuarial Programming Language," *The Actuary* 6 (January 1972):3-6.

The program listings make it possible to study the book without access to IBM's APL/PC. The applications are serious and significant.

The development is rapid. Someone not familiar with the subject matter may wish to supplement it with other textbooks or some of the material on the Casualty Actuarial Society syllabus.

The book is an excellent review for one familiar with its subject matter, a good introduction to APL for one already familiar with actuarial topics, and a good introduction to the mathematical and nonlife actuarial topics for one already familiar with APL.

Typographical errors noted are as follows:

- p. 43, line 7, should start off with "*B."
- p. 46, line 34, The values of lambda should be "0.1, 0.2, 0.3, 0.4, and 0.5."
- p. 64, line 18, should end with "A/B, then."
- p. 76, line 12, word 6 should be "its."

GEORGE Y. CHERLIN

Harry H. Panjer, editor, *Actuarial Mathematics*, Volume 35 in *Proceedings of Symposia in Applied Mathematics*, pp. 127, published by American Mathematical Society, Providence, Rhode Island, 1986.

This book is the result of the thirty-fifth in a series of short survey courses designed to acquaint mathematicians with various topics in applied mathematics. The series began in 1947 and has continued on a fairly regular basis ever since. The course on Actuarial Mathematics was held in Laramie, Wyoming, in August 1985. The proceedings of that meeting, as presented in this volume, include a preface by the editor, Harry Panjer, an introduction by James Hickman, and seven papers.

The first paper, "Updating Life Contingencies" by James Hickman, briefly describes the mathematics involved in calculating premiums and reserves. The loss variable is an integral part of the exposition, and its variance is used as a measure of risk.

The next paper, by Harry Panjer, is called "Models in Risk Theory." The focus of the paper is the various probability distributions available for modeling claim frequency. Compound distributions and mixed models are also discussed. Finally, stop-loss reinsurance is given as an application of the distribution of total claims.

The third paper, entitled "Loss Distributions," was written by Stuart Klugman. This paper first considers the advantages of fitting claim distributions to a parametric model. Then several methods of fitting are considered, and the advantages of one, the maximum likelihood method, are discussed.

Next is a paper entitled "Overview of Credibility Theory," by P.M. Kahn. It explores various methods of determining the credibility factor, Z , in the basic equation:

$$\text{New estimate of claims} = Z(\text{actual claims}) + (1 - Z)(\text{old estimate of claims})$$

The use of various distributions of claim frequencies is considered. A Bayesian approach to the problem is discussed, as well as the use of least-squares theory. Finally, recent developments in credibility theory are briefly discussed.

The fifth paper is "A Survey of Graduation Theory," by Elias Shiu. This paper provides a brief introduction to the concept of graduation of data and then briefly discusses three of the better known graduation methods, namely, Whittaker-Henderson, moving weighted average, and smooth-junction interpolation. The presentation emphasizes the use of linear algebra.

The sixth paper, by John Beekman, is entitled "Actuarial Assumptions and Models for Social Security Projections." Many of the factors used in making estimates for the Old Age, Survivors and Disability Insurance System (OASDI) are discussed with respect to the short-range, medium-range, and long-range projections needed in managing the OASDI program. Some of the factors that must be projected are population distributions by age, sex, and marital status, and effective taxable payroll. These estimates require demographic and economic assumptions. Several of the formulas used by the Social Security Administration are presented and discussed.

The final paper, "On the Performance of Pension Plans" by Cecil Nesbitt, is devoted to a discussion of the benefit formulas used in the TIAA and CREF pension plans, and

the performance of the plans with respect to the actual benefits paid out to various groups of retirees. Several tables are included. The problem of vested benefits losing real value before they are received is also considered.

Although actuaries were not intended to be a major segment of this book's audience, it could be of interest to the actuary who wants a fresh look at some basic topics of actuarial mathematics. Also, the extensive bibliography at the end of each paper provides a rich source for a closer look at some new developments in some familiar areas. This book seems to accomplish well its purpose of acquainting mathematicians with actuarial mathematics and is recommended to any mathematician interested in beginning or furthering his or her knowledge of actuarial science.

WILLIAM B. FRYE

