

Lesson 6 – P&C Ratemaking

Brown – Chapter 4 **EXCLUDING** the following sections:

skip 4.3.3

skip 4.7.5-4.7.6

skip 4.8.2 – end of chapter

(approx. 26 pages)

We will spend 2 weeks on this material. Please make sure you review all examples imbedded in Chapter 4, unless they are in a section which I have asked you to skip.

4.2 Objectives of Ratemaking

- Essential Objectives
 1. Cover Expected Losses and Expenses
 - Income must at least equal outgo.
 - Income items include premium and investment income.
 - Outgo includes losses, loss expenses, sales expenses, premium taxes, general overhead expenses.
 - Each cohort of policyholders should pay for its own expected costs (ideally). I.e., each risk class should pay a premium commensurate with the risk that it contributes to the insurance pool.
 2. Produce rates that make an adequate provision for contingencies
 - Actuary should price for the expected and the unexpected (e.g., 100 year flood).
 - If rates are too high, insurer will lose the best business to competition or self-insurance
 - If rates are too low, the insurer will lose money which could put company growth plans, or even solvency, at risk
 3. Encourage Loss Control
 - A well-designed risk classification process will provide economic incentives for policyholders to reduce loss costs by reducing claim frequency, severity, or both. (e.g., discounts for safe driving, or alarm systems, etc).
 - Loss control benefits society by reducing accidents, injuries, and property damage.
 4. Satisfy rate regulators
 - **Basic regulatory requirement is: Rates must be adequate, not excessive, and not unfairly discriminating.**
 - Proposed rate changes require actuarial documentation
 - Actuary should be using generally accepted actuarial techniques
 - Actuary must be prepared to defend methods and assumptions used, even if they appear socially unacceptable (e.g., different rates by gender or marital status), or if they appear unaffordable.

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- Non-essential but Desirable Objectives
 1. Produce rates that are reasonably stable
 - The impact of natural catastrophes is usually spread out over long periods
 2. Produce rates that are reasonably responsive to changes
 - e.g., speed limit change
 - Need to balance (1) Stability and (2) Responsiveness
 3. Simply and easy to understand
 - Complex systems are more expensive to explain and maintain
 - It is helpful to use a methodology that is understandable to non-technical audiences

4.3.1 Accident Year (AY)

- This is the year in which a loss event (accident) occurred. E.g., an insured event that occurred on 10/31/14 is in AY 2014.
- This is the most common method for compiling P&C actuarial loss data (e.g., triangle format).
- As time passes, all losses in an AY are paid and reserves eventually decline to zero. This stage is known as “ultimate”

4.3.2 Policy Year (PY)

- This is the year in which a policy becomes effective. All policies that became effective during calendar year 2014 are referred to as PY 2014, whether the policy was issued on 1/1/14, 7/1/14, or 12/31/14 – these are all policy year 2014.
- [Janet to demonstrate policy years using parallelogram method]

4.4 Premium Data

- Written premiums categorize premium by effective date of the policy. If a policy with \$100 of premium is effective on December 31, 2014, then the entire written premium of \$100 is recorded in 2014.
- Earned premiums refer to the amounts actually earned in a period (analogous to accrual accounting). Continuing the example directly above, virtually all of the \$100 of written premium will get earned in 2015
- Unearned premium refers to the difference between written premium and earned premium. Continuing the example directly above, virtually all of the \$100 of written premium is unearned as of 12/31/14

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4.5 The Exposure Unit

- A good exposure base should (ideally):
 - Be an accurate measure of the quantitative exposure to loss
 - Be easy for the insurer to determine (at the time premium is calculated)
 - Not be subject to manipulation by the insured
 - Be easy to record and administer
 - Be understood by the policyholder
 - Be inflation sensitive (responsive), i.e., automatically adjust to changes in the cost of settling claims. E.g., dollar exposure bases like payroll or sales receipts work well

In reality, the exposure base is a compromise among these criteria and doesn't satisfy all these attributes. E.g.,

- Rates are expressed per unit of exposure
- $\text{Premium} = \text{Rate (per unit)} \times \# \text{ Exposure Units}$

4.6 Expected Effective Period

- Experience Period = the historical period from which the actuary is pulling data.
- Expected Effective Period = the forecast period for which rates are being made.
- There will be a lag period between the end of the Experience Period and the Effective Date of the Expected Effective Period.
- One Policy Year will cover portions of two Calendar Years in terms of exposure to the occurrence of losses.

4.7.1 Loss Development Factors (LDFs)

- See Chapter 3 for details on LDFs
- LDFs can be less than 1.000, but this is unusual
 - Subrogation and salvage can cause factors less than 1.000
 - Conservative (high) case reserves from Claim Dept could result in development less than 1.000
- Large losses should be capped or smoothed over time so as not to distort LDF selections

4.7.2 Trend Factors

- Trend factors bring past experience period data to current cost levels
 - Trend mostly reflects economic inflation, but could also reflect other changes like judicial decision.
 - E.g., if cost levels over a 3 year period increase from \$100 to \$103 to \$106, the annual trend factor is 3%.
 - Trend fits can be linear, exponential, or other approaches. There is no uniquely correct answer or approach. However, actuary should be able to explain approach.

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- External forces that could affect future loss costs:
 - Recent court adjudications (e.g., an increase or decrease in the legal no-fault threshold)
 - Interpretation of recent legislative changes (e.g., a change in speed limit)
 - An expected change in the rate of economic inflation (e.g., Financial crisis years of 2008-2011 were basically recessionary. After that, inflation started to grow again slightly each year).
 - The level of economic activity (e.g., during a recession, WC and Fire claims tend to increase, whereas auto claim rates fall).
 - Recent changes in underwriting criteria or definitions
 - Changes in mandated benefit levels
- Selecting an appropriate trend factor involves significant actuarial judgment
- Management and regulators may respond negatively to subjective considerations (actuarial judgment), however, this is imperative and defensible
- Trend and Development do not overlap.
 - Development factors bring an immature loss period to an ultimate expected payment value
 - Trend factors bring estimated or actual ultimate losses from historical periods forward to a prospective rating period. Trend factors adjust the experience period indication from the average accident date of the past experience period to the average accident date of the future effective period.
- Premiums sometimes need trend as well depending on changes between an experience period and a prospective period. This is beyond the scope of what we will study in our class.

4.7.3 Expenses

- Expenses can be divided into at least two categories:
 1. Loss Adjustment Expenses – relate to the claims handling/adjustment/payment process
 - Allocated Loss Adjustment Expenses (ALAE) – expenses related to a particular claim file (e.g., lawyer's fees, expert witness fees, medical reports).
 - ALAE typically exhibit behavior similar to losses and are usually combined with losses for ratemaking and reserving purposes
 - For US Statutory Reporting these are also known as Defense and Cost Containment (DCC) expenses
 - Unallocated Loss Adjustment Expenses (ULAE) – expenses related to routine claim handling such as claim adjuster salaries, as well as rent/heat/electric of claim department.
 - Actuarial methods for estimating ULAE are beyond the scope of our class.
 - For US Statutory Reporting, these are known as Adjusting & Other (AO) expenses.
 2. All Expenses Other than LAE (i.e., all expenses that are not claim-related)
 - Commissions, premium taxes, head office expenses (this is where actuarial dept expenses get classified).

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- Expense Ratio
 - For ratemaking purposes only, a Profit & Contingency Load may be included with the All Expenses Other than LAE (while LAE is included with Losses)
 - Expense Ratio = All Expenses Other than LAE / Gross Rate
 - **Permissible LR = 1.0 – Expense Ratio – Profit Load**
 - The Permissible LR is usually (but not always) the target LR that would lead to a break-even Combined Ratio of 100% when combined with the Expense Ratio and Profit Load (if applicable).
I.e., Permissible LR + Expense Ratio = 100% Combined Ratio

PLR Example

Assume the following:

Commissions = 15%
Premium Taxes = 2%
Other General Expenses = 10%
Profit & Contingency Load = 3%

Then:

Expense Ratio = 0.30
Permissible LR = $1 - 0.30 = 0.70$
Permissible LR + Expense Ratio = 70% + 30% = 100%

- Gross Rate = Trended & Developed Loss Cost per Unit of Exposure / PLR
= Trended & Developed Pure Premium / PLR

Gross Rate Example

Continuing with Example 4.1 on Brown pg 113, assume the following:

Selected Pure Premium for AY 7 = 234.19
Selected PLR = 70%

Then:

Gross Rate = $334.56 = 234.19 / .70$

This basically means that if you charge a Gross Rate of 334.56 per exposure unit, then 7234.19 (or 70%) will cover Losses (including LAE) and the remaining 100.37 (or 30%) will cover Expenses.

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- Fixed vs. Variable Expenses

- Not all Expenses should be expressed as a % of Gross Rate because they are more fixed in nature and do not vary with exposure. E.g., Home Office Rent is relatively fixed in the short-term regardless of how much business is sold (that is until a company decides to expand or contract its rental space which is not a very flexible thing to do). So in the near-term, Rent is relatively fixed. In contrast, Commission expense paid to agents is directly related to exposure (agents usually receive 10-15% of premium), which means Commission is a variable expense.
- Therefore, the more generalized formula for Gross Rate is:

Gross Rate

$$= (\text{Trended \& Developed Pure Prem} + \text{Fixed Expenses per Exposure}) / (1 - \text{Variable Expense Ratio})$$

[Note, this is a generalized formula. I.e, if Fixed Expenses = 0, then you have the original Gross Rate formula above which is a special case with all variable expenses.]

Gross Rate Example revised

Continuing with Example 4.1 on Brown pg 113, assume the following:

Selected Pure Premium for AY 7 = 234.19

Selected PLR = 70%

Variable Expense Ratio = 20% (15% Commission + 2% Prem Tax + 3% Profit)

Fixed Expenses per Exposure = 33.45 (General Expenses)

Then: $\text{Gross Rate} = 334.55 = (234.19 + 33.45) / (1 - .20)$

So if you charge a Gross Rate of 334.56 per exposure unit, then 234.19 will cover Losses (including LAE), 33.45 will cover Fixed Expenses, and the remaining 100.37 (or 20%) will cover Variable Expenses.

I did rig this example to come up with the same answer, so this time let's assume all the same assumptions as above, but with Fixed Expense = 25 per Exposure.

Then: $\text{Gross Rate} = 323.99 = (234.19 + 25.0) / (1 - .20)$

So if you charge a Gross Rate of 323.99 per exposure unit, then 234.19 will cover Losses (including LAE), 25.0 will cover Fixed Expenses, and the remaining 64.80 (or 20%) will cover Variable Expenses.

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4.7.4 Loading for Profit & Contingencies

- It is normal to include provisions for profit and adverse deviations in the rate, i.e., loading for profit and contingencies.
 - Implicit approach – means actuaries select conservative assumptions at various stages throughout their ratemaking so that final rate is conservative. The expectation is that on average, the actual experience will be better than expected experience, resulting in a profit.
 - Regulators have not supported this approach in recent years because the selections are not objectively supported and the level of conservatism is not measured.
 - Explicit approach – means actuaries select their best estimate for all ratemaking assumptions with no conservatism intended. Then a specific factor for profit and contingencies is loaded into the formula (typically with the variable expense ratio).
- Profit & Contingency Loads are sometimes negative due to reflection of Investment Income in setting the target for a Gross Rate.
 - Some actuaries would explicitly load 0% Profit & Contingencies and figure that any investment income earned would be the profit. Regulators now frown on this approach and expect to see an explicit assumption for investment income as well as for profit & contingency. So an actuary may target a combined ratio of 102% instead of 100% because they assume investment income will cover the underwriting loss. A 102% combined ratio target mean that the profit & contingency load is (2)%.

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4.8.1 Overall Average Rate Change

- Rate Changes are also known as Rate Indications or Indicated Rate Changes
- Two methods can be used to calculate overall average rate change.
 1. The Loss Cost (or Pure Premium) method
 2. The Loss Ratio (LR) method

Loss Cost (or Pure Premium) method

Note that this method actually derives a New Rate, not a Rate Change. You would need to compare New Rate with Old Rate to calculate the Rate Change.

$$\text{New Average Loss Cost} = \frac{\text{Trended \& Developed Expected Loss \$ in Effective Period}}{\text{Number of Expected Earned Exposure Units in Effective Period}} \quad (4.6a)$$

Then,

$$\text{New Average Gross Rate} = \text{New Ave Loss Cost} + \text{Fixed Expense per Exposure} / \text{PLR}, \quad (4.6b)$$

Where,

$$\text{PLR} = 1 - \text{Variable Expense Ratio} - \text{Profit \& Contingencies Ratio} \quad (4.6c)$$

[This is same formula we just used in the section 4.7.3]

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Loss Ratio method

Unlike the Loss Cost method, this method derives a Rate Change, not a New Rate. If you want a New Rate, you need to multiply Old Rate by Rate Change.

$$\text{Indicated Rate Change} = [\text{Expected Effective LR} + \text{Fixed Expense Ratio} / \text{PLR}] - 1.0 \quad (4.7a)$$

Where,

$$\text{Expected Effective LR} = \frac{\text{Trended \& Developed Expected Loss \$ in Effective Period}}{\text{Earned Premium \$ at Current Rates}} \quad (4.7b)$$

And,

$$\text{Fixed Expense Ratio} = \frac{\text{Fixed Expense \$ per Exposure}}{[\text{Earned Premium \$ at Current Rates} / \text{Number of Expected Earned Exposure Units in Effective Period}]} \quad (4.7c)$$

- Earned Premium \$ at Current Rates - There are two approaches to calculating this:
 1. Extending Exposures method - Re-rate historical exposures using current rates, i.e., you are extending historical exposures forward using the current rate level.

Example:

Assume you insured the following HO exposures over the past 3 years:

2012: 1100 homes (and the overall average rate at this time was \$100/home)

2013: 1000 homes (and the overall average rate at this time was \$105/home)

2014: 900 homes (and the overall average rate at this time was \$110/home)

Also assume the current overall average rate for 2015 is \$115/home.

Then, the Extending Exposure method of calculating Earned Premium \$ at Current Rates would be to simply re-rate the historical exposures at the current rate level.

So,

2012: 1100 homes x \$115/home = \$126,500 EP at Curr Rates

2013: 1000 homes x \$115/home = \$115,000 EP at Curr Rates

2014: 900 homes x \$115/home = \$103,500 EP at Curr Rates

Total experience period EP at Curr Rates = \$345,000

2. Parallelogram method – Adjusts actual historical premium forward to current rate levels by reflecting rate changes subsequent to when the earned premium was written.

See Example 4.2 in Brown book. It would be difficult to simplify this in notes.