

3.5.2 → UW expenses: All variable method

→ overview → In addition to loss adjustment expenses, writing insurance policies incurs underwriting expenses, also called operational & administrative expenses. Recall that these expenses are incurred in the acquisition & servicing of policies & are typically classified into the following categories:

- 1) commissions & brokerage: paid to insurance agents or brokers as compensation for generating business, typically paid as a percentage of premium written
- 2) other acquisition costs: paid to acquire business, such as marketing costs
- 3) Taxes, licenses & fees: paid by the insurer
- 4) General expenses: associated w/ the insurer's operation

→ when estimating the UW expense provision, it is common to categorize UW expenses as either variable expenses or fixed expenses.

→ Variable expense are expenses that vary w/ premium, so they're declared as a constant percentage of the premium. Examples: variable expenses are premium taxes & commissions.

→ Fixed expenses are assumed to be the same for each policy, so they don't vary w/ premium. An example of a common fixed expense is overhead costs associated w/ the home office.

→ To get an understanding of how UW expenses & profit are incorporated in the ratemaking process, consider the following simple example.

→ Example →

You are given the following:

- The average expected loss and LAE for each policy is \$225.
- The fixed cost for writing a new policy is \$30.
- 10% of each dollar of premium collected covers expenses that vary with premium.
- The target profit provision is 5% of premium.

Determine the average premium that should be charged.

→ start w/ the fundamental insurance equation:

$$\text{Premium} = \text{Loss} + \text{LAE} + \text{UW expenses} + \text{UW profit}$$

→ Expenses are split up into fixed & variable, & profit is given as a percentage of premium, so we can rewrite the fundamental insurance insurance equation as

$$\boxed{\begin{array}{c} P = L + E + (E_F + V_F) + \alpha_P \cdot P \\ \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \\ \text{Loss} \quad \text{LAE} \quad \text{Fixed} \quad \text{Variable} \quad \text{UW profit} \\ \text{expenses} \quad \text{expenses} \quad \text{expenses} \end{array}}$$

→ Therefore,  $V_F$  is the variable expense provision, &  $\alpha_P$  is the target profit provision, both given as a % of premium.

→ We can further rearrange the equation above to get:  $(P_F, V_F, \alpha_P)$

$$\begin{aligned} P_F &= \frac{L + E + E_F}{1 - \alpha_P - \alpha_V} \\ \downarrow \quad \downarrow \quad \downarrow \\ V_F &= \frac{(L + E + E_F)/\alpha_V}{1 - \alpha_P - \alpha_V} \\ \downarrow \quad \downarrow \quad \downarrow \\ P &= \frac{L + E + E_F}{1 - \alpha_P - \alpha_V} \end{aligned}$$

→ Using the values in the context, we get an average premium of

$$\bar{P} = \frac{225 + 30}{1 - 0.05 - 0.05} = 300$$

→ Note that in Part of section 3.5, we will look at methods for determining  $E_F$ ,  $V_F$ , &  $\alpha_P$ .

→ Note → Recall there are two common ways to incorporate non-proportional reinsurance in ratemaking:

→ 1) Reduce projected losses for any expected reinsurance & reduce total premium by the cost of reinsurance

→ 2) Divide the cost of reinsurance among the expected reinsurance as an expense item

→ If the second approach is used, we would add an additional expense item to the fundamental insurance equation above to account for the cost of reinsurance.

→ Continuing on

→ For now, we will start w/ UW expense provisions. In the past, UW expenses were not broken down into fixed or variable categories, so they would be estimated in the same way. However, techniques have been developed to separately estimate these expenses, which is especially important when both types of expenses are material.

→ The treatment of UW expenses varies by LOS & by company. Different LOS may have significantly different types or sizes of UW expenses. For example, LOS that require a detailed inspection at the start of a policy (e.g. large commercial property) will typically have higher commissions than other lines that don't require this (e.g. personal auto). In addition, UW expenses can vary by company w/in the same LOS. For example, a mutual direct writer may have large acquisition costs for advertising, while an agency-based company will have lower acquisition costs but higher commission expenses bc they rely more on agents to generate new business. As a result, the methods used to incorporate UW expenses in the ratemaking process can vary.

→ We will cover 3 general methods for incorporating UW expenses:

- 1) All variable expense method
- 2) Premium-based projection method
- 3) Exposure/policy-based projection

→ The first two methods have historical precedent, while the third method addresses some of the distortions that can occur w/ the other two, which is particularly relevant if fixed expenses make up a significant portion of total expenses.

→ All variable expense method

→ Under the all variable expense method, there is no differentiation between fixed & variable UW expenses. Instead, all UW expenses are treated as variable w/ premium. It is a constant percentage of premiums, while this method was used more commonly in the past, it can still be used for pricing insurance products where most UW expenses are variable, which is common in commercial lines.

→ For this method, the variable expense provision as a percentage of premium is estimated using historical expense ratios (i.e. the ratio of historical UW expenses to historical premium). So, this method also assumes that expense ratios during the projected period will be consistent w/ historical expense ratios.

→ To derive the historical expense ratios, historical CY expense & premium data will be needed. The type of expense being estimated will affect whether the analyst should use:  
→ Countrywide or state data, &  
→ Written or earned premium data

→ Some expenses vary by state, while others are typically assumed to be uniform across all locations. So, for expenses that vary by state, divide historical expenses at the state level by premiums at the state level. For expenses that are uniform across locations, divide historical countrywide expenses by countrywide premiums. In terms of UW expense categories, general expenses & other acquisition costs typically use countrywide data. Taxes, licenses, & fees can vary by state (or sometimes by territory w/in a state), so state data is often used for these expense ratios. Commissions & brokerage expense ratios vary by insurer, as some company's commission plans vary by location. So, some insurers will use state-level data, while others use countrywide data for commissions & brokerage expenses.

→ The choice of whether to use written or earned premium data depends on when the expenses are incurred. Written premium reflects premium at the onset of a policy, so it should be used for expenses incurred at the start of a policy. EP reflects the general carrying of premium over the policy term, so it should be used for expenses that are incurred throughout the policy (e.g. liability maintenance). The choice of whether to use written or earned premium will have a relatively small impact when the company's balance of business is not changing materially. Typically, EP is used for general expenses, while WP is used for commissions & brokerage, other acquisition costs, & taxes, licenses, & fees.

→ In summary, the historical expense ratios for each category use the following data:

| Expense Category          | Data Used         | Divided By      |
|---------------------------|-------------------|-----------------|
| General Expenses          | Countrywide       | Earned Premium  |
| Other Acquisition Costs   | Countrywide       | Written Premium |
| Commissions and Brokerage | Countrywide/State | Written Premium |
| Taxes, Licenses, and Fees | State             | Written Premium |

→ There are a few other considerations that should be made when gathering data for UW expenses.

→ Non-recurring expense items: the materiality & nature of any non-recurring expense items that occur in the historical period should be considered to determine how or if to incorporate them in the analysis. If the aggregate annual spend of non-recurring expenses is expected to be similar in the future no adjustment is needed.

→ Extraordinary expenses: any extraordinary expenses, such as a major project to improve the automated policy issuance process should be examined to determine the extent to which those expenses should be reflected in the rates for insurance. If the new system will be used for a significant length of time, so they may come to spread the expense over a period of several years. Another option is to not reflect the expense in the rates, which means it will be shared by any existing surplus.

→ Restrictions on expenses: a few states restrict which expenses can be included when determining rates. For instance, some states do not allow charitable contributions or lobbying expenses to be included in the rates. So, actuaries will need to be aware of their state.

→ Once the data is gathered, follow these steps to calculate the UW expense provision:

→ 1) Derive the expense ratio for each year & each category. This can be done by dividing the historical CY expenses for a category by the CY written or earned premium during the same historical period. Repeat this for each year & category.

→ 2) Select a ratio for each expense type. As w/ other steps in the ratemaking process, the selection should be made w/ what is expected in the future. So, this may involve selecting a multi-year average (either straight or weighted), the last year's ratio, or a judgemental pick.

→ 3) Sum the selections for each expense category to create the total UW expense provision. This provision will then be used directly in the rate level judgements formula (round to seven digits).

→ Consider the following simple example, which only includes one year of historical data. Note that this table mirrors the style & format of prior cases sections. Note we divided countrywide or state data above, these will be incorporated into the table for this example.

→ Example → You are given the following information:

|                           | Countrywide Data | State-Level Data |
|---------------------------|------------------|------------------|
| General Expenses          | 63,200           | -                |
| Other Acquisition Costs   | 38,750           | -                |
| Commissions and Brokerage | -                | 3,900            |
| Taxes, Licenses, and Fees | -                | 1,250            |
| Written Premium           | 780,000          | 46,000           |
| Earned Premium            | 735,000          | 42,000           |

Calculate the variable expense ratio using the All Variable Expense Method.

→ Divide the countrywide data by the countrywide premium, & the statewide data by statewide premium. Recall that EP is typically used for general expenses, while WP is used for the other categories. So,

| Expense Category          | Ratio                    |
|---------------------------|--------------------------|
| General Expenses          | 63,200 / 735,000 = 8.60% |
| Other Acquisition Costs   | 38,750 / 735,000 = 5.20% |
| Commissions and Brokerage | 3,900 / 46,000 = 8.48%   |
| Taxes, Licenses, and Fees | 1,250 / 42,000 = 2.72%   |

→ Finally, the total variable expense ratio is

$$0.0860 + 0.0520 + 0.0848 + 0.0272 = 24.70\%$$

→ This example used only one year of data, so there was only one possible ratio to select for each category. Typically, an analyst will involve multiple years of data. Some examples of price changes that should be considered when selecting expense ratios are:

→ Commission changes: If the commission structure is changing, the expected commission percentage should be used instead of the historical percentage for the commissions & brokerage category.

→ Productivity increases: If there was increased productivity during the latest historical expense period, resulting in reduced staffing levels, ratios should be selected based on expected post-reduction expenses rather than an all-year average.

→ Portfolio growth: For a growing portfolio, expense ratios may decrease, as volume often increases faster than expenses. However, if a new cell center is opened to handle growth monthly, expect fixed costs to increase in the short term.

→ Potential disturbances using this approach

→ By definition, the all variable expense method treats all expenses as variable. So, if there are any expenses that are constant or almost constant for each LOS, this method can result in inaccurate expense estimates.

→ Since the expense provision varies directly w/ premium, this method will underestimate rates w/ below-average premium & overcharge rates w/ above-average premium.

→ To see how this works, let's look at the simple example we went through at the beginning of this section.

→ We found that the average premium should be 300. Instead of a fixed cost of \$30 for each new policy, let's assume that we treat the fixed expense as variable, i.e. as

$$\frac{30}{30} = 10\%$$

of premium. Include this w/ the other 10% variable expenses (V) for a total underwriting expense provision of 20%. Then the premium calculation is

$$\bar{P} = \frac{(L + E) + V}{1 - \alpha_P - \alpha_V}$$

$$= \frac{225 + 30 + 30}{1 - 0.05 - 0.05} = 300$$

$$\downarrow = 300$$

→ The result is the same in this case bc this is the average ratio. Consider the results of the two methods for premium above & below the average.

→ Using a fixed dollar amount for fixed expenses,

| Loss Cost | Fixed Expense | Variable Expense | Profit | Premium |
|-----------|---------------|------------------|--------|---------|
| 191       | 30            | 10%              | 5%     | 250     |
| 225       | 30            | 10%              | 5%     | 300     |
| 259       | 30            | 10%              | 5%     | 345.33  |

→ Using the all variable expense method,

| Loss Cost | Fixed Expense | Variable Expense | Profit | Premium |
|-----------|---------------|------------------|--------|---------|
| 191       | -             | -                | -      | 250.67  |
| 225       | -             | -                | -      | 280.50  |
| 259       | -             | -                | -      | 325.00  |

→ notice that when using the all variable expense method, the ratio w/ LC or 191 is unchanged by 205%.

$$\frac{205}{191} = 1.07 = 7\%$$

→ On the other hand, the ratio w/ LC or 259 is unchanged 1.57%.

$$\frac{259}{259} = 1 = 1.57\%$$

→ So, at this simplicity, companies that use the all variable expense method may choose to implement one of the following:

→ A premium discount structure that reduces the expense hardness based on the amount of premium charged (this is common for workers compensation).

→ An expense constant that covers proxy insurance, writing & handling expenses that apply uniformly to all policies.

→ Trends

→ Generally, UW expenses are likely to change over time due to inflationary pressures & other factors. However, since variable expenses are a constant percentage of premium, they will automatically adjust as premium changes. I.e., the variable expense ratio does not need to be tracked, which means that no trending is needed when the all variable expense method is used.