

3.1.1 → RAK Classification

3.1.1.1 → Importance of rating variables

→ Goal: To separate an area in order to charge the same rates to each group in its portfolio, thus reducing rating selection.

- reduces selection costs when you charge the same rate different segments
- a result, understand certain groups & over time your actuaries make more informed decisions
- **improvable** \rightarrow **rating variable**
- **rate changes** \rightarrow **rating variable** in more refined manner
- **reputable** \rightarrow **rating variable**, not **rating variable only**

→ opposite side of rating selection.

→ "knowing the customer" is using these characteristics to identify areas to select on lower-risk insureds

3.1.2 → Criteria for evaluating rating variables

→ The first step in classification methodologies is to identify the rating variables that will be used to classify risks. The criteria for evaluating the importance of rating variables can be grouped into four categories:

- **Statistical criteria**
 - Statistical significance \rightarrow different levels of the rating variable should have distinct expected loss that are statistically significant so that over time
 - Homogeneity \rightarrow the risks with the same level should have similar expected losses
 - Credibility \rightarrow Each level should be large enough to allow credible estimates and tests
 - Intensity \rightarrow how far it moves the scores
 - **Operational criteria**
 - Objective \rightarrow clear & measurable
 - Intuitiveness \rightarrow risk manager can obtain sound & robust estimates
 - Verifiability \rightarrow not easily manipulated & easily verifiable
 - **Social criteria**
 - Acceptability \rightarrow insurance should be available for all risks from high-risk to low-risk \rightarrow can never be perfect
 - Fairness \rightarrow a clear correspondence between a rating variable & current losses will increase acceptability of the classification
 - Consistency \rightarrow rating bodies generally prefer to have some degree of control over to class to which they belong & the ability to influence premium classes (i.e. as time progresses whether or not a security system is installed)
 - Policy fairness \rightarrow not unfair or morally unacceptable
 - **Legal criteria** \rightarrow follows applicable laws
 - Classification markings \rightarrow groups risks by similar characteristics / less propensity \rightarrow both use historical data & risk characteristics to determine a rate
 - appropriate claim ratios in homogeneous group of risks
 - Individual risk ratings tailored to the individual insured
 - Standard rates set by the state via another rating plan
- Working of question \Rightarrow EVALUATED means DECREASED + RECOMMEND (highlighted)

3.1.3 → Univariate classification

→ Goal \rightarrow determine premiums for each level of a rating variable \Rightarrow (i) determines rate differentials by examining historical experience of each level of a rating variable independently.

→ Pure premium approach

- The basic pure premium approach determines the insurance relativities by comparing the losses for each rating levels with a rating variable.
- when using the pure premium approach, you need to think & develop the loss & claim reports on the nature of the portfolio.
- data should be adjusted for credibility of catastrophic events prior to a classification analysis.

→ The table below shows the insurance relativities for each territory using the pure premium approach:

Territory	Exposures	(1) Premium at Base AOI			(5) Current Rate Level	(6) Loss & ALAE	(7) Pure Premium	(8) Indicated Relativity	(9) Cred-Wid Indicated Relativity
		(2)	(3)	(4)					
1	300	\$15,698.08	\$32.53	0.7096	0.7231	0%			
2	390	\$28,221.07	\$72.85	1.0000	1.0000	(4)/(4)			
3	310	\$24,072.96	\$77.65	1.1421	1.0731				
Total	1,000	\$67,992.11	\$67.99	1.0000	0.9396				

→ Loss ratio approach

→ The loss ratio approach determines the indicated relativities by comparing the LRs for each rating levels with a rating variable. When using this approach, EP should be brought to the current level for each class in LR.

→ The table below shows the indicated relativities for each territory using the LR approach:

Territory	Premium at Base AOI	(1) Premium at Current Rate Level			(5) Current Rate Level	(6) Loss & ALAE	(7) Pure Premium	(8) Indicated Relativity	(9) Cred-Wid Indicated Relativity
		(2)	(3)	(4)					
1	\$25,740.66	\$15,698.08	0.6395	1.0753	0.6000	0.6458	0.6354		
2	\$49,002.80	\$28,221.07	0.5759	1.0145	1.0000	1.0164	1.0000		
3	\$45,256.64	\$24,072.96	0.5131	0.9397	1.3000	1.2204	1.2007		
Total	\$120,000.10	\$67,992.11	0.5666	1.0000					

→ Adjusted pure premium approach

→ In the LR approach requires premium at base for each level of the rating variable, which may not always be available or practical to obtain. In such cases, it is necessary to use the pure premium approach. To mitigate the impact of any distributional bias, the pure premium approach can be performed using exposures adjusted by the exposure-weighted average of all other variables

→ The exposure-weighted rate relativity for each territory is calculated as follows:

AOI		Charged AOI Factor	Exposures by Territory		
(1)	(2)	(3)	(4)	(5)	(6)
Low	0.80	10	130	150	
Medium	1.00	110	120	120	
High	1.36	180	140	40	
Wtd Avg AOI Relativity by Territory		1.2093	1.0626	0.9497	

→ For example, the weighted average AOS relativity of territory 3 is

$$\frac{0.80 \times 10 + 1.00 \times 110 + 1.36 \times 180}{(1.2093 \times 1) + (1.0626 \times 1) + (0.9497 \times 1)} = 1.2043$$

→ The table below shows the indicated relativities for each territory using the PR approach:

Territory	Exposures	(1) Premium at Base AOI			(5) Current Rate Level	(6) Loss & ALAE	(7) Pure Premium	(8) Indicated Relativity	(9) Cred-Wid Indicated Relativity
		(2)	(3)	(4)					
1	300	\$1,209.3	\$36.2	0.7096	0.7231	0%			
2	390	\$1,027.96	\$72.85	1.0000	1.0000	(4)/(4)			
3	310	\$1,049.74	\$77.65	1.1421	1.0731				
Total	1,000	\$3,707.01	\$67,992.11	1.0000	0.9396				

→ So we were to reduce the relativities in the LR approach, here is what it would look like:

Territory	Premium at Base AOI	(1) Premium at Current Rate Level			(5) Current Rate Level	(6) Loss & ALAE	(7) Pure Premium	(8) Indicated Relativity	(9) Cred-Wid Indicated Relativity
		(2)	(3)	(4)					
1	\$25,740.66	\$15,698.08	0.6395	1.0753	0.6000	0.6458	0.6354		
2	\$49,002.80	\$28,221.07	0.5759	1.0145	1.0000	1.0164	1.0000		
3	\$45,256.64	\$24,072.96	0.5131	0.9397	1.3000	1.2204	1.2007		
Total	\$120,000.10	\$67,992.11	0.5666	1.0000	0.9396				

→ Below is a set of relativities to the totals:

$$\rightarrow (1) = \text{total} - (2) - (3) - (4)$$

$$\rightarrow (5) = (1) \times (6) \times (7)$$

$$\rightarrow (6) = (5) + (1) - (2) - (3)$$

$$\rightarrow (7) = (6) \times (8) \times (9)$$

$$\rightarrow (8) = (7) + (5) \times (6)$$

→ The resulting relativities should have a weightings sum of 1.

→ For one variable, say AOI, the total values for the rates were a values that we just found

$$\rightarrow \text{sum for all the values lead to values, the rate for the values was a values that we just found}$$

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