4.1 → Constraints + Considerations

< just readings >

↳ Considerations + constraints that influence the rate implementation. These can be broken into three categories:

→ Regulatory constraints
→ Operational — — —
→ Marketing considerations

4.2 → Finalizing rates

4.2.0 → Overview

→ Non-pricing + Pricing solutions to an imbalanced Fundamental Insurance equation (ie current rates do not yield an avg premium sufficient to cover expected costs + target uw profit)

- Non-pricing:
  - underwriting adjustments → Tighter control (limit exposure)
  - coverage modifications → Adjust deductibles/limits
  - operational improvements → Better claims management
- Pricing:
  - Rate adjustments
  - New products

→ The steps for implementing a rate change are:

→ 1) Select an overall average premium
→ 2) Construct a rating algorithm
→ 3) Select relativities for each rating variable expense fees + other additive components
→ 4) Calculate any applicable expense fees + other additive components
→ 5) Derive the base rate required to reach the selected overall average premium

Expense fees + other additives

→ Total premium = $\underbrace{\text{Base premium} * \text{relativity}}_{\text{variable premium}}$ + Additive premium

→ Expense fee → $\bar{P}_s = \dfrac{\bar{L} + \bar{E}_L + \bar{E}_F}{1-V-Q_T} = \underbrace{\dfrac{\bar{L}+\bar{E}_L}{1-V-Q_T}}_{\text{variable premium}} + \dfrac{\bar{E}_F}{1-V-Q_T}$

$\dfrac{\bar{E}_F}{1-V-Q_T}$ = expense fee (adjusted for VER + profit provision) $= \dfrac{\text{Fixed expense per exposure}}{\text{VPLR}}$

→ other additive fees work the same way

4.2.2 → Deriving Base rates

→ Avg premium = $\boxed{\text{Base rate}}$ * Avg rating factor + Additive fee

↳ Final step is to derive this

↳ Tricky to derive

⇒ easier method:

→ Let the average premium, base rate, weighted average rating factor, + expense fee w/ $\bar{P}, B, R, + A$, respectively, + subscripts P to indicate "Proposed" + C to indicate "Current"

⇒ restating above: $\bar{P}_P = B_P * R_P + A_P$

$\bar{P}_C = B_C * R_C + A_C$

→ If we take a ratio of the proposed variable premium to the current variable premium, we discover another relationship

$$\frac{B_P * R_P}{B_C * R_C} = \frac{\bar{P}_P - A_P}{\bar{P}_C - A_C}$$

$$B_P * R_P = \frac{\bar{P}_P - A_P}{\bar{P}_C - A_C} * (B_C * R_C)$$

$$* \quad B_P = \frac{\bar{P}_P - A_P}{\bar{P}_C - A_C} * B_C * \frac{R_C}{R_P}$$

$\frac{R_C}{R_P}$ → assuming not changing relativities ⇒ = 1

→ Deriving base rates: changing relativities → three methods

→ Approximated average rate differential

→ The method is called approximated average rate differential because it allows us to approximate the proposed average rating factor (a.k.a. proposed rate differential) component in the equation. Specifically, we will approximate the average rating factor as the product of the weighted average rating factors (rate differentials) for each individual rating variable. For instance, if there are two rating factors, class + Territory, the average rating factor would be approximated as:

→ Avg rating factor = Avg Class Factor * Avg Territory Factor

→ when calculating the weighted average rating factors for each rating variable, there are a few different options for the weights. The most accurate option would be to weigh by the current variable premium at base level. Variable premium at base level is the total multiplicative premium a level would be charged if it were re-rated as the base level. In other words, it is the variable premium if the level had a relativity of 1.

→ This is equivalent to weighing relativities by the adjusted exposures (ie the pure premium method was used to calculate the proposed

→ Approximated change in average rate differential

→ OBF = $\dfrac{R_C}{R_P}$ in * equation above (note proposed is in denominator bc OBF ~ go backwards)

eg) Current LC 1.0 m ← moving here; adjusted LC 1.5 m ← starting here; OBF 0.667

⇒ Proposed Base rate = $\dfrac{\text{Proposed Avg Premium} - \text{Proposed additive fee}}{\text{Current Avg premium} - \text{Current additive fee}}$ * Current Base rate * OBF

→ $OBF_{overall} = \dfrac{\text{Current Avg rating factor}}{\text{Proposed Avg rating factor}}$

$= OBF_{var\,1} * OBF_{var\,2}$

→ when calculating OBF_i, have two equivalent options

→ 1) ← w/ variable premium at base level or adjusted exposures when weighting

→ 2) OBF = $\dfrac{1}{\text{Avg relativity change factor}}$, w/ variable premium not at base level when weighting

→ Extension of exposures (no approximation)

→ Proposed Base rate = Seed Base rate * $\dfrac{\text{Proposed Avg Premium} - \text{Proposed Additive fee}}{\text{Proposed Avg Premium w/ seed base rate} - \text{Proposed Additive fee}}$

Seed Base rate → can be anything ≠ 0 ⇒ just use 1

4.2.3 → Capping rates

→ Capping helps maintain fairness among insureds by ensuring that rate changes changes are not excessive or unfairly discriminatory. While capping may deviate from strictly cost-based pricing, it balances equity considerations with practical market realities + regulatory requirements. Additionally, limiting large rate increases can support customer retention + foster regulatory goodwill, aligning w/ the broader goals of sustainable + equitable ratemaking.

→ Because capping generally reduces the total premium collected from the capped classes, this may lead to a premium shortfall relative to the target rate change. To meet the overall rate objectives, actuaries must adjust the base rate + other class relativities so that the non-capped classes contribute enough to make up for the shortfall. Here, we will explore two methods for handling a premium shortfall:

→ Capping a Non-base class

→ Method 1 → A structured, formula-based adjustment for both capped + non-capped classes.
(formulas)

→ 1) Reduce capped class's relativity: Initial capped relativity = $\dfrac{\text{Current relativity} * (1 + \text{cap }\%)}{\text{OBF} * (1 + \text{target rate change})}$

→ 2) Increase base rate: Shortfall Adjustment Factor = $\dfrac{\text{Premium shortfall}}{\text{Total proposed premium from uncapped classes}}$

→ 3) Re-adjust relativity of capped class: Final capped relativity = $\dfrac{\text{Initial capped relativity}}{\text{Shortfall adjustment factor}}$

☆ → As for the final premium amounts, we've already established that the final premium for class A must be $108,000 in order to comply w/ the cap. The relativities for classes B + C are not touched, but the base rate is scaled by the shortfall adjustment factor. Then the final premium amounts for classes B + C are just their proposed premiums multiplied by the shortfall adjustment factor.

→ Final premium = Proposed premium * Shortfall adjustment factor

→ Benefits → Method 1 provides a precise, formula-driven solution, ideal for formal calculations

→ It is effective for structured, standardized scenarios, where accuracy in achieving the cap + target rate is prioritized

→ Drawbacks → Method 1 can feel complex + less intuitive due to its step-by-step recalculations, especially in large or multi-capped portfolios

→ Problem solving → Notice that the % change in premium is not larger than 20% for any one class + that the overall target rate change is achieved. Additionally, the total final premium amount is the same as the total final premium we found before applying the cap. Verifying that these relationships hold true is a good way to check your work.

→ Method 2 → An intuitive, proportional reallocation approach that simplifies adjustments, especially useful for multi-capped portfolio
(manually relocate the shortfall)

→ Example →

Class	Proposed Premium	Shortfall Reallocation	Final Premium
A	\$120,778	−\$12,778	\$108,000
B	\$345,081	$\$12{,}778 \times \dfrac{\$345{,}081}{\$517{,}622} = \$8{,}519$	\$353,600
C	\$172,541	$\$12{,}778 \times \dfrac{\$172{,}541}{\$517{,}622} = \$4{,}259$	\$176,800
Total	\$638,400	\$0	\$638,400

→ Reallocating the shortfall in this way effectively alters each of the relativities, not the base rate. We can derive the adjusted relativities by comparing the final premium amounts to the proposed premium amounts.

→ Adjusted relativity = Proposed relativity * $\dfrac{\text{Final premium}}{\text{Proposed premium}}$

→ Benefits → Method 2 is practical + intuitive, avoiding the need for recalculations + providing a streamlined way to achieve the target rate

→ Especially useful in real-world situations w/ multiple capped classes, as it requires only one reallocation + rebasing step

→ Drawbacks → May feel less structured than Method 1 due to the reallocation process

→ Requires a final re-basing step for consistency, setting the base class relativity to 1.00

→ Capping a base class

→ Applying a cap to the base class inherently lowers the base rate when compared to the uncapped proposed base rate. As a result, there are a few changes to the first approach to handling the premium shortfall. The second approach is essentially unchanged. Nonetheless, we will demonstrate both approaches using a modified version of the example above where the base class is capped.

→ Method 1 → Just have to 1) apply an extra factor to the base rate + then 2) adjust the non-base class relativities accordingly
(formulas)

→ 1) Capped Base Adjustment factor = $\dfrac{1 + \text{cap}\%}{1 + \text{proposed }\%\text{ change in premium}}$

→ 2) Adjust non-base class relativities → Suppose decrease base rate by x% ⇒ then [Base rate (1−x)] * [factor/(1−x)] ≐ premium

need to balance

→ Method 2 → < pretty much the same >
(manually relocating the shortfall)

4.2.4 → Other considerations

→ Effect of minimum premium = $\dfrac{\text{Total premium w/ minimum}}{\text{Total premium w/o minimum}} - 1$

→ Minimum premium offset factor = $\dfrac{1}{1 + \text{Effect}}$
