

## 2.5 → Expenses & Profit (Cont...)

### 2.5.4 → UW Expenses: Exposure/Policy-based Method

→ An alternative to premium-based projection method is to use a method that projects fixed expense based on exposure or # of policies, i.e. the exposure/policy-based projection method.

→ Under this method, variable expenses are handled the same way as in other methods, i.e. divided by premiums. However, historical fixed expenses are divided by historical exposures or policy counts, rather than premium. The choice depends on whether fixed expenses are assumed to be constant for each exposure (in which case, divide historical expenses by exposures) or for each policy (in which case, divide by the # of policies).

→ The historical expense ratios for each category use the following data:

| Expense                   | Data Used         | Fixed Divided By | Variable Divided By |
|---------------------------|-------------------|------------------|---------------------|
| General Expense           | Countrywide       | Earned Exposure  | Earned Premium      |
| Other Acquisition         | Countrywide       | Written Exposure | Written Premium     |
| Commissions and Brokerage | Countrywide/State | Written Exposure | Written Premium     |
| Taxes, Licenses, and Fees | State             | Written Exposure | Written Premium     |

→ The steps for determining the UW expense provisions under the Exposure/Policy-based Projection method are:

- 1) Split each expense into fixed or variable components
- 2) Derive the expense ratio for each year + category. Divide by exposures (or policy counts) for fixed expenses + premium for variable expenses
- 3) Select a ratio for each expense type
- 4) Sum the fixed expense ratios selected for each expense category to find the total fixed expense provision. Repeat for variable expenses

→ This procedure results in the average fixed expense per exposure. So if the projected fixed expense ratio is needed instead, it can be found as

$$\text{Projected Fixed Ratio} = \frac{\text{Avg. Selected Fixed Expense per Exposure}}{\text{Projected Avg. Premium}}$$

→ Potential distortions (which can be remedied slightly (not written here though))

→ While the Exposure/policy-based projection method corrects the distortions caused by the other two methods, it still has its own shortcomings. These are discussed below, along w/ additional enhancements that may be needed:

- 1) Expense categorization into fixed & variable components often relies on judgment.
- 2) UW fixed expenses are allocated to states based on exposure or policy distribution but actual average fixed expense levels may differ by location (e.g. higher advertising costs in some states)
- 3) Some "fixed" expenses can vary by a certain characteristic (e.g. higher advertising costs for new business). This can result in inequitable allocations if fixed expenses in the rate distribution significantly changes or varies by state.
- 4) When there are similar values for the projected average expense per exposure, this implies that expense are changing proportionately to exposures. However, not all fixed expenses behave this way due to economies of scale.

→ Trending

- Variable expenses don't require trending as they are a constant percentage of premium. However, fixed expenses will likely need to be trended, as they are a constant dollar amount.
- For an inflation-sensitive exposure base (e.g. payroll per \$1M), trending is not necessary if expenses + exposures are trending at the same rate. For a non-inflation-sensitive exposure base (e.g. car year or house year) or for policy counts, the average fixed expenses are expected to change over time, & thus trending is needed.
- Selecting a trend for expenses → Internal expense data can be used, but can be volatile  $\Rightarrow$  Can use government indices along w/ incorporating any anticipated changes in internal company practices.
- Find trend for expenses in the same way as for premium/ticks. The trend period will be from the average date expenses were incurred in the historical experience period to the average date they will be incurred in the future rates are expected to be in effect.
- For expenses incurred at the beginning of a policy, trend using the average date that policies are written.
- For expenses incurred throughout a policy, trend using the average date that policies are earned (i.e. half a policy period longer than?)
- One possible way to simplify expense trending is to assume that all expenses are incurred in the same way (i.e. either all at inception or all throughout the policy period). The impact of this simplification will depend on the magnitude of the expense trend & the portion of premium that fixed expenses represent.
- Another possible simplification is to trend historical fixed expenses from a single date, rather than determining the trend length for each historical year separately. For instance, assume a 3-year average expense ratio is selected, this ratio could be incurred from the midpoint of the 3-year period. This should give approximately the same result as trending each year's expense ratio separately & then averaging the results. If the ratio selected was only the latest year, there would be no difference.

$$\xrightarrow{\text{assume to}} \xrightarrow{\text{single H}} \xrightarrow{\text{trend Hs}} \xrightarrow{\text{individually}} \xrightarrow{\text{avg. Hs}} \xrightarrow{\text{avg. trend}}$$

→ Summary of trending expenses

- Fixed → Premium-based projection  $\rightarrow$  Only if fixed expenses trend different than premium
- Exposure-based projection  $\rightarrow$  Yes if exposure base is non-inflation-sensitive  
Yes if fixed expense trends different than exposure
- Variable → never

→ Two methods for deriving expense provisions

$$\rightarrow \text{1) Premium-based projection} \rightarrow \text{Fixed} = \frac{\text{Total Expenses} \times \% \text{ of Fixed Expenses}}{\text{WP or EP}} \\ \text{variable} = \frac{\text{Total Expenses} \times \% \text{ of Variable Expenses}}{\text{WP or EP}}$$

$$\rightarrow \text{2) for exposure-based projection} \rightarrow \text{Fixed} = \frac{\text{Total Expenses} \times \% \text{ of Fixed Expenses}}{\text{WP or EP}} \\ \text{variable} = \frac{\text{Expenses}}{\text{Exposure}}$$

### 2.5.5 → UW Profit Provision

→ Total profit = Investment income + UW profit

→ Using the fundamental insurance equation  $\rightarrow$  UW profit = Premium - LAE - UW expenses

→ Permissible loss ratio (PLR)

→ The variable claimable loss ratio (VCLR) is the percentage of each premium dollar that is intended (or "permitted") to pay for projected losses + LAE. The remaining portion of each premium dollar is then intended to pay for variable expenses + profit. The VCLR is calculated as:

$$\rightarrow \text{VCLR} = 1 - \text{Variable expense \%} - \text{Target UW profit \%}$$

$$\downarrow = 1 - V - \alpha_t$$

↳ where F is the fixed expense ratio

→ VCLR & PLR are the same when all expenses are treated as variable expenses.

$$\rightarrow \text{Profitability} = \text{Investment Income} / \text{UW Premium} = \alpha_t$$

↳ It's safe to assume as a standard, equal to constant as well

BUT depend on market & choose different ratios

↳ How choose different ratios?  $\Rightarrow$  Higher premium for higher PLR & lower premium for lower ratios

### 2.6 → Overall rate level indications

#### 2.6.1 → Pure premium method

→ Pure premium method  $\rightarrow$  Indicated avg. rate =  $\frac{\text{Pure premium including LAE} + \text{Fixed UW expense per exposure}}{1 - \text{Variable UW expense \%} - \text{Target UW profit \%}} - 1$

$$P_p = \frac{L + E_L + E_F}{(1 - V - \alpha_t)} \rightarrow \text{Pure PP method}$$

$$\text{per exposure: } P_p = \frac{L + E_L + E_F}{(1 - V - \alpha_t)} \rightarrow \text{Fixed expense per exposure} = \frac{\text{Projected Fixed Expenses}}{N \text{ policies}}$$

→ If develops a formulaic treatment for other adjustments

$$\text{Loss} + \text{LAE} = \text{Non-act. Loss} + \text{LAE} \times \text{LAE factor} \times \text{Current Loss Factor} \times \text{Projected trend factor}$$

$\Rightarrow$   $\uparrow$  by exposures to get PLR

→ At end of CP operation  $\rightarrow$  Develop losses, then trend

→ When selecting method  $\rightarrow$  Sometimes you just have to read the problem & choose an interpretation that makes sense.

If you're worried that your assumption isn't correct, just state what your assumption is & move forward anyway.

Unless your assumption is illegal, that's probably enough for full credit.

→ Problem solving  $\rightarrow$  order doesn't matter when looking at LAEs & LDFs  $\rightarrow$  LDFs factor in current trend factor to projected trend factor

$\Rightarrow$  can select LDF from all years & LAE from all years

OR can select LDF to all years & then select LAE to all years

OR can select LDF to all years & then select LAE to all years

↳ when comparing loss ratios for mortality, everything needs to be accounted for

$\Rightarrow$  i.e. OLEP, developed losses, born trended

$\Rightarrow$  ensures applies to applied component across years/claims/etc.

→ Selecting final LR  $\rightarrow$  use straight-average if stable / assume fluctuations are just random fluctuations

$\Rightarrow$  use weighted-average if results are more volatile

→ PP method preferred when can't get OLEP, e.g. if historical rate change information isn't available

→ There are three main differences between the pure premium method (PP method) & the LR method (LAE method).

→ 1) The underlying loss measure used in the calculations are different. The PP method utilizes pure premium & the LR method utilizes the losses. This means that the premium & LAE is needed for the LR method, but not the PP method. In addition, clearly defined expenses are needed for the PP method, but not the LR method.

→ 2) If the PLR is typically used before premium at the LDF is not available or difficult to calculate accurately. For instance, if there are significant changes to rating variables for an insurance product w/ a complex rating algorithm, this can make it difficult to calculate current premium.

→ On the other hand, the LR method is preferred when exposure data is not available or exposures are not clearly defined for an insurance product. For example, commercial general liability policies can have several sub-lines to cover a wide variety of risks, but these sub-lines may have different exposure data, which can make it difficult to establish a consistent exposure measure.

→ 3) The two methods result in different outputs. The PP method results in an indicated rate, while the LR method results in an indicated rate change.

→ Since the LR method involves calculating the percent change from current rates, this method cannot be used for a new company that wants to determine an indicated rate. In that case, external data or judgement can be used to estimate corrected PP + expense provisions + to select a target profit provision + use in the PP method.

→ Converting between indicated average rate to indicated avg. rate change

$$\Rightarrow \text{Ind. avg. rate} = 1 + \text{Ind. rate change} \quad \&$$

$$(1 + \text{Ind. rate change}) \times \text{Act. current rate} = \text{Ind. avg. rate}$$

→ Results from PP method vs LR method should be equivalent

(assuming consistent data + assumptions)

$\hookrightarrow$  using reinsurance method for one + extension of exposures for another

→ Stillwater  $\rightarrow$  (1) Year-end Current LDF  $\rightarrow$  (2) Cumulative trended Current LDF  $\rightarrow$  (3) (1) + (2) = Total LDF  $\rightarrow$  (4) Current LDF  $\rightarrow$  (5) LDFs  $\rightarrow$  (6) Ultimate non-act. incurred Loss + LAE  $\rightarrow$  (7) Ultimate trended Loss + LAE  $\rightarrow$  (8) Trended Ultimate non-act. incurred Loss + LAE  $\rightarrow$  (9) Ultimate non-act. incurred Loss + LAE  $\rightarrow$  (10) Avg. weight

→ can do weighted average  $\frac{\sum (\text{E}_i \cdot \text{W}_i)}{\sum (\text{E}_i)}$  OR straight average  $\frac{1}{n} \sum \text{E}_i$

Mathematically, this is the sum of doing a traditional weighted average (weighted by denominator)

→ When writing up pure premium (losses), can write net losses & convert to PP at end (i.e. by dividends or earnings)

→ When writing up PLR from beginning  $\rightarrow$  need net losses though

$\hookrightarrow$  Net losses, less adjustments, etc.

→ Factors that affect loss cost trends  $\rightarrow$  Trend!!! Stillwater vs ISD

$\Rightarrow$  mix of business, inflation, shifting deductions/policy limits, etc.