ANY ROOM LEFT FOR SKIMMING THE CREAM?

BY

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In writing private passenger automobile liability insurance there has always been a need for underwriters to select the good business and turn down the poor because the rate classification systems have never been perfect. Within any one class and territory there have always been some risks better or worse than the others. Where the rating plans left off, the underwriters took over in recognizing other factors in risk selection. The operation of rating plans combined with underwriting selection exerts a powerful competitive influence. Advances in underwriting selection are often incorporated into the rating plans so that actually both are part of the same program. Those companies which develop a more effective rating and underwriting selection program are able to "skim off the cream".

Back in 1953 the bureau companies attempted to meet the competitive pressure by expanding the three class plan to six or seven classes and sharply increasing the spread of relativities among the classes. This undoubtedly helped their competitive position but it didn't eliminate the problem. Far from it. So in 1959 the class plan was expanded again to include merit rating in the hope that this would improve their competitive position and would reduce the room for competitors to select the better risks within each rate class.

It is probably safe to say that we will never be able to devise a classification system which will produce a precisely correct rate for each risk, but we attempt to come as close to this ideal as is possible and practical. Considering the new class plan which includes merit rating, how close to the ideal has it come? How much room, if any, is left for skimming the cream?

A generally accepted measure of the relative amount of variation within a group, and an appropriate one for this problem, is the so-called coefficient of variation, which is the standard deviation divided by the mean. If the rate for each class were based on the experience for that class and if the class plan were perfect in assigning a rate to each risk which exactly reflected the inherent hazard of the risk, the coefficient of variation for the rates would be the same as for the risks. If we can measure the coefficient of variation for the risks, we can then compare it with the coefficient of variation for the rates to see how effective the class plan is and how close to the ideal it comes. The less effective the class plan, the more room there is for skimming off the cream.

Using the negative binomial distribution (see "Some Considerations on Automobile Rating Systems Utilizing Individual Driving Records" by Mr. Lester Dropkin, *Proceedings of the Casualty Actuarial Society,* 1959, p. 165) we can estimate the coefficient of variation of the risks from two sources: The California Driver Record Study and the Canadian automobile statistics on merit rating. Using Mr. Dropkin's symbols, the coefficient of variation of T (m), the distribution of the inherent hazard of the risks, is $1 \div \sqrt{r}$. Mr. Dropkin shows that the value of r for the total California population of

licensed drivers is .8927. Using the technique discussed in the review of Mr. Dropkin's paper and using the data shown in Table 1 of "Two Studies in Automobile Insurance Ratemaking", (both in PCAS, 1960) the value of r for the Canadian data can be derived from the credibility of .0682 for one accident-free year for all classes combined and equals 1.3301.

Therefore, the two estimates of the coefficient of variation for the total population of private passenger automobile risks are 1.06 based on the California Driver Record Study and .87 based on the Canadian merit rating data. The result obtained from the California data is a little too high because it is based on licensed drivers which have more variation than licensed automobiles. The result obtained from the Canadian data is a little too low because the technique used to derive the value of r assumes that a risk does not change from one year to the next. Because risks do change, the value of r is overstated and the coefficient of variation is understated. It appears therefore, that the coefficient of variation for risks in private passenger automobile liability insurance is approximately 1.00. This is in close agreement with the value of .977 which M. Pierre Delaporte calculated for the coefficient of variation of pleasure use automobiles in France. (See *Sixteenth International Congress of Actuaries,* 1960, Vol. II, p. 127.)

The next step is to calculate the coefficient of variation for the rates and compare the results with 1.00. For this purpose a distribution of exposures by class and territory is needed. In this paper the exposure distribution written in Pennsylvania during the first quarter of 1960 by a stock agency company and the rates of the same company are used because they were readily available and because Pennsylvania is a fairly representative state. This company's only deviation from National Bureau rates in Pennsylvania during the first quarter of 1960 was in the merit rating plan where it used the same experience period and number of points for accidents and convictions as the National Bureau used in California. Some available data is also shown for the Canadian and Texas merit rating plans.

The exposure distributions and the coefficients of variation are shown in the exhibits at the end of this paper. They are summarized below.

Pennsylvania—Rates as of March 31, 1960

Rating Criteria	*Coefficient of Variation*
Six Class Plan only	.362
Territory only	.273
Discount for Two or More Cars only	.085
Merit Rating only	.050
Farm Versus Non-Farm	.034
Assigned Risk Surcharge only	.030
Driver Training Credit only	.007
Everything above except Territory and Merit Rating	.397
Everything above except Merit Rating	.495
Everything above	.510
Three Class Plan using 1952 Relativities	.190

Canada—Indicated Relativities

Rating Criteria	*Coefficient of Variation*
Five Class Plan only	.352
Merit Rating only	.225
Both Combined	.402

Texas—Rates as of June 30, 1960

Rating Criteria	*Coefficient of Variation*
Merit Rating only	.232

It was interesting to note that the 12,732 cars included in the Pennsylvania sample were distributed among 570 out of the total of 3,675 possible rate classes in Pennsylvania (21 territories times 175 classes in each territory). This means that a sample of this size still left 84% of the rate classes without any exposure. We may be making our rating plans too complex. Let us hope that further advances will be made toward the goal of more effective and, if possible, less complex risk classification systems.

The data shown above permits comparisons to be made among the various rating and merit rating plans, leading to a number of conclusions:

1. The six class plan represents a substantial improvement over the former three class plan although all this improvement did not take place when the six class plan was first introduced in 1953 but developed as the six class plan was improved with experience.

2. The National Bureau merit rating plan in Pennsylvania, which assigns two points for each accident, and uses a three-year experience period, is estimated to have a coefficient of variation of about .10 which is about twice as large as the California-type plan. The small coefficients of variation for these plans may be partially the result of using an exposure distribution for a single company which may not be strictly average; but even allowing for this, the merit rating plans introduced into Pennsylvania, California and other states beginning in 1959 can be made much more effective as can be seen by comparing their coefficients of variation with those of merit rating in Canada and Texas. The Canadian plan, however, started out with an effectiveness of about .10 and attained its present effectiveness gradually as the plan was improved with experience. The most recent Canadian improvement, using a five-year experience period, is not reflected in the data shown in this paper. It is to be expected that substantial improvement will likewise take place in the U. S. plans as experience develops.

3. That the Texas merit rating plan developed a coefficient of variation at inception which is about the same or a little larger than that for the 1959 Canadian plan, is a substantial accomplishment and is attributable to the use of convictions as well as accidents and the use of all the accidents and convictions during the experience period instead of only the most recent one. The measurement of the Texas plan is only tenta-

tive because the relativities in the Texas plan are not yet based directly on experience, although they are probably conservative.

4. The U.S. merit rating plans other than the Texas plan have comparatively little effectiveness as mentioned above in 2. Looking at it another way, under the California-type plan, risks with the lowest merit rating are getting a rate only about 1½% lower than the average merit rating which contrasts with 13% in Texas and 9% in Canada. This points out that the present California-type merit rating plans will have to be improved if they are to continue to justify the work involved in administering them. They presently are less effective in some areas than the discount for two or more cars. They could be made about as effective as the territory rating criteria.

The following conclusions can be drawn from the data for all rating criteria combined and provide an answer to the question raised in the title of this paper:

5. The present multiple classification system in all its complexity takes care of only half of the total variation among risks.

6. The introduction of merit rating has not eliminated the need for careful underwriting and has not eliminated the opportunity to skim off the cream through more effective rating plans and underwriting selection.

Pennsylvania - First Quarter 1960
Private Passenger Automobile Liability Insurance

Territory Code	Written BI Exposure (Car Months)	BI+PD Rate Class 1A as of 3-31-60
01	3,956	$90
03	11,089	65
05	419	50
06	1,569	34
07	7,293	34
08	3,218	39
09	586	44
10	1,450	38
11	1,863	43
12	6,271	29
13	43,605	44
14	15,727	57
15	7,635	37
16	3,751	55
17,18	4,545	52
19	7,296	34
21	4,989	34
22,23,24,25	7,380	28
25	3,227	41
27,28,29	16,137	40
34	780	52
Total	152,786	
Mean		44.836
Standard Deviation		12.225
Coefficient of Variation		.273

Merit Rating Code		Relativity
9	139,486	85
1	11,628	95
2	1,261	100
3	264	120
4	26	140
5	72	170
6	49	200
Total	152,786	
Mean		86.032
Standard Deviation		4.315
Coefficient of Variation		.050
Assigned Risk Surcharge	2,275	125
No AR Surcharge	150,511	100
Total	152,786	
Mean		100.372
Standard Deviation		3.036
Coefficient of Variation		.030

Class	Written BI Exposure (Car Months)	Relativity
1A	63,781	100
1B Small Cities	36,918	100
1B Large Cities	23,015	110
1C	4,499	145
2A	10,270	190
2C Small Cities	2,001	360
2C Large Cities	1,642	310
3	10,660	150
Total	152,786	
Mean		118.032
Standard Deviation		42.751
Coefficient of Variation		.362
1	128,213	70
2	13,913	115
3	10,660	100
Total	152,786	
Mean		76.191
Standard Deviation		14.452
Coefficient of Variation		.190
Non-Farm	150,852	100
Farm	1,934	70
Total	152,786	
Mean		99.620
Standard Deviation		3.361
Coefficient of Variation		.034
Driver Training Discount	682	90
No D. T. Discount	152,104	100
Total	152,786	
Mean		99.955
Standard Deviation		.719
Coefficient of Variation		.007
Multi-Car Discount	18,764	75
No M-C Discount	134,022	100
Total	152,786	
Mean		96.880
Standard Deviation		8.262
Coefficient of Variation		.085

Pennsylvania - First Quarter 1960
Private Passenger Automobile Liability Insurance

Class	Small City Territories Written BI Exposure (Car Months)	Relativity	Large City Territories Written BI Exposure (Car Months)	Relativity
1A	25,113	100	17,668	100
1A Multi-Car	13,436	75	5,328	75
1A Assigned Risk Surcharge	276	125	243	125
1B	27,931	100	19,262	110
1B M-C	8,710	100	3,596	110
1B A-R Surcharge	277	125	157	138
1C	2,127	145	942	145
1C M-C	1,084	145	178	145
1C A-R Surcharge	120	181	48	181
1AF	930	70	168	70
1AF M-C	415	61	192	61
1AF A-R Surcharge	12	88	0	88
2A	5,865	190	3,595	190
2A A-R Surcharge	127	238	48	238
2A Driver Training	228	171	238	171
2C	1,729	360	1,389	310
2C A-R Surcharge	116	450	145	388
2C Driver Training	108	324	108	279
2AF	157	133	12	133
2AF A-R Surcharge	0	166	0	166
2CF	48	252	0	217
2CF A-R Surcharge	0	315	0	271
3	4,368	150	2,972	150
3 M-C	2,185	150	1,111	150
3 A-R Surcharge	0	188	24	188
Totals	95,362		57,424	
Grand Total	152,786			
Mean		114.789		
Standard Deviation		45.532		
Coefficient of Variation		.397		

All Rating Criteria Except Merit Rating

Mean	51.688
Standard deviation	25.607
Coefficient of variation	.495

All Rating Criteria

Mean	44.581
Standard deviation	22.733
Coefficient of variation	.510

Average Merit Rating .8625

Canada Excluding Saskatchewan - All Companies
Policy Years 1957 and 1958 as of 6-30-59
Private Passenger Automobile Liability Insurance — Non Farmers

Class		Earned Exposure (Car Years)	Indicated Relativity*
(Age	1	3,325,714	.863
Sex	2	168,998	1.372
and	3	321,327	1.313
Use)	4	252,397	2.269
	5	81,639	1.154
Total		4,150,075	
Mean			1.00980
Standard Deviation			.35577
Coefficient of Variation			.352
(Merit	A	3,356,480	.895
Rating)	X	175,553	1.174
	Y	219,597	1.277
	B	398,445	1.610
Total		4,150,075	
Mean			.99566
Standard Deviation			.22354
Coefficient of Variation			.225

Class	Earned Exposure (Car Years)	Indicated Relativity
1A	2,757,520	.786
1X	130,706	1.016
1Y	163,544	1.115
1B	273,944	1.358
2A	130,535	1.269
2X	7,233	1.747
2Y	9,726	1.519
2B	21,504	1.784
3A	247,424	1.212
3X	15,868	1.285
3Y	20,369	1.450
3B	37,666	1.885
4A	156,871	2.050
4X	17,707	2.192
4Y	21,089	2.412
4B	56,730	2.853
5A	64,130	1.071
5X	4,039	1.079
5Y	4,869	1.410
5B	8,601	1.642
Total	4,150,075	
Mean		1.00575
Standard Deviation		.40434
Coefficient of Variation		.402

Texas — All Companies — Second Quarter 1960
Private Passenger Automobile Liability Insurance

Merit Rating	Written Exposure (Car Months)	Relativity
0	4,202,958	.80
1	858,947	1.00
2	551,716	1.20
3	174,319	1.40
4	97,547	1.60
5	31,405	1.80
6	39,740	2.00
Total	5,956,632	
Mean		.90983
Standard Deviation		.21075
Coefficient of Variation		.232

*See "Two Studies in Automobile Insurance Ratemaking", R. A. Bailey and L. J. Simon, PCAS 1960