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THE BENEFIT RATIO RESERVE METHOD

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ABSTRACT

Among several new provisions incorporated into proposed new "Minimum Reserve Standards for Individual and Group Health Insurance," now pending with the National Association of Insurance Commissioners for possible adoption, is a new type of contract (or so-called "active life") reserve called the "benefit ratio reserve," which has proved to be highly controversial.

This paper discusses the purpose and nature of this reserve in relation to the class of health insurance contracts to which it is intended to apply. It first explores the theory, mathematical foundation, and operation of the reserve. This is followed by discussion of several practical and theoretical issues and questions that have been raised concerning the reserve and the way in which it functions. Further thought and written discussion on this subject from others in the profession are earnestly sought.

The author accepts full responsibility for the content of the paper but wishes to express his deep appreciation to the members of the American Academy of Actuaries Committee on Health: Subcommittee on Liaison with the NAIC Accident and Health (B) Committee. These patient individuals put in many hours reviewing and discussing the concepts and further hours analyzing and discussing the many comments received on three successive exposure drafts of the proposed revisions to the NAIC health insurance reserve standards. Their contributions were essential and invaluable.

I. INTRODUCTION

Among the major new provisions included in the revised "Minimum Reserve Standards for Individual and Group Health Insurance Contracts" proposed for adoption by the National Association of Insurance Commissioners (NAIC) is a new type of contract reserve called the *benefit ratio reserve*. This reserve is proposed as a minimum valuation standard for a broad class of contracts that have, in general, the following two characteristics:

1. The premiums applying to such contracts are not guaranteed premiums but are *leveling* premiums. In the proposed standards, a *leveling premium* is defined as "a premium calculated to make advance provision for some portion of those annual claim costs that are expected to be incurred beyond the contract year to which the premium

applies. *Leveling* premiums need not be calculated to remain level. *Level* premiums, however, are included within the term *leveling* premiums, unless their calculation involves no advance provision for claim costs beyond the year to which each premium applies."

2. The benefits provided by such contracts are not limited to scheduled benefits or benefits payable at stated time-period rates (for instance, daily hospital indemnity, monthly disability indemnity) for which tabular minimum morbidity standards are specified or are otherwise acceptable to the regulating authorities concerned.

Contracts of this general class are prone to rapidly changing trends: in particular, interest rates, medical cost inflation, and changes in medical practice and technology, which tend to have a major impact on the utilization of medical and hospital services. Consequently, such contracts are subject to a high probability of premium adjustment, which may be both frequent and substantial in amount. This in turn may lead to accelerating rates of lapsation with increasing antiselection.

When applied to such contracts, traditional contract valuation methods—almost entirely tabular in nature—tend to fail entirely or, at best, prove cumbersome as a means of valuing prospective liability. When such methods are based on assumptions locked in from inception, as is common under statutory and GAAP valuation, the wandering parameters and resulting premium changes rapidly render the ongoing valuation obsolete and unrealistic, with little correspondence to the actual prospective liability. The use of locked-in assumptions in such situations is comparable to a navigational decision to lock in the wheel of a ship leaving Hong Kong harbor and headed for San Francisco, maintaining fixed rudder bearing regardless of wind and current. The ship may reach Santiago, or it may run aground on the Great Barrier Reef, but it is unlikely to arrive at the Golden Gate.

On the other hand, if corrections in course are applied without restraint, any actuarially valid tabular valuation method will become increasingly complex and cumbersome if it is to remain close to reality.

The benefit ratio reserve method has been devised to address in a realistic manner the peculiar problems of the applicable general class of contracts. This method incorporates the ability to change course readily and rapidly, while also retaining relative simplicity in the mechanics of the ongoing methodology, because it deals with the block of contracts wholly in aggregate terms.

II. GENERAL DESCRIPTION OF THE METHOD

The basic actuarial hypothesis underlying the benefit ratio reserve method is that aggregate benefit net premiums (or valuation net premiums) for a reasonably homogeneous group of contracts may be approximated satisfactorily as a level percentage of the corresponding aggregate gross premiums. This percentage is equivalent to the ratio of the value of all expected benefits under the group to the corresponding value of all expected gross premiums.

The ratio itself is thus an estimate of the cumulative lifetime loss ratio, as measured at any valuation point during the lifetime of the group of contracts. This ratio, although "level" or tentatively constant, need not be fixed, but can be adjusted in the aggregate from time to time based on actual experience. At each valuation date, the cumulative lifetime ratio can be adjusted, based on the experience up to that point. This may be done, for example, by measuring actual-to-expected loss ratios and trends for the group and adjusting the original anticipated loss ratio accordingly. Once an adjusted cumulative ratio has been so determined, a reserve can then be determined retrospectively as the excess of the accumulated value of benefit premiums over the accumulated value of incurred claims. This excess will be equal, assuming the estimated cumulative loss ratio to be reliable, to the prospective present value of the excess of future claims over future benefit premiums.

The concept is similar, at the outset, to the net benefit reserve used with GAAP accounting, under which reserves are accumulated on the basis of a benefit net premium, with values determined using realistic assumptions as to morbidity, persistency and interest. It is an adaptation of the method described by Hogeman [1].

The process is illustrated, using policy year terminal reserves, in Exhibit 1 in the Appendix. Here the contract group is assumed to be 1,000 identical level premium contracts all issued on the same date, at age 45 and renewable to age 65. The exhibit projects terminal reserve values for the 1,000 contracts over a 20-year contract lifetime, based on expected morbidity and persistency and at 7.5 percent interest. The three right-hand columns of Exhibit 1 show the conventional net premium development under the heading "Natural Net Premium Reserve." The 1,000 contracts can be valued in aggregate because they are completely homogeneous and all fall into a single valuation cell.

The three columns under the heading "Benefit Ratio Reserve" show the corresponding development on this basis, with gross premiums anticipating a 56.48 percent loss ratio over the expected 20-year lifetime. The net premium of $265.27 is also 56.48 percent of the gross premium of $469.69. The yearly reserve increments and the aggregate accumulated terminal reserves are identical with those of the natural reserve development. The final accumulated residue in each case, a negative $24, is the result of rounding. This ending value should of course be zero.

The equality of the two reserves accumulations here are trivially obvious, the calculations themselves being exactly equivalent.

What, then, is different about the benefit ratio reserve method? The first difference is that it can be applied on an aggregate basis, subject to one key criterion, to broader groups of contracts than that illustrated in Exhibit 1. Thus, the "group" can be extended to all contracts of every issue age issued in the same year. It can be extended further to contracts issued over several years, including more than one plan of coverage and rating classification. The process illustrated in Exhibit 1 can be readily extended to these more complex "contract groups," because the added complexity may be dealt with implicitly, working with gross premiums in aggregate for the total contract group. The one key criterion is that the aggregated group of contracts reasonably can be assumed to be subject to one composite anticipated contract lifetime loss ratio. The same identical loss ratio need not be separately applicable to every subcell, as long as a composite value reasonably can be determined to be applicable in the aggregate. Thus, gross premiums for different issue ages often will be subject to varying anticipated loss ratios, but if an expected distribution of issued business can reasonably be compiled, a composite aggregate anticipated loss ratio also can be estimated, as is commonly done in individual policy rate filings.

This leads to the second difference. Given these added dimensions of *assumed distributions* of contracts issued, as well as the fact that the type of contract proposed to be subject to benefit ratio reserves is vulnerable to many factors that may result in differences between actual and expected experience, it becomes unrealistic to assume that appropriate reserves can be accumulated over any period of time locked in on the original assumptions. Were the entire accumulation to be locked in on originally specified or expected assumptions, the valuation could stray so far from reality as to become meaningless, as in the case with attempts to value liabilities on such contracts using tabular methods, including GAAP benefit reserve methods. Actuarial prudence demands that original assumptions be reviewed and tested periodically to determine whether they remain appropriate. This can be done best, and in the aggregate, by valuing the reserve accumulation on the basis of actual retrospective experience, while at the same time using this actual experience to correct the lifetime retrospective/prospective anticipated loss ratio continually. The periodically corrected values will thus tend to move away from the original anticipated loss ratio more and more in the direction of a "probable" loss ratio. Ultimately, when the lifetime history of the block of contracts has been completed, the "probable" loss ratio obviously will have evolved into the actual retrospective, fully developed, lifetime loss ratio of the particular contract group. As the lifetime of the contract group becomes more and more advanced, while periodic correction is systematically continued, the probable loss ratio necessarily will move closer and closer to its actual ending value when all experience has become retrospective.

Provided this monitoring and correcting process is carried out, and provided that appropriate contract groups are established with each group subject to one carefully determined composite loss ratio, the method can serve as an effective and understandable aggregate basis for generating contract reserves. Moreover, it can be seen that it is an extraordinarily powerful and economical method, one that cuts right through all the multiple arrays of subcells according to issue years, issue ages, rating classes and plans of coverage that must all be recognized in order to operate a conventional system of tabular reserve valuation.

While, at any one point in time, the anticipated loss ratio is viewed as a constant ratio, the implied net premiums themselves need not be at all constant or level. They will reflect the structure of the gross premiums: level, if the gross premiums are level; increasing, if the gross premiums are increasing. If the gross premiums anticipate inflationary trends for a number of years, or aging, or cumulative antiselection, so will the implied net premiums and in the same pattern. They duplicate, on a net basis, the rating structure on which the gross premiums are based, somewhat like a reduced holographic image reproduces on a diminished scale every dimension of the object it copies.

III. MATHEMATICAL FOUNDATION OF THE METHOD

A. The Principle of Equivalent Monetary Value over Time

It is an unquestioned and long-established actuarial principle that any known or assumed finite time stream of monetary payments, no matter how irregular, when either discounted or accumulated at a stated effective rate of interest, may be shown to be equivalent in value to some determinable single monetary amount valued as of any given point in time or, alternatively, equivalent in value to some other determinable finite periodic series of uniform (or changing) monetary amounts, payable at stated points in time.

This principle serves as the foundation for calculation of actuarial single premiums, level periodic premiums, yearly one-year term premiums and similar values, any of which can be determined so as to be equal in aggregate value to another changing stream of values, such as annual claim costs, varying over time.

An irregular or changing monetary stream may be valued in the aggregate as of a beginning point in time, for example, as a present value at inception of all future benefit payments expected to be made under a continuing insurance contract, or under a group or aggregate of such contracts. It may also be valued in the aggregate as of an ending point in time: for example, as the accumulated value, upon termination of the contract (or upon termination of the last of a group of contracts), of all actual benefit payments that have been incurred under the contract or group of contracts.

B. Replacement of Expected by Actual Values As Time Passes

It is further apparent that as time passes, expected payments may be replaced sequentially in the equation by actual payments made within the increasing period of elapsed time, and the combined aggregate values of past actual payments and expected future payments may repeatedly be redetermined or corrected. As time continues to pass, the past actual and future expected values so combined clearly will shift from the original present value of purely expected payments to an eventual accumulated value of purely actual payments.

We refer to a *present value* as an aggregate discounted value of expected future payments, to an *accumulated value* as an aggregate value of past payments (including either expected or actual payments) accumulated to some point in time, and to an *intermediate value* as a value determined at a point within the time stream that combines both present and accumulated values, measured at that point in time.

C. Mathematical Representation of the Amounts in the Time Stream

The payment streams being discussed can more readily be analyzed and equated through algebraic representation.

The irregular, changing time stream that we are concerned with is a stream of benefit payments. Let us represent any isolated benefit payment amount by the symbol B.

The stream of periodic payments payable at regular time intervals, with which we are concerned, is a stream of premium payments. Let G represent such an isolated gross premium and P the corresponding net benefit premium.

Let i represent the rate of interest used for discounting future amounts or accumulating past amounts. Expected (future) or actual (past) persistency will be assumed to be implicit to the aggregate amounts developed. We will use a set of definitional symbols to define B, G and P more specifically, as follows:

Agg indicates a discounted or accumulated aggregate value, combining isolated amounts.

T indicates some intermediate point in time, for instance, a valuation date.

TI indicates date of inception.

TT indicates time of termination.

$T\{$ indicates that future payments are discounted back to time point T.

$\}T$ indicates that past payments are accumulated forward to time point T.

Superscript E indicates expected amounts.

Superscript A indicates actual amounts.

Thus, $T\{Agg\ {}^{E}B^{i}$ indicates the discounted value, at time T, of the aggregate of expected future benefit payments, at rate of interest i. $Agg\ {}^{A}P^{i}\}T$ indicates the accumulated value, at time T, of the aggregate of past actual net benefit premiums, and so on.

We desire to equate the aggregate value of all net benefit premiums to the corresponding aggregate value of all benefit payments. At time of inception TI, we have

$$TI\{Agg\ {}^{E}B^{i} = TI\{Agg\ {}^{E}P^{i} \tag{1}$$

and, at time of termination TT,

$$Agg\ {}^{A}B^{i}\}TT = Agg\ {}^{A}P^{i}\}TT \tag{2}$$

with all originally expected values now replaced by actual values.

At any intermediate date of valuation T we have

$$Agg\ {}^{A}B^{i}\}T \text{ and } Agg\ {}^{A}P^{i}\}T \tag{3}$$

as accumulated past actual values and

$$T\{Agg\ {}^{E}B^{i} \text{ and } T\{Agg\ {}^{E}P^{i} \tag{4}$$

as discounted future expected values.

At this intermediate valuation date in the lifetime of the contract group, we desire to achieve, as a result of correcting from expected to actual, an intermediate, "corrected" equivalence between the aggregate values of all benefits and all net premiums. That is, we desire that

$$Agg\ {}^{A}B^{i}\}\ T + T\{Agg\ {}^{E}B^{i} = Agg\ {}^{A}P^{i}\}T + T\{Agg\ {}^{E}P^{i}, \tag{5}$$

$$T\{Agg\ {}^{E}B^{i} - T\{Agg\ {}^{E}P^{i} = Agg\ {}^{A}P^{i}\}T - Agg\ {}^{A}B^{i}\}T. \tag{6}$$

That is, if we can develop a reasonable basis of estimating, or inferring, the values of the quantities in Equation (5), then Equation (6) also will be reasonably valid; in other words, the retrospective valuation on the right-hand side will be reasonably equivalent to the prospective valuation represented by the left-hand side.

These equations involve benefit payments and rates of persistency that are subject to high likelihood of change from original expectations, due to changing trends and other pressures. Consequently, nonguaranteed premiums also will be subject to high likelihood of change, possibly at frequent intervals. Accordingly, we are aiming at a target that is both moving and changing. The only known quantity in Equation (6) is $Agg\ {}^{A}B^{i}\}T$. We need to find ways to reduce, at least, the scope of uncertainty in all three of the other quantities.

$Agg\ {}^{A}P^{i}\}T$ is not a known quantity, in the general case, even though we conceptually identify its amounts here as "actual," since the appropriate values of all net benefit premiums may depend on the entire benefit stream, not just that actual portion that is now past and known. This is one of several reasons why any ongoing contract valuation method, based on valuation premiums and other "expected" assumptions locked in at inception, or based throughout the contract lifetime on some defined, hence "objective" statutory table, offers no assurance of developing an appropriate valuation of future contract liability. From inception, any such method is subject to increasing danger of parting company with reality and of growing increasingly artificial and arbitrary with the passage of time. The resulting "valuations" are thus increasingly likely to generate only meaningless numbers.

D. Gross Premiums and Anticipated and Probable Loss Ratios as Elements in the Benefit Valuation Equation

In determining both original and revised gross premiums for contracts of the type we are addressing, insurers presumably will develop assumptions and projections with some care. In most cases, prospective anticipated loss ratios also will be determined, since a number of jurisdictions require that this be done as a measure of the reasonableness of gross premiums in relation to the benefits expected. In those jurisdictions that have adopted some version of the NAIC individual health rate filing guidelines, a prospective anticipated loss ratio is required to be included in original rate filings, and at the time of any rate revision both a revised prospective loss ratio and a retrospective-prospective "lifetime" loss ratio are required, under which the prospective element pertains to the future period over which the revised rates have been calculated to apply. Using this retrospective-prospective lifetime loss ratio, the insurer should be able to estimate a reasonable value for the probable loss ratio—that would now replace the previous anticipated loss ratio and become the R' value (or one of several such values) required for computation of benefit ratio reserves.

In any case, such ratios should be reasonably determinable for representative gross premium cells, since any insurer surely should have a clear idea of the components of its gross premiums with respect to provision for benefits, expenses and margin. Thus, insurers should be able to make reasonable estimates of expected loss ratios for relatively homogeneous groups of contracts. Accordingly, we shall proceed on the assumption that reasonable estimates of the required anticipated loss ratios can be determined and in fact are being determined presently.

Let us return to Equations (5) and (6) and make some substitutions. For each $Agg\ P$ value, substitute the equivalent estimated value $Agg\ R_T\ G$, where R_T indicates the anticipated or probable lifetime (that is, retrospective-prospective) loss ratio associated as of time T with $Agg\ G$. This substitution is made on an aggregate basis only and does not presume that every individual P item is necessarily equal to its own corresponding gross premium multiplied by R_T. We are concerned only with the premiums of the contract group in the aggregate. We must, however, require that the aggregated P amounts for the contract group be allocated in such a way that, under the aggregate basis of valuation we are using, each separate $Agg\ {}^AP$ value is set equivalent to the corresponding $Agg\ {}^AR_T\ G$ value and each separate $Agg\ {}^EP$ value is set equivalent to the corresponding $Agg\ {}^ER_T\ G$ value.

Equation (5) may now be restated as

$$Agg\ {}^AB^i\}T + T\{Agg\ {}^EB^i = Agg\ {}^AR_T\ G^i\}\mathrm{T} + T\{Agg\ {}^ER_T\ G^i, \qquad (7)$$

leading to a restated Equation (6):

$$T\{Agg\ {}^EB^i - T\{Agg\ {}^ER_T\ G^i = Agg\ {}^AR_T\ G^i\}T - Agg\ {}^AB^i\}T. \qquad (8)$$

In this restated equivalent of Equation (6), both terms of the right-hand side are now known quantities, subject, of course, to how well R_T has been estimated. The right side is the *retrospective* reserve and is equivalent in value to the *prospective* reserve on the left side, under the reserving method employed.

The ultimate reliability of this equivalence depends of course on the accuracy with which R_T has been determined. A terminal value R_{TT} does exist but will be known precisely only when time TT has been reached. Thus, we can restate Equation (2), without reliance on any estimate,

$$Agg\ {}^{A}B^{i}\}TT = Agg\ {}^{A}R_{TT}\,G^{i}\}TT. \qquad (9)$$

As the lifetime of the contract group advances and corrected values of R_T are adopted, the reliability of the equivalence may in general be expected to improve, since more and more of the eventual total values become represented by $Agg\ {}^{A}B$ and $Agg\ {}^{A}R_T\,G$ values, rather than by expected values.

While projections of future G values are necessary to the determination of R_T values, note that a necessary and sufficient condition to evaluating the right-hand side of Equation (8) is a reasonable estimate of ${}^{A}R_T$. Estimated values of $Agg\ {}^{E}G$ or $Agg\ {}^{E}R_TG$ are not, in themselves, directly involved in the calculation of the retrospective side. *If R is accurate, the equivalence is accurate. Therefore the retrospective valuation is accurate.*

A particular benefit ratio reserve basis may provide that different levels of R may be employed with respect to different calendar periods, in which case the various equivalent values would need to be expressed as summations of two or more aggregate subsets. Thus, when multiple calendar-time-period values of R apply, Equation (9) becomes

$$Agg\ {}^{A}B^{i}\}TT = Agg\ {}^{A}R_{TT1}\,G_1^{i}\}TT + Agg\ {}^{A}R_{TT2}\,G_2^{i}\}TT + \ldots. \qquad (10)$$

Equations (7) and (8) would need to be restated in similar summation form, and in an actual case, the reserve valuation as of valuation date T, represented by the right-hand (retrospective) side of Equation (8), would involve a summation of as many $Agg\,R_{Tn}\ G_n$ values as there were distinct R_T values in use. Usually there would be little need to identify more than two or three, within what would otherwise be one relatively homogeneous contract group.

In connection with the relation of gross premiums and loss ratios to reserve valuation, the reader will find it instructive to refer to the papers by Hogeman [1] and Pharr [2].

Mr. Hogeman's paper develops the concept of calculation of reserves directly on an aggregate basis, making use of aggregate gross premiums and loss ratios in the method (Mr. Hogeman used the term *constant percentage* instead of *loss ratio*). He also emphasizes the importance of regular monitoring and correction of assumptions.

Mr. Pharr's paper examines the distorting effects on variously defined loss ratios using additional reserves calculated on various assumptions. Of particular interest is Mr. Pharr's demonstration that stable yearly loss ratios, when calculated by adding the change in additional reserves to the incurred claims of the year, result only when the reserves are based on realistic assumptions that track with the experience projections in all respects, including investment income assumptions.

E. Use of Actual Retrospective Claims

Questions about the validity or propriety of using actual retrospective claims surely will linger for some. The objective of the benefit ratio reserve method, however, is to achieve a real-world valuation of real-world contracts that are subject to high likelihood of changing costs and frequent premium revision in the regulatory environment. It is the actual experience that gives rise to the need for such revision, and moreover, actual realized claims and loss ratios, rather than expected, govern the revision of assumptions and therefore the magnitude of premium revisions. Additionally, actual retrospective loss ratios have a limiting impact, in many jurisdictions, on the level of revised rates that will be accepted for filing. Finally, the levels of the R values required, from the standpoint of the adequacy of the reserve valuation, obviously are dependent on an insurer's practical ability to put adequate rate revisions into effect on a timely basis.

Valuations on a purely prospective basis, or using specified tabular standards or original net benefit premium assumptions locked in, as with a typical GAAP valuation, simply do not address or resolve the valuation problems peculiar to this general class of benefits. Valuation on the basis of actual retrospective experience, using R values that are corrected regularly to take into account revised estimates of loss ratio levels realistically to be expected under future premiums, provides a credible basis that remains closely honed in on emerging experience.

IV. CONSIDERATION OF MORE COMPLEX SCENARIOS

The calculation of benefit ratio reserves is simple and straightforward as long as the ratio (as estimated at any valuation date) of each year's net to gross premium is assumed to be constant. If this is not a reasonable assumption, or ceases to be such, then the calculation becomes more complex.

For example, suppose that a stream of gross premiums is calculated to anticipate a loss ratio of 55 percent over an initial 10-year term period and then 65 percent over the remainder of the policy lifetime. The reason for this might be that excess first-year expense is intended to be amortized over ten years. In such a case, it might be reasonable to calculate the aggregate benefit net premiums as 55 percent of the corresponding gross premiums at the outset, but after 10 years as 65 percent of the then renewing gross premiums.

Another complexity may arise where more than one single, constant rate of interest accumulation is involved. For example, a common practice in both gross and net benefit premium computation is the assumption of a high initial interest rate, followed by either graded reductions or a lower ultimate rate after several policy years. Varying interest rates may be used in an aggregate benefit reserve accumulation provided each change in interest rate reasonably may be assumed to occur at one calendar point in time. If this is not a reasonable assumption, then the contract group must be subdivided—by year-of-issue blocks, for example—to assure that the single aggregate interest rate assumption being used at each point in calendar time for each aggregate block remains reasonable.

Or suppose that the first premium increase takes effect. This may very well be accompanied by a change in the expected loss ratio, arising directly from the various assumptions entering into the calculation of the increment in the premium or of the adjusted premium. Average premium size alone in relation to per contract expenses may alter the loss ratio; or associated acquisition or renewal costs may have an impact. Thus, the very fact of a change in premiums may necessitate some adjustment in the composite loss ratio used to generate the benefit ratio reserve. There are several ways in which such an adjustment may be accomplished.

Exhibits 2 and 3 in the Appendix illustrate one such scenario, assumed to apply to the same group of 1,000 originally issued contracts illustrated in Exhibit 1.

The assumption here is that rate increases become necessary, the first taking effect at the outset of the fifth year that the group of contracts continue in effect. This is illustrated in Exhibit 2. The rate increase is designed to cover an expected 10 percent increase in morbidity. All other assumptions remain the same, including first-year expenses assumed on the incremental premium, except that a one-time increase in renewal lapsation occurs at the end of the fifth year. The result is that this fifth-year increment develops, on its own, an anticipated loss ratio of 58.49 percent, as compared to the original 56.48 percent ratio illustrated in Exhibit 1. Exhibit 2 shows the *increment* reserve development for the fifth year incremental premium only.

A second rate increase takes effect at the outset of the eighth year, to cover a second expected incremental increase in morbidity of 15 percent of the original level. This combination of assumptions yields an anticipated loss ratio, for this increment separately, of 57.82 percent. Exhibit 3 shows the reserve development for the eighth year incremental premium only.

Additional rate increases would be expected, further complicating the scenario, but these two are sufficient for illustrative purposes.

Let us next consider the aggregate results here on an expected basis only, under which the reserves accumulated for each of the three premium components are not adjusted for any changes from expected to actual. Exhibit 4 shows the total reserves, where the values are simply the summation of the three component parts, each remaining on its own original expected basis, somewhat similar to a tabular reserving method that recognizes each additional increment as it arises.

The accumulated reserves in the 20-year development reach zero (except for rounding), but only because reality has been ignored, both for actual morbidity and for actual persistency. (Actual persistency, incorporating both of the one-time increases in lapsation occurring upon rate increase, is shown in the left hand column of Exhibit 4.)

Exhibit 5 illustrates the benefit ratio reserve method, using actual retrospective experience. Beyond the eighth year, actual experience is assumed to be such that no further rate increases are required, to facilitate illustrative simplicity.

The middle column of Exhibit 5 shows the way the R and R' (anticipated and corrected probable loss ratios) values are assumed to be handled. The second column shows the actual incurred loss ratios experienced year by year, illustrating the need for the two rate increases. Since actual-to-expected loss ratios were consistently above 100 percent and reached about 110 percent for the third and fourth years, not only has our hypothetical actuary put a fifth-year rate increase into effect, he also has begun a reserve strengthening process at year five, in keeping with the provisions of the proposed NAIC standards, since the benefit ratio reserve then shows indications of inadequacy in relation to an increased expected lifetime loss ratio. This strengthening process is continued as the eighth-year rate increase takes effect. By the twelfth year it no longer appears that further rate increases or adjustment of the reserve ratio will be needed, and the strengthened value of R' is then held at 57.24 percent, as compared to the original anticipated loss ratio of 56.48 percent. After 20 years, when all the remaining contracts terminate, the accumulated reserve reaches zero, the negative value shown in Exhibit 5 again being an accumulated rounding error.

This terminal rounding error of $6,894 appears large, but residual errors of this size will occur unless benefit net premiums are carried to the nearest 0.1 or even 0.01 of a cent. In Exhibit 5, the R and R' values would have to be carried to two or three more decimal places to eliminate the residual error.

With the benefit of illustrative clairvoyance we have endowed our hypothetical actuary with the ability to make a quite precise forecast of a cumulative actual lifetime loss ratio of 57.24 percent. In an actual situation, further R' corrections undoubtedly would have been needed after year 12, as well as further rate increases after year eight. Had the need of these occurred, however, attempts to reserve by tabular methods or on a purely expected basis would have become very complex and also would have had a high likelihood of leading to reserves far removed from reality.

Since Exhibit 4 is shown only on an "expected" basis with respect to both morbidity and persistency, the accumulated reserve values are not directly comparable with Exhibit 5 values.

In the scenarios illustrated in Exhibits 1 through 5, the eventual actual loss ratio and final R' value of 57.24 percent differ only modestly from the original 56.48 percent. In many actual cases, or even in a scenario assuming more drastic adjustments, the cumulative change could easily be much greater and the need (and importance) of adjustment from original assumptions would likewise be much greater.

Exhibit 6 illustrates the same contract as assumed as in Exhibit 1, but this time using annual renewable term rates instead of level premiums. Morbidity and persistency are assumed to be the same as in Exhibit 1; in actual practice, this would be unrealistic, since heavier lapsation and more antiselection normally should be anticipated under an ART premium scale.

Exhibit 6 shows that, because select morbidity is assumed in the early years, benefit ratio reserves may be needed even with ART premiums and that they can reach quite substantial levels. In such a case, the ART premiums employed are an example of "leveling" premiums.

Exhibit 7 uses the same morbidity and persistency as Exhibit 6, but provides an illustration under which two levels of anticipated loss ratio are used, rather than the single lifetime anticipated loss ratio of 61.4 percent used to generate the Exhibit 6 reserves. In Exhibit 7, an original anticipated loss ratio of 60 percent is adopted, on the expectation that the plan will continue to be issued and that the same ART premiums will apply to both new and renewing business. After five years, continued sale of the plan is discontinued and premiums become renewal only. Accordingly, the actuary provides that continuing reserve development be based on a new anticipated loss ratio level of 63.8 percent, while retrospective reserves of the first five years are allowed to remain on a 60 percent basis to support rapid amortization of first-year expense. The reserve burden is considerably relieved on this basis, although reserves remain substantial. The Exhibit 7 scenario is actuarially justifiable, because more rapid amortization of first-year expense permits a higher portion of the gross premiums for the sixth and later years to be regarded as the implicit net benefit premium. The proposed NAIC reserve standards provide for this multiple level method as the *minimum* reserve.

Rate increases adjusting the ART scale are to be expected even more than under the level premium scenario illustrated in Exhibits 2 through 5. Such changes would be handled in a comparable manner, but applied to the ART premium structure. The benefit ratio reserve method would handle this in virtually the same way as was illustrated for the level premium case, because recognition of the increasing ART scale would be implicit to the method.

When benefit ratio reserves are strengthened, as illustrated in Exhibit 5, as a result of an increased value of R', it will be evident that the increase in reserves is calculated on the basis of past earned premiums. This may appear improper, from an accounting point of view, as a form of restatement of past earnings. However, the actual increase in reserves is charged to the current accounting period, the accounting being the same as for any other type of reserve strengthening. Alternatively, the strengthening increase may be charged to surplus, as is often done in actual cases of strengthening of existing reserves. It must be kept in mind that the reserves have exactly the same prospective purpose as any other actuarial reserve. The modification used in Exhibit 7 avoids the impact of restated reserves with respect to the premiums of the first five years.

V. RECOGNITION OF FIRST-YEAR EXPENSE

There are various ways of offsetting surplus drain arising from first-year expenses under the benefit ratio reserve method. The traditional tabular reserving method for health insurance has been the use of two-year preliminary term as a means of allowing for some recovery of excess first-year expense before the formal reserve accumulation begins.

There are two reasons for considering a different approach under the benefit ratio method. First, use of any true preliminary term method requires, actuarially, the calculation of modified R values appropriate to valuation starting from the end of any preliminary term period. While it is entirely possible to derive such modified values, they represent added complications, especially with respect to proper recognition of retrospective experience. Aside from this, there are practical advantages in using anticipated loss ratios consistent with those that have been filed.

The second reason is that two-year preliminary term only coincidentally provides an appropriate offset against excess first-year expense. It may be more than sufficient for the purpose in one case and insufficient in another. Development of a new reserving method provides a good opportunity to improve on the arbitrary effect of two-year preliminary term reserves.

In the evolution of the proposed revisions in the standards, several other concepts have been considered. The method finally adopted by the AAA subcommittee is closely similar to the treatment of deferred acquisition cost under GAAP accounting, but with several basic differences in keeping with statutory minimum reserve standards.

A deferred-expense asset, or "initial expense," may be established initially, based on an insurer's actual excess of first-year expenses over ongoing expenses, not to exceed 60 percent of first-year premiums. This asset is then amortized over a period not to exceed 10 policy years, using an expense amortization premium equal to all actual gross premiums earned multiplied by a constant "expense amortization ratio." The net reserve held, resulting from the benefit value reduced by the unamortized expense value, may not be less than zero. In the proposed standards, it is this net reserve value that actually is called the "benefit ratio reserve," or BRR.

The differences from GAAP are designed primarily to introduce a measure of conservatism appropriate to the purpose of statutory reserves. Both the 10-year limitation on amortization of the initial expense and the prohibition of negative net reserves produce conservatism. These two features are the only elements of the proposed benefit ratio reserve method specifically designed to produce conservatism. While the R values used may provide for a measure of conservatism, this is not required as a minimum standard.

It should be pointed out that the R values are quite sensitive. A small percentage margin usually will tend to build up substantial conservatism in the reserve, because of the increasing retrospective accumulation held to cover the prospective liability related to the declining present value of future benefits under a closed block of contracts.

For further information concerning recognition and amortization of first-year expense, the reader is referred to the reports of the AAA subcommittee which developed the proposed standards. These reports are published in the *1985, 1986* and *1987 Journals of the American Academy of Actuaries.*

VI. CONSIDERATION OF SPECIFIC ISSUES AND PROBLEMS

The benefit ratio reserve proposal has evoked substantial controversy, focusing on a number of specific issues and conceptual and practical questions. The first to be discussed is the issue of the use of actual retrospective experience in the calculation of the reserve.

A. The Factors That Affect Prospective Benefit Liability

The use of actual retrospective experience rather than expected claims in the calculation of the reserve presents conceptual difficulties because, all other factors and quantities remaining equal, higher past claims result in lower reserve values and vice versa. This appears inconsistent with the function of the reserve as an estimator of prospective liability. In particular, if the cumulative retrospective incurred loss ratio actually exceeds the benefit ratio used to derive aggregate benefit net premiums from the aggregate gross premiums, the resulting reserve is zero. The question then becomes whether a value of zero can be considered reasonable as the measure of prospective liability under a leveling premium structure, especially when the zero value results from adverse past experience.

In examining the impact of retrospective experience on the reserve, it is necessary to keep all of the elements that play a role in determining prospective liability clearly in view. The key phrase in the preceding paragraph is ". . . all other factors and quantities remaining equal . . . ." They probably will not remain equal.

The key elements involved are: the signals as to future trends and claim levels to be read from the cumulative retrospective experience; the resulting expectations as to premium adjustments, with particular attention to regulatory limitations of such adjustments; and the resulting effect, if any, on the cumulative projected lifetime loss ratio.

The prospective contractual benefit liability is the excess, if any, of the present value of unincurred future claims over the present value of unearned future premiums. The latter are not guaranteed and are subject to change; in fact, they are *likely* to change under the class of contracts we are considering. That likelihood *increases* when retrospective incurred claims exceed expected levels, since the insurer is surely more likely to seek rate increases in such a situation and also more likely to obtain regulatory approval of filed increases. And the likelihood *decreases* when retrospective incurred claims fall below expected levels. Consequently, the probable value of future premiums tends to change, in response to deviation of retrospective experience from expected, in a direction that has an opposite impact upon the intermediate value of the prospective liability as compared to the impact to be expected from adverse experience considered in isolation.

On the other hand, the cumulative projected lifetime loss ratio must be expected to move in a direction that has an impact upon the prospective liability similar to that of the retrospective experience, if the loss ratio needs to move at all. If the insurer is confident that premium adjustments can be effected sufficient to maintain the projected lifetime loss ratio at an unchanged value, then it is entirely reasonable that the immediate impact of adverse retrospective experience should be a reduction in the existing reserve below the value otherwise to be expected. Similarly, if there appears to be no necessity of adjusting the benefit-to-premium ratio, favorable past experience should have the immediate impact of increasing the existing reserve.

Here the reader should keep in mind the theoretical basis of the benefit ratio reserve: Aggregate cumulative benefits and, therefore, aggregate cumulative benefit net premiums will have a ratio to aggregate cumulative gross premiums. This ratio is assumed to be applicable uniformly over all contracts in a given valuation block. Initially, it is wholly projected, but as time elapses it may be estimated with increasing accuracy as more and more of the aggregate experience becomes retrospective and known. The retrospective accumulation does not involve expected values: it involves actual values. The mathematical validity of this process, dependent only on the accuracy of the estimated benefit ratio, has been demonstrated in Section III of this paper.

The proposed NAIC standards require that the reasonableness of the benefit ratio reserve be reviewed each year. The actuary examining the business, after analyzing the cumulative experience up to the valuation date, must estimate the extent to which premium adjustments must be initiated or expected and then assess the expected effect of the interaction between projected premiums and benefits on the probable lifetime loss ratio, adjusting the latter if revision appears to be indicated. Should it be reasonable to assume that no adjustment in loss ratio is called for, the temporary immediate impact of a year of high incurred claims, with an incurred loss ratio exceeding the probable loss ratio, will be to reduce the reserve, possibly even to zero.

By way of illustrative example, consider the following hypothetical situation existing at the completion of two calendar years of experience under a particular major medical contract group, with an initial anticipated loss ratio of 55 percent:

Item	Year 1	Year 2	Cumulative (at 6%)
Earned Premium	$500,000	$1,000,000	$1,575,000
Incurred Claims	100,000	700,000	830,000
Actual Ratio	20%	70%	52.7%
Expected Ratio	25%	40%	34.8%

SCENARIO 1:

The actuary finds that the Year 2 experience includes two shock-loss claims aggregating to $400,000 incurred, comprised of $75,000 paid and a claim reserve of $325,000. Otherwise, all the experience looks normal, as to both trend and level.

He may conclude that there is no reason, at this point, to anticipate anything other than the originally expected anticipated 55 percent lifetime loss ratio. He considers the 55 percent loss ratio to be sustainable by projected rate increases. The benefit ratio reserve as of December 31, Year 2 is allowed to stand at 2.3 percent of the $1,575,000 accumulated premium.

On the other hand, the two shock-loss claims may imply more of the same in the future, their characteristics and causes suggesting something more than random jumbo losses. The actuary further believes that future rate increases may not be able to stay ahead of developing claim experience, if his assessment proves correct, so he initiates a three-year reserve strengthening process, toward a 65 percent ratio. During the three years, if emerging experience indicates this decision to have been overly pessimistic, he can back off some from the target ratio of 65 percent.

SCENARIO 2:

The actuary finds that the Year 2 experience contains a lot of claims, with no shock-loss impact discernable. The indications are that a severe adverse trend is already in evidence. In spite of a decision to initiate a substantial rate increase immediately, the actuary decides that the benefit ratio must be strengthened to 70 percent. In this case, the strengthened reserve must be established immediately, as loss recognition. In part, this decision is influenced by the past experience of the company in filing for rate increases, under which the increased premium revenue realized was less than intended due to delays in obtaining approval of revised rate filings and, in several jurisdictions, approval of lesser increases than those submitted. Again, evaluation of the results of Year 3 and beyond may indicate further adjustment, either less or more severe.

Some critics of the "inverse" movement of the reserve, in response to deviations of actual from expected experience, have gone so far as to assert that the reserve always changes in the wrong direction in response to even transitory deviations of actual from expected experience.

Two further illustrations, however, will serve to show that the reserve reacts in precisely the right way to transitory deviations, whenever adjustment of premium rates is subject to regulatory approval.

Let us consider any of the states that have in effect Rate Filing Guidelines modeled on the NAIC Guidelines, requiring both a lifetime and a prospective loss ratio test in justifying a rate increase filing. There are about 20 such states, and 29 with at least some loss ratio standard. Hence, rate filings in a regulatory environment based on loss ratio guidelines must be taken into account, unless an insurer writes business only in jurisdictions without rate regulation.

SCENARIO I:

Consider first this hypothetical retrospective/prospective example, valued as of the tentative effective date under consideration by the insurer for a rate increase:

Item	(A) Accumulated Values: Retrospective Experience	(B) Present Values: Prospective Experience	(C) Lifetime Values A + B
Incurred Claims	$ 8,000,000	$13,600,000	$21,600,000
Premiums	20,000,000	16,000,000*	36,000,000
Ratio	40.0%	85.0%	60.0%

*At *existing* rates.

The loss ratio standard applicable is 60 percent. The rates assumed in projecting the values in Column B are the existing, unchanged rates; they are all that the state will allow, because of the 60 percent lifetime ratio in Column C. Also, assume that the insurer has carried benefit ratio reserves up to the moment of the effective rate increase date using $R = 0.6$ (Its original rate filing having anticipated the 60 percent guideline ratio). Moreover, retrospective cumulative experience is *below* an expected level of 50 percent because of low early-duration incurred claims, whereas the trend has since been *higher* than expected, this being the reason that the insurer is now considering filing for a rate increase.

Use of actual cumulative retrospective experience, lower than expected, leads to a current benefit value of $4,000,000. Expected experience (at 50 percent) would have produced a current value of $2,000,000. The $2,000,000 upward adjustment due to actual retrospective experience is in the appropriate direction. The insurer needs the $4,000,000 retrospectively adjusted benefit value in order to overcome the projected inadequacy of future premiums, since no rate increase will be granted.

SCENARIO II:

Now consider this reverse scenario with adverse, rather than favorable early-duration experience, but with subsequent experience the same as before:

Item	(A) Accumulated Values: Retrospective Experience	(B) Present Values: Prospective Experience	(C) Lifetime Values A + B
Incurred Claims	$12,000,000	$13,600,000	$25,600,000
Premiums	20,000,000	20,800,000*	40,800,000
Ratio	60.0%	65.0%	62.75%

*At rates increased by 30%.

Here the values in Column B assume a 30 percent rate increase (the insurer determining that it can live with a 65 percent renewal year loss ratio), which the insurance department should approve, particularly with a projected lifetime loss ratio of 62.75 percent.

Again, our insurer has carried benefit reserves at 60 percent, the originally filed loss ratio, and without adjusting the loss ratio prior to the effective date of increase. The current benefit value is zero, due to retrospective experience. But the insurer determines that it can carry benefit reserves from the rate increase date forward at 65 percent, on the renewal-year basis, and therefore need not retrospectively increase its R value to 0.65. Or, it could make the conservative adjustment to an R' of 0.6275 over the entire contract group lifetime, producing a current benefit value of $550,000 (versus an expected basis value of $2,000,000).

Again, the adjusted current benefit value of zero (or $550,000 under the conservative alternative) is in the appropriate direction, because of the fact that retrospective experience in excess of expected makes it possible to file a rate increase that otherwise would not have been accepted by the state.

Like all hypothetical illustrations, these are oversimplified: for example, in Scenario II the actuary would need to consider the possibility that a 30 percent rate increase could provoke antiselective lapsation, reducing the projected volume of premiums in relation to the projected volume of claims, thus resulting in a higher prospective loss ratio. There are an infinite number of possible situations, but these illustrations clearly show that one cannot simply leap to the conclusion that the reserve automatically reacts in the wrong direction to deviations in experience. Far more searching analysis is necessary.

The question at issue here becomes more substantial when experience consistently continues to deviate in the same direction from expected. In such situations, the actuary must consider two corrective courses of action: First, is a premium adjustment in order (as in Scenario II), and if so, is it reasonable to expect that such an adjustment will rebalance the equation (again, as in Scenario II, with a prospective 65 percent loss ratio)? Second, if a premium adjustment alone cannot be expected to rebalance the equation, then R itself must be adjusted, as provided for in the reserve basis proposed in the standards draft.

It is instructive to observe how any tabular reserve basis, locked in on original assumptions, fails to serve its purpose under Scenarios I and II. Such a basis fails precisely because it develops the same reserve in either case. Take any illustrative tabular reserve amount, assumed to exist as of the tentative effective date of rate adjustment. Suppose it is $2,000,000, the same as the originally expected "benefit value." Under one scenario, this is deficient. Under another scenario, it is excessive. No tabular value, being the same amount in both cases, can approximate a reasonable valuation of the prospective liability under both scenarios. Once actual experience departs significantly from expected, any fixed tabular reserve basis merely generates numbers, with no assurance of any correspondence to the realistic prospective liability.

B. The Subjectivity and Sensitivity of the Reserve

Both excessive subjectivity and excessive sensitivity have been voiced as criticisms of the benefit ratio reserve concept. The possible alternative actuarial judgments observed in the preceding scenarios will illustrate the grounds advanced for both criticisms.

But if actuarial judgment, carefully and prudently formed, is to be deemed excessively subjective or excessively sensitive, what alternative is there? According to some, the alternative is an "objective" tabular reserve basis, looked in on original assumptions or else dictated by regulatory fiat.

Such a basis certainly would be objective and very insensitive. But would it lead to anything resembling appropriate valuation of prospective contractual liability under the scenarios described previously and under a host of other possible situations? How likely is it that our ship from Hong Kong will arrive at the Golden Gate, rather than run aground on the shoals of the Great Barrier Reef? There is far too much casual reliance on statutory tabular reserves, simply because they are minimum standards, *presumed* to be conservative.

Given the general class of business proposed to be subject to the benefit ratio reserve, it is this author's opinion that no realistic alternative to actuarial judgment is to be found.

C. Very High Probable Loss Ratios

When emerging experience indicates adjustment in the probable contract lifetime loss ratio, one of the obvious possibilities is that a very high loss ratio is to be expected, possibly even exceeding 100 percent of the gross premium or else exceeding 100 percent of the gross premium reduced by the necessary expense ratio. In either case, a situation of nonrecoverability is emerging.

The proposed NAIC minimum reserve standards call for immediate establishment of adequate reserves in such cases, based on a gross premium valuation. Even the existing NAIC standards call for adequate reserves, and if these exceed the specified minimum standards, higher reserves are to be held.

If the process involved in the benefit ratio reserve method leads to an extremely high probable loss ratio in a given instance, even exceeding 100 percent, this clear and present warning in itself potentially will be of immense importance to the insurer. Such a situation may easily be overlooked in cases where traditional tabular reserves are in use. If the potential deficiency in future premium revenue is of sufficient amount, the insurer's surplus may be threatened. The need for urgent and drastic action should be clearly apparent, whatever that action may be in a specific case. It may be to establish a loss recognition liability immediately. It may be to launch a hard-nosed drastic program of rate increases immediately. It may necessitate nonrenewal of a contract group, if contract renewal provisions permit such action.

This scenario, involving a probable loss ratio exceeding 100 percent, has been cited as a criticism of the benefit ratio reserve method. Surely, however, it is better to know that this is what must be expected, than to rely on some "objective" tabular system, or none at all, which may well leave the insurer unaware of what is developing. Citation of the greater-than-100-percent probable loss ratio scenario would seem, therefore, to illustrate the value and appropriateness of the method, rather than representing a weakness.

D. Small Contract Blocks and Reinsurance

Small contract blocks that cannot be expected to produce credible experience present an obvious problem with respect to use of the benefit ratio reserve method. Random fluctuation in the experience of successive years could render the results of normal application of the method meaningless (as also tends to be true, by the way, when tabular methods are used).

Several techniques are available, however, to mitigate the potential problems to some extent. One of these is to value such a block on a net-of-stop-loss basis, or on an actual net-of-stop-loss reinsurance basis, if reinsurance is in effect. In such cases, claim amounts in excess of the stop-loss attachment point can be charged to surplus, for reserving purposes, or to actual reinsurance if it exists. In place of such excess amounts, a pooling net premium or net reinsurance premium can be charged to the block as a benefit charge. Such a procedure can have substantial effect in stabilizing the ongoing results.

For example, take the hypothetical Scenario 1 situation illustrated earlier, involving two shock-loss claims. For the block involved, the insurer might set up an attachment point of $25,000 per incurred claim in any one year, charging the excess to surplus. Then, again by way of illustration, let us assume that a stop-loss pooling premium of, say, 5 percent of gross is set up as a benefit charge against the block. In this case, the figures for the two years would look like this:

Item	Year 1	Year 2	Cumulative (at 6%)
Earned Premium	$500,000	$1,000,000	$1,575,000
Incurred Claims	100,000	700,000	830,000
Stop-Loss Credit	0	(350,000)	(360,000)
Stop-Loss Charge	25,000	50,000	79,000
Adjusted Incurred Claims	125,000	400,000	549,000
Adjusted Loss Ratio	25%	40%	34.8%

It is marvelous the way hypothetical illustrations can be made to work out so nicely. The adjusted results in this case agree exactly with the expected ratios in Scenario 1, restoring the yearly loss ratios to a stable pattern.

In any case, it is clear that such a technique can help materially to stabilize results under a small block. Utilization of actual stop-loss reinsurance can accomplish the same result. An additional unknown quantity that needs to be considered here is the likelihood that the reinsurance premium itself will be changed.

Another similar criticism directed at the benefit ratio reserve method is that it creates unstable gain and loss results for the small company. Actually, the reverse will tend to be true. Benefit ratio reserves react to transitory deviations in retrospective experience in a way that smoothes out such deviations (within limits, of course). Tabular reserves exhibit no such stabilizing effect.

VII. CONCLUSION

The author makes no pretense that all criticisms and problems involved with benefit ratio reserves can be answered or dismissed readily. He does believe, however, that suitable response has been made with respect to some of the more frequently heard criticisms and problems.

Undoubtedly, substantial problems will occur under the method in practice. Undoubtedly also, solutions will be devised to deal with these, with greater or lesser success.

The method has clear advantages. The ability to apply it in the aggregate is an enormous advantage. It possesses the necessary capacity to handle adjustments as needed, in response to emerging experience. Unless others can come forward with other proposals that will more ably address the problems of the particular class of business involved, this method deserves a period of serious trial use for statutory purposes.

REFERENCES

The following papers and their discussions are cited as useful and important references. Each of these papers contains discussions regarding interrelationships among loss ratios, benefit reserves, and the interpretation of experience.

1. HOGEMAN, G.L. "Adjusted Benefit Reserves for Individual Hospital and Individual Major Medical," *TSA* XXV (1973):681–88.
2. PHARR, J.B. "The Individual Accident and Health Loss Ratio Dilemma," *TSA* XXXI (1979):373–406.
3. BLUHM, W.F. "Cumulative Antiselection Theory," *TSA* XXXIV (1982):215–246.
4. CUMMING, J.B. "Regulatory Monitoring of Individual Health Insurance Policy Experience," *TSA* XXXIV (1982):617–34.

APPENDIX

This Appendix contains seven exhibits that are explained and discussed in Parts II and IV. Each Exhibit provides projections of contract reserve accumulation and related information with respect to particular illustrative situations encountered under a hypothetical plan of individual major medical insurance.

EXHIBIT 1

ILLUSTRATIVE MAJOR MEDICAL PLAN
INTEREST AT 7.50 PERCENT
1,000 POLICIES ORIGINALLY ISSUED

		Benefit Ratio Reserve Initial Gross Premium: $469.69			Natural Net Premium Reserve Initial Net Premium: $265.27		
Policy Year	Persistency Scale	Expected Claim Ratio	Reserve Increment	Accumulated Reserve	Expected Claim Ratio	Reserve Increment	Accumulated Reserve
1	1,000.00	26.33%	$141,620	$ 152,242	46.61%	$141,620	$ 152,242
2	683.35	40.88	50,069	217,484	72.38	50,069	217,484
3	506.62	51.40	12,093	246,795	91.00	12,093	246,795
4	400.94	60.90	−8,324	256,357	107.83	−8,324	256,357
5	335.07	70.12	−21,468	252,506	124.15	−21,468	252,506
6	293.43	74.21	−24,437	245,174	131.39	−24,437	245,174
7	256.96	78.48	−26,549	235,022	138.95	−26,549	235,022
8	225.03	82.89	−27,919	222,635	146.77	−27,919	222,635
9	197.06	87.37	−28,593	208,595	154.70	−28,593	208,595
10	172.57	91.92	−28,729	193,355	162.76	−28,729	193,355
11	151.12	96.69	−28,542	177,174	171.20	−28,542	177,174
12	132.34	101.81	−28,178	160,171	180.27	−28,178	160,171
13	115.90	107.42	−27,731	142,373	190.20	−27,731	142,373
14	101.49	113.54	−27,202	123,808	201.04	−27,202	123,808
15	88.88	120.09	−26,555	104,547	212.63	−26,555	104,547
16	77.83	127.02	−25,787	84,667	224.90	−25,787	84,667
17	68.16	134.30	−24,915	64,233	237.80	−24,915	64,233
18	59.69	141.91	−23,951	43,304	251.26	−23,951	43,304
19	52.27	149.93	−22,943	21,888	265.47	−22,943	21,888
20	45.77	158.40	−21,910	−24	280.46	−21,910	−24

Anticipated Loss Ratio: 56.48% 100.00%

EXHIBIT 2

ILLUSTRATIVE MAJOR MEDICAL PLAN
INTEREST AT 7.50 PERCENT
5TH YEAR INCREMENTAL PROJECTION

		Benefit Ratio Reserve Gross Premium: $86.64			Natural Net Premium Reserve Net Premium: $50.68		
Policy Year	Persistency Scale	Expected Claim Ratio	Reserve Increment	Accumulated Reserve	Expected Claim Ratio	Reserve Increment	Accumulated Reserve
5	335.07	37.02%	$ 6,236	$ 6,703	63.28%	$ 6,236	$ 6,703
6	278.90	44.64	3,347	10,804	76.32	3,347	10,804
7	234.29	51.84	1,352	13,067	88.61	1,352	13,067
8	198.60	58.89	−68	13,975	100.67	−68	13,975
9	169.81	65.88	−1,087	13,855	112.63	−1,087	13,855
10	146.43	69.31	−1,372	13,419	118.49	−1,372	13,419
11	126.28	72.90	−1,576	12,731	124.63	−1,576	12,731
12	108.89	76.77	−1,724	11,833	131.24	−1,724	11,833
13	93.90	80.99	−1,830	10,753	138.46	−1,830	10,753
14	80.98	85.61	−1,902	9,515	146.35	−1,902	9,515
15	69.83	90.55	−1,939	8,144	154.79	−1,939	8,144
16	60.22	95.78	−1,945	6,663	163.73	−1,945	6,663
17	51.93	101.27	−1,924	5,094	173.13	−1,924	5,094
18	44.78	106.99	−1,882	3,454	182.91	−1,882	3,454
19	38.62	113.05	−1,825	1,750	193.27	−1,825	1,750
20	33.30	119.44	−1,758	−8	204.18	−1,758	−8

Anticipated Loss Ratio: 58.49% 100.00%

EXHIBIT 3

ILLUSTRATIVE MAJOR MEDICAL PLAN
INTEREST AT 7.50 PERCENT
8TH YEAR INCREMENTAL PROJECTION

		Benefit Ratio Reserve Gross Premium: $152.27			Natural Net Premium Reserve Net Premium: $88.05		
Policy Year	Persistency Scale	Expected Claim Ratio	Reserve Increment	Accumulated Reserve	Expected Claim Ratio	Reserve Increment	Accumulated Reserve
8	198.60	37.60%	$ 6,115	$ 6,574	65.03%	$ 6,115	$− 6,574
9	166.28	45.17	3,204	10,511	78.11	3,204	10,511
10	140.50	52.18	1,208	12,598	90.23	1,208	12,598
11	119.78	59.02	−218	13,309	102.07	−218	13,309
12	103.00	65.96	−1,276	12,935	114.07	−1,276	12,935
13	89.32	69.59	−1,601	12,184	120.35	−1,601	12,184
14	77.46	73.56	−1,856	11,103	127.21	−1,856	11,103
15	67.18	77.80	−2,044	9,739	134.55	−2,044	9,739
16	58.26	82.29	−2,171	8,136	142.32	−2,171	8,136
17	50.53	87.01	−2,245	6,332	150.47	−2,245	6,332
18	43.82	91.94	−2,276	4,360	158.99	−2,276	4,360
19	38.00	97.14	−2,275	2,242	167.98	−2,275	2,242
20	32.95	102.62	−2,248	6	177.45	−2,248	−6

Anticipated Loss Ratio: 57.82% 100.00%

EXHIBIT 4

ILLUSTRATIVE MAJOR MEDICAL PLAN
INTEREST AT 7.50 PERCENT
1,000 POLICIES ORIGINALLY ISSUED

Policy Year	Persistency Scale	Benefit Ratio Reserve: Expected Claim Ratio	Benefit Ratio Reserve: Reserve Increment	Benefit Ratio Reserve: Accumulated Reserve	Natural Net Premium Reserve: Expected Claim Ratio	Natural Net Premium Reserve: Reserve Increment	Natural Net Premium Reserve: Accumulated Reserve
		Initial Gross Premium: $469.69			Initial Net Premium: $265.27		
1	1,000.00	26.33%	$ 141,620	$ 152,242	46.61%	$ 141,620	$ 152,242
2	683.35	40.88	50,069	217,484	72.38	50,069	217,484
3	506.62	51.40	12,093	246,795	91.00	12,093	246,795
4	400.94	60.90	−8,324	256,357	107.83	−8,324	256,357
		Incr. Gross Premium: $86.64			Incr. Net Premium: $50.68		
5	335.07	64.96	−15,232	259,209	114.39	−15,232	259,209
6	278.90	70.38	−21,090	255,978	123.93	−21,090	255,978
7	234.29	76.12	−25,197	248,089	134.04	−25,197	248,089
		Incr. Gross Premium: $152.27			Incr. Net Premium: $88.05		
8	198.60	72.56	−21,872	243,183	127.26	−21,872	243,183
9	166.28	79.48	−26,476	232,961	139.41	−26,476	232,961
10	140.50	86.04	−28,893	219,372	150.90	−28,893	219,372
11	119.78	92.76	−30,336	203,214	162.69	−30,336	203,214
12	103.00	99.73	−31,178	184,939	174.93	−31,178	184,939
13	89.32	106.25	−31,162	165,310	186.35	−31,162	165,310
14	77.46	113.42	−30,961	144,426	198.93	−30,961	144,426
15	67.18	121.16	−30,538	122,430	212.51	−30,538	122,430
16	58.26	129.45	−29,903	99,466	227.05	−29,903	99,466
17	50.53	138.25	−29,085	75,660	242.49	−29,085	75,660
18	43.82	147.54	−28,108	51,118	258.78	−28,108	51,118
19	38.00	157.44	−27,043	25,880	276.15	−27,043	25,880
20	32.95	168.00	−25,916	−38	294.66	−25,916	−38
Anticipated Loss Ratio:		56.71%			100.00%		

EXHIBIT 5

ILLUSTRATIVE MAJOR MEDICAL PLAN
INTEREST AT 7.50 PERCENT
1,000 POLICIES ORIGINALLY ISSUED

Policy Year	Persistency Scale	Benefit Ratio Reserve: Actual Claim %	Ratio R to R_1	Reserve Increment	Accumulated Reserve
Initial Gross Premium: $469.69					
1	1,000.00	26.90	56.48	$ 138,900	$ 149,318
2	683.35	44.26	56.48	39,204	202,660
3	506.62	56.19	56.48	689	218,601
4	400.94	66.84	56.48	−19,522	214,010
Incr. Gross Premium: $86.64					
5	335.07	65.57	56.57	−15,329	213,582
6	278.90	74.29	56.67	−25,605	202,076
7	234.29	81.22	56.76	−29,853	185,139
Incr. Gross Premium: $152.27					
8	198.60	70.23	56.86	−16,504	181,282
9	166.28	75.67	56.95	−19,433	173,988
10	140.50	80.62	57.05	−20,521	164,977
11	119.78	85.69	57.15	−20,959	154,820
12	103.00	91.04	57.24	−24,671	139,909
13	89.32	96.06	57.24	−24,571	123,989
14	77.46	101.54	57.24	−24,314	107,151
15	67.18	107.39	57.24	−23,873	89,524
16	58.26	113.59	57.24	−23,262	71,231
17	50.53	120.10	57.24	−22,506	52,380
18	43.82	126.90	57.24	−21,628	33,058
19	38.00	134.08	57.24	−20,689	13,296
20	32.95	141.65	57.24	−19,710	−6,894
Actual Loss Ratio:				57.24%	

EXHIBIT 6

ILLUSTRATIVE MAJOR MEDICAL PLAN
ANNUAL RENEWABLE TERM
INTEREST AT 7.50 PERCENT
1,000 POLICIES ORIGINALLY ISSUED

		Benefit Ratio Reserve				Natural Net Premium Reserve			
Policy Year	Persistency Scale	Gross Premium	Expected Claim Ratio	Reserve Increment	Accumulated Reserve	Net Premium	Expected Claim Ratio	Reserve Increment	Accumulated Reserve
1	1,000.00	$349.82	35.35%	$ 91,139	$ 97,975	$214.79	57.57%	$ 91,139	$ 97,975
2	683.35	369.70	51.93	23,914	131,031	227.00	84.58	23,914	131,031
3	506.62	390.91	61.75	−700	140,106	240.02	100.58	−700	140,106
4	400.94	413.31	69.20	−12,933	136,711	253.77	112.71	−12,933	136,711
5	335.07	436.75	75.41	−20,498	124,929	268.16	122.81	−20,498	124,929
6	293.43	461.09	75.59	−19,202	113,656	283.11	123.12	−19,202	113,656
7	256.96	485.97	75.85	−18,040	102,787	298.39	123.53	−18,040	102,787
8	225.03	511.51	76.12	−16,939	92,287	314.07	123.97	−16,939	92,287
9	197.06	538.21	76.25	−15,747	82,281	330.46	124.18	−15,747	82,281
10	172.57	566.60	76.20	−14,471	72,895	347.89	124.10	−14,471	72,895
11	151.12	597.19	76.05	−13,218	64,153	366.67	123.85	−13,218	64,153
12	132.34	629.99	75.90	−12,093	55,965	386.81	123.62	−12,093	55,965
13	115.90	664.65	75.91	−11,178	48,146	408.10	123.63	−11,178	48,146
14	101.49	701.17	76.06	−10,431	40,543	430.52	123.87	−10,431	40,543
15	88.88	739.55	76.27	−9,773	33,078	454.08	124.21	−9,773	33,078
16	77.83	779.79	76.51	−9,169	25,702	478.79	124.61	−9,169	25,702
17	68.16	833.81	76.65	−8,101	18,922	511.96	123.21	−8,101	18,922
18	59.69	887.83	75.07	−7,246	12,552	545.13	122.27	−7,246	12,552
19	52.27	941.86	74.77	−6,581	6,419	578.30	121.77	−6,581	6,419
20	45.77	995.88	74.70	−6,065	381	611.47	121.67	−6,065	381

Anticipated Loss Ratio: 61.40% 100.00%

EXHIBIT 7

Illustrative Major Medical Plan: Annual Renewable Term
Interest at 7.50 Percent
1,000 Policies Originally Issued

		Benefit Ratio Reserve				Natural Net Premium Reserve			
Policy Year	Persistency Scale	Gross Premium	Expected Claim Ratio	Reserve Increment	Accumulated Reserve	Net Premium	Expected Claim Ratio	Reserve Increment	Accumulated Reserve
Anticipated Loss Ratio:			60.00%				100.00%		
1	1,000.00	$349.82	35.35%	$ 86,242	$ 92,710	$209.89	58.91%	$ 86,242	$ 92,710
2	683.35	369.70	51.93	20,377	121,569	221.82	86.56	20,377	121,569
3	506.62	390.91	61.75	;3,472	126,954	234.55	102.92	−3,472	126,954
4	400.94	413.31	69.20	−15,253	120,078	247.99	115.34	−15,253	120,078
5	335.07	436.75	75.41	−22,547	104,846	262.05	125.68	−22,547	104,846
Anticipated Loss Ratio:			63.80%				100.00%		
6	293.43	461.09	75.59	−15,955	95,558	294.18	118.48	−15,955	95,558
7	256.96	485.97	75.85	−15,043	86,554	310.05	118.88	−15,043	86,554
8	225.03	511.51	76.12	−14,176	77,806	326.34	119.30	−14,176	77,806
9	197.06	538.21	76.25	−13,201	69,450	343.38	119.51	−13,201	69,450
10	172.57	566.60	76.20	−12,125	61,625	361.49	119.44	−12,125	61,625
11	151.12	497.19	76.05	−11,052	54,366	381.01	119.19	−11,052	54,366
12	132.34	629.99	75.90	−10,092	47,595	401.93	118.97	−10,092	47,595
13	115.90	664.65	75.91	−9,329	41,135	424.05	118.98	−9,329	41,135
14	101.49	701.17	76.06	−8,723	34,843	447.35	119.21	−8,723	34,843
15	88.88	739.55	76.27	−8,195	28,646	471.83	119.54	−8,195	28,646
16	77.83	779.79	76.51	7,712	22,504	497.51	119.92	−7,712	22,504
17	68.16	833.81	75.65	6,737	16,949	531.97	118.58	−6,737	16,949
18	59.69	887.83	75.07	−5,974	11,798	566.44	117.67	−5,974	11,798
19	52.27	941.86	74.77	−5,399	6,879	600.91	117.19	−5,399	6,879
20	45.77	995.88	74.70	−4,971	2,052	635.37	117.09	−4,971	2,052

DISCUSSION OF PRECEDING PAPER

DONALD D. CODY:

Mr. Barnhart has written an impressive paper on the benefit ratio reserve (BRR) method for statutory reserves for leveling premium health insurance contracts. These classes of contracts (for example, major medical) involve claims that increase with attained age intrinsically and that are subject to inflationary costs and wild cards dealt by governmental regulation of the medical environment. Thus, the business plan for such contracts must contain a policy for rerating of premiums at intervals that offers assurance of reasonable profits while preserving the fairness and competitiveness of the pricing.

I see statutory reserves here as having three basic characteristics:

- They must be adequate prospectively.
- They time the emergence of statutory profits and losses.
- They should have a demonstrable relationship to the premium structure of the contract. In the case of benefits subject to inflationary and other pressures (for which the business plan would include a policy for expected rerating of premiums), the reserve basis should be compatible with both the premium structure and the rerating policy, particularly in relation to the lifetime loss ratio objective inherent in the business plan.

Some of the objections to the BRR method, I believe, arise essentially from disagreement with the third characteristic, such as these:

- Concern that BRR reserves, calculated retrospectively, based on actual experience, may not be efficient determinations of adequate prospective reserves, which must reflect expected levels of future claims and expenses and expected levels of future premiums feasible in the market and are subject to regulatory control—even though the BRR method, as shown in the paper, does produce adequate reserves prospectively over the lifetime of the contract class, subject to the usual gross premium reserve testing needed in any formulated reserving system.
- Concepts of equity to policyholders, though important, should not be a feature of statutory reserves.
- Shift in the historical patterns of statutory net income.
- Difficulty in obtaining regulatory approval of appropriate reratings on renewal.
- Concern that some companies could not remain in the market.

Other practical objections are these:

- Complications and need for new systems.

While accepting the sincerity of the objections, which have been so widespread that the BRR method will not appear in any model statutes in the foreseeable future, I do regret the absence of a disciplined connection between the design of appropriate statutory reserves and a stated rating/rerating policy that inherently incorporates experience rating in some form. It has occurred to me that the BRR concept might be more acceptable at some future date, if it were modified to reflect experience rating less strongly and if it were tied to a stated rating/rerating policy. This has led me to search for a family of modified BRR method reserves in which a compromise might be found.

I consider a family of benefit reserves with an underlying rating/rerating policy in a simplified situation so as to convey concepts without the complications of real life pricing and valuation practice so thoroughly treated in the paper. The family of reserves and underlying rating/rerating policy could, however, be elaborated to comprehend such complications as a formulated two-year preliminary term design instead of a GAAP-type deferred acquisition cost or premium loadings that are not a flat percentage by duration.

The key to this family of reserves is a written policy of rating/rerating that would govern rerating practice as experience emerges. The policy is based on a specific degree of experience rating and a modified lifetime loss ratio reflecting the degree of experience rating recognized. The benefit reserves would be consistent with the mechanics of the rating/rerating policy. The rating/rerating policy might be stated as follows:

Rerating intent, subject to future amendment on a formal basis: Premium rerating on each rerating date will be determined, to the extent feasible, with the objective that a modified retrospective-prospective lifetime loss ratio of 100 $Y\%$ will be produced, incorporating weighted claims equal to the sum of $100x\%$ of actual claims plus 100 $(1 - x)\%$ of expected claims prior to such rerating date and equal to expected claims thereafter. The expected claims each year are those assumed in the rerating in effect in that year. Actual termination rates apply prior to the rerating date and expected terminations thereafter. Interest is on the assumed interest rate.

The weighting factor, x, and the factor Y would have specified values, constant in all years. $0 \leq x \leq 1$. On major medical, $0.55 \leq Y \leq 0.65$ probably.

On each rerating date, statutory benefit reserves would be based on the above modified assumptions, with net premiums equal to gross premiums multiplied by the modified retrospective-prospective lifetime loss ratio. Such reserves would be identical on retrospective and prospective bases.

On dates between rerating dates, the reserves could be determined on either of two bases:

(1) Prospective, utilizing future expected claims, expected termination rates, expected net premiums, and the assumed interest rate.
(2) Retrospectively, utilizing weighted claims, actual termination rates, actual net premiums, and the assumed interest rate.

With $x = 1$, the reserves are identical to BRR reserves at all durations under basis (2), but only on rerating dates under basis (1). With $x = 0$, the reserves are prospective net premium reserves without any formulated experience rating on both bases (1) and (2).

Although the weighting formula for claims is in the form of the theoretically sound credibility formula used in group and casualty insurance, here the value of x is more of a practical choice dictated by the degree of discipline desired to attain actual lifetime loss ratio objectives.

The theoretical and practical implications of this modified BRR approach and the underlying rating/rerating policy are shown in the following analysis, which applies to the simplified structure. The analysis utilizes the definitions and operational nomenclature of the paper with several additions:

${}^{A}r^{i} = {}^{A}B^{i}/G^{i}$ = actual loss ratio in year i

${}^{E}r^{i} = {}^{E}B^{i}/G^{i}$ = expected loss ratio in year i assumed in the rerating in effect in year i

${}^{E}r^{i}$ increases with duration, being well below the lifetime loss ratio at early durations and well above it at later durations. ${}^{A}r^{i}$ has a similar shape on the average.

${}^{M}R_{T}$ = modified retrospective-prospective lifetime loss ratio for rerating at time T as defined in the rating/rerating policy

${}^{M}R_{TT}$ = corresponding modified retrospective lifetime loss ratio for $T = TT$

${}^{A}R_{TT}$ = actual lifetime loss ratio at time TT

${}^{E}R_{TT}$ = lifetime loss ratio at time TT, based on ${}^{E}B^{i}$, where ${}^{E}B^{i}$ is that assumed in the rerating in effect in year i

P_{T}^{i} = ${}^{M}R_{T}\,G^{i}$ = net benefit premium in statutory benefit reserves in year i based on rerating at time T.

The modified retrospective-prospective lifetime loss ratio for rerating at T is as follows:

$$^{M}R_{T} = \frac{Agg[x^{A}\, r^{i} + (1 - x)\, {}^{E}r^{i}]\, G^{i}\}T + T\{Agg[{}^{E}r^{i}\, G^{i}]}{Agg\ G^{i}\}T + T\{Agg\ G^{i}}$$

where $Agg[\cdot]\}T$ involves actual terminations and the assumed interest rate and $T\{Agg[\cdot]$ involves expected termination rates and the assumed interest rate. The rating/rerating policy calls for setting $^{M}R_{T}$ equal to Y at each rerating to the extent feasible. This condition is satisfied by appropriately designing G^{i} for $i > T$.

The statutory benefit reserve V_{T} at time T is consistently and naturally as follows:

$$V_{T} = Agg[{}^{M}R_{T} - x\,{}^{A}r^{i} - (1 - x)\,{}^{E}r^{i}]G^{i}\}T \quad \text{(retrospective)}$$
$$= T\{Agg[{}^{E}r^{i} - {}^{M}R_{T}]G^{i}. \quad \text{(prospective)}$$

The retrospective reserve formula involves the accumulation of actual net premiums and actual claims, using actual termination rates, as in the paper, but with the additional need to accumulate expected claims, which have to be recorded. The prospective reserve formula is the familiar tabular formula, using expected factors.

The implications of the choice of the value of x can be examined as follows:

$$^{M}R_{T} \longrightarrow {}^{M}R_{TT} \quad \text{as} \quad T \longrightarrow TT$$
$$^{M}R_{TT} = {}^{A}R_{TT} - (1 - x)\,({}^{A}R_{TT} - {}^{E}R_{TT})$$

where $^{E}R_{TT} = Agg[{}^{E}r^{i}\ G^{i}]\}TT/Agg[G^{i}]\}TT$.

Since $^{M}R_{TT} = Y$,

$$^{A}R_{TT} = Y + (1 - x)\,({}^{A}R_{TT} - {}^{E}R_{TT})$$

where the second term on the right reflects the 100 $(1 - x)$ % of the excess of actual claims over expected claims taken each year immediately into net income as a loss (profit) and ignored thereafter.

To the extent that $|{}^{A}R_{TT} - {}^{E}R_{TT}|$ is small due to skillful and/or lucky estimates of future expected claims at successive rerating dates, $(1 - x)$ $({}^{A}R_{TT} - {}^{E}R_{TT})$ will be small for any value of x.

For $x = 1$, as in the BRR, $^{A}R_{TT} = Y$.

For $x = 0$, as in the prospective net premium reserve with no formulated experience rating, ${}^{E}R_{TT} = Y$, and ${}^{A}R_{TT}$ is not under any formulated control.

I am sure that there are other families of rating/rerating policies with consistent benefit reserves. For instance, x could be set higher in years in which actual claims are lower than expected claims, thereby deferring net income conservatively into reserves. Or $(1 - x)$ could be set equal to $(1 - y)^{n-1}$ where n is the number of previous ratings and $0 < y < 1$, thereby approaching full experience rating with successive reratings.

The IASB has issued an Exposure Draft, dated April 1988, on "Recommendations and Interpretations Concerning Health Insurance Filings." The proposed standards of practice refer to business plans and thus impinge on the ideas of this discussion. I would be hopeful that if a stated rating/rerating policy, designed as discussed above, governs reratings as part of the business plan, regulatory approval of reratings in conformity with the policy would be fairly prompt without contrary pressures because of the size and changes in statutory reserves consistent with the rating/rerating policy.

T.J. STOIBER:

Overview

Mr. Barnhart's paper makes a significant contribution to actuarial literature, not only because it addresses the neglected topic of open-ended health insurance but also because it bridges the often wide gap between theory and practice. Even though the method developed may never be directly incorporated into any specific reserve standards, the aggregate focus of the method gives it the potential for widespread use as a tool in reasonability testing on otherwise established health reserves and the establishment of reserves for less significant classes of health insurance policies that often find themselves as afterthought appendages to other major lines of business on a company's books.

Framework

Reference is made throughout the paper to use of R as a constant percentage of gross premium, with accuracy of the method providing reserve values dependent upon the accuracy of R, while at the same time the paper provides for instances in which R may change from time to time, under different circumstances. At first I had a great deal of difficulty in understanding these apparently conflicting statements, but, after a great deal of thought, came to the realization that in fact they are not conflicting, nor do they undermine the actuarial and mathematical development of the method. The statements merely created confusion in my mind that I believe I can dispel for other students of this paper.

With the understanding that situations can exist and arise in which multiple R values are acceptable, it's important that one understands the actuarial freedom one has in selecting an array of R values that will make the application of the BRR method valid in any given situation. To this end, I will attempt to expand on one specific situation Mr. Barnhart uses as an example and then extend the logic to yet another—one I feel to be very important to the valuation of major medical-type policies.

For the sake of clarification, I have attempted to illustrate with sample calculations the points I make in the remainder of this discussion. All are based on the following assumptions:

A company is to value its individual (or individually underwritten trust or association) major medical policy, currently selling for $1,000 gross annual premium, but attained age rated. Due to the underwriting, certain pre-existing provisions, benefit limitation provisions, and expense levels, claim costs are anticipated to be 40 percent, 60 percent, and 70 percent of gross premium for policy years 1, 2, and 3 or more, respectively. The impact of additional claim cost increases beyond the first year resulting from inflation/technology trends is ignored. Also assume that any of the aggregate assumptions regarding the distribution of business and persistency do not change over the life of the policy. Persistency is expected to be 60 percent in year 1 and 80 percent each year thereafter. It is also assumed that the attained age gross premium scale is computed such that the difference between consecutive ages is proportional to the ultimate claim costs for those ages. For simplicity of illustration, because such a proportionality causes no generation of reserves, the models and examples shown in this paper ignore this element. Also for simplicity, interest is assumed to equal 0 percent.

Tables 1 and 2 illustrate the anticipated experience under the above assumptions for a 35-year-old insured under a policy expiring at age 65. Table 2 differs from Table 1 in that it illustrates the effect of six continuous years of sales at a constant level. These two tables provide the support values for the illustrations that follow.

Multiple R*'s*

In a perfectly predictable world a constant lifetime R is a readily obtainable quantity. Unfortunately, as Mr. Barnhart frequently points out, this in practice is not the case for health policies with characteristics such as those stated in the Introduction. This leads to one of the reasons for employing multiple

TABLE 1

LOSS RATIO DEVELOPMENT FROM ASSUMPTIONS FOR REPRESENTATIVE AGE 35 POLICY EXPIRING AT AGE 65

Policy Year	Lives at Year Beg.	Gross Premium	Year's			Cumulative		
			Loss Ratio	Premium	Claims	Premium	Claims	Loss Ratio
1	1.0000	1,000	0.4	1,000.00	400.00	1,000	400	0.400
2	0.6000	1,000	0.6	600.00	360.00	1,600	760	0.475
3	0.4800	1,000	0.7	480.00	336.00	2,080	1,096	0.527
4	0.3840	1,000	0.7	384.00	268.80	2,464	1,365	0.554
5	0.3072	1,000	0.7	307.20	215.04	2,771	1,580	0.570
6	0.2458	1,000	0.7	245.76	172.03	3,017	1,752	0.581
7	0.1966	1,000	0.7	196.61	137.63	3,214	1,889	0.588
8	0.1573	1,000	0.7	157.29	110.10	3,371	2,000	0.593
9	0.1258	1,000	0.7	125.83	88.08	3,497	2,088	0.597
10	0.1007	1,000	0.7	100.66	70.46	3,597	2,158	0.600
11	0.0805	1,000	0.7	80.53	56.37	3,678	2,215	0.602
12	0.0644	1,000	0.7	64.42	45.10	3,742	2,260	0.604
13	0.0515	1,000	0.7	51.54	36.08	3,794	2,296	0.605
14	0.0412	1,000	0.7	41.23	28.86	3,835	2,325	0.606
15	0.0330	1,000	0.7	32.99	23.09	3,868	2,348	0.607
16	0.0264	1,000	0.7	26.39	18.47	3,894	2,366	0.608
17	0.0211	1,000	0.7	21.11	14.78	3,916	2,381	0.608
18	0.0169	1,000	0.7	16.89	11.82	3,932	2,393	0.608
19	0.0135	1,000	0.7	13.51	9.46	3,946	2,402	0.609
20	0.0108	1,000	0.7	10.81	7.57	3,957	2,410	0.609
21	0.0086	1,000	0.7	8.65	6.05	3,965	2,416	0.609
22	0.0069	1,000	0.7	6.92	4.84	3,972	2,421	0.609
23	0.0055	1,000	0.7	5.53	3.87	3,978	2,425	0.609
24	0.0044	1,000	0.7	4.43	3.10	3,982	2,428	0.610
25	0.0035	1,000	0.7	3.54	2.48	3,986	2,430	0.610
26	0.0028	1,000	0.7	2.83	1.98	3,989	2,432	0.610
27	0.0023	1,000	0.7	2.27	1.59	3,991	2,434	0.610
28	0.0018	1,000	0.7	1.81	1.27	3,993	2,435	0.610
29	0.0015	1,000	0.7	1.45	1.02	3,994	2,436	0.610
30	0.0012	1,000	0.7	1.16	0.81	3,995	2,437	0.610

TABLE 2

ANTICIPATED LOSS RATIO CALCULATION
FOR SIX CONTINUOUS YEARS OF SALES FOR REPRESENTATIVE PLAN

	Yearly			Cumulative		
Year	Premium Total	Claim Total	Loss Ratio*	Premium	Claims	Loss Ratio
1.......	1,000	400	0.400	1,000	400	0.400
2.......	1,600	760	0.475	2,600	1,160	0.446
3.......	2,080	1,096	0.527	4,680	2,256	0.482
4.......	2,464	1,365	0.554	7,144	3,621	0.507
5.......	2,771	1,580	0.570	9,915	5,201	0.525
6.......	3,017	1,752	0.581	12,932	6,953	0.538
7.......	2,214	1,489	0.673	15,146	8,442	0.557
8.......	1,771	1,240	0.700	16,917	9,682	0.572
9.......	1,417	992	0.700	18,333	10,673	0.582
10.......	1,133	793	0.700	19,467	11,467	0.589
11.......	907	635	0.700	20,373	12,101	0.594
12.......	725	508	0.700	21,099	12,609	0.598
13.......	580	406	0.700	21,679	13,015	0.600
14.......	464	325	0.700	22,143	13,340	0.602
15.......	371	260	0.700	22,514	13,600	0.604
16.......	297	208	0.700	22,812	13,808	0.605
17.......	238	166	0.700	23,049	13,974	0.606
18.......	190	133	0.700	23,239	14,108	0.607
19.......	152	106	0.700	23,392	14,214	0.608
20.......	122	85	0.700	23,513	14,299	0.608
21.......	97	68	0.700	23,611	14,367	0.609
22.......	78	55	0.700	23,688	14,422	0.609
23.......	62	44	0.700	23,751	14,466	0.609
24.......	50	35	0.700	23,801	14,500	0.609
25.......	40	28	0.700	23,840	14,528	0.609
26.......	32	22	0.700	23,872	14,551	0.610
27.......	26	18	0.700	23,898	14,569	0.610
28.......	20	14	0.700	23,918	14,583	0.610
29.......	16	11	0.700	23,935	14,594	0.610
30.......	13	9	0.700	23,948	14,603	0.610
	10	7	0.700	23,957	14,610	0.610
	7	5	0.700	23,964	14,615	0.610
	4	3	0.700	23,968	14,618	0.610
	3	2	0.700	23,971	14,620	0.610
	1	1	0.700	23,972	14,621	0.610

*Stationary population is reached when 30 years of continuous sales occur. Yearly loss ratio is clearly sum of claims (400 + 360 + ... + 0.81) divided by sum of premium for each year of sales (1000 + 600 + ... + 1.16), which equals 0.610. (See Table 1.)

R values. The paper refers to this process as "corrections" of R and labels such a correction as R'. The mathematical justification is given in the last sentence of Section III and amply explained in the discussion of Exhibit 5 in Section IV, "Consideration of More Complex Scenarios." Obviously, a "correction" to an estimated value in a mathematical equation simply serves to improve the validity of the original equation. As has been stated and emphasized in Section III.D, "If R is accurate, the equivalence is accurate. Therefore the retrospective valuation is accurate."

Not so obviously valid is the other set of circumstances justifying multiple R values. These could be categorized as "pricing reasons," that is, reasons that lead to the creation of a series of premiums intended to cover changing levels of costs over time. The creation of such a series of premiums could have been intended at inception or else arise at some time after inception due to a significant change in expectations, usually evidenced by a rerate. Exhibit 7 illustrates one such situation. It is intended that premium rates in the early life of a policy be loaded to cover "more rapid amortization of first-year expense" than is planned under later years' premium rates. This also provides an example of a change in the expectations—in this example, the discontinuance of sales after five years. Working through the algebraic formulas in Section III with an array of R values does in fact prove also to be valid in situations in which $Agg^{E}P$, corresponding to the given array element of R, is set equal to the $Agg^{E}B$ over the same time interval.

Of course, it is very probable in real life that combinations of both reasons would lead to the use of multiple R's or, using this paper's terminology, multiple R primes, once sufficient experience has emerged to transform the "expected" to the "probable."

Let's now expand on Exhibit 7. Exhibit 7 anticipates a lifetime loss ratio of 60 percent, somewhat greater than the cumulative loss ratio of the initial five years of sales, but less than the 61.4% of the actual policy lifetime loss ratio developed in Exhibit 6. Obviously, renewal loss ratios are necessarily greater than the 61.4 percent true lifetime ratio (because first-year expenses are then being amortized less rapidly), and that is illustrated to be 63.8 percent. Selection of 60 percent as the initial element of the array of 2 R's is somewhat arbitrary from what I can tell from the paper. Certainly 61.0 percent could have been chosen, giving a little more conservatism to the reserve. How about selecting 55 percent, or some other value for that matter? There obviously exists a family of possible R arrays. The real question concerns determination of the boundaries of the range.

The answer is to be found in two sources. One is in the pricing assumptions. If the reason for selecting a dual R in the first place was to recognize the accelerated amortization of first-year expense, the initial R must be calculated to be consistent with the rate of acceleration. Take the extreme case, for instance, that of amortizing the entire first-year expense in the first year. The first R could then be as low as the first-year loss ratio, 35.35 percent. But there may have been a five-year minimum anticipation of sales at time of inception that was priced in the product. In this case, in order to avoid a negative reserve at the end of the five-year period (which of course would mean inadequate funding, rendering the plan insolvent), the initial R would necessarily need to be as great as the present value of five years of anticipated claims divided by five years of anticipated premiums. I will call this the *pricing* loss ratio. In Exhibit 7, this proves to be 44 percent.

Now the second source needs to be considered, that is, the regulatory environment. If in fact the actuary certified that the premium rate schedule filed would produce a minimum loss ratio of 55 percent, then 55 percent becomes the low boundary of the acceptable R range. For the high boundary, any value that would not leave the gross premiums insufficient to fund expenses would be acceptable, but there would be no reason that it be set greater than the *policy* lifetime loss ratio, so far as minimum reserve standard purposes are concerned.

Let me use my example to illustrate how I would select an array of R's consistent with pricing intentions and regulatory requirements.

Selecting the First R *of a Multiple* R *Array*

After review of the regulations, let's say that I find that the minimum acceptable loss ratio is 50 percent. My company also has the practice of amortizing expenses more rapidly than the full policy lifetime, so I have computed an R less than the 61 percent policy lifetime loss ratio (Table 2). The premium rates that lead to this illustration were divided by considering only projected experience over the six years in which sales were expected. Loss ratio expectations were extended beyond the sixth year simply to convince myself that the priced rates would not require significant rate increases (without consideration for inflation trend) that may be unrealistic because of regulatory reasons or persistency reasons (one has to carefully recognize that even though the policy provides the right for the insurer to raise rates, the insurer has an obligation to make it reasonable for the insured to retain the policy to its natural expiry). The development of loss experience for the later years shows that annual loss ratios stabilize at 70 percent, so I'm satisfied that with the lower renewal expenses I have met the policyholder persistency concern. Computation of my first R is simple. I select the anticipated loss ratio over the six-year pricing lifetime, which as Table 2 illustrates, is 53.8 percent. It's greater than the statutory minimum and, by definition, will develop a sixth-year terminal reserve of zero. Table 3 shows this development.

TABLE 3

LEVEL BRR CALCULATION BASED ON ALR = 0.538, CUMULATIVE SIX-YEAR OUTSET PRICING
7TH YEAR ILLUSTRATED BEFORE ANTICIPATED RENEWAL RATE CALCULATION

	Yearly			Cumulative			BRR (0.538 − Cumulative Loss Ratio) • Premium
Year	Premium Total	Claims Total	Loss Ratio	Premium	Claims	Loss Ratio	
1	1,000	400	0.400	1,000	400	0.400	138.00
2	1,600	760	0.475	2,600	1,160	0.446	238.80
3	2,080	1,096	0.527	4,680	2,256	0.482	261.84
4	2,464	1,365	0.554	7,144	3,621	0.507	222.67
5	2,771	1,580	0.570	9,915	5,201	0.525	133.74
6	3,017	1,752	0.581	12,932	6,953	0.538	4.99
7	2,214	1,489	0.673	15,146	8,442	0.557	N/A

Selecting Renewal R'*s of a Multiple* R *Array*

Let me complicate this scenario to better illustrate real-life situations. Assume that the actuary, in the fourth year, after observing that the year-to-year loss ratio is growing rapidly from 40 percent in the first year to 55.4 percent in the latest year, makes a computation that shows that the year-to-year loss ratio will continue to grow into the 60 percent and higher range before long. Rather than waiting until the expiry of the initial six-year pricing term, a rerate is calculated, increasing rates to target a new loss ratio of 55 percent for the next three years. The future projected loss ratio, therefore, is 55 percent. I recompute the new anticipated lifetime loss ratio from inception and find it to be 54.4 percent. As before, I am assuming that the regulation of the state would allow an ALR originally filed as low as 50 percent. In this example, the new lifetime anticipated loss ratio would exceed 50 percent, so this is a reasonable assumption.

Table 4 illustrates the rerate calculation described above, the developing loss ratio, and reserve development using the R' reasoning referred to above. The footnote of that table shows the computation of the rerate. Note that the reserve existing at the time of rerate (the fourth-year terminal reserve of $222.67) is used to offset the otherwise needed rate increase. As the paper notes, reserves may alternatively be calculated as the summation of the components of the individual rates (Exhibits 2–4 in the paper). My Table 5 demonstrates the calculation for my example.

Finally, let me complete this line of thinking by examining the consequences of ignoring the reserve balance at the end of year 4 in determining

TABLE 4

LEVEL BRR CALCULATION BASED ON R' RESULTING FROM RERATE AFTER YEAR 4.
RERATE PERIOD IS YEARS 5–7, TARGET LOSS RATIO =0.55 WITH CURRENT RESERVE OFFSET

Year	Original Premium Total	Rerated Premium* Total	Claims Total	Yearly Loss Ratio	Cumulative Premium	Cumulative Claims	Cumulative Loss Ratio	BRR (R – Cumulative Loss Ratio) • Premium
				BRR Method "R" = 0.538				
1........	N/A		N/A	N/A	1,000	400	0.400	138.00
2........	N/A		N/A	N/A	2,600	1,160	0.446	238.80
3........	N/A		N/A	N/A	4,680	2,256	0.482	261.84
4........	N/A		N/A	N/A	7,144	3,621	0.507	222.67
				Revised Premium = 1.0449 of Original; BRR Method "R" = 0.544†				
5........	2,771	2,896	1,580	0.546	10,040	5,201	0.518	260.91
6........	3,017	3,152	1,752	0.556	13,192	6,953	0.527	233.95
7........	2,214	2,313	1,489	0.644	15,505	8,442	†0.544	0.00

*Rerated premium equals: (cumulative claims years 5–7 less terminal BRR, year 4)
as a ratio to (cumulative premiums year 5–7) divided by target loss ratio times originial premium
= 4599/8002 divided by 0.55 times original premium
= 1.0449 times original premium.

†R' equals the cumulative loss ratio after premium adjustment (before any grading from original R is done). Original "R" (0.538) still pertains to years 1–4 in the BRR calculation, Table 2.

TABLE 5

LEVEL BRR CALCULATIONS BASED ON SEPARATE RENEWAL RATE "R" STREAM, AFTER YEAR 4. RERATE PERIOD IS YEARS 5–7, TARGET LOSS RATIO =0.55 WITH CURRENT RESERVE OFFSET

Year	Original Premium Total	Rerated Premium* Total	Rerate Portion Stream‡	Claims Total	Yearly Loss Ratio	Cumulative-Rerate Stream‡ Premium	Cumulative-Rerate Stream‡ Claims	Cumulative-Rerate Stream‡ Loss Ratio	BRR (R − Cumulative Loss Ratio) • Premium	BRR Original Stream of Premiums (Table 3)	Total BRR
BRR Method "R" = 0.538											
1........	N/A		0	N/A	N/A	0	0	0.000	0.00	138.00	138.00
2........	N/A		0	N/A	N/A	0	0	0.000	0.00	238.80	238.80
3........	N/A		0	N/A	N/A	0	0	0.000	0.00	261.84	261.84
4........	N/A		0	N/A	N/A	0	0	0.000	0.00	222.67	222.67
Revised Premium = 1.0449 of the Original Premium*; BRR Method "R" = 0.579											
5........	2,771	2,896	124	1,580	0.546	124	0	0.000	72.04	133.74	205.78
6........	3,017	3,152	135	1,752	0.556	260	0	0.000	150.47	0.00	150.47
7........	2,214	2,313	2,313	1,489	0.644	2,573	1,489	0.579†	0.00	0.00	0.00

*Rerated premium equals: (cumulative claims years 5–7 less terminal BRR, year 4) as a ratio to (cumulative premiums year 5–7) divided by target loss ratio times original premium
=4,599/8,002 divided by 0.55 times original premium.
= 1.0449 times original premium.

†R' equals the cumulative loss ratio after premium adjustment (before any grading from original R is done).

‡Since year 7's premium or claims were not considered in the original "R", all of them must be considered attributable to the rerate portion, while for years 5 and 6, only the increase is attributed to the rerate stream. (In this illustration no increase in claims is driving the rerate, but it could have without affecting the calculation method.)

the renewal rate. Obviously, the first consequence is a required higher renewal premium rate. Table 6 illustrates the results. Note that the reserve calculation starting with year 5 is independent of the first four years, so the fourth year reserve can be released in its entirety. Rerating by this method illustrates that the initial pricing period, with the benefit of hindsight, was adjusted to four years, and not six as originally expected. Had our actuary known initially that the pricing period would be four years, the anticipated loss ratio would have been 50.6 percent (see Table 2), and the reserve would have been built and released normally to a final balance of zero by the end of the fourth year. Again, let me emphasize that the rating regulation would have to have allowed 50.6 percent in the first place. If state regulation allowed a loss ratio as low as 50 percent, this pricing mechanism would be perfectly acceptable, but on the other hand would not have been if rerating was to take place after only the second or third year (because the loss ratio developing over the six years under the revised premium rates would fall below minimums).

Passing through the Risk Rewards—"Prospectively or Retrospectively"

With Scenarios I and II in Section VI, "Consideration of Specific Issues and Problems," Mr. Barnhart rationalizes that the retrospective BRR method is acceptable in situations in which claims experience deviates from expectations, with the assistance of a couple of examples. I see the issue as this: Utilization of the BRR retrospective method of computing reserves may prevent companies from realizing the reward side of the risk formula inherent in rate setting until after a block of business is closed or until sometime after the time in which the reward is earned.

As I see it, it is a basic right of any party who assumes a "risk" to benefit from the up side of the risk to offset the costs for the down side. This right can be removed by law, as is the case in more than half the states that have in effect the Rate Filing Guidelines modeled on the NAIC Guidelines. In these states, Scenario I is perfectly valid; however, in the other states I have to question the need for the additional $2,000,000 reserve in Mr. Barnhart's example.

On the reverse side of the coin, when experience is worse than expected, as in Scenario II, there is no law to my knowledge to prevent the risk formula from taking its natural course, which is to incur the cost immediately. In the discussion of this scenario, Mr. Barnhart points out that the expected reserve is $2,000,000, the conservative reserve is $550,000, and the adjusted

TABLE 6

LEVEL BRR CALCULATIONS BASED ON SEPARATE RENEWAL RATE "R" STREAM, AFTER YEAR 4.
Rerate Period Is Years 5–7, TARGET LOSS RATIO =0.55 WITHOUT CURRENT RESERVE OFFSET

Year	Original Premium Total	Rerated Premium* Total	Claims Total	Yearly Loss Ratio	Cumulative Premium	Cumulative Claims	Cumulative Loss Ratio	BRR (R − Cumulative Loss Ratio • Premium	BRR Original Stream of Premium (Table 3)	Total BRR
BRR Method "R" = 0.538										
1........	N/A		N/A	N/A	N/A	N/A	N/A	0.00	138.00	138.00
2........	N/A		N/A	N/A	N/A	N/A	N/A	0.00	238.80	238.80
3........	N/A		N/A	N/A	N/A	N/A	N/A	0.00	261.84	261.84
4........	N/A		N/A	N/A	N/A	N/A	N/A	0.00	222.67	222.67
Revised Premium = 1.0955 of Original Premium; BRR Method "R" = 0.550										
5........	2,771	3,036	1,580	0.520	3,036	1,580	0.520	89.96	0.00‡	89.96
6........	3,017	3,305	1,752	0.530	6,341	3,332	0.525	155.87	0.00	155.87
7........	2,214	2,425	1,489	0.614	8,766	4,821	0.500†	0.00	0.00	0.00

*Rerated premium equals: (cumulative claims years 5–7) as a ratio to (cumulative premiums years 5–7)
divided by target loss ratio times original premium
= 4,821/8,002 divided by 0.55 times original premium.
= 1.0955 times original premium

†R' equals the cumulative loss ratio after premium adjustment (before any grading from original R is done).

‡The original year 5 reserve of 133.74 is replaced by the new reserve 89.96 because the new premium rate is adequate in and of itself; therefore 43.78 is immediately released as an immaterial overstatement.

is zero. Is the adjusted zero value really "approriate," given the "fact that retrospective experience in excess of expected makes it possible to file a rate increase that otherwise would not have been accepted by the state"? A number of states do not allow rate increases to recoup past losses. To some degree, is this not what the BRR does in such situations? It seems to me that the "appropriate" value ought to fall somewhere between zero and $2,000,000 and the method ought to specify how to derive it. I believe that the penalties, as well as the rewards, of undertaking a risk should be incurred immediately and not deferred as the BRR method tends to do.

This belief does not mean that the BRR method as proposed by Mr. Barnhart has no value in estimating reserves. It simply means that some adjustment might be reasonable in situations in which substantial deviation from expectation is identified. One such adjustment technique might be an expansion of the "net of stop loss basis" Mr. Barnhart develops in Section VI.D., "Small Contract Blocks and Reinsurance," to apply to large contract groups.

Conclusion

The BRR method is one of several methods we, as health actuaries, have as tools to value our business. Mr. Barnhart has done a great favor to our organization by the addition of this well-thought-out paper to our body of knowledge on the subject of valuation. I do not believe this will be the end of this subject, but it has for me, as I believe it will for others today and in days to come, provided a stimulus for thought on how to best accomplish our mission as professionals in the area of health insurance valuation.

(AUTHOR'S REVIEW OF DISCUSSION)

E. PAUL BARNHART:

I want to thank Don Cody and Tom Stoiber for their interest in the subject dealt with by the paper and for the insights and constructive analyses that both of their very useful discussions contain.

Don Cody has shown that the BRR method as developed in the paper, employing actual retrospective experience, falls at one extreme of a "family of reserves," while net premium reserves using no experience element in their determination fall at the opposite extreme.

Of particular interest is Mr. Cody's demonstration that intermediate methods, employing credibility factors that give variable degrees of recognition to actual experience, can readily be defined and utilized. BRR systems can therefore be developed involving partial experience rating, similar in concept to group experience rating methods based on degrees of credibility. The timing of profit-or-loss recognition is shown to depend on the degree of credibility of experience that is assumed.

Mr. Cody's discussion shows that choice of method does not have to be an all-or-nothing decision between 100 percent recognition of experience and 0 percent recognition of experience. Any appropriate degree of credibility along the scale can be employed.

Tom Stoiber's discussion is an interesting complement to Don Cody's, because his discussion also deals with variability in the application of, and choices used within, a broad family of methods. Mr. Stoiber's discussion, however, focuses on the use of R values varying over periods of time, rather than on credibility factors that may vary with respect to the whole lifetime of the reserve and the contracts valued. It is interesting to note that each approach can in its own way have a direct impact on the timing and recognition of profit and loss.

Mr. Stoiber challenges the effect that the BRR concept, as developed in the paper, can have in deferring income and profit into later years when experience temporarily deviates toward the favorable side of expected. Conversely, it can also mitigate the impact of losses, deferring these as well, when experience temporarily deviates toward the adverse side. His preference is that the penalties, as well as the rewards, of accepting risk should be incurred immediately rather than deferred.

The question here centers on how one views the ongoing nature of the contract. Is the risk accepted a single year at a time, subject to renewal from year to year as the contract may provide? Or is the risk more properly viewed as accepted for the entire period over which the contract may be renewed? One can no doubt answer this question either way. If renewability by the insured is guaranteed, I prefer to view the risk as long term. Viewed in a long-term perspective, I see no reason why "rewards or penalties," that is, profit or loss, should not be spread out more or less evenly over the long term, rather than have each separate year accept full and immediate impact of favorable or unfavorable deviation. This long-term view is, in my opinion, actuarially more logical. But I don't mean by this to contend that short-term recognition of gain or loss is invalid.

Mr. Stoiber questions, as a particular example, the appropriateness of my illustration of a zero value intermediate duration reserve, resulting from experience deviating strongly toward the adverse side of expected. He views this as a partial recoupment of past loss. I see it, however, more as limited *deferral* of temporary loss, an acceptable and logical effect occurring within the long-term duration of an ongoing contract. It is important here to recognize that only *limited* deferral is possible; since the reserve balance may not be negative. If a large temporary adverse loss were fully deferrable, the reserve would need to be allowed to go negative. If its minimum value is held at zero, any excess loss is incurred immediately.

So I think that Mr. Stoiber and I are really only emphasizing different aspects of ongoing long-term contracts. He is taking more the short-term, year-by-year view, while I am taking more of a long-term view. Don Cody's "family of reserves" approach also permits direct impact on short-term versus long-term timing of profit-and-loss recognition through the variable experience credibility factors that he discusses.

Again, my sincere thanks to both gentlemen for the insights and contributions contained in their respective discussions.