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RPM WORKSHOP 1: BASIC RATEMAKING

Introduction to Ratemaking Relativities

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INTRODUCTION TO RATEMAKING RELATIVITIES

"The grouping of risks with similar risk characteristics for the purpose of setting prices is a fundamental precept of any workable private, voluntary insurance system.

This process, called risk classification, is necessary to maintain a financially sound and equitable system.

It enables the development of equitable insurance prices, which in turn assures the availability of needed coverage to the public.

This is achieved through the grouping of risks to determine averages and the application of these averages to individuals." (page 1)

Note: all quotes in this presentation are from the American Academy of Actuaries' Risk Classification Statement of Principles. Only page numbers will be noted.

INTRODUCTION TO RATEMAKING RELATIVITIES

Agenda

- Why risk classification?
- What is the purpose of risk classification?
- What are considerations in designing a risk classification system?
- How do you determine the correct rate relativity?
- What implementation issues do you need to consider?

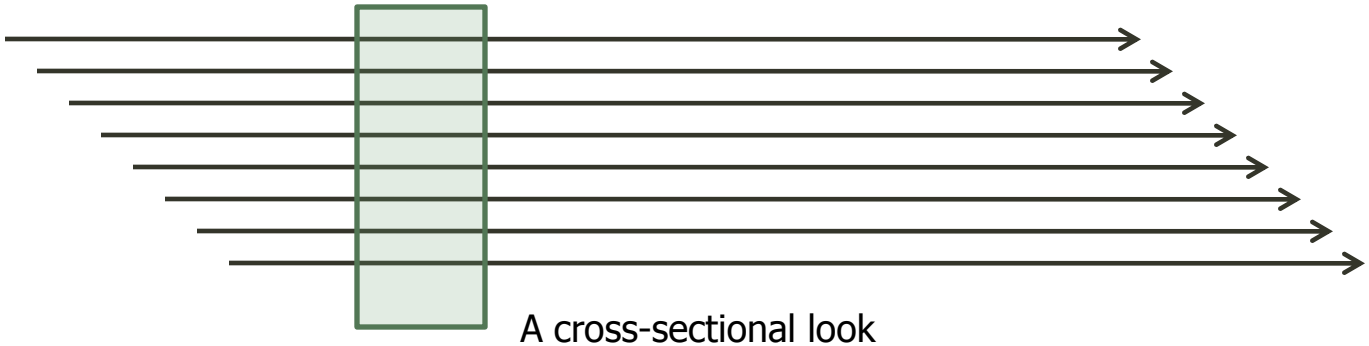
INTRODUCTION TO RATEMAKING RELATIVITIES

How might you determine a fair price for a given risk?

1. Wisdom and judgment
2. Examine that risk's experience over time

A longitudinal look

3. Examine the experience of similar risks



A cross-sectional look

PURPOSE OF RISK CLASSIFICATION

Three purposes of risk classification:

1. Protect an insurer's financial soundness
2. Enhance fairness
3. Provide an insurer with economic incentive to write large portions of the market

PURPOSE OF RISK CLASSIFICATION

Adverse selection occurs when economic forces are not in equilibrium, when buyers move in, out, and throughout the market.

For example…

- Group A expected costs = $100
- Group B expected costs = $200
- Your company charges $150 for both
- Competitor charges $100 for A and $200 for B
- Assume you still make money at a 60% loss ratio

PURPOSE OF RISK CLASSIFICATION

At time 0, you price to the total…

YOU	Current Exp	Price	Expected Prem	Expected Loss	Expected LR
Group A	10,000	$150	$1,500,000	$900,000	60.0%
Group B	10,000	$150	$1,500,000	$900,000	60.0%
Total	20,000	$150	$3,000,000	$1,800,000	60.0%

Your competitor changes their price to match the cost…

Competitor	Current Exp	Price	Expected Prem	Expected Loss	Expected LR
Group A	10,000	$100	$1,000,000	$600,000	60.0%
Group B	10,000	$200	$2,000,000	$1,200,000	60.0%
Total	20,000	$150	$3,000,000	$1,800,000	60.0%

What happens during the next year at these prices?

PURPOSE OF RISK CLASSIFICATION

Assume ¼ of customers shop at renewal. During year 1…

YOU	Actual Exp	Ave Prem	Actual Prem	Actual Loss	Actual LR
Group A	7,500	$150	$1,125,000	$450,000	40.0%
Group B	12,500	$150	$1,875,000	$1,500,000	80.0%
Total	20,000	$150	$3,000,000	$1,950,000	65.0%

Group A shoppers all choose your competitor.
Group B shoppers all choose you.

Competitor	Actual Exp	Ave Prem	Actual Prem	Actual Loss	Actual LR
Group A	12,500	$100	$1,250,000	$750,000	60.0%
Group B	7,500	$200	$1,500,000	$900,000	60.0%
Total	20,000	$150	$2,750,000	$1,650,000	60.0%

You don’t know about Group A or B. You just see a rate need.

PURPOSE OF RISK CLASSIFICATION

At time 1, you think you need an 8.3% increase…

YOU	Current Exp	New Price	Expected Prem	Expected Loss	Expected LR
Group A	7,500	$163	$1,218,750	$731,250	60.0%
Group B	12,500	$163	$2,031,250	$1,218,750	60.0%
Total	20,000	$163	$3,250,000	$1,950,000	**60.0%**

With your new rates, you *expect* to be back at a 60% loss ratio. But what happens during the year?

Competitor	Current Exp	New Price	Expected Prem	Expected Loss	Expected LR
Group A	12,500	$100	$1,250,000	$750,000	60.0%
Group B	7,500	$200	$1,500,000	$900,000	60.0%
Total	20,000	$150	$2,750,000	$1,650,000	60.0%

Note: your competitor didn't have to change its prices.

PURPOSE OF RISK CLASSIFICATION

But during year 2, the mix shifts more…

YOU	Actual Exp	Ave Prem	Actual Prem	Actual Loss	Actual LR
Group A	5,625	$163	$914,063	$337,500	36.9%
Group B	14,375	$163	$2,335,938	$1,725,000	73.8%
Total	20,000	$163	$3,250,000	$2,062,500	63.5%

Even with your rate increase, you continue to lose money…

Competitor	Actual Exp	Ave Prem	Actual Prem	Actual Loss	Actual LR
Group A	14,375	$100	$1,437,500	$862,500	60.0%
Group B	5,625	$200	$1,125,000	$675,000	60.0%
Total	20,000	$150	$2,562,500	$1,537,500	60.0%

…and your competitor continues to make money.

PURPOSE OF RISK CLASSIFICATION

Several notes on the example…

- Your primary defense against adverse selection is risk classification. This is Purpose 1 of a risk classification system.
- Because no subsidization was occurring and each insured's price matched its average risk, your competitor's prices were more fair. This is Purpose 2 of a risk classification system.
- Because they were properly priced, your competitor was happy to write the whole market. This is Purpose 3 of a risk classification system.

RISK CLASSIFICATION CONSIDERATIONS

How a risk classification system is designed will affect its ability to achieve the three purposes. We'll consider…

- Underwriting
- Marketing
- Program design
- Statistical considerations
- Operational considerations
- Hazard reduction
- Public acceptability
- Causality
- Controllability

RISK CLASSIFICATION CONSIDERATIONS

Underwriting

"Underwriting is the process of determining the acceptability of a risk based on its own merits." (page 7)

Developing a risk classification system is separate from underwriting, and provides the context in which underwriting is done.

Marketing

Marketing impacts the mix of business you write. If there are distortions in the risk classification system, the mix of business can impact profitability.

RISK CLASSIFICATION CONSIDERATIONS

Program Design

Degree of choice available to the buyer – if coverage is compulsory and without competitors, broad classifications may be possible without adverse selection.

Experience based pricing – to the extent this is used, less refined initial classifications are needed.

Premium payer – broad classifications can also be used if the insured is not the one bearing the cost.

RISK CLASSIFICATION CONSIDERATIONS

Statistical considerations

Homogeneity – expected costs for risks in a class should be reasonably similar.

Credibility – the larger the number of observations, the more accurate are statistical predictions.

Predictive Stability – ultimately we are trying to predict future costs. "The predictive capability must be responsive to changes in the nature of insurance losses, yet stable in avoiding unwarranted abrupt changes in resulting prices." (page 10)

RISK CLASSIFICATION CONSIDERATIONS

Operational considerations

Expense – the cost of the whole risk classification system should be as low as possible. The cost of collecting, storing and processing a given variable should be reasonable in relation to the benefit.

Constancy – characteristics should remain constant for a given risk, at least over the insured period. To the extent that it is not, this will tend to increase the expense and decrease the utility.

RISK CLASSIFICATION CONSIDERATIONS

Operational considerations

Availability of coverage – while availability of coverage should be increased through the use of a risk classification system, it is possible that the correct highest rate is beyond what can be afforded. Sometimes this can be mitigated through limitations on coverage.

Avoidance of extreme discontinuities – there should be enough classes to establish a reasonable continuum, but few enough classes to leave reasonable differences. The extreme ends should be examined for possible large rate differences between adjacent classes.

RISK CLASSIFICATION CONSIDERATIONS

Operational considerations

Absence of ambiguity – there should be no ambiguity in the assigning of classes. Classifications should be mutually exclusive and exhaustive.

Manipulation – there should be minimal ability for the insured to manipulate or misrepresent their characteristics.

Measurability – risk classes should be conveniently and reliably measured.

RISK CLASSIFICATION CONSIDERATIONS

Hazard Reduction

Sometimes a risk classification system can provide an incentive for an insured to reduce their risk.

For example, a stability control discount may encourage the purchase of vehicles with this feature.

While desirable, this is not a necessary feature of a risk classification system.

RISK CLASSIFICATION CONSIDERATIONS

Public Acceptability

A risk classification system must be in line with society's values. However, this can be difficult because values…

- "…are difficult to ascertain" (page 14)
- "…vary among segments of the society" (page 14)
- "…change over time" (page 14)

To increase public acceptability, a risk classification should…

- "…not differentiate unfairly among risks" (page 14)
- "…be based upon clearly relevant data" (page 14)
- "…respect personal privacy" (page 14)
- "…be structured so that the risks tend to identify naturally with their classification" (page 14)

RISK CLASSIFICATION CONSIDERATIONS

Causality

Establishing cause and effect can boost the acceptability of a classification, however this is not a requirement. It is enough to establish a plausible relationship between the classification and the underlying risk.

Controllability

There are two sides to this coin. If an insured can control which classification they are in, this can mean that the system is encouraging hazard reduction. It can also mean that the system can be manipulated, leading to irrelevant results.

DETERMINING RATE RELATIVITIES – THE BASICS

Two basic univariate methods for determining rate relativities:

- Loss ratio method
  - Compare actual loss ratio to expected loss ratio
  - Produces an indicated change in relativity
- Pure premium method
  - Develop expected cost per unit of exposure
  - Produces an indicated relativity

The methods produce identical results when identical data and assumptions are used.

DETERMINING RATE RELATIVITIES – THE BASICS

Loss Ratio Method

Class	Premium @CRL	Losses	Loss Ratio	Loss Ratio Adjustment	Current Relativity	Proposed Relativity
1	$1,168,125	$759,281	0.65	1.00	1.00	1.00
2	$2,831,500	$1,472,719	0.52	0.80	2.00	1.60

Note: the univariate loss ratio method assumes that all other relativities in the classification system are correct.

DETERMINING RATE RELATIVITIES – THE BASICS

Pure Premium Method

Class	Exposures	Losses	Pure Premium	Proposed Relativity
1	6,195	$759,281	$123	1.00
2	7,508	$1,472,719	$196	1.60

Note: the univariate pure premium method does not take into account the rest of the rate classification system, which may already predict at least part of this relativity.

IMPLEMENTING RATE RELATIVITIES

Rates are considered to have two pieces:

1) Overall Rate Level & 2) Rate Relativity

Why?

1. Having the overall rate separate lets you…
   a) Use all the experience to find overall indications.
   b) Use overall trends and development.
   c) Gives the most credible answer by using all the data.
2. Determining correct rate rels requires dealing with all the complexity of different rates…
   a) Slicing and dicing data.
   b) Dealing with the multivariate nature of the problem.
   c) Can ignore trends and loss dev – everything's relative!

What assumption do you make by saying trends and loss dev can be ignored?

IMPLEMENTING RATE RELATIVITIES

Example:

Insured	Base Rate	Age	Territory	Deductible	Premium
Adult Age 40 Suburban $250 Ded	$100	1.00	1.00	1.00	$100
Senior Age 70 Rural No Ded	$100	1.25	0.80	1.50	$150
Youth Age 18 Urban $500 Ded	$100	2.00	1.50	0.85	$255

IMPLEMENTING RATE RELATIVITIES

Fixed Expenses and "Expense Flattening"

Relativities are found using losses. Consequently, the adjustment is applicable only to the loss portion of the premium.

Companies tend to handle fixed expenses in one of two ways…

1. Use a separate fixed expense fee

   Premium = (Base Rate)(Rate Rels) + (Expense Fee)*

   In this case, there is no need to adjust the calculated rate relativities!

2. Incorporate fixed expenses implicitly within the base rate

   Premium = (Base Rate)(Rate Rels)*

   In this case, you must "flatten" the calculated rate relativities!

IMPLEMENTING RATE RELATIVITIES

Fixed Expenses and "Expense Flattening"

Since the premium, P, is…

$$P = \frac{LC + FED}{1 - VEL}$$

where LC = loss cost,
FED = fixed expense dollars,
VEL = variable expense load.

…we can express the new adjusted premium, P', as…

$$P' = \frac{LC(R) + FED}{1 - VEL} = \frac{(LC + FED)R_F}{1 - VEL} = P(R_F)$$

where R = calculated relativity
R_F = expense flattened relativity

Solving for R_F we get…

$$R_F = \frac{(1 - VEL - FEL)R + FEL}{1 - VEL}$$

where FEL = fixed expense load (the fixed expense expressed as a percent of premium)

IMPLEMENTING RATE RELATIVITIES

Fixed Expenses and "Expense Flattening"

Consider a situation where… LC = \$120 VEL = 0.22 FED = \$32

The unadjusted premium would be…

$$P = \frac{\$120 + \$32}{1 - 0.22} = \frac{\$152}{0.78} = \$194.87$$

If the relativity is 1.50, then the correct new premium would be…

$$P = \frac{\$120(1.5) + \$32}{1 - 0.22} = \frac{\$180 + 32}{0.78} = \frac{\$212}{0.78} = \$271.79$$

By implication, R_F would be…

$$R_F = \frac{P'}{P} = \frac{\$271.79}{\$194.87} = 1.395$$

Find R_F using the formula for expense flattening.

IMPLEMENTING RATE RELATIVITIES

Fixed Expenses and "Expense Flattening"

Consider a situation where… LC = $120 VEL = 0.22 FED = $32

The unadjusted premium would be…

$$P = \frac{\$120 + \$32}{1 - 0.22} = \frac{\$152}{0.78} = \$194.87$$

The formula for expense flattening is…

$$R_F = \frac{(1 - VEL - FEL)R + FEL}{1 - VEL}$$

So, we need FEL… $$FEL = \frac{FED}{P} = \frac{\$32}{\$194.87} = 0.164$$

And finally… $$R_F = \frac{(1 - 0.22 - 0.164)(1.5) + 0.164}{1 - 0.22} = 1.395$$

IMPLEMENTING RATE RELATIVITIES

Rate Impact and Off-Balance

Remember that the overall rate need is determined completely separately from any rate relativity changes.

You find that the rate relativities for Fire Hydrant Distance (FHD) need to be modified.

Currently, houses within 3 miles of a fire hydrant are the base. Houses greater than 3 miles from a hydrant are surcharged 20%.

You believe the surcharge should be changed to 40%. Will this not increase the premium taken in? Will this not impact the overall rate level?

IMPLEMENTING RATE RELATIVITIES

Rate Impact and Off-Balance

All relativity changes have the potential to impact the overall rate level.

The **rate impact** is the change in the overall rate level that any relativity change would cause in and of itself.

The **off-balance** is the adjustment to the base rates needed to off-set the rate impact so that the total change is revenue neutral.

The off-balance is the inverse of the rate impact.

IMPLEMENTING RATE RELATIVITIES

Rate Impact and Off-Balance

There are at least three ways to calculate the rate impact.

1. Exposure-weighted average rate impact

   Simplest and least accurate. Used when premium and a rerating approach are not available.

2. Premium-weighted average rate impact

   Most accurate approach when a rerating approach is not available. Fails when multiple changes are made.

3. Rerated rate impact

   Works even when multiple changes are made. Can calculate total rate impacts.

IMPLEMENTING RATE RELATIVITIES

Rate Impact and Off-Balance

Consider again, the current surcharge for being far from a fire hydrant is 20%. You are changing it to 40%.

The exposure-weighted method…

FHD	Exposures	Current Rel	New Rel
0-3	12,000	1.00	1.00
3+	8,000	1.20	1.40
Total	20,000	1.08	1.16
		Rate Impact	7.4%
		=1.16/1.08 - 1	
		Off-balance	-6.9%
		=1/(1+.074) - 1	

Other relativities may impact the average premium of each class. This method ignores that.

IMPLEMENTING RATE RELATIVITIES

Rate Impact and Off-Balance

Consider again, the current surcharge for being far from a fire hydrant is 20%. You are changing it to 40%.

The premium-weighted method…

FHD	Exposures	Current Prem	Current Rel	Base Prem	New Rel	New Prem
0-3	12,000	15,048,000	1.00	15,048,000	1.00	15,048,000
3+	8,000	8,784,000	1.20	7,320,000	1.40	10,248,000
Total	20,000	23,832,000		22,368,000		25,296,000

Rate Impact	6.1%
=25,296,000/23,832,000 - 1	
Off-balance	-5.8%
=1/(1+.061) - 1	

This method assumes that every other relativity, the relativities that generated those premiums, are correct. If you are simultaneously changing other relativities, this is a dubious assumption.

IMPLEMENTING RATE RELATIVITIES

Rate Impact and Off-Balance

Consider again, the current surcharge for being far from a fire hydrant is 20%. You are changing it to 40%.

The rerating method…

This method works entirely differently. Assume, as before, that the collected premium under the old rate relativities is $23,832,000.

Record by record, recalculate the historical premium as if the new relativities were used. This requires extensive preparation and computing power.

If the rerated premium is $26,471,000 using the new relativities, then the premium increased 11.1%, and that is the rate impact.

RPM WORKSHOP 1: BASIC RATEMAKING

QUESTIONS?

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