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AN EXTENSION OF THE NAIC SYSTEM FOR LIFE INSURANCE COST COMPARISONS

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ABSTRACT

The interest-adjusted method has come to be the most widely accepted method for comparing costs of individual life insurance policies. It has the important advantages of simplicity, understandability, and consistency with tradition. It has no important theoretical weaknesses as long as it is used as originally intended—that is, to compare new policies of similar plans.

There is, however, a growing need for a more general cost comparison method, one that can be employed to compare two policies with different plans of insurance, or to compare a policy already in existence with a new policy replacement. Such a more general method can throw considerable light on the term-permanent choice that faces the new insurance buyer, as well as on the cost efficiency of replacing an old policy with a new one.

It is suggested that a relatively simple modification of the interest-adjusted cost method will serve these more general purposes satisfactorily.

I. THE NAIC METHOD

WHAT is now known as the NAIC method of life insurance cost comparison had its beginnings in the 1969 report of an especially appointed industry task force. This committee concluded that what was then called the "interest-adjusted" method was the most satisfactory from a practical standpoint. Later the life insurance industry and the National Association of Insurance Commissioners accepted the recommendations of the task force. Today the regulations of several states require that the cost index of any new life insurance policy sold be computed in accordance with this prescribed method, and that such cost indexes be furnished to the buyer.

It has long been recognized that the NAIC method is a compromise between theory and practice. It has the advantages of ease of computation and explanation (particularly in comparison with some of the alternative methods) and closeness to the older ways of illustrating life

insurance costs. At the same time it corrects the obvious theoretical flaw inherent in the older approach, and produces a theoretically satisfactory result for the kinds of comparison for which it was designed. The method has, however, an obvious limitation: it is theoretically sound only when the policies being compared have the same plan of insurance and effective date.

Although the NAIC cost index system can be explained in more than one way, for the purposes of this paper it will be described as follows:

The cost index represents the level annual amount that each $1,000 of death benefit will have cost the policyowner over the first n policy years, assuming that

1. The insured is alive at the end of n years.
2. The policyholder has paid all premiums to date.
3. The policyowner's personal interest rate over the n years is i.
4. Any dividends illustrated by the insurer for the n-year period actually will be paid.

The basic net cost calculation recognizes that the policyowner has a right at the end of n years (whether or not he chooses to exercise it) to the cash value plus any termination dividend; an otherwise similar calculation that ignores this right is displayed under the title "net payment index." The net payment index is best interpreted as an indication of the annual cost of the protection if the policyowner dies during the n-year period, although for participating insurance with nonlevel dividends this view is technically correct only when death occurs at the end of that period.

The interest rate i is appropriately an after-tax rate; in the current NAIC model regulation, it is assumed to be 5 percent. Illustrations at $n = 10$ and $n = 20$ are called for. Thus, four values are typically displayed: net cost and net payment indexes at each of ten and twenty years.

Illustrations of the principle for nonparticipating insurance are displayed in Table 1. Dividends make the participating case only slightly more complicated.

II. THEORETICAL CONSIDERATIONS

The NAIC method has some confusing features, especially in that there are four indexes (rather than one), and the comparisons may give different indications depending upon which of the four is the point of focus. The interpretation of such conflicting results is not too difficult, however, as long as the policies being compared are on the same plan of insurance.

If Policy A looks better than Policy B on the basis of the twenty-year comparisons, but the reverse is true for the ten-year comparisons, the pricing of the two policies cannot be too dissimilar, and the technical explanation lies in differences in the timing of dividends or cash values.

If Policy A looks better on the net payment indexes, but the reverse is true on the net cost indexes, the technical explanation must lie in Policy B's having somewhat higher cash values or termination dividends. As long as cash-value differences are relatively small (as they normally will be if similar plans of insurance are being compared), this kind of reversal will occur relatively infrequently and it is not too confusing when it does occur.

TABLE 1

ILLUSTRATIONS OF NAIC METHOD FOR NONPARTICIPATING POLICIES

	Ordinary Life—Premium per Thousand, $12.25		20-Year Term—Premium per Thousand, $5.02	
	10 Years	20 Years	10 Years	20 Years
Cash value	$120.05	$274.51	$22.36	None
Net payment index	12.25	12.25	5.02	5.02
Net cost index	3.16	4.34	3.33	5.02

The only theoretical difficulty with the NAIC method lies in the assumption that the policyholder is alive at the end of n years. Obviously the more realistic assumption is that the policyholder is a member of a group of people whose chances of dying follow a mortality table. Substitution of the second assumption for the first can be accomplished, at the expense of a more complex calculation and a more difficult explanation; but the additional realism can be shown to affect the results very little if similar policies are being compared.

It is appropriate at this point to note the reason why the NAIC method is *not* endorsed for comparisons of dissimilar policies. The reason is essentially that the assumption of no mortality distorts the comparisons between policies at different points in the term-permanent spectrum. The examples introduced previously will be used to make this clear.

It happens that the premiums and cash values of the term and whole life policies illustrated earlier are exact actuarial equivalents. The premiums are net level premiums at age 35 on the 1958 CSO Table with interest at 5 percent. The cash values are full net level reserves on the

same interest-mortality basis. If one believes that the 1958 CSO Table is representative of the mortality to be experienced by the group to which this prospect belongs, and if the prospect's personal interest rate is 5 percent, any indexes of the cost of these two policies should turn out to be exactly the same.

The actual results show the difficulty. The net cost indexes show the ordinary life policy to be "cheaper"—as indeed it will be if the policyowner is still alive after n years. The net payment indexes show the term policy to be "cheaper"—as indeed it will be if the policyowner dies before n years. The dilemma is that the prospective policyowner cannot recognize that the two policies are priced *exactly alike* when the probabilities of living to the end of n years are correctly taken into account.

III. THE PROPOSAL

As a solution to the technical problems associated with a comparison of dissimilar policies, it is proposed that a "discount for mortality" be introduced into the calculation of a single index for a given n. Just as the NAIC method modifies the traditional net cost method by introducing an interest element, so the interest-adjusted method could become interest- and mortality-adjusted. If this were done, we could eliminate the restriction that only similar policies can be compared.

This author is not the originator of the interest-and-mortality-adjusted concept. Two earlier papers by Ryall[1] and one by Hill[2] employed the mortality discount, as did several of the methods investigated by the industry committee. Later the Society's Committee on Cost Comparison Matters and Related Issues described the interest-and-mortality-adjusted method but confirmed the industry view that in comparing similar policies it offers little improvement over the simpler interest-adjusted index.

The mechanics of the interest-and-mortality-adjusted calculation will be clear immediately to actuaries. The term $(1 + i)^t$ is replaced by D_x/D_{x+t} throughout. In less actuarial terms, premiums, dividends, and cash values are taken into the calculation in a way that recognizes that they will not be payable if death occurs.

The resulting index will be larger than the NAIC net cost index but smaller than the net payment index. It can be interpreted best as the level annual amount that each $1,000 of death benefit will have cost the

[1] Peter L. J. Ryall, "A Fast, More Meaningful Twenty-Year Net Cost Formula," *TSA*, XXI (1969), 101; "Twenty-Year Policyholder Cost Comparisons among Ordinary Insurance Plans," *TSA*, XXI (1969), 119.

[2] J. Stanley Hill, "Net Cost Comparison of Dissimilar Life Insurance Contracts: The Standard Mortality Cost Method," *TSA*, XXIII (1971), 289.

group of policyowners buying insurance on that policy at that age over an n-year period, recognizing that those who die before the end of the period will have had a higher annual cost.

Continuing with the earlier illustration, the proposed index is calculated to be the following:

	10-Year Index	20-Year Index
Ordinary life...	3.37	5.02
Term.....	3.37	5.02

It is left for the reader to convince himself that these results, when compared with the NAIC results shown earlier, and in light of the artificial rate structure assumed in these illustrations, are just what one would expect.

IV. COMPARISON BETWEEN POLICIES OF SIMILAR ISSUE DATE AND AMOUNT BUT DIFFERENT PLANS

It has been suggested here that a modification of the NAIC method, to introduce a discount for mortality as well as one for interest, will make possible valid comparisons between otherwise similar policies of different plans. Before this conclusion is accepted too wholeheartedly, we should examine any caveats or limitations.

The most important of these is that the cost index suggested is fairly sensitive to both the interest rate and the mortality table. The higher the assumed rate of interest and the higher the assumed rates of mortality, the higher (in general) the cost indexes, but the effect is a function of the size of the nth-year cash value.

It is important to recognize the reason for this, which in turn will explain any exceptions to the general rule. The higher cost indexes (when higher rates of interest or mortality are used) arise because the higher discount factors make the nth-year cash value (and any associated termination dividend) relatively less valuable. For a level premium nonparticipating term policy that has no termination value after n years, the suggested cost index is unaffected by variation in mortality and interest assumptions, but for a policy with a substantial nth-year termination value, the suggested cost index will be sensitive to such assumptions.

The implications of this varying sensitivity to interest and mortality variables are as follows: In order to be fair to all policies within the term-permanent spectrum, both the interest rate and mortality table chosen for the calculation of the cost index must meet the test of realism. There

must be agreement upon an interest rate and a mortality table before valid comparisons can be drawn, and these assumptions must be realistic from the policyowner's viewpoint.

To illustrate the point, let us go back to our earlier examples of ordinary life and twenty-year term. Identical cost indexes are produced as long as 5 percent interest and the 1958 CSO Table are chosen; that is, the two policies are actuarial equivalents (i.e., offered at the same price) if interest is at 5 percent and mortality follows 1958 CSO. Varying these assumptions, however, produces the results shown in Table 2. Ordinary life looks better if the discount rates are reduced; term looks better if the discount rates are raised. A similar force is always operating when any two policies have substantially different values at the end of the comparison period.

TABLE 2

EFFECT OF VARYING MORTALITY AND INTEREST ASSUMPTIONS

INTEREST	MORTALITY	20-YEAR INDEX	
		Ordinary Life	20-Year Term
5%.....	1958 CSO	5.02	5.02
6%.....	1958 CSO	5.83	5.02
5%.....	125% 1958 CSO	5.19	5.02
4%.....	1958 CSO	4.14	5.02
5%.....	75% 1958 CSO	4.86	5.02

If the suggested cost index is to be employed for the comparison of dissimilar policies, it is clear that any pressure from term advocates (to push the discount rates up) and from whole life advocates (to push them down) must be resisted. If an interest rate and a mortality table fair to both can be agreed upon, much light can be thrown upon the question as to the price patterns by plan of insurance.

In the real world, of course, term and permanent policies will never produce identical cost indexes; which of the two will tend to show higher is a matter of conjecture. Reasons why actuaries may suspect that term may be priced higher in the marketplace include higher actual mortality and poorer persistency. On the other hand, term insurance commissions and associated selling costs tend to be lower. Use of the cost indexes suggested here will add fuel to any "term versus permanent" controversy, but which side will be favored is not immediately apparent.

It should be noted that the lack of a valid method of comparing the pricing of term and whole life (and various combinations of the two) has led to considerable pressure from federal government sources to develop an acceptable method. The Federal Trade Commission and a subcommittee of the House Committee on Interstate and Foreign Commerce are promoting methods that compare a whole life policy with a hypothetical arrangement made up of separate insurance and savings elements. This approach (in any of its several forms) is extremely complicated and cumbersome, involves a comparison with a hypothetical term policy rather than with term policies actually in the marketplace, is objectionable to many because it misrepresents the indivisible structure of the whole life arrangement, and is in general a poor solution to the problem of illustrating term-permanent pricing differences. The pressure exists nonetheless, based on the not unreasonable premise that the buyer of life insurance has a right to assistance in making the decision between permanent and term. The author believes that the suggested extension of the NAIC cost disclosure method will meet this need.

V. COMPARISON BETWEEN EXISTING POLICIES AND NEW POLICIES

The introduction of the mortality discount into the NAIC cost comparison method also makes it possible to compare fairly an existing policy now at duration t with a new one issued at age x. The period of comparison is over the first n years of the new policy (durations t to $n + t$ of the existing policy). Assuming only that the two policies are alike in that they provide the same death benefits over years of age x to $x + n$, the n-year cost indexes of the two policies can be computed as follows and then compared.

For the new policy issued at age x	No modification to the method previously described.
For the existing policy issued at age $x - t$	Compute the index based on premiums and dividends over policy years $t + 1$ to $t + n$, and the cash value at duration $n + t$. Then make a positive correction to recognize CV_x, the cash value (and any terminal dividend payable on withdrawal) of the existing policy. The correction can be expressed as $CV_x/\ddot{a}_{x:\overline{n}\rceil}$, where $\ddot{a}_{x:\overline{n}\rceil}$ is a temporary life annuity calculated using the agreed-upon mortality and interest basis. Alternatively, the cash value at age $x + n$, before it enters the calculation, can be reduced by $CV_x(D_x/D_{x+n})$. The results should be the same.

The upward adjustment to the cost index for any cash value of the existing policy may seem, at first glance, to present its cost unfairly. It is nonetheless necessary to recognize the lost "opportunity" of converting the existing policy to cash.

Continuing the hypothetical examples previously used, assume that after ten years it is proposed to replace the ordinary life policy issued at age 35 with a twenty-year term policy issued at age 45. The premiums and appropriate cash values on the two policies are as follows:

	Existing Policy	New Policy
Age at issue	35	45
Premium	$ 12.25	$11.78
Cash value:		
Duration 10	120.05	54.78
Duration 20	274.51	.....
Duration 30	449.76	.....

The ten- and twenty-year cost indexes, calculated in accordance with the methods previously proposed, are as follows:

Attained Age	Cost Index	
	No Replacement	Replacement
55	$ 7.86	$ 7.86
65	11.78	11.78

The fact that the cost indexes are exactly the same in this hypothetical case is no accident. The premiums and cash values of the old policy and the new are contrived to be on an identical pricing structure as to interest and mortality, and expenses are treated as zero. Moreover, the mortality and interest assumptions in the premium and cash-value calculations are the same as those used in making the comparison. When these rigorous conditions exist, the indexes for the old and new policies must be identical, even though the policies differ as to duration and the plans of insurance are not the same.

As in the comparison involving unlike plans (Sec. IV), the choice of mortality and interest to be used in the cost index computation is important. In general, high interest and mortality assumptions will improve the relative position of any replacement, while lower assump-

tions for these two discounts will make the existing arrangement look relatively better. Agreement upon mortality and interest assumptions that are fair to both sides will be difficult but not outside the realm of possibility.

There is a popular presumption that, when all other things are equal and when a fair comparison is made, the existing policy will ordinarily show up as "cheaper" than a replacement. This presumption stems from the high first/lower renewal commission practice almost universally used in the life insurance industry, and the additional first-year expenses that the pricing must bear if one policy replaces another. Other factors are involved, of course, that may overcome this presumption. When they do, the indexes for the replacing policy will be shown to be lower, and from the policyowner's point of view the replacement may be justified.

There may be a question in some minds as to the necessity of extending life insurance cost comparisons to policies already in force. Once a policy is on the books, the policyowner presumably is less likely to be interested in competing arrangements. There has so far been no strong push from industry or government sources for the extension of cost comparison methods to in-force policies.

In view of the considerable interest in the matter of replacements, this is somewhat surprising. To the author of this paper, the inability of any of the cost disclosure methods heretofore introduced to compare a new policy with the future costs of one already in existence is a serious weakness. Demands for a less limited cost disclosure method will surely develop, if indeed they are not with us already.

Another development that clearly leads toward price disclosure on existing policies is the introduction of policies that incorporate new coverage into already existing contracts. Adjustable life is the most conspicuous example. Present cost disclosure methods give no help to the holder of such a policy as he considers the possibility of adding to his life insurance program through adjustment.

VI. AN INTEREST-MORTALITY TRANSPOSITION

Up to this point, this paper has advocated the introduction of a mortality table, as well as an interest rate, into the NAIC cost disclosure method, in order to make the method more widely applicable. Only if mortality is taken into account does the method have satisfactory theoretical characteristics when dissimilar policies are to be compared.

It is possible, however, to introduce the mortality assumption indirectly, by an increment to the assumed interest rate i. For any values

of t and x, the equality $D_x/D_{x+t} = (1 + i')^t$ holds for some i' greater than i. The value of i' is a function of x, t, i, and the underlying mortality table. The accompanying table indicates the magnitude of i', based on

x	i'	
	$t = 10$	$t = 20$
25.....	5.23%	5.30%
35.....	5.39	5.65
45.....	5.91	6.58
55.....	7.25	8.92
65.....	10.60	14.39

$i = 5$ percent and the 1958 CSO Mortality Table. We see that i' exceeds i by about $\frac{1}{4}$ percent at age 25, by about $\frac{1}{2}$ percent at age 35, and by rapidly increasing amounts as x goes beyond age 40. The value of i' is noticeably greater for twenty-year than for ten-year comparisons, especially at the higher values of x. The variability of i' by age at issue and duration makes the approximation somewhat difficult to justify. It does have some merit, however:

1. Use of an interest rate increment in place of an explicit mortality adjustment minimizes the change from the present NAIC method and may at the same time make the calculations easier.
2. In view of the fact that there is no real agreement as to either the assumed interest rate or the assumed mortality table, an i' of something like

x	i'
25.....	$5\frac{1}{4}$%
35.....	$5\frac{1}{2}$
45.....	$6\frac{1}{4}$
55.....	8
65.....	12

might find as much acceptance as some combination such as $i = 5$ percent and mortality based on 1958 CSO.

The author of this paper does not advocate the use of such an approximation, but he offers it as an alternative that some may find more acceptable.

VII. AN EXAMPLE FROM THE REAL WORLD

An example of the application of the comparison method suggested, this one taken from the practical world of life insurance pricing, is shown

in Table 3. For this illustration, we compare, over a twenty-year period, policies of $25,000 face amount for a male insured at age 35. Two participating whole life plans (ordinary life and life paid up at age 65) offered by the author's former company are compared with participating five-year renewable and convertible term in the same company, and with a combination of $12,500 ordinary life and a $12,500 twenty-year term rider. The five-year term is treated as if it were renewed at ages 40, 45, and 50, and also as if it were converted to ordinary life at age 40. The interest- and mortality-adjusted net cost indexes are shown on two assumptions as to interest (5 and 6 percent) and a single assumption as

TABLE 3

ILLUSTRATION OF PROPOSED COMPARISON METHOD

POLICY	INTEREST- AND MORTALITY-ADJUSTED NET COST INDEXES—PER THOUSAND			
	5% 1958 CSO	Ratio	6% 1958 CSO	Ratio
Ordinary life	5.06	1.00	6.17	1.00
Life paid up at age 65	5.76	1.14	7.09	1.15
5-year term—renewed	6.64	1.31	6.53	1.06
5-year term—converted	6.02	1.19	6.60	1.07
One-half ordinary life, one-half 20-year term rider	6.72	1.33	7.27	1.18

to mortality (1958 CSO). Ratios are also shown, with the ordinary life index as the base.

It will be noted that in the pricing structure of this company, the ordinary life policy appears less costly than any of the combinations involving term, and less costly than the higher-premium life paid up at age 65 plan as well. The relative position of term improves when the policyowner's personal interest rate is assumed to be 6 percent. These results are in line with what might be expected from theoretical considerations.

Turning now to policies that are already in force, the following shows similar interest- and mortality-adjusted cost indexes for $25,000 policies issued five years ago at age 30 by the same company. Only the ordinary life and five-year renewable and convertible term plans are shown, the latter now expiring without value but assumed to be renewed until age

55. The ratios shown are for comparison with the new ordinary life policy illustrated above.

Policy	Interest- and Mortality-adjusted Net Cost Indexes—per Thousand			
	5% 1958 CSO	Ratio	6% 1958 CSO	Ratio
Ordinary life—5 years old	3.68	0.73	5.18	0.84
5-year term—5 years old	5.99	1.18	5.90	0.96

The results indicate that in this company it is *not* to the policyowner's advantage to (1) replace old ordinary life with new, (2) replace old five-year term with new, or (3) replace old ordinary life with new term. Converting old term to new ordinary life is a more debatable proposition, the indications being in favor under the 5 percent interest assumption, against under 6 percent.

It should be noted carefully that the results displayed here are the result of pricing patterns within one specific company and cannot be generalized to others. Results are unpredictable if comparisons are made involving more than one company. These illustrations nonetheless indicate the power and versatility of the cost comparisons proposed.

VIII. STRENGTHS AND WEAKNESSES OF THE COST COMPARISON SYSTEM PROPOSED

If the goal of the cost comparison system is only to facilitate comparison of two or more new policies of similar plan, the interest-and-mortality-adjusted system proposed here is no improvement over the interest-adjusted system now backed by the NAIC. By consolidating the net cost and net payment indexes into a single interest- and mortality-adjusted index, the number of comparisons with which the prospect must cope is cut in half; but the calculations are more complex and less explainable. Moreover, any change will tend to halt progress in getting a satisfactory method generally accepted.

If, however, the goal is to include comparisons between new policies differing as to plan, or between new policies and policies already in force, the existing NAIC approach is not theoretically sound, and a modification becomes necessary. Fortunately, a conceptually simple modification seems to serve the purpose. Discount for both interest and mortality must be employed, rather than for interest alone. Otherwise the strengths of the NAIC method remain.

There is, however, one new sensitivity to be concerned about. When employed to compare dissimilar policies, the proposed methods result in price comparisons that are sensitive to the underlying interest and mortality assumptions. An agreed-upon actuarial basis that is fair to both high and low premium-per-thousand plans, and to both replacers and preservers of existing policies, will be difficult to find. If this hurdle can be overcome, price comparisons of a much less limited nature may well become practical.

DISCUSSION OF PRECEDING PAPER

ROBERT B. LIKINS:

This interesting paper attempts the worthwhile goal of expanding the use of cost indexes to the comparison of unlike policies as well as of policies issued at different times. Of particular interest is the fact that Mr. Trowbridge confined his index method to a form similar to the surrender cost index (SI) calculation suggested by the NAIC Model Life Insurance Solicitation Regulation.

Surrender Cost Index

A result not specifically mentioned by Mr. Trowbridge is that his suggested SI calculation is equivalent to calculating the n-year level annual term premium for his theoretical (using only 5 percent interest and 1958 CSO mortality) policies. That is, if

m = Number of past policy years for the existing insurance,
n = Future index measurement period, and
${}_{m}^{n}SI_{x-m}$ = n-Year surrender cost index using interest and mortality as suggested by Trowbridge for a policy issued at age $x - m$ that has been in force for m years (this is the index for the subsequent n-year period, from age x to age $x + n$),

then

${}_{m}^{n}SI_{x-m} = P^{1}_{x:\overline{n}|}$, the n-year level annual term premium

Note that this result is independent of m and the type of policy (term, whole life, or endowment).

Select and Ultimate Mortality

If the Trowbridge calculation of SI is used, the most appropriate mortality table to use in comparing new policies or in comparing new policies with in-force policies is a select and ultimate table based on current experience. A select and ultimate table more nearly represents the mortality an applicant purchasing a new policy should expect to experience, since most applicants, and particularly those considering replacement of a standard issue policy, would be issued at standard (select and ultimate) rates. For simplicity, one male-and-female composite table of select and ultimate mortality can be used, but it is theoretically less accurate than two separate tables.

Interest Substitute for Interest and Mortality

The interest rate, i', which Trowbridge approximates from $D_x/D_{x+n} = (1 + i')^n$, can be approximated somewhat more closely by using a series of accumulation factors, since policies normally require premium payments—and may illustrate dividends—over the entire n-year period. I suggest solving for the value of i' that satisfies

$$\frac{N_{[x]} - N_{[x]+n}}{D_{[x]+n}} = \ddot{S}_{[x]:\overline{n}|} \doteq \ddot{S}_{\overline{n}|i'} .$$

Table 1 of this discussion illustrates, in columns 1–4, the values of i' derived using the actuarial functions described above and one of Prudential's composite tables of select and ultimate mortality. A comparison of columns 1 and 3 and columns 2 and 4 shows that the values are close, but the greater weight given to the higher mortality at the older ages in the $S_{[x]:\overline{n}|}$ function makes the i' values calculated from that function slightly higher. For comparison purposes, columns 5 and 6 illustrate the accumulated temporary life annuity values of i' using 1958 CSO mortality. Five percent interest is used throughout Table 1 as the value of i.

A review of Trowbridge's SI calculation suggests several options for approximating interest and mortality using interest only. The approximations are desirable because index calculations sometimes are done manually by the agent. They are shown below, starting with the least accurate and easiest to use and ending with most accurate and most difficult to use.

TABLE 1

VALUES OF i' EQUIVALENT TO 5 PERCENT INTEREST AND SELECT AND ULTIMATE MORTALITY

AGE [x]	FORMULA USED TO CALCULATE i'							
	$D_{[x]}/D_{[x]+n} = (1+i')^n$		$\ddot{S}_{[x]:\overline{n}|} = \ddot{S}_{\overline{n}|i'}$		$\ddot{S}_{x:\overline{n}|} = \ddot{S}_{\overline{n}|i'}$ 1958 CSO		Formula (1)	
	$n=10$ (1)	$n=20$ (2)	$n=10$ (3)	$n=20$ (4)	$n=10$ (5)	$n=20$ (6)	$n=10$ (7)	$n=20$ (8)
15	5.1%	5.1%	5.1%	5.1%	5.2%	5.2%	5.3%	5.4%
25	5.1	5.1	5.1	5.2	5.2	5.3	5.4	5.5
35	5.2	5.3	5.2	5.4	5.4	5.8	5.5	5.6
45	5.4	5.9	5.5	6.1	6.0	6.9	5.6	5.9
55	6.1	7.1	6.3	7.7	7.5	9.7	6.0	6.6
65	7.4	10.7	7.9	12.1	11.2	15.8	6.8	12.1

1. A single i' equal to, say, 5.5 percent for all ages and index durations.
2. A simple formula—varying by age, index calculation period, underlying interest rate, and underlying mortality table—for determining values of i'.
3. A table of i' values that vary according to the parameters in item 2 above.
4. An interest rate and a table of select and ultimate mortality to be used in calculating the desired accumulations directly and without approximation.

Option 4 deviates most from the NAIC interest-only formula. When developing a cost index, we should keep in mind the important practical considerations of simplicity and current practice. The existing NAIC formula for SI is familiar to many agents as well as to an increasing number of insurance publishers and insurance buyers.

Option 3 is illustrated by columns 3 and 4 of Table 1. Option 2, using 5 percent interest and the table of select and ultimate mortality used in Table 1, is illustrated by the following formula:

$$i'_{[x],n} = \frac{1.05(84 - x - 0.8n)}{(83.81 - x - 0.8n)} - 1 . \qquad (1)$$

Columns 7 and 8 of Table 1 show values of i' based on the above formula. This formula was developed from DeMoivre's expression for l_x, which is $l_x = k(\omega - x)$, where ω is the first age at which there are no survivors and where k is equal to l_0/ω. With a suitable adjustment of constants, the i' formula can be used to approximate interest and mortality over a large range of ages. Of course, the 1.05 is changed if other than 5 percent interest is assumed. The formula for i' does not calculate usable values for $n = 20$ beyond age $[x] = 66$.

On the basis of the values of i' in columns 3 and 4 of Table 1, one could make a case for using the Trowbridge SI formula with $i' = 5$ percent for all ages and dropping the NAIC caveat that only similar policies can be compared. This is similar to option 1 and has the substantial advantage of being the same calculation—adapted to consider the initial cash value on the in-force policy—as the current NAIC index calculation, but it stretches the approximation for those ages when i' in columns 3 and 4 is beyond, say, 5.5 percent.

Table 2 illustrates SI results on three bases—select and ultimate mortality, zero mortality ($i' = 5$ percent) and 1958 CSO mortality—for three participating policies offered to males in 1980 by a large mutual company. Each is a $25,000 policy sold in states allowing an 8 percent interest rate on policy loans. The results illustrate that using zero mortality and 5 percent interest to approximate select and ultimate mortality and 5 percent interest is reasonable in the case of the five-year

TABLE 2

VALUES OF ${}_{n}^{m}SI_{[x]-m}$ FOR TEN- AND TWENTY-YEAR INDEX PERIODS USING TROWBRIDGE'S FORMULA, 5 PERCENT INTEREST, AND THREE DIFFERENT MORTALITY ASSUMPTIONS

POLICY	ATTAINED AGE [x]					
	25		45		65	
	$n=10$	$n=20$	$n=10$	$n=20$	$n=10$	$n=20$
	Select and Ultimate Mortality					
New-issue life paid up at 65	3.87	3.02	11.03	10.64	*	*
10-year-old life paid up at 65	1.37	1.11	3.65	5.69	17.78	32.04
New-issue whole life	4.13	3.22	10.34	10.67	38.34	46.89
10-year-old whole life	1.41	1.12	4.10	6.14	26.77	39.41
New-issue 5-year renewable term	2.80	2.66	6.51	8.88	*	*
10-year-old 5-year renewable term	*	*	5.41	8.12	33.92	*
	Zero Mortality					
New-issue life paid up at 65	3.81	2.83	10.32	7.79	*	*
10-year-old life paid up at 65	1.26	0.84	2.30	2.28	2.20	3.29
New-issue whole life	4.08	3.05	9.84	8.76	33.29	32.22
10-year-old whole life	1.30	0.87	2.97	3.42	17.15	19.14
New-issue 5-year renewable term	2.80	2.66	6.49	8.97	*	*
10-year-old 5-year renewable term	*	*	5.41	8.23	33.79	*
	1958 CSO Mortality					
New-issue life paid up at 65	3.96	3.25	11.76	12.73	*	*
10-year-old life paid up at 65	1.60	1.47	5.13	8.38	33.73	50.49
New-issue whole life	4.21	3.37	10.87	12.08	43.40	52.39
10-year-old whole life	1.62	1.46	5.34	8.29	38.20	50.16
New-issue 5-year renewable term	2.80	2.67	6.53	8.79	*	*
10-year-old 5-year renewable term	*	*	5.41	8.02	33.96	*

* Policy not issued or not renewable.

renewable and convertible term policy and also in the case of the permanent policies at age 25 for a ten-year index.

The select and ultimate results in Table 2 are about halfway between the 1958 CSO results and the zero mortality results. The 1958 CSO calculation provides too great a mortality accumulation, while the zero mortality calculation is at the other extreme. As we would expect, on any of the three bases the ten-year-old policies, with their cash values and/or dividends, have lower surrender cost indexes than the new policies.

If a cost index uses mortality as well as interest for comparing either new policies or new and in-force policies, the use of select and ultimate mortality is the most appropriate.

RICHARD F. FISHER:

Mr. Trowbridge should be commended for tackling the difficult problem of cost comparison of dissimilar life insurance policies. When widely dissimilar policies are involved, the choice of assumptions usually dictates the conclusion no matter how refined or accurate a method is used to define cost. When moderately dissimilar policies are compared, the assumptions may not override the methodology, and it is important to use an actuarially correct methodology. Mr. Trowbridge's index is a vast improvement over the interest-adjusted cost (IAC) for this purpose.

What is the cutoff between widely dissimilar and moderately dissimilar policies? Policies may vary in death benefit, cash value, and net payment. Two policies are similar if two of these three series are the same; otherwise, they are dissimilar. We might say that they are moderately dissimilar if the present values, using interest and mortality, of all three series are within, say, 25 percent of one another. Otherwise, I would call them widely dissimilar.

As I have already stated, with widely dissimilar policies the choice of assumptions usually dictates the conclusion. It is difficult to reach agreement on a standard set of assumptions, and some people will use their own assumptions in any event to suit their own purposes. Further, even if a completely unbiased observer chose the assumptions, no one set would be correct for all people. A standard interest rate obviously is unrealistic because different people have different tax situations and investment opportunities and the differences may be material. A unique mortality assumption probably is not appropriate either.

The mortality rates used in calculating the index should not be the probabilities of death but rather the value the policyowner places on one-year term insurance. One problem is that the value of term insurance

is not proportional to some per-thousand dollar value such as the 1958 CSO mortality rate. The unit value of any product or service varies as the amount provided varies. For example, a person needing $50,000 of term insurance valued at $X would not be willing to pay $20X for a million-dollar policy. Further, the relative value the policyowner places on a risk coverage generally will vary from one part of the age span to another. Thus, even if a given table were appropriate initially, it is unlikely that it would continue to be so for an entire period of coverage.

All in all, the comparison of widely dissimilar policies with a single index based on one mortality table and interest rate will provide misleading information to a great many users, even if a set of "fair" standard assumptions were strictly adhered to.

For moderately dissimilar policies, the assumptions are less dominating. If such comparisons are to be made, a better methodology than IAC should be used. I believe the Trowbridge index is a vast improvement over IAC for this purpose. The IAC index represents the residual cost of the insurance at risk provided by a policy. The problem is that the IACs of two dissimilar policies are not comparable because the two policies provide different amounts of insurance at risk. The Trowbridge index adjusts the IAC index by adding a charge related to mortality applied to the savings element. The result is a cost per $1,000 of pure risk. That is why term and permanent policies with the same pricing have the same Trowbridge index as shown in the paper.

Using the Trowbridge index to compare moderately dissimilar policies has some interesting side benefits. First, the index lends itself to a comparison with a simple base, namely, the premium for level term insurance. One could compare the Trowbridge index for any policy to the value of $P^1_{x:\overline{20}|}$ calculated using the standard assumptions. This ratio would have some meaning itself without requiring other companies' data. For example, it might be helpful for a person to know that he would be paying $0.90 for term insurance valued at $1.00 according to the standard. A comparable base does not exist for the IAC index. Second, if the index period were extended over the life of the policy, it would provide a "death cost," which would be far more appropriate than the ten- or twenty-year interest-adjusted net payment indexes. Third, the calculation of an equivalent level amount under this method would provide reasonably valid cost comparisons if it were assumed that dividends were used to purchase additions. The necessity of assuming premium reduction with IAC has been a most unfortunate limitation of that index.

I think the mortality assumption should be based on a recognized table that approximates competitive term rates—the new $K(M)$ and $K(F)$ tables would qualify. The interest assumption should reflect the return on a portfolio of moderately long-term debt instruments. Such a return today would be in the area of 5–6 percent after taxes and investment expenses. Some will argue that 6 percent is on the high side. One must be careful not to base the interest assumption on either current short-term yields, which may be different upon reinvestment, or yields on risky or leveraged investments, which contain less security, or yields on new money only, because such yields are not characteristic of the return on a typical individual's *existing* portfolio.

In conclusion, cost comparison of widely dissimilar policies is a difficult process, and no one index, based on one set of assumptions, will do it fairly. If comparisons of moderately dissimilar plans are going to be made, however, the Trowbridge index is a substantial improvement over the IAC and may well prove to have significant advantages over the other indexes that have been put forward in recent years.

JAMES H. HUNT:

This is the fifth actuarial paper to appear in the *Transactions* in the last dozen years on the subject of life insurance cost comparison methods. Each has suggested an alternative to the interest-adjusted method (IAM hereafter), now in wide use throughout the United States under the NAIC cost disclosure system. No paper has appeared in support of the NAIC method, nor has the Society ever taken a position on the question of cost disclosure techniques. I think the public has suffered as a result. As far as I am aware, the only formal opinion on the subject is that of the Canadian Institute of Actuaries; it found IAM inferior to Professor Belth's company retention method.

Although the author implicitly faults the NAIC method by his recommendation for change, he is otherwise too kind in his remarks about it. The NAIC method is confusing, if not bewildering, to the average consumer or agent, and it lends itself to deceptive uses. The use of six index numbers has as its real justification the disparate business needs of competing industry factions, but the other side of that coin is public confusion ("confusing features," in the author's words); and the fact that term insurance indexes come out higher than those for whole life and other cash-value policies can be used as an argument that whole life is the better buy when, as the author shows, this is misleading. But even if this were not the case, I submit that any system of life insurance

cost disclosure that does not permit comparison of dissimilar plans of insurance—reasonable alternatives for buyers, in other words—ought to receive immediate rejection by the actuarial profession. What of the difficult term/whole life choice? And what about comparing deposit term policies, which lend themselves to deceptive uses, with either whole life or term? How absurd that one is limited under the NAIC method to comparing such policies with themselves; no actuary in his right mind would buy a deposit term policy without comparing it with annual renewable term insurance, and over 95 percent of such comparisons would be unfavorable. Increasingly, the term/deferred annuity package is competing with whole life. The NAIC method offers the buyer no help in assessing any of these choices.

The author, in breathing life into the interest-and-mortality-adjusted method (irreverently, IMAM hereafter), has clarified what the Society's Special Committee on Cost Comparison Methods and Related Issues confused: whether IMAM can be used to compare dissimilar policies. The special committee adopted the rigid criterion that any method failing to take into account interim cash values (cash-flow elements) could not be used fairly to compare dissimilar policies; in so doing, it cast both IAM and IMAM in the same mold, and both failed the test. There is an enormous difference, of course, between the suitabilities of the two techniques in comparing dissimilar policies: IAM fails completely, whereas IMAM appears to be as justified for comparing dissimilar policies as IAM is for comparing similar policies.

The author's suggested extension of the NAIC method at once removes the major actuarial deficiency of IAM—the inability to compare dissimilar policies—and, in eliminating any rationale for the twin disclosures of net payments and net costs, reduces appreciably the confusion generated by IAM. In particular, it removes the officially sanctioned opportunity for agents to "whipsaw" buyers between the two sets of indexes; if there is a 50 percent chance that any buyer will drop his policy within twenty years from issue, but less than a 1 percent chance that he will live most of those twenty years and then die, it seems disingenuous at best to argue that the net payment index can best measure the buyer's future interest in the purchase. And if a new NAIC method based on IAM were to follow the example recently set in Maine, the confusing display of the equivalent level dividend would also be dropped.

In an unpublished paper entitled "The Case for Rate of Return Disclosure in Life Insurance," which had a limited circulation among actuaries involved in trade association cost disclosure matters, I sug-

gested that IAM could be used to compare dissimilar policies if the following simple adjustment were made:

$$\text{Adjusted } IAC_n = \frac{IAC_n}{(1 - 0.0005CV_n)}.$$

This approximate reflection of the aggregate amounts at risk over the term of n years, when applied to the example shown in Table 1 of the paper, gives an answer of $5.03, as compared with the more precisely computed answer of $5.02. The rationale for this adjustment may be more apparent than that for the author's recommendation, but of course IMAM is much more satisfying actuarially. Each technique has the same goal: to remove from the analysis the "What if I die?" question that begs for a probability to be assigned to it.

In the remainder of this discussion, I will respectfully take exception to a few of the author's statements, and I will contrast the advantages of the Linton yield (LY hereafter) method with that of IMAM on the critical question of term versus whole life.

At the outset of his paper, the author states that the NAIC method has the advantages of simplicity and understandability, that it is easy to compute and explain, and that it has no important theoretical weaknesses when used to compare similar plans of insurance. I would not want these putative attributes of the NAIC method to receive actuarial blessing simply because they were uttered by such a respected authority. My opinion is that the method is simple, understandable, and easy to compute and explain only on an actuary's relative scale of difficulty. There is considerable evidence that the method is confusing even to life insurance agents. And the Canadian Institute of Actuaries statement on cost comparison methods said that "while the *mathematics* of the interest-adjusted method is easier to comprehend than that of the retention method, the *concept* of the retention method is actually easier to understand." Look at any insurer's complete explanation of how to compute the indexes, which would include equivalent level dividends and equivalent level death benefits; I doubt that it would reinforce the notion of ease of computation and understandability in anyone's mind, including that of an actuary. As for theoretical soundness in comparing even similar policies, the absence of mortality and lapse discounts can affect rankings significantly, as the Institute has noted in the case of dividend-paying policies over twenty-year observation periods. Although the use of indexes without lapse discounts has a sound rationale, the argument in its favor is not necessarily the more satisfying one: consider the high level of industry lapse rates, and the popularity of terminal dividends

in any comparison of similar policies from a list of insurers some of whom do not pay such dividends.

It is stated that the choice of interest rate for the NAIC method is "appropriately an after-tax rate," implying that the inside buildup of policy values is tax-free. In one low-cost company, current dividend illustrations for its whole life policy indicate that for a male aged 35 at issue a taxable gain of about 30 percent of the cash value will apply on surrender at age 55; on the other hand, for a male aged 55 at issue there is no taxable gain on surrender at age 75. (By way of contrast, 54 percent of the proceeds of a no-load, deferred annuity paying 20 percent for twenty years would be taxable.) With dividend scales likely to rise in the future, taxable gains likewise will increase in frequency and amount. Some consideration should be given to these realities in the selection of an interest rate.

Mr. Trowbridge argues that rate of return (ROR hereafter) cost disclosure methods urged by some as an alternative to the NAIC method are "extremely complicated and cumbersome," involve comparisons with a "hypothetical term policy rather than with term policies actually in the marketplace," are "objectionable to many" because they split whole life policies into savings and protection elements, and are "in general a poor solution" to the term/whole life problem. He concedes, however, that it is not "an unreasonable premise that the buyer of life insurance has a right to assistance in making the decision between permanent and term" and suggests that IMAM will meet this need. I have problems with all of this.

Calculation of LYs is indeed extremely cumbersome if done by hand, but if a computer is poised to calculate a twenty-year interest-adjusted net cost, it will take only an instant longer (if the time is measurable) to calculate an LY, especially when such calculations are done seriatim and the trial LY is the calculated LY for the previous age. This is true, of course, because both methods use the same data. And, although the set of formulas and instructions necessary to describe the LY calculation is not easy to digest, the concept of the calculation is probably much easier to get across to the layman than is the concept of IAM.

The hypothetical term rates referred to by the author should be based on term rates actually current in the marketplace; as such, it seems to me they are not *conjectural*—the definition of "hypothetical"—but rather the product of a demonstration. It is my observation, at least for policies of $50,000 and over, that the range of term rates for current sales of such policies clusters closely about their mean, and I believe

that LYs based on such mean term rates can reasonably be described as estimates of investment returns on cash-value policies.

The author is the same person who pointed out in TSA, Vol. XXV, that IAM ought really to be classified as a cost comparison method that splits a policy into a savings element and a protection element. Perhaps that is why he says LY is objectionable "to many"; presumably, he asks the reader not to include him in that crowd. In what way does LY split the policy into such parts? As with IAM, no account is taken of interim cash values and amounts at risk (differences between death benefits and cash values). It is true that the term amounts and side fund balances describe a pattern similar to the split elements, but the policy itself is not split. One could, of course, calculate the ROR needed to accumulate the costs of successive differences between face amounts and cash values to the cash value for the nth year, using the same set of term rates. Such an ROR would differ from an LY and clearly would split the policy. (It also would be subject to the same criticism that the standard mortality cost index received: the policy with higher interim cash values would show the lower RORs. The reason for this paradox appears to lie in the implicit assumption of no lapses: the deduction of a somewhat smaller charge for the lesser amount of term insurance needed should, in real life, be accompanied by a more than offsetting increment for the likelihood of receiving a larger surrender value.)

The author's statement that an LY calculation is a poor solution to the term/whole life question puzzles me. In what other way would one assess the financial attractiveness of paying the higher premiums for a whole life policy? Perhaps the author's statement is consistent with the testimony of the American Council of Life Insurance in the Maine cost disclosure hearing:

> We believe that the decision as to type of policy has to be made first, and should be based on such considerations as the customer's insurance needs, ability to pay, and length of time for which he or she wishes to pay premiums. Only after this choice has been made should the customer look at cost comparison indices, which are designed only to measure costs of similar policies.

It seems to me this is another way of saying that the industry would prefer that the buyer not use any kind of financial analysis to compare term and whole life, and it is this weakness of the NAIC method that the author, at least in part, wishes to overcome with his paper. What is wrong with the following steps in reaching a decision on whether to buy term or whole life: (1) decide how much life insurance is necessary; (2) decide whether the rate of return on a whole life policy or other cash-

value policy warrants paying premiums higher than those for annual renewable term insurance, taking into consideration tax implications and any other advantages of the cash-value policy?

Mr. Trowbridge believes that IMAM could be used to assist buyers in making the term/whole life choice, but he cautions that selection of the mortality and interest assumptions "must be realistic from the policyowner's viewpoint." I have no doubt that a disinterested panel of actuaries could come up with a schedule of mortality rates meeting this criterion, but selection of an interest rate would be a bit dicier. What is a realistic interest rate for one buyer may not be for another; moreover, it is evident there is an interest rate that favors term over whole life, a fact with compelling implications. It seems likely that these considerations will lead to demands to show results for multiple interest rates, as the author found helpful. Furthermore, federal interest rate ceilings on passbook savings accounts will be phased out in the next few years, making it likely that realistic rates will be subject to greater fluctuations in the future.

It strikes me as presumptuous for the industry and its regulators to select an interest rate that will represent the diverse interests of the buying public. Does it not make more sense to supply buyers with RORs and let them decide whether these estimates of investment returns are satisfactory? Although RORs vary in accordance with variations in assumed term rates, for the popular ages these variations should be within ± 10 percent, a tolerance I find reasonable.

Mr. Trowbridge is to be congratulated for lending his considerable prestige to the notion that the most glaring deficiencies of the NAIC method can be removed or lessened by the simple expedient he advances. And his emphasis on replacement comparisons is timely, for much harm is now being done by unfettered replacement activity. Although the resulting system would still produce index numbers without independent meaning, a weakness I find critical, at least it would be a method that is *actuarially* satisfying. Such is not the case with the existing NAIC method.

E. J. MOORHEAD:

I agree with the author of this valuable paper throughout much of his analysis and recommendation. It is true that the interest-adjusted method's usefulness is diminished by its inapplicability to comparisons of dissimilar policies. One might go even further and assert that, to a significant extent, the objection cited by Mr. Trowbridge applies to comparisons of policies that are nominally similar but that differ sharply in the reserve bases upon which cash values have been determined.

Mr. Trowbridge has rendered an especially great service in Section V of his paper, which discusses policy comparisons when replacements are being analyzed. Attempts to prescribe methods for such cases have been abject failures so far; I believe the author has advanced a plan of great promise.

Furthermore, any valid means for extirpating net payment indexes deserves careful attention. The original 1970 committee report warned against burdening buyers with more than just one index (at each of two policy durations). Great damage has been done by regulations that require three indexes, including the noisome equivalent level annual dividend as well as the payment and surrender cost index. William M. Snell, (*The Actuary*, May, 1980) has recorded the unholy compromise (the adjective is mine) that makes it child's play to conceal the defects of high-priced policies.

The American Council of Life Insurance, in its official explanations intended for agent education and buyer enlightenment, has made a bad condition even worse by suggesting that greater significance should be attributed to the payment index than to the surrender cost index. This is a grave disservice that ACLI has perpetrated, and one for which there is little excuse within an organization well populated with actuaries capable of grasping what is at issue.

Thus, I favor the Trowbridge plan if it offers the quickest and best route to removing payment indexes from required disclosure exhibits. Nevertheless, I have reservations about what the mortality-interest comparison system can accomplish, my doubts having to do mainly with the difficulty, discussed by the author, of choosing the right interest rate when comparing term and whole life alternatives.

The 5 percent interest rate specified in the present NAIC model is reasonably defensible for making comparisons that are confined to whole life policies. It is true that prevailing interest yields available even to those who are saving modest amounts are much higher than 5 percent, but use of that rate nevertheless may be reasonable if it is borne in mind that the savings element of a whole life policy in its early years is small, and that nobody can predict the future course of interest rates accurately. But the outside savings element in a "term insurance with separate investment" plan builds rapidly, and I doubt that comparisons between such a plan and whole life should be made on a 5 percent interest assumption. Yet the use of an interest rate materially higher than 5 percent would be bound to accelerate the trend to term insurance despite the suitability, in my view, of the whole life plan for many people and circumstances. If this line of reasoning is tenable, we

should, I think, continue to champion the proposition that buyers are best advised to make their choice in two separate steps: first, decide whether or not some of their saving should be undertaken through whole life policies; then, look for attractively priced policies of the kind that fits that decision.

On a matter of detail (though not of triviality, I believe), I wish that Mr. Trowbridge had not said (in Sec. IV): "This [FTC, etc.] approach . . . is objectionable to many because it misrepresents the indivisible structure of the whole life arrangement." In my view the interest-adjusted method violates the untenable indivisibility theory just as much as, though less obviously than, those other systems the author is discussing. Whether the author is among the diehard supporters of the indivisibility theory is not made clear; I suspect that he is not, and that he might be amenable to removing "because" and substituting "who argue that."

CLAUDE Y. PAQUIN:

Commendably, Mr. Trowbridge has suggested a modification of the NAIC interest-adjusted method of comparing individual life insurance policy costs, so that the method might be adapted to the comparison of dissimilar policies. He argues that adding a mortality adjustment to the existing interest adjustment would do the job, but it appears to me that the key point he has made is that the current cash value of an existing policy must be considered as a gross single premium in the calculations. As he shows, adding a mortality adjustment does little that an interest adjustment will not do.

The formulas and valuation standards prescribed by law or regulation generally are artificial and have a way of becoming obsolete. (One may contrast statutory reserves and GAAP reserves as an example.) The resulting figures can be helpful, much like Environmental Protection Agency (EPA) mileage data on new cars, but only moderately. Thus Mr. Trowbridge's approach is fine as far as it goes. If it is adopted as part of a regulation on replacements, its results will have the same significance, and degree of helpfulness, as EPA mileage ratings on automobiles.

Life insurance coverage replacements do not occur in a vacuum. They are almost always the result of calculations and more or less scientific demonstrations by a life insurance agent. If we do not trust insurance agents to do a good job in their calculations, we can impose "cookbook formulas" on them. One suspects, though, that the resulting figures will have a way of being brushed aside in the sales process. One can go further

and insist that no figures shall be presented unless they conform to the cookbook formulas. Moreover, one can force the customer to sign a receipt certifying that he has been given the figures derived from the cookbook formulas and no other. There is virtually no limit to the red tape with which we can entangle both agents and consumers.

If we do not regulate the replacement calculation process, perhaps we can regulate the processors, that is, the persons who do the calculating. We can have them examined for competency and take reasonable steps to ensure (and even police) their integrity. Needless to say, the fact that a commission will be received only if the replacement takes place presents a conflict of interest strong enough to disqualify the replacing agent.

The solution I am leading up to is one to which no attention seems to have been given, namely, independent consulting actuaries, paid on a fee basis, who would analyze replacements professionally and impartially. Just as doctors send blood samples to the laboratory for analysis, agents could send their replacement cases to the actuarial laboratory. Actuaries could have a special license from the state to do this work and, like automobile safety inspectors, could be subject to certain standards and limited to a set fee. There is no question that with computers and the specialization and efficiency that can come from sufficient volume, replacement laboratories could do a much more thorough and sophisticated analysis than all the cookbook methods will ever provide, and at a reasonable cost.

All too often, actuaries think of themselves exclusively as solvers of mathematical problems rather than as solvers of human problems. The consumer has a problem with replacements. He needs sound and impartial advice. A cookbook formula will not help him one-tenth as much to solve that problem as will a competent, independent professional actuary. The time for the actuarial profession to "go public" (with respect to individual insurance) may be upon us, if only we will recognize the public need and our opportunity to meet it.

JULIUS VOGEL:

The paper is premised on the idea that consistently priced insurance policies should have the same net cost indexes. As the author says:

> If one believes that the 1958 CSO Table is representative of the mortality to be experienced by the group to which this prospect belongs, and if the prospect's personal interest rate is 5 percent, any indexes of the cost of these two policies should turn out to be exactly the same.

The actual results show the difficulty. The net cost indexes show the ordinary life policy to be "cheaper"—as indeed it will be if the policyowner is still alive

after n years. The net payment indexes show the term policy to be "cheaper"—as indeed it will be if the policyowner dies before n years. The dilemma is that the prospective policyowner cannot recognize that the two policies are priced *exactly alike* when the probabilities of living to the end of n years are correctly taken into account.

Accordingly, the author proposes discounting future payments and benefits for mortality as well as interest in order to equalize the net costs on surrender, at least for policies priced at net rates calculated at 5 percent.

It seems to me, however, that the author may be finding a difficulty where none exists. If one accepts the NAIC model's simple definition of "cost" as what you pay less what you get back, with future payments and benefits discounted at an appropriate interest rate, and if premiums and cash values are calculated as in the paper, then it really is the case that the net cost on surrender of a permanent policy is less than that of a consistently priced term policy. It is also really the case that the net cost on death of a term policy is less than that of a consistently priced permanent policy.

Accordingly, it is not clear to me why it is desirable to introduce in the calculation of surrender cost indexes an adjustment designed to equalize the surrender cost of term and permanent policies. I would have equal difficulty with a proposal to adjust the calculation of net payment indexes in order to equalize the net payment indexes of term and permanent policies. Any apparent advantage of permanent insurance in the event of surrender, and of term insurance in the event of death, is not an artifact of how the indexes are calculated, nor does it indicate an unfair bias. In my opinion it merely reflects the real situation.

I do not think that the object of the calculation of surrender cost and of net payment indexes is somehow to handicap the policies so that the race ends in a dead heat. On the contrary, we are trying to find out which horse really is faster. It turns out that the permanent horse is faster over the surrender track and the term horse is faster over the death track. I do not understand why an adjustment should be introduced into the calculation to obscure these facts.

Let me add, moreover, that I do not think a consumer's choice between term and permanent insurance should be based on which has the lower cost index. The choice should be based on which kind of insurance best suits the consumer's needs and means. The comparison of cost indexes should then become part of the process of deciding which term policy or which permanent policy to buy.

PAUL J. OVERBERG:

Mr. Trowbridge has contributed another learned paper on the subject of life insurance cost disclosure. It deserves study and discussion. I believe, however, that the time has come for the life insurance industry to address the subject of cost disclosure seriously from the consumer's viewpoint.

A review of the discussions in our Society's meetings shows that little concern has been devoted to the consumer. I think that we should make cost disclosure simple and easy for consumers to understand by putting ourselves in their shoes and making them aware of the vast area of uncertainties in life insurance cost.

1. Let us make sure they understand that their average annual cost for the life insurance protection under a cash-value life insurance policy can and usually will vary considerably depending on how (by death or surrender) and when the policy is terminated. Therefore, no actuary, no agent, no professor, and no insurance regulator can tell them at the time of purchase what their cost will be.
2. Let us make sure they understand that many nonparticipating policies and all participating policies have a part of their cost that is not guaranteed.

Once consumers are aware of the above uncertainties, they will have no difficulty in realizing that small differences in cost indexes should be ignored.

The present four NAIC cost indexes can be used to compare the cost of a whole life policy with the cost of a term policy. The results usually will be predictable to actuaries—but they are not quite so obvious to the consumer. This in itself will give the consumer needed education.

The current NAIC cost disclosure system is the best system yet devised. Its greatest weakness is a need for a more simplified presentation and more genuine support by the industry. Let us describe the concept in general terms (each cost index approximates the average annual cost of $1,000 of protection under a specific set of circumstances) and not try to teach the agents and customers how they are calculated.

JOHN E. ASCHENBRENNER AND WILLIAM R. CLAYPOOL:

Mr. Trowbridge's paper comes at a time when there is considerable controversy regarding the relative costs of life insurance policies and the most appropriate method of comparing costs. We agree with his comment that a discount for both interest and mortality is a more theoretically sound basis for comparing unlike policies or policies at different durations. However, if any method is to achieve widespread acceptance, it will have to provide an acceptable blend of theory and practicality.

Mr. Trowbridge discusses the difficulty of agreeing on a mortality table. This may be the biggest stumbling block to the inclusion of mortality in cost comparisons. In fact, the choice of a mortality table or tables may be as critical as or even more critical than the decision to include mortality. Table 1 compares cost indexes on various mortality tables with an interest-only index. Indexes are calculated at issue ages 35 and 55 for six policies, each offered by a different life insurance company. The "experience" mortality used is based on our most recent

TABLE 1

TWENTY-YEAR INTEREST- AND MORTALITY-ADJUSTED COST INDEXES AT 5 PERCENT INTEREST USING VARIOUS MORTALITY TABLES

Mortality Used to Calculate Cost Index	Participating 20-Payment Life	Participating Ordinary Life I	Participating Ordinary Life II	Participating Ordinary Life III	Nonparticipating Ordinary Life	Nonparticipating 20-Year Level Term
	Issue Age 35					
1958 CSO	7.40	3.04	3.19	5.70	6.42	5.34
Table K (male)	7.04	2.84	3.01	5.49	6.27	5.34
Experience	6.41	2.49	2.70	5.11	6.01	5.34
Interest only	5.67	2.09	2.32	4.68	5.69	5.34
	Issue Age 55					
1958 CSO	28.16	20.28	20.18	26.32	27.34	28.94
Table K (male)	25.97	18.81	18.69	24.80	26.24	28.94
Experience	22.79	16.68	16.56	22.60	24.64	28.94
Interest only	16.61	12.60	12.45	18.37	21.37	28.94

company experience for standard and preferred lives combined. Note that the indexes using 1958 CSO mortality and the interest-only indexes are approximately equidistant from the "true" cost using an actual experience table. In other words, use of an inappropriate mortality table could produce as large an error as the use of interest only.

As Mr. Trowbridge points out in his paper, using mortality that is too high generally tends to favor term insurance unfairly, while using mortality that is too low unfairly favors permanent insurance. Figures 1 and 2 show the indexes from Table 1 in graphical form. In each graph, the six policies are ordered, starting on the left, from lowest to highest cost index using experience mortality. The fact that higher mortality produces a higher cost index is of little significance, but the change in

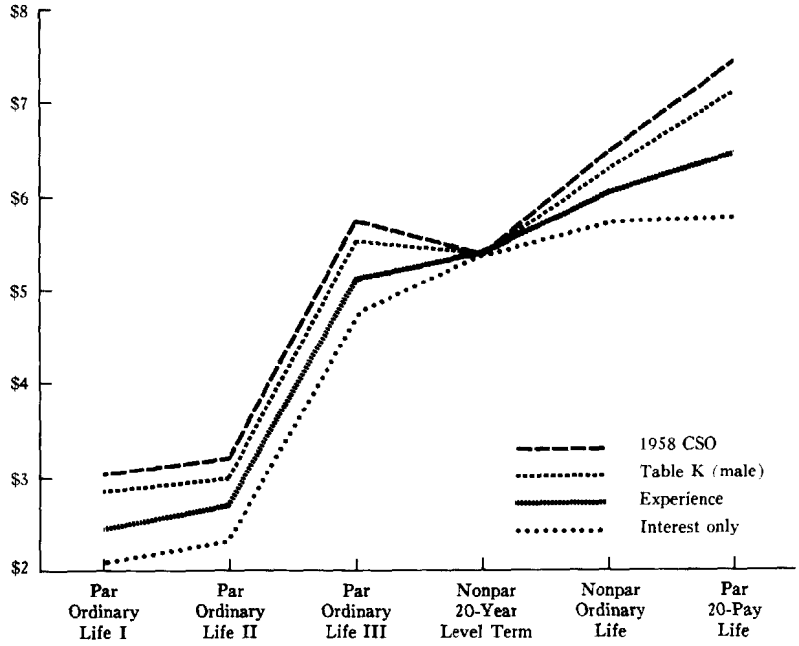

FIG. 1.—Twenty-year interest- and mortality-adjusted cost indexes at 5 percent interest using various mortality tables: issue age 35.

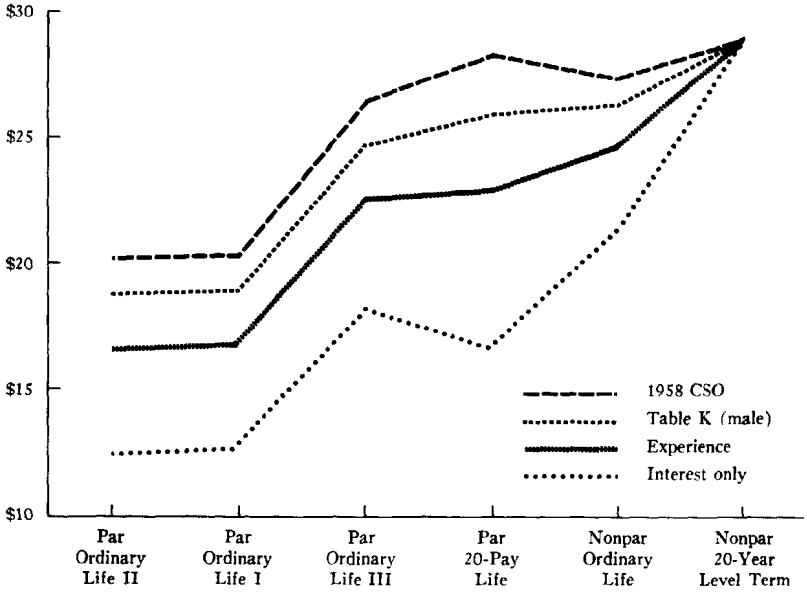

FIG. 2.—Twenty-year interest- and mortality-adjusted cost indexes at 5 percent interest using various mortality tables: issue age 55.

the rankings of the six policies resulting from a change in the level of mortality used is of more concern. Even in our small sample of six policies, the level of mortality affects the ranking as illustrated in Figures 1 and 2. The choice of mortality table has a greater effect on the absolute level of the cost index of permanent plans, and especially on limited-payment permanent plans. Therefore, the use of inappropriate mortality causes distortions in rankings when two different types of policies are compared. The level of mortality seems to have little effect on the relationships among similar plans of different companies.

The use of mortality in cost indexes would raise the question of differing mortality assumptions for smokers and nonsmokers; preferred risks, standard risks, and rated risks; and males and females. The index

TABLE 2

PREFERRED ORDINARY LIFE
20-YEAR INTEREST- AND MORTALITY-ADJUSTED
COST INDEXES USING VARIOUS
MORTALITY TABLES

Mortality Table	Age 35	Age 55
1958 CSO	2.43	18.18
Table K (male)	2.24	16.70
Experience	1.89	14.55
50% of experience	1.69	12.59
Interest only	1.48	10.43

should be calculated using a mortality table appropriate for the individual being insured. For example, a recent study found that nonsmoker mortality for issue ages in the range 30–39 was approximately 31 percent of combined smoker and nonsmoker mortality. Even if it is assumed that nonsmoker mortality is as high as 50 percent of combined mortality, Table 2 shows that the "true" cost for a nonsmoker falls about halfway between the interest-only cost and the cost using combined experience mortality. It falls only about one-quarter of the way between the interest-only cost and the cost using 1958 CSO mortality. An opposite result could be expected on rated policies. For example, the "true" cost on a policy rated for 100 percent extra mortality might fall fairly close to the cost based on 1958 CSO.

Mr. Trowbridge also mentions that mortality rates that are too high tend to favor new issues unfairly and therefore encourage replacements, which may not be in the best interest of the insured. Table 3 illustrates the consequences of using an inappropriate mortality assumption. An

existing whole life policy issued ten years ago to a male aged 25 is compared with a similar policy issued today to a 35-year-old male. Dividends on the original policy have been adjusted so that the twenty-year costs are the same based on the experience table. If the experience mortality is correct, the two policies are equivalent over the next twenty years. Using interest only would indicate that the existing policy was better, while using the 1958 CSO would indicate that the new policy was better.

If mortality is added to the index calculation, a logical question is whether the calculation should be extended one step further to reflect the probability of lapse. We feel that while something may be gained by the inclusion of mortality, the inclusion of lapse rates adds nothing to the usefulness or accuracy of the index. It is important to keep in

TABLE 3

COMPARISON OF TWENTY-YEAR INTEREST- AND MORTALITY-ADJUSTED COSTS IN A REPLACEMENT SITUATION

Mortality Table	Policy Issued at Age 25; Insured Now Age 35	Policy Issued at Age 35; Insured Now Age 35
1958 CSO	3.24	3.04
Table K (male)	2.98	2.84
Experience	2.49	2.49
Interest only	1.95	2.09

mind the primary use of a cost index—allowing an *individual* to compare two or more policies. The indexes are not intended for comparing the costs of two or more policies for a *group* of policyholders. An individual has very little control over when he will die. The probability of death for a newly underwritten individual can be expected to match closely an experience table for similar risks. It makes sense to calculate his cost on the basis of this experience mortality table. However, an individual has considerable control over lapsing his policy. The probability of an individual lapsing at various durations is likely to be significantly different from the lapse rates of a similarly underwritten group. Costs based on a lapse-experience table probably would bear little relationship to the true expected cost for that individual. A twenty-year interest- and mortality-adjusted index compares the cost of a policy assuming that the policy will lapse after twenty years if the insured is still alive. Likewise, the ten-year index assumes lapse after ten years if the insured is still alive. If an individual feels that there is a good chance he will

lapse his policy in x years, he might want to compare x-year indexes rather than the more common ten- and twenty-year costs.

DINKAR KOPPIKAR:

The NAIC method discounts for interest only. Mr. Trowbridge's method discounts for mortality and interest. Mr. Trowbridge's formula is the one by which the development of terminal reserves from one duration to another is explained in actuarial textbooks.

If the Linton yield (LY) formula is similarly analyzed, assuming yearly renewable term rates to be equal to mortality factors to be assumed in Mr. Trowbridge's formula, it will be found that LY similarly discounts for interest and mortality, except that under LY the discount factor is initially the unknown and the risk charge (q times the death benefit minus the accumulating fund) is to be deducted from the policy fund at the beginning of the policy year (instead of continuously as under a continuous function formula, or at the end of the year as under a curtate function formula, but more consistent with the normal insurance practice of charging the premium at the start of the risk interval).

If the mortality factors assumed in Mr. Trowbridge's formula and the yearly renewable term factors assumed for LY computation are the same, then (after adjusting for the discrepancy explained above) how is the difference between LY and the interest rate assumed in Mr. Trowbridge's formula to be explained? (Or, alternatively, how is the difference between Mr. Trowbridge's cost figure and a cost figure derived by using Mr. Trowbridge's formula and the LY factor to be explained?) If LY is smaller than the interest rate assumed for computing the Trowbridge cost factor, then the difference in interest rate compensates the insurer for additional marketing expenses in selling a cash-value policy. If the actual interest rate expected to be earned by the insurer on investments is higher (usually double-digit, or nearly, at present), the allowance available for additional marketing costs for a cash-value policy is still higher. However no method—neither the NAIC method, the Trowbridge method, nor the Linton yield method as proposed—discloses this pertinent information or the true incidence of marketing costs to the consumer.

What we need is an annual cost disclosure system, under which the average interest rate earned by life insurance companies and the average cost of risk for a policy are disclosed to the policyholder, and, after accounting for dividends and increase in cash value, the retention of the insurer to cover its marketing costs and profit is computed and disclosed. This would make life insurance pricing truly competitive.

(AUTHOR'S REVIEW OF DISCUSSION)

C. L. TROWBRIDGE:

The author is highly appreciative of the nine discussions that his paper attracted, not because the discussants reinforce the author's point of view (several of them clearly disagree) but because each sheds some further light on a confusing and complex subject. Any attempt by the author to reply to every comment from each discussant is clearly impractical, but some comment on what seem to be the most important matters may be well worthwhile.

Both Mr. Likins and Mr. Fisher make the point that the interest- and mortality-adjusted cost index is essentially the level annual amount charged under the policy for n-year term insurance. The paper could well have had more emphasis on this important point. Any cash value at the end of n years is treated as a pure endowment, the level annual premium for which,

$$\pi_{x:\overline{n}|}^{1} = \frac{(\text{Cash value})_n D_{x+n}}{N_x - N_{x+n}},$$

is subtracted from the level "net payment," thereby obtaining the level annual premium for the n-year insurance alone. This procedure, as several of the discussions have pointed out, is one form of splitting the premium into insurance and savings elements. Its validity depends upon the interest and mortality assumptions underlying the calculation of $\pi_{x:\overline{n}|}^{1}$.

The preceding paragraph is also intended to meet the most serious of Mr. Hunt's criticisms. He states that "the resulting system would still produce index numbers without independent meaning." The author feels that he has demonstrated, and that Messrs. Likins and Fisher agree, that the suggested interest- and mortality-adjusted index has the same basic meaning as the level premium charged for n-year term insurance. The interpretation is no different in the case of a policy issued y years ago, with a cash value at the beginning of the n-year period as well as at the end, except that the index represents the amount that is charged for the death benefit over durations y to $y + n$, not 0 to n.

The mirror image of this procedure is to subtract $\pi_{x:\overline{n}|}^{1}$, a "standardized" premium for n-year term insurance, from the net payments and then to accumulate the differences (with both interest and survivorship) to the end of n years. Equating the result to the nth-year value, and assuming a mortality table, one can solve for the interest rate. This is the essence of the Linton yield method. As Mr. Hunt notes, the two

methods use the same data, but IMAM (in his terminology) assumes an interest rate and calculates the cost of the insurance, while LY assumes the cost and calculates the interest rate. Note that both require an assumption as to mortality. The LY breaks down for term insurance, since neither positive nor negative amounts can accumulate to zero unless interest rates are negative.

The paper seems to get passing marks from Messrs. Hunt, Moorhead, Likins, and Paquin for tackling the problems of comparing old policies with new. The author would have liked more discussion on this part of the paper, because he views the application of the suggested method to the replacement problem as the paper's most meaningful contribution. It is simply amazing that the considerable earlier efforts in life insurance cost comparison methods have ignored what may be, at least to some observers, the most important cost comparison problem of them all.

On the other hand, the paper gets low marks from Messrs. Vogel and Overberg, and to a lesser extent from Mr. Moorhead, for suggesting that term and permanent policies can be validly price-compared. Mr. Vogel is an articulate spokesman for those actuaries who consider term and permanent so different that cost comparisons across the term-permanent line are senseless. He seems to be happy with the NAIC calculation, which shows what we all know, namely, that the term horse is faster over the death track, and the permanent horse likely is faster over the living track. Mr. Vogel does not seem to be bothered that the NAIC method has nothing to say as to which horse is faster overall. Mr. Overberg also advocates leaving the NAIC method alone.

Mr. Moorhead suggests that a prospective buyer should first decide, on other than relative cost grounds, between term and permanent, and then confine his cost comparisons to the form he has chosen. If I understand Mr. Moorhead correctly, he fears that calculations, at least those employing a rate higher than 5 percent, will show term to be the better choice "despite the suitability of the whole life plan for many people and circumstances." The author suspects that term-permanent price differences are not one-sided, that some term will appear to be cheaper than some permanent (and vice versa), and that buyers will continue to base their choices on many factors other than price. Valid price comparison will hurt permanent (in its competition with term) only if the industry is truly selling term appreciably cheaper. If it is doing so, in direct conflict with its often expressed desire to market permanent insurance predominantly, it has only itself to blame. Note that Table 3, admittedly based on the rate structure of only one company, shows permanent to be cheaper than term, even at 6 percent interest. The

tables furnished by Messrs. Aschenbrenner and Claypool point in the same direction.

Messrs. Hunt and Koppikar are in the other camp, each of them believing in term-permanent cost comparison but neither liking the author's method for making the comparison. Mr. Hunt prefers the Linton yield approach, while Mr. Koppikar would compare retentions.

Mr. Fisher breaks pairs of insurance offerings into three kinds—the similar, the moderately dissimilar, and the widely dissimilar. He defines similar policies as those where any two of three series—death benefits, cash values, and net payments—are identical. This extremely rigid test is seldom met, and, when it is, there is little problem in determining which offering is the most attractive. A direct comparison of the one factor that is not the same is usually a simple matter.

Policies with identical death benefits, and with net payments and cash values that are relatively close but not identical, might fit Mr. Fisher's "moderately dissimilar" criterion. These are, however, similar policies for NAIC purposes. Here the interest-adjusted method does reasonably well, although (as suggested by both Mr. Fisher and Mr. Moorhead) the interest-and-mortality-adjusted method is (theoretically) an improvement. In the author's view, the interest-adjusted method is valid for any comparisons where the nth-year cash values are close.

Mr. Fisher's final classification is the "widely dissimilar," presumably including most term-permanent and old-new comparisons. Here Mr. Fisher seems to side with those who feel that price comparisons are invalid, on the grounds that the choice of assumptions dictates the conclusion. Recognizing that the investment earnings assumption (and to a lesser extent the mortality assumption) does present difficulties, the author respectfully disagrees.

The author does agree with Mr. Hunt's comment about the conclusions of the Society's Special Committee on Cost Comparison Methods. By adopting an extremely rigid test, this committee made it close to impossible for any method to get its endorsement for comparing dissimilar policies. Mr. Hunt endorses the paper's approach at least to the extent that "IMAM appears to be as justified for comparing dissimilar policies as IAM is for comparing similar policies." This is just what the paper attempts to accomplish. In view of Mr. Hunt's coolness toward the IAM, the above quotation is hardly a ringing endorsement. It is appreciated nevertheless.

Several of the discussions get into the matter of the interest and mortality assumptions. Mr. Likins speaks for pitching the mortality assumption at the select level, on the hard-to-argue grounds that any-

one considering the purchase of new insurance at standard rates can be considered "select." Messrs. Aschenbrenner and Claypool demonstrate that the indexes are sensitive to the level of mortality assumed, and suggest that the 1958 CSO Table is at the extreme end of any reasonable range. Mr. Fisher would base the mortality assumption on the value that the prospect places on one-year term insurance. The author has trouble following Mr. Fisher, because the mortality assumption is needed only to subtract out the pure endowment; it is not used to value the insurance.

Whatever one believes about the mortality matter, it is clear from the paper and Mr. Likins' discussion that, except for high attained ages, the interest assumption is the "dicier"—to use Mr. Hunt's phrase. Not only is there more room for disagreement, but the results are much more sensitive to reasonable variation in the interest assumption than in the mortality assumption. Mr. Hunt questions whether "after-tax" rates are always appropriate. Mr. Moorhead wonders how the 5 percent in current NAIC regulations can remain creditable in inflationary times.

The paper takes no position as to these two important assumptions, except to point out how troublesome they may be. The use of 5 percent and the 1958 CSO Table, for illustrative purposes only, came about because no clearly better assumptions were readily available. The author, at least at the moment, endorses neither.

We come now to the sentence "This approach . . . ," which appears at the end of Section IV of the paper. At least two of the discussants take exception to this sentence on the grounds that the NAIC method also separates insurance and savings elements, or because they understand "complicated and cumbersome" differently than I do, or because they cannot accept the indivisibility argument put forth by the insurance industry. As Mr. Moorhead suggests, the author's view would be separated more clearly from that of others if this sentence were rewritten. With 20-20 hindsight, the author would like to change the offending short sentence to the following two paragraphs.

> This approach (in any of its several forms) is objectionable to many. Some of the arguments against the approach are that (1) these methods are complicated and cumbersome, (2) they misrepresent the indivisible structure of the whole life arrangement, and (3) they require the difficult choice of a specific price structure to represent the term insurance marketplace. In the author's opinion, these methods are a poor solution to the problem of illustrating term-permanent pricing differences, though not necessarily for the above reasons.
>
> In the author's view, the Linton yield calculation is a valid one, one that can teach experts something about pricing differences. Given an assumption as

to a fair price for the insurance coverage over the comparison period, a "rate of return" can be calculated for any permanent policy, old or new. The policy with the higher yield then can be said to be the cheaper. The author nonetheless prefers the method suggested in the paper, because (1) it emphasizes the cost of the insurance, the essential element in the usual reason for purchasing insurance, and (2) the index proposed here is applicable to a wide range of comparisons, while the LY approach seems largely limited to term-permanent comparisons. Because the interest-and-mortality-adjusted approach will work for term versus term, permanent versus permanent, term versus permanent, and old versus new, and because its result is easily interpreted as the cost of the insurance the buyer is purchasing, it seems to the author to have compelling advantages (in dealing with the buying public) over any of the "internal rate of return" methods.

Finally, let me comment on Mr. Hunt's remarks to the effect that this paper is another in a long series of alternatives to the interest-adjusted method, none of which supports the recommendations of the original industry committee. In fact, the author was a member of the original industry committee that proposed the interest-adjusted method, and has no interest in tearing down the good work that has already been done. The purpose of the paper is to *strengthen* the NAIC approach to make it more widely applicable by removing the restriction that only similar policies may be compared.

It is interesting that Mr. Moorhead, the chairman of the original industry task force, likes one aspect of the paper's suggestion for an unexpected reason. The author originally viewed the consolidation of the net payment and net cost indexes into one interest- and mortality-adjusted index as merely a corollary of the generality he was attempting, but of no real importance per se. Mr. Moorhead views the separation of the original single interest-adjusted index into two (or even three, if the level equivalent dividend is included) as a highly unfortunate modification of the original recommendation. Mr. Hunt has a similar comment in his discussion. The author finds himself in general agreement with Messrs. Hunt and Moorhead on this point, and now views the consolidation of the indexes as an important point in favor of the paper's suggestion. Messrs. Vogel and Overberg clearly have the opposite view.

Before this reply to the nine discussions becomes longer than the discussions themselves, the author will close by noting Mr. Paquin's suggestion of setting up an actuarial laboratory to give objective advice about the desirability of specific suggestions as to replacement. Some of us are attracted by the idea that actuarial expertise can be harnessed to serve the public in this important area. The concept may be fraught with practical difficulty, but perhaps we should encourage Mr. Paquin to try.