MULTIPLE COVERAGE EXPERIENCE RATING PLAN

BY

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Background

With the exception of Workmen's Compensation, experience rating plans for casualty lines have not been materially altered for many years despite radical changes in the business to which they have been applied. The pertinent changes which suggest a re-evaluation of our experience rating plans are (1) an ever increasing settlement cost of claims, (2) intensifying competition, (3) a narrowing of profit margins, (4) increasing use of EDP machines, and (5) the trend toward packaging of casualty coverages in a single policy or a limited number of separate policies.

Apropos the increasing cost of claim settlement, we note that virtually all current experience rating plans provide a loss limitation per accident, which, in some cases reaches as low as $200. Yet these plans provide no compensating insurance charge for that portion of the losses which is discarded. While the loss of premium income resulting from this consistent bias may not have been severe at the time these plans were conceived, loss levels since then have increased under the forces of inflation so that a substantial off-balance exists today.

The problems of increasing competition and inadequate manual rate levels have made it difficult for casualty underwriters to achieve an adequate premium income even with a properly balanced experience rating plan. While the underwriter is the dominant factor in producing a profitable loss level, it requires a very astute underwriter to overcome the effect of a biased experience rating plan when rating small and moderate sized business risks for whom limited quantities of data are available.

With the widespread use of high speed computing machinery, it becomes possible to introduce refinements or complexities in rating plans which formerly could not be accommodated because of the burden of clerical work necessary. Because the application of present rating plans – and the one to be proposed here – can be easily reduced to a standardized worksheet, they are quite susceptible to mechanical processing. The initial modification factor, then, can and should be performed mechanically as a part of the normal premium and claims processing.

Assuming that the inherent hazard of any one coverage is correlated with that of other coverages for a given risk, it should be reasonably possible to combine the experience of all lines for a particular risk when determining a rate modification. Greater responsiveness as well as greater stability can be achieved from the use of a greater quantity of data resulting from the combining of coverages, whether or not the several coverages are written in a single policy. While this procedure creates some problems of allocation of premiums by line, the overall effect should be superior. The allocation of premiums is already distorted by the use of such procedures as composite rating plans and retrospective rating plans.

After some initial thought, it was decided, at this time, at least, to restrict the combination of coverages to auto liability, miscellaneous liability, and auto physical damage. Workmen's compensation was excluded because (1) the current rating plans appear to be operating effectively and have been recently revised, (2) regulatory problems might arise from attempting to include Workmen's Compensation and (3) reporting machinery for the NCCI would be disrupted. The minor lines such as burglary, plate glass, and boiler and machinery were excluded because of lack of data.

The principal objective of any experience rating plan should be to obtain the best estimate of a risk's inherent hazard. Corollary objectives should be (1) a reasonable compromise between stability and responsiveness, (2) an adequate overall rate level, and (3) a high degree of equitableness among experience rated risks.

The achievement of these objectives has been attempted with a model which is quite conventional. In order to produce the best estimate of a risk's inherent hazard, a theoretical derivation of credibility values was carried out. This derivation was taken from Arthur L. Bailey's paper, "Sampling Theory in Casualty Insurance," PCAS Volume XXIX, with minor notational changes. The details of this work are shown in Appendix I. The computation of the moments required for the credibility values necessitated the development of frequency functions of claims by size. The source of these data and the final frequency functions for the three coverages under study are shown in Appendix III. The frequency functions were intentionally distorted by including approximately 50% greater frequency of claims in the over $5000 category than the data indicated. This bias was built into the frequency functions for two reasons both based upon my personal opinion. First, it seems reasonable that the larger risks, e.g., those eligible for experience rating, produce relatively more claims in the over $5000 category than small risks that are manually rated. Both groups of risks were represented in the data. Second, I feel that the growth in claim size has been more marked in recent years among the large claims than among small claims. The data used were drawn from claim settlements in 1954 to 1957. This was projected to 1961 by assuming a growth rate of about 5% per year for all claims. The arbitrarily higher base for claims in excess of $5000 has the effect of using a projection factor greater than 5% for this category of claims.

The distorting effect of large losses has to be minimized in order to obtain any degree of stability in a risk's rate level. It appeared to me that the most appropriate device for solution of this problem was the multi-split concept used in Workmen's Compensation. This concept required some modification in order to accommodate the conventional split between basic limits and increased limits in the liability lines. The first $5000 of each claim was adopted as a basis common to all lines. The choices of starting value and discounting formula were largely arbitrary, but the principles by which I was guided were (1) the discounted losses (which I shall refer to as "primary" hereafter) should exceed 75% of basic limits losses, (2) a single maximum claim should produce a modification of not more than 35%, and (3) less than 10% of the claims by number should be subject to discounting. The final choice of formula was:

$$\text{Primary Loss} = 621.33 \log_e \frac{\text{Actual Loss}}{200}$$

where the starting value is $1000. As an additional modifier, I have chosen to use only the first $25,000 of any claim and the corresponding premium for purposes of experience rating.

The choice of $25,000 was made for two reasons: First, virtually all non-personal risks will carry limits to this extent so that a common denominator was established for all risks. Second, the maximum modification produced by this value in the modification formula is quite conventional at about 35%. While this swing is similar to those produced by current plans, it may be noted that the probability of occurrence of a maximum loss is much smaller than in current plans. For example, a risk with $500 of expected basic limits losses will produce a 30% modification from a single accident of $1900 or more under operation of the New York Automobile Liability Experience Rating Plan. The probability of this occurrence is of the order of .04. Under the proposed plan an individual claim of about $15,000 would be required to produce the same modification. The probability of this event (Auto Liability) is about .0036.

Note that the loss limitations discussed above are per claim whereas the traditional method of loss limitation is made per accident. A loss limitation per accident has the greater appeal from a logical standpoint, but I believe a case can be built for the use of a per claim limitation in the current context. First, we are combining coverages with widely varying propensity toward multi-claim accidents, and each coverage for different risks will comprise a widely varying proportion of the total losses. Second, some current ambiguities are eliminated such as coverages written on an occurrence basis and late reported claims for a multi-claim accident which may not get into the current rating. Third, claims may be somewhat more adaptable to machine processing than accidents. Also, as noted in the preceding paragraph, the probability of a maximum loss is considerably smaller under this proposed scheme than under current plans.

The modification formula which I propose includes a provision for rating excess losses for all sizes of risk. While the practical effect is not substantial, there is an aesthetic value resulting from the elimination of discontinuities at the point where excess rating is first introduced and where the primary credibility becomes 1.00. It also makes possible the use of a uniform formula for all risks, which has some value for purposes of machine application.

Other Ideas

During the course of development of this experience rating plan, a number of other ideas were pursued which proved to be unworkable at present. The field of experience rating is I believe in a rudimentary stage of development and much can be accomplished with time and effort. With the idea that someone might wish to investigate some of these possibilities further, I would like to offer some brief comments on several of these concepts.

First, consideration was given to rating by means of two modifications, one to measure variation in frequency and the second modification to measure variation in size of loss. The measurement of variation by size of loss itself could be subdivided into primary and excess.

The conventional division of losses into "primary" and "excess" is, in itself, an arbitrary choice. Could improve ratings result from the use of three or more "tiers" of losses? It would, in fact, be conceivable that credibility formulas could be developed on a continuous basis differentiating each infinitesimal portion of each loss.

In the formula for rating excess coverage in my proposed plan and most others the excess modification applies to expected losses already modified by the primary modification. This assumes perfect correlation between primary and excess regardless of inherent hazard. This is certainly not true and the proper handling of this concept would involve a weighting of the primary modification and 1.00. I do not know, however, any empirical means of determining the strength of this relationship with the data presently available.

Another consideration was to use different "K" values and "D" ratios for different territories of the country to reflect differences in average size and/or distribution of claims by size in different areas. To the extent to which we were able to develop this concept, differences by territory were adjudged to be too small to warrant the additional complexity, but this might be worth considering if accurate data by state and territory were available.

It was also considered possible to develop credibility formulas which would produce increasing credibility as the difference between the risk's actual experience and the normal increased.

As a means of measuring a risk's propensity toward large losses more accurately some thought was given to modification of excess coverage on the basis of the average primary loss. There should be some correlation between average size of loss and losses in excess of a fixed value. This idea, like most of the others was abandoned, as too little factual matter was available to make a meaningful study.

Another concept that might be introduced in the rating formula is to determine expected basic limits losses by use of a variable expected loss ratio, the expected loss ratio to be determined from the aggregate experience developed by state or territory during the experience period. An additional modifier would then need to be applied to the current manual rates in order to produce an adequate rate level. This, of course, has some obvious non-statistical implications!

The Plan

As it was finally drawn together, this proposed experience rating plan produces greater stability and less responsiveness than the plans to which we are accustomed. The credibility assigned a risk of any given size is approximately equal to credibility assigned a risk one-half as large by the New York Automobile Liability Experience Rating Plan. Also, this plan makes no provision for schedule rating, which is included in the rating plans currently used in most states. While the underwriting factors generally used in schedule rating undoubtedly have some validity, they can be misused and, in any event, I am no underwriter and hence would not feel adequate to draw up a schedule of debits or credits. No attempt has been made in this plan to refine its language to conform to any state regulation; it is, rather, presented as a model from which it is expected that considerable modification would be required if any company were to use it.

The determination of the minimum size of risk for eligibility was largely arbitrary. It was, however, necessary to set this minimum sufficiently high so that a meaningful modification would be produced. With the minimum eligibility set at $500 of expected basic limits losses, a credit of about 4% would be produced for clear experience. It was considered desirable to use expected basic limits losses instead of premium for this criterion — as well as in the modification formula — to overcome the problem of combining coverages with different expected loss ratios.

Three completed policy years were selected as the normal experience period. The objective in the selection of this period was to obtain as broad a period as possible which would predict the risk's future inherent hazard accurately. While many current plans allow as much as five years for the experience period, it was my opinion, in present times, with business conditions changing rapidly that any experience incurred five or six years ago would not be indicative of the risk's future experience. Even an individual person has a changing inherent hazard from year to year as recently pointed out by LeRoy Simon and Robert Bailey in their paper, "An Actuarial Note on the Credibility of Experience of a Single Private Passenger Car," PCAS XLVI. This variability as well as changing methods of operation apply to a business risk. Experience incurred during the current policy year was excluded for obvious reasons — loss reserves are highly conjectural and premiums, due to late collections or awaiting audit, can only be estimated.

The concept of Expected Basic Limits Losses as applied to Physical Damage may be controversial. I have suggested that 90% of manual premiums written for ACV is equivalent to manual premiums for the first $5000 of coverage per vehicle. In the aggregate, I believe this is reasonably accurate as projected from the experience of my own company. As applied to individual risks, however, there will be many instances where the risk does not have any vehicle with a value in excess of $5000. The error, should, however, be small because the physical damage coverages are unlikely to compose more than 20-25% of the expected losses of any risk.

The rating procedure has been illustrated by means of a sample worksheet, Appendix IV. The procedure is somewhat similar to the rating of Workmen's Compensation risks. It may be noted that although the formula can be applied manually, it represents a substantial increase in clerical work as compared to current experience rating plans other than Workmen's Compensation. With a machine application, however, the processing of this type of procedure should be only slightly more expensive than the procedures presently used. The rather complex experience modification formula used here is derived from the conventional forms of experience modification formulae as shown in Appendix II. The objective in using this type of formula is to avoid the lengthy tables of credibility values and to make it easier to program for machine processing. It may be noted that no provision is made for departing from the credibility curves to provide for self-rating at some arbitrary point. As a practical matter, this should not be necessary. The uniform processing of all risks regardless of size is advantageous from a machine viewpoint and any reasonable value at which self-rating could be applied would be sufficiently large so that any underwriter would give it considerable individual attention, anyhow.

Both the expected loss ratios and "D" ratios shown are intended to be illustrative rather than recommended values. The "D" ratios were derived directly from the projected frequency functions shown in Appendix III. That is,

$$D = \frac{621.33 \int_{1000}^{25,000} \log_e \frac{x}{200} f(x)\,dx + 3000 \int_{25,000}^{\infty} f(x)\,dx + \int_{1}^{1000} x f(x)\,dx}{\int_{1}^{5000} x f(x)\,dx + 5000 \int_{5000}^{\infty} f(x)\,dx}$$

The denominator of this expression is probably overstated. I have used, in effect, a limit of $5/\infty$ as an approximation to $5/10$ or basic limits. This produces a "D" ratio which is somewhat conservative. The expected loss ratios shown are accurate only for certain states and certain lines. In order to apply this plan efficiently, it would be desirable to make some compromises so that uniform expected loss ratios may be used countrywide, but considerably more attention would have to be given this problem. It might also be desirable to refine the "D" ratios such as using separate values for each line of miscellaneous liability.

Multiple Coverage Experience Rating Plan

Eligibility–Any risk which develops a total of at least $500 of expected basic limits losses from all lines of auto liability, miscellaneous liability, and auto physical damage to be included for rating shall be eligible for application of this experience rating plan.

Experience Period–The normal experience period shall be the three policy years ending with the last completed policy year. Where, however, the risk has been insured less than three years or experience is not available for three completed policy years, a lesser period may be used subject to a minimum of one completed policy year.

Experience Used–Incurred losses and earned premiums developed by the company from operations of the risk during the experience period in all states and from all lines to be included for rating shall be used. Incurred losses are to include allocated claim expense. Experience of other companies or self-insured experience may be used if available in the form necessary for application of the rating procedure.

Expected Basic Limits Losses–The manual basic limits premium for the experience period multiplied by the expected loss ratio for each line of insurance included for rating is defined as expected basic limits losses. All limits of medical payments, 90% of Ph D written for ACV and the first $5000 of Ph D written for stated amount may be considered basic limits. The expected loss ratio is to be applied to 50% of the manual basic limits premium for elevator liability. Expected loss ratios are .47 for Miscellaneous Liability, .61 for Auto Liability

(Publics & Long Haul), .58 for Auto Liability (all other), .60 for Ph D (Publics & Long Haul), and .55 for Auto Ph D (all other).

Rating Procedure—(1) Determine total ratable losses by recording all incurred claims subject to a limit of $25,000 each. (2) Determine primary losses, Ap, by adding the total of all claims of less than $1000 each to the primary value of all other claims as determined from the Table of Primary Losses. (3) Excess losses, Ae, may be determined by subtracting primary losses from total ratable losses. (4) Determine a composite "D" Ratio by weighting the "D" ratio for each line by the expected basic limits losses for that line. "D" ratios are .759 for Miscellaneous Liability, .802 for Auto Liability, and .809 for Auto Physical Damage. (5) Determine a composite "Y" value by finding the ratio of the sum of total limits expected losses (subject to $25,000 per claim limit) for all lines to the sum of the expected basic limits losses for all lines. (6) Determine expected basic limits losses, E, from the sum of the expected basic limits losses for each line. (7) The experience modification may be found from the following formula, the result of which is to be applied to the manual total limits premium at current rates to determine the renewal premium:

$$M = \frac{(Ap + 12{,}000D)(500{,}000Y + DE) + DAe(E + 12{,}000)}{DY(E + 12{,}000)(E + 500{,}000)}$$

TABLE OF PRIMARY LOSSES

Actual Claim		Primary	Actual Claim		Primary
From	To	Value	From	To	Value
$1001	$1016	$1005	$ 3867	$ 3993	$1850
1017	1032	1015	3994	4123	1870
1033	1066	1030	4124	4257	1890
1067	1101	1050	4258	4396	1910
1102	1137	1070	4397	4540	1930
1138	1174	1090	4541	4689	1950
1174	1212	1110	4690	4842	1970
1213	1252	1130	4843	4999	1990
1253	1294	1155	5000	5184	2010
1295	1336	1170	5185	5397	2035
1337	1379	1190	5398	5618	2060
1380	1424	1210	5619	5849	2085
1425	1471	1230	5850	6089	2110
1472	1519	1250	6090	6339	2135
1520	1569	1270	6340	6600	2160
1570	1620	1290	6601	6871	2185
1621	1673	1310	6872	7153	2210
1674	1728	1330	7154	7446	2235
1729	1784	1350	7447	7752	2260
1785	1843	1370	7753	8070	2285
1844	1903	1390	8071	8402	2310
1904	1965	1410	8403	8747	2335
1966	2030	1430	8748	9142	2360
2031	2096	1450	9143	9595	2390
2097	2165	1470	9596	10069	2420
2166	2236	1490	10070	10567	2450
2237	2309	1510	10568	11090	2480
2310	2385	1530	11091	11639	2510
2386	2463	1550	11640	12215	2540
2464	2544	1570	12216	12819	2570
2545	2628	1590	12820	13453	2600
2629	2714	1610	13454	14119	2630
2715	2801	1630	14120	14877	2660
2802	2892	1650	14878	15739	2695
2893	2987	1670	15740	16651	2730
2988	3085	1690	16652	17616	2765
3086	3186	1710	17617	18637	2800
3187	3291	1730	18638	19716	2835
3292	3398	1750	19717	20860	2870
3399	3509	1770	20861	22068	2905
3510	3624	1790	22069	23441	2940
3625	3743	1810	23442	24999	2980
3744	3866	1830	25000 or More		3000

APPENDIX I

Derivation of Credibility Formulas

For a risk with expected losses of E at manual rates during a given experience period, the true inherent hazard of that risk $= E(1+m)$, $m > -1$.

The ratio of inherent hazard to expected hazard, then, $= 1+m$.

The ratio of actual losses, A, to expected losses for risks with expected losses of E may be defined as $A/E = R$.

If we plot the frequency of $1+m$ on one axis and the frequency of R on a second axis, we obtain a frequency surface whose marginal distributions $g(1+m)$ and $h(R)$ are skewed normal curves.

The regression line of R on $(1+m)$ is $R = (1+m)$ because for each group of risks with inherent hazard $E(1+m)$, the average actual loss must be $E(1+m)$. Since the usual form for a regression line may be expressed as

$$y_x = \left(r_{xy}\frac{S_y}{S_x}\right)x + \left(V_{1:y} - r_{xy}\cdot\frac{S_y}{S_x}V_{1:x}\right)$$

it is evident that $r_{R(1+m)}\dfrac{S_R}{S_{(1+m)}} = 1$

or that $r_{R(1+m)} = \dfrac{S_{(1+m)}}{S_R}$

and $V_{1:R} - r_{R(1+m)}\dfrac{S_R}{S_{(1+m)}}V_{1:(1+m)} = 0$

The regression line of $(1+m)$ on R is then

$$(1+m) = r_{R(1+m)}\frac{S_{(1+m)}}{S_R}R + (V_{1:(1+m)} - r_{R(1+m)}\frac{S_{(1+m)}}{S_R}V_{1:R})$$

$$= \frac{S^2_{(1+m)}}{S^2_R}R + \left(1 - \frac{S^2_{(1+m)}}{S^2_R}\right)$$, if we may assume the rate level

to be correct so that $V_{1:(1+m)} = V_{1:R} = 1$

Then $E(1+m) = \dfrac{S^2_{(1+m)}}{S^2_R}A + \left(1 - \dfrac{S^2_{(1+m)}}{S^2_R}\right)E$

$= ZA + (1-Z)E$, where $Z = \dfrac{S^2_{(1+m)}}{S^2_R}$

By defining $K = E\left(\dfrac{S^2_R}{S^2_{(1+m)}} - 1\right)$, $Z = \dfrac{E}{E+K}$

which is the familiar formula used in determining credibility values. In application to a particular class of insurance, this requires only a determination of S^2_R and $S^2_{(1+m)}$ to determine credibility values.

$$S_R^2 = \frac{S_A^2}{E^2} = \frac{S_A^2}{\bar{n}^2\bar{c}^2}$$

where n is the number of claims variable and c is the size of claim variable. Then the sample variance of A is

$$S_A^2 = \frac{S_{xc}^2}{\bar{x}}\,\overline{(1+m)}^2 + S_{(1+m)}^2\bar{x}^2\bar{c}^2$$

$$= S_x^2\,\bar{c}^2 + \frac{S_c^2}{\bar{x}}\,\bar{x}^2 + S_{(1+m)}^2\,\bar{x}^2\bar{c}^2, \text{ since } \overline{(1+m)} = 1$$

$= \bar{x}(c^2 + S_c^2) + S_{(1+m)}^2\,\bar{x}^2\bar{c}^2$, if we assume that x, a purely chance variable defined by $n = x(1+m)$, forms a Poisson Distribution

$$\text{Therefore, } K = E\left(\frac{S_R^2}{S_{(1+m)}^2} - 1\right)$$

$$= \bar{n}\bar{c}\left(\frac{\bar{x}(\bar{c}^2 + S_c^2) + S_{(1+m)}^2\;\bar{x}^2\bar{c}^2}{\bar{n}^2\bar{c}^2} - 1\right)$$

$$= \frac{\bar{c}^2 + S_c^2}{\bar{c}S_{(1+m)}^2}, \text{ because } \bar{n} = \bar{x}$$

$$= \frac{U_{2:c}}{\bar{c}S_{(1+m)}^2}$$

where $U_{2:c}$ is the second moment about the origin of the distribution of claims by size.

For the purposes of this experience rating plan, $U_{2:c}$ was calculated from the frequency functions shown in Appendix III. Where the functions were not directly integrable, the appropriate integrations were carried out by use of Simpson's rule, using 5 points between c=1,000 and c=5,000, 5 points between c=5,000 and c=10,000, and 7 points between c=10,000 and c=25,000.

No empirical basis is available for computation of $S_{(1+m)}^2$. It is, therefore, necessary to assume an appropriate value. The "K" values shown below have been computed using $S_{(1+m)}^2 = .10$. If we assume, for the moment, that $(1+m)$ is normally distributed, the implication of the choice of $S_{(1+m)}^2 = .10$ is that 50% of all risks have inherent hazard between .79 and 1.21, and that 99% of all risks have inherent hazard between .19 and 1.81. Because the distribution of $(1+m)$ is undoubtedly skewed, the 50% interval is probably being ascribed to a range of about .85 to 1.30 while the 99% range more likely runs from about .40 to 2.50. It may be noted that a computation of $S_{(1+m)}^2$ for New York Workmen's Compensation risks, using their experience modifications as an estimate of $(1+m)$, produced $S_{(1+m)}^2 = .06$ approximately. Because Workmen's Compensation insurance utilizes a more refined classification system than Auto Liability, Miscellaneous Liability, or Physical Damage, we would expect the latter coverages to produce $S_{(1+m)}^2$ greater than that for Workmen's Compensation.

On these bases, K values were computed as follows:

	Kp (1)	Ke (2)	Kp (3)	Ke (3)
Auto Liability	9,099	177,786	11,343	581,957
Miscellaneous Liability	10,884	186,304	14,334	463,817
Auto Physical Damage	8,735	152,250	10,801	710,880

(1) in terms of primary losses
(2) in terms of excess losses
(3) in terms of basic limits losses

As working values for application to this Multiple Coverage Experience Rating Plan, I have suggested the use of Kp=12,000 and Ke=500,000.

APPENDIX II

Derivation of Rating Formula

Let the modification of primary losses be:

$$Mp = \frac{Zp\,Ap + DE(1-Zp)}{DE},$$

where Zp = primary credibility
Ap = actual primary losses
E = basic limits expected losses
D = "D" ratio

Let the modification of excess losses be:

$$Me = \frac{Ze\,Ae + (Y-D)E\,Mp(1-Ze)}{(Y-D)E\,Mp}$$

where Ze = excess credibility
Ae = actual excess losses
Y = the composite increased limits factor

Therefore, the total modification would be:

$$Mt = \frac{MpDE + MeMp(Y-D)E}{YE}$$

$$= \frac{Mp(D + MeY - MeD)}{Y}$$

Substituting for Mp and Me in the above equation,

$$Mt = \frac{ZpAp + DE(1-Zp)}{YDE}\left[Y(1-Ze) + ZeD + \frac{ZeAeD}{ZpAp + DE(1-Zp)}\right]$$

Substituting $Zp = \frac{E}{E+Kp}$ and $Ze = \frac{E}{E+Ke}$,

$$Mt = \frac{Ap+DKp}{YD(E+Kp)}\left[\frac{YKe+DE}{E+Ke} + \frac{AeD(E+Kp)}{(E+Ke)(Ap+DKp)}\right]$$

$$= \frac{(Ap+DKp)(YKe+DE)+AeD(E+Kp)}{YD(E+Kp)(E+Ke)}$$

APPENDIX III

Frequency Distributions

Miscellaneous Liability

Interval	Data	Fitted Function	Projected Function
\$ 1 – \$ 24	.27450	.26517	.20663
25 – 49	.17223	.15740	.13915
50 – 99	.16630	.17223	.16878
100 – 249	.16561	.19070	.21086
250 – 499	.09526	.09415	.11506
500 – 999	.06256	.05626	.07267
1,000 – 1,999	.03375	.03098	.04140
2,000 – 2,999	.01258	.01077	.01467
3,000 – 3,999	.00596	.00551	.00748
4,000 – 4,999	.00316	.00332	.00459
5,000+	.00809	.01351	.01870

Source of Data: NBCU Special Call—Claims Settled in Calendar Year 1954.

Fitted Function: $f(x) = \frac{68.608}{(x+95)(x+46)}, x \geqslant 1$

Projected Function: $f(x) = \frac{95.376}{(x+133)(x+64)}, x \geqslant 1$

Auto Liability

Interval	Data	Fitted Function	Projected Function
\$ 1 – \$ 24	.18824	.20948	.17678
25 – 49	.20956	.17876	.15689
50 – 99	.22402	.23676	.23085
100 – 249	.21023	.20833	.23840
250 – 499	.08493	.08013	.09405
500 – 999	.04315	.04242	.05032
1,000 – 1,999	.02035	.02184	.02605
2,000 – 2,999	.00711	.00738	.00882
3,000 – 3,999	.00388	.00371	.00444
4,000 – 4,999	.00218	.00223	.00267
5,000+	.00635	.00896	.01075

Source of Data: NBCU Special Call – Claims Settled in Any 12 Month Period of 1956-57 for BI and Any 3 Month Period of 1956-57 for PD.

Fitted Functions: $f(x) = .0095657 - .000064407x,\ 1 \leqslant x < 100$

$$= \frac{45}{(x+20)^2},\ x \geqslant 100$$

Projected Functions: $f(x) = .0079445 - .000044503x,\ 1 \leqslant x < 120$

$$= \frac{54}{(x+24)^2},\ x \geqslant 120$$

AUTO PHYSICAL DAMAGE

Interval	Data	Fitted Function	Projected Function
\$ 1 – \$ 99	.62701	.62701	.57970
100 – 499	.26542	.28574	.31226
500 – 999	.05379	.04536	.05657
1,000 – 1,999	.03097	.02189	.02807
2,000 – 2,999	.01153	.00828	.00883
3,000 – 3,999	.00405	.00340	.00420
4,000 – 4,999	.00285	.00194	.00242
5,000+	.00428	.00638	.00795

Source of Data: Continental Casualty Company – Claims Settled in Calendar Year 1957.

Fitted Function: $f(x) = \frac{244.305}{(x+78)^{2.214}},\ x \geqslant 1$

Projected Function: $f(x) = \frac{305.612}{(x+94)^{2.214}},\ x \geqslant 1$

APPENDIX IV

Experience Rating Worksheet - Page 1.

Coverage	Policy Year	Manual Basic Limits Premium	Exp. Loss Ratio	Expected Basic Limits Losses	"D" Ratio	Expected Primary Losses	Incr. Lim. Factor	Total Expected Losses
			E			B	C	

D = B/E

Y = C/E

Experience Rating Worksheet - Page 2.

Loss Experience

	Ratable Losses	Policy Year	Primary Losses
Total of Claims $1,000 or Less Each			
Individual Claims of More Than $1,000			
T		Ap	

Ae	= T - Ap

Rating Procedure

(1)	12,000 x D	
(2)	(1) + Ap	
(3)	500,000 x Y	
(4)	(3) + B	
(5)	E + 12,000	
(6)	(5) x D	
(7)	E + 500,000	
(8)	(7) x Y	
(9)	(2) x (4)	
(10)	(6) x Ae	
(11)	(9) + (10)	
(12)	(6) x (8)	
(13)	(11) + (12)	