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PROCEEDINGS

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PERSONAL LINES PRICING: FROM JUDGEMENT TO FACT

COSTANDY K. KHURY

INTRODUCTION

The event of an insurer undertaking to write a new line of business is not, under the most optimistic circumstances, a common occurrence. Such comparative rarity precludes the uniform accumulation of statistical observations, and, therefore, analysis of the common attributes of such ventures is not feasible.

The most recent past has witnessed a vigorous new interest in the marketing of personal lines business by various insurers and especially by those whose traditional expertise has been in the life and accident and health lines. The fact that life insurers dominate this renewed interest is not critical to the concept of this paper. The intensity of this interest, however, has served to highlight certain problems with the pricing of the insurance product which, not only the new insurer, but any insurer expanding its portfolio must face.

The opening statement regarding the difficulty of obtaining data on such new ventures is further complicated by the diversity of approaches individually attempting to translate this interest into the market place. There are direct writing life insurance companies establishing fully self-reliant operations, agency companies branching out into mail order merchandising of personal lines, direct writing life insurance companies utilizing a property/casualty "partner" for the placement of its agents' personal lines production, and the list goes on.

While the diversity of style grows, one basic fact remains constant: an initial base price must be established. This initial pricing process by necessity has to consider numerous marketing aspects, underwriting criteria, industry experience trends, etc. Ultimately, however, a price emerges which has to be demonstrated to the regulator to be sound and to the consumer to be competitive; all of this alongside a full anticipation by the insurer of a reasonable underwriting profit. One must hasten to add that there is comparatively little room for statistically based argument over the initial price as it admittedly represents the consensus judgement of actuarial, underwriting, and marketing expertise.

After experience evolves for a period of time, say one year, the first rate level review becomes due. Whatever pricing problems initially confronted the insurer are now further complicated by the presence of a smattering of experience. This is the point at which this paper is intended to attach.

PROBLEM

The problem will first be illustrated and then stated.

The initial base rate is predicated on a projected pure premium and assumed expense, profit, and contingency loadings. Attention will be focused on the pure premium segment, inasmuch as the expense assumptions problem is different and is subject to different considerations altogether.

The determination of the initial base pure premium, at least in the classical sense, makes use of the following information:

The target market segment(s).
The projected underwriting selection criteria.
Pertinent experience[1] data.
Pertinent collateral data.

The principal thrust, of course, is to achieve a correct actuarial balance among the multiplicity of factors which [will] interact throughout the insurance transaction.

Accordingly, the collectives identified above generate a model market segment, a model underwriting policy, and a model pure premium realized by some (group of) insurer(s). In short, a model prospective competitor[2] emerges whose pure premium represents the new writer's "kick-off" point

[1] Policy contract considerations are not addressed in this presentation. That is, an already existent policy is contemplated by the new writer.

[2] This model "competitor" may be a rating organization.

in constructing its initial base pure premium. Let the new writer's initial pure premium be denoted by P_u, and the model competitor's pure premium be denoted by P_c. Initially, P_u is a function of P_c, and this relationship is intended to measure the extent to which the judgement of the new writer would anticipate P_u to differ[3] from P_c.

A period of time goes by during which both P_u and P_c are "tested" as actual experience figures are accumulated. Let the raw experience pure premiums be $\overline{P}_u$ and $\overline{P}_c$, respectively. Current standard credibility procedures would yield [new] experience adjusted pure premiums, $\overline{\overline{P}}_c$ and $\overline{\overline{P}}_u$, as follows[4]:

$$\overline{\overline{P}}_u = Z_u \cdot \overline{P}_u + (1\text{-}Z_u) \cdot P_u \qquad \text{(I)}$$
$$\overline{\overline{P}}_c = Z_c \cdot \overline{P}_c + (1\text{-}Z_c) \cdot P_c \qquad \text{(II)}$$

Now, P_u as a linear function of P_c $(P_u = K \cdot P_c)$ may be assumed (for illustration purposes) to be less than P_c (i.e., $K < 1$). Also, suppose (for illustration purposes) that:

$$\overline{P}_c > P_c \text{ and } \overline{P}_u < P_u \qquad \text{(III)}$$

which, when combined with (I) and (II) would produce:

$$\overline{\overline{P}}_c \geq P_c \text{ and } \overline{\overline{P}}_u \leq P_u \qquad \text{(IV)}$$

and altogether yielding:

$$\overline{\overline{P}}_u \,/\, \overline{\overline{P}}_c \leq K \qquad \text{(V)}$$

thus raising immediate question about the initial judgement regarding the magnitude of K whenever strict inequality holds for (V).

If condition (III) is revised so as to reflect a movement "in formation" such as:

$$\overline{P}_c > P_c \text{ and } \overline{P}_u > P_u$$
$$\text{with } \overline{P}_c \,/\, P_c = \overline{P}_u \,/\, P_u \qquad \text{(VI)}$$

then the simple likelihood of Z_u being less than Z_c would still generate the same relationship as in (V) as well as the same questions arising therefrom.

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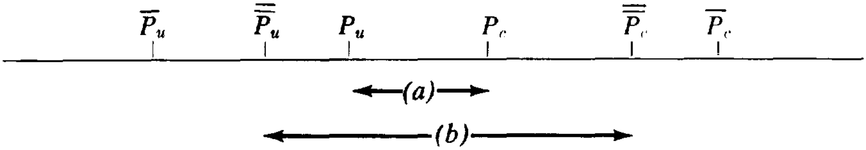
[3] A static hazard exposure (against a background of a static economy) is assumed so as to isolate the particular issue with which this paper is concerned.

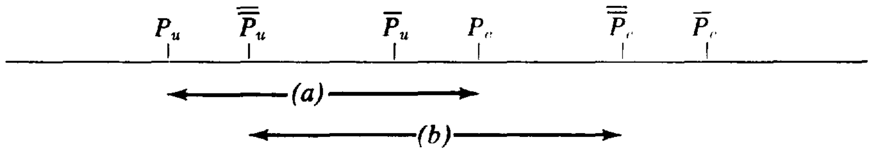
[4] Although trend is not specifically reflected in (I) or (II), footnote 3 assumed certain static conditions which provide license for this omission. Furthermore, the incorporation of trend is a relatively simple extension of the proposed modification procedures.

The following real number lines depict both situations described above as leading to (V):

(1) $K < 1; \overline{P}_u < P_u$ and $\overline{P}_c > P_c$



(2) $K < 1; \overline{P}_u > P_u$ and $\overline{P}_c > P_c; Z_u < Z_c$



(a) and (b) identify $|P_u - P_c|$ and $|\overline{\overline{P}}_u - \overline{\overline{P}}_c|$, respectively. For the sake of completeness, it should be noted that similar situations can occur for $K \geq 1$.

The interpretation problems attendant to the illustrated movements in the pure premium are numerous and do not lend themselves to ready explanation. Although not always as starkly present as suggested here, these movements need to be properly reconciled prior to "closing the book" on the revision of P_u. The examples provided herein demonstrate the potential inadequacy of present credibility procedures in effecting a proper transition from the initial pure premium through a series of experience modifications to a fully "seasoned" pure premium. This paper provides a means whereby standard credibility procedures, as presently utilized, may be augmented to produce a systematic transition from judgement to fact.

DISCUSSION

The motivation for the manner of construction of the solution would probably be aided by a brief discussion of some of the more prominent aspects of the judgement underlying the selection of the initial pure premium.

In considering the marketing aspects, suppose one is given an ongoing product distribution apparatus with varying degrees of penetration of certain population strata. The new writer has to carefully gauge the potential of this marketing force in several respects. Among them:

Will the already penetrated strata be the target strata for the new product?
Will the degree of penetration of each stratum contract or expand?

Will production quotas be established?
Will there be advertising support?
Will there be an inter-product (new & old) coordination?

This list is by no means exhaustive. It does illustrate, however, the many judgements which must be made en route to a full visualization of the typical expected risk. Each of these items is subject to a full range of judgements in its own right. Each must be gauged for the present and projected into the future. The combined judgements relative to all the pertinent marketing questions [if the questions are distilled to a single appropriate inquiry] will reduce to the marketing input in the process of arriving at the initial pure premium.

On the underwriting side, the considerations are of necessity quite different. Although the average expected risk should have been largely identified, the underwriting policy must also accommodate several environmental conditions. For example:

The extent of new staff acquisition and training.
The existing (and probably) statutory underwriting constrictions.

Also, the underwriting policy proper has to be defined in the appropriate fine detail within the projected environment. Without detailing the many facets which have to be defined in order to produce such policy, the aggregate of all judgements may be reduced to certain key projections, such as:

Prospective rejection ratios.
Prospective non-renewal ratios.
Prospective frequency of loss.

These projections would naturally utilize the marketing input already provided. Also, as new business is processed, these ratios are subjected to the initial acid test. And, as the first experience pure premium is reviewed, the fact that this is the initial test must be acknowledged and injected into the interpretation.

The claim aspects face yet a different set of complications. The severity element must be projected with largely no historical performance yardsticks of the projected claim apparatus, at least for the new line of business. The first experience pure premium, on the other hand, is heavily impacted by judgement. To put it another way, case reserves, incurred but not reported reserves, and all other bulk loss reserves enter the first experience pure premium at full face. And, for third party coverages, these reserves easily constitute the greater portion of the corresponding pure premium. Finally, questions regarding the claim environment must be correctly formulated and resolved.

These illustrations highlight the many, many facets which must not only be recognized but also be projected forward. The first experience pure premium, presumably, provides the first glimpse of how the composite of these judgements fared. As the section describing the problem noted, if one subjects this first glimpse merely to standard credibility procedures, potential pricing problems are likely to arise. The next section demonstrates how this potential may be eliminated.

SOLUTION

Once the projected target has been numerically established for an underlying component, the progress towards the full achievement of this target may be considered to be a function of both actual observations and time. For example, if one considers the claim operation to be fully "mature" once at least 10,000 claims have been paid and closed and the operation has been in existence for at least five years, then a simple progress function may be defined[5] as follows:

$$f(N,t) = [(N/10{,}000)\ (t/60)]^{1/2}$$

with:

N = Number of claims paid and closed since inception of operations, and

t = Number of months elapsed since inception of operations.

Actually in order to assure $f(N, t)$ will always be ≤ 1, the following construction is needed:

$$f(N,t) = \begin{cases} f(N,t) & \text{if} \quad f(N,t) \leq 1 \\ 1 & \text{if} \quad f(N,t) > 1 \end{cases}$$

Table I illustrates sample values of f for the indicated sample combinations of N and t.

To construct this piece of the solution formally, denote the progress functions corresponding to the measurable attributes for which numerical

[5] This example is deliberately oversimplified. No attempt is made here to identify all the components which would contribute to the full maturation of a claim operation.

targets have been established by:

$$C_1, C_2, \ldots C_n$$

TABLE I

NUMBER OF CLAIMS PAID AND CLOSED

Time	. . .	374	. . .	2,805	. . .	8,022	. . .	12,422	. . .
⋮		⋮		⋮		⋮		⋮	
6 mos	. . .	0.06	. . .	0.17	. . .	0.28	. . .	0.35	. . .
⋮		⋮		⋮		⋮		⋮	
22 mos	. . .	0.12	. . .	0.32	. . .	0.54	. . .	0.67	. . .
⋮		⋮		⋮		⋮		⋮	
49 mos	. . .	0.17	. . .	0.48	. . .	0.81	. . .	1.00	. . .
⋮		⋮		⋮		⋮		⋮	
86 mos	. . .	0.23	. . .	0.63	. . .	1.00	. . .	1.00	. . .
⋮		⋮		⋮		⋮		⋮	

where n is the number of distinct subject attributes.

Each C_i is a function of time, t, as well as some raw observation, u_i, as follows:

$$C_1 = f_1(u_1, t), C_2 = f_2(u_2, t), \ldots, C_n = f_n(u_n, t)$$

Since each C_i is subject to a maximum of 1 (objective accomplished), a new set of truncated functions, $\bar{f}_i$ will be needed. For example, for every i, redefine C_i as follows:

$$C_i = \bar{f}_i(u_i, t)$$

with:

$$\bar{f}_i(u_i, t) = \begin{cases} f_i(u_i, t) & \text{if} \quad f_i(u_i, t) \leq 1 \\ 1 & \text{if} \quad f_i(u_i, t) > 1 \end{cases}$$

Having established $\bar{f}_i(u_i, t)$, a system of time-dependent weights is needed:

$$w_1(t), w_2(t), \ldots, w_n(t)$$

subject to the condition:

$$\sum_i w_i(t) = 1 \quad \text{for every } t.$$

$w_i(t)$ attaches to $\bar{f}_i(u_i, t)$ in the process of aggregating the combined progress of the new writer as the raw data are accumulated.

Accordingly, the experience modified pure premium, $\overline{\overline{P}}_u$, is subject[6] to the weight function W, defined as follows:

$$W(u_1, u_2, \ldots, u_n, t) = \sum_i w_i(t)\,\bar{f}(u_i, t) \qquad \text{(VII)}$$

Therefore, the revised experience modified pure premium, P_u, can now be constructed as:

$$\begin{aligned}\overline{\overline{\overline{P}}}_u &= W \cdot \overline{\overline{P}}_u + (1\text{-}W)\ (K \cdot \overline{\overline{P}}_c) \\ &= W \cdot [Z_u \cdot \overline{P}_u + (1\text{-}Z_u) \cdot P_u] + \\ &\quad [(1\text{-}W) \cdot K]\,[Z_c \cdot \overline{P}_c + (1\text{-}Z_c) \cdot P_c]\end{aligned} \qquad \text{(VIII)}$$

Some observations should be made regarding the nature of the underlying components and their collective impact on $\overline{\overline{\overline{P}}}_u$:

(a) $u_i \, \varepsilon \, [a_i, b_i]$, where a_i is the value of u_i at $t=0$ and b_i is the target for u_i.

(b) $t \, \varepsilon \, [0, T]$, where T is the maximum period needed for all $\bar{f}_i(u_i, t)$ to achieve a value of 1 regardless of the behavior of u_i.

(c) $\bar{f}_i(u_i, t) \to 1$ as $t \to T$ or $u_i \to b_i$.

(d) $W(u_1, u_2, \ldots, u_n, t) \to 1$ as $t \to T$ or $u_i \to b_i$ for every i.

(e) $(1\text{-}W) \cdot K \to 0$, as $W \to 1$ [directly from (d)].

(f) $\overline{\overline{\overline{P}}}_u \to \overline{\overline{P}}_u$, as $W \to 1$ [directly from (e)].

While it may be obvious, it is probably worth noting that $\overline{\overline{\overline{P}}}_u$, as stated in (VIII), essentially reconstructs the value of K as given by $\overline{K} = \overline{\overline{P}}_u/\overline{\overline{P}}_c$. Thus

[6] This modification in fact assures that the actual rate revision does not reflect [temporary] operational conditions at full face, such as by way of the construction suggested in (VIII).

when the second experience review becomes due, the process of reconstructing $\overline{K}$ becomes iterative with $\overline{K}$ as the basis judgement of the now not-so-new writer. With this in mind, statement (e) is true regardless of what stage of development K derives from. Also, statement (f) depicts how the original judgement as reflected by K evolves through a succession of K's and ultimately [judgement] reduces to zero as the experience pure premium, $\overline{\overline{P}}_u$, [usually] eventually displaces $\overline{\overline{P}}_u$ until it [$\overline{\overline{P}}_u$] becomes the operating basis pure premium without qualification.

DEMONSTRATION

Given a situation producing the following circumstances subject only to normal credibility procedures at the conclusion of the first twelve months of operation:

$$K = .80$$

$$P_c = \$50.00, \overline{P}_c = \$54.00, \overline{\overline{P}}_c = \$52.80 \quad (Z_c = .70)$$

$$P_u = \$40.00, \overline{P}_u = \$36.00, \overline{\overline{P}}_u = \$39.20 \quad (Z_u = .20)$$

Also, suppose that overall operational progress is dependent on precisely two attributes which have been identified as follows:

> Total sales, S, as measured by the total direct premiums written since the inception of operations.
>
> Number of claims closed and paid, N, since the inception of operations.

Furthermore, suppose that the corresponding $\overline{f}$'s have been constructed (very simply) as follows:

Sales:

$$\overline{f}_1(u_1, t) = \overline{f}_1(S, t)$$

$$= \begin{cases} (S/10^7)\ (t/36)^{1/2} & \text{if} \quad (S/10^7)\ (t/36)^{1/2} \leq 1 \\ 1 & \text{if} \quad (S/10^7)\ (t/36)^{1/2} > 1 \end{cases}$$

Claims:

$$\overline{f}_2(u_2, t) = \overline{f}_2(N, t)$$

$$= \begin{cases} [(N/10{,}000)\ (t/60)]^{1/2} & \text{if} \quad [(N/10{,}000)\ (t/60)]^{1/2} \leq 1 \\ 1 & \text{if} \quad [(N/10{,}000)\ (t/60)]^{1/2} > 1 \end{cases}$$

Given that:

$$S = \$2{,}825{,}000$$
$$N = 8{,}022$$

$\bar{f}_1$ and $\bar{f}_2$ derive immediately:

$$\bar{f}_1\,(2{,}825{,}000\ ;\ 12) = 0.16$$
$$\bar{f}_2\,(8{,}022\ ;\ 12) = 0.40$$

Finally, suppose a system of weights $w_i(t)$ has been defined as follows:

$$w_1(t) = (2t^2 - 5t + 1)\ /\ [2t(t+1)]$$
$$w_2(t) = (7t - 1)\ /\ [2t(t+1)]$$

And, for $t = 12$,

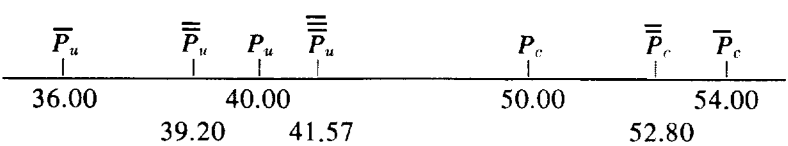
$$w_1(t) = .73 \quad \text{and} \quad w_2(t) = .27$$

Substituting in (VII) and (VIII) respectively yields:

$$W(S, N, t) = \sum_i w_i(t)\,\bar{f}_i\,(u_i, t)$$
$$= w_1(t)\,\bar{f}_1\,(S, t) + w_2(t)\,\bar{f}_2\,(N, t)$$
$$= .22$$

$$\text{and } \overline{\overline{\overline{P}}}_u = \$41.57$$

Once again, on a real number line, the following depicts the entire demonstration:



To illustrate the iterative properties of the process as described herein, the new value of K (at 12 mos) reduces to

$$\overline{K} = \overline{\overline{\overline{P}}}_u / \overline{\overline{P}}_c = \$41.57/\$52.80 = 0.787$$

Thus the initial judgement setting K at .800 has been augmented and is now reset at $\overline{K} = 0.787$. When the second review becomes due, equation (VIII) will utilize $\overline{K}$, ultimately producing $\overline{\overline{K}}$, and so on. It should be noted that the "evolution" of K, through its various updates, does not impact the continued application of (VIII) with the same originally selected $\bar{f}_i$'s and w_i's.

CONCLUSION

Although the discussion has been couched in terms of the pure premium, the principles espoused here are equally applicable to any measurable aspect of the insurance transaction with, of course, appropriate modifications to the construction. The use of the pure premium is primarily in deference to the genesis of the idea within a personal lines framework.

One important application presents itself when an insurer elects to expand its operation to another jurisdiction. The "seasoning" of this new book of business will be an important aspect in assessing operational results during the early stages.

A word about the matter of selecting the functions $\bar{f}_i$ and w_i. Although each function can take innumerable forms—just which form(s) is the most responsive to the particular prospective modus operandi of the new writer is a matter of great import. These selections truly represent a new writer's insight, experience, and planning. This issue is not of as much moment for the already operational writer simply expanding its operations geographically as there probably exists a great store of knowledge about likely performance standards.

Finally, while the role of judgement in the ratemaking process could not be denied, this effort hopes to have established a framework for the systematic and consistent application of judgement by the new writer as the character of its operations evolves into an ongoing posture.

DISCUSSION BY FREDERICK W. KILBOURNE

Once upon a time there was an artillery captain who was told by his commanding officer to shell the enemy. "Yes, Sir," said the captain, "but where, pray tell, is the position of our enemy?" "It is your job to determine that position," said the commanding officer, who then turned and walked away.

The captain was perplexed and upset for a moment, but soon he recovered his composure and set about proving that he was worthy of his position. He called before him one of his lieutenants and said, "Lieutenant, find out for me how the other artillery captains are shelling the enemy."

Little more than a fortnight passed when the lieutenant reported back as follows: "Sir," he reported, "the other artillery captains are reluctant to give you the information you request because you are not Regular Army, Sir, and because they envy the size of the artillery weapon at your disposal. I have been able to get some information, however, from a lieutenant who is a friend of mine in one of the other divisions. He tells me that his captain fires regularly and with some success at position 50.00, although there is some concern that the enemy may be moving from that position. Reports from the field indicate that the enemy may now be bivouacked at position 54.00. Since the captain has 70% confidence in those reports he is now in the process of adjusting his gun to shell position 52.80. Therefore, Sir," said the lieutenant with obvious pride at the intelligence he had gathered, "it is clear that you should shell position 52.80."

"You've done a soldierly job, Lieutenant," said the Captain, but he thought to himself, "do I not know more that will help me perform my job? The enemy division that is my target is on foot and therefore has probably not gone so far as the cavalry division with which the other captain is concerned. My gun is a splendid and expensive weapon, though untried, and should be capable of great accuracy. I think I should aim for position 40.00."

And so it came to pass that our artillery captain fired for a year at position 40.00. During that time his lieutenant kept careful count of the number of bodies blown skyward with each blast and at the end of the year he reported once again. "Captain, Sir," said the Lieutenant, "our observations have been somewhat obscured by the smoke from the constant shelling but our body count leads me to recommend that you shift the gun to shell position 36.00. Should the smoke and my inexperience so concern you, however, that you have only 20% confidence in my report, Sir, it is clear to both of us I am sure that you should aim for position 39.20." So saying, the lieutenant saluted, smiled and was dismissed from the parable.

The captain again thought to himself. "According to the Army manual," he thought, "I should indeed now fire at position 39.20. But even as I cannot completely accept the observations of my lieutenant, neither can I completely deny the relationship between my original setting and the original setting of the other captain. In fact on reflection I find that my confidence in that relationship remains as high as 78%, although I must admit that I now have 22% confidence in my own operation. Accordingly it is clear that I should not overlook the change undertaken by the other captain, and thus that I should now aim at position 41.57."

At this point the commanding officer returned to the scene and addressed himself to the captain over the roar of the gun now shelling position 41.57. "Captain," he said, "you have done well and show promise of one day helping this army win the war. The enemy is in a defensive position, though not yet beaten. I do not mean to tell you how to calibrate your gun, but I do have some suggestions that you may wish to consider. We now have available at headquarters a machine with which you can measure the wind, and thus adjust your setting to compensate for this factor. Also, I have here the experience reported by an anti-aircraft unit operation in the area which, though not directly applicable to your problem, contains information that is useful by analogy. Further, our intelligence unit has completed a survey of the opinions of peasants in the area as to the probable location of the enemy division with which you are concerned. Better yet, we have captured one of the enemy forces and find that he is willing to plea-bargain and to tell us all that he knows which, though subjective, is enlightened and is useful input indeed. Also, I think you will find that repositioning your gun after each firing rather than merely at yearend will improve its accuracy. And finally, come peer with me through the smoke for I think you will find that, although we cannot see the enemy, we can catch fragmentary glimpses of information that bears witness to his location."

So saying the commanding officer turned and again left the captain to his thoughts. "How proud I am," thought the captain, "of the progress I have made this year. How excited I am to see that there is a wealth of information useful to my job and available, given the proper equipment and supporting staff. How happy I am that we will win the war this year."

The story ends happily, but not quite so quickly as within the year. The captain found that he needed approval from the general before he could obtain the equipment and manpower necessary to expand his job and improve his product. The general, it turned out, was impressed by the enthusiasm of the captain, but understood him not at all. The captain thus found that it was not enough to have the right idea, but that it was also necessary to communicate and sell that idea to the general. This he did in time and the war, though not won, at least was not lost.

And they all lived happily ever after, though it took many years indeed before they were really welcomed by the other branches of the Army.

HOMEOWNERS INSURANCE RATEMAKING

MICHAEL A. WALTERS

INTRODUCTION

The approach taken in this paper is a little different from some other ratemaking papers in that no specific historical development was attempted. The only historical background felt to be needed was the "invention" of the homeowners policy in the 1950's and the introduction of a more detailed statistical plan in the 1960's. Because the homeowners policy is not much beyond its infancy, or at most adolescence, it is not surprising to find changes in ratemaking techniques occurring more frequently for this line of insurance. These changes are generally inspired by new insights into the nature of the coverage or by greater awareness of the statistical plan capabilities.

Because of these inevitable changes in techniques, and since ratemaking papers in the CAS *Proceedings* are not updated annually, the procedures described in this paper may not be "current" for very long. However, they can provide insight for other lines of insurance with similar problems, in addition to bringing the record up-to-date at least as of 1974. The main purpose, therefore, was to deal with some of the important concepts in Homeowners ratemaking and to illustrate some appropriate procedures consistent with basic ratemaking principles and made possible by the available statistical data.

The contents are not sufficient for a complete "Cookbook", and in order to keep the length of the paper manageable, presume a basic knowledge of policy forms, coverages, and statistical plans. The scope of the paper consists of:

1) General ratemaking perspective;
2) Statewide ratemaking for the basic policy forms (HO-1, 2, 3 & 5);
3) Territory ratemaking for the same forms;
4) Tenants Form (HO-4) ratemaking;
5) Summary and conclusions;
6) Appendices including some classification treatment of Policy Form and Amount of Insurance, as well as more detailed developments not appropriate for the body of the paper.

In addition to describing the procedures within each topic, some justification and perspective will also be given, along with any alternative methods that come to mind. Although the procedures are basically taken from a rating bureau standpoint (i.e. Insurance Services Office), some application can be made to individual company ratemaking.

SOME PERSPECTIVES ON RATEMAKING

Since one of the most difficult elements of the "scientific method" is the proof or verification of the hypothesis involved, perhaps insurance ratemaking should be viewed as more of an art than a science because no one can scientifically guarantee the future.With this in mind, insurance ratemaking could be defined as the art of projecting scientifically measured past experience into valid (but not absolutely certain) conclusions about future insurance experience.

Usually one of three situations or stages confronts the ratemaker in his attempt to project the future for a line of insurance. The first occurs when no data is available, or essentially when a new product is being formed; the next stage occurs when experience exists, with no expected changes in the nature of the product; and lastly when experience exists but modifications in coverage are expected to take place. Given the basic tenet in the art of ratemaking that "history will repeat itself", Stage Two is obviously the easiest environment in which to make rates.

Stage One No Data

Stage One is a most difficult time for ratemakers, especially when a product like Homeowners insurance comes along, with the packaging of many heretofore separate coverages on a mandatory basis into one policy. It may have been true that the contractual coverages looked similar to the monoline policies for fire, windstorm, theft, other physical damage, and personal liability; but no one could predict with accuracy the behavior of insureds with all those coverages together. Not only was "adverse selection" eliminated by mandating all these coverages, but amounts of insurance were also preordained for contents (both on and away from premises) once the value of insurance on the dwelling building was determined. This eliminated or reduced substantially the problems of underinsurance.

The result of all this was a policy form with lower pure premiums (loss cost per unit of exposure) for each of the coverages involved than on a monoline level where insureds may select only those coverages they think are necessary, choosing to self-insure those hazards with much lower expected losses. The spread of loss achieved from this packaging of coverages on a mandatory basis gives the policyholder more coverage at a much lower total pure premium than obtained from buying the monoline policies separately, plus the advantage of the expense savings in a package policy. In this regard, no more successful package policy has existed before, nor is likely to be devised again, because of the nature of the hazards covered and the type of market involved.

The ratemaking for this first phase necessarily contains a lot of judgment, with the selection of package discounts from the monoline policy costs being based more on theory and hope than on empirical data. The rapid development of actual experience under the new product depends, of course, on its success in the marketplace. Ideally, the use of actual experience rapidly substitutes for the initial estimates based on theory and judgment.

Stage Two—Actual Experience

For Homeowners insurance, Stage Two built up rapidly with not too many of the transitional problems of having both monoline and package policies marketed simultaneously to the same types of customers. Consequently, the actual experience collected under Homeowners insurance could be used directly and more quickly in appropriate projections of the future experience for purchasers of this coverage.

Of course, ratemaking is not as simple as "history repeating itself". Even for a line of insurance remaining fairly stable as regards type of coverage, there is more to predicting the future than knowing precisely what happened in the past.

Certain modifications are needed to put past experience on current conditions. Premium levels may have changed such that today's manual rates are different from those in effect during the past experience period. Loss patterns may be changing such that a past year's value is but one observation in a changing sequence of pure premiums due to inflation, increased affluence, varying accident frequencies, and changes in claim consciousness. Furthermore, the observed experience in the past may have been a non-typical value owing to random fluctuations inherent in the data or to unusual events with a cyclical frequency extending beyond one or even ten years in cycle.

These phenomena, of current level adjustments, trend, credibility, and catastrophe, are present to some extent in every line of insurance and will be discussed in more detail in the procedures for Homeowners insurance ratemaking.

Stage Three—Changes in Coverages

Marked changes in coverage or conditions cause additional difficulties for the ratemaker since past experience must be supplemented by additional judgment.Homeowners insurance has been, and still is, in this third stage of ratemaking because of changes in deductibles over the past few years. The upheaval in coverage may not be as large when compared to No-Fault implementation in automobile insurance, but new insights are just as necessary in trying to project the most appropriate rates.

At this point it might be well to consider the differences between the "loss ratio" and the "pure premium" methods of ratemaking. The "loss ratio" method is a simpler approach and relies greatly on the actual premiums charged to insureds in the past. Class or territory detail need not be maintained to ascertain a statewide rate level change. As long as class, territory, and coverage relationships have stayed relatively constant, overall losses compared to overall premiums (adjusted to current conditions) are sufficient to decide how much to change current overall premiums to provide for future losses and expenses. In the simplest case, statewide earned premiums and statewide incurred losses can be adjusted to current levels. The resulting loss ratio when compared to an expected loss ratio yields the indicated statewide rate level change.This overall statewide rate level change is then applied to each class, territory and coverage manual premium to arrive at enough overall dollars in the future, keeping the same relationships among class, territory, and coverage.

However, what if there have been two optional coverages available, one of which was inadequately priced (e.g. a 50 deductible option), while the other was more properly rated (e.g. full coverage)? If the volume of premiums has also been switching from the full coverage to the 50 deductible option, then the loss ratio method using total statewide premium and losses would, in this example, show less of a rate level need than is appropriate.[1]

Example:

	Experience Pure Premium	Pure Premium (Avg. Rate × Expected Loss Ratio)	Number of Exposures
Full Coverage	\$ 110	\$ 120	100,000
\$50 Deductible	100	80	100,000
Average	\$ 105	\$ 100	200,000

Indicated Rate Level Change (Loss Ratio Method) $= \frac{\$105 \times 200{,}000}{\$100 \times 200{,}000} = \frac{\$21{,}000{,}000}{\$20{,}000{,}000} = +5\%$

However, if current distribution is 100% in \$50 Deductible,

True Indicated Rate Level Change $= \frac{\$100}{\$\ 80} = +25\%$.

The "pure premium" approach, on the other hand, would have the ability to identify the average loss per policy for each of the two coverages separately. It has the advantage of being independent of the actual premiums that were charged in the past and of the relative adequacy by class, territory or coverage. Taking the set of exposures in the past that produced the experience pure premiums, the current manual rates can be used to hypothetically re-rate those exposures as a test of the adequacy of today's rates. In addition, if only one coverage is being offered now, then the exposures can be extended at that particular set of rates, and the pure premiums can be modified accordingly.

Expressed more simply, the "pure premium" method is more concerned with rating a particular coverage properly, regardless of what the average insured may have paid or is paying today. After the coverage is rated, then an effort is made to see what the change is for the average insured to arrive at the new rate. On the other hand, the "loss ratio" method first determines an indicated change in rates. The difficulty with that method is then to find out whether some of the change has already been accomplished by recent switches in coverage or class.

STATEWIDE RATE LEVEL FOR BASIC HOMEOWNERS POLICY FORMS

Lest this paper dwell too long in a theoretical vein, it would be worthwhile to look at an example of a statewide rate level-review. However, so that a concrete illustration won't bore the reader with simplicity, a further complication is introduced into the theory. Let us say that two optional coverages have existed in a state for some time: full coverage and a $50 disappearing deductible[2] on Section I (non-Liability) perils, with only the deductible premiums now being displayed in the manual. Suppose the intention is to withdraw those two options and only offer a third coverage in the future—namely, a $100 flat deductible on Section I perils. The idea is to test the adequacy of the current manual premiums (although they are for $50 deductible coverage) as being possibly appropriate for the new $100 deductible coverage. In case any changes are indicated, the resulting change in premiums might be a convenient way of calculating the new rate for the new coverage, but it would be insufficient to describe the entire transaction. The true rate level change would be the combination of the premium level change to the

[2] $50 deductible "disappears" at $500 via formula: Deductible amount equals $50 less 11% of loss amount above $50 up to $500.

present mix of deductible options and the change in coverage from the present options to a $100 Flat deductible.

Adjusted Premiums

For many lines of insurance, the traditional way of adjusting premiums for ratemaking purposes was to start with the actual written premiums. In addition to being earned into a particular calendar period, they would also be adjusted to current level by means of "on-level" factor based upon price changes since the policies were originally written. This usually entails making assumptions as to when the policies were actually written (with the average policy customarily assumed to be written July 1, for example). Of course, any varying changes by class, territory, or coverage would compound the assumptions or calculations necessary to convert past premiums to current levels.

With the advent of computers, data bases, and more sophisticated statistical plans, however, many of those assumptions need not be made in arriving at premiums adjusted to current level. The existence of exposures in class and territory detail, for example, permits the calculation of premiums at present manual rates by extending each set of exposures by class and territory by the appropriate present manual rates. By accumulating the results over all classes and territories, a statewide total of adjusted premiums is produced without ever having to deal with past collected premiums and making assumptions on subsequent changes.Furthermore, a much better estimate is also produced for each subset of statewide totals, such as by territory or by class, for purposes of reviewing relative adequacy of the rates for those subsets. This method is also superior when experience for many insurance companies is pooled, because of the possibility of non-uniformity by company of both past rate levels and effective dates of changes in rate levels.

For Homeowners insurance, this method of extending exposures has the further advantage of being able to hypothetically re-rate all insureds at one particular coverage, regardless of what they had originally purchased. For example, if a mixture of full coverage and $50 disappearing deductible policies had been sold in the past, enough information is retained on the statistical record to extend all those policies at the current manual rates for the $50 deductible. The important concept is that adjusted premiums can represent a past set of insureds evaluated at a particular set of current rates for a specified coverage. Inherently, this exposure extension technique is a "pure premium" method rather than a "loss ratio" method of ratemaking.

The example given below illustrates the major steps involved in the computer calculation of adjusted premiums from full class and territory detail. The computer scans the records sorted by state, territory, policy form, construction, protection, and amount of insurance. Written exposures in house years are then earned into calendar segments ("earned quarters") by means of term and inception month. The earned exposures in house-years for a calendar year or fiscal year (consisting of the sum of four appropriate earned quarters) are then multiplied by the corresponding annual premium for a particular coverage (usually the broadest deductible displayed in the manual). The manual premium depends upon the territory, policy form, construction and protection class, as well as the amount of insurance.

COMPUTER DEVELOPMENT OF ADJUSTED PREMIUM

(1) Detail	(2) Class	(3) Code	(4) Earned Number of House Years	(5) Unity ($15,000) Premium For Broadest Deductible	(6) Policy Size Relativity Factor	(7) Total Adjusted Premium (4) × (5) × (6)
State:	xx	xx				
Territory:	yy	yy				
Policy Form:	Form 1	1				
Construction:	Brick	3				
Protection:	3	3				
Amt. of Insurance:						
	:					
	$10,000	10	25.0	$49	.86	$1,053.50
	:					
	$12,000	12	6.0	$49	.90	264.60
	:					
	$15,000	15	45.0	$49	1.00	2,205.00
	:					

Additional factors[3] are then applied in appropriate detail to account for increased limits of liability, and additional endorsements such as credit card,

[3] Statistical Plan changes effective January 1, 1974 will facilitate the calculation of basic coverage losses and therefore the elimination or modification of these additional factors. For example, watercraft, snowmobile, and secondary dwellings will be identified on separate reporting records. A new "Type of Loss" code will also permit the subtraction of excess coverage losses from the total in order to more accurately price the "basic" Homeowners coverages found in every policy.

snowmobile, watercraft, etc. The result of all these detail calculations are summarized on a statewide basis and appear in Column (1) of the Statewide Rate Level Exhibit as "Adjusted Premiums". In Exhibit 1 the current broadest deductible used as the input premium was assumed to be a $50 disappearing deductible on Section I perils. Consequently, the initial evaluation will be to test those premiums for adequacy in providing $100 Flat deductible coverage in the future.

Adjusted Losses

The base from which adjustments are made consists of accident year incurred losses[4] as reported in class detail. This means that as of a particular evaluation date, e.g. March 31, 1973, accident year 1972 incurred losses are defined as all losses on accidents occurring during calendar year 1972 which were paid as of March 31, 1973, or which were unpaid as of then but which had loss reserves set up and reported as of March 31, 1973. Loss development factors are obviously needed, as incurred-but-not-reported (IBNR) claims may exist three months after the end of the year, for which no payments have been made nor reserves set up. In addition, the reserves as of March 31, 1973 are likely to be imprecise (generally to the same extent as 15 month reserves have been in the past) when payments are ultimately traced out.

Loss development factors for Homeowners insurance can be calculated in similar fashion as automobile liability insurance. Generally, for an accident year valued as of 15 months, they average less than 1.03 on a countrywide basis, but can vary by state, depending upon the percentage of liability losses. (See Appendix B.)

If changes in deductible are contemplated, as is the case in Exhibit 1, then adjustments should be made to convert the past losses to the new deductible level. In this particular state, the conversion is principally from a $50 disappearing deductible to a $100 flat deductible. However, since full coverage had been offered in the past, the losses under those policies must also be converted to a $100 deductible level.

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[4] Calendar year incurred losses can also be used, consisting of calendar year paid losses plus the increase in reserves over the calendar year period. If reserves in class detail are used in this calculation, a factor for the change in IBNR reserves (not included in class detail reserves) should be applied to the total, since only the paid IBNR losses are in the total paid losses. See Charles F. Cook, "Trend and Loss Development Factors", *PCAS*, Vol. LVII (1970) p. 15.

The method of conversion is through loss elimination ratios (LER's). Since the effect of a deductible will vary according to the distribution by size of loss, LER's should be calculated for each subset of losses which are likely to have a different size of loss distribution. Fire losses tend to have a much higher average size of claim than theft losses. (It is more difficult to imagine a total loss by theft than by fire.) Different policy forms are also likely to produce different average sizes of loss.

LER's are currently developed by cause of loss by policy form. (See Appendix A for method of calculation.) For credibility purposes, countrywide distributions by size of claim are usually utilized separately for each cause of loss and policy form. Once established, these LER's can be applied to a particular state's own loss distributions, including territory and class. The result of applying LER's in full class detail with summarization back to a statewide level is shown in Column (2) of Exhibit 1, as "Losses Adjusted to $100 Flat Deductible."

Catastrophe Losses

From a statistical plan standpoint, a "serialized loss" is defined as any loss arising from an event designated with a Catastrophe Serial Number. A Catastrophe Serial Number is currently assigned shortly after an event by the Statistical Agent (ISO) if all insured property losses from that event are expected to exceed one million dollars for all lines of insurance in all states. Generally, Catastrophe Serial Numbers arise from hurricanes and large tornadoes, and possibly explosions or large area fire conflagrations. For Homeowners insurance currently, "catastrophe losses" are defined to be the sum of all "serialized losses" in a state for each year.

Conceptually, a catastrophe loss is one which ought not be assigned exclusively to the year it occurred because of its unusually large size and infrequent nature. Large hurricanes do not occur every year, and to penalize insureds with a huge rate level increase the year after such an occurrence is to ignore a fundamental precept that ratemaking is not intended to recoup past losses but rather to predict future experience. By the same token, if no hurricanes or other catastrophes have occurred during the experience period under review (now five years for Homeowners insurance[5]), it would also be a

[5] Some states require consideration of "at least five years" experience in reviewing property insurance rate levels. It remains to be seen whether a long-term catastrophe experience period would be sufficient to satisfy the intent of these regulations. This would enable the basic (non-catastrophe element) experience period to be shortened further to three or even two years of premium and loss experience, provided enough volume existed on a statewide basis for credibility purposes. A two or three year experience period might also require the "normalization" of other fluctuating (though not catastrophe) perils by means of some averaging process.

mistake to assume that the potential for catastrophe has vanished.

Therefore, an averaging process is utilized whereby the actual incurred losses from catastrophic events during the experience period are removed and substituted by the expected value of such losses based upon a long range view of at least twenty years of experience for that state. Appendix C discusses a procedure utilizing catastrophe losses from both Homeowners insurance and Dwelling Extended Coverage policies which preceded the Homeowners Program. Essentially, a two-step procedure is involved, with the use of Dwelling EC and Homeowners catastrophe losses to obtain the ratio of catastrophe losses to non-catastrophe windstorm losses. This ratio is then applied to non-catastrophe windstorm Homeowners insurance losses and compared to all non-catastrophe Homeowners losses. This factor (supplemented by a Civil Disorder loading, if necessary) is then applied to the adjusted losses excluding catastrophes for each year in the experience period to arrive at a more normalized set of losses in Column (5) of Exhibit 1.

An alternative approach that is used in other lines of insurance is to keep some of the catastrophe losses in the year they occurred and remove only the excess portion over some specific cap[6]. This implies that perhaps the frequency of event was not so unusual as the severity of loss. A case could be made for either approach, and admittedly either one would show a certain distortion if adjusted loss ratios were used to attempt a loss ratio trending procedure. (Leaving in losses below the cap still shows a high "normal" loss ratio for the year, while removing all losses from the catastrophic event, would depress the "normal" loss ratio.)

A future possibility for Homeowners insurance might be the elimination of serialized numbers entirely, and the identification of unusual events by means of the distortion in cause of loss distributions on an annual, quarterly, or accident month basis. Of course, some flexibility in such a method may be necessary when applying the criteria to individual company experience versus bureau experience.

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[6] For example, automobile bodily injury liability insurance excludes excess losses above $10,000/$20,000 from basic statewide rate level experience, while both Commercial and Dwelling Extended Coverage ratemaking procedures keep an amount in losses up to 100% of the earned premium in the year of occurrence.

Loss Adjustment Expenses

Countrywide expenses as reported in the Insurance Expense Exhibit by company are broken into various functions: General Expense, Acquisition, Taxes, and Loss Adjustment Expenses. While the first three vary more with total premium volume, loss adjustment expenses are more logically a function of losses. Therefore, for Homeowners insurance, the ratio of loss adjustment expenses incurred to pure losses incurred obtained from the Insurance Expense Exhibit can be applied to the accident year incurred losses on a statewide basis to produce losses including Loss Adjustment Expense as shown in Column (6) of Exhibit 1. It currently takes about eleven cents to settle each dollar of a Homeowners claim for the average company.

Trend Factors

Observation of past experience may give the appearance of static conditions, while in fact certain dynamics are at work which influence both the size and frequency of claims. Inflation is perhaps the best known of these influences, and certainly any prediction of future loss experience should include some measurement of past and expected future changes in claim costs due to the increased cost of goods and services which are covered under the policy provisions.

Claim frequencies (within deductible options) can also be changing in Homeowners insurance due to increases in affluence, rising crime rates, and changes in claims consciousness.

Increases in coverage can also be anticipated as inflation causes a rise in the value of residences. Under current procedures, a price exists in the manuals for increased amounts of insurance which reflects both increased coverage and classification differences between houses of different values, (i.e. due to higher affluence, greater theft risk, etc.). The extent to which the classification difference exceeds the coverage difference at higher amounts of insurance represents a potential offset for expected rises in either claim cost or claim frequency.

For Homeowners insurance a simple trend factor can be utilized to track essentially the inflation element in claim costs. As illustrated in Appendix D, a combination of external indices can be used to develop a Composite Construction Cost Index by calendar year and quarter. It is a simple matter then to adjust a past year's losses to current conditions via "known" changes in these costs, and furthermore to project future changes based upon the latest rates of change. "Current Cost Factors" and "Trend Factors" represent the respective adjustments of past values to the date of the latest published government figures and the adjustment from that point to the average date of occurrence of losses payable under policies written after the proposed effective date of the new rates. (The average occurrence date would thus be one year past the effective date, assuming annual policies written over a period of one year.)

When exposure and loss information is available in Homeowners insurance for a sufficient period of time, it is in order to test whether the other elements of change should be quantified and brought into use. Increasing affluence can cause claim costs to rise faster than inflation, as well as affecting frequency and amounts of insurance. Because of changes in deductibles for Homeowners in the past few years, statewide observed claim frequency may not be used by itself. Pure premiums also have this disadvantage unless loss elimination ratios (LER's) are used to put the experience on a common deductible level. Even with this, random cause of loss fluctuations can mask a true pattern of changes by state. Nevertheless, some combination of statewide and countrywide pure premium by cause of loss offers perhaps the best chance to test the continued propriety of using government indices as trend factors.

In recent years, both inflation and increasing demand for personal residences has accelerated the cost of houses and the need for increased amounts of insurance to protect the owners. As mentioned before, the current policy size relativity factors provide for both increased coverage and differences in classification for the higher amounts of insurance. Abrupt increases in coverage amounts can therefore provide an increase in price without a commensurate increase in risk. (If an insured has been underinsured in the past, however, the increase in price is justified on an individual case basis.)

There are various ways of measuring the increase in premium due to this potential excess of price over true coverage. With the current accumulation of "two exposure bases" in Homeowners (number of house years and amount of insurance years), average amount of insurance can be calculated for a period of years. Average premiums at current manual rates can also be determined using the "extension of exposures" technique.

Because fluctuation in average amounts of insurance can occur from year to year due to abrupt lags and pushes in "insurance to value" as well as the influence of new construction, it is better to avoid using the simple observation of loss ratios for trend purposes or the simple fitting of least squares lines to average amounts of insurance in the past.

Whatever the measurement of this phenomenon may be, it is still likely to require a separate treatment of "current cost factors" and "trend" factors. In the illustration for statewide rate level purposes on Exhibit 1, Columns (7) and (8) show Current Cost/Amount Factors and a Trend Factor used to put loss ratios on a prospective experience period level. These factors were derived in Appendix D by one method of factoring out the increase in premium due to increasing amounts of insurance. The change in average policy size relativities is calculated and projected on Sheet 3 of Appendix D. Some tempering is needed to reflect the influence of new construction on average policy size changes.

Indicated Premium Adjustment

The weighting of adjusted loss ratios for all years in the review period is more arithmetical than scientific. With greatest weight given to the most recent year for responsiveness, any reasonable set of weights adding up to 100% could really be used. This presumes that any fluctuations due to catastrophic occurrences are identified and removed. On Exhibit 1, weights of .10, .15, .20, .25, and .30 are used for the five years. Perhaps in the future, some volume criteria could be imposed to allow for reviews with three or even fewer years of Homeowners insurance statewide normal loss experience.

The "Weighted Adjusted Loss Ratio" obtained in Column 8 of Exhibit 1 represents a projected average portion of the premium dollar that will be needed to cover losses and loss adjustment expenses at a $100 deductible level. It should be recalled in this example that the premium dollar being tested is the current broadest deductible premium displayed in the manual—in this case, the premium heretofore charged for a $50 disappearing deductible.

The Balance Point Loss Ratio of .602 in this example consists of the portion of the premium dollar that is available to pay losses and loss adjustment expenses. Identical in concept to the Expected Loss and Loss Adjustment Ratio for automobile insurance ratemaking, it consists of the sum of various appropriate expense ratios plus an allowance for underwriting profit and contingencies. Using the Insurance Expense Exhibit for an expense review of General Administration Expenses and Other Acquisition Costs, and knowing budget requirements for such items as Taxes, Licenses, and Fees as well as Commissions, an Expense Ratio is calculated to which is added a provision for Profit and Contingencies, also expressed as a function of premiums (margin on sales).

The tradition in property insurance has been for a higher provision for profit and contingencies than in casualty insurance due to the presumably greater risk generated by large scale catastrophes such as conflagrations, hurricanes, etc. However, a catastrophe factor dealing with the loss portion in the ratemaking procedure does not affect the need for an extra contingency loading in the profit and contingency factor because no amount of actuarial smoothing or averaging of past loss data for prospective ratemaking purposes has any influence on the inherent risk of loss. Since profit is essentially a reward for risk-taking, increased risk can be reflected in the profit provision independently of the average loss provision however calculated, i.e. through either long-term averaging or no averaging.

The complement of the combined expense and profit provision is called the Balance Point Loss Ratio, and illustrates the portion of premiums available to pay losses and loss adjustment expenses. The extent to which the Adjusted Loss Ratio exceeds the Balance Point Loss Ratio is called the indicated premium adjustment to the broadest deductible. In Exhibit I, it shows how much today's manual premiums for $50 disappearing deductible coverage should be increased to provide $100 deductible coverage in the future, i.e. +4.2%.

Indicated Rate Level Change

The premium change is not the entire story, however, Since an increase in deductible represents a reduction in coverage, the indicated change in rate level is defined to be the change in premium related to the reduced coverage. In this example, the reduced coverage consists of an estimated average of 10.2% (Column (14)) of losses eliminated from the two coverages now offered (given the current distribution of premiums by deductible in Column (15)). The average premium level change from today's options to an automatic $100 deductible would be -0.6% (Column (13)). Therefore, the indicated rate level change is the average premium level change divided by the reduced coverage (.994 ÷ (1.000 − .102) = 1.107) or +10.7%.

Once the indicated rate level change is determined from the underlying experience, there are usually several ways of implementing the indication. One way is simply to change the coverage to the new deductible at the indicated change to the broadest deductible premium (in this example, the $50 Disappearing Section I deductible premiums).

A second alternative is to keep the old deductibles, with the premium change equal to the rate level change. A third choice is to offer two new deductibles—both a $100 flat deductible and a new $50 flat deductible. Since the indicated rate level is fixed, as are the percentage of losses eliminated in switching to those new deductibles, the selection of a price relationship[7] between the $50 and $100 deductibles will determine the premium level change. For example, Exhibit 2 shows how, with certain assumptions as to distribution of business between the new $50 and $100 deductibles, a rate level change is converted to an average premium level change, which is then converted to the change in premium level for the new $100 deductible from the old $50 disappearing deductible level. Note that the appropriate rate for the $100 deductible can be different, depending on whether a $50 deductible option is available. With only a $100 deductible available, the rate can be directly determined from the experience. With the 50 deductible option, more adverse experience can be anticipated for those insureds with the greater coverage, and therefore a lower rate is permitted for the better risks with the $100 deductible.

TERRITORY RATE LEVEL

The purpose of a territory rate level review is to determine whether a statewide rate level inadequacy or redundancy is concentrated in only some geographic areas or is relatively uniform throughout the state. However, the measurement of appropriate rate level by territory for Homeowners insurance presents certain problems which may not exist at the statewide level.

First of all, the volume of data in each territory is less than statewide, with only partial credibility to be expected in some of the smaller territories. Secondly, the identification of catastrophe losses by territory may not have been possible for a long enough historical period. The result is that, even after removal or modification of actual catastrophe losses in the latest review period, a territory catastrophe factor cannot be empirically calculated from long-term experience. A third problem is whether to use the same factors and techniques by territory as in the statewide review, such as: trend factors, loss development factors, loss elimination ratios, accident year weights, etc.

By keeping in mind the purpose of territory ratemaking to distribute the statewide change equitably, it is easier to conclude that more judgment is

[7] With a Loss Elimination Ratio (LER) of 7% or 8% from a $50 Flat to a $100 Flat Deductible, a reasonable additional price for $50 Flat is 10% above $100 Flat with a minimum of $10 and a maximum of $25 as the additional premium.

permissible in the establishment of territory changes since the results are ultimately balanced to the statewide change. Therefore, the question of credibility becomes more of an arithmetic problem in deciding how much weight to give a territory observation versus the statewide indicated change. As an interim standard for Homeowners insurance, the use of 40,000 house years of exposure in a territory during the review period can be considered "fully credible" in calculating an indicated change for that territory. Assuming an average claim frequency of about ten percent for Homeowners insurance, this is equivalent to approximately 4,000 claims as the 100% credibility standard if number of claims were used. Partial credibility[8] can then be determined by the formula $Z = \sqrt{n/K}$, where K is the 100% credibility standard, and n is the individual territory number of exposures in house years. (Currently, K = 40,000 house years.)

The problem of catastrophe factors by territory can be resolved on an interim basis by using whatever information is available in the most recent years in the selection of factors by territory that average to the statewide catastrophe factor calculated from long-term data. In the example given in Exhibit 3, the Territory Catastrophe Factors in Column (6) of Sheet 2 balance to the Statewide Catastrophe Factor of 1.055. Columns (2) through (5) consist of the same data that underlies the statewide rate level experience. Even though future reviews of statewide rate level might contain fewer than five years of experience, it may still be desirable to use five years for territory review purposes. With regard to weights by years, actual premium weights might give more stability than arithmetically weighting the loss ratios. In addition, since judgment is used in the selection process, it is no doubt also sufficient to use the same loss development and other factors by territory as statewide, unless they are suspected to be substantially different.

Sheet 1 of Exhibit 3 shows the recapitulation of some useful information by territory, and illustrates the concept of a "base" territory (with largest volume) as the key to which all other territory indications are related (in Column (5)). This provides a framework and basis for judgment in the selection of relative changes. Additional items to be taken into account in the final selection may be the following: current rate differences among territories (Column (8)); consistency of loss ratios by year (including cause of loss fluctuations); and tempering of the magnitude of changes (realizing that ultimate

[8] See L. H. Longley-Cook, "An Introduction To Credibility Theory," *PCAS*, XLIX (1962).

relativities may have to be achieved over a longer period than one or two years).

Of course, the selection process can just as easily take place in Column (7), especially if a specific limit or "cap" were decided for the changes by territory, such as a maximum change in premium level of 25%. This could be accomplished by imposing the statewide premium level change on Column (7), limiting any changes to + or −25%, and readjusting the other territories accordingly to balance to unity (1.000) again in Column (7). It is important to have this key column balance to "no change" rather than the indicated statewide rate level change, at this stage, because ultimately this column is used to distribute the final premium changes statewide, which can vary depending upon what deductible options are offered. The change to the broadest deductible premium can also be altered due to any classification changes, such as policy size relativities and policy form relativities.

Future innovations in territory ratemaking for Homeowners insurance are likely to include a regional approach to catastrophe factors by territory. This geographical expansion might overcome some of the chronological limitations of catastrophe experience by territory.

TENANTS (FORM 4)

The Tenant's Form in Homeowners insurance provides essentially the same coverage as the Broad Form (Form 2), but is restricted to contents only. Therefore, the nature of the risk can be substantially different since large amounts of insurance are not required for the residence building. This is reflected in the actual distribution of losses by cause of loss for tenants policies, with a majority of losses being from theft, whereas fire is the dominant peril in the basic Homeowners Forms (i.e. HO-1, 2, 3, 5).

The volume of experience under the Tenants Form is also much less than the other forms and at this point the ratemaking techniques are much more simplified. The adjustment of premiums to current manual rates is similar to that used in statewide fire insurance ratemaking[9]. Nevertheless, despite the lower volume, with changes now taking place in the rating of Tenants policies as well as in the marketplace, the extension of exposures is also a technique worth using in the future for this coverage. The example shown in Exhibit 4

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[9] See Robert L. Hurley, "Commercial Fire Insurance Ratemaking Procedures for Statewide Rate Levels and Classification Adjustments", *PCAS*, Vol. LX (1973).

has premium adjusted to the latest premium level (although not necessarily to the broadest deductible level).

The treatment of losses is similar to the other Homeowners forms except that no formal catastrophe factor is deemed necessary owing to the "contents only" nature of the coverage and the relative location of risks generally purchasing Form 4.

Without the conversion of premiums to the broadest deductible, the indicated change is from the average premium (i.e. all deductibles) to the new $100 deductible coverage. Therefore this indication must then be converted to the change from each specific deductible available in the past. Column (12) shows this conversion, with Line (15) being the overall statewide rate level indication reflecting both premium changes and losses eliminated. The further conversion of this indication to premium changes under additional deductible options is similar to the other forms.

SUMMARY AND CONCLUSION

Homeowners insurance appears to be a unique line of insurance. It is a classic illustration of the advantages of a package policy, covering many perils and spanning the entire range of property and casualty insurance. The ratemaking techniques for this line of insurance will no doubt change and evolve along with the nature of the underlying experience data, which follows the changes in insureds themselves who reflect the evolution of society and the environment.

At various stages, the ratemaking for Homeowners insurance by state can become more complicated. This is especially true when there are coverage changes at the same time there are classification changes, all occurring at the time of a state and territory rate level revision. The illustration in this paper covers such a complex situation and is analogous to an automobile insurance rate revision by state and territory where the class plan and increased limits factors are being changed, at the same time as a No-Fault implementation.

Hopefully, there will be more stability in the future when all classes have been reviewed and are up-to-date in the Homeowners package. However, in reality new classes are likely to be formed as others are streamlined. For example, protection classes may be modified in the future, and construction class relativities are also likely to be revised.

While everyone would like to opt for a world of more stable conditions, the actuarial review process is never really finished, if only to verify that conditions are not changing radically so as to warrant a more simplified treatment of the ratemaking process.

Exhibit I

STATEWIDE DEVELOPMENT OF INDICATED RATE LEVEL CHANGE—HOMEOWNERS FORMS 1, 2, 3, 5

YEAR	(1) ADJUSTED EARNED PREMIUMS	(2) LOSSES ADJUSTED TO $100 FLAT DEDUCTIBLE	(3) CATASTROPHE LOSSES ADJUSTED TO $100 FLAT DEDUCTIBLE	(4) INCURRED LOSSES LESS CATASTROPHES (2)−(3)
1968	$12,705,202	$ 6,504,561	$ 1,828,291	$ 4,676,270
1969	13,635,421	6,132,361	10,595	6,121,766
1970	14,391,884	7,287,662	343,183	6,944,479
1971	15,373,390	7,622,374	184,919	7,437,455
1972	16,675,396	10,345,604	2,147,956	8,197,648

YEAR	(5) LOSSES X CATASTROPHE FACTOR (4)×1.055	(6) LOSSES INCL. LOSS ADJUSTMENT EXPENSE (5)×1.115	(7) CURRENT COST/AMOUNT FACTOR	(8) ADJUSTED LOSS RATIOS [(6)×(7)×1.071[a]]÷(1)
1968	$ 4,933,465	$ 5,500,813	1.127	.523
1969	6,458,463	7,201,186	1.090	.617
1970	7,326,425	8,168,964	1.076	.654
1971	7,846,515	8,748,864	1.058	.645
1972	8,648,519	9,643,099	1.021	.632
		(WEIGHTED .10, .15, .20, .25, .30)		.627

(9) Indicated Premium Adjustment for $100 Flat Section I Deductible from $50 Disappearing Section I Deductible[b]:
.627÷.602=1.042 (=+4.2%)

(10) PRESENT DEDUCTIBLE OPTIONS	(11) PRESENT AVERAGE PREMIUM LEVEL	(12) INDICATED $100 FLAT SECTION I PREMIUM LEVEL	(13) (12)÷(11)−1 AVERAGE PREMIUM CHANGE	(14) % OF LOSSES ELIMINATED	(15) CURRENT PREMIUM DISTRIBUTION BY DEDUCTIBLE
Full Coverage	1.300	1.042	−19.8%	16.8%	20%
$50 Dis. Ded.	1.000	1.042	+4.2%	8.5%	80%
Average			−0.6%	10.2%	100%

(16) Indicated Rate Level Change =[1+(13)]÷[1−(14)]−1=+10.7%

[a] Factor to adjust loss ratio on current cost level to 4/1/75.

[b] Balance Point Loss Ratio: .602.

Exhibit 2

DEVELOPMENT OF INDICATED CHANGES STATEWIDE REFLECTING OPTIONAL $50/$100 FLAT DEDUCTIBLES FORMS 1, 2, 3, 5

(1) Indicated Rate Level Change (See Exhibit 1, Line (16)) +10.7%

(2) Estimated Losses Eliminated Under Optional Deductible Program 7.0%[d]

(3) Indicated Total Premium Level Effect [1+(1)]×[1−(2)]−1 + 3.0%[e]

(4) Indicated Premium Level Adjustment by Deductible Option:

(5) Present to Proposed Deductible Options	(6) Present Average Premium Level	(7) Indicated Average Premium Level	(8) (7)÷(6)−1 Average Premium Change	(9) % of Losses Eliminated	(10) Projected Deductible Distribution[a]
Full Coverage					
$50 FD	1.300	1.144[b]	−12.0%	10.6%	20.0%
$50 Dis. Ded.					
$50 FD	1.000	1.144[b]	+14.4%	1.9%	28.5%
$50 Dis. Ded.					
$100 FD	1.000	1.026	+ 2.6%[c]	8.4%	51.5%
Average			+ 3.0%[e]	7.0%	100.0%

Indicated Rate Level Change = +10.7% [1.030÷(1.000−.070) = 1.107]

NOTE: If no change in deductible option were proposed, the premium level change would be +10.7%. The proposed optional ($50 and $100) Flat Section I Deductible decreases the needed premium level to +3.0%; this is due to the losses eliminated by the coverage change. The rate level change (or combined effect) remains the same, regardless of changes in deductible options.

[a] In Forms 1, 2 and 3, assumes 50% of the written premium volume will in the future be in the $50 Flat Deductible and 50% will be in the $100 Flat Deductible.

[b] The effect of the 10% additional charge for the $50 Flat option, with a minimum additional charge of $10 and a maximum of $25 is estimated to be 11.5%. (1.144 = 1.026 × 1.115).

[c] The premium change for the $100 Deductible is less than that developed on Line (9), Exhibit 1 (+4.2%). In recognition of anti-selection, the charge for the $50 deductible is greater than that indicated by loss elimination ratios. Therefore, the adjustment for the $100 Deductible is comparably reduced.

[d] Line (2) is derived by weighting Columns (9) and (10).

[e] Line (3) is then derived, and used to calculate the values in Column (8). (+2.6% is the deduced change to the broadest deductible premium level that reproduces the average change of +3.0% for all deductibles.)

Exhibit 3
Sheet 1

DEVELOPMENT OF INDICATED RATE LEVEL CHANGES BY TERRITORY FORMS 1, 2, 3, 5

Territory	(1) 1972 Distribution of Adjusted Earned Premium	(2) 1968-72 Loss Ratio (Column 8, Sheet 2)	(3) Relativity to Base Territory[a]	(4) Credibility[b]	(5) (3)×(4)+ (1.0−(4))× ((3) Avg.) Indicated Relative Change	(6) Selected Relative Change	(7) (6)÷Avg. (6) Relative Change With No Change Overall	(8) Estimated Current Average Relativity	(9) (5)×(8) Indicated Relativity
01	.546	.490	1.000	1.000	1.000	1.000	.947	1.00	1.00
02	.344	.594	1.212	1.000	1.212	1.100	1.042	1.00	1.21
03	.110	.644	1.314	.900	1.293	1.200	1.136	1.14	1.47
Average[c]	1.000	.543	1.108			1.056	1.000		

Description of Territories: 01 Eastern
02 Central
03 Western

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[a] (2)÷[(2) in Territory with largest volume].
[b] Based on 100% credibility standard of 40,000 house years.
[c] Weighted on 1972 Adjusted Earned Premium Distribution.

Exhibit 3
Sheet 2

1968-1972 ADJUSTED EXPERIENCE BY TERRITORY
FORMS 1, 2, 3, 5

(1) Year	(2) Earned Prem. at Current Prem. Level[a]	(3) Adjusted Incurred Losses[b]	(4) Adjusted Catastrophe Losses[b]	(5) (3)−(4) Adjusted Incurred Losses Excl. Cats.[b]	(6) Territory Catastrophe Factor[c]	(7) (5)×(6)×1.115 Incurred Losses and Loss Adj. Exp. Excl. Trend	(8) (7)÷(2) Loss & Loss Adj. Ratio Excl. Trend
Territory 01: Eastern							
1968	$ 7,577,685	$ 2,332,324	$ 164,144	$ 2,168,180	1.043	$ 2,521,474	.333
1969	7,861,253	3,411,453	2,876	3,408,577	1.043	3,963,988	.504
1970	8,115,055	3,465,230	29,519	3,435,711	1.043	3,995,543	.492
1971	8,499,227	3,948,150	38,351	3,909,799	1.043	4,546,881	.535
1972	9,098,222	4,956,526	536,989	4,419,537	1.043	5,139,678	.565
Total	41,151,442	18,113,683	771,879	17,341,804		20,167,564	.490
Territory 02: Central							
1968	4,397,526	2,595,368	598,489	1,996,879	1.064	2,369,017	.539
1969	4,700,689	2,151,078	2,419	2,148,659	1.064	2,549,083	.542
1970	4,940,659	2,802,216	28,616	2,773,600	1.064	3,290,488	.666
1971	5,249,356	2,960,728	54,761	2,905,967	1.064	3,447,523	.657
1972	5,735,865	3,174,394	479,948	2,694,446	1.064	3,196,583	.557
Total	25,024,095	13,683,784	1,164,233	12,519,551		14,852,694	.594
Territory 03: Western							
1968	729,991	1,576,869	1,065,658	511,211	1.085	618,450	.847
1969	1,073,479	569,830	5,300	564,530	1.085	682,954	.636
1970	1,336,170	1,020,216	285,048	735,168	1.085	889,388	.666
1971	1,624,807	713,496	91,807	621,689	1.085	752,104	.463
1972	1,841,309	2,214,684	1,131,019	1,083,665	1.085	1,310,991	.712
Total	6,605,756	6,095,095	2,578,832	3,516,263		4,253,887	.644

[a] Reflects the current manual premium level for the $50 Disappearing Section I Deductible.

[b] Losses are developed and on a $100 Flat Section I Deductible Level.

[c] The territory catastrophe factors balance to the statewide catastrophe factor of 1.055; (*weighted on Column (5)*) *and satisfy the equation:*

01: 1+X
02: 1+1.5X (The factors 1.5 and 2.0 are selected by judgment.)
03: 1+2.0X

Exhibit 4

STATEWIDE DEVELOPMENT OF INDICATED RATE LEVEL CHANGE—TENANTS—FORM 4

YEAR	(1) ADJUSTED EARNED PREMIUMS	(2) LOSSES ADJUSTED TO $100 FLAT DEDUCTIBLE[a]	(3) LOSSES INCL. LOSS ADJUSTMENT EXPENSE (2)×1.115	(4) CURRENT COST FACTOR
1968	$ 588,318	$ 231,267	$ 257,863	1.256
1969	698,673	302,109	336,852	1.185
1970	837,047	395,424	440,898	1.114
1971	1,046,955	499,867	557,352	1.067
1972	1,184,752	529,937	590,880	1.031

YEAR	(5) LOSSES ON CURRENT COST LEVEL (3)×(4)	(6) TRENDED INCURRED LOSSES (5)×1.062[b]	(7) ADJUSTED LOSS RATIOS (6) / (1)
1968	$ 323,876	$ 343,956	.585
1969	399,170	423,919	.607
1970	491,160	521,612	.623
1971	594,695	631,566	.603
1972	609,197	646,967	.546
	(WEIGHTED .10, .15, .20, .25, .30)		.589

(8) Indicated Premium Level Adjustment for $100 Flat Section I Deductible from Present Deductible options[c]: .589 ÷ .602 = .973 (= −2.2%).

(9) Present Deductible Options	(10) Present Average Premium Level	(11) Indicated $100 Flat Section I Premium Level	(12) (11)÷(10)−1 Average Premium Change	(13) % of Losses Eliminated	(14) Current Premium Distribution by Deductible
Full Coverage	1.250	1.063	−15.0%	17.1%	40%
$50 Dis. Ded.	1.000	1.063	+ 6.3%	10.9%	60%
			− 2.2%	13.4%	100%

(15) Indicated Rate Level Change = +12.9% [.978 ÷ (1.000 − .134) = 1.129]

[a] Average Loss Elinination Ratio (for 5 year period): .112.
[b] Factor to adjust losses on current cost level to 4/1/75.
[c] Balance Point Loss Ratio: .602.

Appendix A
Sheet 1

$100 FLAT DEDUCTIBLE LOSS ELIMINATION RATIO SUPPLEMENT

This memorandum explains the analysis and development of loss elimination ratios (LER's) recognizing the effect of a $100 Flat Deductible.

LER's can be developed from a study of accident year loss data from a large sample of companies. The data consists of claims which are broken down by form, by deductible, by cause of loss and by size of loss. This is the basis for the computation of a $100 Flat Section I Deductible LER, i.e. the percentage of loss eliminated in converting full coverage losses to losses payable under a $100 Flat Section I deductible.

The following example is a step by step development of a $100 Flat Section I Deductible LER for Form 1—Cause of Loss—Fire.

PART 1

The data shown on Sheet 2 is an extract of the data underlying the development of the aforementioned LER for Form 1, Cause of Loss—Fire. This extract represents Homeowners Policy Form 1, Deductible Code 1 (Full Cover), Cause of Loss—Fire; and shows the number and amount of losses broken out by size intervals (as shown below).

		Formula Identification	
Size of Loss Intervals[a]	Size of Loss Code	Number of Losses	Amount of Losses
.00- 1.77	1	N1	L1
1.78- 3.15	2	N2	L2
3.16- 5.61	3	N3	L3
5.62- 9.99	4	N4	L4
10.00- 17.77	5	N5	L5
17.78- 31.61	6	N6	L6
31.62- 56.22	7	N7	L7
56.23- 99.99	8	N8	L8
100.00- 177.82	9	N9	L9
177.83- 316.22	10	N10	L10
316.23- 562.33	11	N11	L11
562.34- 999.99	12	N12	L12
1000.00- 1778.27	13	N13	L13
1778.28- 3162.28	14	N14	L14
3162.29- 5623.37	15	N15	L15
5623.38- 9999.99	16	N16	L16
10000.00-17782.79	17	N17	L17
17782.80-31622.84	18	N18	L18
31622.85-56233.74	19	N19	L19
56233.75-99999.99	20	N20	L20
100000.00 and above	21	N21	L21

[a] Intervals selected from logarithmic scale (as size of loss distributions are often log-normal).

Appendix A
Sheet 2

LER SUPPLEMENT

HOMEOWNERS HO-1

FULL COVER, CAUSE OF LOSS FIRE

SIZE OF LOSS INTERVAL CODE(X)	NUMBER OF LOSSES(N)	AMOUNT OF LOSSES(L)
1	151	4.05
2	14	38.65
3	93	435.77
4	228	1806.39
5	736	10033.31
6	1159	28078.54
7	1225	52661.88
8	1120	86978.56
9	821	110678.75
10	636	149308.81
11	396	167214.81
12	257	192336.19
13	157	198823.31
14	96	224101.44
15	71	306616.31
16	75	574609.31
17	100	1280350.00
18	22	490346.25
19	1	42574.00
20	1	66000.00
21	0	0.0

Summary of above Data:

$\sum_{X=1}^{8} L_X$ = Sum of the amount of losses under \$100.00 = \$ 180,037

$\sum_{X=1}^{21} L_X$ = Sum of the total amount of losses = \$3,982,996

$\sum_{X=9}^{21} N_X$ = Sum of the number of losses for loss amounts greater than or equal to \$100.00 = 2,633

Appendix A
Sheet 3

LER SUPPLEMENT

PART 2

The following sets forth the formula for development of the Loss Elimination Ratio on a $100 flat basis and shows its application to the data summarized in Part 1. The Loss Elimination Ratio developed is .083 for the peril of Fire under Form 1. The same formula is used for other causes of loss under Forms 1, 2, 3 and 5.

$$\frac{\sum_{X=1}^{8} L_X + \$100 \sum_{X=9}^{21} N_X}{\sum_{X=1}^{21} L_X} = \text{LER}$$

The $100 Flat Deductible Loss Elimination Ratio formula described:

LER	$100 flat deductible loss elimination ratio
=	equals
$\sum_{X=1}^{8} L_X$	(a) the elimination of all losses under $100.00
+	plus
$100 $\sum_{X=9}^{21} N_X$	(b) the elimination of $100 of every loss over $100.00
÷	divided by
$\sum_{X=1}^{21} L_X$	the total amount of losses.

The application of the formula to the data summarized in Part 1 develops the LER for Form 1, Cause of Loss Fire:

$$\text{LER} = \frac{\$180{,}037 + [\$100 \times 2{,}633]}{\$3{,}982{,}996} = \frac{\$443{,}337}{\$3{,}982{,}996} = .111$$

Tempered LER: .111 x .75 = .083

The LER's are tempered to recognize the prospective change in loss settlement patterns resulting from increasing the size of deductibles for insureds.

Appendix B

LOSS DEVELOPMENT SUPPLEMENT

	Accident Year	Factor 15 to 27 Months	Weight	Factor 27 to 39 Months	Weight	Factor 39 to 51 Months	Weight	Factor 51 to 63 Months	Weight
Statewide	1968	1.041595	.07	1.007904	.10	1.002720	.20	.996567	1.00
	1969	1.032352	.27	1.006483	.40	1.005274	.80		
	1970	1.017355	.33	.992399	.50				
	1971	1.011214	.33						
	Weighted Average	1.021074		.999583		1.004763		.996567	
Countrywide	1968	1.028596	.07	1.000352	.10	.998903	.20	1.000000	1.00
	1969	1.025400	.27	1.000585	.40	1.000518	.80		
	1970	1.026445	.33	1.003333	.50				
	1971	1.021209	.33						
	Weighted Average	1.024586		1.001936		1.000195		1.000000	

Selected Factors

Applicable to Accident Years	Factor[a]
1968 (63 months to ultimate)	1.000
1969 (51 months to ultimate)	1.000: 1.000000 = (51 to 63 months) x (63 months to ultimate)
1970 (39 months to ultimate)	1.000: 1.000195 = (39 to 51 months) x (51 months to ultimate)
1971 (27 months to ultimate)	1.002: 1.002131 = (27 to 39 months) x (39 months to ultimate)
1972 (15 months to ultimate)	1.023: 1.023250 = (15 to 27 months) x (27 months to ultimate)

[a]State factor used for 15 to 27 months and Countrywide factors for 27 to 63 months.

Appendix C
Sheet 1

STATEWIDE

DERIVATION OF CATASTROPHE FACTOR BASED ON 1953-1972 EXPERIENCE

	(1) Catastrophe Serial Numbered Losses	(2) Homeowners Wind Losses	(3) Normal Wind Losses (2)−(1)
1953-1967[a] Dwelling ECE Losses	$ 2,544,426	$26,362,835	$23,818,409
1957-1972 Homeowners Losses	11,126,556	26,982,744	15,856,188
Total	$13,670,982	$53,345,579	$39,674,597

(4) Loading for Catastrophe = Total (1)/Total (3) = .345

(5) Provision for Cats. = (4) × Homeowners (3) = $15,856,188 × .345 = $5,470,385

(6) Total (All Causes) Homeowners Losses 1957-1972 = $111,070,095

(7) Total (All Causes) Normal HO Losses 1957-1972 = (6) − Homeowners (1):

$111,070,095	=	(6)
11,126,556	=	Homeowners (1)
99,943,539	=	Total Normal HO Losses 1957-1972

(8) Catastrophe Factor for Normal Homeowners Losses = 1 + ((5)/(7)):

$$1 + \frac{\$\ 5{,}470{,}385}{\$99{,}943{,}539} = 1.055$$

---

[a] After 1967 Dwelling ECE is considered a truly residual coverage.

Appendix C
Sheet 2

DERIVATION OF STATEWIDE CIVIL DISORDER FACTOR BASED ON 1965-1972 EXPERIENCE

(1)	Statewide Reported Losses (1965-1972) (Forms 1, 2, 3, 5)	\$ 69,065,557
(2)	Statewide Reported Catastrophe Losses, Including Riot and Civil Disorder Losses	7,139,025
(3)	Statewide Normal Losses: (1) − (2)	61,926,532
(4)	Statewide Reported Riot and Civil Disorder Losses	11,103
(5)	Statewide Civil Disorder Potential: (4) ÷ (3)	.0002
(6)	Statewide Civil Disorder Factor: (5) subject to maximum and minimum[a]	.0002
(7)	Statewide Catastrophe Factor (from Sheet 1)	1.055
(8)	Statewide Catastrophe Factor, Including Civil Disorder Factor: (6) + (7) (Rounded to three decimal places)	1.055

[a] To assure credibility the maximum Civil Disorder Factor is the higher of twice the countrywide potential and the mean of the state and countrywide potentials. The minimum is one-half the countrywide potential.

Countrywide Civil Disorder Potential:

$$= \frac{\text{Reported Civil Disorder and Riot Losses (1965-1972)}}{\text{Normal Reported Losses (1965-1972)}}$$

$= .0004$

Appendix D
Sheet 1

DEVELOPMENT OF CURRENT COST FACTORS (CSF) AND TREND FACTOR FOR FORMS 1, 2, 3, 5

QUARTER ENDING JUNE 30, 1973

PART A: ESTABLISHMENT OF MONTHLY COMPOSITE CURRENT COST INDEX (CCCI), WITH:

60% WEIGHT TO BOECKH RESIDENTIAL CONSTRUCTION COST INDEX
40% WEIGHT TO MODIFIED CONSUMER PRICE INDEX (MCPI)[a]
(BOECKH BASE: 1967 = 100   MCPI BASE: 1967 = 100)

	1970				1971				1972			
MO.	BOECKH	MCPI	CCCI	3 MOS. AVG.	BOECKH	MCPI	CCCI	3 MOS. AVG.	BOECKH	MCPI	CCCI	3 MOS. AVG.
7	123.6	118.1	121.4		135.6	123.5	130.8		146.7	127.5	139.0	
8	123.9	118.7	121.8		136.3	123.9	131.3		147.6	127.7	139.6	
9	125.1	119.5	122.9	122.0	137.5	124.5	132.3	131.5	148.3	128.5	140.4	139.7
10	125.3	120.2	123.3		137.5	124.9	132.5		148.8	128.9	140.8	
11	126.1	120.9	124.0		137.5	125.3	132.6		149.3	129.3	141.3	
12	126.2	121.4	124.3	123.9	137.5	125.6	132.7	132.6	149.6	129.6	141.6	141.2

	1971				1972				1973			
MO.	BOECKH	MCPI	CCCI	3 MOS. AVG.	BOECKH	MCPI	CCCI	3 MOS. AVG.	BOECKH	MCPI	CCCI	3 MOS. AVG.
1	126.4	121.4	124.4		140.1	125.6	134.3		149.7	129.4	141.6	
2	126.6	121.5	124.6		141.9	126.0	135.5		151.4	129.9	142.8	
3	128.5	121.6	125.7	124.9	142.8	126.3	136.2	135.3	154.7	130.4	145.0	143.1
4	129.7	121.9	126.6		143.7	126.7	136.9		157.3	131.0	146.8	
5	129.7	122.7	126.9		144.6	127.1	137.6		159.2	131.6	148.2	
6	130.3	123.2	127.5	127.0	145.6	127.4	138.3	137.6	160.3	132.0	149.0	148.0

DEVELOPMENT OF CURRENT COST FACTORS (CSF) AND TREND FACTOR FOR FORMS 1, 2, 3, 5

QUARTER ENDING JUNE 30, 1973

PART B: USE OF AVERAGE ANNUAL CCCI TO CALCULATE CURRENT COST FACTORS (CCF)

CALENDAR YEAR AVERAGE CCCI				CURRENT COST FACTORS BASED ON AVERAGE CCCI VALUE FOR QUARTER ENDING JUNE 30, 1973 = 148.0
YEAR	BOECKH	MCPI	CCCI	
1968	107.3	104.7	106.3	148.0/106.3 = 1.392
1969	116.2	111.0	114.1	148.0/114.1 = 1.297
1970	122.4	118.0	120.6	148.0/120.6 = 1.227
1971	132.8	123.3	129.0	148.0/129.0 = 1.147
1972	145.8	127.6	138.5	148.0/138.5 = 1.069

[a] Modified Consumer Price Index (MCPI) = combination of following items in Consumer Price Index (with weights 60%, 20%, 10% and 10%): housing, apparel, recreation and medical care.

Appendix D
Sheet 2

PART C: COMPUTATION OF LOSS TREND FACTOR FOR FORMS 1, 2, 3, 5

CALENDAR YEAR	QUARTER ENDING	TIME (2X)	AVERAGE CCCI (Y)	(2XY)	($4X^2$)
1970	SEP. 30	−11	122.0	−1342.0	121
1970	DEC. 31	−9	123.9	−1115.1	81
1971	MAR. 31	−7	124.9	−874.3	49
1971	JUN. 30	−5	127.0	−635.0	25
1971	SEP. 30	−3	131.5	−394.5	9
1971	DEC. 31	−1	132.6	−132.6	1
1972	MAR. 31	1	135.3	135.3	1
1972	JUN. 30	3	137.6	412.8	9
1972	SEP. 30	5	139.7	698.5	25
1972	DEC. 31	7	141.2	988.4	49
1973	MAR. 31	9	143.1	1287.9	81
1973	JUN. 30	11	148.0	1628.0	121
		0	1606.8	657.4	572

EQUATIONS:

$$Y = A + BX$$

$$SY = NA + BSX$$

$$SXY = ASX + BSX^2$$

WHERE A = MEAN OF FITTED LINE
B = AVERAGE QUARTERLY INCREMENT
S = SUMMATION
N = NUMBER OF OBSERVATIONS

$2SXY = 657.4$ OR $SXY = 328.70$

$4SX^2 = 572$ OR $SX^2 = 143$

A(MEAN OF FITTED LINE) = 1606.8/12 = 133.90

B(AVG. QUARTERLY INCREMENT) = 328.70/142 = 2.299

AVG. ANNUAL INCREMENT = 4 × 2.299 = 9.20

FITTED CCCI TREND AT MIDPOINT OF QTR. ENDING JUNE 30, 1973 = 133.90 + (5.5 × 2.299) = 146.54

LATEST ANNUAL RATE OF CHANGE = 9.20/146.54 = 6.3%

Appendix D
Sheet 3

CALCULATION OF CURRENT COST/AMOUNT FACTORS (FORMS 1, 2, 3, 5):

(1) YEAR	(2) AVERAGE RELATIVITY[a]	(3) RELATIVITY TO LATEST POINT (2)(1973)÷(2)	(4) CURRENT AMOUNT FACTOR (3) TEMPERED 85% [((3)−1)×.85]+1	(5) CURRENT COST FACTOR[c]	(6) CURRENT COST/AMT. FACTOR (5) ÷ (4)[d]
1968	1.292	1.276	1.235	1.392	1.127
1969	1.348	1.223	1.190	1.297	1.090
1970	1.415	1.165	1.140	1.227	1.076
1971	1.500	1.099	1.084	1.147	1.058
1972	1.562	1.055	1.047	1.069	1.021
5-15-73	1.648[b]	1.000	1.000		

[a] Computed as an average of policy size relativities weighted by exposures by amount of insurance.

[b] This is a projected value based on a least squares fit of the preceding five values.

[c] Based on Quarter Ending June 30, 1973 (See Sheet 1)

[d] Factor to adjust loss ratio to 5/15/73 level. (These are the factors used in Exhibit 1, Column (7).)

CALCULATION OF TRENDED COST/AMOUNT FACTOR (FORMS 1, 2, 3, 5):

Latest Annual Rate of Change of Average Relativities (from Column (2) above) = 4.4%

Tempered 75% = 3.3% = R

C = Latest Annual Rate of Change of Loss Cost (From Sheet 2) = 6.3%[e]

$$\frac{1+C}{1+R} = \text{Latest Annual Rate of Change in Loss Ratios} = 1.029\ (=2.9\%)$$

Modified Trend Factor to Adjust Loss Ratio to a 4/1/75 level[f] from 5/15/73[g]:

$$1 + (.029 \times \frac{16.5}{12}) + (.063 \times \frac{6}{12}) = 1.071$$

[e] Based on CCCI trend data through 6/30/73.

[f] One year past proposed effective date on losses; six months past effective date for average relativities.

[g] Midpoint of latest quarter of trend experience.

Appendix D
Sheet 4

DEVELOPMENT OF CURRENT COST FACTORS (CCF) AND TREND FACTOR FOR FORM 4

QUARTER ENDING JUNE 30, 1973

PART A: ESTABLISHMENT OF QUARTERLY AVERAGE OF MODIFIED CONSUMER PRICE INDEX (MCPI)

(MCPI BASE: 1967 = 100)

	1970		1971		1972	
MONTH	MCPE	3 MOS. AVG.	MCPI	3 MOS. AVG.	MCPI	3 MOS. AVG.
7	118.1		123.5		127.5	
8	118.7		123.9		127.7	
9	119.5	118.8	124.5	124.0	128.5	127.9
10	120.2		124.9		128.9	
11	120.9		125.3		129.3	
12	121.4	120.8	125.6	125.3	129.6	129.3

	1971		1972		1973	
MONTH	MCPI	3 MOS. AVG.	MCPI	3 MOS. AVG.	MCPI	3 MOS. AVG.
1	121.4		125.6		129.4	
2	121.5		126.0		129.9	
3	121.6	121.5	126.3	126.0	130.4	129.9
4	121.9		126.7		131.0	
5	122.7		127.1		131.6	
6	123.2	122.6	127.4	127.1	132.0	131.5

PART B: USE OF AVERAGE ANNUAL MCPI TO CALCULATE CURRENT COST FACTORS (CCF)

CALENDAR YEAR AVERAGE MCPI		CURRENT COST FACTORS BASED ON AVERAGE MCPI VALUE FOR QUARTER ENDING JUNE 30, 1973 = 131.5
YEAR	MCPI	
1968	104.7	131.5/104.7 = 1.256
1969	111.0	131.5/111.0 = 1.185
1970	118.0	131.5/118.0 = 1.114
1971	123.3	131.5/123.3 = 1.067
1972	127.6	131.5/127.6 = 1.031

Appendix D
Sheet 5

PART C: COMPUTATION OF TREND FACTOR FOR FORM 4

CALENDAR YEAR	QUARTER ENDING	TIME (2X)	AVERAGE MCPI (Y)	(2XY)	($4X^2$)
1970	SEP. 30	−11	118.8	−1306.8	121
1970	DEC. 31	−9	120.8	−1087.2	81
1971	MAR. 31	−7	121.5	−850.5	49
1971	JUN. 30	−5	122.6	−613.0	25
1971	SEP. 30	−3	124.0	−372.0	9
1971	DEC. 31	−1	125.3	−125.3	1
1972	MAR. 31	1	126.0	126.0	1
1972	JUN. 30	3	127.1	381.3	9
1972	SEP. 30	5	127.9	639.5	25
1972	DEC. 31	7	129.3	905.1	49
1973	MAR. 31	9	129.9	1169.1	81
1973	JUN. 30	11	131.5	1446.5	121
		0	1504.7	312.7	572

EQUATIONS:

$$Y = A + BX$$
$$SY = NA + BSX$$
$$SXY = ASX + BSX^2$$

WHERE A = MEAN OF FITTED LINE
B = AVERAGE QUARTERLY INCREMENT
S = SUMMATION
N = NUMBER OF OBSERVATIONS

$2SXY = 312.7$ OR $SXY = 156.35$

$4SX^2 = 572$ OR $SX^2 = 143$

A(MEAN OF FITTED LINE) = 1504.7/12 = 125.39

B(AVG. QUARTERLY INCREMENT) = 156.35/143 = 1.093

Appendix D
Sheet 5

PART C: COMPUTATION OF TREND FACTOR FOR FORM 4

AVG. ANNUAL INCREMENT = 4 × 1.093
= 4.37

FITTED MCPI TREND AT MIDPOINT OF QTR. ENDING JUNE 30, 1973 = 125.39 + (5.5 × 1.093)
= 131.40

LATEST ANNUAL RATE OF CHANGE = 4.37/131.40 = 3.3%

TREND FACTOR TO ADJUST LOSSES[a] TO A 4/1/75 LEVEL FROM 5/15/73:

$$1 + (.033 \times \frac{22.5}{12}) = 1.062$$

[a]Losses only are projected because Form 4 is an Actual Cash Value coverage on depreciating contents values, not subject to the same inflationary pressure as that on replacement cost for building values.

Appendix E

REVISION OF HOMEOWNERS INSURANCE RELATIVITY CURVE

CALCULATION OF PREMIUM OFF-BALANCE RESULTING FROM INTRODUCTION OF NEW RELATIVITY CURVE BY AMOUNT OF INSURANCE

ILLUSTRATION: FORM HO-2 STATEWIDE OFF-BALANCE

(1) Amount of Insurance (in $1,000's)	(2) Estimated Exposure Distribution	(3) Present Average Relativity	(4) Revised Average Relativity	(5) Relative Change Incl. Effect of Off-Balance[a]
08-12	7.2%	.86	.86	−3.0%
13-17	16.9%	1.00	1.00	−3.0%
18-22	29.5%	1.24	1.24	−3.0%
23-27	16.0%	1.55	1.57	−1.7%
28-32	12.3%	1.90	2.02	3.2%
33-37	8.0%	2.30	2.44	2.9%
38-42	4.7%	2.70	2.86	2.8%
43-47	1.6%	3.10	3.28	2.7%
48-52	1.2%	3.50	3.70	2.6%
53-57	1.0%	3.90	4.12	2.5%
58-62	.4%	4.30	4.54	2.5%
63-67	.3%	4.70	4.96	2.4%
68-72	.3%	5.10	5.38	2.4%
73-77	.1%	5.50	5.80	2.3%
78-99	.4%	7.42	7.82	2.3%
TOTAL	100.0%	1.607	1.656	0.

OFF-BALANCE = 1.656/1.607 = 1.030. THE OFF-BALANCE IS THE PREMIUM LEVEL CHANGE RESULTING FROM APPLICATION OF THE NEW RELATIVITY CURVE WITH NO CHANGE IN UNITY ($15,000 AMOUNT OF INSURANCE) PREMIUMS. TO PRODUCE NO PREMIUM LEVEL CHANGE, THE FORMER UNITY PREMIUMS MUST BE DIVIDED BY THE OFF-BALANCE.

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[a](5) = [((4) ÷ (3)) ÷ OFF-BALANCE] − 1.0

Appendix F
Sheet 1

REVISION OF HOMEOWNERS INSURANCE FORM RELATIVITIES

This deals with the introduction of premium relativities by Form. In addition to simplifying future experience reviews, the establishment of uniform relationships between forms should facilitate machine rating of Homeowners policies. Sheets 2 and 3 show the development of the new relativities.

Column 1 of Sheet 2 is the current average relativity of Forms 1, 2, and 5 to Form 3 at the unity premium as shown on Sheet 3 (assuming all Forms are on the same policy size relativity curve).

Column 2 is the rate level increase which would result from the introduction of the new policy size relativity curve with no change in unity premiums. (See Appendix E.)

Column 3 Statewide loss ratios by Form balance to the combined adjusted loss ratio, as developed on Exhibit 1.

Column 4 shows the arithmetic "indicated" loss ratios by Form at Form 3 rates, excluding credibility considerations.

Column 5 makes Form 3 the base Form, and contains "indicated" Form relativities.

Column 6 shows the new Form relativities, selected by judgment in comparing Columns (1) and (5), bearing in mind the volume of data implied by Column (7).

Column 7 is the current distribution of premiums by Form.

Sheet 3 shows the current average form relativities by territory and statewide.

The new Form relativities for this state are:

Form 1:	.70
Form 2:	.85
Form 3:	1.00
Form 5:	1.40

Appendix F
Sheet 2

POLICY FORM RELATIVITIES

Form	(1) Current Average Form Relativity[a]	(2) Off-Balance of Revised Relativity Curve[b]	(3) 5 Year Adjusted Loss Ratio	(4) Indicated Loss Ratios at Form 3 Rates (3) × (1) ÷ (2)	(5) Relativity of Loss Ratios to Form 3	(6) Selected Form Relativity	(7) 1972 Form Distribution of Adjusted Earned Premium
1	.652	1.014	.811	.521	.768	.70	.309
2	.871	1.030	.651	.551	.813	.85	.468
3	1.000	1.047	.710	.678	1.000	1.00	.201
5	1.630	1.055	.606	.936	1.381	1.40	.022

[a] Assumes all Forms are on same Relativity Curve by Amount of Insurance.

[b] See Appendix E for illustration of Off-Balance Calculation for Form 2.

Appendix F
Sheet 3

CURRENT AVERAGE FORM RELATIVITIES BY TERRITORY

Territory	Form	Current Average Relativity (to Form 3)	New Form Relativities
01	1	.648	.70
	2	.866	.85
	5	1.582	1.40
02	1	.657	.70
	2	.882	.85
	5	1.663	1.40
03	1	.650	.70
	2	.867	.85
	5	1.624	1.40
STATEWIDE	1	.652	.70
	2	.871	.85
	5	1.630	1.40

Appendix F
Sheet 4

CALCULATION OF REVISED MANUAL PREMIUMS AT $15,000 (UNITY)

The revised manual premiums are developed using the formula shown below:

$$\sum AEP_i \times OB_i \times \frac{PREL_i}{CREL_i} \times (1 + R) = 1 + X$$

Where i = 1, 2, 3, and 5

AEP_i = 1972 Adjusted Earned Premium for Form i as a percentage to total for Forms 1, 2, 3, and 5.

OB_i = Off-Balance of Form i which is the result of introducing a new relativity curve. (See Appendix E)

$PREL_i$ = New relativity of Form i to Form 3 at $15,000. (See Page F-3.)

$CREL_i$ = Current average relativity of Form i to Form 3 at $15,000. (See Page F-3.)

R = Change to Form 3 Broadest Deductible unity premiums to go to $100 Flat Option.

X = Overall change to Forms 1, 2, 3, and 5 Broadest Deductible unity premiums to go to $100 Flat Option.

As an example, the development of the revised unity premiums for a $100 Flat Section I Deductible for Premium Group 1 follows: (Premium Group 1 = Territory 01, Brick, Protection Class 2)

Appendix F
Sheet 4

CALCULATION OF REVISED MANUAL PREMIUMS AT $15,000 (UNITY)

Territory 01:

Form	(1) Distribution of 1972 Adjusted Earned Premiums	(2) Policy Size Relativity Off-Balance[b]	(3) New Form Relativity	(4) Current Form Relativity	(5) Form Relativity Off-Balance (3) ÷ (4)	(6) Off-Balance Factor (1)×(2)×(5)
1	.334	1.011	.700	.648	1.080	.3647
2	.531	1.029	.850	.866	.982	.5366
3	.123	1.045	1.000	1.000	1.000	.1285
5	.012	1.351	1.400	2.110	.664	.0108
					Total (6) =	1.041

Current $50 Dis. Ded. Premium at $15,000 for Form 3		Territory 01 Premium Level Adjustment Factor		Total (6)		Revised $100 FD Premium at $15,000 for Form 3
$64	×	.972[a]	÷	1.041	=	$60

Revised $15,000 Section I premiums:	Form 1	Form 2	Form 3	Form 5
	$42	$51	$60	$84

[a] .972 = 1.026 × .947 [Statewide Change (Exhibit 2, Col. (7)) × Territory 01 Relative Change (Exhibit 3, Sheet 1, Col. (7))].

[b] Off-balance by territory is calculated similarly to statewide off-balance illustrated in Appendix E.

DISCUSSION BY JOHN D. NAPIERSKI AND J. B. REINBOLT

We are coming to realize more and more each year that Homeowners ratemaking is a very complex subject. Mr. Walters has clearly illustrated this complexity in his paper on Homeowners Insurance Ratemaking. He has presented his concepts and the I.S.O. ratemaking procedures in such an excellent manner that even an uninitiated reader could follow, from step to step, the determination of the Indicated Rate Level Change and its distribution by deductible option and territory.

A complete disussion of every theory and procedure Mr. Walters has covered in his paper would, based on our experience, result in a review many times the length of the paper itself. Thus, we will restrict this discussion to only a few major items. First, and probably most important to the entire discussion, is the need to point out the difference between ratemaking from a rating bureau standpoint and from an individual company standpoint. The rating bureau procedure described by Mr. Walters is designed to set actuarially accurate rates for all policies written, or renewed, during some future period. They are not saying that a profit will be made in that period even if the rates do prove to be accurate because obviously there is a carry-over of earned premium and incurred losses from policies written prior to that period. The individual company, however, whether it relies on the rating bureau rates or develops its own, is primarily concerned with a profit in a calendar year period. It cannot, of course, set a rate level that would produce a desired profit in the current calendar year, but the rate level must be one that would have produced that profit, on the average, over the experience review period after making the proper catastrophe adjustments and projections to current and future conditions.

This leads directly to our second major point which is "pure premium" versus "loss ratio" ratemaking. Mr. Walters reflects a very negative attitude toward the loss ratio method for what we feel is the wrong reason. He gives the impression that loss ratio data would never be available on anything except a statewide, all classifications combined basis, and thus could not be used to measure relativity changes. Theoretically, complete statistical data would produce the same result using either the loss ratio method or the pure premium method. Thus, the only difference appears to be one of convenience for the rating bureau or individual company making the analysis. We suspect that the pure premium method is best for rating bureaus because of the difficulty in adjusting reported premiums of all member companies to a common base. An individual company would not have this problem and must only maintain adequate historical records of rate changes. With complete statistics, classification relativities can be measured by loss ratios as well as by pure premiums.

The remaining points we will touch are in the procedural area of Mr. Walters' paper. We applaud the bureau's efforts toward continued improvement in the adjustment of losses to current costs and the recent innovation of adjusting past premiums to current amount of insurance. Although we use different techniques in our company, the concepts are similar. We do feel, though, that the procedure for calculating a Loss Trend Factor requires additional research. The annual rate of inflation projected in the example (Appendix D) is 6.3% and of course this turned out to be a gross underestimate. We have tested numerous methods for projecting inflation and, of all the methods tested, we found that a twenty quarter regression curve combined with a least squares line fitted to the latest three months gave the best correlation to actual inflation for a short term projection of 12 to 15 months. However, even with this method our estimate of annual inflation as of the same date as the example was only 5.5%. Actual inflation from June 1973 to June 1974 based on the weighted Construction Cost-Consumer Price Indexes was 13.3%. We are now projecting an annual inflation of 12.1% with our methods, but we're over a year late with this figure.

Another procedural area that we think needs additional research is the handling of expenses in the Indicated Rate Level Change calculation. The procedure Mr. Walters describes treats all expenses as though they bear a fixed relationship to premium. His example arrives at an Indicated Premium Adjustment of +4.2% by dividing the Adjusted Loss Ratio (.627) by the Balance Point Loss Ratio (.602). Let us assume that the Balance Point formula is as follows:

Loss Ratio	.602
Variable Expenses	.200
Fixed Expenses	.138
Profit & Cont.	.060
	1.000

If the Adjusted Loss Ratio is then .627, a formula approach recognizing Fixed Expenses would produce an Indicated Premium Adjustment of +3.4% as follows:

$$
\begin{aligned}
.627 + .20X + .138 + .06X &= X \\
.765 &= .74X \\
X &= 1.034
\end{aligned}
$$

In the same manner, conversion of the "Percent Losses Eliminated" to an equivalent rate change should also take into consideration Fixed Expense dollars and a constant Variable Expense plus Profit and Contingencies percentage.

On the subject of Loss Elimination Ratios, we wonder whether "credibility" is really necessary. The procedure described by Mr. Walters uses a countrywide study by deductible, cause of loss and policy form and applies the resulting LERs to the individual state's loss distributions. In our experience there are significant differences in average size of loss from state to state and application of countrywide LERs would present an inaccurate picture of the effects of a deductible change. If at all practicable from an operations standpoint, we suggest that losses eliminated can be calculated with a high degree of accuracy on an individual state basis.

As a conclusion to this review, we would like to mention a couple more areas in the Homeowners ratemaking process which are in need of additional research. One of those involves territorial rating. During the past decade average crime losses have increased at a rate twice that of average fire losses. Yet, there has apparently been little effort to reexamine or expand crime rating territories under the Homeowners Program. Similarly, there is little evidence of any study to verify rate relativities by fire protection area or to reidentify windstorm zones. Since multiple peril policies such as Homeowners involve all three of these territorial factors, we can visualize a rating approach which combines them into a single set of rating areas.

The other area for additional research was mentioned by Mr. Walters and it involves using a period of time less than 5 years for determining normal loss experience. If one, two or three years experience could produce a projection as accurate as five years there could be a condiserable savings in analysis time. However, the statutory requirements of at least 5 years of experience must be considered.

Mr. Walters has written a fine paper both in the subject chosen and the treatment of that subject. We hope to see his work regularly updated with future refinements in the rating bureau's techniques and to see additional papers on individual aspects of Homeowners ratemaking.

AUTHOR'S REVIEW OF DISCUSSION

There is no disagreement with the reviewers' observation that the loss ratio method can yield the exact same answer as the pure premium method, given the same degree of statistical detail available under both. However, one of the principal advantages of the loss ratio method, namely, its simplicity of application, can be a potential drawback. In applying the loss ratio method, there is a temptation to use the most summarized form of the data, without checking for distributional differences and rating inequities in the various classification subsets. Also, maintaining on-level factors by class and territory can sometimes be unwieldy, especially if there have been many changes.

On the subject of fixed expense loadings, I am reluctant to agree with an underlying assumption of no change in expense dollars, given today's high rate of inflation which can affect both losses and so-called "fixed expenses". Some projection of expenses is necesary, and tracking with premiums is more appropriate than remaining constant.

The reviewers also suggest the appropriateness of using state data by size of loss as a refinement of the countrywide Loss Elimination Ratio procedure. While using state size of loss distributions alone might cause problems of fluctuating results, there is no reason why the countrywide size of loss studies could not be modified for variation in average size of loss by state and by year. The greater the LER, the more incentive there is to find credible and more responsive variations from the mean. Actually, overall LER's should be declining in magnitude because of inflation, and a lot of the shifting to higher deductibles has already taken place.

DISCUSSIONS OF PAPERS PUBLISHED IN VOLUME LX

COMMERCIAL FIRE INSURANCE RATEMAKING PROCEDURES

ROBERT L. HURLEY
VOLUME LX, PAGE 208

DISCUSSION BY HENRY C. SCHNEIKER

Mr. Hurley's paper fills a major void in the educational material available in our *Proceedings* on the subject of basic ratemaking techniques. The latest general treatment of fire insurance rate revision procedures appeared sixteen years ago. A comparison of the methods described by Hurley in 1973 with those set forth by Magrath in 1958 reveals the obvious improvements made over that period. Nevertheless, the student who studies Mr. Hurley's paper after reading Stern on automobile insurance or Lange on general liability cannot escape the feeling that actuarial methods in fire insurance are rudimentary, indeed. It is scarcely an exaggeration to describe the field as unexplored, virgin wilderness.

This is not as surprising as it may first appear to the uninitiated. Mr. Hurley has supplied some useful historical background and describes the entry of actuaries into the property insurance field in 1958 with the publication of the Inter Regional Insurance Conference's "Recommended Procedure for Fire Rate Level Adjustments." As he hints, the recommended procedure did not immediately become an accepted procedure, and it was not until several years later that actuarial influence began to pervade the fire field. In 1963, deteriorating fire underwriting results contributed to the formation of an ad hoc committee of company chief executives to consider the statistical and ratemaking organization of the fire insurance business. At the same time there was appointed a Subcommittee of Actuaries under the auspices of the National Board of Fire Underwriters which, as its first order of business, gave its attention to the rate level review formula and the way it was administered by the several regional and state rating bureaus. A number of improvements were initiated, foremost of which was the introduction in fire insurance for the first time of the principle of loss trending.

The work of that Subcommittee and the support given it by company managements led to a considerably greater degree of fidelity on the parts of the bureaus to the "Recommended Procedure", which fidelity was cemented in 1971 by their merger into Insurance Services Office (I.S.O.).

The activities of the chief executives and the Subcommittee of Actuaries culminated in the formation in early 1965 of National Insurance Actuarial and Statistical Association, now part of I.S.O., and subsequently in the publication of new statistical plans for fire, allied lines, homeowners and commercial multiple peril insurance. The statistical revolution represented by those plans has opened a clearing in the property insurance wilderness and revealed new trails of actuarial exploration.

If one might pick a quarrel with Mr. Hurley's paper, it would be with its title: "Commercial Fire Insurance Ratemaking Procedures". The perceptive student who comes to Hurley after reading Stern or Lange will quickly realize that, except for the limited area in which class rating is applicable, the fire insurance actuary does not really "makes rates". He merely tests the aggregate results of rates for individual properties determined by fire inspection engineers in applying the numerous rating schedules in use throughout the United States. There exist today no actuarial methods by which one could reproduce the rate applicable to a building such as that in which we are meeting today. In effect, each specifically rated property represents a unique classification, the statistical identification of which has thus far eluded us. This feature of fire insurance, which prevents the actuary from employing pure premium methods, creates some of the most serious difficulties which currently arise in fire insurance rate level adjustment procedures.

A number of the more conspicuous problems associated with the present procedure are discussed below:

The Experience Base

Mr. Hurley refers to the virtually universal use of the fire schedule rate as the starting point in determining the premium for commercial fire insurance policies and the fire component of commercial multiple peril policies. However, he indicates only inferentially that in applying the described rate level review procedure, only that portion of the fire insurance business which is written under ordinary fire insurance policies contributes to the statistical base. Although approximately a billion dollars of fire insurance premiums are now written under multiple peril policies, this business is ignored in the reviews of the rates on which it depends. This is due partly to a previous incompatibility of the statistical plans used for the two segments of the business. It is further due to a failure of actuaries and underwriters alike to agree on whether and how multiple peril policy statistics should be reflected in the rate level review procedure.

In 1973, I.S.O. announced that it would soon begin to determine package discounts for the several Special Multi-Peril (S.M.P.) policy programs by relating package loss and expense experience to the comparable monoline experience for each coverage. This is a useful development, but it must be regarded as a first step. While certain package policies cover relatively homogeneous exposures, others run the gamut of American business activities. Both the effects of package policy selection and the distributions of package and monoline business vary by class of risk. A single differential may not adequately deal with this variation. Further, while I.S.O. has a direct responsibility for establishing S.M.P. rate levels in most states, S.M.P. policies are by no means the only multiple peril programs which depend upon published rates.

A second dilution of the experience base may occur as a result of the failure of part of the industry to adopt the essentials of the Commercial Risks Statistical Plan (C.R.S.P.). In order to provide for continuity of statistical and rating operations while C.R.S.P. data is building up to a useable volume, I.S.O. has converted C.R.S.P. experience back into the coding structure of the Standard Classification of Occupancy Hazards (S.C.O.H.) and has continued to compile statistics in the old S.C.O.H. format. Therefore, the fact that some companies are still contributing statistics under the S.C.O.H. has not yet had a visible effect, but the evolving use of C.R.S.P. data may make the available S.C.O.H. experience obsolete. Longley-Cook has warned of the dangers of combining non-homogeneous experience in the ratemaking base.[1] However, a minimum goal should be the inclusion of the experience of all agency companies which use the published fire rates. Some of those omitted are giants of the industry. These companies are known to have basic philosophical quarrels with the C.R.S.P. which have perhaps not been clearly stated. An initiative on their part toward defining and resolving such differences should be welcomed in the interest of statistical ecumenism.

Credibility

The glaring omission in the statewide rate level formula is a measurement of credibility. In effect, the experience in Idaho is accorded the same respect as that of New York. Obviously a certain amount of prudent judgment is required in applying the results. In third party lines, the stability of

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[1] L. H. Longley-Cook, "Underwriting Profit in Fire Bureau Rates" *P.C.A.S.*, LIII (1966).

ratemaking statistics is enhanced by limiting the data base to the premiums and losses attributable to a comparatively low standard limit of liability. The availability of policy amount coding under C.R.S.P. on losses as well as premiums offers the opportunity to investigate a comparable technique in the commercial property lines.

Trend Adjustment

The method described by Mr. Hurley for adjustment of past incurred losses to prospective cost levels seems, within the present state of our knowledge, to deal adequately with this aspect of the formula. However, little is known about and no formal recognition is given to the effects, if any, of inflation on insured values. Research in this direction is urgently needed.

Adjustment of Premiums

The adjustment of premiums to reflect the current level of the rates under review is a standard procedure in any rate level review computation which is based upon the use of collected premiums. It is not difficult to do this when we know both the level at which the past premiums were written and the subsequent history of changes. The prevalent practice in the fire insurance business of recording term policies written on an installment basis as the installments come due tends to blur the average written premium level. When C.R.S.P. data are utilized to their full potential, the "installment number" code, which is a feature of that plan, will permit a more precise definition of the levels at which premiums were rated.

An ancillary problem is the adjustment to current tariff level of premiums written at other than the tariff rates. There is not universal agreement that this is desirable, and C.R.S.P. does not provide for identification of "deviations". This is becoming a pressing problem in at least two of the states with open competition type regulatory laws where independent rate levels, varying by class and territory, have become commonplace. Although in these states no "tariff" rate level exists, the interests of the industry, regulators and public alike would be served by the availability of industry statistics which relate to some recognizable premium base. I.S.O. is currently attempting to accomplish this by informal means, but a long range solution which employs an exposure base rather than collected premiums is highly desirable. Research now being conducted by I.S.O. which looks to the establishment of greater uniformity in fire rating schedules and an expansion of class rating offers some possibilities in this direction.

Classification Rate Level Relativities

The formula allocating state rate level indications to class groups is an attempt to deal mathematically with an aspect of fire rate revisions that formerly was handled by judgment interpretation of some rather imprecise statistics. The three-way credibility procedure owes much to the general liability formula, but an unnecessary distortion is introduced by failure to adjust the regional experience to the overall state loss ratio level. Also, the introduction of regional experience based on collected premiums carries the assumption that existing rate relationships by class group are equivalent throughout the region. Examination of the results in particular states will disclose apparent inequities which should be corrected on a judgment basis. The importance of the classification procedure lies in the means it affords to ensure that the overall effect of a rate revision is close to the intended result. As Mr. Hurley pointed out, this did not always occur in the past.

In conclusion, we are indebted to Mr. Hurley for his latest contribution. I feel we are on the brink of a technical explosion in property actuarial work, and it is hoped that we will continue to enjoy his leadership as we enter on the new paths.

DISCUSSION BY WILLIAM P. AMLIE

Mr. Hurley stated his partialities for the fire insurance ways. We all might share his feeling after reading, for example, *Best's Review* for January 1974 "The 1969-1973 statutory underwriting gain for fire is the best five year dollar record of any line of business written by the stock insurers . . . and . . . fire insurance is a consistent profit maker for the mutuals."

His appended list of papers in the *Proceedings of the Casualty Actuarial Society* illustrates the wide range of topics a discussion of commercial fire ratemaking could encompass, and justifies narrowing the scope of the paper to recounting the history of the present methods, and explaining an actual calculation of overall rate adjustment and its distribution to classification. Proposing and evaluating other possible procedures, or considering changes entailed in merging monoline and package experience, or data produced under different statistical plans, would have been beyond the purview of the paper.

One consistent extension would have made the paper more valuable to a student seeking a complete description of a current rate revision. These revisions, unlike the paper, do not stop short at determining the change by classification. The revised rates or indicated changes extend to construction/protection groups within classification. A brief outline could have been given of the respective part in these changes of formula-derived credibility-weighted loss ratios, and of judgement, and the necessity of keeping fixed relationships and minimum differences between groups.

Section 5,B. gives in detail the present system of spreading the overall needed rate change to classification. The student might be interested in comparing this method to those described in the *Proceedings of the Casualty Actuarial Society* for other lines in which the change for a segment must be derived by supplementing its own experience by that of larger and more credible geographical or industrial areas. The combined changes for all segments must be adjusted to produce the overall change required. In the author's notation, L, variously subscripted, is the loss ratio made by combining the loss ratios of smaller segments in proportion to their premium, and M is a combination of credibility weighted loss ratios. Thus M_c is the credibility weighted ratio of the state classification loss ratio, ${}_sL_c$, with that of the region for the class and group of classes, ${}_rL_c$ and ${}_rL_g$. These M ratios in turn are combined by weighting them in proportion to premium. No symbols were shown for this, and the clumsy notation of a double subscript may be pardonable: M_{cg} is the average of M_c ratios, each given weight in proportion to its premium in the classification Group. M_{ge} is the average of credibility-weighted Group ratios M_g, weighted in proportion to each Group's share of earned premium in the experience used in determining the statewide overall rate change. Various indices and correction factors are needed in revisions by segment to adjust the M ratios so they produce the required overall change. In Section 5,B; 3.c and d, the relativity for the specific class could be shown as $\frac{M_c}{M_{cg}} \cdot \frac{M_g}{M_{ge}}$.

This formula for deriving specific class adjustment factors is used in ratemaking for some other lines of business. For burglary, column 10 is expressed by the same formula, if M_c is the credibility-weighted territory and entire state loss ratio for a classification, and M_g the weighted average of the state loss ratio for a single classification and for all classifications.[1]

The formula also applies to general liability-manufacturers and contractors, where the territorial division is between state and national.[2] There, in contrast to commercial fire, it was thought necessary to bring the loss ratio of the larger area to the average State level of experience before it could be used. Another difference was in completing M_c to the extent ${}_sL_c$ lacked 100% credibility by the average of ${}_rL_c$ and ${}_sL_g$, rather than using ${}_rL_g$ to the extent the combined credibilities ${}_sZ_c$ and ${}_rZ_c$ were below 100%. The ${}_rL_g$ loss ratio for the larger geographic and industry area was not used in calculating M_c for general liability.

These differences between ratemaking methods for different lines could be more easily identified if someone could establish a better notation than my double subscripts to enable concise comparisons. Similarities between lines are now apt to be obscured in the necessarily lengthy arithmetic examples presented in any description of ratemaking mehods. Comparisons might be gratifying to students of a taxonomic turn of mind, but more significantly they could focus attention on whether methods should differ or be identical. A uniform and concise notation should facilitate comparisons between the methods described in the *Proceedings* for setting classification relativities for the different lines of business.

[1] Steven H. Newman, "Burglary Insurance Ratemaking," *PCAS*, LIII (1966), p. 322.

[2] Jeffery T. Lange, "General Liability Insurance Ratemaking," *PCAS*, LIII (1966), p. 45.

Mr. Hurley's catalogue of papers omitted his own "A Credibility Framework for Gauging Fire Classification Experience", *PCAS*, Volume XLI, (1954). He there proposed separate credibility tables for Dwellings, Mercantile Contents and Manufacturing, to replace the single and arbitrary table then in use. The credibility tables presently used seem to be cruder versions of the tables proposed in that earlier paper. Credibility is now found by dividing six years premium at present rates by this premium plus one of three constants. The constant is $500,000, $2,500,000 or $10,000,000, the largest value being selected for classes of high hazard risks with expectation of unstable loss ratios. The proposed table also intends to vary credibility inversely to fluctuations in the loss ratio.

Perhaps the unstated credibility definitions of the present formula are also close to those proposed then. That standard gave 100% credibility if the body of experience would produce a loss ratio 10% higher than the "true underlying" ratio fewer than 3 times in a hundred, and zero credibility if it would exceed this limit 30 or more times. This corresponded to 1.9 and 0.5 standard deviations, respectively, of experienced loss ratios about the expected. Due warnings were given of possible inapplicability of the binomial distribution for this purpose.

I calculated the standard deviations of annual collected loss ratios about the six year ratio for some of the larger classification in recent commercial fire revisions in two large states. Variations in actual frequency and claim size would have provided a better test than variation in loss ratios, and loss ratios at present levels might be more appropriate than the actual ratios used in the attached graph of this data. The average ratio in the revisions was about 54.0%. By the standard above for zero credibility. 0.5σ would equal 10% of this ratio, 5.4%, and $\sigma = 10.8\%$. At 100% credibility $1.9\sigma = 5.4\%$, and $\sigma = 2.8\%$, by the standard given.

Standards were not set for partial credibility. The graph simply connects σ for zero and 100% credibility by a line. Partial credibility might have been found by the square root rule, for example, or by carrying the definition forward consistently to find σ for 50% credibility so that the area representing classifications with loss ratios more than 10% above the underlying loss ratio is equal to the average of the 3% for 100 and 30% for zero credibility.

The graph is a rough test of credibility in that the greater the fluctuation of loss ratios from year to year the smaller the credence that can be given data for ratemaking. If the formula does not give excessive credibility, the points should fall close to the line for higher credibilities. The extreme variation is in the more hazardous groups B and C, but the annual loss ratios of the least hazardous group, A, seem also to vary more than was contemplated when assigning credibility.

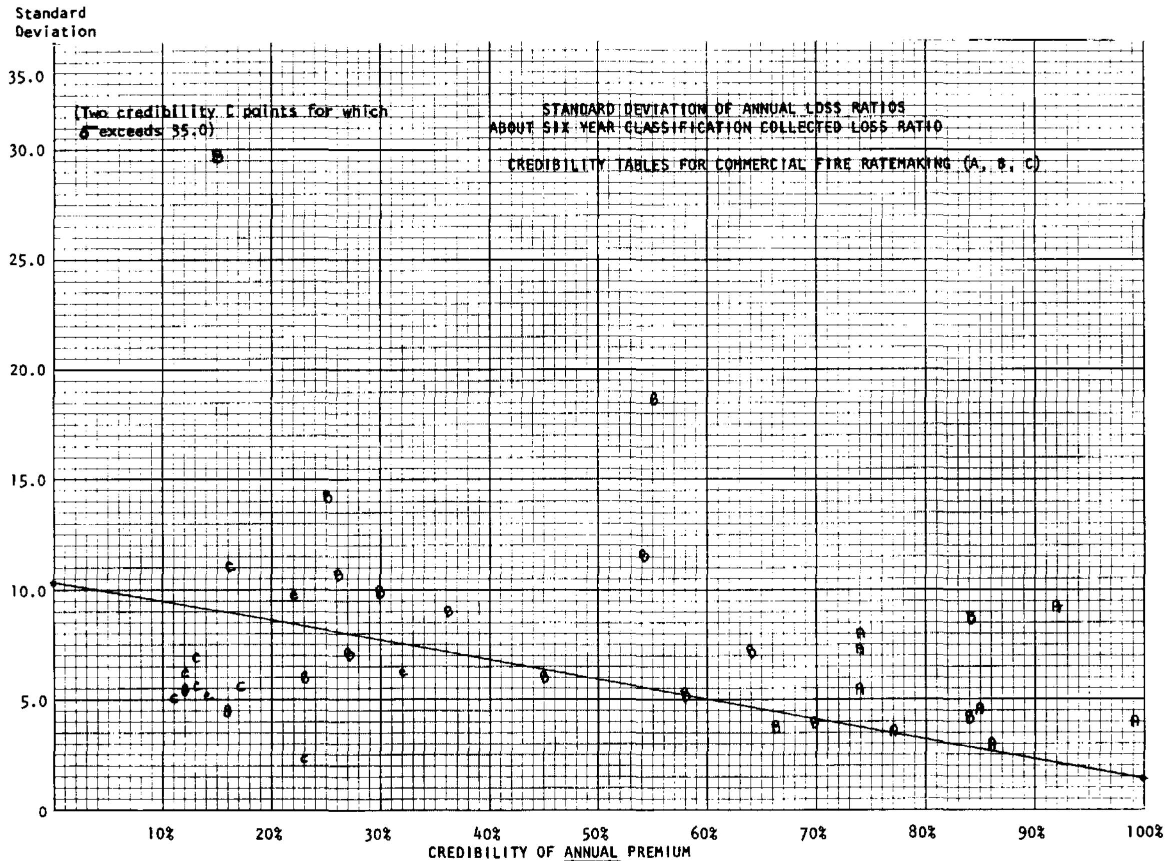
The credibility assigned is one of the more important features of any rate revision. A derivation of a fire table would involve extensive theory and data on the split between "basic" and "peak" or "trivial and non-trivial" losses. The great variation in size of fire claims complicates any theoretical derivation of a credibility standard. Presumably, the effect would be to increase the requirement from those in the *PCAS* XLI paper even more than the liability and automobile numbers of claims were increased when size of claim was introduced in similar formulas. The paper might have mentioned any empiric tests made of the present formula. To what extent, for example, does actual variation in loss ratios support the different constants for the three groups?

Mr. Hurley points out excessive efforts "to 'true up' rates with the vagaries of class loss experience" can imperil rate adequacy. This, and the successful results produced by the ratemaking methods so well described in his paper perhaps show there is no need for any revision, but some basis of comparing credibility standards in commercial fire to those used in other lines would have been of interest.

AUTHOR'S REVIEW OF DISCUSSIONS

It was a happy stroke that the reviewers, Messrs. Amlie and Schneiker, while neither neglected an overview of the paper, each singled out somewhat different aspects for critical analyses and further commentary thereon.

After supplying valuable background on the formation and activities of the National Insurance and Statistical Association, Mr. Schneiker prefaced certain timely and pertinent commentary on present fire ratemaking practices with a valid distinction between manual class rating on many casualty lines and class adjustments in fire insurance when each insured's rate differs contingent on the schedule rating of the physical hazards of the particular risk.


Standard Deviation
STANDARD DEVIATION OF ANNUAL LOSS RATIOS
ABOUT SIX YEAR CLASSIFICATION COLLECTED LOSS RATIO
CREDIBILITY TABLES FOR COMMERCIAL FIRE RATEMAKING (A, B, C)
(Two credibility C points for which σ exceeds 35.0)
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
CREDIBILITY OF ANNUAL PREMIUM

Mr. Schneiker then proceeded to investigate various phases of commercial fire ratemaking wherein further actuarial research is needed. At most points, I found myself in full agreement with his observations. In a few instances, my accord, if not complete, was substantial.

On one item only, do I wish to offer a cautionary note. While it is agreed that further research should (and undoubtedly will) be conducted into what effect inflationary cycles may have on insurable values, we would not wish to slight, in any way, the quick and potential disastrous effect on fire insurance loss payments of breakaway inflationary pressures.

Mr. Amlie's review added certain ideas which should also be helpful to those who wish to contribute to the solution of commercial fire insurance rating problems. His comments on the difficulty and the awkwardness of certain of the algebraic notation are none the less challenging for having been offered in so kindly a manner. Mr. Amlie noted that the algebra could be simplified and the techniques reformed for greater actuarial consistency among the various lines of insurance. Some starts are being made in this direction. We have heard from other actuaries on this aspect of the paper and trust that the members of the Society will be able to find the time to contribute their ideas for publication in the *Proceedings*.

Both reviews called attention to the credibility problems in the commercial fire insurance field. Neither expect that theoretically satisfactory solutions will be found without involving extensive actuarial investigations. Both suggested the need for some reorientations in our basic concepts and each pointed to the likelihood that the ultimate answer may be found in a dual credibility treatment for Normal and Excess losses.

It is believed that both Mr. Amlie and Mr. Schneiker have suggested ideas and approaches which should be helpful for future actuarial research into commercial fire insurance rating methods.

LOSS RESERVE TESTING: A REPORT YEAR APPROACH

WAYNE H. FISHER AND JEFFREY T. LANGE
VOLUME LX, PAGE 189

DISCUSSION BY DAVID SKURNICK

GENERAL DISCUSSION

Fisher and Lange offer a new method of testing the reserve for known claims. Like all reserve tests, the evaluation of the reserve for known claims is important for the purposes of maintaining solvency and correctly stating earnings. Furthermore, it also provides a tool for the management and control of the Claims Department. In fact, for large enough companies, this type of analysis can be applied to individual claims offices. I am particularly happy to see the report year approach used, because I agree with the authors that the report year is the best time grouping for the purpose of testing the reserve for known claims.

One stated goal of this article is to instruct actuarial students who are unfamiliar with loss reserving techniques. This goal has been successfully achieved. In a clear step-by-step fashion, by the use of discussion, example and algebra, Fisher and Lange show how to go from tables of loss statistics to estimated average claim sizes, to reserve estimates, to equity calculations, to the effect on earnings. The discussion of various methods of selecting trend factors and disposal rates includes a broad collection of ideas on projecting time series, a problem faced by actuaries in ratemaking as well as reserving. Students should be well pleased with this paper.

Here is a typical instance of good technique. A claim closed without payment is not counted if closed within the initial year, but it is counted if closed in a subsequent year. The initial year's CWP's are useless for the analysis; eliminating them eliminates inaccuracy caused by fluctuation in their number. CWP's from subsequent years are required in order to maintain a fixed number of claims in the report year.

THE FISHER-LANGE METHOD

The new reserving method recommended in this article is certainly correct in that, all other things being equal, it will produce the proper reserve estimate. In order to test the reserve, the method requires the tabulation of a great deal of data, which may have a variety of uses. However, it is my opinion that the Fisher-Lange method may be no more accurate a reserve test than a simpler method, the Payment Development Method of R. T. Sampson. [1] Later in this review, I will propose a modification that I believe will lead to greater accuracy.

Exhibit I is taken from the Fisher-Lange article. It shows the average cost of closed claims by report year and by settlement year. For example, the second figure in the first column indicates that the average claim reported in 1964 and closed in 1965 cost $790. The figures in parentheses are projections. The final column shows the projected rate of increase in average claim cost for each age group. For example, the second figure in the column indicates that age group 13-24 has a 7.0% annual increase projected.

Exhibit II, also taken from the Fisher-Lange article, shows the disposal rates. For example, the second figure in the first column indicates that .333 of the claims reported in 1964 were settled during 1965. Again the figures in parentheses are projections.

The lower right-hand figure in the main body of Exhibit I, 9.1%, is the weighted average of the projected rates of increase in claim cost, the weights being the product of the average claim cost and the disposal rate for each age group for the 1973 report year. The 9.1% is intended to represent the projected percentage increase in claim cost for the entire 1973 report year.

At the bottom of Exhibit I, a section called "Report Year Totals" has been added. The average claim cost for an entire report year is simply the weighted average of a column in Exhibit I using the weights in the corresponding column of Exhibit II. The percentage shown in the increase in average claim cost over the prior report year.

The figures shown in the exhibits raise certain questions that bear deeper examination.

1. In Exhibit II, why is there a tendency over time to settle claims more quickly?

2. In Exhibit I, why does the assumption of a constant percentage increase in annual claim cost for each age group lead to a varying

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[1] Richard T. Sampson, "Establishing Adequacy of Reserves on Slow Closing Lines Use of Paid Formulae," *Insurance Accounting and Statistical Association Proceedings*, 1959.

increase in average claim for the report year totals?

3. In Exhibit I, why is the 9.1% average increase in claim cost higher than most of the annual increases in the report total claim cost? In particular, why is the 9.1%, which represents 1973, so much higher than the projected 3.8% increase of report year 1973 over 1972?

4. In Exhibit I, why is the average percentage increase in claim cost so high for claims settled at later ages? Would it not seem reasonable to assume that if the average claim settled at ages 0-12 is increasing at 6% per year, then the average claim in each age group is also increasing at 6% per year? Incidentally, this assumption is the foundation of the Payment Development Method.

The authors of the article have answered the first question. They have assumed in this case that the speed-up in claims settlement was the result of a deliberate plan by the claims department. There are two other possible explanations. The speed-up may have been the result of unintentional changes in claims settlement policy, or there may be no real speed-up. We may be seeing a shift in the distribution of type of claims. The company may be experiencing relatively more claims that can be settled quickly, although the company continues to settle each type of claim at the same speed. It seems to me that, in general, a shift in disposal rates is due much more often to a change in claims department policy, either intentional or unintentional, than to a change in distribution of type of claim. This distinction is important because it implies that a change in disposal rate will not affect the total report year average claim cost. A speed-up in claims settlement means that the same claims are settled more quickly than under the prior claims department policy, but for the same amounts.

In response to the second question, the projected increase in report year total average claim varies from year to year for two reasons. First of all, it is based only partly on a projection. Some of the averages in each column are actual figures. These actual figures do not increase consistently. Secondly, the disposal rates change from one report year to another. Mathematically, the report year total average claim depends on the disposal rates.

Continuing to Question Number 3, it should be clear that the 9.1% weighted average figure is higher than the increase in the report year average claim cost due to the increasing percentage of quicker settling claims, which the formulas show are the smaller ones.

The answer to the last question is similar. The high rates of increase in the higher age groups may be due to the shift in disposal rate. For example, consider claims settled in 37-48 months. As claims begin to be settled more quickly, some of the claims that formerly would have been settled in 49-60 months will enter the 37-48 group. This will raise its average claim cost. Also, some of the claims that would have been in the bottom of the 37-48 group will be settled more quickly and leave the group. This will also raise its average claim cost, since the most quickly settled claims in a group tend to be the smallest.

In the light of the observations above, a critical appraisal seems in order. It has been assumed that any change in the speed with which claims are settled will not change the size of these claims. Since the authors have assumed a constant rate of increase from year to year and since the disposal rate does not affect the size of the claims, I believe the assumed rate of increase in total report year average claim cost ought to be more consistent. As was noted earlier, the report year average claim cost depends mathematically upon the disposal rate and the average cost within each age group. But this is the reverse of our causation assumption, that the report year total average claim cost is independent of the disposal rate, but the average claim cost within each age group depends upon both of these factors.

The 9.1% weighted average of the average percentage increases in claim cost appears to be an artificial figure. Fisher and Lange suggest that management may modify this figure to reflect an anticipated rate of increase based upon external information. I believe that a management that agreed to a 9.1% rate for 1973 would be most surprised to learn that it had actually agreed that the average claim for report year 1973 was only 3.8% higher than the previous year.

The average percentage increase in claim cost for the individual age groups also seems artificial, since the difference in this figure from one age group to another is essentially a reflection of the changes in the disposal rate.

If, as has been assumed, the disposal rate has no effect on the report year total average claim, why bother to measure it? The answer is that it does have an effect on the average claim within an age group and this is our basic data. As long as the average claim within an age group is used to estimate the report year total average claim, some adjustment must be made to account for the possibility that the proportion of claims closed during the period differs from the average. That is, under the assumption that all differences in average percentage increase in claim cost from one age group to another reflect changes in the disposal rates, the Fisher-Lange method of separately measuring disposal rate and average claim size is a means of correcting a report year average claim development for changes in the disposal rate.

We may liken this method to the farmer who counts sheep by adding the legs and dividing by four. In this analogy, the report year total average claim costs are the sheep, the average claim costs by age group are the legs and the disposal rates are the number of legs per sheep. It is important to recognize that once the farmer begins to count sheep by counting legs he must follow through by determining the average number of legs per sheep, even though the number of sheep does not actually depend upon the number of legs per sheep.

SAMPSON'S ADJUSTMENT FOR A CHANGING DISPOSAL RATE

The effect of the disposal rate on the average claim size was noted by Sampson in 1959[2]. He wrote:

"Even like payment periods are not wholly comparable, however. Numerous factors can lead to changes in settlement rate, the proportion of claims settled within a given time. This involves chance variations in settlements at the end of the payment period; sometimes a few more than normal will be worked off, sometimes a few less.

"This is significant because these 'variance claims,' the ones which may or may not be settled at the end of the period, are not representative of the whole period. Coming late in the period, they are typically the larger claims. Therefore, faster settlement in a given period will throw in more higher cost claims and artificially increase the average payment as compared with a previous slower settling period."

Sampson then goes on to develop a factor to correct for the variance in the disposal rate. Generally speaking, his method is this: In determining the percentage increase in claim cost, the earlier of two adjacent report years is adjusted by adding or subtracting a sufficient number of claims to equalize disposal rates, and adding these claims at an average dollar amount that is higher than the cumulative average in recognition of the fact that these variance claims are the larger, later claims.

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[2] Ibid., P.2

Incidentally, Sampson mentions that this adjustment is generally small and does not warrant extreme precision. It may be noted that the difference in average percentage increase in claim cost by age group is not as important as Exhibit I might suggest, at first glance, since most claims are settled at early ages. For example, the 1973 disposal rates indicate that 94% of the claims will be settled within ages 0 to 36 months, wherein the projected average percentage increase in claim cost only varies from 6.6% to 7.4%.

BEYOND THE DISPOSAL RATE

I would like to suggest a third method of correction for the variance in disposal rate and show why it should be more accurate than the others. This method is feasible, given today's computer capabilities. The two basic assumptions are that a change in the disposal rate will not affect the report year total average claim cost nor will it affect the order of closings within a report year. It follows that the average of the claims settled within a given time period for two different report years will not be directly comparable if the two years had different disposal rates, but the averages over a certain percentage of all claims to be settled will always be directly comparable. For example, the average of the first 50% of the claims closed within a report year should be directly comparable to the average of the first 50% of the claims closed within another report year. Note that the number of claims in a report year is fixed twelve months after the beginning of the report year, so at any later state of development it is possible to determine the percentage of the report year's claims that have closed.

The foregoing analysis suggests that the comparison of claims be based on the order closed and the percentage of total closed, regardless of the speed of closing. Assume that the claims within a report year are listed in order of the date settled and a cumulative average claim cost is computed as each additional 1% of claims closes. Exhibit III shows a portion of such a table. The underlined figures, which come from Exhibit I, show the average claim costs after twelve months of settlements. The remaining data was constructed for the sake of the example. It is my assumption that the $698 average claim cost of 1973 after one year of closings and after 50% of the claims are closed is more directly comparable to the $620 average after 50% of the 1972 claims are closed than to the $612 average after one year of 1972 settlements. If it had already been decided to estimate the average claim for 1972 at $1,618, it would be reasonable to estimate the average claim for 1973 at this figure, increased by the ratio of 698 to 620. This is the analogue of the Payment Development Method. Note that the need to adjust for variance claims, as well as any error in that adjustment has been eliminated. Under the same assumptions, an alternative approach would be to relate 1973 to 1972 based on a longer term average rate of increase along the fiftieth percentile cumulative averages.

If it is believed that the difference in average percentage increase in claim cost by age group noted in Exhibit I has causes other than variation in the disposal rate, then it will be desirable to group claims in the order closed and compute the separate rates of increase in claim cost. Here it is again desirable to group the claims by the fraction of those closed in order of date of closing, rather than by settlement age, in order to prevent changes in disposal rate from distorting the projections. Exhibit IV, which does not contain actual data, was designed to serve as an example. By way of explanation of this exhibit, the upper left-hand figure of $400 indicates that the average value of the first 40% of claims closed for report year 1966 was $400. The figure just below indicates that the average of the next 10% closed was $420.

An exhibit like this can be projected by any of the methods suggested by Fisher and Lange for projecting Exhibit I. I expect that the projection of Exhibit IV will be smoother than the projection of Exhibit I, since the distortion from changing disposal rates has been eliminated. It would be desirable to perform tests with actual data to determine whether or not the projected average percentage increases in claim cost were the same for each percentile group. These tests could determine whether the simpler method illustrated in Exhibit III would suffice, or whether the more complicated method of Exhibit IV is necessary.

Exhibit I

(Table 4 of LOSS RESERVE TESTING: A REPORT YEAR APPROACH, by Fisher and Lange)

Average Claim Cost for Claims Settled in Interval Indicated

Age of Claim	Report Year 1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	Average % increase in Claim Cost (exponential)
0 12	398	393	413	444	495	577	545	577	612	698	6.6
13 24	790	871	837	961	1084	988	1146	1181	1466	(1426)	7.0
25 36	2348	2128	2288	2471	2438	2865	3375	3598	(3639)	(3906)	7.4
37 48	2430	2500	2998	3146	4261	4344	4317	(5251)	(5883)	(6591)	12.0
49 60	3429	2630	3425	3173	4681	5285	(5368)	(5986)	(6676)	(7445)	11.5
61 72	2572	3629	2944	4034	5211	(5624)	(6546)	(7620)	(8869)	(10322)	16.4
73 Ult.*	1934	3114	5931	4228	4934	(7216)	(8973)	(11158)	(13874)	(17252)	24.3
											9.1%**

NOTE: Numbers in parentheses are projected values.

*These averages include the current Claim Department estimate for any claims still outstanding.

**Weighted average of percentage increases by age of claim, with weights proportional to the product of the appropriate claim costs (above) and disposal rates (from Table 6) for the latest report year (1973).

Report Year Totals

Report Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
Average Claim Cost	860	892	959	1013	1155	(1253)	(1410)	(1493)	(1618)	(1679)
Increase Over Prior Year		3.7%	7.5%	5.6%	14.0%	(8.5%)	(12.5%)	(5.9%)	(8.4%)	(3.8%)

Exhibit II

(Table 6 of LOSS RESERVE TESTING: A REPORT YEAR APPROACH, by Fisher and Lange)

Percentage of Report Year Total Claims Incurred Settled in Interval Indicated

Age of Claim Measured in Number of Months from Beginning of Report Year to Settling of Claim	Report Year									
	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
0 - 12	.508	.503	.496	.505	.500	.497	.471	.477	.477	.502
13 - 24	.333	.333	.340	.334	.345	.344	.351	.350	.367	(.349)
25 - 36	.073	.081	.084	.087	.083	.079	.094	.101	(.091)	(.087)
37 - 48	.037	.036	.038	.035	.033	.040	.047	(.040)	(.036)	(.035)
49 - 60	.021	.022	.020	.019	.021	.024	(.022)	(.019)	(.017)	(.016)
61 - 72	.012	.012	.012	.010	.011	(.010)	(.009)	(.008)	(.007)	(.007)
73 - Ultimate	.016	.013	.010	.010	.007	(.006)	(.006)	(.005)	(.005)	(.004)

Exhibit III

Cumulative Average Closed Claim in Order of Date of Closing

Percentage of Claims Closed In Order of Date of Closing	Report Year									
	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.
46	384	382	400	428	482	561	542	561	596	680
47	387	385	404	430	488	566	545	571	603	685
48	390	388	407	434	490	570	549	577	612	690
49	392	390	410	437	493	572	555	581	614	694
50	395	393	413	440	495	577	559	586	620	698
51	398	396	416	444	500	581	563	589	625	
52	401	400	420	450	502	584	569	594	627	

Exhibit IV

Average Closed Claim Within Percentile Group in Order of Date of Closing

Percentile Group of Claims Closed in Order of Date of Closing	Report Year							
	1966	1967	1968	1969	1970	1971	1972	1973
0—40%	400	420	440	470	510	550	600	670
40—50	420	440	470	510	560	620	680	750
50—60	440	460	500	550	610	690	790	
60—70	470	500	540	590	660	760	900	
70—80	500	540	600	680	710	830	1010	
80—85	550	580	680	770	810	950	1400	
85—90	580	620	740	870	950	1000		
90—95	620	700	820	1000	1100	1200		
95—98	680	800	940	1100				
98—100	850	1000						

AUTHORS' REVIEW OF DISCUSSION

We would like to begin our comments by thanking Mr. Skurnick for taking the time to prepare such a thoughtful review of our paper. In general, we agree with this review. The technique he suggests for organizing the data to overcome the problem of "variance" claims should have merit with many reserving techniques. It will be interesting to see what further steps will be taken to obtain data in this format.

Basically, in his review Mr. Skurnick contrasts our methodology with a different technique described by Mr. R. T. Sampson in the 1959 *Insurance Accounting and Statistical Association Proceedings.*[1] This technique relies on two basic assumptions concerning claim settlement behavior, and Mr. Skurnick accepts them in stating that Mr. Sampson's technique will produce as reliable an answer as our methodology. These assumptions may certainly be valid for some fast-closing lines of business; however, without questioning Mr. Sampson's basic approach, we do question whether these assumptions are valid today for certain slower-closing lines of business. We feel our methodology provides an opportunity to test and compensate for any departures from these assumptions.

Their two assumptions are as follows:

(1) A speed-up in the claim settlement pattern means that the same claims are simply settled earlier than they previously were but for the same amount of money. This, of course, means that the amount of a single claim payment is independent of the length of time taken to settle the claim.

(2) If the average claim settled, say, in the zero to twelve-month age group is increasing at a particular rate from report year to report year, then it is reasonable to assume that the ultimate average claim for the entire report year will increase at the same rate. In other words, that the same factors affecting the small, easily settled claims equally affect the high-cost, long-term claims.

We believe these assumptions may not be valid for some lines of business, in particular the major liability lines.

As for the assumption on the disposal rates, many things could cause them to have an effect on the average amount paid. For example, negligence

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[1] Richard T. Sampson, "Establishing Adequacy of Reserves on Slow Closing Lines Use of Paid Formulae." *Insurance Accounting and Statistical Association Proceedings*, 1959

law is heavily influenced by previous decisions on similar cases. In recent years, our increasingly consumer-conscious society has established new case precedents at a rapid rate.The presence, or absence, of a particular precedent can heavily influence the non-economic portion of a liability settlement. Hence, settling a case sooner means fewer potentially damaging precedents exist. Second, inflation itself must have some impact, for even though the economic loss may be the same, jury attitudes may be influenced by their present circumstances when making awards, awards which on the long-term cases may involve permanent disabilities, and thus current wage rates and a higher general cost of living. For example, put yourself in a claimant's position. You have suffered a $1,000 economic loss and you settle one year after the accident for a total of $2,500. We believe that this "extra" $1,500 might vary with the time elapsed before settlement. Would you have taken a total of $2,000 if they had settled with you at the time of injury? or what if you couldn't settle for five years? Would you, and your lawyer, still take the same money?

Concerning the claim cost assumption, we have observed in our data that the percentage increase from report year to report year is different for the quickly settled claims than for the more slowly settled claims. Independently, our colleagues in the United Kingdom found the same phenomenon in their data. The reasons for this are undoubtedly complex, but just the fact that the quickly settled claims are basically different types of claims could allow this to occur. These quickly settled claims are highly economic in nature, while the long-term cases are heavily influenced by jury attitudes and higher liability limits and levels of retention.

This situation brings one to Mr. Skurnick's analogy on counting sheep. We think the legs should enter the picture. In our local butcher shop, a sheep does not have four legs it has two legs and two shanks. You buy them one at a time, and because of this, the ever-rising price of meat can be seen to be going up at a different rate for the legs than for the shanks.

In conclusion, it doesn't really matter why there is, or at least can be, a relationship between speed of claim settlement and size of payment, and, that different types of claims can be experiencing different rates of inflation; it matters that this does seem to exist. Organizing your data as we have outlined will enable you to know if the patterns we described are occurring in your data. If these patterns do seem to fit your particular situation, we feel our approach will afford you a good, alternative technique to complement your present reserve tests.

MINUTES OF THE 1974 SPRING MEETING

May 19-22, 1974

EL CONQUISTADOR HOTEL, FAJARDO, PUERTO RICO

Sunday, May 19

The Board of Directors held its regularly scheduled meeting at the El Conquistador Hotel from 1:30-5:00 p.m.

Advance registration was held from 5:00-6:00 p.m. for early arrivals.

The President's reception for new Fellows and their wives took place from 6:00-7:00 p.m.

The reception for members and guests was from 7:00-8:00 p.m.

Monday, May 20

Registration began at 8:00 a.m.

The 1974 Spring meeting formally convened at 8:30 a.m.

Following opening remarks by President Liscord, diplomas were presented to the following Associates and Fellows:

Associates

Terry J. Alfuth
Raymond Barrette
William H. Bartlett
Frank C. Creasey, Jr.*
Lyle W. DeGarmo
Charles D. Foley
Steven F. Goldberg
Leon R. Gottlieb
Steven L. Groot
Vicki S. Keene
David M. Klein
Brian C. Moore
Richard W. Ziock

Fellows

John B. Conners
James G. Inkrott
Allan M. Kaufman
David M. Klein
Charles L. McClenahan
Edith E. Price
Ronald C. Retterath
Richard G. Woll

*Not present. Diploma mailed.

Mr. Liscord then introduced Commissioner of Insurance for the Commonwealth of Puerto Rico, Carlos R. Rios, who welcomed the Society to Puerto Rico.

From 9:15 to 10:15 a.m. a panel discussion was held entitled "Residual Markets". Participants in this discussion were:

Moderator:	John Fino Assistant Vice President Allstate Insurance Company
Panel Members:	Steven I. Martin Assistant Vice President Hartford Insurance Group
	John M. Parsons Vice President Aetna Life & Casualty
	Louis G. Runge Vice President Lumbermens Mutual Casualty Company
	Richard Neiley Vice President Insurance Company of North America

Following a 15 minute break, a panel discussion took place from 10:30-11:30 a.m. The panel was entitled "Profitability and Investment Income by Line by State". Participants in this discussion were:

Moderator:	Ruth E. Salzmann Vice President and Actuary Sentry Insurance Group
Panel Members:	Joseph W. Levin Actuary Employers Reinsurance
	James H. Crowley Assistant Vice President Aetna Life & Casualty
	Clyde H. Graves Consulting Actuary

Committee meetings were held in the afternoon.

At 7:00 p.m. there was a reception for members and guests of the Society.

Tuesday, May 21

President Liscord convened the business session at 8:30 a.m.

The following papers were presented:

1) "Personal Lines Pricing: From Judgment to Fact" by C. K. Khury, Actuarial Director, Prudential Property and Casualty Insurance Company.

2) "Homeowners Insurance Ratemaking" by Michael Walters, Vice President-Actuary, Insurance Services Office.

After the presentation of papers, two Constitutional amendments were passed:

1) Providing for the separate offices of Secretary and Treasurer effective with the November 1974 elections and

2) Providing for the waiver of dues at age 62 upon the request of a retired member.

Appointment of P. Adger Williams to the Board of Directors to fill the unexpired term of Ronald L. Bornhuetter was ratified.

The appointment of a Nominating Committee consisting of the past five Presidents was ratified. The members are: Messrs. Johe (Chairman), Hazam, McNamara, Simon and Hewitt.

From 9:00-10:00 a.m. the E & E Committee presented a report on "Change in Examination Structure". Participants were:

George D. Morison, General Chairman of E & E Committee
President
New York Compensation Insurance Rating Board

Earl F. Petz, Education Vice Chairman
Actuary
Kemper Insurance Group

Jeffrey T. Lange, Syllabus Subcommittee
Vice President
Royal-Globe Insurance Companies

There was a break from 10:00-10:15 a.m.

From 10:15-11:30 a.m. three workshop sessions were held:

A. "Rate Making for Commercial Package Policies"

Moderator:	Charles A. Hachemeister Associate Actuary Allstate Insurance Company
Participants:	James E. Scheid Associate Actuary The Hartford Insurance Group
	Richard H. Snader Associate Actuary United States Fidelity & Guaranty Company

B. "Car Design, Damageability and Crashworthiness-Revisited"

Moderator:	John S. Trees Vice President Allstate Insurance Company
Participants:	Henry C. Schneiker Secretary The Home Insurance Company
	Stephen L. Perreault Secretary The Hartford Insurance Group

C. "Improving State Workmen's Compensation Laws"

Moderator:	Roy H. Kallop Actuary National Council on Compensation Insurance
Participants:	Glenn W. Fresch Associate Actuary Aetna Life and Casualty

David Skurnick
Actuary
California Inspection Rating Bureau

The afternoon session convened at 2:30 p.m. with a panel discussion entitled "Captive Insurance Companies". Participants in this discussion were:

Moderator: Steven H. Newman
Vice President & Casualty Actuary
American International Group

Panel Members: William A. Mortimer
Director of Planning for Risk Management Services
Insurance Company of North America

Mrs. Marianne Burge
Partner
Price Waterhouse and Company

Thomas A. Greene
Vice President
General Reinsurance Corporation

Robert E. Norton
President
Elkhorn Insurance Company

The afternoon session reconvened at 4:00 p.m. with a panel discussion entitled "Estimating Costs of Auto Insurance Reform Bills". Participants in this panel discussion were:

Moderator: Charles C. Hewitt, Jr.
Vice President and Actuary
Metropolitan Property & Liability Insurance Co.

Panel Members: Jeffrey T. Lange
Vice President
Royal-Globe Insurance Companies

James R. Berquist
Consulting Actuary
Milliman and Robertson, Inc.

Dale R. Comey
Actuary
Hartford Insurance Group

Jerry A. Hillhouse
Actuary
State Farm Mutual Automobile Ins. Co.

Dr. Hector L. Acevedo
Executive Director
Puerto Rico Accident Compensation Administration

Wednesday, May 22

The business session was convened at 8:30 by President Liscord. The following reviews of papers were presented:

Paper — "Commercial Fire Insurance Ratemaking Procedures for Statewide Rate Levels & Classification Adjustments" by Robert L. Hurley, Associate Actuary, Insurance Services Office.

Reviews by: 1) William P. Amlie, Associate Actuary, Commercial Union Companies.

2) Henry C. Schneiker, Secretary, The Home Insurance Company.

A reply to the reviews by the author, Robert L. Hurley, was presented by Arthur R. Cadorine.

Paper — "Loss Reserve Testing: A Report Year Approach" by Jeffrey T. Lange, Vice President and Wayne H. Fisher, Actuarial Associate, Royal-Globe Insurance Cos.

Review by: 1) David Skurnick, Actuary, California Inspection Rating Bureau.

A reply to the review was made by Wayne H. Fisher.

The following committee reports were presented:

Member-Guest Policy by David Hartman, Chairman.

The new policy permitting members to sponsor attendance of guests was explained.

Financial Reporting Committee

Chairman James H. Crowley outlined the American Academy Committee report on catastrophe reserves to the Financial Accounting Standards Board and described the procedure and timetable which the FASB would follow to establish a position on catastrophe reserves by the end of the year.

Education and Examination Committee

George D. Morison, General Chairman made further comments on the objectives of the Syllabus revision described during the previous morning's panel presentation. He also answered additional questions from those in attendance.

Thanks were given to the Local Committee on Arrangements: John H. Muetterties, Richard S. Biondi, Michael Fusco, Arthur R. Cadorine and Richard Lino.

At 10:15 a.m., following a coffee break, Dr. Stanley Reber of the Conference Board spoke on the topic, "Economic Outlook". His talk was well received.

From 11:00 a.m. until 12:30 p.m. a panel discussion was held entitled "Impact of Energy Crisis on Property and Liability Insurance Current and Future". The participants in this panel discussion were as follows:

Moderator: P. Adger Williams
Vice President
The Travelers Insurance Companies

Panel Members: Frank Harwayne
Vice President and Director of Actuarial Research
National Council on Compensation Insurance

Alan C. Curry
Vice President and Actuary
State Farm Mutual Automobile Insurance Co.

Paul J. Scheel
Vice President and Senior Actuary
United States Fidelity and Guaranty Company

Henry W. Menzel
Vice President
Insurance Services Office

The meeting adjourned at 12:30 p.m.

Registration cards completed by the attendees and filed at the registration desk indicated attendance by 101 Fellows, 68 Associates, 9 invited guests, 8 subscribers, 120 wives and 3 husbands of members and guests.

FELLOWS

Adler, M.
Alexander, L. M.
Amlie, W. P.
Anker, R. A.
Atwood, C. R.
Balcarek, R. J.
Beckman, R. W.
Ben-Zvi, P. N.
Bergen, R. D.
Berquist, J. R.
Bickerstaff, D. R.
Bill, R. A.
Bland, W. H.
Bondy, M.
Bornhuetter, R. L.
Boyajian, J. H.
Brannigan, J. F.
Brian, R. A.
Brown, W. W., Jr.
Comey, D. R.
Conners, J. B.
Cook, C. F.
Crowley, J. H.
Curry, A. C.
Ehlert, D. W.
Eliason, E. B.
Faber, J. A.
Faust, J. E.
Ferguson, R. E.
Fitzgibbon, W. J., Jr.
Forker, D. C.
Foster, R. B.
Fresch, G. W.
Gerundo, L. P., Jr.
Gillam, W. S.
Gillespie, J. E.
Grady, D. J.
Graves, C. H.
Hachemeister, C. A.
Hall, J. A.
Hartman, D. G.
Hartman, G. R.
Harwayne, F.
Hewitt, C. C., Jr.
Hillhouse, J. A.
Hughey, M. S.
Hunter, J. R., Jr.
Inkrott, J. G.
Kallop, R. H.
Kaufman, A. M.
Khury, C. K.
Kilbourne, F. W.
Klein, D. M.
Lange, J. T.
Levin, J. W.
Linden, J. R.
Lino, R.
Liscord, P. S.
MacGinnitie, W. J.
McClenahan, C. L.
McLean, G. E.
Masterson, N. E.
Menzel, H. W.
Morison, G. D.
Muetterties, J. H.
Munro, R. E.
Munterich, G. C.
Naffziger, J. V.
Newman, S. H.
Perreault, S. L.
Petz, E. F.
Phillips, H. J.
Pollack, R.
Portermain, N. W.
Price, E. E.
Retterath, R. C.
Richardson, J. F.
Riddlesworth, W. A.
Rodermund, M.
Rogers, D. J.
Roth, R. J.
Ryan, K. M.
Salzmann, R. E.
Scheel, P. J.
Scheibl, J. A.
Scheid, J. E.
Skelding, A. Z.

Skurnick, D.
Smith, E. R.
Snader, R. H.
Stewart, C. W.
Sturgis, R. W.
Tarbell, L. L., Jr.
Thomas, J. W.
Toothman, M. L.
Walters, M. A.
Webb, B. L.
Welch, J. P.
Williams, P. A.
Wilson, J. C.
Woll, R. G.

ASSOCIATES

Alfuth, T. J.
Ashenberg, W. R.
Banfield, C. J.
Barrette, R.
Bartlett, W. N.
Biondi, R. S.
Cadorine, A. R.
Chorpita, F. M.
Chou, P. S.
Conners, J. B.
Cooper, W. P.
D'Arcy, S. P.
Davis, R. C.
DeGarmo, L. W.
Degerness, J. A.
Dempster, H. V., Jr.
Drennan, J. P.
Fisher, W. H.
Foley, C. D.
Fusco, M.
Goldberg, S. F.
Gottlieb, L. R.
Gould, D. E.
Greene, T. A.
Groot, S. L.
Head, T. F.
Jensen, J. P.
Jersey, J. R.
Jorve, B. M.
Kaur, A. F.
Keene, V. S.
Klingman, G. C.
Kollar, J. J.
Kolodziej, T. M.
Lester, E. P.
Lindquist, R. J.
Luneburg, S. C.
Marino, J. F.
Marks, R. N.
Millman, N. L.
Mohl, F. J.
Mokros, B. F.
Moore, B. C.
Neidermyer, J. R.
Nolan, J. D.
Palczynski, R. W.
Radach, F. R.
Rapp, J. W.
Rosser, H.
Sandler, R. M.
Sawyer, J. S., III
Schaeffer, B. G.
Schneiker, H. C.
Sevilla, E. S.
Sheppard, A. R.
Shoop, E. C.
Singer, P. E.
Stephenson, E. A.
Stergiou, E. J.
Swaziek, R. R.
Thompson, E. G.
Torgrimson, D. A.
Trees, J. S.
Tverberg, G. E.
Wade, R. C.
Walters, M. A.
Wood, J. O.
Ziock, R. W.

GUESTS

*Anderson, E. V.
*Behan, D. F.
*Bell, A. M.
Burge, M.
Dunn, R. P.
Fino, J. A.
*Gamble, R. A.
*Hoyt, F. A.
Knox, F. J.
Martin, S. I.
Mortimer, W. S.
Neiley, R. B., Jr.
Parsons, J. M.
Reber, S. R.
*Smith, D. A.
*White, B. R.
*Yoder, R.

*Invitational Program

Respectfully submitted,

Robert B. Foster
Secretary-Treasurer

Volume LXI, Part II

No. 116

PROCEEDINGS

November 17, 18, 19, 1974

INDEPENDENCE OF THE ACTUARY
A MEASURE OF PROFESSIONALISM

PRESIDENTIAL ADDRESS BY PAUL S. LISCORD

Like many of my predecessors, I'm sure, I have spent a very enjoyable summer re-reading past presidential addresses to the Casualty Actuarial Society for sources of inspiration and guidance in the preparation of this presentation. As can be expected, there is a wide divergence of style as well as content indicating, at least to me, that any accusation of inbreeding over the years within the CAS is completely unfounded. However, I uncovered one basic thread which underlies them all – a sense of awareness for the times they represent. I hope you will find this edition equally as aware.

Any talk on the subject of independence, with our country's bicentennial celebration in the offing, is certainly topical. It is also bound to be regarded as somewhat moralistic when one considers many of those unfortunate individuals drawn into the recent Watergate affair either by exercising or not exercising, as the case may be, independence through overt or covert thought and action. But I'm more interested in discussing this concept and its relation to us in the CAS, as a professional society and as professional actuaries.

Most recently, as many of you may know, a joint committee of the six actuarial bodies on the North American continent rendered a preliminary report on the independence of the actuary, in exploration of setting "guidelines on the circumstances, if any, in which organizational and financial independence of the actuary are desirable to avoid what may appear to be a conflict of interest in certification and other actuarial duties." I have deliberately put those words in quotation since I have great difficulty understanding what they mean in everyday life. However, such difficulty may be symptomatic of my inability over the years in understanding the pronouncements of life actuaries, and life actuaries in this case comprised 10 of the 11 members of the joint committee. However, I'm sure they won't be offended since I have equal trouble understanding most lawyers, and when it comes to economists, my head simply spins over their jargon. It's no wonder the recent economic summit to solve the inflation problem wasn't very productive. Be that as it may, I'd like to spend the next few minutes with you in explanation of what independence of the actuary means to this casualty actuary, on my own terms, and in my own way.

A recent census of our Society has shown that, by far, the greatest number of our active members work for private insurance carriers and their rating and statistical organizations. The other classes of employers of our members can generally be categorized in three relatively smaller segments: consultants, regulators, and educators. In many ways, the notion of actuarial independence is most commonly related to consulting work where the basic conflict is often expressed by the question: which comes first professionalism or fee? However, this same question is germane to activities of any actuary, whether consultant or not, and I would particularly like to examine its application to company actuaries.

One of the most important duties of a company actuary is to advise management in the evaluation of reserves, more specifically, loss and loss expense reserves. I don't need to remind anyone here of the sensitivity of this area. However, it is because of this sensitivity that it is vital that some guidelines be expressed on how far the independence of the professional actuary can be carried in relationship to his continued employment. It is equally vital that management know and recognize what these guidelines are, since, without such recognition, management sometimes turns to practitioners of other disciplines for reserve advice a sometimes drastic alternative, of which we have seen dreadful examples in recent months. Without trying to impose my standards upon anyone, I can offer my own guide which seems to be working at the moment. The measurement of reserves is primarily a professional actuarial function, whereas the recognition of the changes in reserves resulting from actuarial measurement is primarily a prerogative of management.

An equally sensitive area is statistics. We, as an industry, are currently being deluged by new statistical requirements from various governmental bodies all the way from demands for fast track data and VIN numbers to the requirements implied by the open end statistical legislation recently enacted in South Carolina. What bothers me about this whole movement is not just the cost of obtaining the data — which is immense (at a time when the shortage of surplus capacity is most acute) — but the fact that nobody has the remotest idea what to do with the information once it's captured and compiled. In other words, neither side of the cost-benefit equation has been explored — shades of CRSP!

Now what has this to do with independence of the actuary — particularly the company actuary? Well, the ultimate burden of providing the data rests with the companies, and the actuary is really the only professional in company ranks competent to evaluate both the costs and benefits. However, in doing so he must be independent minded enough to properly weigh the benefits: the realization of the public's need to know, accommodation to the underwriter's need for market planning, fulfillment of his own responsibility to more accurately measure risk; against the costs, the costs of various alternative methods of data capture and control. He must not only weigh the benefits and costs independently but also report his findings clearly and firmly. On this latter point, the casualty actuary should always be alert to the garbage in — garbage out syndrome which seems so prevalent under existing plans.

This brings us to a third area where the company actuary must exercise independence, and that is in his relationship with underwriters. In discussing this relationship, I would like to preface my remarks with reference to a previous presidential address by the late Dudley Pruitt entitled, "The Seat of Wisdom." Therein he describes an underwriter friend who in final frustration at having to answer questions about some of the myths of underwriting declares, "Every underwriter worth his salt learns how to underwrite by the seat of his pants."

I can't help carrying this theme a bit further by charging some of my more production-minded friends in underwriting as acting like the man who, in stooping over to pick up a coin lying on a sidewalk in a shopping center, puts his fanny through a plate glass window.

Dudley Pruitt goes on to discuss the underwriter's preoccupation with such words as seasoning, spread, capacity and retention. I will go even further and question the underwriter's understanding of the terms classification structure, schedule rating, cream-skimming and adverse selection.

As regards classification structure, the Actuarial Review, in its June 1974 editorial, points out that our rating classifications in automobile insurance are being changed through the introduction of no-fault and suggests that maybe we actuaries ought ourselves to challenge them as being less than logical, if not actuarially precise. To my mind, there is a great deal of sense in that suggestion and I'd like to think that we as professionals have the independence (from underwriters) to pursue it. But the job shouldn't stop with auto. Most every one of our lines of business requires this kind of independent analysis.

I think one of the problems that underwriters have in structuring classifications is that they fail to distinguish between classifications for risk and classifications for marketing. Too often a class is established at a given rate differential simply because it will sell and not because inherently there is a difference in risk. That statistics may sometimes ultimately support the original rate differential is completely a matter of chance, particularly since the exposure base is usually chosen as a matter of convenience rather than by a true measurement. Couple those judgments on rate differentials with inadequate statistical control of the compilation of exposures and the result is biases piled on top of biases.

Compounding the situation in some lines is, too frequently, the underwriters' unrealistic application of schedule rating for individual risks. This is seat-of-the-pants underwriting to the nth degree, particularly where little, if any, discipline is imposed by underwriting management on the ultimate price charged. Indeed, this condition may be impossible to control directly since the concept of schedule rating is strictly judgmental. However, I'd like to think that proper measurement of off-balance on the part of company actuaries could assist in that effort.

By these remarks, I want it clearly understood that I am not advocating the elimination of flexible pricing. But a certain amount of price monitoring must be maintained if only to measure deviations from some standard. How else can a company attempt to manage its own results?

When it comes to describing the term "cream-skimming," I'm always reminded of the marketing oriented underwriter who is forever admonishing his actuary to find pockets of profit from which to mine all sorts of good things. What the underwriter means, of course, is to isolate some areas of rate redundancy so that he, in turn, can cut rates and sell a lot more business. This becomes a problem for the actuary, if he is at all independently honest (I certainly hope those two words go together), because he has to consider properly the credibility of his loss data and the accuracy of the expense allocations on which he must rely, in order to uncover the kind of market opportunities the underwriter desires.

What usually happens is that the underwriter becomes impatient with the caveats of the actuary and proceeds to implement a marketing program based upon the seat-of-his-pants. If he has any success, as measured by improved production and immature loss experience, he is tempted to expand his program to cover marginal business. Too often, these seat-of-the-pants decisions eventually catch up with him in terms of disastrous underwriting results. It's no wonder many companies have underwriting cycles. As Pogo says, "We have met the enemy and he is us."

My last underwriting item for discussion deals with the term "adverse selection." The problem usually arises when there is an actuarially proven need to increase rates and the underwriter hesitates to implement the increase because he foresees many of his better agents, brokers, and customers seeking a change in carrier, thus leaving him with a residue of the poorer risks and accounts. His concern obviously presupposes that his competitors are not also going to increase price, which has to mean he assumes that: their claims adjusting is under better control, or their actuaries are better at finding pockets of profit, or they are superior selectors of risk, a possibility to which our underwriter friend is not likely to admit. It also assumes that this residue of poorer risks and accounts is improperly priced at the higher rate level, or even more subtly, that those risks really are poorer in relation to the price charged. For some reason, many otherwise capable underwriters still feel that a debit rated risk is automatically poor. I call it the pig-iron-under-water syndrome.

I could go on in this vein at the expense of my underwriting friends (if I have any left) excepting that these underwriting inconsistencies often exist because they are never pointed out by the experts upon whom the underwriters must rely most heavily — their actuaries. If blame has to be handed out for underwriting failure the actuary must share it, particularly if he fails to communicate his findings and to insist that his recommendations be properly considered. As my old boss, Sterling Tooker, advocated when, as president of Travelers, he spoke to us seven years ago. He said, "Learn to communicate your ideas; and when you know your ideas are right, be willing to fight for them." If that isn't a ringing statement for independence of the actuary, then I've never heard one.

I probably could go on exploring aspects of the company actuary's experience where his independence as a professional is important, either to his personal advancement, to the well being of the organization which employs him, or to the industry he serves, but time does not permit.

I'd like next to explore briefly what the concept of independence means to the Casualty Actuarial Society itself. Without reciting the full history of our organization in detail, I think it reasonably accurate to observe that in the sixty years of its existence, the Casualty Actuarial Society has never exercised a professionally independent viewpoint on any industry matter, whether controversial or not. Indeed, our constitution makes this virtually impossible by requiring the attainment of a ninety percent majority of our voting members to present a Society position. I can't imagine nine out of ten casualty actuaries agreeing on anything.

While it is true that our *Proceedings* serves, to some extent, the need for casualty actuarial comment, at best it presents individual or committee opinion on an almost after-the-fact-basis—inevitably much too late to have any effect on current issues.

We further muzzle ourselves by observing the tradition at our semi-annual meetings, of maintaining discussions off-the-record. The thought behind this tradition is to foster more frank and open discusion but at what cost to the need for independent professional opinion, openly and fully expressed outside of the confines of our own fraternity? We seem hell-bent to hide our light under a bushel.

Just think what might have happened had casualty actuaries not abrogated their professional responsibilities to lawyers and underwriters before, during, and after the SEUA decision and the development of rate regulation as we know it today. Would GAAP accounting, and all of its real and potential distortions, have been thrust upon us if we casualty actuaries had been willing to speak forcefully and openly against the dogmatism of the accountants in treating the insurance business the same as some fish cannery?

How much longer will we exercise professional silence: over the proliferation of useless and costly statistical requirements; over the manner in which our profits are measured and our investment results are introduced into rate-making; over the proper means for measuring the double-barreled effect of inflation and recession in our rates and on our reserves? I hope that silence will be broken at this meeting and at future meetings.

In conclusion, let me borrow again from Mr. Tooker by paraphrasing his concluding remarks as follows: independence is a two-edge sword; if we exercise it when the opportunity presents itself we can call ourselves professional. If we fail to exercise it, or exercise it at the wrong time, we are not only unprofessional but are vulnerable to being overwhelmed by other unprofessionals. The key to true professionalism is independence properly determined and practiced.

REVISING CLASSIFICATION STRUCTURE USING SURVEY DATA

DAVID SKURNICK, N. ROBERT HEYER AND G. RAY FUNKHOUSER

DESCRIPTION OF THE PROBLEM

Revising a classification structure requires both underwriting judgment and an analysis of statistical data. The data can be used to estimate the loss experience of the various proposed classifications and to compare it with the loss experience of the existing classifications. When the merging of two classifications is contemplated, the data on hand can be used to compile experience on both separate and combined bases and to test the effect of the merger. However, when the splitting of established classifications is under consideration, the proposed classifications are often not identified in the data base, so a special effort is required to obtain the necessary data. This may involve obtaining additional information from the applications, imputing classification data from other data on hand or conducting on-site inspections of a number of risks. This paper illustrates a method for revising a classification system in which a mail survey was used to obtain statistical data.

The specific problem addressed was the classification structure of workmen's compensation insurance pertaining to California farms. At the time of the study there were five categories of farms, viz.: Orchards; Truck Farms and Vineyards; Poultry Raising, Egg Production and Hatcheries; Dairy Farms and Sheep Raising; and Field Crops and Stock Farms. These classifications were established some twenty years ago, but since that time California agriculture has changed considerably. The size and organization of the farming units have tended toward larger, more efficient farms. New methods of farming and new kinds of farm machinery have been introduced. The amount of irrigation in the state has increased, and various kinds of farm-related operations, for example, packing sheds, are more frequently included among the agricultural operations on California Farms. These changes in California agriculture, and concomitant discussions among the various constituencies involved in, or touched by, farm workmen's compensation insurance, led the California Inspection Rating Bureau (C.I.R.B.) to explore whether changes in the classification structure were desirable and, if so, what they might be.

The existing classifications were based upon the crops or livestock produced on the farm and it was anticipated that any revised classifications would have the same basis. It was therefore necessary to collect crop and livestock data for a sample of farms. The data would be used to relate insurance experience (exposure and loss) for each farm to the specific crops or livestock produced on that farm and enable the C.I.R.B. to make assessments of the present classification structure and various alternatives. One of the two possibilities for gathering the crop data, on-site inspections, would have been inefficient because a very large sample of widely dispersed farms was required. A large sample was required because there are tens of thousands of farms in California with none large enough to dominate any of the farm classifications and because the data had to be sufficient for the evaluation of a variety of potential classification systems. It was decided that a mail survey would be more efficient in gathering the needed data, and Field Research Corporation (FRC) was commissioned to conduct the survey.

SURVEY PROCEDURES

Development

The first step in the survey process was to conduct a pilot study to determine the feasibility of using this research technique in this context. Consultations were held with experts representing the insurance industry, the California Department of Food and Agriculture, the Farm Bureau Federation and other researchers who had conducted surveys on farm safety. Next, a questionnaire was designed which it was believed would gather the necessary data from a sample of farms concerning their products as well as data on size, other operations, machinery and equipment, and certain agricultural practices. This questionnaire was sent (with a cover letter and a stamped return envelope) to a sample of about 500 farms.

From the pilot study we found that the use of a mailed questionnaire to collect crop data from farms was feasible, as well as economical. We also found that crop data from the survey and insurance data from the C.I.R.B.'s unit statistical reports could be satisfactorily linked. Moreover, the pilot study brought to light some problems for which adjustments were made in the main survey that substantially increased the volume and the quality of the data from the farms.

For example, it was found in the pilot study that large farms were inherently harder to reach than small farms were, due to more complex management structures. Corporation ownership, decentralized management and multiple crop activities typical of large farms in California all combined to reduce the effective response rate from large farms. However, the larger farms have a larger impact on insurance loss, and it was imperative that data be obtained from as many of these as possible. As a result of the pilot study, some changes were made in the questionnaire, a sampling plan was designed whereby larger farms were sampled at a higher rate than were smaller farms, and strategies were devised to bring about a higher rate of returns among large farms.

Final Questionnaire

The questionnaire used as the data-gathering instrument for the full-scale survey was a shortened version of that used in the pilot study. Recipients of the questionnaire, which was addressed to the principal individual named in the C.I.R.B. policy master file, were asked to indicate which crops or other products they had raised in the years 1970 through 1973. The format was such that the entire questionnaire was printed on both sides of a single sheet of 8-1/2" × 14" paper. Included with the questionnaire was a cover letter that explained the survey and mentioned that it was endorsed by the Farm Bureau Federation and the California Department of Food and Agriculture.

Sampling

The universe sampled for this survey was the list of farms covered by workmen's compensation insurance and in the C.I.R.B. files. These files are accessible by computer, and a program was written to draw this sample.

The pilot study had indicated that different types and sizes of farms would have different rates of response. Also, some of the present classification codes covered more crops and products than others. Therefore, a stratified sampling plan was devised by which certain types and sizes of farms were sampled at greater rates from the C.I.R.B.'s list than others. Farms with annual exposures of $5000 or less were selected by ratios ranging from 1 out of every 50 to 1 out of every 16, and in higher categories of exposure smaller ratios were used. All farms with annual exposures of $75,000 or greater were selected for inclusion in this sample.

This differential sampling was used so that the farms with the greatest impact on insurance experience would be more likely to be included in the survey data. This plan was adopted to guarantee obtaining enough loss data to provide high credibility for critical classification categories; but because of the disproportionate sampling plan it did not yield directly a true cross-section of California farms. Because of the random selection process within each stratum, a "true cross-section" (in the sense of representing farms of all sizes in direct proportion to their actual frequencies) could be statistically constructed. Since this kind of analysis was not essential for comparing the relative hazard among classifications, it was not performed.

To provide for invalid addresses and duplicate entries due to multiple classification of farms, all strata sampling intervals were increased by 25% so that the final sample size would still be faithful to the projected sampling needs. A total of 5089 different farms comprised the final, mailed sample. Table I shows the final sample draw, broken down by existing farm classification and by amount of exposure in the primary classification. The sampling ratios (and the number of farms drawn) are given for each of the 20 different strata shown in the table.

Table I

Sampling Ratios (and Number of Farms Drawn)

		Exposure Category			
Prior Farm Class	**(Total Farms)**	**$1 to $5,000**	**$5,000 to $20,000**	**$20,000 to $75,000**	**Over $75,000**
Orchards	(1355)	1/50 (278)	1/17 (254)	1/3 (534)	1/1 (289)
Truck Farms & Vineyards	(2003)	1/22 (399)	1/12 (419)	1/5 (685)	1/1 (500)*
Poultry	(259)	1/16 (43)	1/8 (63)	1/2 (83)	1/1 (70)
Dairy and Sheep	(554)	1/2 (85)	1/13 (132)	1/4 (249)	1/1 (88)
Field Crops and Stock Farms	(918)	1/25 (325)	1/13 (224)	1/3 (275)	1/1 (94)
Total Sample	(5089)	(1130)	(1092)	(1826)	(1041)

*A total of 936 farms were supplied for this category, but 500 were judged to be an adequate number for the survey.

Data Acquisition

The questionnaires were mailed to the 5089 farms in the sample. Prior to mailing, a serial number for each farm in the sample was entered on the questionnaire sent to that farm, and also on that farm's unit report. This serialization enabled us to relate the returned questionnaires to the farms in the sample, an essential operation because of the need to link the questionnaire data to the insurance experience provided for the farms in the sample.

A second wave mailing was sent two weeks after the first wave to all farms that had not yet responded. Shortly after the second wave mailing went out, a third stage effort was begun by telephone. Calls were made to all farms in certain categories (indicated in Table II) from which it was deemed especially important to secure a high rate of return. In the telephone contact interview, crop data were obtained from the farms, but, to make the interview as brief as possible, other peripheral items on the questionnaire were not asked. Because the crop data were the main objective of the survey, this procedure did not appreciably impair the data base.

All three waves of data gathering were conducted during a period of 25 days. The returns by classification and exposure are shown in Table II. Over-

Table II

Number of Completed Questionnaires (and return rates)

	Exposure Category			
Prior Farm Class	**$1 to $5,000**	**$5,000 to $20,000**	**$20,000 to $75,000**	**Over $75,000**
Orchard	141 (51%)	131 (51%)	278 (52%)	122 (43%)
Truck Farms & Vineyards	203 (47%)	197 (47%)	328 (48%)	219 (44%)
Poultry	27 (63%)	53 (79%)*	62 (75%)*	61 (84%)*
Dairy & Sheep	43 (50%)	83 (63%)*	155 (62%)*	56 (64%)*
Field Crop and Stock	148 (45%)	146 (62%)*	177 (63%)*	70 (76%)*

*Farms inside the dashed line received telephone follow-up calls.

all, questionnaires or telephone responses were obtained from 2476 farms during the period. This amounts to an effective return rate of 50.2% overall, after subtracting from the original sample 156 farms whose addresses proved to be invalid.

Data Linkage

The C.I.R.B. supplied FRC with the necessary insurance data for all of the farms drawn in the survey sample. These insurance data were compiled at the time the sample was drawn from the C.I.R.B.'s files, and were punched on cards in a format that enabled FRC to enter the data from the questionnaires directly onto the cards.

Two kinds of data cards were supplied by the C.I.R.B. First, one "farm card" was supplied for every farm in the sample containing the Bureau Number of the farm, its total exposure, its loss and subject premium for policy years 1970 and 1971 (the two most recent years for which complete insurance data were available), and its pure premium for those two years. The farm cards were used to compare the insurance characteristics of the responding farms and non-responding farms to test for response bias.

The second type of data card consisted of a variable number of "crop cards" for each farm, depending upon the number of class codes under which the farm was covered and the number of years the farm was so covered. A separate "crop card" for each class and for each year of coverage (1970 and/or 1971) was prepared for each farm. Each "crop card" was identified by class code, year, and Bureau Number, and contained the exposure, loss, pure premium and subject premium for that crop and that year.

Questionnaire Data

Crop data from the returned questionnaires were entered onto the "crop cards" by determining which crops reported on the questionnaire accounted for the coverage for each class code and year. The range of data available for coding was limited in some cases by the fact that certain individual crops reported on the questionnaires could not be separated when two or more of them fell within one category in the prior classification system. In such cases, where several crops could not be separated on a given "crop card", a combination crop code was used to designate what group of crops was represented. Thus, for example, a farm growing both oranges and lemons in one year was coded as "combination of orchard crops", since both of these crops occur within the same prior Bureau classifications.

DATA ANALYSIS

Validity of the Survey

The insurance data and farm data were combined and statistically analyzed by computer. Table III shows a comparison between the insurance data representing the farms that responded in the survey and the farms that did not respond.

Table III

Comparison of Insurance Data between Responding and Non-Responding Farms

	Responding Farms	Non-Responding Farms
1. Number of Reports (crop cards)	6,475	6,993
2. Total Exposure	$368,694,656.	$466,475,904.
3. Average Exposure (per year) (2) ÷ (1)	$56,941.	$66,706.
4. Total Loss	$6,930,513.	$9,049,346.
5. Average Loss (per year) (4) ÷ (1)	$1,070.	$1,294.
6. Aggregate Pure Premium 100 × (4) ÷ (2)	1.880	1.940

This comparison shows that there is a slightly higher pure premium among the non-responding farms than among the responding farms. This may be a result of differential return rates among the different sizes and classes of farms, and it may have resulted from a slight tendency of farms with poorer insurance experience not to respond to the questionnaire. As the difference between the pure premiums of the two groups is in the range of 3%, it is doubtful that the discrepancy, no matter what its cause, would have any noticeable effect on the validity of the results of the survey. The conclusion was, therefore, that there is no serious bias in the insurance characteristics of the sample of responding farms, beyond the inherent bias that results from the disproportionate stratified sampling plan discussed previously. On this basis, it was assumed that the questionnaire data on crops produced, linked with insurance experience on a farm-by-farm basis, could be interpreted as validly representing the originally drawn sample of California farms.

As a further check on the survey's validity, the prior classification system was also analyzed and compared to the actual, summary statistics in the C.I.R.B. records. This comparison is shown in Table IV for 1970 (the most recent complete data available at the time of the study).

Comparing the sample data with the summaries of the overall universes they represent, two things stand out:

1. The pure premiums for the samples from each category are reasonably close to the actual universe values.
2. A sample of about 7% of the reports, deliberately drawn to over-represent larger farms, accounted for almost one-quarter of the total insurance loss.

Individual Crop Experience

A computer program summarized the total and average exposure and loss and the aggregate pure premium for each of the 112 crop categories measured in the study. The largest individual crop categories were "Dairy Cows and Calves" with 516 reports and $700,044 of incurred loss and "Chickens and/or Eggs" with 225 reports and $551,388 of incurred loss. However, with only $6,238,343 of incurred loss spread among 112 crops, most crops had very limited experience. Also, it was not possible to allocate exposure and loss for farms with two or more crops in a single prior classification. Experience of such farms had to be shown in appropriate combination codes.

Credibility considerations required that the design of new classifications be accomplished by the process of grouping the crops into various proposed classification schemes and comparing them on the basis of their insurance experience. Dealing with larger classifications also reduced the data lost on account of crop combinations, because, if a farm had two or more crops in one prior classification, but these crops were also in the same proposed classification, then its experience could be used.

Table IV

Comparison of Loss and Pure Premiums
Between Survey Data and the C.I.R.B. Statistical Reports (1970)

Class	Survey Results			C.I.R.B. Records		
	No. of Reports	Pure Premium	Total Loss ($)	No. of Reports	Pure Premium	Total Loss ($)
Orchards	849	2.62	970,211	16,958	2.26	4,118,045
Truck Farms and Vineyards	1,091	1.41	1,067,648	13,930	1.26	5,304,297
Poultry	191	1.30	286,631	1,294	1.74	647,530
Dairy and Sheep	334	2.62	374,898	3,867	2.64	1,507,456
Stock and Field Crops	710	3.21	727,802	9,991	3.80	3,501,322
Total	3,175	—	3,427,190	46,040	—	15,078,650

Selection of the Revised Classifications

A program was written to analyze the insurance characteristics of alternate classification systems proposed by the C.I.R.B. and others. Each proposed system of categorizing crops was entered into the computer, and an analysis was made of exposure, loss, and pure premium for each category in the system. The credibility of each of the proposed categories was calculated according to the formula:

Credibility = $(\text{Total Loss}/1{,}197{,}880)^{2/3}$, to a maximum of 1.0.

The credibility formula approximates the usual three part criterion used in workmen's compensation ratemaking. The amount of loss for full credibility was based upon 50 serious claims, 300 non-serious claims, and 80% of the non-serious amount for medical, but these three amounts were added together and compared to the total incurred loss, rather than applied separately to the three types of expected loss.

Since the insurance data now were linked with individual crops (or with specific combinations of crops), it was possible to form virtually any new set of classification categories desired. Because of the nature of agriculture in California, however, only a limited number of classification systems were considered reasonable.

The first step was to divide the crops into seventeen basic study groups and analyze their sample pure premiums. It was judged that the classifications ultimately chosen should be combinations of these seventeen groups. Four other classification schemes, ranging from four to eight categories, were then analyzed. One of these, Classification System 5, is summarized in Exhibit 1. Exhibit 2 shows how Classification System 5 was formed from the seventeen basic groups.

The commodity experts of the California Farm Bureau Federation had suggested a configuration which the C.I.R.B. modified in two respects to form Classification System 5. The Farm Bureau specialists had included potatoes and sugar beets with field crops, but the data indicated that the pure premium for potatoes and sugar beets was significantly lower than the pure premium for field crops; consequently, the C.I.R.B. decided to establish a separate classification for potatoes and sugar beets until a more comprehensive study could be made. Also, the Farm Bureau specialists had separated Beef Cattle (Farms) from Horses and Feed Yards, but the pure premiums were nearly the same; consequently, the C.I.R.B. decided to establish two new classification wordings placed under a single code number.

Classification System 5 would have been chosen to replace the prior system, were it not for the problem presented by cotton risks. Since they had been included in the Truck Farm classification enjoying a relatively low Manual rate, moving them in with the Field Crops would have resulted in a much higher rate for them. Furthermore, the data compiled in the seventeen study groups indicated that the pure premium for the Cotton group was slightly lower than the pure premium for Field Crops. It was therefore decided to establish a separate classification for Cotton until a more comprehensive study could be performed.

The final classification configuration as filed by the C.I.R.B. is shown in Table V.

Table V

Revised Farm Classification System

Prior Code	Crop	Proposed Code
0016	Orchards	0016
0017	Vegetables	0172
0017	Potatoes	0041
0017	Grapes	0040
0017	Cotton	0044
0034	Poultry Raising	0034
0036	Dairy Farms	0036
0037	Stock Farms	0038
0037	Field Crops	0171

The premium rates and expected loss rates for the proposed codes were calculated from the pure premiums selected. Classifications 0016, 0034, and 0036 were essentially unchanged, so their pure premiums were based on past experience. Pure premiums for classes 0038 and 0171 were selected to be proportional to their sample pure premiums, so balanced that the premium generated by the two new classes would equal the premium that would have been generated at the rate indicated by the past experience of class 0037. Similarly, the pure premiums for Codes 0040, 0041, 0044, and 0172 were based on their sample pure premiums and balanced to the past experience of Code 0017. Selected pure premiums for the new classes were limited to a 25% increase over the pure premiums indicated by past experience, and a balancing adjustment was made so that the total premium income for the farm classes would be unaffected by the change in classification structure.

Exhibit 1

Classification System 5

Category		Number of Reports	Total Exposure	Total Loss	Aggregate Pure Premium	Percent Credibility
Orchards &	Total	1739	78542120.	1657874.	2.111	100%
Nuts	1970	845	36584144.	960895.	2.627	86%
0016	1971	892	41957976.	696979.	1.661	70%
Vegetables	Total	371	36988796.	413803.	1.119	49%
0017	1970	181	17234596.	207809.	1.206	31%
	1971	190	19754200.	205994.	1.043	31%
Grapes	Total	636	19019076.	224278.	1.179	33%
XXXX	1970	311	7834982.	44939.	0.574	11%
	1971	325	11184094.	179339.	1.604	28%
Cotton &	Total	842	19430658.	559748.	2.881	60%
Field Crops	1970	413	8940592.	282692.	3.162	38%
YYYY	1971	429	10490066.	277056.	2.641	38%
Potatoes &	Total	78	6390912.	63267.	0.990	14%
Sugar Beets	1970	41	2977909.	32239.	1.083	9%
ZZZZ	1971	37	3413003.	31028.	0.909	9%
Poultry &	Total	439	46806156.	686618.	1.467	69%
Sheep	1970	218	22547196.	288928.	1.281	39%
0034	1971	221	24258960.	397690.	1.639	48%
Dairy	Total	516	25447544.	700044.	2.751	70%
0036	1970	252	11933190.	345814.	2.898	44%
	1971	264	13514354.	354230.	2.621	44%
Stock Farms	Total	268	13419345.	451933.	3.368	52%
& Feed Lots	1970	129	6241234.	180790.	2.897	28%
0037	1971	139	7178111.	271143.	3.777	37%
	Overall Summary					
	Total	4887	246044607.	4757565.	1.934	100%
	1970	2390	114293843.	2344106.	2.051	100%
	1971	2497	131750764.	2413459.	1.832	100%
	Reports Not Classified Under This System					
	Total	1602	122825072.	2173041.	1.769	100%
	1970	785	57509992.	1083084.	1.883	94%
	1971	817	65315080.	1089957.	1.669	94%

Exhibit 2

Formation of Classification System 5 From the Seventeen Study Groups*

Seventeen Study Groups

	Pure Premium	Percent Credibility	Prior Class Code	Classification System 5 Code
Beef Cattle Farms	3.554	23%	0037	0037
Feed Yards	3.425	27%	0037	0037
Horses (Hogs)	3.362	15%	0037	0037
Field Crops	2.997	55%	0037	YYYY
Dairies	2.750	70%	0036	0036
Orchards	2.341	94%	0016	0016
Cotton	2.220	14%	0017	YYYY
Poultry	1.470	65%	0034	0034
Sheep (Goats)	1.223	5%	0036	0034
Grapes	1.202	33%	0017	XXXX
Vegetables	1.174	46%	0017	0017
Potatoes & Sugar Beets	0.989	14%	0017	ZZZZ
Nuts	0.943	11%	0016	0016
Melons & Strawberries	0.819	10%	0017	0017
Dry Beans & Peas	0.244	1%	0017	0017
Bush Berries	0.128		0017	XXXX
Hops	0.116		0017	XXXX

THE CALIFORNIA TABLE L

DAVID SKURNICK

The retrospective rating plan of the California Inspection Rating Bureau is a tabular plan with a fixed per accident limit. In 1974, in order to bring the rating values up to date, a new table of charges was constructed. In the previous updating the insurance charge had been taken from the countrywide 1965 Table M of the National Council on Compensation Insurance and the charge for the per accident limit had been derived from a study of California claims. The Bureau decided to base the new table of charges wholly upon California experience. Since the per accident limit is fixed in the plan, it was decided to construct a table of charges that would include the cost of the per accident limit in the charge. This table was named "Table L". Its advantage is that it reflects both the charge for limitation of total losses and the charge for limitation of individual accidents, but the overlap between these charges is eliminated.

This article describes the characteristics of Table L and the method by which it was constructed. Section 1 contains a formal definition of the Table L charge and a demonstration of its applicability to retrospective rating. In Section 2 a new formula is derived, which uses Table M to develop retrospective rating plan values for a plan with a per accident limitation. Section 3 contains a description and an explanation of the methodology used by the Bureau to construct Table L. Section 4 describes some of Table L's numerical characteristics.

1. MATHEMATICAL PROPERTIES OF TABLE L

Formal Definition

Assume that a formula for limiting or adjusting individual accidents is given. The Table L charge at entry ratio r, $\phi^*(r)$, is defined as the average difference between a risk's actual unlimited loss and its actual limited loss; plus the risk's limited loss in excess of r times the risk's expected unlimited loss. The Table L savings at entry ratio r, $\psi^*(r)$, is defined as the average amount by which the risk's actual limited loss falls short of r times the expected unlimited loss. The Table L charge and savings are both expressed as ratios to expected unlimited loss.

In general, the "actual limited loss" for a risk may be calculated by adjusting the individual claims according to any pre-set formula, then summing the adjusted claim amounts. The theorems proved in this paper are valid regardless of the type of adjustment formula used, even if the formula prescribes different adjustments for different types of claims. The only requirement is that each adjusted claim amount be completely determined by the unadjusted claim amount and the characteristics of the claim.

For most purposes the adjustment to be used will be the truncation of individual claim amounts at a particular limit. This imposition of a per accident limit will result in a "normal" Table L. In the special case that no adjustment is made to individual claim amounts, the Table L produced is equivalent to a Table M, since the actual limited loss equals the actual unlimited loss.

California law requires that the calculation of a risk's retrospective premium use an average value in place of the actual indemnity loss for any death case. This substitution results in a smoothing of the loss ratios, which was provided for in the California Table L constructed by the Bureau. To accomplish this, an average value of $37,400 was substituted for each actual death indemnity amount before individual losses were truncated at the per accident limit. This use of an average death indemnity value has only a minor effect on the Table L charge, since less than 6% of the loss dollars result from death cases, and most actual death indemnity values are not far from the average value.

In this paper the usual excess pure premium ratio is called a Table M charge and an excess pure premium ratio which includes a provision for a per accident limit (or other adjustment of individual claims) is called a Table L charge.

The definitions will be made precise by utilizing mathematical notation. The annual losses for an insurance risk are a random variable. Let

A = the actual unlimited loss for the risk.

A^* = the actual limited loss for the risk, i.e. the actual loss after adjustment of individual claim amounts.

$E\{\cdot\}$ is the expectation operator: $E\{g(X)\} = \int g(x)\,dF_x(x)$ *for any* random variable X and function g

E = the expected unlimited loss $= E\{A\}$

$F =$ the cumulative distribution function of A/E

$F^* =$ the cumulative distribution function of A^*/E

$k =$ the loss elimination ratio

$$k = (E - E\{A^*\})/E. \tag{1}$$

The Table L charge and savings are defined mathematically for any entry ratio $r \geq 0$ by

$$\phi^*(r) = \int_r^\infty (s - r)dF^*(s) + k \tag{2}$$

$$\psi^*(r) = \int_0^r (r - s)dF^*(s). \tag{3}$$

From these definitions it is possible to prove two results that do not depend upon the application of Table L to any particular retrospective rating plan.

Lemma 1 Given constants r_1 and r_2 with $0 \leq r_1 \leq r_2$, define the random variable L to be the limited loss restricted to be no more than r_2E and no less than r_1E, i.e.

$$L = \begin{cases} r_1E, \text{ if } A^* \leq r_1E \\ A^*, \text{ if } r_1E < A^* \leq r_2E \\ r_2E, \text{ if } r_2E < A^*. \end{cases} \tag{4}$$

Then $E\{L\}/E = 1 - \phi^*(r_2) + \psi^*(r_1)$.

Proof: The random variable L/E can be represented as $g(A^*/E)$, where

$$g(x) = \begin{cases} r_1, \text{ if } x \leq r_1 \\ x, \text{ if } r_1 < x \leq r_2 \\ r_2, \text{ if } r_2 < x. \end{cases} \tag{5}$$

Then

$$E\{L\}/E = E\{L/E\} = E\{g(A^*/E)\} = \int_0^\infty g(s)dF^*(s)$$

$$= \int_0^{r_1} r_1 dF^*(s) + \int_{r_1}^{r_2} s dF^*(s) + \int_{r_2}^\infty r_2\, dF^*(s)$$

$$= \int_0^{r_1} (r_1 - s)dF^*(s) + \int_0^{\infty} sdF^*(s) + \int_{r_2}^{\infty} (r_2 - s)dF^*(s)$$

$$= \int_0^{r_1} (r_1 - s)dF^*(s) + E\{A^*/E\} - \int_{r_2}^{\infty} (s - r_2)dF^*(s)$$

$$= \psi^*(r_1) + 1 - k - \int_{r_2}^{\infty} (s - r_2)dF^*(s)$$

$$= 1 + \psi^*(r_1) - \phi^*(r_2). \quad \text{Q.E.D.}$$

It will now be proved that for Table L, the savings equals the charge plus the entry ratio minus one. This is the same relationship that holds for Table M.

Theorem 1 For any $r \geq 0$, $\psi^*(r) = \phi^*(r) + r - 1$. (6)

Proof: In Lemma 1, take $r_1 = r_2 = r$.

Then, $L \equiv rE$, so that

$$E\{L\}/E = r = 1 + \psi^*(r) - \phi^*(r). \quad \text{Q.E.D.}$$

Application of Table L to Retrospective Rating

In the California Workmen's Compensation Retrospective Rating Plan, the retrospective premium R is given by

$$R = BP + CA^*. \quad (7)$$

subject to a maximum of G and a minimum of H, where

G = the maximum premium

H = the minimum premium

B = the basic premium ratio

P = the standard premium (before any applicable expense gradation.

C = the loss conversion factor (LCF)

Unlike the National Council plans, the California Plan uses only one tax expense ratio, so the tax multiplier is included in the basic premium ratio and the LCF. The formulas derived in this section can also be applied to the National Council plans by adjusting for the different meanings assigned to these two terms.

In order to demonstrate how Table L leads to a balanced plan, it is convenient to introduce the following notation:

L_G = the actual limited losses that will produce the maximum premium

$$L_G = (G - BP)/C \tag{8}$$

$$r_G = L_G/E \tag{9}$$

L_H = the actual limited losses that will produce the minimum premium

$$L_H = (H - BP)/C \tag{10}$$

$$r_H = L_H/E. \tag{11}$$

L = the losses that will produce the retrospective premium in equation (7) without reference to the maximum and the minimum premiums. That is

$$L = \begin{cases} L_H, \text{ if } A^* \leq L_H \\ A^*, \text{ if } L_H \leq A^* \leq L_G \\ L_G, \text{ if } L_G \leq A^*. \end{cases} \tag{12}$$

The retrospective premium can be written as

$$R = BP + CL \tag{13}$$

= basic premium + converted losses

I^* = the net Table L insurance charge

$$I^* = [\phi^*(r_G) - \psi^*(r_H)]E. \tag{14}$$

Theorem 2 $\quad E\{L\} = E - I^*.$ (15)

Proof: Apply Lemma 1 taking r_G for r_1 and r_H for r_2. Then

$$E\{L\}/E = 1 - \phi^*(r_G) + \psi^*(r_H)$$

$$E\{L\} = E - [\phi^*(r_G) - \psi^*(r_H)]E. \quad \text{Q.E.D.}$$

A retrospective rating plan is said to be balanced if the expected value of the retrospective premium equals the standard premium adjusted for any expense gradation built into the plan. Let D denote the expense gradation in the plan, expressed as a ratio to P. From equations (13) and (15) balance will require that

$$E\{R\} = BP + CE - CI^* = P(1 - D). \tag{16}$$

It follows that the basic premium ratio must be selected as

$$B = 1 - D - CE/P + CI^*/P. \tag{17}$$

The retrospective premium can be separated into loss and expense components, and it can be shown that the expected value of each of these components equals the value of the corresponding component of standard premium adjusted for expense gradation.

Theorem 3 The use of equations (13) and (17) will produce a plan that is balanced with respect to losses.

Proof: The loss portion of R is $L + I^*$.

$$E\{L + I^*\} = E\{L\} + I^* = E. \quad \text{Q.E.D.}$$

Theorem 4 The use of equations (13) and (17) will produce a plan that is balanced with respect to expenses.

Proof:

$$\text{Expense in basic premium} = P(1 - D) - CE + (C - 1)I^*. \quad (18)$$

$$\text{Expense in converted losses} = (C - 1)L. \quad (19)$$

The expected value of the expense portion of R is

$$E\{P(1 - D) - CE + (C - 1)\ (I^* + L)\}$$
$$= P(1 - D) - CE + (C - 1)\ (I^* + E\{L\})$$
$$= P(1 - D) - CE + (C - 1)\ (I^* + E - I^*)$$
$$= P(1 - D) - E. \quad \text{Q.E.D.}$$

Two Useful Formulas

Table M formulas have been derived to express both the entry ratio difference and the charge difference in terms of the minimum premium, the maximum premium and the expense provision. Snader has shown that these formulas must be satisfied in order to have a balanced retrospective rating plan.[1] The formulas are the basis of the National Council's "Method 2" for determining rating values.[2] The use of these formulas facilitates the trial and error search for rating values corresponding to selected maximum and minimum premiums. Comparable formulas also exist for Table L.

[1] R. H. Snader, "Fundamentals of Individual Risk Rating and Related Topics," CAS Study Note, Part II, p. 3.

[2] National Council on Compensation Insurance, "Rating Supplement for Workmen's Compensation and Employers' Liability Insurance Retrospective Rating Plan D." p. 9.

Theorem 5 $\phi^*(r_H) - \phi^*(r_G) = (P - PD - H)/CE.$ (20)

Proof:

$$H = BP + CEr_H = P(1 - D) - CE + CE[\phi^*(r_G) - \psi^*(r_H)] + CEr_H$$
$$= P(1 - D) + CE[\phi^*(r_G) - \psi^*(r_H) + r_H - 1]$$
$$= P(1 - D) + CE[\phi^*(r_G) - \phi^*(r_H)].$$

Therefore

$$\phi^*(r_H) - \phi^*(r_G) = (P - PD - H)/CE. \quad \text{Q.E.D.}$$

The usual Table M formula for the entry ratio difference also holds for Table L, since the Table L entry ratios are also ratios to expected unlimited loss. This formula is

$$r_G - r_H = (G - H)/CE. \tag{21}$$

Formulas (20) and (21) were used in the construction of the updated California Plan. A selection of rating values will satisfy these two equations if and only if they yield a balanced plan.

2. THE INCREMENTAL CHARGE FOR PER ACCIDENT LIMITATION

In computing rating values for a plan with a per accident limitation, the standard method has been first to use Table M to select a maximum, a minimum, a basic, and an LCF that would provide balance if accidents were not limited; then add an incremental charge to the basic. Dorweiler describes this incremental charge as the increment on the excess pure premium ratio due to superimposing a per case limit on a per loss ratio limit.[3] He points out that the incremental charge will vary between zero and the loss elimination ratio depending upon the per accident limit, the expected loss ratio, the risk premium size and the entry ratio. The variation in incremental charge reflects the varying amount of overlap between the effect of a per accident limit and the effect of an overall loss amount limit. Conceptually, the Table L charge represents the sum of a Table M charge and an incremental charge. Let

[3] P. Dorweiler, "On Graduating Excess Pure Premium Ratios," *PCAS*, XXVIII (1941), p. 140.

$\phi(r)$ = the Table M charge at entry ratio $r = \int_r^\infty (s-r)dF(s)$

$\psi(r)$ = the Table M savings at entry ratio $r = \int_0^r (r-s)dF(s)$

$\triangle\phi(r)$ = the increment on the Table M charge due to superimposing a per accident limit (or otherwise adjusting individual claims)

$$\triangle\phi(r) = \phi^*(r) - \phi(r). \tag{22}$$

Uhthoff describes a convenient method of using excess loss premium factors to calculate approximate incremental charges, which do not vary by entry ratio, but which do vary by state.[4] This method is currently in use in most jurisdictions. In the 1966 updating of the California Retrospective Rating Plan the C.I.R.B. computed incremental charges that did vary by entry ratio. Although the incremental charges actually used may be approximate, the formula by which they modify the rating values can be precise.

Under the usual methodology the incremental charge $\triangle\phi(r)$ is estimated, and then the basic (including excess loss) premium ratio is taken as

$$1 - D - CE/P + C[\phi(r_G) - \psi(r_H) + \triangle\phi(r_G)]E/P. \tag{23}$$

Formula (23) is evidently not exact since it is unequal to the basic premium ratio as defined in equation (17). While formula (23) takes into account the incremental effect of a per accident limit on the Table M charge, it fails to include the incremental effect of a per accident limit on the Table M savings. It will be shown that the incremental savings, $\psi^*(r) - \psi(r)$, equals the incremental charge, so that formula (23) can be corrected by subtracting the incremental charge at the entry ratio producing the minimum premium from the incremental charge at the entry ratio producing the maximum premium.

Theorem 6

$$\phi^*(r) - \phi(r) = \psi^*(r) - \psi(r). \tag{24}$$

Proof: Theorem 1 and its Table M analogue show that

$$\phi^*(r) - \psi^*(r) = 1 - r = \phi(r) - \psi(r). \quad \text{Q.E.D.} \tag{25}$$

[4] D. R. Uhthoff, "Excess Loss Ratios Via Loss Distributions," *PCAS*, XXXVII (1950), p. 82.

Theorem 7

Use of the basic (including excess loss) premium ratio

$$1 - D - CE/P + C[\phi(r_G) + \triangle\phi(r_G) - \psi(r_H) - \triangle\phi(r_H)]E/P \quad (26)$$

will produce a plan that is balanced with respect to losses and expenses.
Proof: From Theorems 3 and 4 it is sufficient to show that

$$I^* = [\phi(r_G) + \triangle\phi(r_G) - \psi(r_H) - \triangle\phi(r_H)]E. \quad (27)$$

Indeed, equations (14) and (24) imply that

$$I^*/E = \phi^*(r_G) - \psi^*(r_H) = \phi(r_G) + \triangle\phi(r_G) - \psi(r_H) - \triangle\phi(r_H). \quad \text{Q.E.D.}$$

In actual practice $\triangle\phi(r_H)$ is small for most retrospective rating plans, so Formula (23) generally provides a good approximation.

3. CONSTRUCTION OF TABLE L

Adjustments to Current Level

The Bureau constructed Table L's for eleven premium size intervals separately for six different per accident limits. All the tables reflect California workmen's compensation experience from policy year 1969 second reports, adjusted to April 1, 1974 rate and benefit levels. A Table M was also constructed from the same data.

Premiums and losses at April 1, 1974 rate and benefit levels were used throughout the construction of the tables. Since all the data came from a single state, it was possible to bring losses to an April 1, 1974 benefit level using separate California benefit increase factors for Death, Permanent Total, Major, Minor, and Temporary claims. Premium was brought to an April 1, 1974 rate level by using a factor reflecting only the portion of the rate level change due to benefit increases and experience. A California permissible loss ratio of .635 was used to estimate the expected loss.

As shown in Exhibit 1, the benefit increase factors were particularly high for Deaths and Permanent Totals, the categories with the largest claims. Consequently, inadequate charges would have resulted if an average benefit increase factor had been used for all types of claims, as was done in the construction of the 1965 Table M. From the standpoint of use in California, another advantage of the 1974 California Table L over the

1965 Table M is that a California permissible loss ratio was used, rather than a countryside average.

The Table L Tabulation

A California Table M was constructed by means of Simon's procedure.[5] The risks were sorted by premium size group. Working with one group at a time, the standard premium P for each risk was multiplied by the permissible loss ratio to obtain the estimated expected loss E. The ratio of the actual unlimited loss to the estimated expected loss was designated R^M. The risks were then sorted on R^M and each premium size group was tabulated as in Exhibit 2. The smallest value of R^M was zero.

In the construction of Table L, losses were limited by substituting the average death indemnity value for the actual indemnity in each death case and truncating at the per accident limit. The same premium size groups, permissible loss ratio and estimated expected loss were used as for the California Table M. Within each premium size group, the ratio of the actual limited loss to estimated expected loss wes denoted E^L. The risks were then sorted on R^L and each premium size group was tabulated as in Exhibit 3. The value of the loss elimination ratio k was based upon all premium size groups combined.

The tabulations for Table M and Table L will now be compared column by column. Note that superscripts ^{L} and ^{M} are used to denote values in, or corresponding to, the tabulations. A subscript denotes the row of the table. The absence of a subscript in a symbol indicates that it represents a theoretical value for an individual task.

[5] L. J. Simon, "The 1965 Table M," *PCAS*, LII (1965), p. 1 ff.

Table M		Table L	
Standard Premium (P_i^M)		Standard Premium (P_i^L)	
Actual Unlimited Loss (A_i^M)		Actual Limited Loss (A_i^L)	
Ratio (R_i^M) $= A_i^M/.635\ P_i^M$	(28)	Ratio (R_i^L) $= A_i^L/.635\ P_i^L$	(33)
Number of Risks (N_i^M) $=$ number with a ratio of R_i^M		Number of Risks (N_i^L) $=$ number with a ratio of R_i^L	
Sum 1 ($S_{1,i}^M$) $= \sum_{j \geq i} N_j^M$	(29)	Sum 1 ($S_{1,i}^L$) $= \sum_{j \geq i} N_j^L$	(34)
Sum 2 ($S_{2,i}^M$) $= S_{2,i+1}^M + (R_{i+1}^M - R_i^M)\ S_{1,i+1}^M$	(30)	Sum 2 ($S_{2,1}^L$) $= S_{2,i+1}^L + (R_{i+1}^L - R_i^L)\ S_{1,i+1}^L$	(35)
Adjusted Ratio (r_i^M) $= R_i^M\ S_{1,0}^M/S_{2,0}^M$	(31)	Adjusted Ratio (r_i^L) $= R_i^L\ (1-k)\ S_{1,0}^L/S_{2,0}^L$	(36)
Charge (ϕ_i^M) $= S_{2,i}^M/S_{2,0}^M$	(32)	Charge (ϕ_i^L) $= k + (1 - \mathrm{k})\ S_{2,i}^L/S_{2,0}^L$	(37)

Notes: These formulas correspond to the tabulation shown in Exhibit 2 and Exhibit 3. The index *i* descends in magnitude, going from top to bottom on the tabulations.

Explanation of the Tabulation

Here is an intuitive explanation of why the charge produced by the Table L tabulation is an estimate of the Table L charge as defined by equation (2). The first six columns are the beginning of a Table M calculation based on limited loss. The Table L adjustment factor would be $S_{1,0}^L/S_{2,0}^L$ if one wanted the Table L entry ratio to be a ratio of expected limited losses. Since it is desired that the Table L entry ratio be a ratio to expected unlimited losses, an adjustment factor of $(1 - k)\ S_{1,0}^L/S_{2,0}^L$ is used instead. (Recall $1 - k =$ expected limited losses $\div$ expected unlimited losses.)

The term $S_{2,i}^L/S_{2,0}^L$ would be an appropriate charge for only the limited losses, with this charge represented as a ratio to the expected limited loss. The expression $(1 - k)\ S_{2,i}^L/S_{2,0}^L$ is the charge for limited losses, with the charge now represented as a ratio to expected unlimited losses. Finally, adding k to the $(1 - k)\ S_{2,i}^L/S_{2,0}^L$ includes in the charge a provision for the per accident limitation, also expressed as a ratio to the expected unlimited loss.

Here is a formal explanation of why the charge produced by the Table L tabulation is an estimate of the Table L charge as defined by equation (2). The entries in the tabulation are indexed by i, where i goes up the table from the zero entry. $R^L_{i+1} > R^L_i$ and $R^L_0 = 0$. P^L_i is the amount of standard premium for the risks with Ratio R^L_i. A^L_i is the limited loss for these risks. $\hat{E}^L_i$ the estimated expected unlimited losses for these risks, is taken as $.635P^L_i$, under the assumption that the expected loss is the same for all risks in the premium size group. Other columns are as defined. From the recursive definition of $S^L_{2,i}$ it can be shown by downward induction that

$$S^L_{2,i} = \sum_{j \geq i+1} (R^L_j - R^L_i)\ N^L_j. \tag{38}$$

It is assumed that the mean of the limited loss ratios over a premium size group equals the expected value of the limited loss ratio for any risk in the group, where all these ratios are to the estimated expected loss. That is,

$$\sum_{j \geq 0} (A^L_j/\hat{E}^L_j)\, N^L_j \Big/ \sum_{i \geq 0} N^L_j = E\{A^*\}/\hat{E}. \tag{39}$$

An analagous assumption was made for unlimited losses in the construction of the 1965 Table M. From equation (38) and the fact that $A^L_j/\hat{E}^L_j$ equals R^L_j, it follows that the left-hand side of equation (39) equals $S^L_{2,0}/S^L_{1,0}$.

It is also assumed that the actual loss elimination ratio for all premium size groups combined equals the expected loss elimination ratio for a risk in the group, k. That is, for any risk,

$$k = 1 - \left[\left(\sum_{\substack{\text{all premium}\\ \text{size groups}}} \sum_{i \geq 0} A^L_i\right) \div \left(\sum_{\substack{\text{all premium}\\ \text{size groups}}} \sum_{i \geq 0} A^M_i\right)\right]. \tag{40}$$

This assumption is supported by Exhibit 4, which shows that the percentage of losses eliminated by per accident limitation does not vary by premium size in any meaningful manner.

From equation (39) an expression for the estimated expected unlimited loss of a risk can be obtained by substituting from equations (1), (34), (33) and (38):

$$E = (1-k)E\, S^L_{1,0}/S^L_{2,0} \tag{41}$$

Letting E_i^L denote the expected unlimited loss for the risks in row i, it follows that

$$\hat{E}_i^L/E_i^L = (1-k)S_{1,0}^L/S_{2,0}^L. \tag{42}$$

It is desired that r_i^L be the ratio of actual limited loss to expected unlimited loss. Then

$$\begin{aligned} r_i^L &= A_i^L/E_i^L \\ &= \frac{A_i^L}{\hat{E}_i^L} \times \frac{\hat{E}_i^L}{E_i^L} \\ &= R_i^L(1-k)/S^L_{1,0}S^L_{2,0} \end{aligned}$$

Thus equation (36) is justified.

In order to justify equation (37), the definition of the Table L charge, equation (2), is applied to a particular entry ratio r_i^L.

$$\phi^*(r_i^L) = k + \int_{r_i^L}^{\infty} (s - r^L)dF^*(s).$$

From the two prior assumptions and from the assumption that the actual distribution of limited loss ratios is the same as the theoretical distribution of limited loss ratios, it follows that

$$\begin{aligned} \phi^*(r_i^L) &= k + \sum_{j \geq i+1} (r_j^L - r_i^L) \text{ Prob } \{A^*/E = r_j^L\} \\ &= k + \sum_{j \geq i+1} (r_j^L - r_i^L) \; N_j^L/S_{1,0}^L \\ &= k + (1-k) \sum_{j \geq i+1} R_j^L - R_i^L) \; N_j^L/S_{2,0}^L \\ &= k + (1-k) \; S_{2,1}^L / S_{2,0} = \phi_i^L. \end{aligned}$$

This justifies equation (37).

4. NUMERICAL PROPERTIES OF TABLE L

The Table L charge is a function of entry ratio and premium size. The asymptotic properties of this charge are important for extrapolating it to those risks of premium size above the average of the largest size group or below the average of the smallest size group. These properties can be inferred from the properties of the Table M charge and of the incremental charge, described by Dorweiler.[6]

For a given premium size, the Table L charge approaches the loss elimination ratio as the entry ratio goes to infinity. The asymptotic behavior of the charge for a fixed entry ratio depends upon whether the entry ratio is smaller or larger than the complement of the loss elimination ratio. For a fixed entry ratio r, as the premium size approaches infinity, the charge approaches

$$\begin{cases} k, & \text{if } r \geq 1 - k \\ 1 - r, & \text{if } r < 1 - k. \end{cases}$$

For a fixed premium size, the charge approaches unity as the entry ratio approaches zero. For a fixed entry ratio, the charge also approaches unity as the premium size approaches zero.

Exhibit 6 is a graph of California Table L charges for a per accident limit of $25,000. It can be seen that the charge is a monotone decreasing, concave function of the entry ratio and a monotone decreasing function of premium size.

Exhibit 5 lists comparative insurance charges from the 1974 California Tables L and M and the 1965 and 1972 countrywide Table M's of the National Council. California charges from each size group were applied only to the average premium size for the group. Charges for other premium sizes were interpolated from these average values.

The charges in the 1974 California Table M are much higher than the charges in either National Council Table M. The higher California charges reflect a higher variation in loss ratio for risks of a given premium size, which may be the result of higher benefits. The differences between the California Table L and Table M charges are much smaller than the loss elimination ratios shown in Exhibit 4, due to the overlap, discussed in §2. It is apparent that the use of an incremental charge that does not vary by premium size results in the overcharging of small risks and the undercharging of very large risks.

In some instances the California Table M charge is a little higher than the corresponding California Table L charge. The cause of this

[6] P. Dorweiler, op. cit., p. 133 ff.

slight incompatibility is that each table was compiled on an individualized basis. In the construction of Table M an estimated expected loss ratio of .635 was initially used, but each premium size group had its figures adjusted to reflect the actual unlimited loss ratio of the group. This is the procedure used by Simon.[7] Similarly, each premium size group of each Table L had its figures adjusted to reflect the actual limited loss ratio of the group and the loss elimination ratio for all size groups combined. This was regarded as the most accurate method for constructing Table L, although the anomaly suggests that a more accurate Table M could be constructed if a special adjustment were made to correct for any irregularity in the distribution of large losses from one size group to another.

If each size group had been allowed to determine its own loss elimination ratio by using the formula $1 - S^L_{2,0}/S^M_{2,0}$, then formula (36) would have been replaced by

$$r^L_i = R^L_i \, S^L_{1,0}/S^M_{2,0} \tag{44}$$

and formula (37) would have been replaced by

$$\phi^L_i = 1 - (S^L_{2,0}/S^M_{2,0}) + (S^L_{2,0}/S^M_{2,0}). \tag{45}$$

Table L's for various per accident limits produced using these formulas would be consistent with each other and with the Table M actually produced.

5. CONCLUSION

From a mathematical point of view, Table L represents an advance over Table M. Every important Table M formula has an appropriate Table L generalization. The Table L versions are stronger than the Table M versions, since Table M is a special case of Table L.

From a practical point of view a Table L should produce more accurate rating values than a Table M. An incremental charge that does not vary by entry ratio and risk size does not take into account variation in the overlap between per accident limitation and overall loss amount limitation. Table L takes this variation into account. A retrospective rating plan constructed from Table L automatically includes the effect of the incremental savings. A Table L can be adapted to a retrospective plan that requires special adjustments of individual cases. Table L is no more difficult to con-

[7] L. J. Simon, op. cit., p. 4.

struct than Table M, if the data base includes individual large losses. Retrospective rating plan values can be found as easily from a Table L as from a Table M, using equations (20) and (21). The use of a Table L also helps by making excess loss premium factors unnecessary. It follows that Table L is preferable to Table M for any retrospective rating plan with a fixed per accident limit.

Even for a plan with a choice of per accident limits, it may be desirable to develop a set of Table L's corresponding to the various per accident limits in order to obtain more accurate insurance charges. Formulas (44) and (45) can be used to construct a consistent set of Tables. Such a set of Table L's would provide insurance charges that fully reflect the effect of premium size, entry ratio and per accident limit.

Acknowledgements

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APPENDIX

Table of Symbols

A = The actual unlimited losses

A* = the actual limited losses

$E\{\cdot\}$ is the expectation operator

E $= E\{A\}$

F = the cumulative distribution function of A/E

F* = the cumulative distribution function of A*/E

k = the loss elimination ratio

$\phi^*(r)$ = the Table L charge

$\psi^*(r)$ = the Table L savings

R = the retrospective premium

B = the basic premium ratio

P = the standard premium (before expense gradation)

C = the loss conversion factor

G = the maximum premium

H = the minimum premium

L_G = the actual limited losses that will produce the maximum premium

r_G = L_G/expected loss

L_H = the actual limited losses that will produce the minimum premium

r_H = L_H/expected loss

L = the losses which will produce the retrospective premium

I* = the net Table L insurance charge

D = the expense gradation, expressed as a ratio to P

$\phi(r)$ = the Table M charge

$\psi(r)$ = the Table M savings

$\Delta\phi(r)$ = the increment on the Table M charge due to superimposing a per accident limit

A superscript ^{M} and subscript $_i$ refer to the ith row of the Table M tabulation, for a particular size group.

P_i^M = the standard premium

A_i^M = the actual unlimited losses

E_i^M = the estimated unlimited losses

E_i^M = the expected unlimited losses

N_i^M = the number of risks

$S_{1,i}^M$ = Sum 1

$S^M_{2,i}$ = Sum 2

r^M_i = the adjusted ratio

ϕ^M_i = the Table M charge

A superscript ^{L} and subscript $_i$ refer to the ith row of the Table L tabulation, for a particular size group.

P^L_i = the standard premium

A^L_i = the actual limited losses

E^L_i = the estimated unlimited loss

E^L_i = the expected unlimited loss

N^L_i = the number of risks

$S^L_{1,i}$ = Sum 1

$S^L_{2,i}$ = Sum 2

ϕ^L_i = the Table L charge

Exhibit I

FACTORS USED TO DEVELOP POLICY YEAR 1969 PREMIUM AND LOSSES TO 4/1/74 RATE AND BENEFIT LEVEL

A. Policies effective 1/1/69-9/30/69

Premium:	1.312*	
Losses:	Indemnity	
	Death	2.086
	Perm. Total	2.016
	Major	1.411
	Minor	1.169
	Temporary	1.434
	Medical	1.063

B. Policies effective 10/1/69-12/31/69

Premium:	1.341*	
Losses:	Indemnity	
	Death	2.086
	Perm. Total	2.016
	Major	1.411
	Minor	1.169
	Temporary	1.434
	Medical	1.043

C. The factor to be applied to the adjusted premium to derive the adjusted expected losses is .635.

*These factors reflect only the changes due to experience and benefit levels.

Exhibit 2

TABLE M TABULATION

Per Accident Limit None
Premium Group $50,000-$74,999

P^M Standard Premium	A^M Unlimited Losses	R^M Ratio A^M /.635 P^M	N^M No. of Risks	S_1^M Sum 1	S_2^M Sum 2	r^M Adjusted Ratio	ϕ^M Table M Charge
52560	613844	18.39	1	1	.00	19.69	.0000
67149	359698	8.44	1	2	9.95	9.04	.0122
55952	252361	7.10	1	3	12.63	7.60	.0155
66066	284590	6.78	1	4	13.59	7.26	.0167
54224	233166	6.77	1	5	13.63	7.25	.0168
62008	257002	6.53	1	6	14.83	6.99	.0182
52908	212986	6.34	1	7	15.97	6.79	.0196
64705	218974	5.33	1	8	23.04	5.71	.0283
60916	199527	5.16	1	9	24.40	5.52	.0300
54882	169679	4.87	1	10	27.01	5.21	.0332
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
129538	83761	1.02	2	297	248.26	1.09	.3052
337975	216228	1.01	6	303	251.23	1.08	.3088
61387	39021	1.00	1	304	254.26	1.07	.3126
257966	161917	.99	4	308	257.30	1.06	.3163
60512	37487	.98	1	309	260.38	1.05	.3201
474696	292505	.97	8	317	263.47	1.04	.3239
125436	76567	.96	2	319	266.64	1.03	.3278
269485	162348	.95	4	323	269.83	1.02	.3317
182042	108794	.94	3	326	273.06	1.01	.3357
115205	67993	.93	2	328	276.32	1.00	.3397
170616	99546	.92	3	331	279.60	.99	.3437
170812	98793	.91	3	334	282.91	.97	.3478
169417	97123	.90	3	337	286.25	.96	.3519
242806	137449	.89	4	341	289.62	.95	.3560
170335	95167	.88	3	344	293.03	.94	.3602
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
427583	24645	.09	7	834	736.71	.10	.9056
241566	12210	.08	4	838	745.05	.09	.9159
118387	5524	.07	2	840	753.43	.07	.9262
354826	13465	.06	6	846	761.83	.06	.9365
517000	16238	.05	9	855	770.29	.05	.9469
251374	6484	.04	4	859	778.84	.04	.9574
421285	8971	.03	7	866	787.43	.03	.9680
186661	2124	.02	3	869	796.09	.02	.9786
69061	253	.01	1	870	804.78	.01	.9893
73929		.00	1	871	813.48	.00	1.0000
53246049	31504086		871				

Exhibit 3

TABLE L TABULATION

Per Accident Limit $25,000
Premium Group $50,000-$74,999

P^L Standard Premium	A^L Limited Losses	R^L Ratio $A^L/.635 P^L$	N^L No. of Risks	S_1^L Sum 1	S_2^L Sum 2	r^L Adjusted Ratio	ϕ^L Table L Charge
64705	155790	3.79	1	1	.00	4.13	.1244
72430	154658	3.36	1	2	.43	3.66	.1249
119890	233142	3.06	2	4	1.03	3.33	.1257
54882	103120	2.96	1	5	1.43	3.22	.1262
124015	214953	2.73	2	7	2.58	2.97	.1276
52908	90696	2.70	1	8	2.79	2.94	.1279
53381	90782	2.68	1	9	2.95	2.92	.1281
71059	119030	2.64	1	10	3.31	2.88	.1285
54071	90284	2.63	1	11	3.41	2.87	.1287
62370	102733	2.59	1	12	3.85	2.82	.1292
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
135956	88016	1.02	2	268	137.21	1.11	.2960
538802	345005	1.01	9	277	139.89	1.10	.2994
132415	84256	1.00	2	279	142.66	1.09	.3028
500604	314540	.99	8	287	145.45	1.08	.3063
60512	37487	.98	1	288	148.32	1.07	.3099
412211	254086	.97	7	295	151.20	1.06	.3135
249776	152440	.96	4	299	154.15	1.05	.3172
269485	162348	.95	4	303	157.14	1.03	.3209
294239	175722	.94	5	308	160.17	1.02	.3247
246740	145880	.93	4	312	163.25	1.01	.3286
359509	210121	.92	6	318	166.37	1.00	.3325
472991	273365	.91	8	326	169.55	.99	.3365
273313	156216	.90	5	331	172.81	.98	.3405
242806	137449	.89	4	335	176.12	.97	.3447
224497	125549	.88	4	339	179.47	.96	.3489
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
427583	24645	.09	7	834	623.27	.10	.9040
241566	12210	.08	4	838	631.61	.09	.9144
118387	5524	.07	2	840	639.99	.08	.9249
354826	13465	.06	6	846	648.39	.07	.9354
517000	16238	.05	9	855	656.85	.05	.9460
251374	6484	.04	4	859	665.40	.04	.9567
421285	8971	.03	7	866	673.99	.03	.9674
186661	2124	.02	3	869	682.65	.02	.9782
69061	253	.01	1	870	691.34	.01	.9891
73929		.00	1	871	700.04	.00	1.0000
53246049	27161165		871				

Exhibit 4

PERCENTAGE OF LOSSES ELIMINATED BY PER ACCIDENT LIMITATION

Premium Group	No. of Risks	Standard Premium	Unlimited Losses	Percentage of Losses Eliminated by Per Accident Limitation					
				$25,000	$30,000	$35,000	$50,000	$75,000	$100,000
1,312- 1,499	6,662	9,358,863	4,952,782	14.72%	11.28%	8.65%	5.16%	2.77%	1.13%
1,500- 2,499	21,605	41,765,968	21,601,634	11.62	8.95	6.98	4.80	3.73	3.05
2,500- 4,999	20,081	70,432,208	36,033,170	11.07	8.49	6.58	4.49	3.28	2.55
5,000- 7,499	7,919	48,346,275	26,378,640	11.33	8.21	5.93	3.31	1.94	1.23
7,500- 9,999	4,301	37,181,359	20,712,830	10.61	7.57	5.36	2.99	1.78	.93
10,000-14,999	4,412	53,755,635	27,899,522	10.00	7.22	5.21	3.11	2.24	1.77
15,000-24,999	3,704	70,901,480	40,345,585	13.79	11.15	9.21	6.87	5.36	4.33
25,000-49,999	2,627	91,073,043	54,578,452	14.00	11.27	9.30	6.69	4.86	3.68
50,000-74,999	871	53,246,049	31,504,086	13.79	10.87	8.77	6.07	4.65	3.80
75,000-99,999	421	36,319,106	20,427,558	11.31	8.50	6.49	3.94	2.78	2.26
100,000 & over	969	247,044,882	157,077,074	12.65	9.75	7.69	4.94	3.23	2.38
Total	73,572	759,424,868	441,511,333	12.44%	9.61%	7.56%	5.02%	3.52%	2.67%

Note: Limitation of losses includes use of average death indemnity value of $37,400.

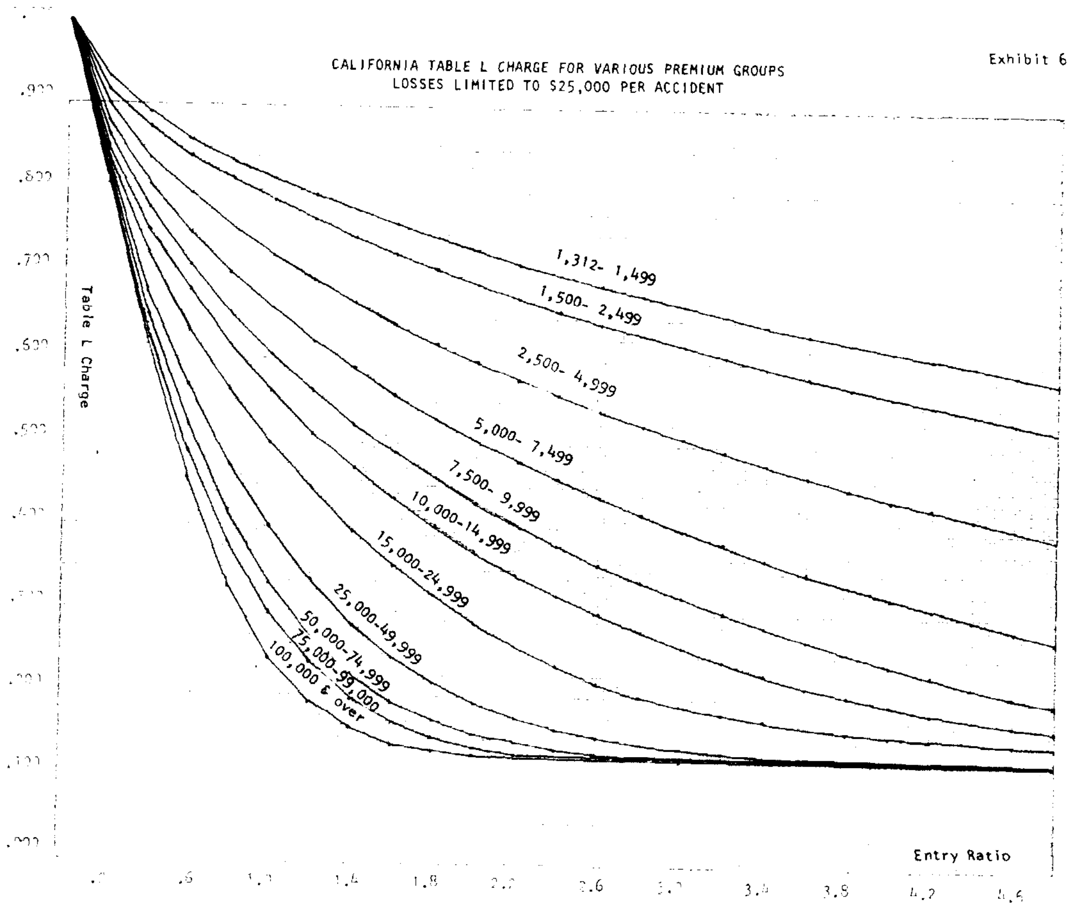
Exhibit 5

COMPARATIVE INSURANCE CHARGES FOR SELECTED PREMIUM SIZES

Standard Premium	Entry Ratio	1965 Countrywide Table M	1972 Countrywide Table M	1974 California Table M	1974 California Table L Per Accident Limit of: $25,000	$30,000	$35,000	$50,000	$75,000	$100,000
2,500	1.85	.519		.669	.672	.671	.671	.670	.670	.669
5,000	1.70	.393	.420	.578	.581	.581	.580	.580	.580	.580
7,000	1.64	.351	.376	.525	.528	.529	.528	.529	.528	.528
10,000	1.57	.302	.338	.468	.473	.474	.474	.474	.471	.471
15,000	1.50	.249	.281	.420	.421	.421	.420	.420	.419	.418
25,000	1.43	.212	.221	.355	.347	.347	.346	.346	.348	.347
35,000	1.37	.194	.204	.297	.292	.290	.289	.290	.290	.293
50,000	1.32	.174	.195	.268	.268	.263	.261	.258	.260	.260
67,500	1.27	.164	.186	.234	.243	.236	.231	.230	.229	.229
80,000	1.25	.157	.180	.211	.233	.224	.217	.213	.213	.213
254,948	1.08	.126	.136	.187	.219	.207	.199	.191	.190	.188

Note: The tabulated California Table M and Table L charges were applied at the average risk *premium size in the premium group*; charges for other premium sizes were derived from these values by linear interpolation.

Exhibit 6


CALIFORNIA TABLE L CHARGE FOR VARIOUS PREMIUM GROUPS
LOSSES LIMITED TO $25,000 PER ACCIDENT
Table L Charge
Entry Ratio
1,312- 1,499
1,500- 2,499
2,500- 4,999
5,000- 7,499
7,500- 9,999
10,000-14,999
15,000-24,999
25,000-49,999
50,000-74,999
75,000-99,000
100,000 & over
.6
1.4
1.8
2.6
3.8
4.6

NONPROPORTIONAL REINSURANCE AND THE INDEX CLAUSE

RONALD E. FERGUSON

Not since the Depression of the '30s has the country been so concerned about the state of the economy and, in particular, inflation. Everyone recognizes inflation to be the cruelest tax of all—a phenomenon that in its most virulent form can tear asunder the fabric of society. We are confronted with double digit inflation and double digit prime rates. In the words of President Ford, "Inflation is domestic enemy number one."

THE DIAGNOSIS

It is difficult to make a diagnosis of the problem; even the economists cannot seem to agree among themselves. Some would say the cause is deficit spending; some, in light of recent supply shortages and crop failures, hold to a cost-push theory; while still others blame wage-pull or demand-pull forces. Monetarists contend it is the supply of money and credit, while the "gold bugs" and "silver bugs" blame it on a currency that has no inherent value.

Of all the diagnoses offered, the one that makes the most sense to this author is that of Professor James S. Duesenberry, Chairman of the Department of Economics, Havard University.[1] He contents the etiology of this disease is complex and deeply embedded in our economic system. In the first part of his diagnosis he argues convincingly that our economy has a built-in bias toward inflation stemming from three major areas.

The first of the factors contributing to the inflation bias arises out of the need for changes in relative prices, engendered by shifts in supply and demand. Demographic changes, changes in tastes, changes in availability of raw materials and technological changes all translate into supply and demand changes and make changes in price relativities necessary. To achieve the appropriate relativities, some prices should go up while others go down. Professor Duesenberry argues, however, that in our economy for a variety of reasons these realignments are often accomplished only by price increases.

The second part of the bias problem involves linkages. It is easy to imag-

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[1] J. S. Duesenberry, "Can We Control Inflation?" a lecture presented at the University of Michigan of September 20, 1973. Printed copies were distributed by the Graduate School of Business Administration.

ine examples of wage linkages. Personnel management and union operations have, in their quest for order and equity, established a complex set of wage linkages. For example, a police chief might be paid X% more than his captain, who will in turn be paid Y% more than the lieutenants, who will in turn be paid Z% more than the sergeants and so on down the line. Sometimes the linkages are even more complicated. In New York City, for example, the salary scale for firemen is directly related to the policemen's scale, and even the sanitationmen's salaries are keyed to police salaries. Such complex linkages make it difficult or impossible to respond to a supply and/or demand change without tilting the whole system.

The third element contributing to the bias is our commitment by law (Employment Act of 1946) and by deed to the concept of a full employment economy. A full employment policy coupled with welfare economics, deficit spending, and other biases mentioned above make it difficult or impossible for our present economy to go through the dislocation and wrenching that is needed to arrest inflation and regain an economic equilibrium point.

The second part of the Duesenberry diagnosis is the "dynamic" part of the problem, and involves what could be called the snowballing effect of a surge in demand. The results of a demand surge might be felt in several ways. A greater demand and utilization of capacity in one area will attract labor and capital from another area resulting in a higher cost of attracting labor and capital to both the first and second areas.

In addition, surges in demand are used (especially in oligopolistic industries) to push prices up to new levels. The new level becomes the norm, and a price retreat becomes unlikely. Remember the gas crisis? Similarly, a surge in demand may give a union a better bargaining position to exploit.

The stage may then be set for an inflation psychology with inflation spawning inflation. Expectations change and everybody wants "theirs": wage earners and pricemakers become aggressive in trying to protect their interests.

The situation is further complicated and compounded by the built-in biases mentioned above. The net result is a potential for mild recessions (or worse) with inflation, a tandem that until recently would have been considered improbable or even impossible. Professor Duesenberry explains, "The problem is that once we have built up a set of wage distortions and have changed expectations, a mild relaxation of demand pressures may not be sufficient to check the inflation. We'll just find ourselves on a new plateau where we can only beat that inflation down to its former rate by some drastic sacrifice a big recession or major surgery with such instruments as price controls.[2]

Professor Duesenberry finished his lecture with the story of the executive who told his staff he wanted to learn all about economics. He didn't have time to read the several books they suggested, they then suggested one, but he didn't even have time for that. Finally the staff boiled the one book down to 50 pages, then 30, then finally down to a single sentence—a summary of the whole science of economics "There is no such thing as a free lunch."

THE PROGNOSIS

As for the prognosis, no one seems to have the answer and the problem continues to fester. In July 1974, the seasonally adjusted wholesale price index rose 3.7% over June, a staggering annual rate compounded monthly of 54.6%! As we approach "banana republic" inflation rates, everyone from the man on the street to the ivory tower economist has a suggested therapy. Interestingly enough, one of the "solutions" is directly related to the subject of this paper.

In an article in *The New York Times* on April 3, 1974, Milton Friedman, the well-known classical economist from the University of Chicago, was quoted as suggesting escalator clauses might be the answer. Wages, interest rates, income tax, and accounting practices would all be adjusted to reflect the impact of rising prices. Few observers, however, agree that such an institutionalization of inflation would solve our inflation problem. In the *Wall Street Journal,* Walter Heller referred to Friedman's proposal as "economic streaking." Although it is generally conceded that such a scheme did help bring inflation under control in Brazil, it is argued that social and economic conditions were different enough in that country so as to make the experiment non-transferrable to other economies. In any case, Friedman's idea does not address the root cause of the problem, it is rather an accommodation to it, and it is likely the proposal will never gain much currency in this country. It is, however, an idea to which we will return as a possible solution to the inflation problems faced by one segment of the insurance industry.

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[2] J. S. Duesenberry, op. cit.

THE PECULIAR PROBLEM OF THE EXCESS WRITER

Severe inflation is not a new problem for the liability insurance ratemaker. He was looking at double-digit inflation well before it became "fashionable." A recent Insurance Services Office (ISO) report indicated total limits general liability claims inflation was running between 13% and 23% per annum depending on the subline.[3] Auto claims inflation rates were over 8% per annum as early as the mid '60s when the Consumer Price Index (CPI) was going up at what now looks like a comfortable 2% to 3% annual rate. It seems that the collection of goods and services and loss of income that underlie an insurance claim have traditionally gone up faster than the overall market basket. Insurance, unlike other sectors, has suffered from a double arrelled inflation effect. The ordinary economic inflation discussed above and what might be called social inflation. By social inflation is meant the various non-economic forces that have increased claim costs including lenient or compassionate (depending on your point of view) juries, increased claim propensities and erosion of the negligence concept.

To the credit of the industry these problems have been perceived and the industry has reacted on two fronts. Many carriers marshall a whole panoply of cost reducing efforts: experiments in early settlements, engineering services, rehabilition services and other risk management services. The second front is defensive rather than offensive and involves ratemaking endeavors. By and large it is safe to say that actuaries attempt to price the product to reflect the cost levels expected to ultimately obtain (giving full recognition to inflation). While it may be true (indeed must be true over the long run) that the primary ratemaker responds to total limits inflation, the carrier in an excess position must take extra precautions.

The problem the excess writer faces is the leveraged effect of inflation. If losses are insured over a fixed retention, say $50,000, all losses that exceeded the retention before inflation will, with inflation, treat the excess writer to a double dose of inflation. The excess writer will experience an increased cost on its part of the claim and also will bear the inflation on the retention, for on this type of loss, all the inflation is passed on to the excess area. The excess carrier experiences yet a more insidious inflation effect. Some losses that would not have pierced the retention without inflation now will, because of

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[3] Report to the ISO Commercial Casualty Actuarial Subcommittee, August 2, 1974.

inflation, become excess losses. For example, with 10% inflation the $48,000 claim which formerly produced no excess loss, would now generate a $2,800 excess loss. Inflation increases the severity of losses that already exceeded the retention and increases the frequency of claims by actually creating new excess losses.

J. T. Lange demonstrated the problem in an interesting way. If a line (he used a least squares line) is fitted to both basic limits and total limits data (same population) the effect on the excess area can be estimated as follows:[4]

TABLE I

	Average Claim Cost	Average Annual Change in Claim Cost From Fitted Line
Total Limits	$1,100	$100
Basic Limits	1,000	80
Difference	$ 100	$ 20
Total Limits Trend	$\frac{100}{1,100} = 9\%$	
Basic Limits Trend	$\frac{80}{1,000} = 8\%$	
Increased Limits Trend	$\frac{20}{100} = 20\%$	

Mr. Lange said of this demonstration, "While this approach is not perfect, it can be easily applied to readily available data, is relatively simple to explain, and does demonstrate the magnitude of the problem." It should be noted that this approximating technique is currently used by ISO for increased limits ratemaking for some lines.

[4] J. T. Lange, "The Interpretation of Liability Increased Limits Statistics," *PCAS*, LVI (1969), p. 170.

The leveraged effect of inflation does vary greatly by retention. This phenomenon was studied by Mr. L. H. Roberts, who prepared a lengthy technical report, although a summary did appear in the trade press. Mr. Roberts started with actual loss distributions to which he fitted a sequence of connected second and third degree polynomials and used a Pareto type curve for the last (top) group. Various inflation rates were assumed and run against the loss model. A sample of the results is set forth below:

TABLE II

OVERALL INFLATION RATE 8.6% PER ANNUM[5]

(1) Retention	(2) Effect on Losses (limited to retention)	(3) Effect on Excess Losses
$10,000	7.27%	17.95%
15,000	7.67	18.94
20,000	7.83	21.21
25,000	7.97	23.02
50,000	8.35	29.59

As the retention increases, Column (2) will approach 8.6% and Column (3) will increase without bound.

It may be that the excess writer faces yet another peril arising out of inflation. It is commonly believed, or at least assumed, that inflation is uniform and does not vary by size of claim. Whether small claims inflate at an annual rate that differs from that affecting large claims has not been explored and remains a matter of conjecture. It is likely, however, that large claims would inflate at a higher rate due to their mix of indemnity and medical/rehabilitation. Large claims may have a higher proportion of medical/rehabilitation costs and thus be more sensitive to inflation.

The leveraged effect of inflation is without a doubt one of the most serious problems faced by any carrier writing longtail business over fixed retentions or significant deductibles.

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[5] L. H. Roberts, *Best's Review* Property/Liability Edition, "The Impact of Inflation on Reinsurance Costs," March, 1973, p. 16.

THE SOLUTION

There are a number of possible solutions to the leveraged inflation problems of the excess writer:

1. If excess prices are to be a function of increased limits tables, the ratemaking underlying the tables must properly take into account the leveraged effect of inflation.

2. It is not difficult to devise a loss rating scheme where the projected claims inflation can be fully taken into account. (See for example, formula 2 in Appendix II). It is however, in these uncertain economic times questionable whether inflation can be predicted with sufficient accuracy to make such schemes work.

3. Experience rating schemes (either adjustable commission or premium arrangements) may have enough latitude to absorb the increased costs resulting from inflation.

4. Coverage does not have to attach on the traditional losses occurring basis. There has been talk recently of "claims made" coverage—it would be theoretically possible, although perhaps not too practical, to have coverage attach on a "claims settled" basis.

Done properly, each of these approaches could be aceptable, but it does mean that increased limits tables and rates developed from a loss rating approach would have to be revised at least annually.

The great and relentless pressure on excess rates can be seen in the following example. For purposes of this example, a loss distribution was invented (losses below $30,000 are not shown since they are not germane to the point) and the following assumptions employed:

1. Losses take four years to settle

2. There is no loss development other than that caused by inflation

3. Gross losses inflate by 10% per annum

4. The initial total limits (or subject) premium is $10,000,000

TABLE III

Number of Losses	1974 Initial Gross Losses $29,999 and Over	1974 Accidents Settled At 1978 Values	1975 Accidents Settled At 1979 Values	1976 Accidents Settled At 1980 Values
10	$ 30,000	$ 43,923	$ 48,315	$ 53,147
5	40,000	58,564	64,420	70,862
3	50,000	73,205	80,526	88,578
2	60,000	87,846	96,631	106,294
1	80,000	117,128	128,841	141,725
1	100,000	146,410	161,051	177,156
Losses Excess of $50,000	$100,000	$351,665	$446,832	$582,983

	Total Limits Premium	Excess Rate Before Expense And Profit		
1974	$10,000,000	3.52%		
1975	11,000,000		4.06%	
1976	12,100,000			4.82%

Even if rated properly and nothing else changes (the legal climate, underwriting, accident frequencies and product mix are all stable, and the primary carrier properly reflects inflation in his total limits ratemaking), the excess rate cannot hold up under the attack of inflation. The excess carrier must, even if the exposure was properly priced in the first year, constantly reassess his pricing and seek rate increases every year. In this example, the subject premium and the excess premium increased 10% each year, but in addition, the excess writer needs a 15% increase for the second year and a 19% increase for the third year. If inflation can be predicted with reasonable accuracy, and if both the ceding company and the primary carrier understand the forces eroding the adequacy of the excess rate, there is no reason why the excess coverage cannot be written over a fixed retention. Both parties would simply have to become accustomed to the need for frequent rate increases.

INDEX CLAUSE

There is a way to achieve stability in the excess rate, even in the face of inflation. The only way stability can be achieved is for the ceding company and the excess carrier to share the effects of inflation. This can be accomplished by adjusting the retention over time in phase with changing economic conditions.

The part of the contract that spells out the terms of the adjustable retention is usually called the "Index Clause," although it is sometimes referred to as a "Stability Clause." The contractual language is neither long nor complicated. It may state that it is the intent of the parties that the company's retention and the excess carrier's limit of liability retain their relative monetary value (by means of the index clause). It could be, and often is, stated in a different way, but, of course, the end result is the same. Another example it is intended to equitably share the effect of inflation or deflation between the ceding and assuming carrier (by means of the index clause). Yes, the index clause is a two-edged sword, but, for the reasons mentioned in the first section, the deflation edge is probably only of academic interest.

Operation

The contract will then go on to explain the mechanics or operation of the clause. Exhibit I of Appendix I is a complete index clause agreement. In this agreement, the mechanics of the indexation are described in a general way. Examples of the operation of the index are, however, included to illustrate the intent. Exhibit II of Appendix I is a contract used in the London market and actually spells out the mechanics in considerable detail.

In the case of a single claim (payment) the operation is very simple: the retention is merely adjusted in direct proportion to the change in the selected index between the time coverage was priced (i.e., inception of a reinsurance treaty) and the date of claim settlement. If, for example, the index went up 20% (say from 100 to 120 or from 150 to 180), the retention would be increased by 20%.

For example, suppose a retention of $50,000 was selected and priced when a certain type of gross claim was expected to cost $65,000. If such a claim occurred and was settled not for $65,000 but $78,000 by reason of inflation, the excess carrier without an index clause would have a claim severity 87% greater than expected, while the ceding carrier's loss would have stopped at $50,000 for a 0% effect. With the index clause, the retention would go to $60,000 (50,000 x 1.20) and both carriers would have experienced a 20% claims inflation. In other words, the two carriers would have ratably shared the effects of inflation.

Returning to the rating problem and assumptions discussed earlier (Table III) with a $50,000 retention, it was demonstrated that:

TABLE IV

	Losses Excess of $50,000	Excess Rate Before Expenses
No Inflation	$100,000	1.00%
10% Per Annum Inflation		
1974 Accidents (settled 1978)	$351,665	3.52%
1975 Accidents (settled 1979)	$446,832	4.06%
1976 Accidents (settled 1980)	$582,983	4.82%

Assuming the index selected went up 10% per annum (just as the losses), the retention with respect to cases settled in 1978 would be $73,205, $80,526 in 1979, and $88,578 in 1980. Under these circumstances, the expected excess loss cost and rate would be:

TABLE V

	Excess of Indexed Rentention	Excess Rate Before Expenses
1974 Accident Year	$146,410	1.46%
1975 Accident Year	161,050	1.46
1976 Accident Year	177,157	1.46

Thus, it can be seen that, other things being equal, the index clause can create a stable excess rate by sharing inflation between the two carriers. Both carriers under the index clause are liable for the same percentage of the total limits losses they would have had without inflation. In other words, the retention and limit have been adjusted so as to maintain relative monetary values consistent with those that obtained when the business was originally underwritten and priced.

If more than one claim is subject to the same retention, the intent and concept remain the same although the execution is more complicated. As an example, consider the case of some excess business underwritten in 1974 with a retention of $50,000 and with claims inflation and the selected index increasing at 10% per annum. Suppose an automobile accident occurred resulting in three claims settled as follows:

TABLE VI

	Settled	**Amount**	**Index (1974 = 1.00)**
Claimant A	1975	$ 10,000	1.10
Claimant B	1976	15,000	1.21
Claimant C	1980	150,000	1.77
Total		$175,000	

To determine the properly indexed retention involves a two-dimensional weighting of the retention adjustment – for time and money. The easiest way to accomplish this is to deflate all values to "time O" or the inception of the contract and determine the relationships between retention and the deflated settlements. In other words, how would the total loss have been allocated absent inflation? These relationships are then used to allocate the actual settled values.

TABLE VII

	Actual Value	Deflated Value
Claim A	$ 10,000	$ 10,000 ÷ 1.10 = $ 9,091
Claim B	15,000	15,000 ÷ 1.21 = 12,397
Claim C	150,000	150,000 ÷ 1.77 = 84,746
	$175,000	$106,234

Original retention as a percent of deflated losses 50,000/106,234= .4707

Excess recovery (deflated basis) 56,234/106,234=.5293

Thus, the $175,000 should be allocated as follows:

$$\text{Retention} = \$50{,}000 \times \frac{175{,}000}{106{,}234} = \$175{,}000 \times \frac{50{,}000}{106{,}234} = \$175{,}000 \times .4707 = \$82{,}372$$

$$\text{Recovery} = \$56{,}234 \times \frac{175{,}000}{106{,}234} = \$175{,}000 \times \frac{56{,}234}{106{,}234} = \$175{,}000 \times .5293 = \$92{,}628$$

A single claim with multiple payments presents similar problems and would usually be treated the same as a multiple claim incident (above). Strictly speaking, there should be a distinction made between a partial payment that represents a partial settlement as opposed to one that is merely an advance payment. In the former case, that part of the claim is closed and can be indexed at the time of payment. The advance payment, on the other hand, has little or no effect (an arguable point) on the inflation forces operating on the claim as a whole and is indexed at the settlement date. In other words, all advance payments are collected and the actual final payment, treated as one final payment.

Obviously, multiple claims or multiple payment situations can get quite complex from an index clause point of view. One immediate problem is that it is not possible to make a final apportionment of the loss until all elements are known. It is, of course, possible to make provisional apportionments along the way. If the claim involves a string of payments similar to an annuity, it might be possible to commute the payments for index clause/retention computation purposes. There will, nevertheless, be complicated situations where the parties might have to develop a mutually agreeable and equitable application of the index clause.

Variations

A few interesting variations (although not widely used in the United States) on the operation of the index clause are the so-calle franchise, cut-off, and exemption. All of these serve to limit in some way the operation of the index. The first, the franchise deductible or severe inflation index, simply makes the index clause inoperative unless inflation is more than X% per year, or has accumulated to more than Y% since the contract's inception. Used properly (X and Y fairly low), this variation may have some value reducing the nuisance and expense of the index clause in times of low inflation.

The second idea, the cut-off, is simply an agreement to cap the adjustment of the retention. The contract may specify that inflation of no more than X% per annum or Y% since inception will be considered in computing the retention adjustment. The cut-off is difficult to price and tends to vitiate the whole index clause concept but may, in certain situations, (for very small ceding companies) serve a valid purpose.

A third variation is to allow for an exemption or deviation from the indexation. If it can be demonstrated that the settlement was unusual and at least in part not related to inflation, the indicated retention might be deviated, but probably not below the retention indexed to the year of occurrence.

All these innovations, and more are undoubtedly on the way, served useful purposes at first, but use has in some cases given way to abuse. One recent development is the announcement by a London broker that a facility has been arranged "whereby reinsurance can be offered to reduce loss to ceding companies due to the application of an index or stability clause in excess of loss reinsurance treaties."[6] This sort of gap coverage will perhaps appeal to some, though it lacks logic. After all, from a ruin theory, or even common sense, point of view, it would appear the retention should change (quite apart from the excess writer's problem) as the value of money changes, and it would hardly seem justifiable to insure the difference between the old or original retention and the indexed retention.

A final comment on the mechanics of index clauses involves layers. Many excess coverages and nearly all reinsurance arrangements involve more than one layer. The logical rules concerning indexation and layers appear to be:

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[6] Article appearing in June 1974 edition of *Reinsurance*, p. 72.

1. If the attachment point (i.e., retention) of the preceding layer is indexed, but the length of the layer is not indexed, it is possible to leave subsequent layers unchanged. This, of course, means the layer between the first (indexed) attachment point and the next (unindexed) point will shorten and perhaps even be eliminated eventually.
2. The first attachment point might be indexed with the length of the first layer remaining constant. In other words, the constant first layer would float over the indexed retention. In this case at least the second attachment point would have to be adjusted.
3. If the attachment point and the length of the layer below are both indexed, the attachment point of the next layer must be indexed. If it isn't indexed, there will be an overlap in coverage.

Pricing

Obviously, a contract with an index ought to carry a price that is different from a contract without an index (assuming the latter was priced properly as respects anticipated inflation). An interesting problem is then presented: How much should the unindexed rate be discounted in contemplation of the index?

One can take either an empirical or theoretical approach to determine the value of an index clause. The approaches and discounts discussed below begin with the premise that the proper rate (i.e., proper in the sense that the rate is valid for the future rating period) is now being charged. To the extent the present rate structure is deficient the discount would, of course, require modification.

The empirical approach would simply involve performing a loss rating analysis on two bases: pitching gross losses to anticipated levels by trending from the midpoint of the accident year to the midpoint of the exposure period, and in one case, using the fixed retention and in the other, adjusting the retention based on an estimated elapsed time between occurrence and settlement. The difference between the two rates is the indicated discount. The resulting number is, of course, subject to whatever shortcomings exist in the loss rating techniques and in the data itself, and it must be tempered accordingly.

The theoretical approach is handy, but it is built on a set of assumptions (it can be argued that the empirical approach is also built on a set of assumptions the principal one being that the past will be replicated with (trending) adjustments in the future). The formula derived in Appendix II is not difficult to use, once the assumptions are developed.

$$\text{Discount} \doteq 1 - \frac{1}{1 + [(1+i)^t - 1] \cdot R/\overline{X}}$$

Where i = Gross inflation rate
t = Average number of years to settle a loss
R = Retention
$\overline{X}$ = Expected average loss in excess of the indexed retention.

Assuming the data have some credibility, the empirical approach is probably the method of choice, although there is value in going through the formula approach. Developing the formula result highlights the assumptions the sensitive areas. The value of an index clause varies by retention level, inflation rate, life (longevity) of a claim, and the frequency and severity of excess losses.

Prudence would seem to militate against allowing the full indicated discount. Since the data are seldom fully credible, and since numerous assumptions must be used, and since the primary industry may not be responding fully to total limits inflation, the discounts probably should be discounted.

Reserves

An excess contract with an index clause has loss reserving ramifications for both the ceding and assuming carriers. While it is true in a narrow and technical sense that the index clause is oriented toward settlement, it would be imprudent not to take the indexed retention into account during the life of the claim. For example, suppose a primary carrier reserved all its claims on a basis geared toward settlement and both carriers set up reserves without consideration of the indexed retention. It seems clear that such a procedure would overstate the liability of the assuming carrier with a corresponding understatement of the ceding carrier's liability.

In order to reflect the proper allocation of the loss, the carriers could agree to register (book) claims on an indexed basis. Periodically there should be a reevaluation of the claim and an adjustment of the retention. Another approach would be to process individual claims without regard for the indexed retention and calculate or estimate a bulk reserve adjustment (normally negative for the assuming carrier and positive for the ceding carrier) at statement dates.

Either the indexed case or the formula approach should help to develop a more accurate reserve structure. Perhaps the most important single point is to have adequate communication between the carriers on the handling of reserves.

Economic Barometers

There are myriads of indices from which to select — none of them perfect. Ideally the index should move directly in phase with all of the forces that affect the claims inflation of the particular line of insurance. The index values must be available on a regular and timely basis. The index must have continuity and the confidence of both parties.

No single economic barometer meets all of these tests, but some come closer than others. As respects test number 1, we might be very willing to settle for an index that explains or accounts for 70% or 80% of the line's inflation.

Availability (timing) can be a problem. If the index clause wording is not carefully planned it could happen that it is time to settle a loss and the applicable index value is not yet published. A lag factor can be built into the index clause as was done in Exhibit I of Appendix I, or losses could be settled provisionally and adjusted when the index value is known — a cumbersome and expensive procedure.

There are four possible sources for the index:

1. Internal — If dealing with a very large primary company, their severity data may be credible and usable.
2. External — Private — Industrywide or nearly industrywide statistics as published by organizations such as ISO are theoretically the best source, but continuity is a problem. Companies come and go from the data base; sometimes whole states come and go!
3. Government Statistics — Dozens and dozens of indices are published by branches of the U. S. Government. The CPI is the best known, but probably least suitable. It has a narrow scope and lags behind other indicators. The Wholesale Price Index and manufacturing wage data are probably better indicators.
4. In some circumstances, it may be possible (necessary!) to synthesize an index using selected government and/or private indices. Masterson has done a considerable amount of work in this area.[7]

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[7] N. E. Masterson, "Economic Factors in Liability and Property Insurance," *PCAS*, LV (1968), p. 61.

SUMMARY

There is ample evidence to suggest that inflation, perhaps even severe inflation, will be a serious problem for the excess writer in the foreseeable future. A fixed retention excess contract with inflation, will result in a disproportionate distribution of the effects of inflation, thereby eroding the excess carrier's position.

The excess carrier's rating problem can be solved by exercising vigilance and responsive imaginative pricing schemes. If a stable excess rate is sought, the only answer is to share equitably the effects of inflation by means of an index clause or something like it.

The index clause can be a powerful and useful tool, but it is important to also understand what it cannot do. The index clause is not a panacea. If the excess position is deteriorating for reasons other than (or in addition to) inflation, the index clause is not the total answer. The index will not counterbalance changed underwriting standards, product mix changes, changing claim philosophies, and the like. The index clause does not even solve the problem of inflation; it merely solves the problem of allocating the effects of inflation.

Although not a panacea, the index clause does deal effectively with what is probably the number one problem on the nonproportional carrier. If both the primary and nonproportional writers are operating consistently and soundly, the index clause can produce a stable rate and a stable relationship.

Appendix I
Exhibit I

ENDORSEMENT NO. 2

Attached to and made a part of
AGREEMENT NO. 123

As respects losses resulting from accidents taking place on and after January 1, 1974, IT IS MUTUALLY AGREED that the amount(s) of the Company Retention, and the amount(s) of the First Excess Covers set forth in Agreement Number 123 (as amended by prior Endorsements thereto), is provisional and shall be subject to adjustment at the end of each calendar quarter in accordance with the provisions of the attached "Index Clause" and the attached EXAMPLES OF THE APPLICATION OF THE INDEX CLAUSE

IN WITNESS WHEREOF, the parties hereto have caused this Endorsement to be executed in duplicate this 1st day of January, 1974.

RELIABLE REINSURANCE COMPANY

By ____________________

A + INSURANCE COMPANY

By ____________________

INDEX CLAUSE

Attached to and made a part of
Agreement No. 123

The amount(s) of the Company Retention and the amount(s) of the First Excess Covers shall all be correspondingly adjusted as respects accident occurring on and after January 1, 1974 so as to equitably share the effect of deflation or inflation between the Company and the Reinsurer. The retention and above-mentioned cover(s) shall be adjusted based on changes in the Index of Countrywide total limits of Automobile Bodily Injury Liability average paid claim cost data for all types of Automobiles as compiled by the Insurance Services Office. Such data are compiled on a quarterly basis and the average paid claims costs for the twelve month period ending December 31, 1972 shall be deemed the index base existing at January 1, 1974.

Accordingly, the amount of the Company Retention and above mentioned limit(s) shall be decreased or increased on a quarterly basis in proportion to the variation between the Index figure for the twelve month period ending December 31, 1972 and the applicable Index figure set out in the following schedule.

January 1 thru March 31 of calendar year	12 month period ending four calendar quarters prior to previous December 31
April 1 thru June 30 of a calendar year	12 month period ending four calendar quarters prior to previous March 31
July 1 thru September 30 of a calendar year	12 month period ending four calendar quarters prior to previous June 30
October 1 thru December of a calendar year	12 month period ending four calendar quarters prior to previous September 30

EXAMPLES OF THE APPLICATION OF THE INDEX CLAUSE

Attached to and made a part of ENDORSEMENT NO. 2
AGREEMENT 123

A. Index Clause effective January 1, 1974

Twelve Months Ending	Countrywide Average BI Paid Claim Cost	Index
12/31/72	$1,880 (Estimated	1.000
12/31/73	1,975 (Estimated)	1.051
6/30/74	2,025 (Estimated)	1.077

B. Single Settlement Date First Excess Cover-$65,000 per person excess of $35,000 per person and Second Excess Cover-$900,000 per person excess of $100,000 per person.

An accident occurs on March 1, 1974 and is settled on February 1, 1975 for $200,000. Based on the information in paragraph A, the company's retention of $35,000 on January 1, 1974 is adjusted to $35,000 x 1.051 or $36,785, and the second excess attachment point of $100,000 is adjusted to $100,000 x 1.051 or $105,100. For this claim the Reinsurer would reimburse the company $163,215 ($200,000 - $36,785). The Reinsurer's payments would be allocated between the First Excess Cover ($68,315) and the Second Excess Cover ($94,900) for a total of $163,215.

C. Multiple Settlement Dates First Excess Cover $65,000 per occurrence excess of $35,000 per occurrence and Second Excess Cover $900,000 per occurrence excess of $100,000 per occurrence.

If an accident occurs on March 1, 1974 and results in settlement with two Automobile Bodily Injury claimants, the calculations would be as follows:

$200,000 paid to claimant E on February 1, 1975

$200,000 paid to claimant F on July 3, 1975

Claim E	$\frac{\$200,000}{1.051}$	=	\$190,295
Claim F	$\frac{\$200,000}{1.077}$	=	185,701
	Sub-Total		\$375,996
	Less original retention of		\$ 35,000
			\$340,996
	Less original First Excess Cover of		\$ 65,000
			\$275,996

Final Apportionment of Claims

Retention	$\frac{\$ 35,000}{375,996}$	×	\$400,000	=	\$ 37,234
First Excess Recovery	$\frac{\$ 65,000}{375,996}$	×	\$400,000	=	69,150
Second Excess Recovery	$\frac{275,996}{375,996}$	×	\$400,000	=	293,616
			Total Claims		\$400,000

Appendix I
Exhibit II

INDEX CLAUSE

1. It is the intention of this Agreement that the retention of the Company and Reinsurer's maximum limit of liability shall retain their relative monetary values as they exist at . . . .

2. At the date of settlement of any claim by the Company any change in relative monetary values shall be ascertained from the latest figures issued in respect of the Index specified below.

3. The retention of the Company and the maximum limit of Reinsurer's liability shall be modified in proportion to any variation in the Index as between the . . . . and the date of settlement of the claim by the Company.

4. The date of settlement of a claim shall, unless otherwise agreed, be the date of settlement by the Company or the date upon which the amount of an award is finally determined by the Courts.

5. In the case of a claim being settled by the Company in more than one payment:

   a. Any interim payment, other than specified in (b) below shall be added to the final payment and the Index applied as above described.

   b. In the case of claims involving continuing payment which cannot be commuted, the Company and the Reinsurer shall consult together with regard to an equitable application of this clause.

6. In the case of an event/accident/occurrence (as defined in Article . . . . of this Agreement) consisting of more than one claim, each claim shall be dealt with separately in accordance with the terms of Section 2 of this clause. The factor produced by dividing the total of the amounts actually settled by the Company in respect of all claims by the total of their indexed values shall then be applied to the retention of the Company and to Reinsurers' maximum limit of liability and the loss apportioned accordingly.

7. The Index to be applied shall be . . . .

APPENDIX II

INDEX CLAUSE DISCOUNT

n = Number of reinsurance losses

G_j = Gross Loss (settled or outstanding, as the case may be) in observation period ($G > R$)

X = Average excess loss trended and indexed =

$$\frac{\sum_{j=1}^{n} [G_j (1+i)^u - R (1+i)^t]}{n}$$

R = Retention (i.e., current or proposed fixed retention)

E = Subject premium base in observation period [$E (1 + i)^u$ could be replaced, indeed it would be preferable, by premiums on level]

LDF = Loss Development Factor

t = Number of years from occurrence to settlement

u = Number of years from occurrence to midpoint of new exposure period

i = Inflation Rate

P_{WI} = Price with indexed retention

P_{NI} = Price — no index

D = Discount

$\triangle$ = Excess cost on claims that exceed retention as a result of inflation

$$P_{WI} = \frac{\sum_{j=1}^{n} [G_j (1+i)^u - R (1+i)^t]}{E (1+i)^u} \cdot LDF = \frac{n\overline{X} \cdot LDF}{E (1+i)^u} \tag{1}$$

$$P_{NI} = \frac{\sum_{j=1}^{n} [G_j (1+i)^u - R] + \triangle}{E (1+i)^u} \cdot LDF$$

$$P_{NI} = \frac{\sum_{j=1}^{n} [G_j (1+i)^u - R(1+i)^t + R(1+i)^t - R] + \triangle}{E(1+i)^u} \cdot LDF \qquad (2)$$

$$P_{NI} = \frac{n\overline{\overline{X}} + nR[(1+i)^t - 1] + \triangle}{E(1+i)^u} \cdot LDF$$

$$\frac{P_{WI}}{P_{NI}} = \frac{n\overline{\overline{X}}}{n\overline{\overline{X}} + nR[(1+i)^t - 1] + \triangle} =$$

$$\frac{1}{1 + \frac{R}{\overline{\overline{X}}}[(1+i)^t - 1] + \frac{\triangle}{n\overline{\overline{X}}}}$$

$$D = 1 - \frac{P_{WI}}{P_{NI}}$$

$$D \doteq 1 - \frac{1}{1 + [(1+i)^t - 1] \cdot \frac{R}{\overline{\overline{X}}}}$$

As a practical matter, the discount formula might be used with some modification since it is usually difficult to determine $\triangle$ with much accuracy. Leaving $\triangle$ out of the discount formula makes the discount somewhat more conservative from excess carrier's point of view. Another way to get a perspective on the difference or discount is to relate formulas (1) and (2) as follows:

$$P_{NI} = P_{WI} + \frac{nR[(1+i)^t - 1] + \triangle}{E(1+i)^u} \cdot LDF$$

Therefore, the difference in price is a function of inflation on the retention for each of the old excess claims (i.e., those that without inflation already exceeded the retention) and the new excess claims that come through the retention as a result of inflation.

DISCUSSION BY CHARLES F. COOK

The Society is indebted to Mr. Ferguson for a clear and understandable analytical disclosure of one of the arcane processes which have lead to the remarkable increases in recent excess of loss reinsurance rates. As a reinsurance buyer with no significant reinsurance actuarial experience, I feel enlightened and somewhat reassured that my reinsurance is not a rip-off.

The technical portion of my review may be divided into three sections: some generalization of the formula details from the author's Appendix II; a buyer's guide to simplified rate estimates; and an example from my experience with a related type of indexed property catastrophe contract, which might serve as an extension of the author's concept from casualty and property insurance. My review is indebted to the author for discussion of some of his earlier developmental concepts, and to my company's reinsurance broker and reinsurers, who have worked patiently with us for over four years of indexation.

FORMULAS

The author implicitly questions the adequacy of early reserves for large claims; indeed, his examples assume that settlements tend to be approximately $(1 + i)^v$ greater than early reserves for a period from valuation to settlement of v years. The loss development factor is assumed to take care of this part of inflation. Similarly, R is set as a fixed retention level as of the initiation of the new contract. In experience rating of an existing index contract, there may be a retention for some past period which has already been inflated to the present period. The existence of an LDF that does not reflect (or imperfectly reflects) inflation, or of an earlier level of R, requires generalization of the formulas in the author's Appendix II.

LDF *Inadequate for Inflation*

First consider an LDF which reflects no inflation. Then it is appropriate to inflate G_j (an individual claim valuation) from its present estimate to the settlement value of a comparable claim which might occur during the new exposure period. If the observed claim has been settled, that inflation period is u (occurrence to midpoint of new exposure period), as the author shows, but if it is an outstanding case, the period would be u + v, where v is the period from present valuation to settlement.

For example, consider a claim reported at \$100,000 on July 1, 1969. If it is expected to be settled in about three years, it is implicit in the index-clause-to-settlement-date concept that it will inflate at i per year from 7/1/69 to 7/1/72, an inflation of $(1+i)^3 = (1+i)^v$. If a rate were set as of 1/1/70 for one year, u would be 1, but properly this claim would be inflated by $(1+i)^4 = (1+i)^{u+v}$, because a comparable claim occurring in 1970 would be expected to be settled in 1973, four years after the \$100,000 valuation used for rating. In this type of situation, each place the author shows $G_j\,(1+i)^u$, we should use $G_j\,(1+i)^{u+v}$, a higher claim valuation.

If the LDF includes some element of inflation, or if inflation is assumed to be different from occurrence of a claim to its settlement than it is from earlier to later occurrences, then we can estimate k = the rate of inflation on known open claims, beyond the inflation part of LDF. Then the proper valuation of G_j is $G_j\,(1+i)^u(1+k)^v$. Obviously, $v = 0$ for settled claims or for claims fully developed and reserved for expected inflationary increases (as assumed by Mr. Ferguson).

It should be noted that this approach may be advisable even if LDF could be totally adequate, because LDF is applied to $(G_j - R)$; in the calculation LDF would apply to R as well as G, which requires that LDF be adequate for the leveraged excess claim, whereas the reviewer's explicit inflation of G_j without inflating R need only be adequate to inflate the unleveraged gross loss G_j.

Indexed Retention During the Experience Period

In re-rating an already existing indexed contract, we have net claims $G_j - R^*$ where R^* is $< R =$ presently proposed initial retention. Generally, $R = R^*\,(1+i)^u$, unless i has changed. If it has, let h = the old index per year, and $R = R^*\,(1+h)^u$. Then, if R^* is substituted for R, the formulas would use $R(1+i)^t(1+h)^u$ instead of $R(1+i)^t$.

New Generalized Formulas

$$\bar{X} = \frac{\Sigma[G_j(1+i)^u(1+k)^v - R(1+i)^t(1+h)^u]}{n}$$

$$P_{WI} = \frac{\Sigma[G_j(1+i)^u(1+k)^v - R(1+i)^t(1+h)^u]}{E(1+i)^u} \cdot \text{LDF}$$

$$= \frac{n\,\bar{X} \cdot \text{LDF}}{E(1+i)^u}$$

$$P_{NI} = \frac{\Sigma[G_j(1+i)^u(1+k)^v - R] + \triangle}{E(1+i)^u} \cdot LDF$$

$$= \frac{\Sigma[G_j(1+i)^u(1+k)^v - R(1+i)^t(1+h)^u + R(1+i)^t(1+h)^u - R] + \triangle}{E(1+i)^u} \cdot LDF$$

$$= \frac{n\overline{X} + nR[(1+i)^t(1+h)^u - 1] + \triangle}{E(1+i)^u} \cdot LDF$$

$$\frac{P_{WI}}{P_{NI}} = \frac{n\overline{X}}{n\overline{X} + nR[(1+i)^t(1+i)^u - 1] + \triangle}$$

$$P_{NI} = P_{WI} + \frac{nR[(1+i)^t(1+h)^u - 1] + \triangle}{E(1+i)^u} \cdot LDF$$

These formulas yield the author's formulas if $h = 0$ and $k = 0$ or $v = 0$. If $i = k = h$, we have (perhaps must usefully, if least generally):

$$\overline{X} = \frac{\Sigma[G_j(1+i)^{u+v} - R(1+i)^{t+u}]}{n}$$

Other formulas can be similarly expressed by substituting $u + v$ for u and $t + u$ for t.

BUYER'S GUIDE

A premium with no inflation can be derived from P_{WI} or P_{NI} by setting $i = 0$:

$$P^* = \frac{\Sigma(G_j - R)}{E} \cdot LDF$$

If claims are fully developed, so that the valuations G_j are fully adequate, then $v = 0$, and if R is chosen currently so that the factor $(1 + h)^u$ is unnecessary, and if $u \simeq t$ (which can be set by an appropriate selection of experience period), we have:

$$PWI \simeq P^*(1+i)^u$$

In words, if the experience period is old enough so that the average claim has just been settled, then $u \simeq t$ and $v \simeq 0$, and for the current retention R the indexed premium equals the inflationless experience premium indication multiplied by the gross, unleveraged trend factor from the experience period to the exposure period. This is approximate, but is a rational buyer's test of the reasonableness of a reinsurer's quote.

INDEXED PROPERTY CATASTROPHE COVER

It may be useful to consider the use of an index clause in a property catastrophe treaty. Other property reinsurance does not really fit Mr. Ferguson's concept, but this type of cover has only one major difference. Instead of inflating only for the change in money value, an aggregate property cover (or a casualty stop-loss cover) also should inflate to reflect the increase in units exposed.

With reason, premiums in property covers measure both value changes, because the price is set per $100 of insured value. If insurance-to-value is kept current, both the inflation in unit values and the increase of units are measured by the gross premium subject to the treaty.

In early 1971, faced with the same kind of dramatic rate of inflation illustrated by the author for a casualty excess of loss contract, United Services Automobile Association negotiated a long-term treaty providing the following coverage:

Net retention = 5% of subject premium for the prior twelve months.
First excess = 50% of 2½%, excess of 5%
Second excess = 75% of 5%, excess of 7½%
Third & Fourth excess = 90% of 20%, excess of 12½%

Similar to Mr. Ferguson's examples, this treaty provides a complete sharing of inflation, plus, in this case, growth. The retention, coinsurance participation, and the total amount recoverable all increase with the subject premium, which serves as a surrogate measure of exposure in floating dollars. The ceding company accepts a fixed percentage risk, and receives in turn a fixed percentage of coverage, both of which grow with the primary carrier's volume.

For a company with a compound growth rate in excess of 30% per year, this type of indexed contract provides comfort for both parties and stabilizes the relationship and the premium without annual renegotiation.

Substantial judgment is required in rating such a cover. In our case, the rate per $100 declines as volume grows, to reflect an assumed improvement in geographic spread due to the small initial exposure concentrated on the Gulf and Atlantic coasts. For other companies this might be inappropriate, but in our case the rate declines each year while the premium increases, to the satisfaction of both parties.

The use of historical experience (which was ten years in our case but could be up to twenty or more if relevant experience exists) is facilitated by an indexed approach. We valued each past catastrophe by inflating it by the ratio of current subject premium to subject premium at the time of the observed catastrophe, generating a catastrophe loss valued at current price level and market size. In some cases we used state premiums, in some countrywide, depending on judgment as to whether the hazard was local or national. This produced an indicated ten-year average pure premium adjusted to current retention, exposure, and cost levels. Subsequent development is dealt with by the index clause. During the period this contract has been in force, we have more than doubled in volume without a major renegotiation, other than increasing the cut-off limit. The rates have been constant, despite the occurrence of catastrophes for which USAA had losses larger than in the past, because our increasing retention has protected our reinsurers. I recommend the approach heartily, in both casualty and property coverages.

AN ECONOMETRIC MODEL OF WORKMEN'S COMPENSATION

JAN A. LOMMELE
AND
ROBERT W. STURGIS

PURPOSE

Recent workmen's compensation underwriting experience has been unprofitable for the insurance industry. Traditional methods of analyzing experience have failed to yield a clear-cut explanation of this trend. This, combined with our company's emphasis on planning and forecasting, caused us to initiate this project: to apply regression analysis techniques in an effort to explain past results and forecast future results.

METHOD

The first step of the project is to identify insurance and economic variables which, over a period of time, demonstrate an important relationship to workmen's compensation premiums and losses. After these variables are identified, models are developed which define a functional relationship between the important independent variables and each of three dependent variables: written and earned premiums, and incurred losses. The models in turn can be used to analyze and explain past results, and to forecast future results.

Listed below are the variables that were studied.

Dependent Variables

$WPREM_i$: Workmen's compensation premiums written in thousands of dollars for stock and mutual companies in year(i).[1]

$EPREM_i$: Workmen's compensation premiums earned in thousands of dollars for stock and mutual companies in year(i).[1]

$LOSS_i$: Workmen's compensation losses and loss adjustment expenses incurred in thousands of dollars for stock and mutual companies in year(i).[1]

[1] *Best's Aggregates and Averages: Property-Liability,* (1948-1973). "Review and Preview," *Best's Review,* LXXIV (January, 1974), p. 97.

Exhibit A, Sheet 1, shows the values for each of the above dependent variables from 1948-1973.

Independent Variables

$WAGE_i$: Wages and salaries disbursed in billions of dollars in year(i).[2]

PC_i: Percent of the workforce covered by workmen's compensation in year(i). This includes certain state funds.[3]

$RATE_i$: Average countrywide rate level index in year(i) for workmen's compensation including law amendments.[4]

WO_i: A wage offset calculated to reflect the effect of payroll limitations for year(i).[4]

$PRODUCT_i$: This variable is the product of $(WAGE_i)(RATE_i)$ (PC_i) (WO_i), and represents workmen's compensation exposures adjusted for rate changes.

$LOSS_{(i-1)}$: Loss in year(i—1).

$WPREM_{(i-1)}$: Written premium in thousands of dollars in year (i—1).

$UNEMP_{(i-1)}$: Unemployment rate in year(i—1).[2]

GNP_i: Gross national product in billions of dollars in year(i).[2]

EMP_i: The number, in thousands, of persons employed in non-agricultural industries in the civilian labor force in year(i).[5]

AWW_i: Average weekly wages of persons employed in non-agricultural industries in the civilian labor force in year(i).[5]

Exhibit A, Sheet 2, shows the values of $WAGE_i$, $RATE_i$, PC_i, WO_i, and $PRODUCT_i$ from 1948-1973. Exhibit A, Sheet 3, shows the values of the economic variables $UNEMP_{(i-1)}$, GNP_i, EMP_i, and AWW_i from 1948-1973.

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[2] Data Resources, Inc. (29 Hartwell Avenue, Lexington, Massachusetts).

[3] D. N. Price and A. M. Skolnik, "Another Look at Workmen's Compensation," *Social Security Bulletin* (October, 1970), p. 6.

[4] National Council on Compensation Insurance, New York, New York.

[5] *Monthly Labor Review* (November, 1972), pp. 93 and 98.

We began by graphing the relationship between these variables (Exhibit B, Sheets 1-5). From these graphs it can be seen that there are indeed some strong relationships between the independent variables and the dependent variables. Since most of the graphs show a linear trend, the statistical technique chosen for the analysis was linear regression.

SELECTING A MODEL

Presented below are three models which tested out most successfully, and a fourth which was proposed but was not selected for use.

Model I: $WPREM_i = A + B_1(PRODUCT_i) + error$

Model II: $LOSS_i = A + B_1(PRODUCT_i) + B_2(UNEMP_{(i-1)}) + B_3(LOSS_{(i-1)}) + error$

Model III: $EPREM_i = A + B_1(WPREM_i) + B_2(WPREM_{(i-1)}) + error$

Model IV: $EPREM_i = A + B_1(GNP_i) + B_2(AWW_i) + B_3(EMP_i) + error$

In the above models, the coefficients (A and B) of the variables are determined by the application of linear regression techniques. An error term is included by convention; it serves to remind the reader that the models do not describe the real world situation perfectly.

Establishing Criteria

We established seven criteria to determine the strength and validity of each model:

1. The importance of an independent variable can be determined by examining the Student's t-statistic associated with the coefficient. The coefficients are the "B's" in the above equations, and the higher the absolute of t, $|t|$, the better. Generally speaking, if $|t| > 2$, then the independent variable may be regarded as significant.

2. The sign of t indicates whether the relationship is direct or inverse. That is, the sign indicates whether the dependent variable varies directly with, or inversely to, the independent variable. For example, we would expect premium to vary with GNP_i but inversely to unemployment. This criterion requires that the sign of t indicates a correct relationship.

3. R^2 is the multiple correlation coefficient, where $0 \leq R^2 \leq 1$. R^2 is the proportion of total variation about the mean of the dependent variable which has been explained by the regression. In other words, $100R^2$ is a measure of the percent of variation in the dependent variable which has been explained by the independent variables, and so an R^2 very close to 1.00 is desired.

4. In models where more than one independent variable is used, one would expect correlation between some of the independent variables. For example, GNP and average weekly wages are positively correlated. However, each independent variable should be more highly correlated with the dependent variable than it is with any other independent variable. High correlation between independent variables can produce relationships which are not sensible.

5. There are several assumptions made on the errors when doing a linear regression, one of which is that the errors from one year to the next are not correlated. That is, a positive error in one year does not increase the likelihood of a positive or negative error in the following year. If errors are positively correlated, then positive autocorrelation is present. The Durban-Watson "d" statistic is a check on autocorrelation. It would go beyond the scope of the paper to go any further than to say that

$$d = \frac{\sum_{i=2}^{n} (e_i - e_{i-1})^2}{\sum_{i=1}^{n} e_i^2}$$

where $e_i = (y_i - \hat{y}_i)$, y_i and $\hat{y}_i$ are the observed and fitted values, respectively, for the dependent variable in the ith year, and n is the number of years in the model. A sufficiently small value of "d" indicates positive autocorrelation. More will be said about this in Table 1.

6. The percent of mean absolute error is an indicator of the historical and recent accuracy of the model.
The percent of absolute error for year(i) equals

$$\frac{|\text{observed}_i - \text{fitted}_i|}{\text{fitted}_i} \times 100\%$$

Actually, the error variance is the conventional statistical measure of model precision, but this will suffice for our purposes.

7. Ideally, the model will be intuitively sensible. For example, it's possible that written premiums may have a strong relationship to some extraneous independent variable, such as air passenger miles. Although this might turn out to be an excellent predictor, it would provide little insight into what is really happening.

Table 1 summarizes Models I – IV matched against these seven criteria.

Results vs. Criteria

In this section each of the models presented is evaluated on the basis of the above seven criteria. The reader should refer to Table I for a summary of the discussion.

The model $WPREM_i = A + B_1(PRODUCT_i) + error$ was chosen to forecast written premium. Model I suggests a linear relationship between written premium and exposures adjusted for rate changes.

Model I was chosen to forecast written premium for the following reasons:

1. The value of t for B_1 indicates a highly significant relationship between $PRODUCT_i$ and $WPREM_i$.

2. The sign of t is correct. That is, its positive value tracks with the intuitive notion that written premiums increase with exposures.

3. An R^2 value of .9961 indicates that the model explains more than 99% of the variability observed in written premiums.

4. The correlation of independent variables is not relevant in this model since $PRODUCT_i$ is the only independent variable.

5. Positive autocorrelation is present in the model, indicating that there are periods where the model consistently overestimates written premiums for a period of years or underestimates written premiums for a period. The effect of autocorrelation in the model can be reduced through a transformation on the data using the Durban-Watson statistic and econometric methods. The details of the transformation are quite complex and will not be described in this paper. There is an alternative to a transformation on the

model, which is to adjust the forecast produced by the model. This will be described later in the paper. It also uses the Durban-Watson statistic and produces a more reliable forecast than if no adjustment for autocorrelation were made.

6. The mean absolute error is quite small historically, but greater than we'd like for the last five years. This increased error is largely due to the autocorrelation described in (5) above.

7. Intuitively, the model does very well, since we would expect a linear relationship between premium and exposures adjusted for rate changes.

Model II is $LOSS_i = A + B_1 (PRODUCT_i) + B_2 (UNEMP_{(i-1)}) + B_3 (LOSS_{(i-1)}) + error$. That is, losses in workmen's compensation in year (i) are a function of $PRODUCT_i$, the unemployment rate the previous year, and losses the previous year. This is a linear model, hypothesizing that there is a linear relationship between $LOSS_i$ and each of the independent variables. Each of the seven criterion is discussed below for this model.

1. Each of the variables in the model is significant.

2. The sign of t is correct for each variable.

3. An R^2 value of .999 indicates an almost perfect fit to the data.

4. The independent variables are all more highly correlated with losses than they are with each other.

5. The Durban-Watson "d" is at the upper end of the inconclusive range; so we cannot say for sure there is no autocorrelation. Even if it is present, which is very doubtful, the R^2 value is so high that the effect of autocorrelation would be negligible, i.e., the error is so small that it is of little importance that the error may be of the same sign for a few years.

6. The mean absolute error is 1.95% historically and even better the last five years, .60%.

7. The relationships that have been established statistically are consistent with our intuition. Incurred losses are expected to increase as wages and the percent of the workforce increase; for that reason $PRODUCT_i$ is a significant variable. However, incurred losses generally show a smoother, less erratic pattern than premiums,

i.e., they appear to be less directly affected by outside economic influences. Thus, the prior year's unemployment rate was more significant than the current year's rate, indicating that the full effect of unemployment on loss experience is not felt immediately. Also, the prior year's losses are highly predictive of current losses, which, in addition to reflecting the smoothness of the loss curve, may reflect a steady pattern of year-end reserve run-off. That is, a portion of many calendar years' incurred losses has been the developing inadequacy of the previous year-end reserves.

Model III is $EPREM_i = A + B_1 (WPREM_i) + B_2 (WPREM_{(i-1)})$ + error. This linear model says that earned premium in year(i) is dependent on written premium in year (i) and written premium in year(i—1). That is, the relationship is linear between the dependent variable and each of the independent variables. This model is excellent in six of the seven criteria.

1. Both variables are significant, although premiums written in year(i) are much more significant than premiums written in year(i—1).

2. Each t has a correct sign.

3. $R^2 = .9999$, indicating a near perfect fit.

4. Naturally, premiums written in year(i) are correlated with those written in year(i—1). However, the written premiums in year(i) and year(i—1) are more highly correlated with earned premium than with each other.

5. Slight autocorrelation is present. A small adjustment will be made to the 1974 and 1975 forecasts. The decision to make the adjustment is optional, since R^2 is so high. However, the 1971 and 1972 models did overestimate 1972 and 1973 actual results.

6. The mean absolute error is an impressive .46% historically, and even better the last five years.

7. The model is intuitively consistent with our knowledge of how written premiums are earned. The higher significance of premiums written in year(i) than in year(i—1) surprised us at first. This seems to suggest a widespread practice in the industry of underestimating exposures, and collecting additional premium at the time of audit — this premium is fully earned when booked. That is, premium produced from audits is identically written and earned.

Model IV is $EPREM_i = A + B_1 (GNP_i) + B_2 (AWW_i) + B_3 (UNEMP_{(i-1)})$ + error. This again is a linear model. It is hypothesized that the premium earned in workmen's compensation in year (i) is linearly dependent on the GNP for year(i), the average weekly wages in year(i), and the number of employees in the civilian workforce in year(i). The model has been included to give an example of a model which was tested and rejected.

1. All three of the variables are significant, although AWW is just barely significant.

2. The sign of t indicates that earned premiums decrease as average weekly wages increase. We know this is not reasonable and the reason for this is given in paragraph 4 below. The signs of the other t statistics are correct.

3. $R^2 = .9943$, which is reasonably good.

4. If two variables are very highly correlated in a model, they may interfere with each other in such a way so as to produce unlikely results for the less important of the two variables considered. This is the case for Model IV. GNP_i and AWW_i are very highly correlated, but GNP_i is a much more significant variable than is AWW_i, and so the interference between the two variables has caused the negative t for AWW_i.

5. Autocorrelation is present in this model also. The model was discontinued when it was current through 1971. Model IV almost certainly would have had more autocorrelation when updated through 1973.

6. The mean absolute error is 3.34% for the 24 year period.

7. This model is reasonably accurate for forecasting earned premium. However, Model I is a far better representation of how premiums are actually calculated and produced, and therefore, a more useful analytical tool.

FORECASTING

Models I, II, and III have been shown to closely represent the historic interrelationships between insurance and economic variables. Careful analysis of the models reveals much about the causes of fluctuations in results from year to year. These models can also be used to forecast future results. Obviously though, to forecast values for the dependent variables, we need to input values for the independent variables, and our forecasts of insurance results will be only as good as this input.

Future values of WO_i are quite easy to predict accurately, because these values have been so close to unity since 1960 and should continue so, as more states adopt the unlimited payroll rule.

Future values for PC_i are more difficult to predict, because they are dependent on future legislation. However, in view of The Report of the National Commission on State Workmen's Compensation Laws, we feel confident in predicting that this percentage will continue to increase.

Future values for $RATE_i$ can be based on past changes, pending and likely large benefit increases, and a consideration of how recent experience will affect experience rate indications.

Future values for the several economic indicators ($WAGE_i$, EMP_i, $UNEMP_{(i-1)}$, and GNP_i) are available from the myriad of economic forecasts published. We worked with DRI economic forecasts.[6]

Forecasts need not be single point predictions. A range of reasonability can be established by inputting alternative values for the independent variables. For example, we used values for $RATE_i$ on either side of our best estimate along with both a DRI Control Economic Forecast and Pessimistic Financial Economic Forecast.

Adjusting for Autocorrelation

It was mentioned earlier that an adjustment should be made on the forecast if autocorrelation is present. The procedure involves the calculation of an adjustment factor. The factor is: $\rho = \frac{2.0 - d}{2}$, where "d" is the value of the Durban-Watson statistic in the regression. We then multiply the 1973 error in the model by ρ and add the product to the 1974 forecast. We add the product of ρ^2 and the 1973 error to the 1975 forecast etc. Thus,

1974 final prediction $= \rho$ (1973 error) $+$ 1974 prediction
1975 final prediction $= \rho^2$ (1973 error) $+$ 1975 prediction
1976 final prediction $= \rho^3$ (1973 error) $+$ 1976 prediction,

and so on until the adjustment factor is significant.

[6] Data Resources, Inc. (29 Hartwell Avenue, Lexington, Massachusetts).

An Example

The example below is worked out in detail for 1974 using a 7.5% rate increase and the DRI Control Economic Forecast.

Model I: $WPREM_i = 289{,}184 + 5{,}687.23\,(PRODUCT_i)$. In 1974 we anticipate $PRODUCT_i = (753.6)(1{,}490)(.9977)(.90) = 1{,}008.253$. Therefore, $WPREM_i = 6{,}023{,}351$ is the first estimate.

Now, 1973 error $= 4{,}860{,}000 - 5{,}049{,}000 = -189{,}000$ where 5,049,000 is the fitted value for 1973 $WPREM_i$.

$$\rho = \frac{2 - .5745}{2} = .71275$$

1973 error $= -134{,}710$

Final estimate $= 6{,}023{,}351 - 134{,}710 = 5{,}888{,}641$

Model II: $LOSS_i = -18{,}198.1 + 2{,}117.2(PRODUCT_i) + 11{,}515.7\,(UNEMP_{(i-1)}) + .00057977(LOSS_{(i-1)})$.

In 1974 we anticipate

1. $PRODUCT_i = 1{,}008.253$
2. $UNEMP_{(i-1)} = 4.9$
   (Note: This is the 1973 unemployment rate.)
3. $LOSS_{(i-1)} = 3{,}613{,}772{,}000$

Therefore, $LOSS_i = 4{,}268{,}059$.

Model III: $EPREM_i = 10{,}081.6 + .07774(WPREM_{(i-1)}) + .89995(WPREM_i)$ where

1. $WPREM_i = 5{,}888{,}641$
2. $WPREM_{(i-1)} = 4{,}860{,}000$

$EPREM_i + 5{,}687{,}380$ is the first estimate. There is slight autocorrelation present in this model. $\rho = \frac{2 - 1.1934}{2} = .4033$. This formula was used for a preliminary estimate of $EPREM_i$ in 1973, so this is the second year ρ is used.

ρ^2 (1972 error) $= (.4033)^2(-24{,}000) = -3{,}904$. The final $EPREM_i$ prediction is $5{,}687{,}380 - 3{,}904 = 5{,}683{,}476$.

$$\text{Loss Ratio: } \frac{4{,}268{,}059}{5{,}683{,}476} = .751$$

The above procedure is essentially the same for any forecast using these models.

CONCLUSION

The application of econometric methods to build models for workmen's compensation has proven to be of practical use, since the models proposed give us a better understanding of the linear relationships between insurance results and certain indicators, both insurance and economic. From the models we have also been able to determine the relative importance of the indicators. Finally, a method for using these models to forecast a range of future results was described, although we have not presented herein a specific range of forecasts.

The methods described above are of more relevance than the specific formulas shown. To be of value, they should undergo a continuing process of updating and fine-tuning (the data contained in this paper was compiled one full year prior to this presentation). These methods are applicable to other lines of insurance. However, efforts to apply these methods to other lines of insurance should not be discouraged if the relationships prove to be less direct than for workmen's compensation.

EXHIBIT A
Sheet 1

WORKMEN'S COMPENSATION EXPERIENCE*
('000 omitted)

Accounting Year	Written Premiums	Earned Premiums	Incurred Losses and Loss Adjustment Expenses	Ratio (4)÷(3)
(1)	(2)	(3)	(4)	(5)
1948	$ 731,888	$ 707,262	$ 425,622	.602
1949	718,283	706,827	440,571	.623
1950	697,267	694,076	489,277	.705
1951	817,380	802,558	596,167	.743
1952	917,872	897,134	641,873	.715
1953	1,031,139	995,763	683,023	.686
1954	1,016,493	998,740	637,694	.638
1955	1,035,444	1,017,260	673,324	.662
1956	1,110,732	1,093,290	736,949	.674
1957	1,199,476	1,181,217	808,191	.684
1958	1,209,319	1,201,948	854,139	.711
1959	1,296,947	1,277,933	936,536	.733
1960	1,419,361	1,386,805	1,006,646	.726
1961	1,484,009	1,456,324	1,072,723	.737
1962	1,603,940	1,572,207	1,125,581	.716
1963	1,725,158	1,686,013	1,229,594	.729
1964	1,868,411	1,836,256	1,319,680	.719
1965	2,042,231	1,990,355	1,423,910	.715
1966	2,347,828	2,290,022	1,647,891	.720
1967	2,601,625	2,525,288	1,814,342	.718
1968	2,890,872	2,833,023	1,973,845	.697
1969	3,199,743	3,128,806	2,207,136	.705
1970	3,492,307	3,406,433	2,431,040	.714
1971	3,660,066	3,568,271	2,729,889	.765
1972	4,104,090	3,964,267	3,096,354	.781
1973	4,860,000**	4,693,211	3,614,000	.770

**Rest's Aggregates and Averages: Property-Liability* (1948-1973).
"Review and Preview," *Best's Review*, LXXIV (January, 1974), p.97.
**This is a preliminary estimate from *Best's Review*. The other 1973 figures are based upon this estimate.

EXHIBIT A
Sheet 2

COMPONENTS OF THE INDEPENDENT VARIABLE "PRODUCT"

Year	Wage	Rate*	PC**	WO	Product
1948	135.341	0.811	.7700	0.9955	84.1361
1949	134.551	0.784	.7690	0.9912	80.4064
1950	146.748	0.758	.7720	0.9869	84.7485
1951	171.019	0.803	.7840	0.9826	105.792
1952	185.098	0.860	.7890	0.9873	124.001
1953	198.335	0.866	.8000	0.9739	133.820
1954	196.474	0.844	.7970	0.9679	127.919
1955	211.266	0.825	.8000	0.9618	134.109
1956	227.842	0.813	.8020	0.9558	141.993
1957	238.695	0.841	.8050	0.9497	153.469
1958	239.926	0.849	.8020	0.9436	154.151
1959	258.187	0.886	.8030	0.9376	172.227
1960	270.844	0.910	.8040	1.0000	198.160
1961	278.080	0.937	.8030	1.0000	209.230
1962	296.091	0.972	.8040	1.0000	231.392
1963	311.095	0.997	.8050	1.0000	249.680
1964	333.683	1.025	.8080	1.0000	276.356
1965	358.885	1.067	.8150	1.0000	312.088
1966	394.499	1.104	.8310	1.0000	361.923
1967	423.075	1.134	.8310	0.9999	398.647
1968	464.862	1.129	.8380	0.9998	439.719
1969	509.690	1.166	.8360	0.9995	496.585
1970	541.976	1.183	.8340	0.9992	534.298
1971	573.250	1.208	.8340	0.9988	576.840
1972	627.845	1.295	.8500	0.9977	689.511
1973	691.500	1.386	.8750	0.9980	836.939

*Rate = 1.000 in Base Year 1939

**The values for PC in 1971, 1972, and 1973 are the authors' estimates based on a review of law changes, since more recent data could not be found.

EXHIBIT A
Sheet 3

ECONOMIC INDEPENDENT VARIABLES

Year	UNEMP	GNP	EMP	AWW
1948	3.8	257.6	50,713	49.00
1949	5.9	256.5	49,990	50.24
1950	5.3	284.8	51,760	53.13
1951	3.3	328.4	53,239	57.86
1952	3.0	345.5	53,753	60.65
1953	2.9	354.6	54,922	63.76
1954	5.5	364.8	53,903	64.52
1955	4.4	398.0	55,724	67.72
1956	4.1	419.2	57,157	70.74
1957	4.3	441.1	58,123	73.33
1958	6.8	447.3	57,450	75.08
1959	5.5	483.7	59,065	78.78
1960	5.5	503.7	60,318	80.67
1961	6.7	520.1	60,546	82.60
1962	5.6	560.3	61,759	85.91
1963	5.6	590.5	63,076	88.46
1964	5.2	632.4	64,782	91.33
1965	4.5	684.9	66,726	95.06
1966	3.8	749.9	68,915	98.82
1967	3.9	793.9	70,527	101.84
1968	3.6	864.2	72,103	107.73
1969	3.5	929.1	74,296	114.61
1970	5.0	974.1	75,165	119.46
1971	6.0			
1972	5.6			

EXHIBIT B
Sheet 1

Written Premium Versus
Gross National Product
1948 to 1973

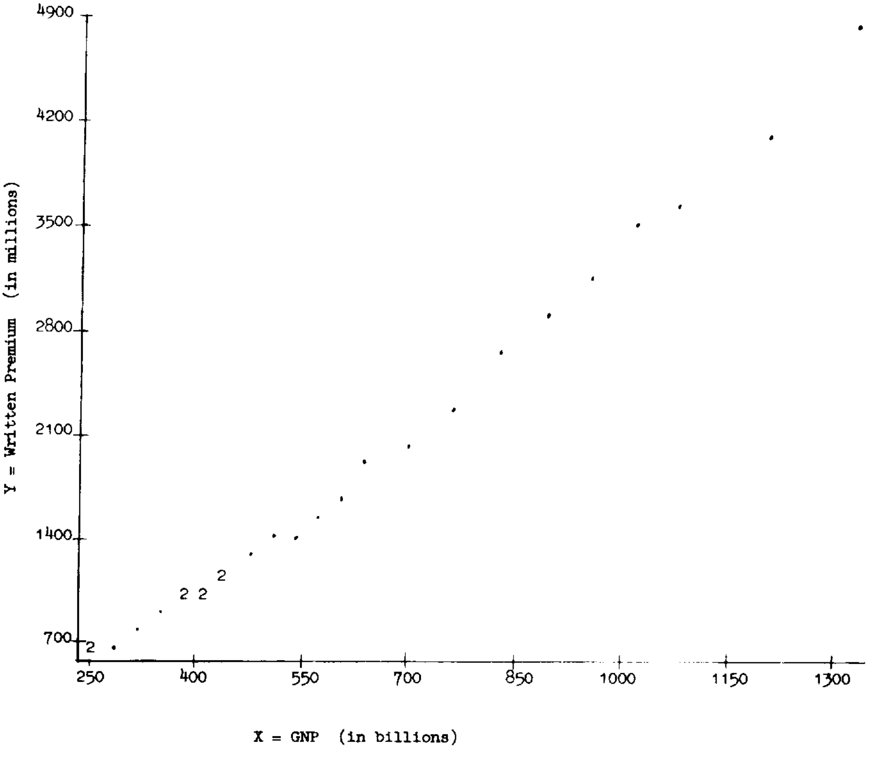

EXHIBIT B
Sheet 2

Written Premium
Versus $PRODUCT_i$
1948 - 1973

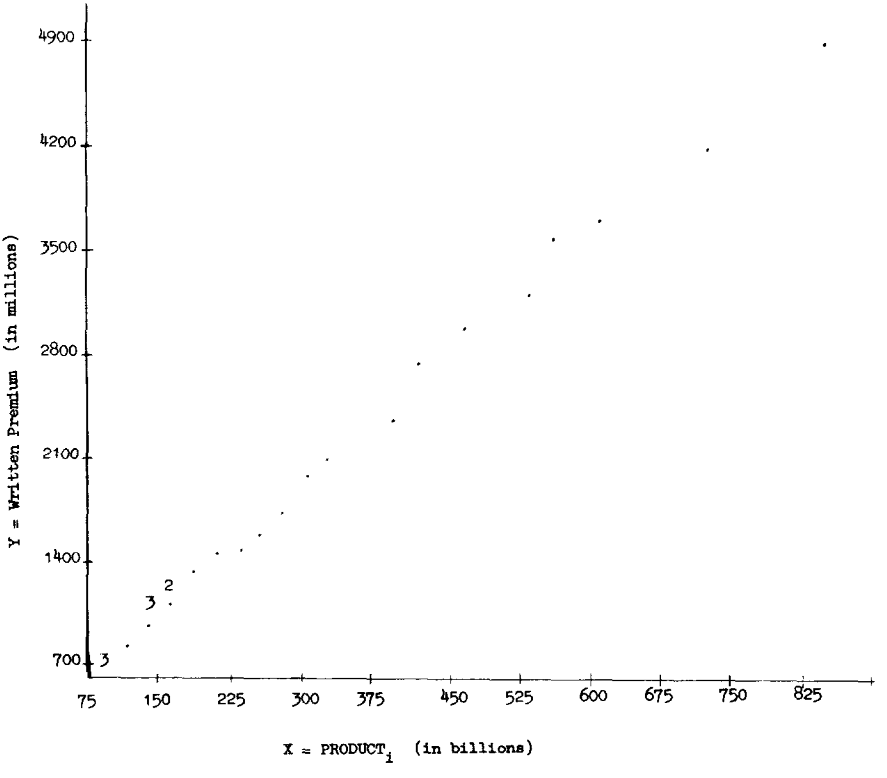

EXHIBIT B
Sheet 3

Loss and Loss Adjustment
Expenses Incurred
Versus $PRODUCT_i$
1948 - 1973

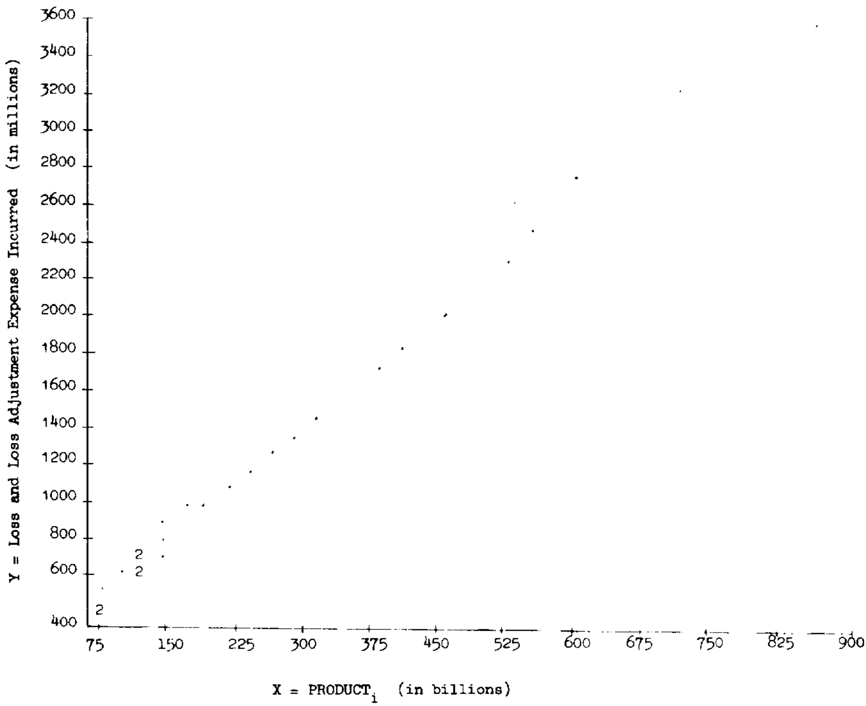

EXHIBIT B
Sheet 4

Loss and Loss Adjustment
Expenses Incurred
in Year(i) Versus Year(i-1)
1948 - 1973

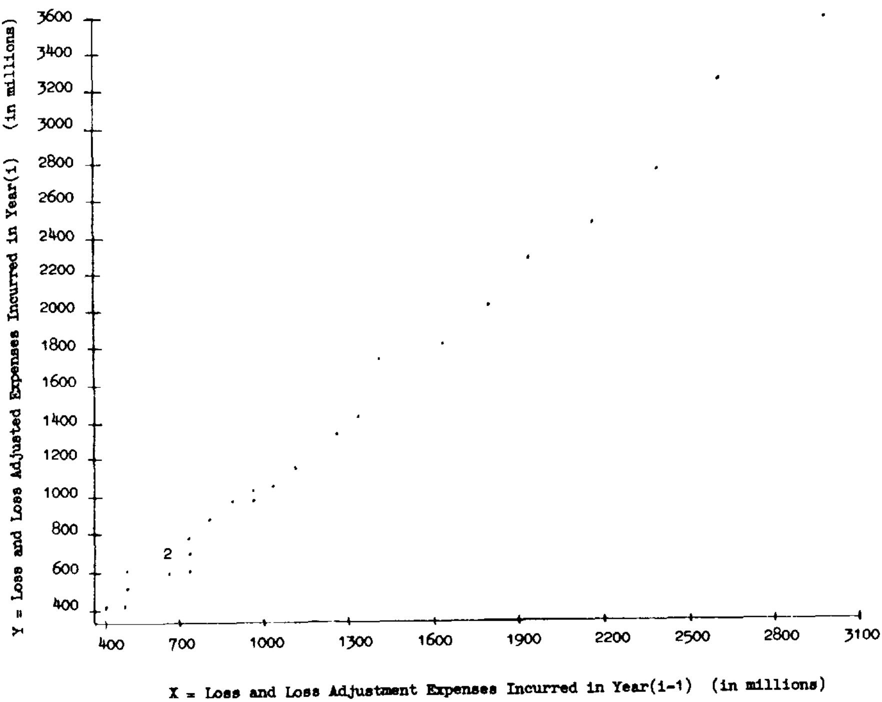

EXHIBIT B
Sheet 5

Written Premium
Versus
Earned Premium
1948 to 1973

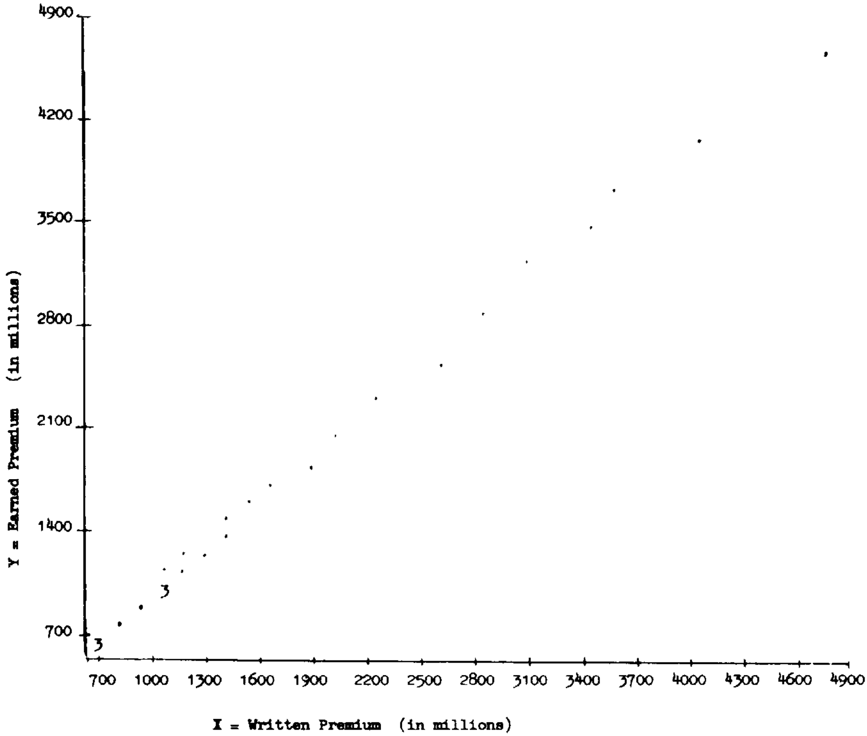

TABLE 1

	Values of A and B_i	Value of t for A and B_i	Sign of t Correct	R^2	Correlation of Independent Variables	Durban-Watson Statistic	Mean Absolute Error	Intuitive Criteria
MODEL I								
Intercept	A = 289184.0	11.7719	*	.9961	None	d = .5745	2.86% historically; 3.30% last 5 years	Good
$PRODUCT_t$	B_1 = 5687.23	79.8545	Yes			d_L = 1.30**		
						d_U = 1.46		
MODEL II								
Intercept	A = −18198.1	−.646560	*	.9990	Slight Correlation	d = 1.6041	1.95% historically; .60% last 5 years	Good
$PRODUCT_t$	B_1 = 2117.20	6.30748	Yes			d_L = 1.14		
$UNEMP_{(t-1)}$	B_2 = 11515.7	2.2575	Yes			d_U = 1.65		
$LOSS_{(t-1)}$	B_3 = .00057977	6.37912	Yes					
MODEL III								
Intercept	A = 10081.6	2.37009	*	.9999	Slight Correlation	d = 1.1934	.46% historically; .42% last 5 years	Good
$WPREM_t$	B_1 = .899949	29.0373	Yes			d_L = 1.21		
$WPREM_{(t-1)}$	B_2 = .077736	2.25731	Yes			d_U = 1.55		
MODEL IV								
Intercept	A = −1494860	−1.61492	*	.9943	Serious Correlation	d = 1.0115	3.34% historically; .0193 last 5 years	Fair
GNP_t	B_1 = 4719.37	8.02251	Yes			d_L = 1.10		
AWW_t	B_2 = −26836.5	−4.71399	No			d_U = 1.66		
EMP_t	B_3 = 44.2167	1.7887	Yes					

*Neither the sign nor the magnitude of t is important for A.

**If $d < d_L$, positive autocorrelation is present.

If $d_L \leq d \leq d_U$, the test is inconclusive.

If $d > d_U$, no autocorrelation is present.

MINUTES OF THE 1974 FALL MEETING

November 17-19, 1974

MARRIOTT HOTEL, NEW ORLEANS, LOUISIANA

Sunday, November 17

The Board of Directors held its regularly scheduled meeting at the Marriott Hotel from 1:30-5:00 p.m.

Registration was held from 4:30-6:00 p.m. for early arrivals.

The President's reception for new Fellows and their wives and husbands took place from 5:30-6:30 p.m.

A reception for members and guests was held from 6:30-7:30 p.m.

Monday, November 18

Registration began at 8:30 a.m.

The Fall meeting formally convened at 9:00 a.m.

Following opening remarks by President Paul S. Liscord, diplomas were presented to the new Associates and Fellows. The names of the new Associates were read in groups of ten. Their diplomas were distributed at the time of the coffee break and following the taking of photographs of the new Fellows and Associates.

Associates

Gregory N. Alff
Dean R. Anderson
Charles M. Angell
David A. Arata
Galen R. Barnes
Gary F. Bellinghausen
Robert S. Briere
Randall E. Brubaker
Diana M. Childs
Douglas J. Collins
Michael D. Covney
Patrick J. Crowe
James O. Curley
George E. Davis
Rodney D. Davis
Dennis D. Fasking
Richard I. Fein
Thomas L. Gallagher
Christopher P. Garand
Mary Jo E. Godbold
Nathan T. Godbold
Anthony J. Grippa
Charles Gruber
John Herzfeld
Paul H. Inderbitzin
Aguedo M. Ingco

Ronald W. Jean
Gerald J. Jerabek
Alan E. Kaliski
Charles B. Knaus
Merlin R. Lehman
Pamela A. Martin
David L. Miller
Karl G. Moller, Jr.
Allan R. Neis
Ellen M. Ostrowski
Robert G. Palm
Marc B. Pearl
Charles I. Petit
Steven Petlick
Charles M. Potok
Al J. Quirin
David E. Renze
John D. Reynolds
Sheldon Rosenberg
Joseph R. Schumi
Young B. Song*
Sanford R. Squires
James N. Stanard
Lee R. Steeneck
John W. Swisher, Jr.
Jane C. Taylor
Oakley E. Van Slyke
Thomas V. Warthen, Jr.
Joel S. Weiner
Walter C. Wright, III
Reginald C. Yoder*
R. James Young, Jr.
Dorothy A. Zelenko
Theodore J. Zubulake

*Not present.

Fellows

Karen H. Balko
John G. Bradshaw, Jr.
Charles A. Bryan
Robert J. Finger
James F. Golz
Howard R. Hardy
Douglas S. Haseltine
Edward P. Lester
Alan R. Sheppard

The following Officers and Directors were elected:

President-Elect	Ronald L. Bornhuetter
Vice President	George D. Morison
Secretary	Robert B. Foster
Treasurer	Walter J. Fitzgibbon, Jr.
Editor	Luther L. Tarbell, Jr.
General Chairman, Education & Examination Committee	Charles F. Cook
Directors (Terms To Expire in 1977)	Dale A. Nelson
	Martin Bondy
	Jerome A. Scheibl

President Liscord delivered his Presidential address entitled "Independence of the Actuary A Measure of Professionalism".

A brief moment of silence was held in remembrance of members who died during the past year:

Gustav F. Michelbacher
George I. Shapiro
O. D. Dickerson
John Edwards
Richard H. Butler

The Secretary and Treasurer reports were presented by the Secretary-Treasurer.

Following a coffee break, a panel discussion entitled "State Regulation of Financial Condition" was presented to the membership. Participants in this discussion were as follows:

Moderator: Kevin M. Ryan
Regional Vice President
Insurance Services Office

Panel Members: Christy P. Armstrong
Chief Deputy
California Insurance Department

Peter B. Walker
McKinsey & Company

Robert A. Bailey
Actuary
National Association of
Insurance Commissioners

Charles L. McClenahan
Casualty Actuary
Illinois Insurance Department

A formal luncheon was held following which Mr. Bornhuetter introduced Mr. Roy C. McCullough, Chairman of the Maryland Casualty Company, who spoke using as the title of his address, "The Emperor Has No Clothes". Mr. McCullough had previously addressed the CAS membership in 1952 and 1956.

At 1:30 p.m. there was a panel discussion entitled "Catastrophe Reserves – The FASB Report". Participants in this part of the program were as follows:

Moderator: James H. Crowley
Assistant Vice-President
Comptroller's Department
Aetna Life & Casualty

Panel Members: Ronald E. Ferguson
Assistant Vice President
General Reinsurance Corporation

Paul E. Singer
Vice-President and Actuary
CNA/Insurance

Following a coffee break the following concurrent workshops were presented:

A. "Accident & Health—Current Developments"

Moderator: John R. Bevan
Vice President & Actuary
Liberty Mutual Insurance Company

Panel Members: Robert J. Schuler
Vice President
Blue Cross of Western Pennsylvania

Robert F. Bartik
Assistant Actuary
Kemper Insurance Group

Allen D. Pinney
Actuary – Group Department
The Travelers Insurance Companies

B. "Malpractice – Ratemaking Problems, Market Availability, and Reserving"

Moderator: Warren P. Cooper
Vice President & Actuary
Chubb & Son, Inc.

Panel Members: Thomas N. Kellogg
Vice President
General Reinsurance Corporation

John P. Welch
Vice President & Actuary
Argonaut Insurance Company

James R. Berquist
Consulting Actuary
Milliman and Robertson, Inc.

C. "Financial Forecasting"

Moderator: Raymond W. Beckman
Consulting Actuary
Booz-Allen Consulting Actuaries

Panel Members: Robert A. Anker
Second Vice President and Actuary
American States Insurance Companies

Richard W. Ziock
Associate Actuary
Continental Assurance Company

D. "Underwriting Personal Automobile Recent Developments"

Moderator: Richard E. Munro
Vice President and Actuary
California Casualty Group

Panel Members: Robert W. Butcher
Actuary
The Travelers Insurance Companies

Darrell W. Ehlert
Product Development Director
Allstate Insurance Company

Neil L. Millman
Assistant Actuary
Colonial Penn Insurance Company

After a break the four workshop sessions were repeated.

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The afternoon activities concluded at 5:15 p.m.

There was a reception for members, their wives and husbands and guests from 7:00 p.m. to 8:00 p.m.

Tuesday, November 19

Mr. Hughey convened the morning session at 8:30 a.m. The following papers and reviews were presented to the membership:

Papers

1. "Revising Classification Structure Using Survey Data" by David Skurnick, N. Robert Heyer and G. Ray Funkhouser. (Presented by David Skurnick).
2. "An Econometric Model of Workmen's Compensation" by Jan A. Lommele and Robert W. Sturgis. (Presented by Jan A. Lommele).
3. "Nonproportional Reinsurance and the Index Clause" by Ronald E. Ferguson.
4. "The California Table L" by David Skurnick.

Reviews

1. Charles F. Cook presented a review of Ronald E. Ferguson's paper "Nonproportional Reinsurance and the Index Clause".
2. A review was presented by Frederick W. Kilbourne of Costandy K. Khury's paper "Personal Lines Pricing: From Judgment to Fact".
3. A joint review by John Napierski and James B. Reinbolt of Michael Walters' paper "Homeowners Insurance Ratemaking" was presented by John Napierski.
4. Michael Walters presented a Reply to Reviewers of his paper "Homeowners Insurance Ratemaking".

The Woodward-Fondiller prize was awarded to Costandy K. Khury for his paper "Personal Lines Pricing: From Judgment to Fact". The award was presented by Lewis H. Roberts, Vice President and Manager of Woodward and Fondiller.

The Dorweiler prize was awarded to Jeffrey T. Lange and Wayne H. Fisher for their jointly authored paper "Loss Reserve Testing: A Report Year Approach".

The reading of the minutes of the May meeting was waived.

At 9:30 there was an American Academy presentation. Participants in this were the following:

Moderator:	W. James MacGinnitie Professor of Actuarial Science Graduate School of Business Administration University of Michigan
Panel Members:	Thomas P. Bowles, Jr. President-Elect American Academy of Actuaries
	Mary H. Adams Consulting Actuary George B. Buck Consulting Actuaries, Inc.
	Samuel H. Turner Director Life Insurance Operations, Europe ITT Financial Services, Europe

In addition, P. Adger Williams, Vice President and Actuary, The Travelers Insurance Companies, reported for the Committee on Independence of the Actuary.

After a coffee break, at 10:45 a.m. a panel discussion "Double Digit Inflation and its Impact on Property and Casualty Insurance" was presented. Participants were as follows:

Moderator:	John W. Wieder, Jr. Vice President and Actuary Aetna Life and Casualty
Panel Members:	Del R. Jones Associate Actuary The Travelers Insurance Companies

Martin Bondy
Vice President
Corporate Analysis and Planning
Crum and Forster

George F. Reall
President
National Council on Compensation
Insurance

Edward J. Hobbs
Senior Vice President
Insurance Company of North America

Mr. Liscord acknowledged the contribution to the success of the meeting by the participants and by the Local Committee on Arrangements: David R. Bickerstaff, Chairman, with the assistance of Barbara Cook, Edward J. Carter, Jr., Steven F. Goldberg, Robert A. Daino and E. LeRoy Heer. He also extended his thanks to M. Stanley Hughey, the other officers, and members for their support.

Mr. Hughey adjourned the meeting at 12:15 p.m. expressing the thanks of the Society to President Liscord with the audience rising with applause.

Registration cards completed by the attendees and filed at the registration desk indicated attendance by 110 Fellows, 112 Associates, 25 guests (including 5 subscribers), and 87 husbands and wives, as follows:

FELLOWS

Adler, M.	Bornhuetter, R. L.	Eyers, R. G.
Anker, R. A.	Boyajian, J. H.	Faber, J. A.
Bailey, R. A.	Bradshaw, J. G., Jr.	Ferguson, R. E.
Balcarek, R. J.	Brannigan, J. E.	Finger, R. J.
Balko, K. H.	Brian, R. A.	Flynn, D. P.
Bartik, R. F.	Bryan, C. A.	Fossa, E. F.
Beckman, R. W.	Cook, C. F.	Foster, R. B.
Bennett, N. J.	Crowley, J. H.	Gibson, J. A., III
Berquist, J. R.	Curry, H. E.	Gillam, W. S.
Bevan, J. R.	Dahme, O. E.	Golz, J. F.
Bickerstaff, D. R.	DeMelio, J. J.	Hachemeister, C. A.
Bill, R. A.	Drobisch, M. R.	Hall, J. A., III
Blodget, H. R.	Dropkin, L. B.	Hardy, H. R.
Bondy, M.	Ehlert, D. W.	Hartman, D. G.

Harwayne, F.
Haseltine, D. S.
Heer, E. L.
Hillhouse, J. A.
Hobbs, E. J.
Honebein, C. W.
Hughey, M. S.
Hurley, R. L.
Inkrott, J. G.
Jones, A. G.
Kallop, R. H.
Khury, C. K.
Kilbourne, F. W.
Klaassen, E. J.
Klein, D. M.
Kreuzer, J. H.
Lange, J. T.
Lester, E. P.
Levin, J. W.
Linden, J. R.
Linder, J.
Lino, R.
Liscord, P. S.
Lowe, R. F.
MacGinnitie, W. J.
Makgill, S. S.
Masterson, N. E.
McClenahan, C. L.
Morison, G. D.
Muetterties, J. H.
Munro, R. E.
Munterich, G. C.
Murray, E. R.
Newman, S. H.
Oien, R. G.
Otteson, P. M.
Petz, E. F.
Phillips, H. J., Jr.
Pinney, A. D.
Pollack, R.
Portermain, N. W.
Retterath, R. C.
Richards, H. R.
Richardson, J. F.
Roberts, L. H.
Rodermund, M.
Rosenberg, N.
Ross, J. P.
Roth, R. J.
Ryan, K. M.
Scheibl, J. A.
Schuler, R. J.
Scott, B. E.
Sheppard, A. R.
Simon, L. J.
Skurnick, D.
Smith, E. M.
Snader, R. H.
Strug, E. J.
Tarbell, L. L., Jr.
Uhthoff, D. R.
Walters, M. A.
Webb, B. L.
Welch, J. P.
White, H. G.
Wieder, J. W., Jr.
Williams, P. A.
Zory, P. B.

ASSOCIATES

Alff, G. N.
Anderson, D. R.
Andler, J. A.
Angell, C. M.
Arata, D. A.
Barnes, G. R.
Bellinghausen, G. F.
Berry, C. H.
Briere, R. S.
Brubaker, R. E.
Carson, D. E. A.
Carter, E. J.
Childs, D. M.
Chorpita, F. M.
Cohen, H. S.
Collins, D. J.
Cooper, W. P.
Copestakes, A. D.
Covney, M. D.
Crow, P. J.
Curley, J. O.
Daino, R. A.
Davis, G. E.
Davis, R. D.
Fallquist, R. J.
Fasking, D. D.
Fein, R. I.
Feldman, M. F.
Flack, P. R.
Foley, C. D.
Franklin, N. M.
Fusco, M.
Gallagher, T. L.
Garand, C. P.
Godbold, M. E.
Godbold, N. T.
Goldberg, S. F.
Gossrow, R. W.
Grippa, A. J.
Gruber, C.
Head, T. F.
Herzfeld, J.

Hoylman, D. J.
Inderbitzin, P. H.
Ingco, A. M.
Jensen, J. P.
Jerabek, G. J.
Jones, D. R.
Kaliski, A. E.
Kaur, A. F.
Kayton, H. H.
Kelly, A. E.
Knaus, C. B.
Kollar, J. J.
Kolodziej, T. M.
Krause, G. A.
Lehman, M. R.
Lis, R. S., Jr.
Martin, P. A.
Marks, R. N.
Miller, D. L.
Miller, P. D.
Millman, N. L.
Mokros, B. F.
Moller, K. G., Jr.
Moore, B. C.
Napierski, J. D.
Neis, A. R.
Ori, K. R.
Ostrowski, E. M.
Pagnozzi, R. D.
Palm, R. G.
Pearl, M. B.
Petit, C. I.
Petlick, S.
Plunkett, J. A.
Potok, C. M.
Powell, D. S.
Quirin, A. J.
Ratnaswamy, R.
Renze, D. E.
Reynolds, J. D.
Rice, M. V.
Rosenberg, S.
Schultz, J. J., III
Schumi, J. R.
Shoop, E. C.
Singer, P. E.
Spitzer, C. R.
Squires, S. R.
Stanard, J. N.
Steeneck, L. R.
Stein, J. B.
Streff, J. P.
Swift, J. A.
Swisher, J. W., Jr.
Tatge, R. L.
Taylor, J. C.
Thompson, E. G.
Torgrimson, D. A.
Tverberg, G. E.
Van Slyke, O. E.
Wade, R. C.
Walters, M. A.
Warthen, T. V., Jr.
Weiner, J. S.
Winter, A. E.
Young, E. W.
Young, R. J., Jr.
Zelenko, D. A.
Ziock, R. W.
Zubulake, T. J.

GUESTS

Adams, M. H.
Armstrong, C. P.
*Armstrong, S. H.
Butcher, R. W.
Coe, L. D.
Davies, B.
Ensley, G. H.
FitzHerbert, R.
*Gamble, R. A.
*Griffith, R. W.
Gring, W. V.
*Hatfield, B. D.
Kellogg, T.
Lommele, J.
Lyon, A. C.
McCullough, R. C.
McSherry, H.
O'Neil, J. E.
Robbins, E. L.
Roland, W. P.
Seiffertt, B.
*Trafton, M.
Trescott, H.
Turner, S.
Walker, P. B.

*Invitational Program

Respectfully submitted,

Robert B. Foster
Secretary

REPORT OF THE SECRETARY

The past twelve months have been busy ones for the Board of Directors and the various committees. As anticipated, the Casualty Actuarial Society continues to grow at a brisk pace. From the November 1973 and May 1974 examinations we gained a total of 73 new Associates and 17 new Fellows (with one person showing up in both categories). This November we had 1,306 persons sign up for the exams, 143 more than a year ago. Interest in the CAS has increased not only in the United States but in other countries as well, as we continue to receive requests for information about the requirements for membership in our Society from people around the world.

Highlights of the year:

The inauguration of *The Actuarial Review* which has improved membership communications greatly and for which Editor Matthew Rodermund is to be congratulated.

The establishing of separate physical headquarters at 200 East 42nd Street for the Secretary-Treasurer's office and the consolidation of the library in the office which represent a big step forward for the Society. The members should feel free to visit the CAS office and to meet Edith Morabito, who is in charge of the office, and her assistants Mrs. Carol Olszewski and Frank Kugel.

The constitutional changes which established the separate offices of Secretary and Treasurer and provided for the waiver of dues for retired members at the age of 62. Walter Fitzgibbon has served very well as Assistant to the Secretary-Treasurer and a smooth transition is assured in implementing the establishment of the separate office of Treasurer. Changing the qualifying age for waiver of dues keeps our Society up to date and in agreement with the Bylaws of the American Academy.

President Liscord presented a silver tray as a gift from the CAS to the Society of Actuaries at its 25th anniversary meeting.

During 1974 the Board of Directors met on the following dates:

February 28-March 1 at the Hilton Inn, Atlanta, Georgia.

May 19 at the El Conquistador Hotel & Club, Las Croabas, Fajardo, Puerto Rico.

September 12-13 at Williamsburg Lodge, Williamsburg, Virginia.
November 17 at the Marriott Hotel, New Orleans, Louisiana.

Highlights of the actions taken by the Board of Directors:

1. A Member-Guest Policy was approved which for the first time allows members to bring guests to our meetings. Details of the Member-Guest Policy have been publicized in *The Actuarial Review* and will be printed in future editions of the *Yearbook*.

2. Two levels of membership in the Casualty Actuarial Society were reaffirmed. This represents the culmination of several years of deliberation by the Board. The deliberation included consideration of an experience requirement, the possibility of a pre-Associateship level and even the elimination of the conferring of Associateship in the future. The transition period to seven examinations as the requirement for Associateship stands as originally approved in conjunction with the introduction of the new Syllabus. It is hoped this will meet the demand to insure that Associates have had adequate experience and also that it will encourage a greater proportion of Associates to become Fellows. As part of the new program, Associateship diplomas are being eliminated after next May's meeting. Taking the place of the diploma will be a letter of official notification from the President. Recognition is also to be given to those students who register for an exam under the new syllabus and who have passed four or more examinations. A list of these students will be published in the *Yearbook*.

3. Individual chapters of the CAS textbook are to be published. Two chapters will become available for inclusion in the new syllabus so that students will not have to wait until the whole book is ready for publication.

4. ASTIN has been invited to hold a meeting in the United States in May 1977. ASTIN will meet with us in Washington and then remain for its own meeting.

5. An Actuarial Research Conference in 1975 to be co-sponsored with the Society of Actuaries was approved.

6. A Long Range Planning Committee is to be charged with taking the long view to see where we should be heading in this period of rapid expansion in membership.

7. Based on the membership survey conducted by the Committee on Professional Conduct the Board approved a recommendation that

the Opinions on Professional Conduct be published along with the Guides to Professional Conduct in the *Yearbook*.

8. New Opinion CAS-5 "Qualifications to Give Advice" was approved for inclusion in the Opinions on Professional Conduct.

9. The Board approved holding the Fall 1977 meeting in Bermuda.

10. Changes in examination procedures were approved. The first provides for private notification of examination results. The second change permits late registration for an examination for a fifteen-day period subject to an additional charge of $50.00 per part.

I wish to close this report by expressing my thanks to Walter Fitzgibbon, Assistant to the Secretary-Treasurer, for handling the financial chores and for his ready willingness to lend a hand whenever needed, Edith Morabito under whose direction all of the routine matters of the Society are capably taken care of, and Harriet Massicotte who, as my secretary, has shared a major portion of the Secretary-Treasurer's work.

Respectfully submitted,

Robert B. Foster
Secretary

REPORT OF THE TREASURER

The audited financial statement for the fiscal year ended September 30, 1974 showed assets of $133,529.86, an increase of $25,857.33 for the year. Approximately $19,000 of this amount was the result of deferring a printing charge to the new fiscal year when the bill for printing the *Proceedings* and *Yearbook* will be received.

During the past year, we have taken advantage of the high interest rates available on U. S. Treasury bills and have made this our primary investment type. The rates at which we were able to invest funds ranged from a low of 7.5% to a high of 9.0%.

The budget approved by the Board continues dues at the current level. Associates of five or more years and Fellows pay $60.00. Associates less than five years pay $40.00 while members residing outside the U.S. and Canada pay $30.00. Retired members, aged 62 or more, pay no dues.

The budget reflects substantial increases in costs associated with the Secretary's office including various printing expenses. During the past year, the CAS secretarial staff and records in New York moved into their own self-contained office. Some of the projected cost increase reflects the fact that space is no longer shared. Also for the first time our library is now housed in the same office space as our records.

Because of the increase in assets of the Society the surety bond limit if being increased for the second year in a row, this time from $125,000 to $150,000.

I am grateful for the excellent job done by Walt Fitzgibbon in his capacity as assistant to the Secretary-Treasurer and I would like to communicate my confidence that the transition to the separate offices of Secretary and Treasurer will be made with a minimum of confusion and to the ultimate benefit of the Society.

Respectfully submitted,

Robert B. Foster
Treasurer

FINANCIAL REPORT

Income and Disbursements (from October 1, 1973 through September 30, 1974)

Income		Disbursements	
Dues	$24,179.75	Printing & Stationery	$ 6,415.34
Examination Fees	37,721.50	Secretary's Office	24,487.00
Meetings & Registration Fees	20,391.13	Examination Expense	20,816.18
Sale of Proceedings	5,874.50	Meeting Expense	19,332.63
Sale of Readings	1,400.58	Library	255.24
Invitational Program	2,175.00	Math. Assoc. of America	1,500.00
Michelbacher Royalties	1,094.52	Insurance	520.00
Interest	6,999.19	Prizes	400.00
Misc.	36.11	Misc.	288.56
Total	$99,872.28	Total	$74,014.95

Assets

As of 9/30/73		As of 9/30/74		Change
Checking Accounts	$ 521.09	Checking Accounts	$ 304.39	$ −216.70
Savings Accounts	95,845.19	Savings Accounts	39,680.57	−56,164.62
Investments	11,306.25	Investments	93,544.90	82,238.65
	$107,672.53		$133,529.90	$25,857.33

Investments

U.S.A. Treasury Bonds	Cost
Due 11/15/74	$ 2,000.00
Due 2/15/75	4,981.25
Due 2/15/80	4,325.00
Treasury Bills	
Due 10/10/74	23,939.25
Due 11/ 7/74	19,124.40
Due 11/ 7/74	39,175.00
Total Investments	$93,544.90

* * * * * *

This statement reflects the deferral to next year of a printing bill estimated at $19,000.

This is to certify that we have audited the accounts and the assets shown above and find same to be correct.

Finance Committee:

Steven H. Newman, *Chairman*
David G. Hartman
Richard D. McClure
Stephen L. Perreault

1974 EXAMINATIONS SUCCESSFUL CANDIDATES

Examinations for Parts 3, 5, 7 and 9 of the Casualty Actuarial Society syllabus were held May 9 and 10, 1974 and examinations for Parts 3, 4, 6, 8 and 9 were held November 7 and 8, 1974. Parts 1 and 2, jointly sponsored by the Casualty Actuarial Society and the Society of Actuaries were given May 16 and November 14. Those who passed Parts 1 and 2 were listed in the joint release of the two Societies dated July 12, 1974 and January 10, 1975.

The following candidates successfully completed the requirements for Fellowship and Asociateship in the November 1973 examinations and were awarded their diplomas at the May 1974 meeting:

NEW FELLOWS

Conners, John B.
Inkrott, James G.
Kaufman, Allan M.
Klein, David M.
McClenahan, Charles L.
Price, Edith E.
Retterath, Ronald C.
Woll, Richard G.

NEW ASOCIATES

Alfuth, Terry J.
Barrette, Raymond
Bartlett, William N.
Creasey, Frank C., Jr.
DeGarmo, Lyle W.
Foley, Charles D.
Goldberg, Steven F.
Gottlieb, Loen R.
Groot, Steven L.
Keene, Vicki S.
Klein, David M.
Moore, Brian C.
Ziock, Richard W.

MAY 1974 EXAMINATIONS

Following is a list of successful candidates in the examinations held in May 1974:

FELLOWSHIP EXAMINATIONS

Part 7

Barrette, Raymond
Bartlett, William N.
Bethel, Neil A.
Blivess, Michael P.
Bovard, Roger W.
Bryan, Charles A.
D'Arcy, Stephen P.
Dickson, Jeffrey J.
Dieter, George H.
Evans, Dale M.
Fallquist, Richard J.
Fisher, Wayne H.
Fusco, Michael
Gossrow, Robert W.
Gottlieb, Leon R.
Groot, Steven L.
Jaeger, Richard M.
Kollar, John J.
Kreuzer, James H.
Leonard, Gregory E.
Lis, Raymond S., Jr.
Nolan, John D.
Potvin, Robert
Powell, David S.
Radach, Floyd R.
Schultz, John J., III
Tverberg, Gail E.

Part 9

Balko, Karen H.
Berry, Charles H.
Bethel, Neil A.
Bradshaw, John G.
Bryan, Charles A.
Carter, Edward J.
D'Arcy, Stephen P.
Engel, Philip L.
Finger, Robert J.
Golz, James F.
Graves, Janet S.
Hardy, Howard R.
Haseltine, Douglas S.
Kayton, Howard H.
Kuehn, Ronald T.
Lamb, R. Michael
Lester, Edward P.
Mohl, F. James
Pagnozzi, Richard D.
Sheppard, Alan R.
Spitzer, C. Robert
Taht, Veljo
Tatge, Robert L.

ASSOCIATESHIP EXAMINATIONS

Part 3

Abrams, Paul T.
Aldorisio, Robert P.
Allaire, Marc
Almer, Monte
Andrus, William R.
Barnes, Galen R.
Barrow, Betty L.
Bayley, Thomas R.
Bealer, Donald A.
Beer, Albert J.
Benjamin, Paul J.
Berard, Johanne
Beverage, Richard M.
Billings, Ralph A.
Bishop, Everett G.
Braia, Ronald V.
Brubaker, Randall E.
Cassity, Howard E.
Chen, Mei C.
Childs, Diana M.
Chorvat, Jan A.
Christiansen, Stephen L.
Chung, Karl K.
Cloutier, Guy
Cohen, Elliot J.
Crifo, Daniel A.
Curley, James O.
Diamantoukos, Christopher
Dinkins, William R.
Dolan, Michael C.
Dorval, Bernard
Ducharme, Clement F.
Ducharme, Louis
Duperrault, Brian
Einck, Nancy R.
Eland, Douglas D.
Eldridge, Donald J.
Eramo, Robert P.
Ernst, Richard C.
Ferland, George A.
Fiebrink, Mark E.
Galiley, Bernard J.
Garand, Christopher P.
Georges, Michael P., Jr.
Glasser, Mark S.
Goddard, Daniel C.
Graham, Timothy L.
Grant, Gary
Gruber, Charles
Hansen, Robert C.
Hartz, Melvin L.
Heller, David M.
Henkes, Joseph P.
Herman, Steven C.
Herzfeld, John
Hesselbacher, Robert W.
Hobart, Gary P.
Hurley, James D.
Javaruski, John J.
Johnson, Larry D.
Johnston, Daniel J.
Judd, Steven W.
Kenney, James A.
Kist, Frederick O.
Knaus, Charles B.
Konopa, Milan E.
Kopan, Irene R.
Lafontaine, Gaetane
Landry, Jean-Yves
Lattanzio, Francis J.
Lindquist, Peter L.
Lino, Richard A.
Livingston, Roy P.
Marker, Joseph O.
Martel, Renaud
Matson, Anne B.
McAllister, Kevin
McDaniel, Gail D.

McManus, Michael F.
McMurray, Michael A.
Meeks, John M.
Miccolis, Robert S.
Mikhail, Raouf G.
Miyao, Stanley K.
Moller, Karl G., Jr.
Morell, Roy K.
Morgan, Stephen T.
Morin, Jean-Jacques
Murad, Aram
Murphy, Francis X., Jr.
Murphy, Richard F.
Nelson, Janet R.
Newlin, Patrick R.
Nishio, Jo Anne
O'Brien, Terrence M.
Ostrowski, Ellen M.
Patrik, Gary S.
Patterson, David M.
Pepin, Marcel
Perron, Claude
Petersen, Bruce A.
Petit, Charles I.
Petrelli, Joseph L.
Pflum, Roberta J.
Piazza, Richard N.
Polagye, Karen C.
Poris, Michael J.
Potter, John A.
Pouliot, Lucien
Racansky, Linda M.
Reynolds, John J., III
Richter, James G.
Roach, Robert F.
Rodgers, Beatrice T.
Roman, Spencer M.
Rosenberg, Martin
Ross, Paul D.
Rowland, William J.
Rush, Mary L.
Scattergood, Elizabeth
Schneider, Harold N.
Schumi, Joseph R.
Seiffertt, Barbara A.
Shatoff, Larry D.
Shepley, Robert J.
Sherman, Richard E.
Smith, Frances A.
Squires, Sanford R.
Stanard, James N.
Steer, Grant D.
Stone, James M.
Storbakken, Terrance E.
Stroud, Richard A.
Sun, Yuan
Surrago, James
Swisher, John W., Jr.
Theberge, Michel
Thorne, Joseph O.
Tobing, Diane
Tudor, Robert P. H.
Urschel, Frederick A.
Vallieres, Laurent
Van Domelen, James P.
Van Slyke, Oakley E.
Vaughan, Robert C.
Venter, Gary G.
Verville, Noel
Washs, Michael M.
Walther, Douglas L.
Wasserman, Forrest
Wilson, Doris S.
Wisecarver, Timothy W.
Young, R. James, Jr.
Zarnowski, James D.
Zatorski, Richard T.

Part 5

Alff, Gregory N.
Anderson, Dean R.
Angell, Charles M.
Arata, David A.
Barnes, Galen R.
Bellinghausen, Gary F.
Boison, LeRoy A.
Bradley, David M.
Brewer, Fred L.
Briere, Robert S.
Childs, Diana M.
Cis, Mark M.
Collins, Douglas J.
Costello, Jeanette R.
Covney, Michael D.
Crifo, Daniel A.
Crowe, Patrick J.
Dangelo, Charles H.
Davis, George E.
Davis, Rodney D.
Fasking, Dennis D.
Fein, Richard I.
Gallagher, Thomas L.
Garand, Christopher P.
Gerlach, Scott B.
Godbold, Mary Jo E.
Godbold, Nathan T.
Gutterman, Sam
Hafling, David N.
Haner, Walter J.
Hermes, Thomas M.
Herzfeld, John
Inderbitzin, Paul H.
Ingco, Aguedo M.
Jean, Ronald W.
Jerabek, Gerald J.

Johnson, Warren H., Jr.
Kaliski, Alan E.
Lehman, Merlin R.
Leimkuhler, Urban E.
Martin, Pamela A.
Masters, Peter A.
Miller, David L.
Moller, Karl G., Jr.
Neis, Allan R.
Newville, Benjamin S.
Ostrowski, Ellen M.
Palm, Robert G.
Pearl, Marc B.
Petlick, Steven
Plunkett, Richard C.
Potok, Charles M.
Priester, David C.
Quirin, Al J.
Renze, David E.
Reynolds, John D.
Rosen, Kenneth R.
Rosenberg, Sheldon
Schumi, Joseph R.
Song, Young B.
Squires, Sanford R.
Steeneck, Lee R.
Symonds, Donna R.
Taylor, Jane C.
Tremelling, Robert N., II
Van Slyke, Oakley E.
Warthen, Thomas V., Jr.
Weiner, Joel S.
Wright, Walter C., III
Yoder, Reginald C.
Young, R. James, Jr.
Zelenko, Dorothy A.
Zubulake, Theodore J.

As a result of the above examinations 9 new Fellows and 60 new Associates were admitted at the Annual Meeting, November 17, 1974:

NEW FELLOWS

Balko, Karen H.
Bradshaw, John F., Jr.
Bryan, Charles A.
Finger, Robert J.
Golz, James F.
Hardy, Howard R.
Haseltine, Douglas S.
Lester, Edward P.
Sheppard, Alan R.

NEW ASSOCIATES

Alff, Gregory N.
Anderson, Dean R.
Angell, Charles M.
Arata, David A.
Barnes, Galen R.
Bellinghausen, Gary F.
Briere, Robert S.
Brubaker, Randall E.
Childs, Diana M.
Collins, Douglas J.
Covney, Michael D.
Crowe, Patrick J.
Curley, James O.
Davis, George E.
Davis, Rodney D.
Fasking, Dennis D.
Fein, Richard I.
Gallagher, Thomas L.
Garand, Christopher P.
Godbold, Mary Jo E.
Godbold, Nathan T.
Grippa, Anthony J.
Gruber, Charles
Herzfeld, John
Inderbitzin, Paul H.
Ingco, Aguedo M.
Jean, Ronald W.
Jerabek, Gerald J.
Kaliski, Alan E.
Knaus, Charles B.
Lehman, Merlin R.
Martin, Pamela A.
Miller, David L.
Moller, Karl G., Jr.
Neis, Allan R.
Ostrowski, Ellen M.
Palm, Robert G.
Pearl, Marc B.
Petit, Charles I.
Petlick, Steven
Potok, Charles M.
Quirin, Al J.
Renze, David E.
Reynolds, John D.
Rosenberg, Sheldon
Schumi, Joseph R.
Song, Young B.
Squires, Sanford R.

Stanard, James N.
Steeneck, Lee R.
Swisher, John W., Jr.
Taylor, Jane C.
Van Slyke, Oakley E.
Warthen, Thomas V., Jr.
Weiner, Joel S.
Wright, Walter C., III
Yoder, Reginald C.
Young, R. James, Jr.
Zelenko, Dorothy A.
Zubulake, Theodore J.

NOVEMBER 1974 EXAMINATIONS

The successful candidates in the November 1974 examinations were:

FELLOWSHIP EXAMINATIONS

Part 6

Anderson, Dean R.
Angell, Charles M.
Ashenberg, Wayne R.
Barnes, Galen R.
Bethel, Neil A.
Carbaugh, Albert B.
Dean, Charles E., Jr.
Einck, Nancy R.
Eland, Douglas D.
Fein, Richard I.
Fisher, Wayne H.
Goldberg, Steven F.
Gottlieb, Leon R.
Groot, Steven L.
Hemstead, Robert J.
Johnston, Daniel J.
Kaliski, Alan E.
Karlinski, Frank J.
Keene, Vicki S.
Kelly, Anne E.
Lamb, R. Michael
Lino, Richard A.
Marker, Joseph O.
Miller, David L.
Miller, Philip D.
Nelson, Janet R.
Palczynski, Richard W.
Petersen, Bruce A.
Reynolds, John J., III
Rosenberg, Sheldon
Schumi, Joseph R.
Steeneck, Lee R.
Stone, James M.
Taht, Veljo
Wood, James O.
Yoder, Reginald C.
Young, R. James, Jr.
Zubulake, Theodore J.

Part 8

Arata, David A.
Berry, Charles H.
Crowe, Patrick J.
Curley, James O.
D'Arcy, Stephen P.
Davis, George E.
Donaldson, John P.
Eddy, Jeanne H.
Graves, Janet S.
Leonard, Gregory E.
Pagnozzi, Richard D.
Radach, Floyd R.
Swisher, John W., Jr.
Weller, Alfred O.

Part 9

Anderson, Dean R.
Biondi, Richard S.
Bovard, Roger W.
Brouillette, Yves J.
Dieter, George H., Jr.
Drennan, John P.
Fusco, Michael
Grippa, Anthony J.
Jaeger, Richard M.
Kollar, John J.
Kreuzer, James H.
Moore, Phillip S.
Stanard, James N.
Tverberg, Gail E.
Wood, James O.
Zelenko, Dorothy A.

ASSOCIATESHIP EXAMINATIONS

Part 3

Applequist, Virgil H.
Asch, Nolan E.
Balchunas, Anthony J.
Bartlett, John W.
Beversdorf, William R.
Bradley, David R.
Brahmer, John O.
Brown, Andrew F., Jr.
Carpenter, James G.
Christhilf, David A.
Clark, David G.
Cohen, Arthur I.
Connor, Vincent P.
Corr, Francis X.
Counihan, Kevin P.
Covitz, Burton
Currie, Ross A.
Egnasko, Gary J.
Elia, Dominick A.
Fisher, Russell S.
Flaherty, Morgan P.
Flanagan, Terrence A.
Gaillard, Mary B.
Gidos, Peter M.
Grannan, Patrick J.
Gwynn, Holmes M.
Hanover, Richard F.
Heagen, Martin G.
Heitt, Maurice
Hine, Cecily A.
Johnson, Marvin F.
Joncas, Philippe S.
Kleinberg, James J.
Koerber, Alan J.
Leimkuhler, Urban E.
Leo, Carl J.
Llewellyn, Barry I.
Lommele, Jan A.
Lowe, Stephen P.
Masters, Peter A.
McHugh, Ronald J.
McLaughlin, Louise
Merves, Brian B.
Meyer, Robert E.
Moorehead, Donald F., Jr.
Murphy, Edward J., Jr.
Natches, Peter D.
Neuhauser, Frank, Jr.
Newville, Benjamin S.
Niemann, James J.
Occi, Peter A.
O'Rorke, Edward J.
O'Sullivan, Deirdre I.
Padlan, Feliciano A., Jr.
Pulis, Ralph S.
Ragan, Evelyn T. M.
Richman, Randy
Roth, Richard J., Jr.
Rowland, Vincent T.
Sczech, James R.
Shayer, Natalie
Sikoscow, Joanne C.
Smith, Byron W.
Spinella, Joseph J.
Stetler, Donald E.
Strickoff, Carol L.
Thibault, Alain
Tierstein, Michael N.
Tong, Alfred E.
Valenti, Anthony T.
Vogel, Jerome F.
Vuong, Shio-Yen L.
Waldman, Robert H.
White, Frank T.
Wilson, William F.

Part 4

Adams, Galen H.
Anderson, Robert C.
Aurora, Salvatore
Barrow, Betty L.
Billings, Ralph A.
Brahmer, John O.
Brewer, Fred L.
Carollo, Linda D.
Casey, Doreen S.
Christiansen, Stephen L.
Counihan, Keven P.
Crifo, Daniel A.
Dahlquist, Ronald A.
Dangelo, Charles H.
Diamantoukos, Christopher
Dinkins, William R.
Dolan, Michael C.
Dorval, Bernard
Duperreault, Brian
Eldridge, Paul A.
Elia, Dominick A.
Ernst, Richard C.
Fagan, Janet L.
Fiebrink, Mark E.
Fuhrmann, Curt L.
Gersie, Michael H.
Guintoli, Philip J.
Grant, Gary
Gunyan, Donald J.
Gutterman, Sam
Henkes, Joseph P.
Hobart, Gary P.
Hurley, James D.
Johnson, Warren H., Jr.
Kenney, James A.
King, Kerry K.

Kleinberg, James J.
Konopa, Milan E.
Kopan, Irene R.
Kozik, Thomas J.
Laing, Richard H.
Lattanzio, Francis J.
Lattanzio, Stephen P.
Ledbetter, Alan R.
Lehmann, Steven G.
Maher, Mary A.
Mansur, Joseph M.
McCarter, Michael G.
McConnell, Douglas M.
McManus, Michael F.
Mill, Dennis C.
Moore, Bruce D.
Murad, Aram
Murphy, Francis X., Jr.
Murphy, Richard F.
Murphy, Thomas M.
Newlin, Patrick R.
Nickerson, Gary V.
O'Brien, Terrence M.
Pagliaccio, John A.
Patrick, Gary S.
Peterson, Arthur J.
Pflum, Roberta J.
Pierce, John
Plunkett, Richard C.
Purple, John M.
Racansky, Linda M.
Rodgers, Beatrice T.
Roland, William P.
Rosen, Kenneth R.
Rosenberg, Martin
Roth, Richard J., Jr.
Ryan, John F.
Shatoff, Larry D.
Shrum, Roy G.
Smith, Frances A.
Stenmark, John A.
Sutton, Thomas C.
Symonds, Donna R.
Thorne, Joseph O.
Tierney, John P.
Vaughan, Robert C.
Wasserman, Forrest
Weaver, James C.
Wickwire, James D., Jr.
Wiegert, Paul M.
Wiser, Ronald F.

Eleven candidates for Fellowship and 16 candidates for Associateship completed their requirements in the above examinations and will, upon approval of the Board of Directors, be admitted at the Spring Meeting in 1975:

NEW FELLOWS

Berry, Charles H.
Bethel, Neil A.
D'Arcy, Stephen P.
Dieter, George H., Jr.
Drennan, John P.
Graves, Janet S.
Lamb, R. Michael
Miller, Philip D.
Moore, Phillip S.
Pagnozzi, Richard D.
Tverberg, Gail E.

NEW ASSOCIATES

Bradley, David R.
Brewer, Fred L.
Covitz, Burton
Dangelo, Charles H.
Ernst, Richard C.
Gutterman, Sam
Hafling, David N.
Leimkuhler, Urban E.
Masters, Peter A.
McHugh, Ronald J.
McManus, Michael F.
Newville, Benjamin S.
Plunkett, Richard C.
Rosen, Kenneth R.
Symonds, Donna R.
Vogel, Jerome F.

NEW ASSOCIATES ADMITTED MAY 1974: Seated left to right: Steven F. Goldberg, Lyle W. DeGarmo, William N. Bartlett, Vicki S. Keene, President Paul S. Liscord, Terry J. Alfuth, Brian C. Moore. Standing left to right: Steven L. Groot, Charles D. Foley, Richard W. Ziock, Raymond Barrette, Leon R. Gottlieb. Absent from the picture: Frank C. Creasey, David M. Klein.

NEW FELLOWS ADMITTED MAY 1974: Left to right: Richard G. Woll, James G. Inkrott, Ronald C. Retterath, Edith E. Price, President Paul S. Liscord, Allan M. Kaufman, John B. Conners, Charles L. McClenahan. Absent from the picture: David M. Klein.

NEW ASSOCIATES ADMITTED NOVEMBER 1974: Seated left to right: David E. Renze, David A. Arata, Randall E. Brubaker, Karl G. Moller, Jr., Anthony J. Grippa, Paul H. Inderbitzin, Pamela A. Martin, outgoing President Paul S. Liscord, Dorothy A. Zelenko, Gary F. Bellinghausen, Theodore J. Zubulake, Joel S. Weiner, Charles I. Petit, R. James Young, Jr., Sheldon Rosenberg, Albert J. Quirin.

Standing left to right, second row:
Marc B. Pearl, Nathan T. Godbold, Mary Jo E. Godbold, Diana M. Childs, Christopher P. Garand, Dean R. Anderson, James O. Curley, Thomas L. Gallagher, Oakley E. Van Slyke, David L. Miller, Charles M. Potok, Ellen M. Ostrowski, Jane C. Taylor, Charles M. Angell, Rodney D. Davis.

Standing left to right, third row:
Joseph R. Schumi, Dennis D. Fasking, George E. Davis, Richard I. Fein, Michael D. Covney, Douglas J. Collins, Patrick J. Crowe, Robert G. Palm, Gregory N. Alff, Thomas V. Warthen III, Lee R. Steeneck, Sanford R. Squires.

Standing left to right, top row:
Galen R. Barnes, Aguedo M. Ingco, Alan F. Kaliski, Steven A. Petlick, Allan R. Neis, Charges B. Knaus, Charles Gruber, James N. Stanard, Robert S. Briere, Gerald J. Jerabek, Merlin R. Lehman, Walter C. Wright III, John W. Swisher, John Herzfeld.

Absent from the picture are:
Ronald W. Jean, John D. Reynolds, Young B. Song, Reginald C. Yoder.

NEW FELLOWS ADMITTED NOVEMBER 1974: Left to right: Edward P. Lester, Robert J. Finger, Charles A. Bryan, Douglas S. Haseltine, James F. Golz, outgoing President Paul S. Liscord, John G. Bradshaw, Jr., Karen H. Balko, Howard R. Hardy.

OBITUARIES

RICHARD H. BUTLER

OLIVER D. DICKERSON

JOHN EDWARDS

JACOB MALMUTH

GUSTAV F. MICHELBACHER

GEORGE I. SHAPIRO

RICHARD H. BUTLER

1909-1974

Richard H. Butler, an Associate of the Casualty Actuarial Society since 1959, died on July 15, 1974 in Greenfield, Massachusetts at the age of 65.

Born September 29, 1909 in West Hartford, Connecticut, he graduated with a Bachelor of Arts degree from Yale University in 1931, and joined the Travelers Insurance Companies where he spent his insurance career. He was named Assistant Secretary of the Compensation and Liability Department in 1945, Secretary in 1956 and Second Vice President in 1964. In the late 1950's he was active in the development of insurance for nuclear energy operations and submitted a paper entitled, "Liability Insurance for the Nuclear Energy Hazard" which was published in the *Proceedings*.

Richard Butler was a perceptive, concerned and very caring man. He was unusually perceptive about his total environment, which was apparent in his great knowledge of animals, birds, fish, trees and weather; he was concerned about the balance of nature and man long before the word "ecology" became popular; he cared about all living creatures and the earth.

Mr. Butler leaves his wife, Elizabeth N. Butler; four sons, John N. Butler, Richard L. Butler, Robert G. Butler and Henry W. Butler; a brother, James G. Butler; a sister, Mrs. L. Edmund Zacher and five grandchildren.

OLIVER DONALD DICKERSON, JR.

1925-1974

O. D. Dickerson, Jr., Professor Emeritus at Florida State University, died of emphysema in Tallahassee, Florida on February 28, 1974. Insurance has lost one of its most outstanding scholars and advocates, though his influence will undoubtedly continue to be felt for years.

Don, as he preferred to be known, had a distinguished career in the insurance business that began when he affiliated with a major life insurance company as an agent while carrying on his studies in the Wharton Graduate Division, University of Pennsylvania, from which he received a Bachelor's Degree in Economics (1948), a Master of Business Administration (1951), and a Doctor of Philosophy Degree (1957).

He had three separate professions: educator, author-editor, and actuary. He joined Florida State's faculty in 1957 as Professor of Risk and Insurance until failing health forced him to retire in 1972. He published many outstanding articles on insurance theory and practice and became a recognized expert on health insurance and social security. His book *Health Insurance* was the first college text in that field.

Dr. Dickerson was also a consulting actuary, primarily in health and life insurance. He became a Fellow of the Casualty Actuarial Society in 1960. He also attained both the Chartered Life Underwriter and Chartered Property and Casualty Underwriter designations. He was a Director of Provident Indemnity Life Insurance Company in which he held a life long interest, being the grandson of one of the founders.

Don is survived by his wife, Barbara, and one son, Oliver D. Dickerson, III.

JOHN EDWARDS

1899-1974

John Edwards, a Fellow of the Casualty Acturial Society Since 1933, died on January 21, 1974, Born in Lancashire, England in 1899, he emigrated to Canada with his parents at an early age.

On completion of secondary school studies in Toronto, he briefly joined the staff of the Dominion of Canada General Insurance Company, leaving that company to become a staff officer of a new insurer having organizational problems. His photographic memory and mathematical skill in this position led to early recognition by the then-Superintendent of Insurance of the Province of Ontario, who prevailed upon him to join the Insurance Department staff in the early 1930's.

In addition to his CAS Fellowship, Mr. Edwards also held accounting degrees with the Certified Public Accountants Association and the Certified General Accountants Association in Canada, and was also awarded two British accounting degrees.

For many years he served as the Assistant Secretary and Treasurer of the Association of Superintendents of Insurance of the Provinces of Canada and, in that capacity, probably knew personally and was known by more senior insurance personnel in Canada and the United States than any other Canadian insurance supervisory official.

Mr. Edwards was an ardent fisherman and traveler by sea. During his retirement he lived in Britain for a year, staying in Wales and traveling on the continent.

JACOB MALMUTH

1900-1974

Jacob Malmuth, an Associate of the Casualty Actuarial Society since 1925, died on July 26, 1974. Born in New York City on December 20, 1900, he was a graduate of New York University, with the degree of Bachelor of Commercial Science, and also a graduate of the Brooklyn Law School. In addition to his membership in the Casualty Actuarial Society, he was a member of the New York State Bar Association.

In 1920 Mr. Malmuth joined the New York Insurance Department, where he became an Examiner in 1922. During his career with the Insurance Department, he served as President of the Association of New York State Insurance Department Examiners. He was appointed Chief of the Department's Rating Bureau in 1960, a position he held until his retirement in 1970.

Mr. Malmuth is survived by his wife, Selma, his three sons, Norman, Bruce and David, and his daughter, Gail.

GUSTAV F. MICHELBACHER

1891-1974

On May 9, 1974 Gustav F. Michelbacher, a charter member and former president of the Casualty Actuarial Society in 1924 and 1925, died at the age of 83 at the home of his daughter in Saratoga, California.

"Gus" was the last, and the youngest, of the pioneers who guided the casualty insurance industry through the formidable, and previously unknown, maze of problems which arose as a result of the enactment in this country of workmen's compensation legislation providing for mandatory insurance and rate regulation.

A graduate of the University of California, he joined the National Workmen's Compensation Service Bureau as statistician in 1915; and served as actuary from 1917 to 1920. When the National Council on Compensation Insurance was organized in 1919 he also served as chairman of that organization's General Rating Committee which was then struggling with the problems of industry classification. In 1920 he joined the National Council on Compensation Insurance as secretary. With the creation of the National Bureau of Casualty and Surety Underwriters he joined that organization in 1921 as secretary-treasurer.

Evidence of his intensive work in the early days of workmen's compensation insurance will be found in the first seven volumes of the *Proceedings* which include papers by him on schedule rating, experience rating, law differentials, ratemaking technique, and the rating of permanent disabilities.

His service as secretary-treasurer of the National Bureau of Casualty and Surety Underwriters brought him in contact with all lines of casualty insurance and included the development of the Acquisition Cost Conference of the Casualty companies. Throughout this period he was most active in the affairs and conduct of the Casualty Actuarial Society. His interest in the Society is further evidenced by his having assigned to it the royalties from his book ***Workmen's Compensation*** (written in conjunction with Mr. T. M. Nial) which has enriched the Society by some $25,000.

In 1926 he joined the Great American Indemnity Company, a newly organized affiliate of the Great American Insurance Company, as vice president and secretary; a post he held until 1947 when he was made president of the company. In 1958 he retired to his native state of California.

"Gus" was an eager student of the business a sincere man with a keen mind; somewhat reserved but an earnest and outspoken advocate of his beliefs.

GEORGE I. SHAPIRO

1896-1974

George I. Shapiro, a Fellow of the Casualty Actuarial Society since 1937, died July 10, 1974 at the age of 78.

Mr. Shapiro began his insurance career by accepting a temporary assignment with the New York State Insurance Department in 1931. He eventually left in 1939 as a Senior Insurance Claims Examiner. After leaving the New York State Insurance Department he joined the Public Service Mutual where he served as Executive Vice President and General Manager. Upon leaving Public Service Mutual in 1949, he went to work for the American Jewish Congress. He was Director of Administration from 1949-1967 and in that capacity combined the duties of Personnel Director for the National office, General Supervisor of the National headquarters and performed the functions of Comptroller. He also acted as Field Auditor and Systems Supervisor in connection with the several branch offices of the Congress. He retired in May 1967 and was retained as a part-time consultant until December 1973.

Mr. Shapiro was a graduate of the College of the City of New York where he received his Bachelor's Degree in Science. He served overseas during World War I and returned to receive his M.S. in Education after completing additional work at City College, Columbia and New York University. He was a licensed teacher of mathematics in the public high schools and was invited to teach Insurance Accounting Principles and Practices at Pace College.

Mr. Shapiro was certified as having passed the New York State examinations for Certified Public Accountant and was a member of the International Congress of Mathematicians and the American Academy of Actuaries.

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