A CASUALTY MAN LOOKS AT FIRE INSURANCE RATE MAKING

BY

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Since we are now a fire insurance society as well as a casualty society, it behooves us to familiarize ourselves with fire insurance rate making procedures. The best way to do this is to hear from fire insurance men, which I understand we shall do this afternoon. However, since many of our members are unfamiliar with fire insurance rate making procedures, it may be helpful to look at fire insurance rate making through the eyes of one who is not familiar with their processes.

Last summer, with this thought in mind I decided to visit the New York Fire Insurance Rating Organization. It proved to be a fortunate decision because both Mr. Rice, the general manager and Mr. Hayden, who acted as my tutor, were exceedingly cooperative. Whatever information I requested was made available immediately, together with a logical and simple explanation. This is a report of that visit.

No attempt was made to investigate schedule rating although it is of the utmost importance in determining the individual policyholder's rate. The study was limited to the processes involved in arriving at the manual, or class rate, as it is called in fire insurance.

Before plunging into a description of the rate making procedures, we must consider a few broad principles upon which fire insurance rate making rests. Only a fire insurance man is qualified to comment fully on fire underwriting considerations but the following are fundamental and must therefore be mentioned:

1. Superior construction should be rewarded with a lower rate, other things being equal. For example, brick construction is better than frame construction and fire resistive construction is better than brick construction, other things being equal.
2. The degree of protection, both public and private should be reflected in the rate (Credit for private protection is largely accomplished through Schedule Rating).
3. In general the contents rate should be higher than the building rate.

Rate making results should not run counter to these principles.

Then there is the conflagration hazard which the fire actuary must consider. Casualty insurance is exposed to a catastrophe hazard also, but generally the catastrophe affects only a single policyholder. The chance that a single catastrophe would involve a large number of casualty policyholders is slight. However, the threat of a conflagration involving hundreds of policyholders is very real in fire insurance and must be considered in arriving at a fire insurance rate.

Similar exposure to catastrophic losses exists with respect to other coverages written by Fire Insurance Companies such as Extended Coverage. The November 25, 1950 windstorm affecting thousands of policyholders in New England and the Middle Atlantic States is a recent example of such a catastrophe. The estimated losses for this storm are almost $200,000,000 and the number of claims may reach 500,000.

Another problem fire insurance actuaries must deal with is the fact that fire insurance and related coverages are admittedly low frequency coverages. Because of low frequency, slavish adherence to indicated rate levels might result in violent fluctuations in rates as well as violent fluctuations in relativity. To achieve a desirable degree of stability, exercise of underwriting judgment is required in selecting rate levels.

Coinsurance is another problem not often encountered by casualty actuaries. Its importance is considered by fire underwriters to diminish as the probability of total loss increases. If all losses were total losses there would be no co-insurance problem.

For these and other reasons, the problems confronting the fire insurance actuary are different from the problems of the casualty actuary. Nevertheless, in spite of these important differences, there is a family resemblance between fire insurance rate making procedures and the procedures we are familiar with in the casualty field. For example, in reviewing the fire rating procedures we encounter such familiar friends as rate level, relativity, classification experience, permissible loss ratio and even our old friend, the credibility factor, though they are sometimes called by different names.

The principal difference between casualty and fire rate making, it seems to me, is not so much in the procedures themselves as in the attitude of the rate maker toward the final result. With respect to lines of insurance involving a large volume of statistics, casualty men are prone to accept the results of their rate making processes as final except in unusual cases. Fire men, on the other hand, seem to look upon their processes merely as tests of the existing rates. Perhaps this is due to the difference in frequency referred to above.

To consider the actual steps followed in arriving at a fire insurance rate, let us review the 1951 New York Rate Revision. The essential features of the revision were:

1. The revision was based upon the experience for 1945 to 1949 inclusive.
2. The revision was based on New York experience, except for classifications with a limited volume of experience.
3. Rates were computed separately for New York City and for the balance of the State.
4. Changes in rates were ignored if they were less than 4%.
5. Credibility was so determined that one year's experience would not affect the final experience change for a classification by more than 10%.

The "permissible loss ratio" used in these calculations was 47.5%. "Permissible loss ratio" has been shown in quotes because fire insurance men, I am told, do not recognize the existence of a permissible loss ratio as we know it. Obviously, however, some basis of comparison must be agreed upon for testing rate levels and 47.5% was used for this purpose. This percentage was based upon the following distribution of premium between losses, expenses, profit and catastrophe:

Losses	47.5%
Expenses	46.5
Profit and Catastrophe	6.0
	100.0%

The arithmetic steps followed in the Rate Revision are shown for several classes in Table 1. They are:

1. The "Written-Paid" loss ratios were determined for each classification. In determining these loss ratios, written premiums were adjusted for rate level changes occurring since January 1, 1945.
2. The "Written-Paid" loss ratios were adjusted to prevent the experience of a single year from increasing or decreasing the final rate more than 10% after the application of the appropriate credibility factor. The table of these factors as well as the derivation of the table is shown in Table 2 following.
3. The "Written-Paid" loss ratios were converted to an "earned incurred" basis. The formulae for this conversion are as follows:

Earned Premium	=	Net Premium Written
	+	Unearned Premium at beginning of year
	−	Unearned Premium at end of year
Incurred Losses	=	Net Losses Paid
	+	Losses Outstanding at end of year
	−	Losses Outstanding at beginning of year

4. The "earned incurred" loss ratios were compared to the permissible loss ratio of 47.5% to determine the gross indicated change for each classification.
5. The credibility factor for each classification was determined from the following table:

Credibility Table

5-Year Premium	*5-Year Credibility Factor*
0— 49,999	.05
50,000— 199,999	.10
200,000— 449,999	.20
450,000— 799,999	.30
800,000—1,249,999	.40
1,250,000—1,799,999	.50
1,800,000—2,499,999	.60
2,500,000—3,199,999	.70
3,200,000—3,999,999	.80
4,000,000—4,999,999	.90
5,000,000 and over	1.00

6. The Credibility factor for each classification was applied to the gross indicated change for the classification to determine the net indicated change.

These operations were performed by the New York Fire Insurance Rating Organization and were based on its own experience. After these calculations were completed a number of discussions were held with the New York Insurance Department. The New York Insurance Department made similar tests combining the experience of non-bureau companies with the experience of the New York Fire Insurance Rating Organization. At the end of these discussions the final rate changes were agreed upon. The Insurance Department's

indicated change as well as the requested change and the adopted change are also shown in Table 1.

Table 1 shows these calculations for several large classifications. All of the steps described above are illustrated by Brick Protected Schools—Upstate, the first sub-division of Table 1 as follows:

1. The "Written-Paid" loss ratio for 1945 to 1949 was
   64.04%
2. The 1947 loss ratio of 94.29% would have influenced the five year rate level by more than 10%, therefore the losses for 1947 were adjusted to produce a loss ratio for the year of 87% (This is in accordance with Table 2 which shows that the loss ratio for a single year should not exceed 87% when classification credibility is .60). This adjustment resulted in a five year adjusted loss ratio on a "Written-Paid" basis of
   62.64%
3. This loss ratio was converted to an "Earned-Incurred" basis and became
   74.01%
4. The gross indicated change in rates was
   $$\frac{74.01}{47.5} - 1.000 = .558 \text{ or } 55.8\%$$
5. The Credibility Table shows that if the five year premium is more than $1,800,000 and less than $2,499,999 the credibility factor should be .60. Since the five year premium for this classification was $2,199,363 the credibility factor was
   .60
6. The net indicated change was therefore
   $.60 \times 55.8\% = 33.5\%$
7. The indicated change obtained by the Insurance Department based on the experience of all companies was
   31.0%
8. The requested change was
   25.0%
9. The adopted change was
   25.0%

Although rate level changes are computed separately for the various subdivisions of the classifications it is customary also to compute the over-all rate level change for the classifications. Since the rate level indications for each subdivision are not always followed entirely it is desirable to have the over-all change as a check on the results for the classification as a whole. The over-all rate level change for Schools has been included on Table 1.

Although the rates for all brick protected schools in New York State, out-

side of New York City were increased 25%, it does not follow that two brick protected schools in upstate New York would have identical rates. Their rates might be different because the cities in which they were situated did not have the same fire-fighting facilities or the same available water supply. They might be different because of varying degrees of protective devices such as sprinklers. They might be different because of the exposure created by surrounding buildings or for many other reasons recognized by schedule rating.

The above has been a description of the rate making procedures for direct fire insurance followed in the State of New York. There are many other fire coverages and many other states. However, direct fire insurance is the largest fire line and New York is the largest state. Consequently, direct fire rating procedures as practiced in New York would seem to be a fair sample of rating procedures in the industry.

Many factors besides rate levels affect loss ratios. Nevertheless, as a rough measure of the effectiveness of fire insurance rate making procedures, New York State and Countrywide loss ratios on an earned incurred basis for the last five years are shown below.

	Countrywide		*New York State*	
Year	*Earned Premiums*	*Loss Ratio*	*Earned Premiums*	*Loss Ratio*
1946	$644,288,459	53.3%	$ 71,648,505	54.9%
1947	770,738,539	53.6	85,031,232	53.2
1948	867,012,493	48.3	100,128,226	45.6
1949	936,198,726	40.7	*115,905,872	39.0
1950	970,732,739	40.3	*114,026,804	39.4

*before reinsurance

The above figures were prepared by Mr. Collins of the New York Insurance Department and appeared in the September 25, 1951 issue of The Journal of Commerce. They were prepared by Mr. Collins from the Insurance Expense Exhibits filed by companies licensed to do business in New York. These figures are on a net premium basis, that is after reinsurance except the New York State figures for 1949 and 1950 which are on a direct basis, that is before reinsurance.

TABLE I

		Written Prem. (Adjusted for) (Rate Changes)	*Paid Losses*	*Written-Paid L.R.* *Actual*	*Written-Paid L.R.* *Adjusted*	*Earned Incurred Loss Ratio*	*Indicated Change (Gross)*	*Credibility Factor*	*Indicated Change (Net)*	*Indicated Change Ins. Dpt.*	*Requested Change*	*Adopted Change*
CLASS 3—SCHOOLS UP-STATE												
Brick Protected	1945	306,786	207,813	67.74								
	1946	395,855	192,970	48.75								
			(365,799)*									
	1947	420,459	396,459	94.29	87.00							
	1948	470,026	287,461	61.16								
	1949	606,237	323,736	53.40								
			(1,377,779)*									
	Total	2,199,363	1,408,439	64.04	62.64	74.01	+55.8	.60	+33.5	+31.0	25.0	25.0
Frame Protected	1945	60,632	38,038	62.73								
	1946	114,467	35,591	31.09								
	1947	106,852	37,922	35.49								
	1948	144,565	31,772	21.98								
	1949	148,909	62,616	42.05								
	Total	575,425	205,939	35.79	35.79	44.01	− 7.4	.30	− 2.2	+ 0.8	no change	
Un-protected	1945	112,060	32,351	28.87								
	1946	135,036	97,476	72.18								
	1947	160,876	28,491	17.71								
	1948	218,471	55,921	25.60								
	1949	199,899	112,281	56.17								
	Total	826,342	326,520	39.51	39.51	47.02	− 1.0	.30	− 0.3	− 2.3	no change	
Fire Resistive	1945	133,221	17,834	13.39								
	1946	130,253	52,230	40.10								
	1947	214,064	152,736	71.35								
	1948	301,138	269,071	89.35								
	1949	338,041	175,692	51.97								
	Total	1,116,717	667,563	59.78	59.78	81.94	+72.5	.40	+29.0	+24.7	25.0	25.0

*Adjusted to produce 87.0% Loss Ratio for 1947.

TABLE I—Continued

		Written Prem. (Adjusted for) (Rate Changes)	*Paid Losses*	*Written-Paid L.R.*		*Earned Incurred Loss Ratio*	*Indicated Change (Gross)*	*Credibility Factor*	*Indicated Change (Net)*	*Indicated Change Ins. Dpt.*	*Requested Change*	*Adopted Change*
				Actual	*Adjusted*							
CLASS 3 SCHOOLS—NEW YORK CITY												
Brick Protected	1945	55,331	20,002	36.15								
	1946	73,946	8,019	10.84								
	1947	71,928	32,635	45.37								
	1948	109,787	3,494	3.18								
	1949	106,275	10,199	9.60								
	Total	417,267	74,349	17.82	17.82	21.14	−55.5	.20	−11.1	−11.2	no change	
Frame Protected	1945	4,326	408	9.43								
	1946	7,802	1,082	13.87								
	1947	30,472	9,481	31.11								
	1948	24,980	6,008	24.05								
	1949	25,040	2,409	9.6								
	Total	92,620	19,388	20.93	20.93	29.95	−37.0	.10	− 3.7	− 4.3	no change	
Fire Resistive	1945	47,897	34,017	71.02								
	1946	53,704	9,029	16.81								
	1947	112,341	26,591	23.67								
	1948	81,609	21,531	26.38								
	1949	96,071	9,189	9.56								
	Total	391,622	100,357	25.62	25.62	32.23	−32.2	.20	− 6.4	− 6.8	no change	
CLASS 3 SCHOOLS—NEW YORK CITY AND REMAINDER OF STATE COMBINED												
Total	N.Y.C.	901,509	194,094	21.53	21.53	26.65	−43.9	.40	−17.6			
	Rem.	4,717,847	2,577,801	54.64	54.64	67.15	+41.4	.90	+37.3			
	Total	5,619,356	2,771,895	49.33	49.33	60.72	+27.8	1.00	+27.8			

*Adjusted to produce 87% Loss Ratio for Brick Protected Schools—up state for 1947.

TABLE I—Continued

		Written Prem. (Adjusted for) (Rate Changes)	*Paid Losses*	*Written-Paid L.R.*		*Earned Incurred Loss Ratio*	*Indicated Change (Gross)*	*Credibility Factor*	*Indicated Change (Net)*	*Indicated Change Ins. Dpt.*	*Requested Change*	*Adopted Change*
				Actual	*Adjusted*							
				CLASS 4 DWELLINGS—UP-STATE								
Brick Protected	1945	1,699,027	706,227	41.57								
	1946	2,240,847	1,144,361	51.07								
	1947	2,477,493	1,006,316	40.62								
	1948	1,815,346	741,662	40.86								
	1949	1,855,375	642,449	34.63								
	Total	10,088,088	4,241,015	42.04	42.04	45.06	− 5.2	1.00	− 5.2	− 5.7	no change	
				CLASS 4 DWELLINGS—NEW YORK CITY								
Brick Protected	1945	5,706,437	3,170,644	55.56								
	1946	6,803,444	3,644,701	53.57								
	1947	7,331,440	3,600,640	49.11								
	1948	8,585,120	3,893,172	45.35								
	1949	9,870,862	3,606,815	36.54								
	Total	38,297,303	17,915,972	46.78	46.78	56.82	+19.6	1.00	+19.6	+17.9	approxim. 10%	
				CLASS 6 MERCANTILE—UP-STATE								
Brick Protected	1945	2,018,457	957,466	47.43								
	1946	2,729,926	1,251,975	45.86								
	1947	3,106,114	1,051,793	33.86								
	1948	2,861,250	1,579,733	55.21								
	1949	3,084,882	1,195,882	38.76								
	Total	13,800,629	6,036,849	43.74	43.74	49.83	+ 4.9	1.00	+ 4.9	+ 3.4	no change	
				CLASS 6 MERCANTILE—NEW YORK CITY								
Brick Protected	1945	5,398,787	3,058,961	56.66								
	1946	6,649,689	2,874,381	43.22								
	1947	6,330,349	2,979,563	47.07								
	1948	7,655,632	3,365,427	43.96								
	1949	7,801,482	2,764,833	35.44								
	Total	33,835,939	15,043,165	44.46	44.46	51.82	+ 9.1	1.00	+ 9.1	+ 6.7	5.0	5.0

TABLE 2

CREDIBILITY FACTORS AND MAXIMUM AND MINIMUM ANNUAL LOSS RATIOS

5-Year Premium	*5-Year Credibility Factor*	*Single Year Loss Ratio Limit*	
		Upper	*Lower*
0— 49,999	.05	5.225	.000
50,000— 199,999	.10	2.850	.000
200,000— 449,999	.20	1.662	.000
450,000— 799,999	.30	1.266	.000
800,000—1,249,999	.40	1.068	.000
1,250,000—1,799,999	.50	.950	.000
1,800,000—2,499,999	.60	.870	.080
2,500,000—3,199,999	.70	.814	.136
3,200,000—3,999,999	.80	.771	.179
4,000,000—4,999,999	.90	.738	.212
5,000,000—and over	1.00	.712	.238

The Five Year Credibility Factors are, of course, arbitrary Factors but the Upper and Lower One Year Loss Ratio Limits are calculated amounts. They are so calculated as to limit the effect of the experience of a single year to a rate level change of 10% after the appropriate Credibility Factor has been applied to the limited five year loss ratio. In the calculation a constant premium volume is assumed for each of the 5 years.

For example, the effect of an annual loss ratio of .870 on a five year rate level would be 16.6% for a classification having 100% credibility.

$$\frac{1}{5} \text{ of } \left(\frac{.870}{.475} - 1.000\right) = 16.6\%$$

But if the credibility for the class is 60%, as in the case of Brick protected schools up-state, the change in rate level would be 10%.

$$60\% \text{ of } 16.6\% = 10\%$$

The formula for the Maximum Annual Loss Ratio is:

$$\left[\frac{X + 4(.475)}{5(.475)} - 1.000\right] C = .10$$

$$\frac{X + 4(.475)}{5(.475)} = \frac{.10}{C} + 1.000$$

$$X + 4(.475) = 2.375\frac{(.10)}{C} + 2.375$$

TABLE 2 (*Continued*)
CREDIBILITY FACTOR AND MAXIMUM AND MINIMUM ANNUAL LOSS RATIOS

$$X = 2.375\frac{(.10)}{C} + 2.375 - 1.900$$

$$X = 2.375\frac{(.10)}{C} + .475$$

The formula for the Minimum Annual Loss Ratio is:

$$\left[\frac{X + 4(.475)}{5(.475)} - 1.000\right] C = -.10$$

$$\left[\frac{X + 4(.475)}{5(.475)}\right] = 1.000 - \frac{.10}{C}$$

$$X + 4(.475) = 2.375 - 2.375\frac{(.10)}{C}$$

$$X = 2.375 - 1.900 - 2.375\frac{(.10)}{C}$$

$$X = .475 - 2.375\frac{(.10)}{C}$$

On the basis of these formulae the Table is built up as follows:

C	$\frac{.10}{C}$	$\frac{2.375\,(.10)}{C}$	*Maximum* $\frac{2.375\,(.10) + .475}{C}$	*Minimum* $\frac{.475 - 2.375\,(.10)}{C}$
.05	2.000	4.750	5.2250	negative
.10	1.000	2.375	2.8500	negative
.20	.500	1.1875	1.6625	negative
.30	.3333	.7917	1.2667	negative
.40	.2500	.5938	1.0688	negative
.50	.2000	.4750	.9500	.0000
.60	.1667	.3959	.8709	.0791
.70	.1429	.3394	.8144	.1356
.80	.1250	.2969	.7719	.1781
.90	.1111	.2639	.7389	.2111
1.00	.1000	.2375	.7125	.2375

Theoretically the Maximum and Minimum Loss Limits should be applied to the "Earned-Incurred" Loss Ratios. In actual practice, however, they are applied to the "Written-Paid" Loss Ratios as shown in Table I. The difference between the two procedures has been found to be negligible.