II

Life Insurance Earnings and the Release from Risk Policy Reserve System

Richard G. Horn

Abstract

This paper is concerned with the fundamental nature of life insurance company earnings. The operation of the policy reserve system as the timing mechanism which determines the incidence of earnings is discussed, and the concept of release from risk is then described.

A policy reserve system based on the concept of release from risk is developed, and the earnings which emerge from this system are analyzed from both an actuarial and an accounting viewpoint.

Some specific policy reserve methods are identified as special cases of the release from risk policy reserve system. Finally, a suggestion is advanced about the role of corporate philosophy in the choice of a policy reserve method.

Introduction

There exists today a considerable amount of interest in the manner in which life insurance companies report their earnings. The financial reporting practices of the entire life insurance industry are being examined in terms of the accounting principles which are generally accepted in other industries. A fundamental exploration of the nature of life insurance earnings would seem to be of some value during this formative period.

The beginning point for our exploration should be the recognition that the actual earnings which a closed block of life insurance will generate can be determined only in retrospect after the last policy terminates. Any prior representation of earnings is of necessity an estimate. Consequently, actual earnings are independent of the policy reserve system employed. The policy reserve system can be considered a timing mechanism which determines the incidence of earnings but which in no way affects the final accumulated amount of earnings.

In order to examine the nature of life insurance earnings, we must address ourselves to the problem of developing a policy reserve system that will produce an incidence of earnings that is theoretically consistent from both an actuarial viewpoint and an accounting viewpoint. The objective of this paper is to establish a generalized policy reserve system that accomplishes this theoretical consistency and that can be used as a frame of reference in analyzing a variety of policy reserve methods.

Scope

The analysis of life insurance earnings presented in this paper is confined to the effect on earnings of the policy reserve system employed. Expenses, as well as mortality, interest, and withdrawals, are considered as elements of the policy reserve and are treated accordingly. Generally accepted accounting principles may suggest that other changes in life insurance accounting practices might be appropriate, but these considerations lie outside the scope of this paper.

In order to focus attention on the concepts involved in the release from risk policy reserve system, this paper is restricted to an analysis of the policy-year earnings of level premium, level death benefit, limited payment, annual mode, nonparticipating, individual life insurance.

Recognition of Risk

Life insurance companies are risk enterprises. Risk is the essence of their business. Beyond the general economic and business risks faced by all business, life insurance companies assume the risks underlying their insurance products—specifically, mortality, investment, expense, and withdrawal.

The company's hazard, however, lies in deviations from the expected values of these risks rather than the expected values themselves. The company must provide for the costs of both the expected values of the risks inherent in their products and the deviations from the expected values.

The risks of adverse variability in realistically assumed rates of mortality, interest, withdrawal, and expense constitute the hazard of the life insurance endeavor. Later in this paper we will observe the manner in which life insurance earnings are influenced by the release of these risks when the underlying policy reserve system contains provisions for the risks of adverse variability.

The adverse variability associated with the expected value of a given risk can be quantified either on the basis of appropriate risk statistics or by determining the margins for variance which the gross premium rate structure implicitly, permits.

The quantification of the risks of adverse variability on the basis of risk statistics would involve an application of risk theory that could warrant a separate paper. A measure of the adverse variability associated with the mortality risk, the investment risk, the withdrawal risk, and the expense risk could be determined separately with relative ease (assuming the existence of the necessary probability distributions), but the quantification of the combined risks taken as a whole is considerably more difficult. The nonadditive character of the separate variabilities complicates matters, but, also, the separate risks of adverse deviations are somewhat related and interdependent. For example, the risk of an adverse deviation in the interest rate assumption is probably inversely related to the risk of an adverse deviation in the expense rate assumption. Various other relationships exist, and the strength of each relationship can vary by duration. If it were considered desirable to recognize possible cyclical trends in adverse deviations, this would add an additional dimension of complexity.

The quantification of the risks of adverse variability can be accomplished in a rather practical manner by allocating all, or a part, of the profit margin contained in the gross premium to the various risk elements. The determination of how much of the profit margin to allocate and the division into the various risk elements would be largely a matter of judgment. The judgment employed in this process would be similar to, or an extension of, the judgment employed in deciding upon a set of assumptions to use in establishing gross premiums. As an example, an actuary might feel that the risk of an adverse mortality deviation should be represented by, say, 5 per cent of his most realistic estimate of future mortality rates. A similar assignment of amounts for the risks of adverse deviation in the interest rate assumption and the withdrawal rate and expense rate assumptions could likewise be made on the basis of the actuary's judgment. The criterion that would need to be satisfied in each instance, however, would be that the premium calculated on the basis of realistic assumptions plus the amounts assigned to the risks of adverse deviations must be no greater than the gross premium.

Depending upon how the measures of adverse variability have been determined, they might be quite concise or they might tend to be rather complex. For simplicity, this paper will use the notation Δ to represent the measure of adverse variability associated with a given rate at a given duration. The Δ notation will thus represent the amount assigned to the risk of an adverse deviation in an expected value assumption.

The notation for the expected value assumptions and the associated risks of adverse variability can now be summarized:

$q_{[x]+n-1}$ = Expected value of the mortality rate for policy year n, issue age $[x]$;

$\Delta q_{[x]+n-1}$ = Amount assigned to the risk of an adverse deviation in $q_{[x]+n-1}$;

$wq_{[x]+n-1}$ = Expected value of the withdrawal rate for policy year n, issue age $[x]$;

$\Delta wq_{[x]+n-1}$ = Amount assigned to the risk of an adverse deviation in $wq_{[x]+n-1}$;

i = Rate of investment income realistically assumed to operate in each policy year;

Δi = Amount assigned to the risk of an adverse deviation in i;

E_n^A = Per-policy expenses realistically assumed to be incurred in policy year n;

ΔE_n^A = Amount assigned to the risk of an adverse deviation in E_n^A;

$E_n^{\%}$ = Per-premium expenses realistically assumed to be incurred in policy year n;

$\Delta E_n^{\%}$ = Amount assigned to the risk of an adverse deviation in $E_n^{\%}$.

For convenience, the mortality rate Δ, the withdrawal rate Δ, and the expense rate Δ will be presented as positive values. The investment income rate Δ will be presented as a negative value and the rate of investment income will be considered to be level by duration.

The Release from Risk Policy Reserve

Assuming, for the sake of simplicity, an end-of-year incidence for deaths and withdrawals and a beginning-of-year incidence for expenses, and no death or withdrawal expenses, the valuation premium for an m-pay whole life policy that recognizes both the expected values of the rates involved and the risks of adverse deviations in the expected values is

$$P'_{[x]} = \text{Valuation premium}$$

$$= \{ \sum_{n=1}^{\infty} l'_{[x]+n-1} [1{,}000(1+i-\Delta i)^{-n}(q_{[x]+n-1} + \Delta q_{[x]+n-1})$$
$$+ {}_nCV_{[x]}(1+i-\Delta i)^{-n}(wq_{[x]+n-1} + \Delta wq_{[x]+n-1})$$
$$+ (E_n^A + \Delta E_n^A + E_n^{\%} G_x + \Delta E_n^{\%} G_x)(1+i-\Delta i)^{-n+1}] \}$$
$$\div \{ \sum_{n=1}^{m} l'_{[x]+n-1} (1+i-\Delta i)^{-n+1} \},$$

where

$$l'_{[x]+n} = l'_{[x]+n-1}(1-q_{[x]+n-1}-\Delta q_{[x]+n-1}-wq_{[x]+n-1}-\Delta wq_{[x]+n-1}),$$

${}_nCV_{[x]}$ = nth-policy-year cash value, issue age $[x]$,

G_x = Gross annual premium, issue age x.

If we now define

$$q'_{[x]+n-1} = q_{[x]+n-1} + \Delta q_{[x]+n-1},$$

$$wq'_{[x]+n-1} = wq_{[x]+n-1} + \Delta wq_{[x]+n-1},$$

$$i' = i - \Delta i,$$

$$E'^A_n = E_n^A + \Delta E_n^A,$$

$$E'^{\%}_n = E_n^{\%} + \Delta E_n^{\%},$$

$$v'^n = (1+i')^{-n},$$

the valuation premium can be expressed somewhat more simply:

$$P'_{[x]} = \{ \sum_{n=1}^{\infty} l'_{[x]+n-1} [1{,}000 v'^n q'_{[x]+n-1}$$
$$+ {}_nCV_{[x]} v'^n wq'_{[x]+n-1} + v'^{n-1}(E'^A_n + E'^{\%}_n G_x)] \}$$
$$\div \{ \sum_{n=1}^{m} v'^{n-1} l'_{[x]+n-1} \}.$$

The nth-policy-year terminal reserve, issue age $[x]$, can now be expressed prospectively,

$${}_nV'_{[x]} = \frac{1}{v'^n l'_{[x]+n}} \{ \sum_{t=n+1}^{\infty} l'_{[x]+t-1} [1{,}000 v'^t q'_{[x]+t-1}$$
$$+ v'^t {}_tCV_{[x]} wq'_{[x]+t-1} + v'^{t-1}(E'^A_t + E'^{\%}_t G_x)]$$
$$- P'_{[x]} \sum_{t=n+1}^{m} v'^{t-1} l'_{[x]+t-1} \},$$

or retrospectively,

$${}_nV'_{[x]} = \frac{l'_{[x]+n-1}}{l'_{[x]+n}} \{ [{}_{n-1}V'_{[x]} + P'_{[x]} - (E'^A_n + E'^{\%}_n G_x)](1+i')$$
$$- 1{,}000 q'_{[x]+n-1} - {}_nCV_{[x]} wq'_{[x]+n-1} \},$$

provided in each case, of course, that $n \leq m$.

Analysis of Earnings

Let us now distinguish among three classes of rates. First, we have realistic assumed rates of mortality (q), withdrawal (wq), expense (E^A and $E^{\%}$), and investment income (i). Next we have defined a class of rates which are equal to the realistic assumptions with an increment to recognize the risk of adverse deviation associated with each realistic assumption. Thus we have a mortality rate (q'), a withdrawal rate (wq'), expense rates (E'^A and $E'^{\%}$), and an investment rate (i').

We now wish to identify rates of *actual* experience for demonstration purposes. A caret over each rate will indicate actual experience. Actual mortality will be indicated by $\hat{q}$, actual rates of withdrawal by $\widehat{wq}$, actual expense rates by $\hat{E}^A$ and $\hat{E}^{\%}$, and actual investment income rates by $\hat{\imath}$.

If we ignore investment income on retained earnings, if any (as well as investment income on capital and other surplus funds), the earnings which emerge during any premium-paying year n from our m-pay whole life policy can now be expressed as

G_x .... (actual premium income)

$+\ \hat{\imath}[{}_{n-1}V'_{[x]} + G_x - (\hat{E}_n^A + \hat{E}_n^{\%} G_x)]$ .... (actual investment income)

$-\ 1{,}000\hat{q}_{[x]+n-1}$ .... (actual mortality)

$-\ {}_nCV_{[x]}\hat{wq}_{[x]+n-1}$ .... (actual surrender values paid)

$-\ [{}_nV'_{[x]}\ (1-\hat{q}_{[x]+n-1}-\hat{wq}_{[x]+n-1}) - {}_{n-1}V'_{[x]}\ ]$ ... (actual increase in policy reserve)

$-\ (\hat{E}_n^A + \hat{E}_n^{\%} G_x)$ .... (actual expenses).

If we rearrange the retrospective form of the reserve equation to yield ${}_{n-1}V'_{[x]}$ in terms of ${}_nV'_{[x]}$ and substitute that expression for ${}_{n-1}V'_{[x]}$, the "actual increase in policy reserve" becomes

$$[P'_{[x]} - (E'^A_n + E'^{\%}_n G_x)]$$
$$+\ i'[{}_{n-1}V'_{[x]} + P'_{[x]} - (E'^A_n + E'^{\%}_n G_x)]$$
$$-\ q'_{[x]+n-1}(1{,}000 - {}_nV'_{[x]})$$
$$-\ wq'_{[x]+n-1}({}_nCV_{[x]} - {}_nV'_{[x]})$$
$$-\ \hat{q}_{[x]+n-1}\,{}_nV'_{[x]} - \hat{wq}_{[x]+n-1}\,{}_nV'_{[x]}.$$

We can now develop a breakdown of earnings by source simply by substituting this last expression for the "actual increase in policy reserves" in the earnings expression above and doing a little combining:

Earnings

$= (G_x - P'_{[x]})(1+\hat{\imath})$ .... (gain from loading)

$+\ (\hat{\imath} - i')[{}_{n-1}V'_{[x]} + P'_{[x]} - (E'^A_n + E'^{\%}_n G_x)]$ .... (gain from interest)

$+\ (q'_{[x]+n-1} - \hat{q}_{[x]+n-1})(1{,}000 - {}_nV'_{[x]})$ .... (gain from mortality)

$+\ [wq'_{[x]+n-1} - \hat{wq}_{[x]+n-1}]({}_nCV - {}_nV'_{[x]})$ .... (gain from withdrawal)

$+\ (E'^A_n + E'^{\%}_n G_x - \hat{E}^A_n - \hat{E}^{\%}_n G_x)(1+\hat{\imath})$ .... (gain from expenses).

After the premium-paying period, the loading gain would obviously be eliminated and the valuation premium and gross premium terms would drop out of the interest and expense gains.

Matching of Revenues and Costs

The breakdown of earnings by source demonstrated above clearly displays the direct manner in which the policy reserve assumptions influence the incidence of earnings. An actuary could probably satisfy himself with regard to the fundamental question "What is the proper incidence of life insurance earnings?" from the standpoint of this analysis alone.

The accounting profession, however, has developed over a great many years a set of standards (generally accepted accounting principles or, more simply, GAAP) which is their frame of reference in considering the question "What is the proper incidence of life insurance earnings?"

According to GAAP, earnings of any accounting period should be the result of matching the revenues of such period to the costs of such period. It is therefore significant to define period costs and period revenues and determine the period earnings that develop from bringing together such revenues and costs.

Bringing period costs and period revenues together for life insurance means deferring the recognition of some current income to a later period or anticipating in the current period some of the costs which will emerge in later periods. The mechanics of the policy reserve system accomplishes the matching process whether current income is regarded as being deferred or later costs are regarded as being anticipated.

It is perhaps more straightforward to think of the policy reserve system as deferring current income. This approach would define the costs of a given period as actual mortality (less reserves released) plus actual surrender values paid (less reserves released) plus actual expenses paid. The period revenues would then be the excess of gross premiums over valuation premiums, plus actual investment income, less required interest, plus the provision for mortality, surrender benefits, and expenses released from the policy reserve system in the period.

Thus the revenues of policy year n would be

$$(G_x - P'_{[x]}) + \hat{\imath}[{}_{n-1}V'_{[x]} + G_x - (\hat{E}^A_n + \hat{E}^{\%}_n G_x)]$$
$$-\ i'[{}_{n-1}V'_{[x]} + P'_{[x]} - (E'^A_n + E'^{\%}_n G_x)]$$
$$+\ q'_{[x]+n-1}(1{,}000 - {}_nV'_{[x]})$$
$$+\ wq'_{[x]+n-1}({}_nCV_{[x]} - {}_nV'_{[x]}) + (E'^A_n + E'^{\%}_n G_x)$$

while $n \leq m$, and the costs of policy year n would be

$$\hat{q}_{[x]+n-1}(1,000 - {}_nV'_{[x]}) + \hat{wq}_{[x]+n-1}({}_nCV_{[x]} - {}_nV'_{[x]}) + (\hat{E}_n^A + \hat{E}_n^{\%}G_x).$$

Subtracting the period costs from the period revenues yields a breakdown of earnings by source that is identical (after some rearranging) with our previous development.

Special Cases

The breakdown of earnings by source reveals both the power and the generality of the release from risk policy reserve system.

If actual experience exactly equals the expected value assumptions, then no deviations whatsoever will occur, and $\hat{q} = q$, $\hat{wq} = wq$, $\hat{E}^A = E^A$, $\hat{E}^{\%} = E^{\%}$, and $\hat{i} = i$.

Making these substitutions in the general expression for the breakdown of earnings by source for policy year n produces the following:

Earnings

$= (Gx - P'_{[x]})(1 + i)$ .... (gain from loading)

$+ \Delta i[{}_{n-1}V'_{[x]} + P'_{[x]} - (E_n^A + E_n^{\%}G_x)]$ .... (gain from investment risk release)

$+ \Delta q_{[x]+n-1}(1{,}000 - {}_nV'_{[x]})$ .... (gain from mortality risk release)

$+ \Delta wq_{[x]+n-1}({}_nCV_{[x]} - {}_nV'_{[x]})$.............. (gain from withdrawal risk release)

$+ (\Delta E_n^A + \Delta E_n^{\%} G_x)(1 + i)$............. (gain from expense risk release),

which illustrates the periodic release into earnings of each of the provisions for the risks of adverse deviation contained in the underlying reserving system.

Case 1.—If all Δ's are set equal to zero (i.e., expected values without provision for the risks of adverse deviations are used in the determination of underlying reserves), then earnings consist solely of "gains from loading" and emerge as a constant percentage of premium income during the premium-paying period.

The reserves that develop from setting all Δ's equal to zero are the "natural reserves" proposed by the December, 1970, exposure draft of "Audits of Life Insurance Companies" prepared by the Committee on Insurance Accounting and Auditing of the American Institute of Certified Public Accountants.

Case 2.—If Δi *is* used and all other Δ's are set equal to zero, then earnings consist of both "gain from loading" and "gain from investment risk release." The gain from loading element of earnings would emerge as in case 1, and the investment gain would emerge each year over the entire benefit period as a function of the initial policy reserve.

Case 3.—If all the Δ's are chosen so that the valuation premium equals the gross premium (i.e., $P'_{[x]} = G_x$), we have what is frequently referred to as the "per cent completion of contract" reserve method. Emerging earnings under this method consist of the four sources of risk release—investment, mortality, withdrawals, and expense—with the loading element dropping out.

It should be emphasized, however, that in each of the three special cases identified above, any deviation between actual experience and the expected value assumptions would directly affect the earnings of the accounting period in which the deviations occur.

Conclusion

The release from risk policy reserve system has been shown to be a generalized reserve system. Several reserve methods can be considered as special cases of the general system. There exists an entire family, or range, of reserve methods within the release from risk policy reserve system, and each method will generate an incidence of earnings that might be appropriate in certain circumstances.

If the management of a particular company considered its corporation to be primarily a marketing organization, it might feel that earnings (other than those which result from deviations between actual experience and realistic assumptions) should emerge as sales are completed. The sale of a life insurance policy could reasonably be thought of as an instalment sale, with the instalment period being the premium-paying period. This management attitude would thus suggest that case 1 of the release from risk policy reserve system would be theoretically appropriate.

On the other hand, if management regarded its corporation as a mechanism for the sharing and carrying of risk, it might reasonably feel that earnings should emerge only as risk is released. Case 3 of the release from risk policy reserve system would be theoretically appropriate in this circumstance.

Discussion of Preceding Paper

Clayton A. Cardinal

The release from risk reserve is defined in Mr. Horn's paper as a reserve intrinsically comprised of two elements, one of which may have a value of zero. One element pertains to and is derived from a consideration of expected values and the mechanism employed to fund those values. The other element is evolved from a consideration of expected deviations from the expected values. It is this latter element which the paper purports may have a value of zero. However, the philosophy presented in support of this position may be valid only from a management viewpoint and may not be a viable philosophy to the accountants. It is noted, however, that the accountants heretofore have not recognized this second element in their deliberations. Their knowledge in the area of insurance reserves must be considered evolutionary, so that it is possible that they may at a later time take a position in conflict with that presented by the paper. The discussion presented here is concerned primarily with the element of the reserve relating to deviations from the expected value. In particular, it is concerned with the propriety and effect of intrinsically combining the two elements of the reserve into a single entity.

The element of the reserve relating to expected values, herein called the "expected value reserve," represents advanced funding of deferred, excess expected costs, and the other element, herein called a "contingency reserve," is necessary to protect shareholders, in the case of a stock company, from financial loss which could otherwise result. Mr. Horn infers the necessity for including a risk charge in the determination of the premium and for establishing a contingency reserve to cover the occurrence of such risks, but he omits any discussion of the patterns of risk revenue (the risk charge) and of risk expense (adverse deviations from expected values). How will accountants view the concept of contingency reserve and the related items, now that it has been forcefully presented to them in various forms by both the insurance industry and the actuarial profession?

If the purpose of generally accepted accounting principles, as properly interpreted and applied to insurance company financial statements by accountants, is in part to achieve a proper matching of expenses and revenue, does the release from risk reserve method satisfactorily result in such matching? To gain some insight into the answer to this question, attention is focused on the contingency reserve. The expected value reserve has, to the accountants' satisfaction, been demonstrated elsewhere to produce an acceptable matching of that portion of revenue necessary to fund that reserve, and the related expense. The release of the expected value reserve is shown in the paper to be governed by the termination of the underlying insurance contracts, and no question has been raised that this release mechanism is improper. But should the release of contingency reserves also be governed solely, if at all, by contract terminations?

The paper takes the position that the release of contingency reserves is acceptably governed by contract termination. The method by which this is accomplished is to inseparably determine both the contingency reserve and the expected value reserve by adjusting the expected values used in the reserve calculation. But is this proper?

If it can be demonstrated that deviations from expected values (the risk expense) can more or less be expected to follow the income pattern of that portion of revenue which can be ascribed to the risk charge, does it not follow that the matching of this expense and the related revenue is direct and proportional? If this is true, then natural reserves based on expected values alone, as described by the accountants in the draft of the audit guidelines for life insurance companies, appear to be the only proper reserve to be taken into a financial statement prepared on the basis of generally accepted accounting principles. Thus the reserve scheme developed in the paper may be considered synthetic. If, on the other hand, risk theory rejects the hypothesis that the pattern of expected deviations and the income pattern of the related revenue are proportional, then the method of properly matching the subject revenue and expense must be found elsewhere. But how can it be found without first examining the expected patterns of risk revenue and expense?

By tying the calculation of the contingency reserve and the expected value reserve together, the release from risk reserve method ignores the fact that a pattern of income is precipitated which may be altogether false, at least insofar as it relates to that pattern which might be produced by independently matching risk expense and risk revenue.

The risk revenue would appear to have the same revenue pattern as does the total premium. Before current risk revenue can be taken into revenue, or be deferred, something must be known of the pattern of expenses to which it relates, after which a consideration of matching of revenue and expenses can be undertaken.

The approach developed by the paper locks in the contingency reserve with the expected value reserve, which subsequently is released only when the contracts which gave rise to such reserves terminate. Does not this approach deviate in part from the purpose for establishing a contingency reserve in the first place? If the risk revenue and the contingency reserve flowing therefrom are designed to cover deviations from expected values, might not the expense and revenue matching concept dictate that the intrinsic generation of the contingency reserve and the expected value reserve together produces an improper matching of risk revenue and risk expense? It seems plausible, at least until it has been demonstrated otherwise. The accumulation of a contingency reserve in conjunction with absorption of a material deviation from expected values, as could occur under the release from risk reserve method, would appear to unduly penalize current income.

After restating assets on the basis of generally accepted accounting principles, the apportionment of the restated assets between reserves and surplus is required. On the income side, if the release of contingency reserves is tied to the release of expected value reserves, deviations from expected values must in part be absorbed, as stated, by the restated surplus. If the deviations are severe enough, companies which capitalize and amortize acquisition costs, or establish a combined expense and benefit reserve, may have, respectively, either a recoverability or a deficiency reserve problem necessitating a gross premium valuation. To some degree this problem is a question of timing of the release of contingency reserves, but, if a company were forced to accelerate its amortization of capitalized acquisition costs or to establish deficiency reserves because the contingency reserves accumulated to cover such deviations were locked in, this would be an unfortunate development. Ultimately, all reserves are released, and in a gross premium valuation the release of contingency reserves would be recognized simply by their exclusion from the valuation. Some might feel it proper even in a gross premium valuation that provision for contingency reserves be made. The purpose in making the valuation would, however, be an overriding consideration in this matter.

Should a consideration of one or several generations of insurance contracts determine the matching of the risk revenue and the expense resulting therefrom? Or should all generations be considered? Again, a demonstration of the purpose and function of contingency reserves seems prerequisite to answering these questions.

This discussion is based in part on conjecture, and more questions are asked than answers given, but this discussant, at least, feels that this is necessary, if for no other reason than to afford Mr. Horn the opportunity to affirm the propriety of the release from risk reserve method developed in the paper. Nevertheless, insight into the proper matching of risk revenue and risk expense may be gained only from the application of risk theory to the problem; it is to be hoped that a paper will be published giving the results of such application, as Mr. Horn suggests. Such a paper would be enlightening, especially if the release of contingency reserves were in fact demonstrated therein to be governed by a consideration of real and material deviation of actual values from expected values.

Joseph C. Noback

The author is to be congratulated on the presentation of this very timely paper. His development of the "release from risk policy reserve system" is very ingenious, thoroughly generalized, and theoretically complete. However, the author fails to evaluate the alternatives which he describes in the light of generally accepted accounting principles. Instead of suggesting any criteria for making such an evaluation, he implies that every alternative is equally valid as a basis for accounting for profit. In this discussion I shall analyze two of the author's alternatives and demonstrate, using specific criteria, that one, the exposure draft method, does not meet generally accepted accounting principles, while the other may.

The author states that his generalized release from risk policy reserve system was developed on the basis of an "analysis of the policy-year earnings of level premium, level death benefit, limited payment, annual mode, nonparticipating, individual life insurance." Hence, to make this discussion specific, let us focus attention upon a homogeneous block of these policies and trace them from issue to the termination of the last surviving policy.

Let us focus upon a block of 100,000 straight life policies issued simultaneously at the same premium rate to 100,000 medically examined lives. Assume that these policies experience realistic rates of mortality, withdrawal, interest, and expense. Based on the rates we assumed, 86,000 policies will terminate by withdrawal and 14,000 policies will terminate by the death of the insured.

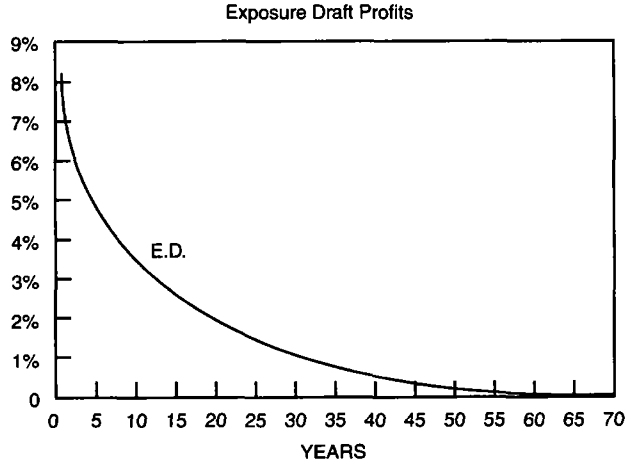
If, at the end of each policy year, reserves are computed on the assumption that the author's Δ's are set equal to zero, and actual experience is the same as expected experience, then the profits reported in each policy year will be in accordance with the December, 1970, exposure draft of the "Audits of Life Insurance Companies." These reserves are the exposure draft natural reserves, and the resulting annual profits are exposure draft profits.

The exposure draft profits for our homogeneous block of business are plotted in Chart I, with the assumption that earnings are distributed as reported. Actually the amount plotted is the ratio of each year's profit to the total profits for all policy years. This curve of profits is concave upward. It is like a ski slide. The annual earnings percentage is 8.16 per cent the first year, 4.69 per cent the fifth year, 2.0 per cent the twentieth year, and 0.5 per cent the fortieth year. The maximum value occurs in the first year.

In presenting his generalized policy reserve formula, the author subdivides the earnings of the company among loading, interest, mortality, withdrawal, and expense. After careful study, I have concluded that there are only two significant earnings criteria: interest and mortality. The remaining elements are of academic interest only. They are not the basis for determining an index of service rendered, a basis for accounting for profit.

CHART 1

Exposure Draft Profits



NOTE.—Curves in Charts I-VI are for straight life plans, and earnings are assumed to be distributed as reported.

Under straight life policies, the policyholder receives two services from the insurer:

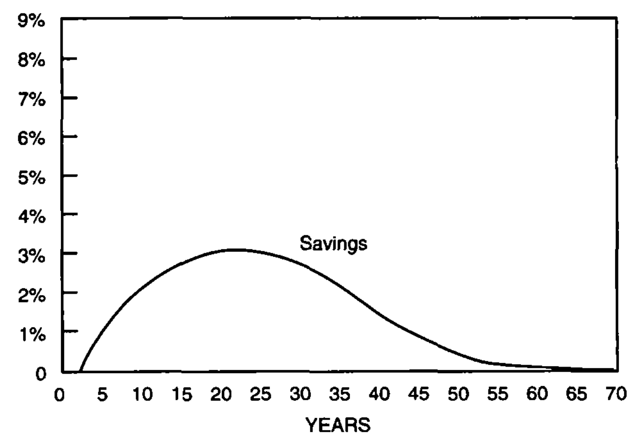
1. The assurance that the beneficiary will receive the face amount of protection in the event that the insured dies while the policy is in force on a premium-paying basis.
2. The assurance that the policyholder can secure his guaranteed cash surrender value in the event that he surrenders the policy while the insured is alive.

From the viewpoint of the insurer, these two assurances measure the risks assumed—the investment risk and the mortality risk.

The investment risk includes both the risk of asset loss and the risk of the failure to earn the required rate of investment return. Under present techniques, the best measure of the investment risk is the size of the assets held for the block of business under study. The asset index curve is concave downward and bell-shaped. In the case of our block of business it attains a maximum of 3.14 per cent in the twenty-first policy year (see Chart II). Note that it is not concave upward, as is the exposure draft earnings curve.

CHART II

Investment Index



The mortality risk assumed by the insurer may be measured by the expected cost of mortality for the homogeneous block of business—that is, by the product of the year's select and ultimate mortality rate and the net amount at risk. This index produces a curve which is concave downward, again a bell-shaped curve. In the case of our block of business it attains a maximum of 2.74 per cent in the twenty-seventh policy year (see Chart III). Note that it is not concave upward.

The author contends that, in view of the fact that the gross premium rate anticipates the expected deaths, the insurer's mortality risk does not lie in the expected deaths. It lies in the "deviations from the expected values." Let us accept the author's premise. Let us determine our mortality risk index, using collective risk theory, and measure it by the expected value of the excess deaths over the expected deaths—that is, by the annual mortality stop-loss premium which would cover those excess deaths. This excess-deaths index produces a curve which is also bell-shaped and concave downward. In the case of our block of business it attains a maximum value of 2.48 per cent in the twenty-fifth policy year (see Chart III). Note that it is not concave upward.

CHART III

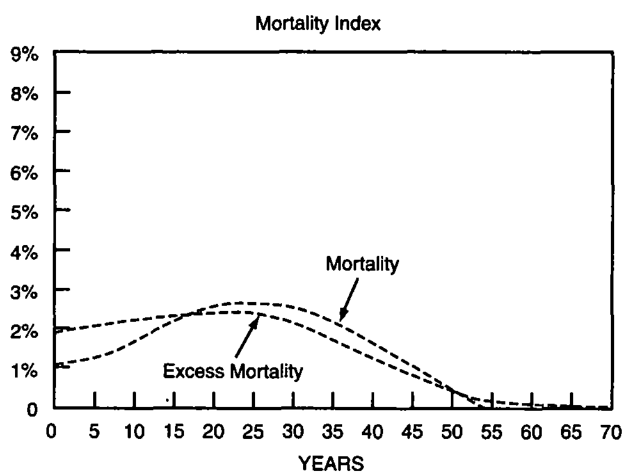
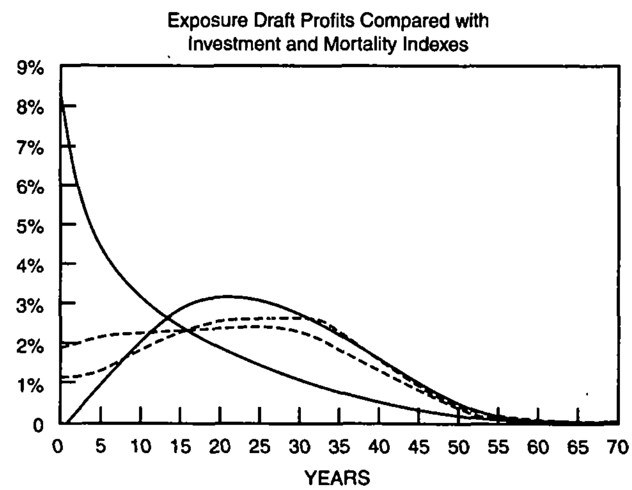


Chart IV compares the exposure draft profits for our block of straight life policies with the investment and mortality indexes described above. This chart demonstrates that the exposure draft profits do not correlate with any of these indexes. Furthermore, it would appear that they would not correlate with any reasonable composite of any investment and mortality indexes.

With the exception of the excess-deaths index, all the material presented in this discussion was extracted from the preliminary draft of the Haskins and Sells Accounting Research Project. Haskins and Sells concluded that the exposure draft method, when applied to permanent plans of life insurance, was not compatible with generally accepted accounting principles as such principles have been applied in other industries. This conclusion was based upon a study of five separate homogeneous blocks of business: (1) single premium life, (2) twenty-payment life, (3) straight life, (4) single premium retirement annuity, and (5) annual premium retirement annuity. The flow of profits was studied on three bases: (1) earnings distributed as reported, (2) earnings retained, and (3) earnings distributed in accordance with a statutory reserve basis—equal assets.

CHART IV



Several reserve systems were studied in the Haskins and Sells project. An effort was made to find a system which would satisfy generally accepted accounting principles. It was concluded that the implicit interest cost (IIC) method achieved the most satisfactory results. Chart V compares the IIC profits for our block of straight life policies with our investment and mortality indexes. This earnings curve is concave downward. It attains a maximum value of 3.12 per cent in the twenty-second policy year. Under the IIC method reserves are determined using "most likely" assumptions as to mortality, withdrawal, expense, and a break even interest rate. The author will recognize that this is his case 2 with

$$G_x = P'_{[x]} .$$

The excess-deaths index was not a part of the Haskins and Sells project. It was developed by application of collective risk theory specifically for this discussion by Mr. William A. Bailey, F.S.A.

In this discussion I have tried to supplement the author's fine theoretical development with some pragmatic observations. My remarks should not detract from the fact that the author has made a very valuable and lasting contribution to actuarial literature.

CHART V

Implicit Interest Cost Profits Compared with Investment and Mortality Indexes

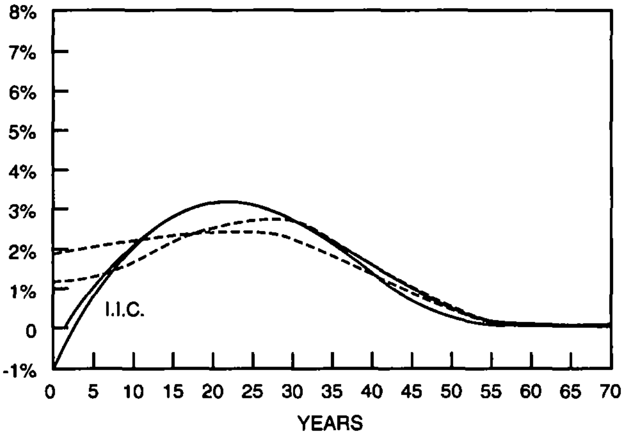
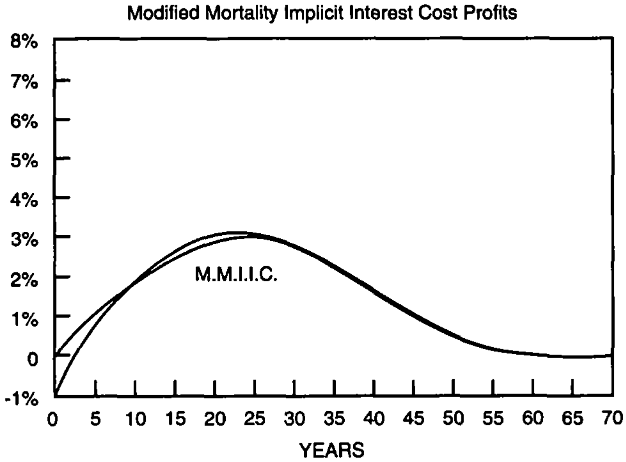


CHART VI

Modified Mortality Implicit Interest Cost Profits



Harwood Rosser

It is my impression that Mr. Horn has shown us only the visible portion of an iceberg. The shape of its greater underwater bulk can only be guessed at, from what he tells us. Perhaps also, as with the iceberg, there are connotations of danger for the unwary.

Again, the paper is strongly reminiscent of Lidstone's famous—or notorious—theorem. (For actuaries who found life contingencies something of a struggle, this will do little to lighten the ominous implications of the earlier metaphor.) This considers the effect on reserves of variations in interest and mortality. The author has added the parameters of withdrawal and expenses, with a bow in the direction of risk theory.

He mentions the similarity to "deciding upon a set of assumptions to use in establishing gross premiums." In the latter case another parameter, average policy amount, would usually be considered. For instance, in another paper presented at the same meeting—"Expected Profit Formulas," by James L. Lewis, Jr.—average size and the withdrawal rate are considered to be the parameters producing the widest swings in anticipated profits and hence having the most influence in setting a scale, or scales, of gross premiums.

Here, however, where we are dealing with reserves and earnings *after* issue has taken place, only rarely does policy size change once the policy is placed. Even less frequently, if ever, is such a change recognized in actuarial calculations of this sort.

Particularly in the section entitled "Recognition of Risk," Mr. Horn raised my hopes only to dash them. As the author of an early (1951) paper on the present value approach to gross premiums, which inspired, or at least preceded, several others, including two Triennial Prize winners, I have a deep interest in any new aspect of this fundamental subject. (Incidentally, the author's second formula for $P'_{[x]}$, the valuation premium, follows the principles laid down in that 1951 paper, especially in his case 3, when it equals the gross premium.)

When the author spoke of "determining the margins for variance which the gross premium rate structure implicitly permits," my interest quickened and my spirits rose. This was accelerated further by his reference to "allocating the profit margin ... to the various risk elements." I began to have visions of some of the work of Wilmer Jenkins, on premium separation into cost components, restated in a modern framework of risk theory, or a similar updating of the 1956 paper by Bicknell and Nesbitt, "Premiums and Reserves in Multiple Decrement Theory." These authors express, for example, the dollar cost, as a part of the premium, of an assumed withdrawal scale, but without any confidence limits or any provision for the risk of adverse deviation. This corresponds roughly to Mr. Horn's case 1.

Especially in my present connection, where I have considerable exposure to casualty rate filings, I have been seeking to reconcile, in my own mind, the concept of credibility with the determination of life premiums. It is clear that most mortality tables suitable for adoption as reserve standards will be fully credible. However, gross life premiums are much more frequently based on more up-to-date mortality tables, often representing the company's own experience and normally unpublished. Certainly these are not always fully credible.

Then there is withdrawal experience. Even in a large company, it is usually necessary to recognize variations by plan or plan group that are not significant for mortality. A "select and ultimate" approach is more imperative for lapses than for mortality. Also, lapse rates are a function of the economic situation, which hardly affects mortality rates. All of these operate to reduce the exposure within a given cell. In short, withdrawal experience and assumptions are even less likely to be fully credible than is mortality.

It was along these lines that I was led to hope for guidance from Mr. Horn, especially after his earlier remarks. Alas! It was but a dream. Possibly he was handicapped by pressure of time. This often happens to actuaries. He can still redeem himself in my eyes if, in replying to the discussion, he furnishes a few numerical illustrations, particularly for case 3. For actuaries, such an illustration is the counterpart of the "picture" in the old (pre-Mao) Chinese proverb.

Perhaps I speak only for a small minority, and my disappointment results mainly from my own lack of sophistication in the theory of risk. Readily I confess to amateur status in this area. If actuaries of my generation were subjected to a more searching examination on certain topics than those of today, or at least to more required reading (for the final Associateship examination in my day there were about twenty different readings in graduation alone, and "Sources and Characteristics" was even more of a nightmare!), the new study students have more subjects to cover. Perhaps I should read some of the new material in the syllabus myself, before I complain.

Turning to more specific comment, I would like to mention a minor criticism that probably has its roots in semantics—that is, the author may not have meant what he appears to say. With that prologue, I proceed.

Mr. Horn seems to say that, in the paper, Δi, along with the other Δ's, is taken as positive by convention. If any one of the other Δ's is positive and not zero, the valuation premium will increase as a result. But my logic says, under this convention, that the more unstable the yield rate is deemed to be, the greater i' $(= i + \Delta i)$ will be but the smaller the corresponding required valuation premium, $P'_{[x]}$, will be. Similar discrepancies appear in the earnings formula.

This can be remedied in at least two ways. One is to permit Δi to be negative. The other, with the same effect, is to define i' as $i - \Delta i$. Perhaps the author, in his reply, will clarify his intention.

In summary, the author is to be complimented on an excellent and timely paper that harrows, to a few inches, a subject that goes deep. After all, a timely short paper is much to be preferred to an encyclopedic one that appears after the issue is dead and buried. It is still devoutly hoped that he, or someone else inspired by this effort, will pursue the matter much further. The result might profoundly affect the outcome of the present controversy involving, among others, the American Institute of Certified Public Accountants, the National Association of Insurance Commissioners, the investing public, and the actuarial profession.

George A. Reynolds

Our appreciation is due Richard G. Horn for the timely paper in which he achieves his objective of establishing a generalized policy reserve system which can be used to develop the incidence of earnings. It is helpful in our considerations of the pros and cons of the GAAP-adjusted earnings proposed by the American Institute of Certified Public Accountants, particularly the point that "the policy reserve system can be considered a timing mechanism which determines the incidence of earnings."

The special cases outlined by the author illustrate the generalized nature of the release from risk policy reserve system. Case 1 reserves are the "natural reserves" of GAAP-adjusted earnings and illustrate the shortcoming of the AICPA proposal in that no provision is made for the risks of adverse deviations. Using "natural reserves" to measure earnings is obviously the method favored by companies which have a relatively high proportion of new business and by investment analysts, brokers, and the like.

For those in the life insurance business who regard life insurance as something more than a commercial adventure, the author's case 3 appears more appropriate as a reserve basis for the calculation of adjusted earnings. In addition to taking into account the basic assumptions inherent in the premium structure, the use of case 3 reserves would recognize earnings only as risk is released.

In actual business situations a good point can be made that the risk cost should be borne by the capital or surplus of a company. If we carried this thought to its conclusion, companies would use reserve systems ranged somewhere between case 1 and case 3, with the position determined as some function of the relation of capital and surplus to assets. Such an approach would militate against uniformity of treatment of companies with respect to determining adjusted earnings and thus return us to advocating the use of case 3 reserves.

Daniel F. Case

Congratulations to Mr. Horn on his fine paper! As Mr. Reynolds mentioned, the paper lists three special cases of the generalized release from risk reserve system. Case 1 is the case in which all the Δ's are set equal to zero, and the author states that in this case the reserves that develop are the "natural reserves" proposed by the December, 1970, exposure draft of the audit guide for life companies. I certainly agree that, when you read the exposure draft, the picture that comes through is that of a case 1 situation.

The joint ALC-LIAA Committee on Financial Reporting Principles feels that natural reserves, if used to determine earnings in accordance with generally accepted accounting principles, should involve a degree of conservatism. There is reason to believe that the AICPA Committee on Insurance Accounting and Auditing feels the same. It is hard to guess just how the AICPA committee felt at the time the exposure draft was written. I think we should bear in mind that the main thrust of the audit guide thus far has been to move away from the statutory accounting basis, which in the accountants' minds is overly conservative. Perhaps in drafting the audit guide the accountants forgot to point out that, of course, financial statements for life companies should involve at least the degree of conservatism which any good accountant would exercise in auditing a statement in any industry. At any rate, the trade association committee has expressed to the AICPA committee its concern over the importance of estimates and assumptions in life insurance accounting and the need for an appropriate degree of conservatism.

I would like to read a few sentences which Jarvis Farley, who is the chairman of the trade association committee, wrote on this point:

> The AICPA Committee and joint ALC-LIAA Committee on Financial Reporting Principles both regard the "natural reserves" proposed by the December exposure draft as recognizing a degree of conservatism by comparison with most likely assumptions. The audit guide natural reserve concept encompasses a significant range of the generalized reserve system which [Mr. Horn's] paper describes. Case 1, with zero deltas, represents the minimum end of the range—it may even be below the minimum end of the range. It is likely that in the majority of cases the audit guide natural reserves used for non-participating insurance would represent a Case 4 in which the deltas are chosen such that the valuation premium is less than the gross premium but the deltas are greater than zero.

Author's Review of Discussion

Richard G. Horn

Mr. Cardinal has expressed some concern over the "propriety" of the release from risk reserve method. His concern seems to result from three things:

1. He views the net effect of the various deltas as producing a contingency reserve equal to the excess of a non-case 1 reserve over a case 1 reserve.
2. He considers this "contingency reserve" as being released only as the under lying insurance contracts are terminated.
3. He identifies the excess of a non-case 1 valuation premium over a case 1 valuation premium as a "risk charge" and then notes that "[t]he risk revenue would appear to have the same revenue pattern as does the total premium."

The generation of a "contingency reserve" could be thought of as happening under a wide pattern of Δ's. It seems, however, that this is conceptually weak, since we are concerned with a reserve function that is to be used for an income statement rather than for a balance sheet. Also, the effect of certain Δ's, such as large early withdrawal rate Δ's or mortality rate Δ's that do not increase in absolute amount by duration, is to produce non-case 1 reserves that are less than case 1 reserves. This latter situation would produce negative "contingency reserves," which again would not seem to be too palatable conceptually.

Mr. Cardinal's second concern would appear to result from some misunderstanding of certain parts of the paper. The difference between non-case 1 reserves and case 1 reserves is not released only as contracts are terminated. If actual experience follows the expected value assumptions, part of this reserve "difference" is released each year according to the formula in the section "Special Cases."

Regarding the revenue pattern of the "risk charge," the approach used in the section "Matching of Revenues and Costs" is enlightening to follow through algebraically both with and without Δ's. The matching principle can be seen to operate for the difference between non-case 1 and case 1 reserves and premiums exactly as it does for the non-case 1 and case 1 reserves and premiums themselves.

Mr. Noback has done an excellent job of demonstrating the curve of the mortality risk and the investment risk. His choice of reserve methods would involve only a mortality rate Δ and an interest rate Δ, since he views the remaining risks as insignificant.

The similarity between the curves of the mortality risk and the investment risk suggests that a Δ for the investment risk could by itself generate an earnings pattern that approximates rather well the release of both the mortality risk and the investment risk. If all Δ's are set equal to zero and an interest rate determined that will produce $P' = G$, the reserves that result will be the implicit interest cost method reserves that Mr. Noback describes. This method has also been termed the "financial intermediary method" and has received some consideration by the Joint Actuarial Committee on Financial Reporting.

Mr. Noback has suggested that the mortality risk release and the investment risk release ought to determine the incidence of earnings because these constitute the services the company provides to its policyholders. The release from risk system described in the paper has attempted to take a broader view of the risks associated with an insurance contract by looking at the situation from the standpoint of the company rather than from that of the insured. In addition to the risks of adverse deviations in mortality rates and investment income rates, a life insurance company takes on two additional risks of great significance when it enters into an insurance contract. It accepts the risk that the contract will not persist long enough for it to recover its initial investment, and it accepts the risk that future administrative costs may be greater than anticipated.

The usual shape of the persistency risk curve would probably be concave upward (similar to Mr. Noback's Chart 1). The expense risk curve would start at zero, increase slightly, and then tend to remain somewhat flat, provided, of course, that some arithmatic or geometric progression of renewal Δ's was assumed.

Mr. Rosser's discussion centers on his disappointment over the paper's rather brief treatment of the theoretical considerations involved in quantifying the risks of adverse deviations. There are two reasons why the paper did not delve into this area further. First, I could not have begun to do the subject justice in any reasonable period of time, and, second, a good treatment of the subject would probably obscure rather than aid the principal purpose of the paper.

An adequate exploration of the theoretical considerations involved in quantifying the risks of adverse deviations would plow a great deal of new ground. For example, our traditional techniques for calculating nonparticipating gross premiums involve "realistic" rates of mortality, withdrawal, interest, and expense. Each of these "realistic" rates could be thought of as being the mean value of some undefined probability density function. If we employed an assumed probability density function in place of each "realistic" rate, we could then generate (given adequate computer strength) a gross premium probability density function. The provision for the risks of adverse deviations contained in a given gross premium could be determined by identifying the patterns of mortality, interest, withdrawal, and expense rates that generated such gross premium. These "provisions" would be the quantification of case 3 Δ's. Confidence levels could also be determined for a given gross premium from the gross premium probability density function. Perhaps an extension of this approach could be used to determine confidence levels for policy reserves.

Regarding the numerical illustrations that Mr. Rosser requests, I suggest that he refer to Appendix B of the Response of the Joint Actuarial Committee on Financial Reporting to the December, 1970, exposure draft of "Audits of Life Insurance Companies." Appendix B contains examples of release from risk reserves and earnings for the nonparticipating model office used by the Joint Actuarial Committee in their evaluation of the various reserve methods.

The release from risk reserves in Appendix B of the Response were produced by a FORTRAN program written by Mr. Charles T. Gibson, A.S.A., of the Security Life and Accident Company. Mr. Gibson's program calculated valuation premiums and reserves for the model office, using high, medium, and low assumptions for each of the mortality, interest, persistency, and expense rates. The program cycled through about fifty different combinations of the various levels of assumptions for each plan/age cell. The Appendix B release from risk reserves were then selected as the reserve set resulting from the least favorable pattern of assumptions for which the valuation premiums did not exceed the gross premiums.

Mr. Rosser has noted that Δi was taken as positive by convention in the galley proof of the paper. Mr. Joseph R. Brzezinski, A.S.A., of the LIAMA staff, pointed out to me in private correspondence that this convention should produce a negative gain from investment risk release. This consequence seemed more undesirable than a slight reduction in generality of notation; thus the final version of the paper defines i' as $i-\Delta i$.

Mr. Reynolds' discussion directs our attention to the relative merits of the various forms of release from risk reserves.

I have always regarded the flat element of the breakdown of earnings by source (i.e., the gain from loading) as representing that portion of emerging profit which can be thought of as resulting from marketing activity. In this sense the $(G - P')(1 + i)$ term could be considered, at least theoretically, by some management groups to be an objective rather than merely being whatever is left over, if anything, after making provision for the risks of adverse deviations. The maximum extension of this view results, of course, in case 1.

Mr. Reynolds' statement that "[f]or those in the life insurance business who regard life insurance as something more than a commercial adventure, the author's case 3 appears more appropriate as a reserve basis for the calculation of adjusted earnings" is an excellent summation of the argument in favor of allocating the profit margin contained in the gross premium among the mortality, investment, withdrawal, and expense gains.

Mr. Case points out that the AICPA committee and the joint ALC-LIAA Committee on Financial Reporting Principles now regard "natural reserves" as proposed by the audit guide to be based on assumptions which *include an intentional degree of conservatism*. In my opinion this constitutes a change from an earlier position. It seems to me that the audit guide proposed the use of "realistic" rates, such as the rates an actuary would use in calculating nonparticipating gross premiums when an identifiable margin for profit is included in the calculation. This class of rates would not, in my opinion, contain an intentional degree of conservatism.

If the AICPA Committee on Insurance Accounting and Auditing concludes that an intentional degree of conservatism in the assumed rates of mortality, withdrawal, interest, and expense is required, then they will in fact be requiring the use of Δ's. Since Δ's do not always increase reserves, their impact on earnings may not always be to defer profit emergence. The use of a high-withdrawal-rate Δ could, for example, result in "front-ending" profits more than would case 1 reserves. A mortality rate Δ that reduced the slope of the mortality curve would likewise tend to anticipate, rather than defer, earnings. It is recommended that the AICPA proceed carefully, and it is hoped that the release from risk concept will be of some value in this process.

This paper grew out of the early deliberations of the joint Actuarial Committee on Financial Reporting, and I would like to acknowledge the outstanding support of all the committee members. The committee chairman, Mr. Robert C. Winters, F.S.A., was the prime moving force behind the project. Had it not been for the encouragement the author received during the Des Moines spring meeting from Robert C. Winters, F.S.A., W. James D. Lewis, F.S.A., and Charles B. H. Watson, F.S.A., this paper would not have been written.

I would also like to extend my thanks to each of the discussants. Messrs. Cardinal, Noback, Rosser, Reynolds, and Case have made significant additions to the value of the paper, and their efforts are sincerely appreciated. If the paper has any lasting value, it will be due in large part to the scope of the discussions.