TITLE: AN ANALYSIS OF RETROSPECTIVE RATING

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I. INTRODUCTION

The purpose of this paper is to address the following question. Should the present retrospective rating formula be modified to account for the claim severity of the risk being insured, and for the loss limit chosen for the plan? It will be shown that there are significant differences in premium adequacy that can attributed to the above mentioned factors. Alternatives to the present formula will be proposed.

The Present Retrospective Rating Formula

The premium for an insured written under a retrospective rating plan is given by the following formula. This formula is generally used in Workers' Compensation insurance.

$$R = [\ (P \times b) + (P \times c \times e) + (c \times A)\ ] \times t$$

subject to a minimum of $h \times P$ and a maximum of $g \times P$.

Where:

R = Retrospective Premium,

P = Standard Premium,

b = Basic Premium Factor,

c = Loss Conversion Factor,

e = Excess Loss Premium Factor,

A = Actual Limited Losses,

t = Tax Multiplier,

h = Minimum Premium Factor and

g = Maximum Premium Factor.

In some plans, losses arising out of a single accident are limited to a specified amount before entering the retrospective premium calculation. The excess loss premium factor provides for the cost of this loss limit.

The basic premium factor can be written as follows:

$$b = a + (c \times i).$$

The factor a provides for acquisition expenses, general underwriting expenses and profit. The factor i is called the insurance charge. This factor provides for the net cost of limiting the retrospective premium between the minimum and maximum premiums.

The standard formula for calculating the insurance charge does not take into account the claim severity distribution of the individual insured, nor does it take into account the loss limit selected for the plan.[1] In other words, the insurance charge, as calculated by the standard formula, will be the same no matter what claim severity distribution applies to the insured, or what loss limit is used.

The loss experience will be more volatile for a high severity, low frequency insured than for a low severity, high frequency insured. Since a high severity, low frequency insured will "break the maximum" more often, he should have a higher insurance charge than an otherwise comparable low severity, high frequency insured.

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1. National Council of Compensation Insurance, Retrospective Rating Plan D

The insurance charge includes a provision for the portion of the losses which exceed any potential loss limit. But, in a plan which has a loss limit, these losses are provided for by the excess loss premium factor. Thus, a plan with a loss limit should have a lower insurance charge than a plan with no loss limit.

It has long been recognized that these factors can significantly affect the adequacy of the retrospective premium. Perhaps the main reason the rating formula has not been modified is that it would involve making an already complex rating formula even more complex. According to one account, it could require 200,000 pages of tables to properly calculate the insurance charge.[2]

Another problem is inherent in the way data has been gathered under the present formula. The distribution of loss ratios is tabulated by direct observation. This allows one observation per insured each year. If one were to create categories of insureds and tabulate the experience for each of the categories, he might well find that the experience is not credible.

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2. An excellent discussion of these issues can be found in "The California Table L", PCAS LXI, by David Skurnick, and the ensuing discussions by Frank Harwayne and Richard H. Snader.

The general approach taken by this paper will be to build a mathematical model of the loss process. This model will be used to generate annual losses for different kinds of insureds. We will then quantify differences in premium adequacy that can be attributed to the factors mentioned above. Next we will explore modifications to the current formula which can more adequately price a retrospective rating plan.

II. THE MODEL

The Generalized Poisson Distribution

The Generalized Poisson distribution will be used to model the loss process.[3] This model is based on the following assumptions.

1. The number of claims has a Poisson distribution.
2. Claim severity is independent of claim frequency.

Three claim severity distributions have been selected. These distributions will represent a standard insured, a high severity insured and a low severity insured. The distributions are given in Exhibit I. These distributions are hypothetical ones selected by the author.

The following information is needed to generate a distribution of annual losses: (1) the expected losses; (2) the claim severity distribution; and (3) the loss limit. Sample values for the distribution are calculated by the following steps.

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3. R. E. Beard, T. Pentikainen and E. Pesonen, Risk Theory, Chapman and Hall Ltd. (1977), Ch.3.

1. Calculate the average claim size from the claim severity distribution.
2. Calculate the parameter, λ , for the Poisson distribution.

$$\lambda = \frac{\text{Expected Losses}}{\text{Average Claim Size}}$$

3. For each sample do the following.
   - 3.1 Randomly select the number of claims, n, from the Poisson distribution.
   - 3.2 Do the following n times.
     - 3.2.1 Randomly select a claim amount from the claim severity distribution.
     - 3.2.2 Adjust the claim amount for the loss limit.
   - 3.3 The sample loss amount is the sum of all claim amounts generated by step 3.2.

The annual loss distributions used in this paper are "empirical" ones consisting of 10,000 samples.

The use of the Poisson distribution for the number of claims deserves some comment. The author chose this distribution because of its widespread use in the actuarial literature. The author has no evidence that the Poisson distribution is the most appropriate. However, if some other distribution is chosen, one should expect only a slight increase in the variance of the annual loss distribution.[4] Thus the results of this paper should hold even if this assumption is changed.

The major results of this paper will be based on the difference between insureds represented by the claim severity distributions in Exhibit I. No attempt has been made to fit this model to live data.

However, using Exhibits IIa and III, one can compare the results of this model with the present retrospective rating formula. Exhibit IIa provides the excess loss premium factors derived from the claim severity distributions in Exhibit I. Exhibit III gives the insurance charges calculated using the standard formula, and by a method (to be described below) using the claim severity distribution for the standard insured.

Adequacy of the Retrospective Premium

When given the parameters of the retrospective rating plan and the 10,000 loss samples generated by the model, it is possible to calculate the average retrospective premium generated by the plan. Similarly, one can calculate the average premium that would be generated by a "cost-plus" rating plan (i.e. a retrospective rating plan with no minimum or maximum premium). The premium for a "cost-plus" rating plan is given by the following formula:

$$CP = [\ (P \times a) + (P \times c \times e') + (c \times A)\ ] \times t,$$

where e' is the "correct" excess loss premium factor as derived from the claim severity distribution.

The retrospective premium adequacy of a plan (RPA) can be defined as follows:

$$RPA = \frac{\text{Average "Cost-Plus" Premium}}{\text{Average Retrospective Premium}}$$

The retrospective premium adequacy of plan is a measure of its profitability. If the retrospective premium adequacy is less than 1.00, the insurer should expect to make more than the budgeted profit. Conversely, if the retrospective premium adequacy is greater than 1.00, the insurer should expect to make less than the budgeted profit.

If all the parameters of a retrospective rating plan are given except the insurance charge, the retrospective premium adequacy can be thought of as a function of the insurance charge. To use the model to find the insurance charge one solves the following equation.

$$RPA(i) = 1$$

This equation can be solved by standard numerical methods.[5] It should be pointed out that solving this equation by hand would be extremely difficult due to the large number of terms involved. However, solving this equation by computer has proved to be very speedy and reliable. It should also be pointed out that this method of finding the insurance charge can easily be adapted to other kinds of retrospective rating formulas.

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5. The author used the Modified Regula Falsi method, which is described in Elementary Numerical Analysis: An Algorithmic Approach, McGraw Hill Inc. (1972), by S.D. Conte and Carl de Boor.

4. R.S. Miccolis, "On the Theory of Increased Limits and Excess of Loss Pricing", PCAS LXIV, p 43.

III. AN ANALYSIS OF THE CURRENT FORMULA

Like it or not, we already have a formula for retrospective rating in use. With some minor exceptions, this formula is used on a countrywide basis for Workers' Compensation.

Since the price of a retrospective rating plan is fixed, the problem becomes one of risk selection. This section seeks to identify those insureds which can profitably be written under a retrospective rating plan.

Another particularly troublesome problem with the current formula is that many people feel that the excess loss premium factors currently in use are inadequate. This section will show how to quantify the effect of such an inadequacy.

A Model of the Current Procedure

Ideally, the current retrospective rating formula can be described in the following manner. A single loss distribution is chosen to represent all insureds with a given expected loss amount. The insurance charge is calculated from this loss distribution on the assumption that no loss limit will be used. This insurance charge is used whether or not a loss limit is actually used in the plan.

The current formula will thus be modeled in the following manner. The standard claim severity distribution will be used to calculate insurance charges. They are given in the last column of Exhibit III. These insurance charges will be used to evaluate the retrospective premium adequacy of a plan no matter what claim severity distribution represents the insured, and no matter what loss limit is selected.

Exhibit V shows the retrospective premium adequacy for the high and low severity insureds when there is no loss limit. As can be seen from this exhibit, there are substantial differences in the retrospective premium adequacy that can be attributed to differences in claim severity. Clearly it is not desirable for the insurer to write a high-severity insured on such a retrospective rating plan.

Exhibit VI shows the retrospective premium adequacy for plans which have a loss limit. As can be seen from the exhibit, the overlap between the excess loss premium factor and the insurance charge results in a very favorable retrospective premium adequacy from the viewpoint of the insurer. This is true even for the high severity insureds which fared poorly when there were no loss limits.

The Effect of Inadequate Excess Loss Premium Factors

After examining Exhibit VI, one might conclude that an insurer should require loss limits on all retrospective rating plans. However, there are some problems with this strategy. In talking with various actuaries and underwriters who work in Workers' Compensation, the author has found a strong consensus that the excess loss premium factors currently in use are inadequate. To get some idea of the effect of inadequate excess loss premium factors, the author calculated the retrospective premium adequacy of plans with the excess loss premium factors cut in half. The results are shown in Exhibit VII.

The results of these calculations show that, in some cases, it still may be more profitable to write an insured with a loss limit. The profitability of a plan depends upon the balance between the amount of inadequacy in the excess loss premium factors and the redundancy in the insurance charge. This balance is more favorable to the insurer in plans with a low maximum premium. It should also be noted that this balance works against the insurer for the larger premium sizes.

If an underwriter is concerned about inadequate excess loss premium factors, he should encourage the insured to take a plan with a high maximum premium and no loss limit, or a plan with a low maximum premium and a loss limit. The author has discussed this underwriting strategy with both underwriting and marketing personel. They both thought that neither of these programs are marketable. It should be clear why a plan with a high maximum would not sell. The marketability of the low maximum plan with a loss limit deserves some comment.

When deciding whether or not to purchase a plan with a loss limit, the insured will look at his past experience and see what he would have paid under each plan. Exhibits VIII and IX provide such a price comparison based on the 10,000 samples generated by the loss model. These exhibits show calculations of retrospective premium at various percentiles. It should be noted that the insured in this example is paying $25,062 in excess premium in the plan with a $30,000 loss limit. In examining these exhibits one can see that the insured would be paying a greater than or equal premium for the plan with a loss limit at every percentile. The only time there is equality is when both plans pay the maximum premium.

The underwriter went on to say that he would be extremely suspicious of any insured that would be willing to accept a plan with a loss limit. Such a plan would be acceptable to an insured who has experienced a severe loss and is afraid of another one.

The possibility of adverse selection in plans with a loss limit is something that could be tested. What is required is a comparison between claim severity distributions for insureds who have, and who have not purchased a plan with a loss limit. The author has not seen such a comparison.

Adverse selection could provide an explanation for inadequate excess loss premium factors.

IV. OTHER RETROSPECTIVE RATING FORMULAS

Insurance Charges Which Reflect Claim Severity and Loss Limits

Given the differences in the retrospective premium adequacy of the various plans mentioned above, it is natural to ask what should the insurance charge be in order to accurately reflect differences due to claim severity and loss limits. Exhibits X and XI provide the proper insurance charges.

The taking into account of differences due to claim severity presents the problem of rating different exposures which are under the same retrospective plan. To do this, one can simply sum the losses incurred by each separate exposure and then proceed as usual. Exhibit XVa provides calculations of insurance charges for an insured with standard premiums of $150,000 in a class represented by the high severity distribution and $50,000 in each of two classes represented by the low severity distribution and the standard distribution. This method can easily be generalized to cases where the expense factors and loss limits are different for each class.

While this method of calculating the insurance charge does not require an excessive number of tables; it does require a great deal of computer time. The overwhelming majority of the computer time is consumed by generating the distribution of annual losses. The author is aware of quicker ways to generate losses, which deserve serious consideration.[6]

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6. R.E. Beard, T. Pentikainen and E. Pesonen, op. cit., Ch.7.

Retrospective Rating Plans Which Require a Loss Limit

In his observations of Exhibit XI, the reader may have already noticed that the insurance charges for plans with the same standard premium and loss limit are nearly equal.[7] The difference in the price for insureds with different claim severity distributions can be attributed almost entirely to the excess loss premium factor. This is true because we are substituting a fixed excess premium for the most volatile part of the actual losses.

This observation suggests that, when using a fixed loss limit, one can devise a retrospective rating formula for which the differences in the insurance charges due to claim severity can be kept to an acceptable minimum. This plan would simply use the insurance charge calculated for the standard insured, as the insurance charge for all insureds. Each insured would still use the appropriate excess loss premium factor. The retrospective premium adequacies for various insureds under such a plan are given in Exhbits XII and XVb.

The author would also propose that the insured not be given a choice of loss limits. This would minimize the number of tables needed to calculate the insurance charge. The loss limit would be determined by the total expected losses of the insured. Furthermore, if it is determined that adverse selection is a cause of inadequate excess loss premium factors, it may be necessary to require that all insureds have the same loss limit.

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7. The reader should note the different definitions of the insurance charge that are in the literature. Skurnick's insurance charge provides for both the excess losses on individual claims and the effect of limiting the retrospective premium. Harwayne suggests reducing the excess loss premium factor to account for the overlap.

If we are to require that a specific loss limit be used for a given insured, we should try to choose a loss limit that will be acceptable to a majority of the insureds. It may be desirable to calculate excess losses by the following formula.

Let L be the total loss arising out of a single accident.

$$\text{If } L \leq A \quad \begin{cases} \text{Primary Loss} = L \\ \text{Excess Loss} = 0 \end{cases}$$

$$\text{If } L > A \quad \begin{cases} \text{Primary Loss} = \dfrac{L \times B}{L+B-A} \\ \text{Excess Loss} = L - \text{Primary Loss} \end{cases}$$

In this case we say the loss limit is (A:B).

One can see that primary portion of the loss will be between A and B when the loss is greater than A. This formula is similar to the one used in multi-split experience rating for Workers' Compensation.

Exhibits XIII and XIV show calculations of the insurance charge and the retrospective premium adequacy for plans with a dual loss limit. It should be noted that a more restrictive loss limit allows less variance in the retrospective premium adequacy. The selection of a required loss limit will depend upon what will be acceptable to a majority of insureds and upon how much variance in the retrospective premium adequacy the insurer is willing to tolerate.

IV. CONCLUSION

This paper discusses three options which can be taken with regard to the retrospective rating formula.

The first option is to leave the present formula unchanged. If this option is elected, a retrospective rating plan will produce premium deficiencies for high severity insured, while it may produce premium redundancies for plans which have a loss limit. Such plans are not appropriate for high severity insureds.

The second option is to replace the present formula with one that properly accounts for claim severity and loss limits. This option would allow complete freedom in choosing the kind of plan to be used. The main drawback to this option is the large amount of computer time needed to calculate the insurance charge. It will be necessary to develop a more efficient loss generation program before this option can be implemented.

The third option is to restrict the number of plans available to the insured. This provides an immediate reduction in the number of tables needed. If we require that all retrospective rating plans have a loss limit, it turns out that the claim severity of an insured has only a slight effect on the insurance charge. Because of this it should not be necessary to have separate tables for each claim severity group in order to calculate the insurance charge. If a single loss limit is required, the resulting procedure should be no more complex than the present one. A single loss distribution and loss limit could be chosen to represent all insureds with a given expected loss amount.

This paper attempts to quantify the effect of each of these options.

The author prefers a flexible formula like that mentioned in option two. Should this approach prove unworkable at the present time, the author would then choose option three. The present retrospective rating formula discards accuracy in order to maintain flexibility. The proposed formula discards flexibility in order to maintain accuracy.

This paper bases its conclusions on computer simulation using hypothetical data. These techniques permitted a vast amount of experimentation with various retrospective rating plans. These conclusions are the results of this experimentation. Any concrete proposal for changing the current procedure must look at real data. The modification of the current procedure will be a very expensive and time consuming undertaking. It is hoped that this paper will convince the reader that such an undertaking is worth the effort.

The ideas expressed in this paper are the result of conversations the author had with many people at his company. The author would like to thank these people for their contributions.

Exhibit I Claim Severity Distributions

Claim Amount	Probability that a claim will be less than Column 1		
(1)	(2)	(3)	(4)
50	0.4310	0.3692	0.2464
100	0.5781	0.5147	0.4385
250	0.8561	0.8419	0.6195
500	0.8994	0.8835	0.8474
750	0.9175	0.9040	0.8684
1,000	0.9291	0.9155	0.8862
1,500	0.9455	0.9310	0.9050
2,500	0.9628	0.9495	0.9225
3,500	0.9718	0.9606	0.9348
5,000	0.9788	0.9704	0.9468
7,500	0.9846	0.9780	0.9592
10,000	0.9886	0.9824	0.9665
15,000	0.9935	0.9878	0.9748
25,000	0.9969	0.9936	0.9823
35,000	0.9982	0.9961	0.9862
50,000	0.9990	0.9977	0.9903
75,000	0.9995	0.9988	0.9941
100,000	0.9997	0.9992	0.9961
150,000	0.9998	0.9996	0.9977
250,000	1.0000	0.9998	0.9989
350,000	-	0.9999	0.9993
500,000	-	1.0000	1.0000

Column 2 - Low Severity Insured
Column 3 - Standard Insured
Column 4 - High Severity Insured

It is assumed that the claim severity distribution is uniform between any two consecutive amounts in Column 1.

Exhibit IIa

Loss Limit	Excess Loss Premium Factor*		
	Low Severity Insured	Standard Insured	High Severity Insured
10,000	0.191	0.270	0.391
15,000	0.146	0.222	0.353
20,000	0.118	0.187	0.322
25,000	0.098	0.162	0.296
30,000	0.084	0.143	0.274
40,000	0.064	0.116	0.237
50,000	0.052	0.098	0.208
75,000	0.033	0.070	0.156
100,000	0.023	0.053	0.124
150,000	0.010	0.034	0.083
200,000	0.003	0.023	0.056
250,000	-	0.016	0.038

Exhibit IIb

Loss Limit**	Excess Loss Premium Factor*		
	Low Severity Insured	Standard Insured	High Severity Insured
(2,000:20,000)	0.206	0.272	0.380
(5,000:60,000)	0.114	0.170	0.276
(10,000:100,000)	0.075	0.124	0.220
(10,000:20,000)	0.155	0.228	0.350
(30,000:60,000)	0.064	0.114	0.227
(50,000:100,000)	0.038	0.076	0.166

* Expected Loss Ratio = .600

**Excess losses for a dual loss limit (A:B) are given by the following formula.

Let L be the total loss arising out of a single accident.

$$\text{If } L \leq A \begin{cases} \text{Primary Loss} = L \\ \text{Excess Loss} = 0 \end{cases}$$

$$\text{If } L > A \begin{cases} \text{Primary Loss} = \dfrac{L \times B}{L+B-A} \\ \text{Excess Loss} = L - \text{Primary Loss} \end{cases}$$

Exhibit III Comparison of insurance-charges indicated by the model, and the standard formula using Table M.

Standard Premium = 50,000
No Loss Limit

Min.	Max.	Insurance Charge* Standard Formula	Model
BxTM	1.00	0.267	0.300
BxTM	1.20	0.173	0.219
BxTM	1.40	0.122	0.174
BxTM	1.60	0.090	0.144
BxTM	1.80	0.068	0.123
0.60	1.00	0.254	0.299
0.60	1.20	0.117	0.195
0.60	1.40	0.038	0.124
0.60	1.60	-0.016	0.071
0.60	1.80	-0.052	0.029

Standard Premium = 150,000
No Loss Limit

Min.	Max.	Insurance Charge* Standard Formula	Model
BxTM	1.00	0.173	0.179
BxTM	1.20	0.092	0.112
BxTM	1.40	0.059	0.079
BxTM	1.60	0.044	0.060
BxTM	1.80	0.029	0.047
0.60	1.00	0.150	0.171
0.60	1.20	0.047	0.087
0.60	1.40	0.000	0.043
0.60	1.60	-0.025	0.014
0.60	1.80	-0.042	-0.005

Standard Premium = 250,000
No Loss Limit

Min.	Max.	Insurance Charge* Standard Formula	Model
BxTM	1.00	0.130	0.128
BxTM	1.20	0.060	0.073
BxTM	1.40	0.033	0.048
BxTM	1.60	0.025	0.033
BxTM	1.80	0.015	0.023
0.60	1.00	0.099	0.119
0.60	1.20	0.012	0.054
0.60	1.40	-0.016	0.021
0.60	1.60	-0.032	0.001
0.60	1.80	-0.040	-0.004

* The parameters for the plans are given in Exhibit IV.

Exhibit IV Parameters for Retrospective Rating Plans

	Total Standard Premium		
	50,000	150,000	250,000
Expected Losses	30,000	90,000	150,000
Loss Conversion Factor (c)	1.125	1.125	1.125
Expense in Basic Premium Factor (a)	0.149	0.139	0.134
Tax Multiplier (t)	1.040	1.040	1.040

Exhibit V Retrospective Premium Adequacy for Plans without a Loss Limit

Standard Premium = 50,000
No Loss Limit

Min.	Max.	Retrospective Premium Adequacy* Low Severity Insured	Standard Insured	High Severity Insured
BxTM	1.00	0.951	1.000	1.127
BxTM	1.20	0.936	1.000	1.161
BxTM	1.40	0.935	1.000	1.170
BxTM	1.60	0.937	1.000	1.170
BxTM	1.80	0.940	1.000	1.163
0.60	1.00	0.951	1.000	1.112
0.60	1.20	0.951	1.000	1.103
0.60	1.40	0.962	1.000	1.084
0.60	1.60	0.974	1.000	1.066
0.60	1.80	0.984	1.000	1.049

Standard Premium = 150,000
No Loss Limit

Min.	Max.	Retrospective Premium Adequacy* Low Severity Insured	Standard Insured	High Severity Insured
BxTM	1.00	0.951	1.000	1.119
BxTM	1.20	0.947	1.000	1.123
BxTM	1.40	0.953	1.000	1.113
BxTM	1.60	0.958	1.000	1.098
BxTM	1.80	0.962	1.000	1.085
0.60	1.00	0.956	1.000	1.078
0.60	1.20	0.964	1.000	1.052
0.60	1.40	0.976	1.000	1.028
0.60	1.60	0.987	1.000	1.008
0.60	1.80	0.994	1.000	0.992

Standard Premium = 250,000
No Loss Limit

Min.	Max.	Retrospective Premium Adequacy* Low Severity Insured	Standard Insured	High Severity Insured
BxTM	1.00	0.961	1.000	1.102
BxTM	1.20	0.961	1.000	1.095
BxTM	1.40	0.966	1.000	1.077
BxTM	1.60	0.972	1.000	1.061
BxTM	1.80	0.977	1.000	1.048
0.60	1.00	0.967	1.000	1.061
0.60	1.20	0.975	1.000	1.031
0.60	1.40	0.987	1.000	1.007
0.60	1.60	0.996	1.000	0.988
0.60	1.80	1.004	1.000	0.974

* The parameters for the plans are given in Exhibits III and IV.

Exhibit VI Retrospective Premium Adequacy for Plans with a Loss Limit

Standard Premium = 50,000
Loss Limit = 10,000

		Retrospective Premium Adequacy*		
Min.	Max.	Low Severity Insured	Standard Insured	High Severity Insured
BxTM	1.00	0.868	0.865	0.855
BxTM	1.20	0.814	0.811	0.800
BxTM	1.40	0.819	0.818	0.813
BxTM	1.60	0.838	0.838	0.836
BxTM	1.80	0.857	0.856	0.856
0.60	1.00	0.868	0.865	0.855
0.60	1.20	0.829	0.827	0.816
0.60	1.40	0.864	0.863	0.859
0.60	1.60	0.912	0.913	0.912
0.60	1.80	0.958	0.961	0.962

Standard Premium = 150,000
Loss Limit = 30,000

		Retrospective Premium Adequacy*		
Min.	Max.	Low Severity Insured	Standard Insured	High Severity Insured
BxTM	1.00	0.904	0.908	0.901
BxTM	1.20	0.889	0.894	0.889
BxTM	1.40	0.906	0.909	0.907
BxTM	1.60	0.924	0.925	0.924
BxTM	1.80	0.939	0.939	0.939
0.60	1.00	0.908	0.912	0.905
0.60	1.20	0.912	0.916	0.914
0.60	1.40	0.944	0.945	0.947
0.60	1.60	0.974	0.973	0.977
0.60	1.80	0.995	0.994	0.999

Standard Premium = 250,000
Loss Limit = 50,000

		Retrospective Premium Adequacy*		
Min.	Max.	Low Severity Insured	Standard Insured	High Severity Insured
BxTM	1.00	0.925	0.931	0.937
BxTM	1.20	0.923	0.927	0.931
BxTM	1.40	0.940	0.941	0.944
BxTM	1.60	0.957	0.957	0.958
BxTM	1.80	0.969	0.969	0.969
0.60	1.00	0.931	0.936	0.943
0.60	1.20	0.942	0.944	0.948
0.60	1.40	0.970	0.967	0.969
0.60	1.60	0.992	0.988	0.987
0.60	1.80	1.010	1.005	1.003

* The parameters for the plans are given in Exhibits IIa, III and IV.

Exhibit VII Retrospective Premium Adequacy for Plans with a Loss Limit and Inadequate Excess Loss Premium Factors

Standard Premium = 50,000
Loss Limit = 10,000

		Retrospective Premium Adequacy*		
Min.	Max.	Low Severity Insured	Standard Insured	High Severity Insured
BxTM	1.00	0.899	0.914	0.936
BxTM	1.20	0.884	0.919	0.978
BxTM	1.40	0.910	0.955	1.031
BxTM	1.60	0.939	0.989	1.076
BxTM	1.80	0.964	1.017	1.110
0.60	1.00	0.899	0.914	0.937
0.60	1.20	0.906	0.944	1.009
0.60	1.40	0.963	1.013	1.102
0.60	1.60	1.021	1.073	1.166
0.60	1.80	1.069	1.121	1.213

Standard Premium = 150,000
Loss Limit = 30,000

		Retrospective Premium Adequacy*		
Min.	Max.	Low Severity Insured	Standard Insured	High Severity Insured
BxTM	1.00	0.928	0.952	1.003
BxTM	1.20	0.930	0.967	1.048
BxTM	1.40	0.955	0.994	1.089
BxTM	1.60	0.976	1.016	1.120
BxTM	1.80	0.993	1.034	1.142
0.60	1.00	0.933	0.957	1.009
0.60	1.20	0.954	0.988	1.062
0.60	1.40	0.991	1.024	1.103
0.60	1.60	1.022	1.054	1.135
0.60	1.80	1.045	1.076	1.156

Standard Premium = 250,000
Loss Limit = 50,000

		Retrospective Premium Adequacy*		
Min.	Max.	Low Severity Insured	Standard Insured	High Severity Insured
BxTM	1.00	0.943	0.968	1.028
BxTM	1.20	0.952	0.982	1.060
BxTM	1.40	0.972	1.004	1.088
BxTM	1.60	0.990	1.023	1.110
BxTM	1.80	1.004	1.038	1.127
0.60	1.00	0.950	0.974	1.027
0.60	1.20	0.970	0.996	1.056
0.60	1.40	1.000	1.024	1.083
0.60	1.60	1.023	1.045	1.102
0.60	1.80	1.042	1.063	1.118

* The parameters for the plans are given in Exhibits IIa, III and IV. The Excess Loss Premium Factors in Exhibit IIa are multiplied by .5.

Exhibit VIII Distribution of Retrospective Premium with 30,000 Loss Limit - Standard Insured

1.	Standard Premium	150000
2.	Basic Premium (Excl Ins Chg But Incl. Tax)	21684
3.	Basic Premium (Incl 0.179 Ins Chg and Tax)	53098
4.	Excess Premium Generated by E.L.P.F. (Inc Tax)	25062
5.	Needed Excess Premium (Inc Tax)	25062
6.	Minimum Premium (= Line 3)	53098
7.	Maximum Premium (Line 1 x 1.000)	150000

A	B	C	D	E
Probability that Subject Losses Are < = Col B *	Losses Subject To Retro Rating *	Retrospective Premium **	Cost Plus Premium***	Difference C - D
Min	10659	88819	57405	31414
.005	18287	96447	65033	31414
.010	20942	99102	67688	31414
.050	30342	108502	77088	31414
.100	37238	115398	83984	31414
.200	48255	126415	95001	31414
.300	57966	136126	104712	31414
.400	66673	144833	113419	31414
.500	75372	150000	122118	27882
.600	84315	150000	131061	18939
.700	95106	150000	141852	8148
.800	108743	150000	155489	-5489
.900	129005	150000	175751	-25751
.950	147786	150000	194532	-44532
.990	184776	150000	231522	-81522
.995	200951	150000	247697	-97697
Max	283075	150000	329821	-179821

Notes

* Subject Losses are adjusted to include L.A.E. and Taxes

** Retrospective Premium = Line 3 + Line 4 + Col B
Subject to Minimum and Maximum Premium

*** Cost Plus Premium = Line 2 + Line 5 + Col B

Exhibit IX Distribution of Retrospective Premium with No Loss Limit - Standard Insured

1.	Standard Premium	150000
2.	Basic Premium (Excl Ins Chg But Incl. Tax)	21684
3.	Basic Premium (Incl 0.179 Ins Chg and Tax)	53098
4.	Excess Premium Generated by E.L.P.F. (Inc Tax)	0
5.	Needed Excess Premium (Inc Tax)	0
6.	Minimum Premium (= Line 3)	53098
7.	Maximum Premium (Line 1 x 1.000)	150000

A	B	C	D	E
Probability that Subject Losses Are < = Col B *	Losses Subject To Retro Rating *	Retrospective Premium **	Cost Plus Premium***	Difference C - D
Min	10659	63757	32343	31414
.005	18287	71385	39971	31414
.010	20942	74040	42626	31414
.050	30342	83440	52026	31414
.100	37238	90336	58922	31414
.200	48273	101371	69957	31414
.300	58668	111766	80352	31414
.400	69178	122276	90862	31414
.500	81194	134292	102878	31414
.600	94581	147679	116265	31414
.700	112488	150000	134172	15828
.800	140164	150000	161848	-11848
.900	190628	150000	212312	-62312
.950	258305	150000	279989	-129989
.990	532459	150000	554143	-404143
.995	615667	150000	637351	-487351
Max	938677	150000	960361	-810361

Notes

* Subject Losses are adjusted to include L.A.E. and Taxes

** Retrospective Premium = Line 3 + Line 4 + Col B
Subject to Minimum and Maximum Premium

*** Cost Plus Premium = Line 2 + Line 5 + Col B

Exhibit X Indicated Insurance Charges

Standard Premium = 50,000
No Loss Limit

		Insurance Charge*		
Min.	Max.	Low Severity Insured	Standard Insured	High Severity Insured
BxTM	1.00	0.230	0.300	0.424
BxTM	1.20	0.153	0.219	0.351
BxTM	1.40	0.113	0.174	0.305
BxTM	1.60	0.089	0.144	0.269
BxTM	1.80	0.072	0.123	0.241
0.60	1.00	0.226	0.299	0.424
0.60	1.20	0.129	0.195	0.351
0.60	1.40	0.071	0.124	0.289
0.60	1.60	0.034	0.071	0.224
0.60	1.80	0.006	0.029	0.159

Standard Premium = 150,000
No Loss Limit

		Insurance Charge*		
Min.	Max.	Low Severity Insured	Standard Insured	High Severity Insured
BxTM	1.00	0.118	0.179	0.303
BxTM	1.20	0.063	0.112	0.217
BxTM	1.40	0.039	0.079	0.168
BxTM	1.60	0.026	0.060	0.135
BxTM	1.80	0.018	0.047	0.110
0.60	1.00	0.111	0.171	0.300
0.60	1.20	0.046	0.087	0.181
0.60	1.40	0.017	0.043	0.096
0.60	1.60	-0.000	0.014	0.031
0.60	1.80	-0.012	-0.005	-0.021

Standard Premium = 250,000
No Loss Limit

		Insurance Charge*		
Min.	Max.	Low Severity Insured	Standard Insured	High Severity Insured
BxTM	1.00	0.083	0.128	0.234
BxTM	1.20	0.039	0.073	0.154
BxTM	1.40	0.021	0.048	0.109
BxTM	1.60	0.011	0.033	0.080
BxTM	1.80	0.005	0.023	0.060
0.60	1.00	0.079	0.119	0.222
0.60	1.20	0.030	0.054	0.107
0.60	1.40	0.009	0.021	0.033
0.60	1.60	-0.003	0.001	-0.021
0.60	1.80	-0.010	-0.014	-0.061

* The parameters for the plan are given in Exhibit IV.

Exhibit XI Indicated Insurance Charges

Standard Premium = 50,000
Loss Limit = 10,000

		Insurance Charge*		
Min.	Max.	Low Severity Insured	Standard Insured	High Severity Insured
BxTM	1.00	0.054	0.049	0.032
BxTM	1.20	0.013	0.012	0.006
BxTM	1.40	0.003	0.003	0.001
BxTM	1.60	0.001	0.001	0.000
BxTM	1.80	0.000	0.000	0.000
0.60	1.00	0.052	0.049	0.032
0.60	1.20	0.008	0.009	0.006
0.60	1.40	-0.004	0.000	0.001
0.60	1.60	-0.006	-0.003	0.000
0.60	1.80	-0.007	-0.004	0.000

Standard Premium = 150,000
Loss Limit = 30,000

		Insurance Charge*		
Min.	Max.	Low Severity Insured	Standard Insured	High Severity Insured
BxTM	1.00	0.046	0.052	0.045
BxTM	1.20	0.010	0.013	0.011
BxTM	1.40	0.002	0.004	0.003
BxTM	1.60	0.000	0.001	0.001
BxTM	1.80	0.000	0.000	0.000
0.60	1.00	0.041	0.047	0.044
0.60	1.20	0.002	0.004	0.007
0.60	1.40	-0.006	-0.006	-0.003
0.60	1.60	-0.008	-0.009	-0.005
0.60	1.80	-0.009	-0.010	-0.006

Standard Premium = 250,000
Loss Limit = 50,000

		Insurance Charge*		
Min.	Max.	Low Severity Insured	Standard Insured	High Severity Insured
BxTM	1.00	0.038	0.044	0.052
BxTM	1.20	0.007	0.010	0.013
BxTM	1.40	0.001	0.002	0.004
BxTM	1.60	0.000	0.000	0.001
BxTM	1.80	0.000	0.000	0.000
0.60	1.00	0.035	0.039	0.047
0.60	1.20	0.002	0.001	0.003
0.60	1.40	-0.004	-0.007	-0.007
0.60	1.60	-0.006	-0.009	-0.011
0.60	1.80	-0.006	-0.010	-0.011

* The parameters for the plan are given in Exhibits IIa and IV.

Exhibit XII Retrospective Premium Adequacy for Alternate Plan #1

Standard Premium = 50,000
Loss Limit = 10,000

Min.	Max.	Retrospective Premium Adequacy* Low Severity Insured	Standard Insured	High Severity Insured
BxTM	1.00	1.004	1.000	0.983
BxTM	1.20	1.002	1.000	0.993
BxTM	1.40	1.001	1.000	0.998
BxTM	1.60	1.000	1.000	0.999
BxTM	1.80	1.000	1.000	1.000
0.60	1.00	1.002	1.000	0.983
0.60	1.20	0.998	1.000	0.997
0.60	1.40	0.996	1.000	1.002
0.60	1.60	0.996	1.000	1.004
0.60	1.80	0.996	1.000	1.006

Standard Premium = 150,000
Loss Limit = 30,000

Min.	Max.	Retrospective Premium Adequacy* Low Severity Insured	Standard Insured	High Severity Insured
BxTM	1.00	0.994	1.000	0.994
BxTM	1.20	0.996	1.000	0.997
BxTM	1.40	0.998	1.000	0.998
BxTM	1.60	0.999	1.000	0.999
BxTM	1.80	1.000	1.000	1.000
0.60	1.00	0.995	1.000	0.998
0.60	1.20	0.998	1.000	1.003
0.60	1.40	0.999	1.000	1.003
0.60	1.60	1.001	1.000	1.004
0.60	1.80	1.001	1.000	1.005

Standard Premium = 250,000
Loss Limit = 50,000

Min.	Max.	Retrospective Premium Adequacy* Low Severity Insured	Standard Insured	High Severity Insured
BxTM	1.00	0.994	1.000	1.008
BxTM	1.20	0.997	1.000	1.004
BxTM	1.40	0.999	1.000	1.002
BxTM	1.60	1.000	1.000	1.001
BxTM	1.80	1.000	1.000	1.000
0.60	1.00	0.996	1.000	1.007
0.60	1.20	1.001	1.000	1.003
0.60	1.40	1.003	1.000	1.000
0.60	1.60	1.004	1.000	0.998
0.60	1.80	1.005	1.000	0.998

* The insurance charges used are those of the Standard Insured in Exhibit XI. The parameters for the plan are given in Exhibits IIa and IV.

Exhibit XIII Retrospective Premium Adequacy for Alternate Plan #2

Standard Premium = 50,000
Loss Limit = (2,000:20,000)

			Retrospective Premium Adequacy*		
Min.	Max.	Insurance Charge*	Low Severity Insured	Standard Insured	High Severity Insured
BxTM	1.00	0.055	0.999	1.000	0.992
BxTM	1.20	0.015	0.999	1.000	0.997
BxTM	1.40	0.005	0.999	1.000	0.998
BxTM	1.60	0.001	1.000	1.000	1.000
BxTM	1.80	0.000	1.001	1.000	1.000
0.60	1.00	0.055	0.998	1.000	0.992
0.60	1.20	0.014	0.996	1.000	0.998
0.60	1.40	0.002	0.997	1.000	1.002
0.60	1.60	-0.002	0.998	1.000	1.004
0.60	1.80	-0.003	0.998	1.000	1.004

Standard Premium = 150,000
Loss Limit = (5,000:60,000)

			Retrospective Premium Adequacy*		
Min.	Max.	Insurance Charge*	Low Severity Insured	Standard Insured	High Severity Insured
BxTM	1.00	0.046	0.992	1.000	1.007
BxTM	1.20	0.012	0.994	1.000	1.003
BxTM	1.40	0.003	0.998	1.000	1.002
BxTM	1.60	0.001	0.999	1.000	1.000
BxTM	1.80	0.000	1.000	1.000	1.000
0.60	1.00	0.043	0.993	1.000	1.008
0.60	1.20	0.006	0.997	1.000	1.006
0.60	1.40	-0.003	1.000	1.000	1.003
0.60	1.60	-0.005	1.000	1.000	1.001
0.60	1.80	-0.006	1.001	1.000	1.001

Standard Premium = 250,000
Loss Limit = (10,000:100,000)

			Retrospective Premium Adequacy*		
Min.	Max.	Insurance Charge*	Low Severity Insured	Standard Insured	High Severity Insured
BxTM	1.00	0.039	0.993	1.000	1.014
BxTM	1.20	0.008	0.997	1.000	1.009
BxTM	1.40	0.002	0.999	1.000	1.003
BxTM	1.60	0.000	1.000	1.000	1.002
BxTM	1.80	0.040	1.000	1.000	1.000
0.60	1.00	0.036	0.994	1.000	1.013
0.60	1.20	0.003	1.000	1.000	1.005
0.60	1.40	-0.004	1.002	1.000	1.000
0.60	1.60	-0.006	1.003	1.000	0.998
0.60	1.80	-0.006	1.003	1.000	0.997

* The parameters for the plan are given in Exhibits IIb and IV.

Exhibit XIV Retrospective Premium Adequacy for Alternate Plan #3

Standard Premium = 50,000
Loss Limit = (10,000:20,000)

			Retrospective Premium Adequacy*		
Min.	Max.	Insurance Charge*	Low Severity Insured	Standard Insured	High Severity Insured
BxTM	1.00	0.029	1.000	1.000	0.987
BxTM	1.20	0.078	0.999	1.000	0.992
BxTM	1.40	0.026	0.998	1.000	0.995
BxTM	1.60	0.010	0.999	1.000	0.997
BxTM	1.80	0.004	1.000	1.000	1.000
0.60	1.00	0.077	0.998	1.000	0.988
0.60	1.20	0.019	0.995	1.000	1.000
0.60	1.40	-0.001	0.995	1.000	1.009
0.60	1.60	-0.008	0.996	1.000	1.012
0.60	1.80	-0.011	0.996	1.000	1.014

Standard Premium = 150,000
Loss Limit = (30,000:60,000)

			Retrospective Premium Adequacy*		
Min.	Max.	Insurance Charge*	Low Severity Insured	Standard Insured	High Severity Insured
BxTM	1.00	0.071	0.989	1.000	1.004
BxTM	1.20	0.022	0.992	1.000	1.004
BxTM	1.40	0.008	0.995	1.000	1.001
BxTM	1.60	0.003	0.998	1.000	1.000
BxTM	1.80	0.001	0.999	1.000	1.000
0.60	1.00	0.064	0.991	1.000	1.007
0.60	1.20	0.008	0.997	1.000	1.004
0.60	1.40	-0.009	1.001	1.000	1.002
0.60	1.60	-0.014	1.003	1.000	0.999
0.60	1.80	-0.016	1.004	1.000	0.999

Standard Premium = 250,000
Loss Limit = (50,000:100,000)

			Retrospective Premium Adequacy*		
Min.	Max.	Insurance Charge*	Low Severity Insured	Standard Insured	High Severity Insured
BxTM	1.00	0.058	0.980	1.000	1.019
BxTM	1.20	0.016	0.995	1.000	1.013
BxTM	1.40	0.005	0.997	1.000	1.006
BxTM	1.60	0.001	1.000	1.000	1.003
BxTM	1.80	0.000	1.000	1.000	1.002
0.60	1.00	0.051	0.994	1.000	1.014
0.60	1.20	0.004	1.001	1.000	1.003
0.60	1.40	-0.009	1.005	1.000	0.996
0.60	1.60	-0.013	1.007	1.000	0.992
0.60	1.80	-0.014	1.007	1.000	0.991

* The parameters for the plan are given in Exhibits IIb and IV.

Exhibit XVa Multi-Exposure Insured

Standard Premium for:	High Severity Insured =	150,000
	Standard Insured =	50,000
	Low Severity Insured =	50,000
Total		250,000

		Indicated Insurance Charge*	
Min.	Max.	No Loss Limit	50,000 Loss Limit
BxTM	1.00	0.183	0.047
BxTM	1.20	0.115	0.011
BxTM	1.40	0.080	0.002
BxTM	1.60	0.057	0.000
BxTM	1.80	0.042	0.000
0.60	1.00	0.175	0.044
0.60	1.20	0.086	0.003
0.60	1.40	0.033	-0.006
0.60	1.60	-0.002	-0.009
0.60	1.80	-0.028	-0.009

Exhibit XVb Multi-Exposure Insured

Loss Limit = 50,000

Min.	Max.	Insurance Charge**	Retrospective Premium Adequacy*
BxTM	1.00	0.044	1.001
BxTM	1.20	0.010	1.000
BxTM	1.40	0.002	1.000
BxTM	1.60	0.000	1.000
BxTM	1.80	0.000	0.999
0.60	1.00	0.039	1.001
0.60	1.20	0.001	1.001
0.60	1.40	-0.007	0.999
0.60	1.60	-0.009	0.999
0.60	1.80	-0.010	0.999

* The parameters for the plan are given in Exhibits IIa and IV.

** From Exhibit XI.