📖 Selecting Data for Trending   🕐 **20m**

As mentioned previously, trending procedures can be used in many different property/casualty analyses, including ratemaking, reserving, valuation, underwriting, and marketing. Our focus in this section will be on how trending can be applied to exposures, premiums, and losses when performing a ratemaking analysis in order to account for changes in these values over time.

In Section 1.3.1, we discussed data sources. As a quick recap, the sources of data used to determine trend amounts in insurance ratemaking include:

1. **Internal Data**: Internal data encompasses two key categories:

   - **Risk Information**: Detailed data on exposures, premiums, claim counts, losses, and other explanatory characteristics related to policies or claims.

   - **Accounting Information**: Aggregated data such as underwriting expenses.

2. **External Data**: External data provides industry-wide context and benchmarks to validate or adjust internal data trends. Key sources include:

   - **Industry Data**: Benchmarks from sources like the Insurance Services Office (ISO) and statistical plan data offer an industry perspective, enabling companies to compare their experience against broader trends and gain insight into market-level shifts.

   - **Other Third-Party Data**: Non-insurance data, such as the Consumer Price Index (CPI) or wage data from the U.S. Bureau of Labor Statistics, can be used to adjust for economic inflation and other factors that impact trends.

Here are additional considerations for exposure, premium, and loss data.

Exposure Data

Some lines of business rely on exposure measures, such as payroll or sales revenue, which can be influenced by time-related factors like inflation. For these lines, it may be essential to analyze exposure trends and account for them when projecting future exposures.

These trends can be studied using internal insurance company data or industry sources. For instance, exposure trends related to payroll can be estimated by examining the insurer's workers compensation payroll data (internal) or through industry benchmarks like the average wage index.

The effect of exposure trends on the overall rate level indication varies based on several factors, including whether the loss ratio or pure premium method is applied and how loss trends are determined.

Premium Data

Along with exposures, the average premium level can change over time due to inflationary pressure. Another type of change over time to the premium level is a *distributional change*, which is a change in the characteristics of the policies written. The resulting change in the premium level is known as *premium trend*.

Consider a few examples of situations that can result in changes to the average premium level:

- A rating characteristic, such as the amount of insurance for a homeowners policy, is typically indexed so that it increases automatically with inflation. So, average premium will also increase.

- An insurer may change the level of deductible for all existing insureds. For instance, if each insured is moved to a higher deductible when their policy is renewed, this will decrease the amount of coverage and premium charged. This decrease in average premium will be spread out over the period where existing policies are renewed, but will likely not continue once all policies are renewed with the new deductible.

- If a company purchases the entire portfolio of another company, the average premium may have a sudden one-time change if the new book of business differs from the existing one.

Notice that the changes in the average premium level can be from trends that are ongoing, trends that only occur over a specific period of time, or an abrupt one-time change. So, when performing a trending procedure, it is important to decide whether any changes are from a one-time event or are expected to continue in the future. Then, any shifts that are expected to continue in the future can be incorporated when determining rates.

When selecting premium data to use for trending, we can either

1. measure all premium shifts at once, or

2. look at changes in premium distributions by individual rating variable.

Considering shifts by rating variable may not be reasonable, as it may not be easy to obtain that detailed data. In addition, there may be several variables with minor changes, which could make it difficult to determine the overall effect on premium. So, it is common to focus on measuring all premium shifts at once.

Another decision to make when selecting premium data is whether to use earned or written premium to determine trends.

- Earned premium may be beneficial to use when estimating a trend because earned premium data is used for most of the ratemaking analysis. So, the trends determined will typically be applied to earned premium.

- Written premium is a leading indicator of changes in earned premium, which means that changes will first be seen in written premium and will then show up as changes in earned premium. So, it may be beneficial to use written premium to determine trends since those trends will be reflected more quickly, even if the trends are then applied to earned premium.

Regardless of which type of data is used, trending should be done on the historical average premium per exposure, rather than on total premium or average premium per policy. Total premium is not used because total premium will change when a company is growing or shrinking, even if the distribution of types of policies does not change.

Loss Data

Changes over time in the expected levels of claim frequency and severity are known as *loss trends*. Loss trends can be driven by many different factors, such as

- monetary inflation

- increasing medical costs

- advancements in safety technology

- social influences

- distributional changes, like a growing proportion of risky policies

Loss trends can be estimated either by analyzing pure premium directly or by separately analyzing frequency and severity, as they may have different drivers. For example, higher deductibles may reduce claim frequency but increase severity.

The choice of historical data years depends on the actuary's judgment, balancing responsiveness and stability.

In stable, short-tailed lines (e.g., auto physical damage), actuaries typically analyze 12-month rolling calendar year paid losses, which avoids distortions from case reserving changes and smooths seasonality. For more volatile, long-tailed lines (e.g., workers' compensation medical), actuaries often analyze accident year reported losses developed to ultimate and adjusted for benefit changes.

Trend analysis should focus on homogeneous claims, which may require splitting data (e.g., indemnity vs. medical losses in workers' compensation). Liability and property claims are usually analyzed separately.

Paid loss data avoids distortions from reserving changes, while reported loss data includes more current information. Linear and exponential regression models are commonly used, with more advanced methods like econometrics or GLMs mentioned but not covered on the exam.

Coordinating Trends

When determining the overall rate level indication (which involves either pure premiums or loss ratios), it is important to trend each component of the formula consistently.

For a **pure premium** rate level indication, there are three types of trends to consider:

- changes in the likelihood of a claim happening

- changes in the average cost of claims

- changes in the level of exposure

When studying a company's frequency or pure premium data, the changes in frequency (i.e., number of claims divided by exposures) or pure premiums (i.e., losses divided by exposures) also account for the changes in exposure.

However, for lines of business that have inflation-sensitive exposure bases, the inflationary pressure on the exposure can make it challenging to understand how the other components (number of claims or losses) are changing over time. To account for this, the historical frequencies or pure premiums can be adjusted for the exposure trend before being studied. The resulting trend can be applied to historical losses, which will then be compared to exposures that have been trended using the selected exposure trend.

For a **loss ratio** rate level indication, one common approach is to examine trends in historical loss ratios after the losses have been adjusted for development, benefit changes, and anomalies and after premiums have been adjusted to the current rate

level. In this case, the trend can be referred to as a "net" trend, which can then be applied to project loss ratios into the future policy period. One downside to this approach is that adjusted loss ratios may not be stable over time. In addition, studying the "net" trend can make it difficult to determine what is causing the changes.
An alternative approach is to study and adjust each component of the loss ratio (i.e., frequency, severity, and average premium) separately. Then, if frequency and average premium are calculated using the historical exposures, each component will be adjusted consistently. This approach of studying the trends for each component separately allows for a better understanding of where any changes are coming from and how the overall loss ratio is affected.

Loss trends may also be selected using external indices. In this case, the loss trend selected won't account for any inflation-related changes in the insurer's premium or exposures. So, the exposure or premium should also be adjusted to reflect the change.

Other Remarks

When applying trends to ratemaking data, selecting the appropriate data requires actuarial judgment. Trending is typically performed after adjusting the data for anomalies like catastrophes and rate or benefit changes, ensuring any distortions to the true trend are eliminated. Additionally, trending can be applied either before or after the data is developed to ultimate values.