



The Newsletter of the
Society of Actuaries

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THE Actuary

Danger to Life Insurance Companies of Asset Default - C-1 Risk

by Faye S. Albert

The life insurance industry has been under more and more pressure to reduce margins in life insurance contracts. And we have seen these margins go down. Each source of profit in life insurance contracts has been identified to the consumer separately, and competition has appeared in each major area, mortality, interest credited and expense allowance. At the same time, life insurance company managements are reviewing their financial positions and options more carefully. Statutory results are used to check for solvency requirements but have been replaced largely in financial analysis with GAAP. Annual profit or loss figures drive company plans. Quarterly and even monthly progress of results versus plans are monitored. The most efficient use of capital is an increasing concern for these managements, and identification of an appropriate level of capital to be in business is a logical outcome. More attention has been given to directing capital to alternative businesses where the return could be higher. Emphasis on operating results has worked to drive down reserve cushions.

These developments have been a source of concern to regulators whose charge is to assure the solvency of individual life insurance companies.

As a result, state regulators have been looking to the actuarial profession for help to make sure life insurers remain solvent.

Attention has been focused on identification of reserve standards, so

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After the Crash: Statistical Implications

by Aaron Tenenbein

The events of Monday, October 19, 1987, during which the Dow Jones Industrial Average dropped over 500 points, has dramatically changed the world. That day, which is sometimes referred to as Black Monday, the crash of 1987, and often even less complimentary terms, charted the general outlook towards investments. I will try to put the effects of Black Monday into a statistical perspective. It is useful to consider what assumptions and underlying statistical methods were used to analyze investments before Black Monday, and how the assumptions are likely to change as a result of the events of Black Monday.

Distribution of Returns

In many investment analyses, including portfolio selection methods and the determination of the value of options, it is assumed that the rate of return has a lognormal distribution. This implies the following: let R be the rate of return on an equity investment over a given period of time.

Then the natural logarithm of $1 + R$ has a normal distribution. This assumption has some properties which make it amenable for approximating the actual distribution of equity returns, namely:

1. The minimum value of R is -1 . This corresponds to a 100% loss in the investment which is the lowest value which R can take.

2. If the individual returns over a given number of n periods have independent lognormal distributions, then the return over the entire single time frame of n periods also has a lognormal distribution. This is not true for many distributions.

3. The lognormal distribution allows for increased skewness for investments which have a high coefficient of variation (the ratio of the standard deviation to the mean). This implies that the skewness increases as the volatility of the instrument increases.

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After the Crash Cont'd.

For a lognormal distribution, the mean is a measure of the expected rate of return on the instrument and the standard deviation is a measure of the average variability of dispersion from the expected rate of return. The standard deviation is then a measure of the volatility of that instrument. Some researchers use the coefficient of variation as a measure of volatility because it expresses this variability as a percentage of the expected rate of return.

It is too early to assess quantitatively the effects which the events of Black Monday would have on this distributional assumption. However, a few statements can be made about the likely impact which these events will have on the distribution of these returns. If the lognormal distribution still represents a reasonable approximation to the actual distribution of returns, then the standard deviation would have to be higher. As mentioned before, the standard deviation is a measure of volatility. Before Black Monday or perhaps before 1987, a change in the Dow Jones Industrial Average of more than 100 points, or equivalently a percentage basis of 5%, was very rare. Now it occurs more frequently.

However, the whole concept of the use of the lognormal distribution may be questionable. The assumption inherent in the use of the lognormal distribution is that the volatility can be measured by the standard deviation. The standard deviation, however, may turn out to be unstable in the presence of large fluctuations in the value of these equity instruments. As a result, the standard deviation may not be a reasonable measure of volatility because of its instability. This implies that any distribution which has a finite standard deviation, such as the lognormal distribution, will fail to model the actual fluctuations of these instruments.

One of the effects of Black Monday may be that other distributions may have to be used to model the distributions of returns on equity investments. These other distributions would have heavy tails in order to measure the increased volatility. One such family of distributions is the so-called stable symmetric family of probability distributions which has been discussed by E. Fama and R. Roll in the *Journal of the American Statistical Association*, particularly "Some Proper-

ties of Symmetric Stable Distributions," Volume 63 (1968), pages 817-36 and "Parameter Estimates for Symmetric Stable Distributions," Volume 66 (1971), pages 331-38. B. Mandelbrot also discussed the topic in "The Variation of Certain Speculative Prices," *The Journal of Business*, XXXVI (1963), pages 394-419. In these papers a family of distributions is introduced. This family is characterized by the parameter alpha which is called the characteristic exponent. This parameter varies from 0 to 2. For alpha = 2, the distribution is normal, and it is the only distribution in this family which has a finite standard deviation. When alpha = 1, the distribution is Cauchy. The Cauchy distribution is a symmetric distribution for which both the mean and standard deviation do not exist. Obviously other measures for the volatility, such as the interquartile range, and other measures of location, such as the median return, would be utilized in this context.

Portfolio Selection Methods

Portfolio selection methods attempt to balance risk versus return. Generally the more risky the portfolio, the greater the return must be in order to justify the selection of that portfolio for investment purposes. In classical portfolio analysis, the risk is measured by the standard deviation of the returns, and the mean is used to measure the rate of return of the portfolio. The problem then becomes one of selecting a portfolio to minimize the risk for a fixed rate of return or vice versa.

With increased volatility, the use of the standard deviation may not be realistic and perhaps other measures of risk will have to be utilized. At any rate, increased volatility will result in the selection of instruments with less risk. As a matter of record, this is precisely what did happen in the marketplace. The increased risk of equity instruments caused a dramatic flight into short-term fixed income instruments such as money market funds, certificates of deposit, and Treasury Bills. This in turn resulted in decreased returns of the instruments.

Option Values

The theoretical determination of the value of a call on an option has been carried by Black and Scholes and is sometimes referred to as the Black-Scholes Option Formula. The value is determined under the assumption of

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After the Crash Cont'd.

a lognormal distribution. The results of Black Monday may have two effects on this pricing methodology. First, if the lognormal distribution is still valid, the option values can be adjusted to take into account the higher volatility of the equities upon which the options are based. Second, if the lognormal distribution is not valid, then the value of the option should be determined under other distributions which may fit the data more effectively.

Summary

It is too soon to forecast the statistical implications of the crash of 1987. However, it is clear that a change has taken place and only time will determine how lasting the effect of this change will be.

Aaron Tenenbein is Professor of Statistics and Actuarial Science and Area Chairman of Statistics and Operations Research at the New York University Graduate School of Business Administration.

C-1 Risk Cont'd.

cash-flow payments out will be anticipated reasonably and will be accommodated by cash coming in. Fluctuations in the value of assets due to changes in interest rates and changes in demand for insurance company contracts has been one part of the focus: the C-3 risk. A more obvious aspect of this concern is, how will the quality of assets be taken into consideration in setting a proper level of surplus for a life insurance company? The C-1 risk deals with the problem of nonperforming assets.

This article relies on data in the C-1 Risk Task Force Report prepared for the Committee on Valuation and Related Areas; the purpose of the article is to summarize those results and conclusions. Please refer to the full report for supporting data.

The major investment vehicle for insurance companies has been bonds, and performance on corporate bonds has been studied since the turn of the century. By looking at this type of asset where most historical information is available, conclusions will be suggested that may be applicable more generally.

Review of the aggregate results shows there has been a radical reduction in the percentage of outstanding bonds going into default after 1940. It is hard to attribute this change to anything except a dramatic change in the financial environment, that is, drastic decrease in default levels after

1945 are the result of a more stable economy. The U.S. government has learned to provide economic adjustments to help the economy steer a more level course.

The incidence of default can be forecast at the time of issue by risk class. Classes have been set up and differences in the probability of default for different classes successfully recognized over the years by a few different systems. Furthermore, changes in the rating of particular bonds appear to properly reclassify these instruments into categories that will give similar default experience. There has been a lot of discussion about junk bonds and how these are different from the kinds of investments available in the past. In the late 1920s, bonds below investment grade constituted about 20% of the issues. However, probably because of the default experience from the 1930s, there were fewer issues in that category until lately. The recent economic climate and particularly the experience for the last 40 years seem to have made investors bolder and willing to take more of a gamble on the bonds' principal for a greater return. Re-rating an existing bond reclassifies the probability of its performance based on updated information. A newly issued "junk" bond can have the same classification as a downward rated existing issue. There is every reason to expect these two bonds to subsequently exhibit the same probability of default. To the extent that existing statutory provisions adequately mark insurance company surplus for lower quality assets through the mandatory securities valuation reserve, the same should conceptually take care of junk bonds.

How bad is an insurance company hurt by a bond default? Of the total loss in value at the time of default, about two-thirds of that loss existed at the beginning of the year before default actually happened. This must be based on the market being informed of what was coming. Further, after default, many bonds returned to good standing, and there is an average recovered, about 60% of their original value, though results differ and depend on the individual security. Providing surplus for defaults, though, seems less of a problem if only 40% of the asset value is permanently lost rather than 100%. And what was the final financial return for bonds that eventually went into default? The yield was less than prom-

ised, but usually the principal was intact by final settlement. Only issues in the 1920s showed a small negative return, that being .003.

Though diversification is considered important in portfolio management, it does not appear that diversification helps modify the loss results on investment bonds. This can partly be explained because default rates in the major industries are correlated with each other and with the total market, and there isn't a particular difference in returns within major industry divisions. The period during which the investment was made is more important in the default results than the particular industry. This harkens back to the idea that the economic conditions are more predictive of default experience than any other factor. In a stable economy, there are not a large number of defaults. In an unstable economy, default rates soar.

The Task Force suggests that the risk to insurance companies of defaults on junk bonds does not justify setting required surplus levels higher than currently exist. This categorical statement is pretty strong and needs to be watched. However, as long as default rates on total bonds are less than 1.5%, it does not appear imprudent.

Faye S. Albert is a Consultant for life insurance companies in Miami, Florida. She was a member of the C-1 Risk Task Force and moderated a session on that topic at the 1987 New York spring meeting.

Book Give-Away

Anyone interested in receiving the following books free by paying the shipping charges may contact Mr. Charles F. B. Richardson, 11562 Bayshore Drive, Crystal River, Florida, 32629. The books are:

Transactions Volumes 33, 37, and 38
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Record Volume 8, Nos. 1-3
 Volume 9, Nos. 1-4
 Volume 10, Nos. 1-3
 Volume 11, Nos. 2, 3, 4A, and 4B
 Volume 12, Nos. 1, 2, 3, 4A, and 4B

Measuring Interest Rate Spread

by Selig Ehrlich

Over the last several years as interest rate sensitive products have begun to proliferate, the phrase "interest rate spread" has crept into common usage as well. As an example, in a recent article in the November 1987 *Actuary* entitled "Single-Premium Whole Life Insurance" by Gary E. Dahlman, determining the "target interest spread" was placed at the very top of the list of pricing issues. The basic concept is simple: by crediting to a contract holder a lower rate than is earned on his/her funds, a margin is introduced. Thus, pricing actuaries speak in terms of needing X basis points to cover expenses, profits, etc. This article will blur the issue somewhat—so as to permit sharper refocus—by drawing explicit attention to the fact that there are various ways in which one may choose to measure the investment/return spread actually "earned." Certain implications are then noted.

Background

Were insurance companies to invest purely in government bonds, purchased at par and held to maturity, there would be little point to this article since all of the investment's total return would consist of interest income; no mandatory securities valuation reserve (MSVR) contribution would be required; and Statutory and GAAP treatments are identical. But clearly, this is too simplistic a portfolio to be representative, as we all know that investing in Treasuries would leave little, if any, room in today's competitive market for subtracting any margins.

Moving just one step along the diversification/risk curve, however, to fixed rate corporate/private placement bonds or mortgages—assumed to yield a given constant spread from purchase until redemption at maturity—probably gets us to within the realm of most pricing work, with only an MSVR expense adjustment coming into play. It's small wonder then that we speak of spreads as if ten actuaries placed in a room and given the same investment performance data would agree on a single number for the spread earned against a given liability rate.

The Expanded Investment Horizon
Whereas bonds and mortgages still comprise a large percentage of insurance company portfolios and many may still be held to maturity, the mere existence of Annual Statement Exhibit 4 indicates that capital gains and losses—both realized and unrealized—are not a new phenomenon. New York's Regulation 130 is further testament to the fact that some insurers have embarked on investing in other instruments such as public and private high yield debt (junk)—often purchased with the intent of sale prior to maturity.

Add to this investments in (1) equity real estate, which typically carries the expectation of future capital gains; (2) common stocks, fraught with the volatility associated with changing market values; and (3) various and sundry limited partnership interests valued under the equity method of accounting, and you arrive at the possibility of a non-eligible portion of investment return coming in the form of realized and unrealized capital gains.

This being the case, let's say that for a given measurement period we can all agree that a portfolio of investments, totaling \$1,000, returned \$100 of interest income (II), \$50 of realized capital gains (RCG), and \$10 of unrealized loss (UCG). The question is: "Is there a single figure for this investment performance that can be used in calculating 'the spread' against a given liability credited rate?"

Measurement Bases/Purposes

While annoying in conversation, often a first step in answering any question is to ask: "Why do you want to know?" Another approach, when unsure of the exact answer, is to determine the range of possible values: "It's either '24' or 'last Tuesday.'" Let's see where these approaches lead us.

As stated earlier, interest rate spread has become a key element in the pricing of interest rate sensitive products. Since a central concern of pricing is to achieve a desired financial result, it follows that measurement of the spread should be consistent with the basis underlying the desired financial result.

Luckily, both the Statutory and GAAP bases carry established rules by investment category (i.e., controlled versus noncontrolled limited partnerships, trading versus nontrading portfolios, etc.), for treatment of the

various investment performance components above vis-à-vis the income statement and balance sheet. Therefore, if we limit our attention to these two bases, it is possible to arrive at exact figures for the dollar amounts bookable as current period earnings versus the amount reclassified to the equity or MSVR portion of the balance sheet—as appropriate.

GAAP

Using the performance numbers already suggested, let's say that the asset categories which gave rise to those numbers are such that \$150 (\$100 of II plus \$50 of RCG) would be permitted to flow into current period earnings, with the \$10 of unrealized loss being reclassified to the balance sheet as a change in equity. (Note: not all unrealized losses are excluded from current period earnings under GAAP, i.e., those arising from noncontrolled partnerships—such as the leveraged buy-out funds marketed to institutions like ourselves—would be included.)

Statutory

Here, \$100 will appear as investment income as part of gain from operations (GFO)—with the remaining \$40 (\$50 of RCG less \$10 of UCG) appearing in the Capital and Surplus Account as net capital gains. Assuming that \$40 out of the total of \$50—and all of the \$10 of unrealized loss—arose from investment subject to the MSVR, the resulting increase in MSVR would be \$30.

Under these assumptions, the relevant sections of the Income Statements and Balance Sheets for the two bases would show the following marginal changes:

GAAP	
Statement of Earnings	
Income	XX
NII	100
Bfts & Exps:	
DB etc.	XX
Income from Ops:	100
Net RCG	-50
Net Income*	150
*(ignoring taxes)	
STATEMENT OF EQUITY	
Retained Earnings:	
Beginning Balance	XX
Net Income	150
Ending Balance	150
Unrealized CG:	
Beginning Balance	XX
Net Increase	(10)
Ending Balance	(10)
Total Equity, End of Yr:	140

Continued on page 5 column 1

Interest Rate Spread Cont'd.

STATUTORY		
Summary of Operations		
Prem	XX	
NIL	100	
Bfts & Expns.		
DB etc.	XX	
Gain from Ops.	100	
CAPITAL & SURPLUS (C&S)		
ACCOUNT		
Beginning C&S	XX	
GFO	100	
Net RCG & UCG	40	
Change in MSVR	(30)	
Ending C&S	110	
Balance Sheet		
Assets	Liabs	
XX	MSVR	+ 30
	C&S	+ 110

As the chart indicates, there are some decisions yet to be made before any conclusion as to spreads can be drawn—the first of which is whether Statutory, GAAP, or both bases are to be the standard of measurement.

If all we are doing is measuring past spread results, deriving answers for both merely involves the extra work of doing the calculation on two bases. If, however, the intent is to develop a new rate recommendation, any differences between the bases creates a more complex problem since there is no way to declare separate Statutory and GAAP rates to the contractholder. Choices will have to be made, or the asset allocation decisions will have to be adjusted to balance potential differences.

If GAAP basis results are chosen to govern, a key remaining decision is to determine the treatment of the \$10 of unrealized loss. Electing to ignore it could be justified, either on the basis of a focus on the earnings statement or by arguing that the loss may likely reverse itself. (Note: these two are not independent, since the "reversal argument" is the logic behind the GAAP treatment of excluding it from current earnings.)

Alternatively, a company may wish to conservatively state its past earnings position to management by immediately recognizing any unrealized losses. In setting new rate actions, it may also choose to scale back its total return expectations. Much may depend on the length of the guarantee being declared and the inherent volatility of the underlying assets.

On the Statutory side, the key issue is the treatment of the MSVR as it relates both to the required annual contribution and the absorption of all realized and unrealized capital gains. As the chart shows, the required statutory contribution to MSVR effectively removes \$30 (plus whatever the required annual addition

is) from the current period's contribution to ending capital and surplus. Therefore, depending on whether true statutory surplus (TSS) or strategic surplus (TSS + MSVR) is the target result being managed to, the earnings assumed would be either \$110 or \$140. Earnings of \$150 would be considered only if unrealized losses were backed out.

Additional Observations/So What
That different answers are possible raises some interesting points regarding asset allocation and competitive standing—even among companies with identical proclaimed interest margins of X basis points.

Those companies managing to Statutory Ending Capital and Surplus results (i.e., \$110 in our example) reap little competitive benefit from assets subject to MSVR whose total return is weighted toward capital gains. Therefore those companies are likely, if competitive credited rate considerations drive the asset allocation decision, to avoid heavy positions in those types of assets regardless of their positive impact on strategic surplus.

Alternatively, those companies are in a much better competitive position (albeit the possible hit to strategic surplus) regarding assets subject to large realized losses absorbed by the MSVR. To see this, just compare the Statutory C&S and GAAP results substituting a realized loss totally subject to MSVR of \$40 for the gain of \$50 in the example. In light of recent market events, this is more than an academic point. (Note: Even with identical performance and spread targets, differences in credited rates could still arise among companies managing to the Statutory C&S financial target based on each one's current level of MSVR—as it impacts the required annual contribution and degree of absorbable gains and losses.)

Lastly, lest a mistaken impression be created, absent any and all differences arising from varying financial targets, investment portfolios or target spreads, a range of credited rates is still likely to be found in the market. This is so because different companies—managing to GAAP results for example—may choose to pass along varying amounts of current period realized gains, based on each one's own assessments as to likely future performance, desired variability in declared rates, and current market demand. Stated differently, even in stable interest environments, the target spread may reflect more of an

average to be achieved over the product's perceived time horizon than a rigid period-to-period requirement.

Conclusion

When presented with a given period's actual (or assumed) investment performance—which includes realized and unrealized capital gains as well as plain vanilla interest income—it is not immediately obvious which figures should be used in calculating the spread earned (or alternatively, in setting new liability credited rates to achieve a given spread). The choice may well hinge on the basis chosen for measuring the financial results the company is trying to achieve—and within a given basis on its attitude toward recognition of realized and unrealized gains/losses and the status of the MSVR.

Not all companies or actuaries are likely to agree on a given approach—a fact which carries financial statement, asset allocation, and competitive implications. Even where agreement exists as to financial targets, individual company preferences as to the timing for recognizing results in rate actions or management financials all but guarantee a wide range of outcomes attributable to identical combinations of investment performance results and spreads.

Selig Ehrlich is Assistant Vice President and Actuary at the Equitable Life Assurance Society. He has recently been named Chief Planning Officer for the insurance company within the Equitable.

Practitioner's Award Announced

The Actuarial Education and Research Fund is pleased to announce the introduction of a new award that will be presented for the first time in 1988. The purpose of this award—the Practitioner's Award—is to:

- recognize the research which is done in the non-academic actuarial community, and,
- encourage the publication of research conducted during the actuary's daily work.

The rules of the award can be found in our insert to this mailing.

If you have any questions or comments about the award, please do not hesitate to contact Randall J. Dutka at (416) 863-3634 or Douglas C. Burton, Chairman of A.E.R.F., at (201) 449-6713.

We will look forward to a successful competition.

FEM Survey Results: Action on FEM Proposals

by Judy Faucett and Michael B. McGuinness

In February 1987, the SOA Education and Examination (E&E) Committee distributed a White Paper on Future Education Methods (FEM), proposals on ways to integrate different educational methods into the SOA system. The White Paper contained a survey, asking SOA members and students to provide their views on the FEM proposals. The input received in response to the FEM survey played a significant part in the deliberations of the E&E Committee, the Education Policy Committee, and ultimately, the Board of Governors in determining how to proceed with respect to the FEM proposals. This article gives a brief summary of the FEM survey results and how the survey results influenced the action taken by the SOA governance.

Response to the FEM survey was gratifying; 2,301 surveys were received by the July 1987 deadline. Of these, 1,866 were from members, an 18% membership return. The membership respondent group overrepresented FSAs (65% versus 54% of membership), and underrepresented Canadians (14% versus 19% membership) and consulting actuaries (30% versus 35% membership).

Respondents presented a true diversity of opinion. While 66% had a favorable overall reaction to the educational approach represented by FEM, there was less agreement about some particular aspects of FEM and of specific FEM proposals. Respondents saw FEM as meeting the objectives of providing better education for actuaries and creating a system to attract and select those people best suited to fill the role of the actuary in the future (55% - 65%). However, a majority (55%) expressed doubt that the FEM proposals would enhance the value of the FSA.

Reaction to specific FEM proposals was varied. Favorable reaction to the educational value of Level 1 and Level 2 college courses and to the examinations of other organizations was not strong (41% - 53%). Reaction to external exams being awarded SOA credit was complicated by the presence of actuarial and nonactuarial

organizations in the proposal presented; comments suggested a highly favorable reaction to granting credit for examinations of other actuarial organizations. The remaining FEM proposals generated a more favorable reaction, respondents indicating a beneficial effect on education from the use of research papers (78% favorable), intensive seminars (73%), and the Fellowship Admission Course (84%).

The specific educational benefits of particular FEM proposals were endorsed by the respondents—84% agreeing that research papers develop research skills, 80% that seminars enhance practical techniques, 86% that case studies are valuable in teaching ethics, and 80% that management simulation exercises could help to integrate knowledge from diverse areas.

The FEM survey results were considered carefully by the SOA governance in determining how to proceed with FEM. Noncontroversial programs—the Fellowship Admission Course, the research paper option, and the intensive seminars were adopted without change. The proposal on examinations of other organizations has been split into its two components; the E&E Committee will recommend which specific exams of other actuarial organizations warrant SOA credit and will recommend, after careful investigation, which professional designations might be considered for small amounts of SOA credit. Proposals on Level 1 and Level 2 college credit received the most negative reaction from survey respondents. To evaluate whether college courses can provide an appropriate alternative qualification, the E&E Committee will proceed with a very tightly controlled, limited experiment based on the Level 2 proposal (e.g., subject matter limited to Courses 120, 130, or 135, evidence of clearly superior educational methods, course approved by SOA).

The FEM programs will be implemented in a careful and deliberate manner. Programs such as the Fellowship Admission Course and the intensive seminars require a great deal of developmental work; both programs should be in operation by 1990. The programs for research papers and examinations of other actuarial organizations may be finalized by the end of 1988; work will proceed more slowly on the implementation

of limited credit for nonactuarial designations, with careful scrutiny applied to determine whether a designation would qualify. A committee will be formed to direct and oversee the limited college credit experiment; formation of that committee will occur in the last quarter of 1988; the experiment might then commence with the 1989-90 academic year.

Judy Faucett is a Consulting Actuary with Milliman & Robertson, Inc. She is the General Chairperson of the Education and Examination Committee.

Michael B. McGuinness is Vice President and Corporate Actuary at National Life Assurance Company of Canada. He is the SOA Vice President overseeing Education and Examinations.

1987 Report of Joint Committee on Role of Valuation Actuary Available

The new report by the Joint Committee on the Role of the Valuation Actuary in the United States, follows the Committee's 1985 Report, reflects on responses to it, and incorporates developments since then in both research and application.

In the fall 1987, the Boards of the Society and the Academy accepted the new report for release to interested members and other parties. Copies are available from either the Society or Academy offices. They also approved several significant modifications to the original report.

One is to suggest that an opinion of the Valuation Actuary on a company's reserves, and the adequacy of the assets supporting them, would continue to accompany the Annual Statement, but that the actuary's report on the overall assets would be provided only to management. The prior report included the latter in the Annual Statement supplement.

Another modification expands the approach to the appointment of the Valuation Actuary to include appointment by management as authorized by the Company's Board.

Editorial

Beat Bristol

by Irwin T. Vanderhoof

The Bristol referred to in the title is Bristol, England. Most of us know of it only because of the use of the name in the phrase "ship shape, Bristol fashion." It means that things are neat and well done. But let's discuss research done in the Society of Actuaries.

A former president of the Society, Edward Lew, once referred to the Education and Examination system as one of the most magnificent educational structures ever created. This is surely true, and it is not only powerful and strong but also vital. I believe that the changes implied by FES and FEM are good changes. But if they are in error, then they will be corrected. Right or wrong, they attest to the vitality of the operation, and the interest and support of the membership in this part of our activities. Such does not seem to be the case for our work in research.

While we take proper pride in our educational activity, the membership has regularly indicated an unfocused disquiet with our research. A poll of the membership a few years ago indicated substantial membership support for increased "practical research." Work on this request was held up, however, when no one could precisely determine what the practical research would be. A task force headed by Anna Rappaport is now investigating ways in which our research activity can be revitalized and extended. The results of these investigations will be presented and will surely prove valuable to our organization.

I don't believe, however, that we should depend upon the work of a task force to rectify the problem for us. Research is important to us all. The Education Committees provide for the continuation of our profession, but research defines it. The research work of past actuaries defines the profession as we now know it. The profession is also defined by the work of the experience committees, the papers in the *Transactions*, and the various other published works of our profession.

This is hardly a unique observation. The profession of physicists is defined by the published work that physicists present. The profession of physicians is defined by the literature that they publish, not just by their work. The profession of lawyers is defined by their publications and written opinions as well as their arguments in court.

These professions are all continually testing the boundaries of their fields as well as defending their turf. We periodically complain about the accountants as they do this. If the complaint is justified, it should not be surprising. It is the normal action of any healthy competitive organization. If we intend that our profession should remain healthy, then we should expect to be involved in the same kind of competitive race.

It would be easy to use this platform to castigate the membership for a failure to do enough research. But I think that would be wrong. I believe that a great amount of research is being done, but perhaps not recognized as such, by ourselves and by the other professions. Research is continually being done by individual actuaries for their companies and for their clients. In addition, research is being presented at Society meetings in the form of panel sessions and in presentation to the various actuarial clubs.

To some extent the desired increase in research could be partially met by making the studies that are done more widely known. The first question would be possible increases in the publication of more of the privately done work of the consultants and company actuaries. The outsider cannot make a judgment as to what constitutes a company secret and what should be construed as research work to be published. That can only be done by the practitioner and the firm. Much of the published work has come from insurance company actuaries. Of the work from consultants, the best known to insurance actuaries would be the James C. H. Anderson method of premium calculation. Certainly it would be appropriate for each of us to consider our recent work and determine if some aspect of it would be an appropriate addition to the literature of the profession. The

recent publication of the AIDS study is a good example of the way that this can take place.

There is also the question of method of dissemination. The AIDS study was prepared by two Society members, printed by three Sections of the Society, and distributed very promptly. The AIDS study will undoubtedly be subject to adequate discussion to establish its validity. Some of the other publications of the sections contain short research reports and need only to be subject to such discussion to move a step up in formality, and be better recognized as involving actual research. Section business meetings held in conjunction with Society meetings would not generally provide enough time for presentation of a paper and an active discussion. When a section holds an independent meeting, such opportunities would exist.

The actuarial clubs would seem a particularly good choice to start the development of published research. Papers could be distributed in advance and presented in a lower pressure setting. The membership could have an opportunity to discuss the methodology and conclusions, and the results could be made available to the entire membership of the Society upon request. In some cases the contents might eventually work their way up to an even more elaborate presentation for the *Transactions*.

The old Student Society of the Institute in Britain has been renamed the Staple Inn Actuarial Society, and ten papers were presented during the last year— independent of the publications of the *Journal* of the Institute. There are other local Societies in Great Britain that seem like our local clubs. In the last year, three papers were presented to the Glasgow Actuarial Students Society, two for the Bristol Actuarial Society and one each at York, Manchester, and Birmingham. I know it would be unreasonable to expect the New York, Los Angeles, Chicago, or our other clubs to compete with Staple Inn or Glasgow. But if the idea that we could use the clubs to start the change towards a more research-oriented culture has any merit, let's "Beat Bristol."

The Nonqualified Plan Market

by Sara K. Miller

A pall has been spreading over the most affluent prospective retirees as they realize the depths of the cuts that Congress has imposed on qualified plans—particularly for the most highly paid. The cuts are real and hurt most for those at the top end of the compensation scale.

Typically a defined benefit pension plan will provide a certain portion of the employees' average salary for the final five years of employment. Often the executive will remember that but will forget the details that take the glitter out of that shining dollar amount. First, very often for executives of that level, a significant portion of their income is in the form of bonuses, not traditional salary, and most often bonuses and other extra compensation don't count when figuring what the final pension payout will be. But that bonus compensation, or rather the loss of it, may not matter anyway since there is a ceiling currently at \$90,000 on the amount that can be paid out, and this normally makes the final payout a much smaller percentage of final compensation than expected. There are also other hindrances. A surtax is now placed on qualified plan payouts if the total annual amount the retiree receives is above \$200,000. 401(k) plans have been further limited. And as a last straw in order to protect the income for a spouse, the retiree may need to elect a joint and survivor payout from the qualified plan.

When all of these limitations are put together, it is not at all uncommon to find the real payout to be less than half of what the executive expected. Since these cuts have caused such a gap between the retirement income not just desired but expected, there is now a tremendously expanded market for nonqualified plans. At Northwestern Mutual Life (NML) we have been developing plans to help our field capitalize on that market opportunity.

Initially we identified five separate tasks or areas of work and attacked each separately. First, the market had to be identified. Just who

are the prospects? We know that a classical definition is that a prospect must be a stable ongoing corporation that has a willingness and desire to benefit top management and that it must have the cash flow to sustain such a program. We also know that the market is not necessarily limited to large public corporations but spans the whole range of sizes and types of businesses. Corporations love these kinds of plans. Where else are they not only allowed, but actually encouraged, to discriminate? In order to keep the plans out of the clutches of most of the ERISA rules, the plans must be for the benefit of the most highly paid employees of the company. Further, the corporation does not have to put up its own money. The plan may be designed as a deferred compensation plan wherein the employee defers his or her own money, and the employer acts as a conduit. Many times, even though the employer was unwilling to put up the initial money for the funding of the plan, it will fund the benefits out of current cash and recover its cash outflow plus interest from the death benefits of the policy.

The next job is to educate the field. We have done the traditional video tapes, articles and seminars talking about the market, the products, the tax laws, and the opportunities. While there are certainly a finite number of Fortune 100 companies, many good agents find their niche with smaller companies. While the corporation may be smaller and the number of lives sold only five to ten, the premium dollars may be large and the persistency excellent.

The third area of work was to provide properly designed products. Up until this time, the agents who had been working in this market had been successful using the same products that were utilized in the individual market. Now, we began looking at this market as one that had particular needs that could be satisfied with specific product design. Many times we were finding that some agents were producing very well using the traditional individual products, but the needs and the competitive nature of the sales of others demanded more specialized products. To satisfy that need we are now ready to release the third product that is designed just with this market in mind.

The fourth area of responsibility was to provide appropriate Home

Office service and support. Four departments have now put together separate groups of people dedicated to responding to this market. The first department to do this was Individual Product Marketing. Within this department an executive benefit unit was formed. This is a small group of four people who spend their time working with agents who are developing cases in this area. This unit helps provide plan designs and accompanying illustrations that are far more sophisticated and individually tailored than those that are available through the standard NML illustration system. Many field associates utilize this unit for case consultation and for illustrations, but more importantly, the people in this unit serve as a sounding board for the agents who don't have anybody knowledgeable to talk over their ideas with, thus facilitating the sharing of information across the country. The idea that helped make a sale in Sacramento may be just what the agent in Buffalo needs to help him finish putting together his presentation. This unit is then familiar with today's marketplace and serves as a liaison with other parts of the company relative to matters concerning executive benefit cases. The unit relates product needs to the actuarial department; documents needed improvements in willing and collecting methods for multilife cases; serves as an on-site representative in matters concerning new business; and knows first-hand exactly what areas need to be concentrated on in future training sessions.

For several years one senior individual has been responsible for coordinating all of the executive benefit guidelines and procedures in new business. He, too, can act as a liaison person with the rest of the company regarding executive benefits cases. The field people really appreciate having one person to go to, if necessary, as a last resort if they feel that they have a special case and a valid reason for needing extraordinary treatment. Policyowner Services has just put together a separate unit of eighteen people who will deal only with this marketplace. Billing and collecting premiums for cases like this, always one of the problem areas, is being attacked first. Again we believe that a great dissatisfaction can be removed when the agent with a problem has someone in the appropriate area to talk with who understands what is

Market Cont'd.

going wrong and has some idea of how it can be fixed. The actuarial department also has dedicated specific resources to working on products and improvements on products for this market.

The last area to be addressed in this market is the need for the agent to do the appropriate servicing at his end. If there is anything we all do know, it is that servicing of the products in these plans and the servicing of the plans themselves are not inexpensive things for the agent to do. We certainly don't know where ultimately the funds will come from to pay for this servicing. Some of it will come as it traditionally does from commissions; some may come from fees. But we are sure that the agent who is able to do this work as efficiently as possible will have a large advantage. Part of this efficiency comes through enhanced home office policy servicing systems; but much of it must come from the agent himself, or his designated representative. Ultimately, that servicing entity must have a system within his own four walls to keep track of all of the plan data and the policy data. That is the last piece to be put into place.

Northwestern Mutual is excited about this market. It has great potential, and it's a lot of fun to sort out the pieces, put them in place, and hear the satisfaction from the agents as they increase their sales.

Sara K. Miller, not a member of the Society, is a J.D., CLU and FLMI. She is Director of Advanced Markets Support at Northwestern Mutual Life in charge of that company's Executive Benefit Marketing Operation.

TSA Papers Accepted

Four more papers have been recently accepted for publication in the *Transactions*, Volume 40. The papers are: James D. Broffitt, "Increasing and Increasing Convex Bayesian Graduation"

Mark D. J. Evans, "Amortizing Acquisition Expenses in Proportion to Premium Revenues"

Thomas N. Herzog, "Analyzing Recent Experience on FHA Investor Loans"

Harry H. Panjer, "AIDS: Survival Analysis of Persons Testing HIV +"

Variable Products— Today's Design Trends

by Timothy C. Pfeifer

New variable life and annuity products have been growing in prominence in the portfolios of many life insurers. Today's products have evolved from the original forms issued in the late 1970s and early 1980s. SEC and state insurance department regulation, as well as increasing consumer sophistication and competition, have shaped the design of these products. We'll examine some of the recent trends in the design features of variable products. Nearly all newly-developed variable life contracts are either flexible premium variable universal life (VUL) or single premium variable life (SPVLI), as opposed to annual fixed premium variable life (VL). Past SEC regulations effectively prohibited premium flexibility on variable life contracts paying typical whole life commissions. In 1983, temporary rule 6e-3(T) enabled VUL designs. Since then, fixed premium VL product development has sharply declined in favor of VUL. Today's variable product designs frequently resemble those of mutual funds. Recent variable annuities and variable life products have moved to back-end load (surrender charge) and asset fee designs. The shift to back-end load products is largely a response to competitive market conditions. In addition, variable products are sold through distribution channels, such as stockbrokers, that are accustomed to selling back-end loaded products.

Single premium variable annuities (SPVA) and single premium variable life products have recently dominated the variable marketplace. This year, some insurers have delayed development of a VUL product until their single premium variable life was completed. Reasons for this current popularity include:

- SPVLI's and SPVA's current tax-sheltered advantages cause them to be more attractive than many other deposit institution products;
- "Fire sale" marketing approaches are being used, since these tax advantages may be short-lived;
- Certain single premium products can be easier to administer;

- Maturing certificates of deposit, which could only be reinvested at low current interest rates, have been sources for premiums in many single premium variable contracts.

Many current SPVLI product designs permit the policyholder to pay additional premiums under certain conditions. This flexibility offers competitive advantages to the insurer. Another reason for permitting additional premiums is that the contract may qualify as a flexible premium contract. A flexible premium life contract can deduct higher maximum annual mortality and expense risk charges (deductions for mortality and expense guarantees) of .90% of the fund versus .60% for fixed premium plans. It appears that the SEC will consider a SPVLI contract to be a flexible premium contract if the policyholder has the contractual right to pay an initial premium as low as 80% of the guideline single premium. Legal counsel familiar with SEC issues should be involved in designing these features.

The foundations of VUL, SPVLI and variable annuity contracts are the individual funds which determine the policyholder's cash values and death benefits. Insurers continue to diversify the types of available funds. Beyond the typical money market, stock, bond, general and managed accounts, separate accounts now include high yield bonds, aggressive growth stock, gold, zero coupon bonds (of different maturities), real estate, and international funds. We expect this expansion to continue as insurers try to market at least one "hot" fund at any time.

Variable annuities and variable life contracts permit transfers of monies between funds. The trend is toward an unlimited number of transfers without transaction charges. Sometimes, the first few transfers are free, and any additional transfers are levied a charge of \$10 to \$25. Actual experience so far has shown little transfer activity. At the time of this

Continued on page 10 column 1

Variable Products Cont'd.

writing, we have begun a study on the changes caused by the recently increased volatility in the financial markets.

Variable annuity and variable life contracts deduct charges periodically from the fund to cover certain risks and expenses. Charges are expressed as percentages of the fund value (asset-based charges), a flat dollar amount, or as an amount per \$1,000 face amount for life policies. Asset-based charges, which are becoming more common, allow the charge to increase over time as the fund value increases. Typical deductions are: the mortality and expense risk charge (M&E charge), a charge for the mortality and expense guarantees in the policy; the investment advisory fee, a charge for management of the separate accounts; and the administration fee, a charge for the administration of the contract. In addition, some products assess cost of insurance and premium tax charges in the form of an asset fee. This is especially true when financial institution representatives are involved. The SEC currently limits the annual M&E charges to .60% of the fund for fixed premium variable life, .90% for flexible premium variable life, and 1.25% for variable annuities. The investment advisory fee is often set equal to the charges assessed the insurer by the investment manager. Consequently, the insurer often does not profit from this fee.

Some contracts deduct front-end loads, expressed either as a percentage of premium, \$X per \$1,000 face or \$Y per policy in the first year. SEC requirements that issue and administration charges be cost-based restrict the levels of these deductions. Front-end loads have been declining in popularity.

Variable life contracts also deduct charges for the cost of insurance (COI) benefits and the cost of any minimum death benefit guarantee. COI charges usually are defined on a maximum guaranteed rate and current rate basis, and frequently vary by sex and smoking status. When COI charges are fund based, they can vary by age, sex, and smoker classifications to avoid gross profitability inequities between classes. A minimum COI charge is sometimes defined to maintain profitability.

In designing variable products to resemble investment vehicles, attempts are made to minimize the amount of life insurance. Variable

annuity contracts generally provide a death benefit equal to the greater of the fund value and premiums paid. Like universal life, VUL contracts offer a choice between Option A and B death benefit patterns. Many variable life products use the guideline premium test to reduce the present value of the death benefits. Insurers can reduce death benefits by using higher guaranteed mortality charges in the guideline premium calculation. However, mortality charges exceeding 1980 CSO rates have been treated as sales loads by the SEC for standard medically underwritten policies.

The SEC does, nevertheless, permit use of guaranteed COI charges greater than 1980 CSO rates if simplified issue underwriting is performed. Although not all states permit use of this higher mortality, the net amount at risk can be reduced significantly. Accordingly, many products are being designed assuming simplified underwriting and guaranteed COI charges of 125% or more of the 1980 CSO rates.

Insurers have also attempted to reduce death benefits in the guideline premium calculation by deducting certain asset-based charges from the gross interest rate defined in the tax code. For example, some insurers deduct administrative and other charges expressed as an annual percentage of the fund from the interest rate used in the guideline premium calculation. This lower interest rate yields a smaller death benefit per \$1 of premium. Tax counsel must play a key role in assessing the advisability of these interest rate adjustments.

A joint and last survivor variable life product, which pays a death benefit upon the second death of two joint insureds, has recently emerged. The death benefit on such a product is funded by COI charges which are significantly smaller than for a single insured plan. An added advantage is that the tax deferred benefits extend over the lives of two people. These products reflect the increasing investment orientation of the new variable designs.

Guaranteed minimum death benefits (GMDB) are available on some variable life plans. The benefit is usually designed in one of two ways. The first provides that the death benefit will never be less than the original face amount, although the policy could lapse if investment

performance is poor. The second provides that the contract will provide a death benefit regardless of the investment performance. For this latter guarantee, many insurers deduct a separate GMDB charge from the fund and hold separate GMDB reserves. GMDBs are more likely to be offered on products sold through life agents than products geared for stockbrokers.

Statutory and tax reserves for variable products have not yet been defined by either the NAIC nor the IRS. Insurers are currently holding statutory reserves which they feel are suitable for their own situation. The full fund value and the cash surrender value are common. Individual insurers' surplus and tax positions are important concerns in establishing these reserves.

Policy loan provisions vary widely, but the "net wash" loan feature found in general account single premium policies is usually absent from SPVLI contracts. This is caused by the loss of the M&E charges and administrative charges on loaned amounts, since loaned amounts are transferred out of the separate accounts and into the general account when a policy loan is requested. The transfer of loaned amounts to the general account will remove the policyholder's investment participation in the variable accounts. Therefore, a fixed account product would be more appropriate if heavy loan utilization is planned. Recently, however, more new SPVLI plans are offering "net wash" loans.

The kinds of design features we can expect in the future will depend on market and regulatory environments. The development of group variable products is beginning in some companies. One fact is for certain—as competition becomes more fierce in the future, product development actuaries will continue to search for new ways to create innovative variable product designs and investment choices.

Timothy C. Pfeifer is a Consultant at Tillinghast/Towers Perrin. Mr. Pfeifer's professional background includes extensive work in the pricing and product development of life and health insurance products, both traditional and interest sensitive.

In Memoriam

Francis T. Driscoll F.S.A. 1966
G. Kingsley Fox F.S.A. 1950

Bien Venue à Montréal!

by Phyllis A. Doran

The 1987 Annual Meeting held in Montréal marked the end of my year as Chairperson of the Program Committee. The meeting was a satisfactory conclusion after a year spent working on program content and the quality of speakers and their presentations.

One of the highlights of the meeting was Michael Cowell's session on AIDS. The panel included Dr. Robert Redfield who discussed the epidemiological projections and their effect on mortality and morbidity trends.

Another well attended session was a Teaching Session on "Getting to Yes." The Associate Director of the Harvard Negotiation Project at Harvard Law School walked registrants through the negotiation process. The session included discussion of measuring success in negotiation and choosing a negotiating style.

The 1988 Program Committee has studied the evaluations from these two sessions and others at that meeting in planning for the 1988 Annual Meeting in Boston.

Exhibits from reinsurance, consulting, and computer software firms again added to the educational opportunities available at the meeting in Montréal. A catalog of exhibitors with a short description of their products or services is available from the Society for a \$6 prepayment fee. Send your order to: SOA, Attn. Librarian, P.O. Box 95668, Chicago, IL 60694.

Thank you to all meeting participants during the 1987 program year. Your willingness to share knowledge with fellow members of the profession is appreciated. I hope you will continue the experience in future program years.

Phyllis A. Doran is a Consulting Actuary with Milliman & Robertson, Inc. She is a member of the Board of Governors and served as the 1987 Program Committee Chairperson.

Correction Notice

Joseph J. Buff's employment information was incorrect in the December 1987 *Actuary*. ("Asset/Liability Management"). He is a Consulting Actuary at Tillinghast/Towers Perrin. We sincerely regret this error.

Montreal Speakers See Expanding Role for Long- Term Care Insurance

by Dale C. Griffin

The 1987 annual meeting in Montreal included a Panel Discussion on "The Future of Long-Term Care" (LTC), sponsored by the Futurism Section. Panelists agreed that the future will bring expansion of private insurance in the LTC field. The panelists did not expect an expanded government role in financing LTC. They expected that the forecasted increase in services needed as the baby boomers age would be financed increasingly by private insurance, both group and individual. One panelist, Stanley Wallack, stated that he thought the market for LTC insurance will encourage development of dramatically new kinds of products which combine insurance and managed care.

Mr. Hal Barney, F.S.A., of Johnson and Higgins, Inc., led off the session. He helped develop the section generation of LTC products of the American Association of Retired Persons while at Prudential, and is now consulting on LTC financing. He started with demographic projections of the U.S. age distribution through the year 2035. These forecasts are critical to the future of LTC for two reasons. First is the tremendous growth which will occur in the "old old" population as the baby boomers (born in 1945-1965) age. Second, the age distribution "squares off" by 2035, leaving fewer young people to support the older people, which will make government financing of LTC politically difficult, which in turn will encourage financing through private insurance.

Mr. Barney cited the large variation by individual in the amount spent on nursing home stays as a strong reason for using insurance, especially for catastrophic costs. He said that he therefore expects to see lengthening of benefit periods. Given the elderly's growing awareness of their lack of LTC coverage, and their increasing affluence, he predicted an increasing market for LTC insurance. Employers will play a key role in this expansion of LTC insurance, even without actually financing the cost. A

large percentage of employees report problems caring for elderly relatives, which he predicted will lead to steps by employers to sponsor and encourage LTC programs, including insurance. He emphasized the actuary's role in shaping the future of LTC insurance by designing sound, stable products which will reduce pressure for tighter regulation or more government involvement.

Stanley Wallack, Ph.D., with LifePlans, Inc. and Brandeis University, an economist with a background in government and in private market managed care approaches to LTC, was the second speaker. He challenged actuaries and the insurance industry to develop products which will meet the evolving desires of the market rather than "privatizing Medicaid." He considered current products inadequate and spelled out market forces which he believed would lead to new kinds of products. His work in surveying the characteristics and desires of the elderly has led him to the conclusion that they want three separate things from LTC insurance. The emphasis on these different desires changes as the elderly grow older. "Younger" elderly are most concerned with protection of income and estates against a catastrophic nursing home stay. At all ages the elderly are concerned about staying at home rather than moving to an institution. The "old old" become increasingly concerned with access to a quality nursing home if they need one. The typical current LTC policy, which he characterized as having a 2-year nursing home benefit period, home health care only after a nursing home stay, and no assistance with access to a quality nursing home, falls short on all three preferences of the elderly. The short benefit period does not cover the financial risk. Home health services are probably not available, since a nursing home stay will probably not occur, and the policy does not help with access to a good nursing home.

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LTC Insurance Cont'd.

Dr. Wallack's view of the kind of product that the increasingly aware and affluent elderly buyer will want is a product which is comprehensive and linked to a local delivery system. He stated a challenge for actuaries to incorporate insurance and managed care into the same product. For example, the insurer could start paying a disability benefit when a well defined, objective "disability" occurs, but pay the money to a provider, which manages the care. Some examples of arrangements which accomplish the integration of managed care and access to a nursing home are the social HMO (SHMO), an HMO offering a LTC product, life care at home (LCAH), and continuing care retirement communities (CCRCs). In the case of the SHMO, the Medicare program functions as the insurer. LCAH is a new concept developed to meet the specific needs of financial protection, home residence, and access. CCRCs are the fastest growing component of LTC, and appeal most to the 75-80 year olds, who are most concerned about access. Because of the changing preferences by age he predicted the market will seek products which allow movement over time from managed care with home residence to CCRCs.

The final speaker was Mr. Dennis DeWitt, Executive Director of the Health and Human Services Task Force on LTC Policies. The Task Force was created by Congress for the purpose of developing policy recommendations for encouraging the private insurance of LTC. Its report was released on September 21, 1987, and includes recommendations on education of the public, regulation, employment-based LTC insurance, tax policies, and use of retirement funds to buy LTC coverage. Mr. DeWitt argued that restraint on taxation and spending will continue even after President Reagan leaves office because Congress will be a largely conservative body, concerned with deficits. He pointed to the growing affluence of the elderly as a reason why federal programs will not be set up to cover LTC expenses. He referred to Brookings Institute studies of the number of elderly who can afford LTC policies (26-45% depending on assumptions) and argued that while the government will be concerned about LTC, it will encourage private approaches rather

than step in with a social insurance program. Seven of the key Task Force recommendations follow. If they are accepted and implemented, they could have a large impact on the future of LTC:

1. Inform consumers that Medicare, Medigap, and acute health care insurance do not cover LTC.
2. Encourage states to adopt the National Association of Insurance Commissioners' LTC insurance model set.
3. Promote the availability of LTC insurance through employment.
4. Develop LTC insurance financing through vested pension funds.
5. Use federal and state tax codes to encourage the purchase of LTC.
6. Encourage new approaches to determine eligibility for LTC insurance benefits.
7. Encourage greater cooperation in the collection and sharing of LTC data.

Before the panelists were recruited, several actuaries from the Futurism Section wrote scenarios of the future of LTC in the year 2010. Two of the scenarios mirrored the panelists' views of an increased role for private insurance of LTC. One scenario envisioned the problems of the aged worsening without government or private solutions developing. It is a sobering contrast, and one which reminds us that scenarios and views on the future can clarify our choices about the future. All of the panelists challenged us as actuaries to take an active role in shaping the future of long-term care.

Dale C. Griffin is a Consulting Actuary with Ann Arbor Actuaries, Inc. in Ann Arbor, Michigan. He was the moderator for Panel Discussion 14 entitled "The Future of Long-Term Care," at the 1987 annual meeting.

Book Review

Hans U. Gerber, *Lebensversicherungsmathematik*, pp. 120, published for the Vereinigung Schweizerischer Versicherungsmathematiker by Springer-Verlag, 1986.

Summary of Review by Cecil J. Nesbitt

This well-written and attractively published book has been influenced by computer developments and by the younger generation's knowledge of probability theory. These factors have

led to a probabilistic approach to actuarial models and formulas and to the relegation of commutation functions to a brief Appendix. In 120 pages, the book covers many of the main concepts presented in the Society's textbook, *Actuarial Mathematics*, and in addition, devotes a chapter to interest theory and to the estimation of basic probabilities. The book is directed to younger readers who take pleasure in applied mathematics and who wish an introduction to life insurance mathematics. A well-organized and elegant introduction awaits their reading.

The text is written in German, but with its many formulas in the international language of mathematics, and with some dictionary assistance, it is not difficult to follow. To actuarial students with lively curiosity it can be both a supplement and an aid to *Actuarial Mathematics*; to practitioners, it can be a useful reference for following up some points they may come up against in applying actuarial mathematics; to educators it can provide a modern introduction to basic actuarial mathematics.

The text appears remarkably error-free. The reviewer has noted only two, a transposition of signs in formula (7.15) of Chapter 1 and a misplaced index in the formula in Section 5.3.4:

$$P_{x:\overline{n}|} \ddot{a}_{x+n}$$

There is no discussion of actuarial accumulated values, or of retrospective formulas for reserves. Under present circumstances, these may be of less importance.

There are a number of enlightening interpretations of formulas, and from time to time numerical examples to illustrate the mathematical theory. There are no exercises, so this is not a textbook in the more usual format. But teachers and students will find the book to be an excellent stimulus for their own understanding of life insurance mathematics. Both pleasure and information await the interested reader.

Cecil J. Nesbitt is Professor Emeritus in the Department of Mathematics at the University of Michigan. He is a co-author of the new *Actuarial Mathematics* textbook.

(Ed. note: The complete version of this review will be published in the TSA.)

Dear Editor:

Making Change

We learn at a very young age how to make change. For example, we learn to make up \$.72 by taking a half dollar, two dimes and two pennies. The process is simple—take the largest number of highest denomination coins possible, the largest number of the next highest denomination coins possible, etc. I'll refer to this process as the "usual method of making change." A property of this method, when used in conjunction with our set of coin denominations, is that it always results in at least one fewer coin than if the specified amount were made up any other way. This is obvious for our \$.72 example and can be proved in general for any amount.

This minimizing property is not true for all sets of coin denominations. For example, consider the old pre-decimal set of coins in Britain (ignoring the half-penny): penny, three-pence, sixpence, shilling, florin, half-crown, i.e., $\{1, 3, 6, 12, 24, 30\}$. By the usual method of making change, 48 pence would be made up of three coins (half-crown, shilling and six-pence). However, 48 pence can be made up of only two coins—namely two florins. Why does the minimizing property work for the set of coin denominations $\{1, 5, 10, 25, 50\}$ but not for the set $\{1, 3, 6, 12, 24, 30\}$? For what sets of coin denominations is it true that the usual method of making change always results in one fewer coin, two fewer coins, three fewer coins, etc.?

After considerable frustration, effort and time, I was able to find a necessary and sufficient condition that must be satisfied by a set of coin denominations in order for it to have the property that, for any specified amount, the usual method of making change results in at least k fewer coins than if the amount is made up in any other way. The proof of this theorem (referred to as the "Change Theorem") is elementary but difficult and long; I would be glad to send a copy of it to anyone who is interested. The following paragraphs give a precise statement of the Change Theorem and explain how it is applied.

Consider the set of coin denominations $\{1, 5, 14, 68\}$. The Change Theorem makes use of a concept called "efficiency" which is defined for

each coin in the set other than the unit coin, as follows:

Efficiency of 68.

- (1) The smallest multiple of 14 which exceeds 68 is 5.
- (2) The amount 70 (i.e., 5×14) consists of 3 coins when made up from $\{1, 5, 14, 68\}$ by the usual method of making change.
- (3) Hence, $\text{Eff}(68) = 5 - 3 = 2$.

Efficiency of 14.

- (1) The smallest multiple of 5 which exceeds 14 is 3.
- (2) The amount 15 (i.e., 3×5) consists of 2 coins when made up from $\{1, 5, 14\}$ by the usual method of making change.
- (3) Hence, $\text{Eff}(14) = 3 - 2 = 1$.

Efficiency of 5.

- (1) The smallest multiple of 1 which exceeds 5 is 6.
- (2) The amount 6 (i.e., 6×1) consists of 2 coins when made up from $\{1, 5\}$ by the usual method of making change.
- (3) Hence, $\text{Eff}(5) = 6 - 2 = 4$.

Note that the efficiency of a coin depends only on the value of the coin and the value of the smaller denomination coins which precede it.

The efficiency of a set of coin denominations is defined as the smallest efficiency of all of its coins. Hence, the efficiency of the set $\{1, 5, 14, 68\}$ is the smallest of 2, 1 and 4, that is, $\text{Eff}(\{1, 5, 14, 68\}) = 1$.

The Change Theorem states the following, for a positive integer k : in order for a set of coin denominations to have the property that, for any specified amount, the number of coins obtained by the usual method of making change is at least k less than if the amount is made up in any other way, it is necessary and sufficient that the efficiency of the set be greater than or equal to k . Where $k = 0$, it turns out that the condition just stated is sufficient, but not necessary.

Hence, the set $\{1, 5, 14, 68\}$ has the property that, for any amount, the usual method of making change will always result in at least one fewer coin than any other method. Similarly, the set of coin denominations $\{1, 5, 10, 25, 50\}$ has the same property since its efficiency is also 1. On the other hand, the set $\{1, 3, 6, 12, 24, 30\}$ does not have such a property, as noted earlier, since its efficiency is -1 ($\text{Eff}(3) = 2$, $\text{Eff}(6) = 1$, $\text{Eff}(12) = 1$, $\text{Eff}(24) = 1$, $\text{Eff}(30) = -1$). A few other examples: $\text{Eff}(\{1, 5, 19, 71\}) = 2$, $\text{Eff}(\{1, 4, 10, 36\}) = 0$, and $\text{Eff}(\{1, 4, 7, 27, 30, 53\}) = -5$. This last

example was difficult to find—even though its efficiency is negative, the usual method of making change always results in at least as few coins as any other method. Contrast this with the pre-decimal British set of coins which also has a negative efficiency but for which this property is not true.

Here is an interesting consequence of the Change Theorem. Suppose we want to create a set of coin denominations for which the usual method of making change always produces at least one fewer coin than any other method, and we start with the set $\{1, 5, 12\}$. This set clearly fails because 15 consists of 4 coins by the usual method of making change, but can be made up of only 3 coins (i.e., three 5s). That particular problem could be solved by adding a coin of denomination 15 to the set, thus obtaining the set $\{1, 5, 12, 15\}$. However, this set also fails because 17, for example, consists of 3 coins by the usual method of making change, but can be made up of only 2 coins (i.e., 12 and 5). The fact is—there are no coins that can be added to the set $\{1, 5, 12\}$ which will result in a set that has the property we want. The reason stems from the fact that $\text{Eff}(12) = -1$, and the efficiency of that coin is unaffected by any higher denomination coins added to the set. Hence, the efficiency of any set obtained by adding higher denomination coins to $\{1, 5, 12\}$ cannot be greater than -1 .

Perhaps this example is a demonstration of the old adage—"you can't make a silk purse out of a sow's ear."

Walter Shur

Actuarial Spoof

In January 1965 I published the first actuarial newsletter spoof, Mr. O. David Green's Live-It-Up policy. The benefit was payable at the start of the year of death, not a year later as was provided for the traditional formula. The most recent spoof is in this publication's November 1987 issue, where Charles H. Connelly adds $3/4$ and $4/13$ to obtain $7/17$. What I wish to discuss is the clever, disguised spoof in the October 1987 issue, by Michael E. Swiecicki.

We were provided with five figures and asked to choose the most unusual one. It was number 4, which did not contain the non-white, non-black area common to the other four. Mr. Swiecicki omitted this solution, substituting two others based on

Continued on page 14 column 1

Dear Editor Cont'd.

supposedly unique similarities. This was to let the unsuspecting casual reader believe that he, Swiecicki, understood the meaning of the quotation with which his letter began.

This would have been unfair except for the language clues. The ability to think and write clearly has long been deemed the prime requisite of the accomplished actuary. The readers who missed the clues surely should seek to remedy their deficiency.

Some casual readers who observed the clues may have avenged themselves, with some justification, for concluding that Mr. Swiecicki's communication skills are deficient. However, they stand accused of substituting impression for the facts.

When Mr. Swiecicki repeatedly misused "unique" and embellished it with "most unique" a couple of times, a hint as to the spoof was provided. But when he based uniqueness on shared characteristics or on a lack of uniqueness, he gave himself away to the discerning reader. To be dissimilar is not to be unique, and "most" is a contradiction of uniqueness.

I am reminded of Monsieur Blot, the title and chief character of a novel published decades ago. M. Blot was an actuary and the most average of Frenchmen as to height, weight, age and other attributes. Being the exact average did not confer uniqueness upon him, nor did his being the subject of the novel. Even being an actuary did not qualify him; ours is not all that unusual a profession.

Ralph E. Edwards

Universal Life Reserves

In the November 1987 issue of *The Actuary*, the question was raised in an article by Douglas Doll as to whether for valuation purposes anticipated subsequent profits should be used to cover earlier anticipated losses. Or more sonorously should future sufficiencies offset current deficiencies? More concisely, this is the sufficiency/deficiency offset question.

This question is akin to a question such as "are fireworks safe?" One respondent, thinking of a patriotic fireworks display, says "Yes"; another, thinking of a backyard display, says "more-or-less," a third, thinking of setting off fireworks in a fireworks factory, says "spectacularly unsafe." All three are correct and incorrect. Such questions are essentially

unanswerable as long as the questioner or respondents do not state their assumptions.

If one assumes a "going concern" like users of GAAP do, or deficit financing as governments sometimes call it, then, of course future profits can offset current deficiencies. If the concern is really going to keep "going," future profits are not even necessary. Unfortunately it seems that negative net worth in a corporation is not easily dealt with, nor is governmental deficit financing. A recent newspaper article indicates that in 1988, due to negative net worth, one savings and loan per week is expected to undergo some sort of reorganization. "Going concerns" do need an infusion of money when they lack money but have future profits; the assumption seems to be that the money can be borrowed. If this does not happen, then it seems that the losses are paid off in lesser dollars, as in bankruptcy, or in dollars of less worth, as in devaluation. Not even the government is immune. Offsetting is actually a nice theoretical exercise in making earnings emerge according to a stipulated formula. To make assets and liabilities balance, one can always introduce an asset such as "present value of future projected profits" or even "deferred acquisition costs" if the former title seems too generous. Of course creditors cannot be paid off with such assets (try it on the IRS), so the ability to keep going as a going concern may not be there. But again it is a nice theoretical device to see how things are going in relation to what was planned, and in that context acceptable. As a measure of continued solvency, such a process is essentially irresponsible.

From this point of view, statutory requirements may seem a little odd. Assets are considered only as good as they are available to pay claims. One cannot exactly give a beneficiary 500 filing cabinets to settle a death claim—nor would the IRS be likely to accept "deferred acquisition costs" for taxes. So these things like "present value of future profits" are generally not recognized as assets. Of course one can try to bury the asset as a deduction from a liability. The sufficiency/deficiency offset is a nice example. But this does not make the asset any more available or able to be recognized for statutory purposes or of any use to creditors. If a company is obligated to pay out \$1,000 on demand, it is of little use to show

liability of \$250 and assume that later profits will generate enough to cover the \$1,000. Statutory accounting is based on solvency at every point in time.

There may be many other circumstances under which the sufficiency/deficiency offset is appropriate—the valuation actuary's valuation seems to be along those lines; using GAAP is another; the IRS reserving procedure is still another; and there are many, many more. All of these assume that the current deficits can be met without insolvency, and require the use of fictitious assets to balance the Balance Sheet. But Heaven help the company which relies on such financial statements for assurance of being able to continue in business.

Balance sheets and earnings are required to be algebraically equivalent. Herein lies the crux of the problem. The accountant who wants to measure earnings must force an unrealistic balance sheet; the regulators' solvency requirement forces what may be an undesirable operating statement. Concepts of solvency and "appropriate" earnings according to some goal cannot coexist. Failure to recognize this fact creates a myriad of problems. For earnings recognition, the sufficiency/deficiency concept would be acceptable; for solvency, that concept is dangerous to the policyholder and foolhardy.

John T. Gilchrist

Unification

Donald P. Minassian apparently is unaware ("Whither Actuarial Education?" November 1987) that students in college actuarial courses frequently head for ACAS and FCAS exams (the number of applications for CAS exams has climbed steadily and dramatically in the last ten years); so I suggest, regarding the thought in his last paragraph, that it would be even nicer to have a group of teacher-researcher FCAS-FSAs under one roof. Mr. Minassian's views would have been more welcome if he had referred to actuarial educational programs broader than those pointed only at ASA or FSA designations.

It is not out of order to mention that his letter displays a parochialism that tends to discourage thoughts of unification of the profession by actuaries outside of the SOA.

Matthew Rodermund
Mr. Rodermund, not a member of the Society,
is Editor of the Casualty Actuary Society
newsletter.

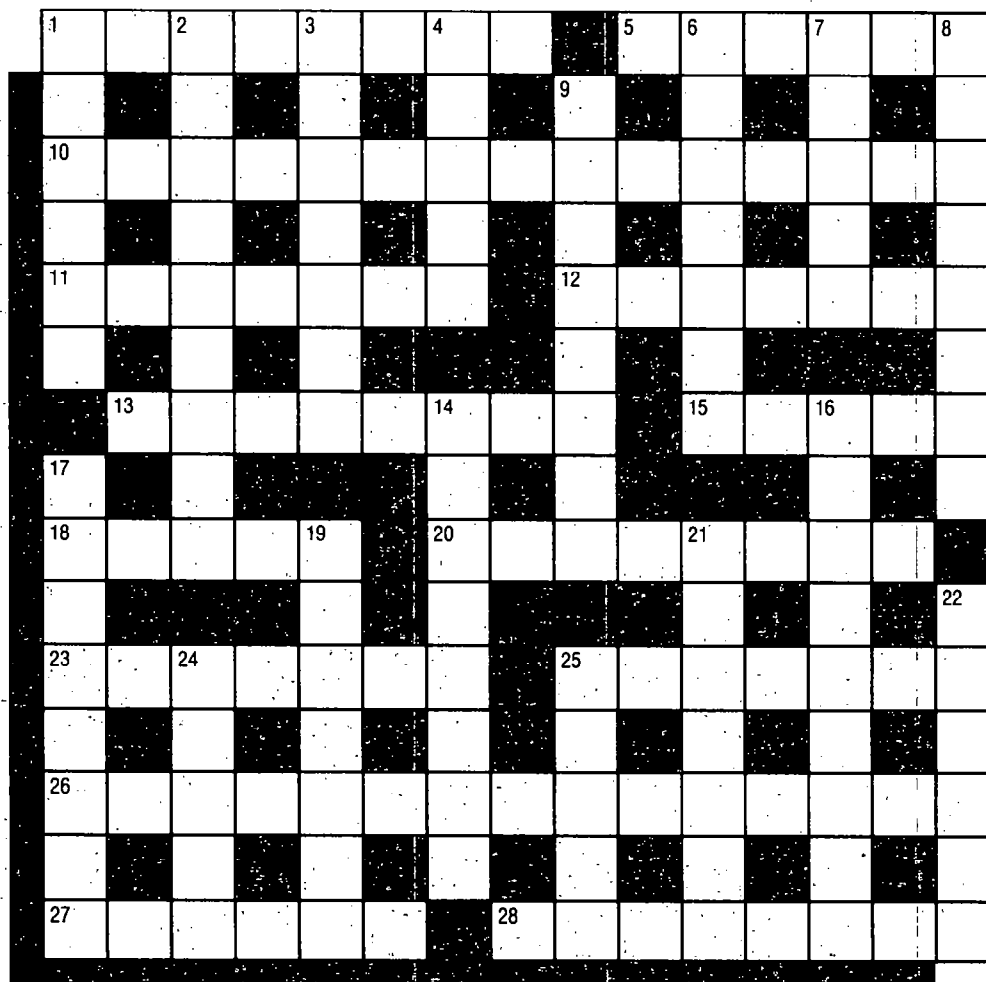
ACTUCROSSWORD

Across

1. Opening mail shares confidentiality with you and me (8)
5. Severe censure for one of consequence (6)
10. Animal cure for suspense (3,4,2,3,3)
11. Nil type in a foolish way (7)
12. Prizeman returns about an Asiatic location (7)
13. Room used by animal of somnolent repute (8)
15. Composer of a concerto, still famed for parting from it (5)
18. Maud's black bat, also famed for departure (5)
20. Possibly relating to something yet essential to it all (8)
23. Reproof for revision of rule, etc. (7)
25. Good score can tell its story. (7)
26. Raids the Navy arm in Massachusetts (7,8)
27. Such nymphs make poor publicity (6)
28. Not a member or suited to become one (8)

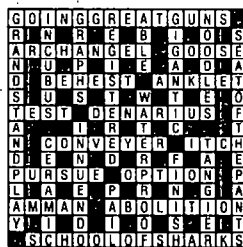
Down

1. Non-classical way to make an itch go (6)
2. Recurring music for egotistic vocalist? (5,4)
3. Result of leaving orphan to meddle? Just imagine! (7)
4. Deviate, but stay right in the middle (5)
6. People in wont (7)
7. Do in new return as source of day identification (5)
8. Great caper after means of transportation (8)
9. Faun left well provided (8)
14. This could ruin Eve's plans for her descendants (8)
16. VIP directors never wrong (9)
17. Two states in one set on fire (8)
19. Crazy thing that a tangent did? (7)
21. Strange assortment of stones (7)
22. Kind offer (6)
24. Cry about an old place—it's hot (5)
25. Soldier finds a way to oil up (5)



January's Solution

100% SOLVERS — *November*: R Carson, K Elder, F Hogan family, E Jenkins, D Kendall, H Messenger, B Packer, J Prescott, F Rathgeber, R. Sher-



wood, J & B Uzzell. *December*: W Allison, D Baillie, J Darnton, C Galloway, R Hohertz, E Jenkins, R & J Koch, R C Martin, G D McDonald, B Mowrey, E Portnoy, N Shapiro, & G Sherritt.

ACTUCROSTIC

A. Universal; unlimited. (hyph)

5 134 27 155 130 114 99 145
41 77 217 58

B. Anarchy; extreme left.

33 125 101 196 86 59 223 165

C. _____ hands.

176 31 85 62 138 200 153

D. Usually we insist on this between the two sides.

163 144 57 157 4 98
188 229 36 207 73

E. A policyholder can do this after a lapse,

72 143 47 211 173 201 21 195 232

F. but not if we know he has this tendency.

111 71 169 199 28 209 146 45

G. A quick, broad summary.

.9 234 220 117 156 92 177 204

H. Recite; relate.

230 42 93 20 174 123 118

I. A regular attraction in Yellowstone Park. (2 wds)

185 139 158 60 235 206 35 96
197 226 6

J. Hitler's creation and milieu. (2 wds)

120 53 218 227 74 194 15 152 170 103

K. A cow who has not calved.

115 179 88 190 63 164

L. Conifer; enduring.

104 178 141 81 116 228 193 109 22

M. A strong, outward current of water.

184 65 127 150 198 219 24

N. What I need at all the better restaurants. (2 wds)

89 149 29 182 119 100

O. One type of hazard or therapy.

34 131 50 7 90 222 162 13 167 78
106 147

P. Twilight; dusk. (2 wds)

154 55 30 126 202 180 231

Q. Automatic door-opener. (2 wds)

8 161 67 192 102 215 82 23
135 46 121

R. _____ acid.

52 113 148 14 237 128 171 38

S. Extremely loud.

181 208 159 17 95 238 43 210 108 76

T. Pursuit of wisdom.

166 124 68 12 212 49 26 133 205 87

U. Break; breach.

122 186 214 61 19 233 94

V. Referee; umpire.

151 66 10 129 221 44 91 168

W. Receptive to outside influences.

187 51 225 79 132 105 37

X. With one foot in the grave. (4 wds)

216 69 83 175 191 18 107 160 142 48

Y. Meek; timid.

.203 224 172 97 137 110 239 2

Z. Absorb.

11 70 40 189 112 140 56 136 213 80

AA. Enjoy yourself; have a ball. (3 wds)

64 16 54 39 75 1 84 25

	1	AA	2	Y	3	X		4	D	5	A	6	I	7	O	8	O		9	G	10	V		11	Z		12	T	13	O	14	R	15	J		16	AA	17	S	18	X			
19	U	20	H	21	E	22	L	23	O	24	M		25	AA	26	T	27	A	28	F	29	N	30	P		31	C	32	X		33	B	34	O	35	I		36	O	37	W	38	R	
39	AA	40	Z	41	A	42	H	43	S	44	V	45	F	46	O		47	E	48	X	49	T		50	O	51	W	52	R	53	J		54	AA	55	P	56	Z	57	D	58	A		
59	B	60	I		61	U	62	C	63	K		64	AA	65	M	66	V	67	O		68	T	69	X	70	Z	71	F	72	E	73	D	74	J		75	AA	76	S		77	A		
78	O		79	W	80	Z	81	L	82	O	83	X	84	AA	85	C	86	B	87	T		88	K	89	N	90	O	91	V	92	G	93	H	94	U	95	S		96	I	97	Y	98	D
99	A	100	N	101	B		102	O	103	J	104	L		105	W	106	O	107	X	108	S	109	L		110	Y	111	F		112	Z	113	R	114	A	115	K		116	L	117	G		
118	H	119	N	120	J	121	O	122	U		123	H	124	T	125	B	126	P		127	M	128	R	129	V	130	A	131	O	132	W	133	T	134	A	135	O		136	Z	137	Y	138	G
139	I	140	Z	141	L	142	X		143	E	144	D	145	A	146	F	147	O	148	R	149	N		150	M	151	V		152	J	153	C	154	P	155	A	156	G	157	D	158	I	159	S
160	X	161	O		162	O	163	O	164	K	165	B		166	T	167	O	168	V	169	F	170	J	171	R	172	Y	173	E		174	H	175	X	176	C		177	G	178	L	179	K	
180	P		181	S	182	N		183	X	184	M	185	I	186	U	187	W		188	D	189	Z	190	K	191	X		192	O	193	L	194	J	195	E	196	B	197	I	198	M	199	F	
200	C	201	E	202	P	203	Y		204	G	205	T	206	I	207	D	208	S		209	F	210	S		211	E	212	T	213	Z		214	U	215	Q	216	X	217	A	218	J	219	M	
220	G		221	V	222	O	223	B	224	Y		225	W	226	I	227	J	228	L	229	D	230	H	231	P	232	E	233	U		234	G	235	I	236	X	237	R	238	S	239	Y		

LAST MONTH'S SOLUTION: Harold Ingraham, Major Issues (Facing the Society of Actuaries), "Another force changing the role of the actuary is (the widespread availability of) computers. . . . Jordan, (and Spurgeon before that,) was directed toward (ingenious mathematical) shortcuts. But . . . valuation . . . today is done seriatim. . . . Our horizons have broadened, but we're also playing on a field that others can play on too. We've got to be better than the others or people aren't going to use us." The ACTUARY, October, 1987.

