

USE OF NATIONAL EXPERIENCE INDICATIONS IN WORKERS' COMPENSATION INSURANCE CLASSIFICATION RATEMAKING

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The use of national experience indications in workers' compensation insurance classification ratemaking is more familiarly known as small credibility ratemaking. It is a response to a current need and one which is closely akin to processes used during the early days of workers' compensation insurance classification ratemaking.

Historically, classification ratemaking depended to a large extent upon national pure premiums¹, that is, pure premiums were derived from observations of the countrywide classification experience. Differences in pure premium from state to state depended upon measured differences in benefit levels provided by workers' compensation law in each state. Subsequently, this approximation to costs under individual state laws was abandoned as being too crude.

The general movement of state regulation has been in the direction of recognition of each state's own experience. The rates produced as a result of this movement are valid to the extent that the experience within a state is credible. To the extent that the classification experience is not credible, the post World War II techniques used have been those of changing the rates for the non-credible classifications (that is, the non-reviewed classes) only to the extent of general changes in rate level, industry level, or law benefit level. The difficulty with this approach is that the limited experience of the non-reviewed classifications is virtually disregarded as being non-credible. Their rates do not reflect changes in actual costs which take place in non-reviewed classifications. Moreover, this approach tends to produce or perpetuate anomalies with respect to competing manufacturers, processors or distributors who operate in different states within the same industry.

Small credibility ratemaking is a way of continuing to use state experience wherever feasible and to meld the national experience to the extent of its credibility. It is more refined than the prior national pure premium system. This refinement was achieved by adjusting the experience for the

¹ Clarence W. Hobbs, *The National Council on Compensation Insurance*, (Globe Printing Co., New York, circa 1930), pp. 6, 100.

differences between state and average national benefit levels. In its initial stages during the late 1950's and early 1960's, the tentative small credibility ratemaking approach established 50 classifications which have a substantial payroll base and which normally exist in most states. The partial (serious, non-serious and medical) claim frequencies and partial claim costs for these 50 classifications were ascertained on a countrywide basis. A system was devised for obtaining the partial claim frequencies and partial claim costs from the national data base exclusive of the state which would be considered for rate revision. Factors to adjust to state conditions were determined for application to the partial claim costs and partial claim frequencies for all classifications. The program also required that these national partial claim cost and partial claim frequency indications be introduced to a limited degree in the following way. What normally had been the complement of credibility was subdivided into the credible part of the countrywide information (but it could never exceed 50% of the usual complement of the credibility factor) and the balance of the 100% weight was assigned to the state underlying average claim cost or claim frequency of the classification.

Although the process of the tentative approach could work, it appeared to have a number of gaps. Only 50 of the 700 odd classifications were included as the basis for establishing credibilities for all classifications and these were not necessarily large volume classifications. The particular formula² which was mathematically correct appeared to require a more so-

² The procedure relied upon fifty key codes or manual classifications to adjust experience in different states to a common level. Countrywide weights based on expected losses for the key codes were used to determine key code average frequencies F_i , and key code average severities S_i , for state i . For the state k , for which rates were to be revised, actual A-sheet experience was employed to calculate F_k and S_k ; for the remaining states data base records were utilized. Separate averages were calculated for serious, non-serious, and medical losses. The national serious pure premium for classification j , when revising state k , was to be computed as:

$$\text{serious pure premiums} = [S_k \sum_{i \neq k} ({}_iL_j \div S_i)] [F_k \div \sum_{i \neq k} ({}_iP_j \times F_i)]$$

where:

S_k = key code average serious severity (cost per case) for state k

${}_iL_j$ = serious losses (from data base) for classification j in state i

S_i = key code average serious severity (cost per case) for state i

F_k = key code average serious frequency (cases per \$100 payroll) for state k

${}_iP_j$ = payroll in hundreds for classification j in state i

F_i = key code average serious frequency (cases per \$100 payroll) for state i

National non-serious and medical pure premiums were similarly derived. The credibility weights assigned to state, national and underlying pure premiums were identical to those finally adopted and described later in the text.

pshisticated knowledge than one might reasonably expect of at least some state regulators; explanations of its derivation and operation could not readily be described to the premium paying public and others who were concerned with workers' compensation insurance costs.

A fresh approach to the problem was undertaken. Instead of the tentative approach of using partial claim frequencies and partial claim costs separately, a partial pure premium was utilized and the 50 classifications were replaced by all classes. The experience of other states was modified to permit its inclusion with the state being revised. Separately, the modified national experience³ serious, non-serious and medical pure premium for each classification was multiplied by the payrolls for that classification code number in the state undergoing revision. The sum of the products for all classifications represents what the dollars of loss would have been if modified national experience were distributed according to the payrolls generated in the state being revised. The difference between these aggregate losses and the actual losses in the state being revised was used to generate a factor to adjust each state's partial pure premium so that it would balance to the average partial pure premium in the state undergoing revision.

With the modified national experience on the level of the state's partial pure premium, the credibility weighting process proceeds. As in the earlier tentative program, the state's own experience is afforded credibility in accordance with customary standards except that credibility intervals of .01 are used in lieu of .10 of the older system. The modified national classification experience is afforded credibility based on number of claims, but is subject to a maximum not to exceed one-half of the complement of the state's credibility for the classification⁴. The remainder of 100% is assigned to the pure premium underlying the present rate for the classification⁵. The process is performed separately for the serious, non-serious and medical pure premiums.

The Appendix contains a technical description, formulae, credibility tables underlying the process described above and an illustrative example.

From an analytical point of view, the new small credibility program looks upon workers' compensation experience at two levels. Primarily, the

³ The term "modified national experience" used in this paper means the experience of all states except the particular state undergoing a rate revision.

⁴ For example: fifty non-serious claims indicates a national credibility of .30. However, if the state non-serious credibility were .60, then the national credibility is limited to one-half the complement of .60; i.e. .20 in lieu of .30.

⁵ Also described as present on rate level pure premium.

first level affords recognition to experience within the state to the extent of the classification credibility. Where the state classification partial pure premium experience is not credible, reliance is placed upon the corresponding partial pure premium for the classification outside the state, with the proviso that the underlying partial pure premium must always be afforded at least half of the complement of the state classification's partial pure premium credibility. In this way, the rate for a manufacturing industry will reflect experience within the state; to the limited extent that no such experience can be relied upon for that industry, reliance is placed upon other states' experience for that manufacturing industry (with appropriate factor adjustments to reflect general state conditions) in combination with the historical record for the class (underlying pure premium) within the state.

This new process is viewed as an improvement in the effort to achieve fair, reasonable, and equitable rates wherein actual experience within and outside the state is expanded substantially.

APPENDIX

SMALL CREDIBILITY RATE-MAKING PROCEDURES

The National Council has developed a small credibility ratemaking procedure which is expected to result in refined ratemaking⁶. The procedure involves the use of a data base consisting of individual classification experience on an individual state basis for three policy years. The experience consists of the following records:

1. payroll
2. number of serious cases
3. amount of serious losses
4. number of non-serious cases
5. amount of non-serious losses
6. amount of medical losses
7. policy periods and law level

Proposed partial pure premiums are the sum of (1) the product of the state indicated partial pure premium and state credibility in 1% intervals, (2) the modified national partial pure premium and national credibility in 1% intervals, and (3) the present on rate level partial pure premium and the residual credibility. State credibility is based upon the same 100% standards and the same formula [criterion for credibility value of Z is equal to $Z^{3/2}$ x full credibility standard] as at present except that the formula is evaluated at 1%, in lieu of 10%, intervals. National credibility utilizes the same formula but, for simplicity, is premised on number of cases rather than expected losses and is limited to 50% of the complement of the state credibility. The national serious full credibility standard is 25 serious cases, the national non-serious standard is 300 non-serious cases, and the national medical standard is 300 indemnity (serious and non-serious) cases⁷.

The small credibility procedure is premised upon the principles of uniform relative hazard among classes. This principle refers to the hazard for any classification in any state having the same relationship (except for chance variation), after suitable adjustment by indices, to the hazard of any second classification chosen.

⁶ See Roy H. Kallop, "A Current Look At Workers' Compensation Ratemaking." *P.C.A.S., LXII* (1975).

⁷ See Appendix, Exhibit II, "Credibility Criteria for National Experience."

The formula recognizes uniform relative hazard by means of statewide average pure premiums derived from actual experience in each state i and the distribution of payroll among classifications in state k , for which rates are to be revised. For any state i , the state average serious pure premium PP_i is computed as:

$$PP_i = \frac{\sum_j ({}_iL_j \div {}_iP_j) {}_kP_j}{\sum_j {}_kP_j}$$

Values of ${}_kL_j$ and ${}_kP_j$ are taken from A-sheet data⁸; for the remaining states, values of ${}_iL_j$ and ${}_iP_j$ are from the data base. The modified national serious pure premium for classification j when revising state k is:

$$\text{serious pure premium} = \frac{\sum_{i \neq k} {}_iL_j (PP_k \div PP_i \div \sum_{i \neq k} {}_iP_j)}{\sum_{i \neq k} {}_iP_j}$$

where ${}_iL_j$ = serious losses (from data base records) for classification j in state i , and

where ${}_iP_j$ = payroll in hundreds for classification j in state i

Modified national non-serious and medical pure premiums are similarly derived.

[In the case of classifications that would involve division by zero in the formula, modified national pure premiums are defined to be zero and have no credibility.]

The small credibility procedure does not attempt to improve classification ratemaking by the introduction of new credibility standards and/or formulas. Rather, it expands the volume of classification experience by recognizing modified national indications. The result is greater equity among classification rates and no change in overall rate level.

A sample calculation of the process for state k is shown in Exhibit I. For simplicity, it is assumed that states a , b and k comprise the countrywide data base. Within each state, codes 1 and 2 represent all classes.

⁸ See Roy H. Kallop, "A Current Look At Workers' Compensation Ratemaking" Exhibit II, *P.C.A.S., LXII* (1975).

EXHIBIT 1

STATE k

COMPUTATION OF PROPOSED SERIOUS PURE PREMIUMS FOR ALL CLASSES (CODE 1 AND CODE 2)

	State k		State a		State b	
	Code 1	Code 2	Code 1	Code 2	Code 1	Code 2
1. exposure	10,846,000	8,304,000	7,250,000	110,000,000	3,250,000	210,000,000
2. number of serious cases	15	2	10	10	5	20
3. amount of serious losses	305,100	20,760	220,000	110,000	220,000	440,000
4. state k serious cred.	54%	9%	xx	xx	xx	xx
5. state k present on rate level serious pure premium	2.750	.326	xx	xx	xx	xx

$$P_k = 100 [305,100 + 20,760] \div [10,846,000 + 8,304,000] = 1.702$$

$$P_a = 100 [(220,000 \div 7,250,000)(10,846,000) + (110,000 \div 110,000,000)(8,304,000)] \div [10,846,000 + 8,304,000] = 1.762$$

$$P_b = 100 [(220,000 \div 3,250,000)(10,846,000) + (440,000 \div 210,000,000)(8,304,000)] \div [10,846,000 + 8,304,000] = 3.925$$

$$N_1 = 100 (1.702) [(220,000 \div 1.762) + (220,000 \div 3.925)] \div [7,250,000 + 3,250,000] = 2.932$$

$$N_2 = 100 (1.702) [(110,000 \div 1.762) + (440,000 \div 3.925)] \div [110,000,000 + 210,000,000] = .093$$

$$\begin{aligned} \text{credibility for } N_1 &= \text{minimum} ((1 - .54) \div 2; ((10 + 5) \div 25)^{2/3}) \\ &= \text{minimum} (.23; .71) \\ &= .23 \end{aligned}$$

$$\begin{aligned} \text{credibility for } N_2 &= \text{minimum} ((1 - .09) \div 2; 1.00) \\ &= \text{minimum} (.45; 1.00) \\ &= .45 \end{aligned}$$

$$\text{state k indicated serious pure premium for code 1} = 100 (305,100 \div 10,846,000) = 2.813$$

$$\text{state k indicated serious pure premium for code 2} = 100 (20,760 \div 8,304,000) = .250$$

$$\text{proposed serious pure premium for code 1} = (2.813)(.54) + (2.932)(.23) + (2.750)(1 - .54 - .23) = 2.826$$

$$\text{proposed serious pure premium for code 2} = (.250)(.09) + (.093)(.45) + (.326)(1 - .09 - .45) = .214$$

*EXHIBIT II*CREDIBILITY CRITERIA FOR NATIONAL EXPERIENCE

NATIONAL CREDIBILITY	SERIOUS CRITERION (SERIOUS CASES)	NONSERIOUS CRITERION (NONSERIOUS CASES)	MEDICAL CRITERION (SERIOUS & NONSERIOUS CASES)
1.00	25	300	300
0.99	xx	296	296
0.98	xx	292	292
0.97	24	287	287
0.96	xx	283	283
0.95	xx	278	278
0.94	23	274	274
0.93	xx	270	270
0.92	xx	265	265
0.91	22	261	261
0.90	xx	257	257
0.89	21	252	252
0.88	xx	248	248
0.87	xx	244	244
0.86	20	240	240
0.85	xx	236	236
0.84	xx	231	231
0.83	19	227	227
0.82	xx	223	223
0.81	xx	219	219
0.80	18	215	215
0.79	xx	211	211
0.78	xx	207	207
0.77	17	203	203
0.76	xx	199	199

Exhibit II (Contd.)

CREDIBILITY CRITERIA FOR NATIONAL EXPERIENCE

NATIONAL CREDIBILITY	SERIOUS CRITERION (SERIOUS CASES)	NONSERIOUS CRITERION (NONSERIOUS CASES)	MEDICAL CRITERION (SERIOUS & NONSERIOUS CASES)
0.75	xx	195	195
0.74	16	191	191
0.73	xx	188	188
0.72	xx	184	184
0.71	15	180	180
0.70	xx	176	176
0.69	xx	172	172
0.68	xx	169	169
0.67	14	165	165
0.66	xx	161	161
0.65	xx	158	158
0.64	13	154	154
0.63	xx	151	151
0.62	xx	147	147
0.61	12	143	143
0.60	xx	140	140
0.59	xx	136	136
0.58	xx	133	133
0.57	11	130	130
0.56	xx	126	126
0.55	xx	123	123
0.54	10	120	120
0.53	xx	116	116
0.52	xx	113	113
0.51	xx	110	110

Exhibit II (Contd.)

CREDIBILITY CRITERIA FOR NATIONAL EXPERIENCE

NATIONAL CREDIBILITY	SERIOUS CRITERION (SERIOUS CASES)	NONSERIOUS CRITERION (NONSERIOUS CASES)	MEDICAL CRITERION (SERIOUS & NONSERIOUS CASES)
0.50	9	107	107
0.49	XX	103	103
0.48	XX	100	100
0.47	XX	97	97
0.46	8	94	94
0.45	XX	91	91
0.44	XX	88	88
0.43	XX	85	85
0.42	7	82	82
0.41	XX	79	79
0.40	XX	76	76
0.39	XX	74	74
0.38	6	71	71
0.37	XX	68	68
0.36	XX	65	65
0.35	XX	63	63
0.34	5	60	60
0.33	XX	57	57
0.32	XX	55	55
0.31	XX	52	52
0.30	XX	50	50
0.29	4	47	47
0.28	XX	45	45
0.27	XX	43	43
0.26	XX	40	40

Exhibit II (Contd.)

CREDIBILITY CRITERIA FOR NATIONAL EXPERIENCE

NATIONAL CREDIBILITY	SERIOUS CRITERION (SERIOUS CASES)	NONSERIOUS CRITERION (NONSERIOUS CASES)	MEDICAL CRITERION (SERIOUS & NONSERIOUS CASES)
0.25	xx	38	38
0.24	3	36	36
0.23	xx	34	34
0.22	xx	31	31
0.21	xx	29	29
0.20	xx	27	27
0.19	xx	25	25
0.18	2	23	23
0.17	xx	22	22
0.16	xx	20	20
0.15	xx	18	18
0.14	xx	16	16
0.13	xx	15	15
0.12	xx	13	13
0.11	1	11	11
0.10	xx	10	10
0.09	xx	9	9
0.08	xx	7	7
0.07	xx	6	6
0.06	xx	5	5
0.05	xx	4	4
0.04	xx	3	3
0.03	xx	2	2
0.02	xx	1	1
0.01	xx	xxx	xxx