2.4 → Trending <cont...>

2.4.3 → Estimating a trend <cont...>

→ Two-step trending

→ If there is a notable change on x date ⇒ ① Trend to exactly that date, then ② Trend beyond

→ two-step trending takes into account that the future trend rate is expected to differ from the historical trend rate.

→ The first step, known as the current trend step, adjusts each year's historical data to the average level of the most recent time period in the trend data. The second step, called the projected trend step, further adjusts this data from the average date of the latest time period to the average date of the of the future policy period.

→ there are two approaches for performing the current trend step. Similar to estimating a trend, the choice of method depends on the stability of the data & the type of trend being measured:

→ For loss trends, where loss data often exhibits volatility, we use approach 1, which adjusts historical data by applying an annual trend factor

→ for premium trends, where changes in average premium are relatively stable, we use approach 2, which adjusts historical data to match the current trend level.

→ Approach 1 → Historical data is adjusted by applying an annual trend factor from the average historical date to the average date of the latest available period.

→ for example, assume the historical data is AY 2016 losses, & the annual trend is 3%. If the latest data is AQ 2018 Q4 losses, the current trend period will be from 7/1/2016 to 11/15/2018, which is 28.5 months or 2.375 years. So,

$$\text{current trend factor} = (1+0.03)^{2.375} = 1.0727$$

→ Approach 2 → Historical data is adjusted to align w/ the most recent known average, based on the assumption that this average serves as a credible reference point for estimating future trends.

→ for example, assume the average EP for CY 2016 is $340, & the average written premium for the latest available quarter, CQ 2017 Q4, is $533. The current trend factor, assuming WP trends are used to forecast EP is,

$$\text{current trend factor} = \frac{\text{Latest Avg WP at CRL}}{\text{Historical Avg EP at CRL}}$$

$$= \frac{533}{520}$$

$$= 1.0288$$

→ No matter which approach is used for the current trend step, the projected trend step is performed like a one-step trending. A projected annual trend rate is selected & applied over the interval between the average date of the latest time period & the average date in the forecast period.

→ For example, if the future trend period spans from 7/1/2018 to 7/1/2020, i.e. a duration of 2 years, & an annual trend of -3% is selected, the projected trend factor is calculated as:

$$\text{Projected trend factor} = (1-0.03)^2 = 0.9409$$

→ Finally, the total trend factor to adjust historical data to the future time period is: Total trend factor = Current trend factor × Projected trend factor

→ Examples

→ Two-step trending

→ Current trend factor = (avg WP @ CRL, latest period) / (historical avg EP @ CRL)

→ You are given the following information:

Calendar Year	Avg Earned Premium at Current Rate Level	Avg Written Premium at Current Rate Level
2016	340	344
2017	360	365
2018	385	391

- The projected annual premium trend is 3%.
- Q4 2018 average earned premium at the current rate level is $387.
- Q4 2018 average written premium at the current rate level is $394.
- All policies are annual.
- The future policy period begins January 1, 2020.
- The proposed rates will be in effect for one year.

Calculate the calendar year earned premium trend factor for each year using two-step trending.

→ Original solution

→ Since we are trending EP using two-step trending, there are 4 possible approaches. For the first step, we can either adjust each historical period level to be equal to the latest level, or we can determine an average trend to apply to each historical period. In addition, we can either use the EP trend or the WP trend to forecast EP.

→ Bc the Q4 2018 average premium amounts are given, it makes sense to adjust each historical period level to be equal to the latest level.

★ In addition, it is generally recommended to forecast EP using WP data when it is given on the exam. So, we'll start by solving w/ this approach.

→ First, find the current trend factor for each year using:

$$\text{Current trend factor} = \frac{\text{Latest Avg WP at CRL}}{\text{Historical Avg WP at CRL}}$$ ← constant numerator

Calendar Year	Current Trend Factor
2016	$\frac{394}{340} = 1.1588$
2017	$\frac{394}{360} = 1.0944$
2018	$\frac{394}{385} = 1.0234$

→ Then, the projected trend period is from the midpoint of Q4 2018 (the latest time period) to the midpoint of the future policy period when premium is written. So, the trend period is from 11/15/2018 to 7/1/2020, which is 1.625 years. The projected trend factor for each year is

$$(1+0.03)^{1.625} = 1.0492$$

→ Finally, calculate each year's total trend factor using:

Total trend factor = Current trend factor × Projected trend factor

Calendar Year	Total Trend Factor
2016	$1.1588\,(1.0492) = \mathbf{1.2158}$
2017	$1.0944\,(1.0492) = \mathbf{1.1483}$
2018	$1.0234\,(1.0492) = \mathbf{1.0737}$

→ Alternative Solution 1

→ now, use the EP data to again adjust each historical period level to be equal to the latest level. The current trend factor for each year is

$$\text{Current trend factor} = \frac{\text{Latest Avg EP @ CRL}}{\text{Historical Avg WP @ CRL}}$$

Calendar Year	Current Trend Factor
2016	$\frac{387}{340} = 1.1382$
2017	$\frac{387}{360} = 1.0750$
2018	$\frac{387}{385} = 1.0052$

→ The projected trend period is from the midpoint of Q4 2018 to the midpoint of the future policy period when premium is earned. Since the future policy period is from 1/1/2020 to 12/31/2020, premium will be earned from 1/1/2020 to 12/31/2021. So, the trend period is from 11/15/2018 to 1/1/2021, which is 2.125 years. The projected trend factor for each year is

$$(1+0.03)^{2.125} = 1.0648$$

→ Finally, each year's total trend factor is

Calendar Year	Total Trend Factor
2016	$1.1382\,(1.0648) = \mathbf{1.2120}$
2017	$1.0750\,(1.0648) = \mathbf{1.1447}$
2018	$1.0052\,(1.0648) = \mathbf{1.0704}$

→ Alternate Solution 2

→ now, for the first step, find the WP trend as a simple average of each year's trend:

Calendar Year	Annual % Change
2017	$\frac{365}{344} - 1 = 6.10\%$
2018	$\frac{391}{365} - 1 = 7.12\%$

$$\text{Current trend} = \frac{0.0610 + 0.0712}{2} = 6.61\%$$

→ Since we are using WP data to trend EP, we trend from the average written date of the historical EP to the latest average written date, & then again to the future average written date.

→ policies are annual, so premium earned in a year will be from policies written in that year & the prior year. For instance, premium earned in 2016 is from policies written between 1/1/2015 & 12/31/2016. Therefore, the midpoint of each historical period is January 1 of that year.

→ The latest data used is from 2018, so the midpoint of the latest time period is 7/1/2018. In addition, the future average written date is 7/1/2020. Therefore,

Calendar Year	Current Trend Period	Current Trend Factor	Projected Trend Period	Projected Trend Factor	Total Trend Factor
2016	2.5 years	$1.0661^{2.5} = 1.1736$	2 years	1.0609	**1.2451**
2017	1.5 years	$1.0661^{1.5} = 1.1008$	2 years	1.0609	**1.1679**
2018	0.5 years	$1.0661^{0.5} = 1.0325$	2 years	1.0609	**1.0954**

→ other considerations

→ now that we have thoroughly discussed trending on its own, let's revisit it alongside the other features we've previously covered: anomalies, rate & benefit changes, & development. Up to this point, we've examined each of these topics individually & in isolation from trending. Now, we'll explore how trending interacts w/ each of them & consider their combined effect.

→ Anomalies → Before trending loss data, any extraordinary losses should be removed or adjusted, or the loss trends should be selected based on basic limits loss data.

→ catastrophe losses will result in a significant increase in frequency & severity, while large losses will typically only impact severity since they tend to be individual claims. If catastrophe or large losses cannot be identified, trends should best be determined using 12-month rolling averages, as one anomaly would then affect multiple data points.

→ Once a trend is determined, that trend should also be applied to data where extraordinary losses are removed or adjusted.

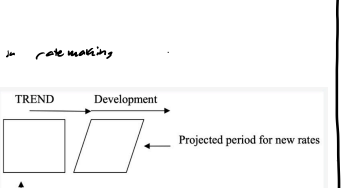
→ rate & benefit changes → It is also helpful to adjust data for rate or benefit changes before determining trends. For instance, assume that a court ruling results in an increase of 4% for all expected loss payments after a specific date. In that case, the data will show a positive severity trend until all claims paid out are under the court ruling.

→ If adjustments for rate or benefit changes are not made, the impacts of these changes should be considered when selecting the trend. In addition, when selecting a trend to apply to historical data that has been adjusted for rate or benefit changes, make sure to select a trend that is not impacted by these same changes. Otherwise, the effects of the changes will be taken into account twice.

→ Development → There is a well known misconception called the overlap fallacy, which states that developing & trending will double count the effect of inflation & other possible changes

→ This is not true b/c the development factors are used to bring immature values to their expected ultimate values, while trending factors are used to adjust the ultimate values from the historical experience period to the period the rates will be in effect. Loss development does incorporate inflation that results in increased payments for reported claims in time after reporting, but it does not include inflation from the experience period to the forecast period.

→ In short, development & trending are two independent steps, both of which are important in rate making



Example (not in book)

→ A good summary example

Imagine the following historical data without any adjustments:

Year	Earned Premium	Incurred Loss
2016	100	90
2017	120	80
2018	125	75
Total	345	245

⇒

OL Trended EP	Trended Ultimate Incurred Loss
134.98	104.19
155.75	97.02
130	94.5
420.73	295.71

→ After adjustments, each premium number represents how much premium we'd collect for the same risk we had in a prior year if we sold it in this year. And the loss column represents what we think the ultimate cost would be of those risks this year

2.5 → Expenses & profit

2.5.1 → Loss adjustment expenses

→ LAE → ULAE, ALAE

OR

LAE → DCC: ALAE; AAO: ULAE → Adjusting & other expenses

Treated as: Defense / cost containment

→ ALAE typically tracks w/ losses ⇒ treated as an extension of losses + ALAE

→ ULAE → Assume it tracks w/ loss + ALAE dollars consistently over time. This assumption applies to both the rate of payment & the amount of losses paid. The steps for incorporating ULAE using this approach are as follows:

→ 1) Calculate the ratios of calendar year ULAE to calendar year paid loss plus ALAE over several years (e.g. 3 or more years, depending on the line of business)

→ 2) Select a ratio to use (e.g. average of last 3 years or volume-weighted average)

→ 3) Apply the ratio to each year's reported loss plus ALAE

→ ULAE provision is pretty much always a factor ⇒ (loss & LAE ratio) * (1 + ULAE %)

2.5.2 → UW expenses: All variable method

→ UW expenses are typically classified into the following categories:

→ 1) Commissions & brokerage
→ 2) Other acquisition costs
→ 3) Taxes, licenses & fees
→ 4) General expenses

★ See table for the typical data used for each category

→ three methods for incorporating UW expenses:
→ 1) All variable expense method } → have historical precedence
→ 2) Premium-based projection method
→ 3) Exposure/policy-based projection } → addresses distortions of other two, which is particularly relevant for fixed expenses make up a significant portion of total expenses

→ when estimating the UW expense provision, categorize UW expenses as either variable expenses or fixed expenses.
↙ constant % of premium ↘ same for every risk

→ fundamental insurance equation

$$\text{premium} = \text{loss} + \text{LAE} + \text{UW expenses} + \text{UW profit}$$

$$P = L + E_L + (E_F + V \cdot P) + Q_T \cdot P$$ ← variable expenses & profit are expressed as a % of premium

(fixed expenses: E_F; variable: $V \cdot P$, $Q_T \cdot P$)

$$\Rightarrow P = \frac{L + E_L + E_F}{1 - V - Q_T}$$ ★ ← aggregate level

$$\left(\frac{1}{x}\right) P = \left(\quad \downarrow \quad\right) \frac{1}{x}$$ → # exposures

$$\Rightarrow \frac{P}{x} = \frac{(L + E_L + E_F)/x}{1 - V - Q_T}$$ under all-variable expense method, UPLR = PLR / 1 - UER - profit

$$\bar{P} = \frac{\bar{L} + \bar{E}_L + \bar{E}_F}{1 - V - Q_T}$$ ★ ← avg per exposure level

→ Incorporating reinsurance → Two options: 1) Reduce losses for recoveries
2) Include net cost of reinsurance as an expense item

→ All variable expense method

→ all expenses are treated as variable to premium

→ Steps to calculate the UW expense provision:

→ 1) Derive the expense ratio for each year & each category
→ 2) Select a ratio for each expense type (should be representative of future)
→ 3) Sum the selections for each expense category to find the total UW expense provision

→ Don't use OLEP when calculating ratios ⇒ need % of historical premium

→ Potential distortions → If there are any constant (or almost constant) expenses for each risk ⇒ can result in inaccurate expense estimates (ie when not to use this approach)

→ b/c expenses vary by premium ⇒ inequity: undercharge risks w/ below-average premium & overcharge risks w/ above-average premium

→ Trending → Even though UW expenses likely increase w/ inflation, b/c they are expressed as a % of premium, this is taken into account ⇒ no trending needed

2.5.3 → UW expenses: Premium-based method

→ Premium-based Projection method → variable & fixed expenses are handled separately
→ important for companies w/ significant amounts of each

→ the steps for determining the UW expense provision are:

same steps as all-variable method, except for

→ 1) Derive the expense ratio for each year & category
→ 2) Select a ratio for each expense type
→ 3) Divide each selected expense ratio into fixed & variable ratios
→ 4) Sum the fixed expense ratio selections for each expense category to find the total fixed expense provision. Repeat for variable expenses.

⇒ results in two separate, total ratios

→ If the average fixed expense per exposure is needed instead, this can be found as

→ Fixed expense per exposure = Fixed expense ratio × Projected average Premium

→ Potential distortions

→ Assumes that historical fixed & variable expense ratios will be the same in the projected period. Since variable expenses vary directly w/ premium, the historical variable expense ratio will likely be appropriate. However, by definition, fixed expenses do not vary w/ premium. So, the fixed expense ratio will be distorted if historical & projected premium levels differ materially.

→ there are 3 main circumstances that can cause this:

→ 1) Recent rate changes can impact historical expense ratios, as they are based on either WP or EP. This can result in a rate level indication that is either too high or too low. The magnitude of the rate changes & the # of years of expense ratios can both impact the degree of distortion. One potential solution is to on-level premiums before calculating expense ratios.

→ 2) Expense ratios can also be affected by premium &/or expense trends. Since historical ratios are based on WP or EP during the historical period, any changes in the average premium that don't also affect UW expenses will cause the estimated fixed expense ratios to either be overstated or understated. One way to correct for this is to trend historical premium & expenses to prospective levels before calculating expense ratios. Trending can be skipped if both average premium & average fixed expense trend at the same rate, as the trend factors will cancel each other out.

→ 3) For regional or national insurers, this method can create inequitable rates if UW expense ratios are applied to state-level premium to determine expected fixed expenses. In other words, fixed expenses will essentially be allocated to each state based on premium. So, states w/ premiums above average will get a higher allocation of fixed expenses, which may not be fair. One solution is to calculate fixed expense ratios by state.

→ Trending → For exam, assume fixed expenses don't need trended either

Examples → If it is fixed expense 'per exposure', the denominator will be exposures (not premium)
⇒ if fixed expense ratio ⇒ then divide by premium (% of premium dollars)

→ overall indications → if given a fixed expense %, use in numerator (ie premium-based projection method)
↳ as opposed to all-variable expense method which includes in denominator