

2.4 → Trending (cont...)

2.4.3 → Estimating a trend (cont...)

→ If there is a reliable change in x data → tend to consider that data is from a trend period

→ Two-step trending

→ 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 or the latest time period to the average date or 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 level trends, where last 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 amounts 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 series

→ for example, assume the historical data is as follows: if the annual trend is 3%, if the latest data is 1/1/2018, the current trend period will be from 7/1/2016 to 1/1/2018, which is 2 years or 229 days. so,

$$\text{Current trend factor} = (1 + 0.03)^{229} = 1.0722$$

→ 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 Q4 2018 is \$850, & the average written premium for the latest available period, Q4 2018, is \$857. the current trend factor, assuming level trends are used to project EP is:

$$\begin{aligned} \text{Current trend factor} &= \frac{\text{Latest Avg EP at CRL}}{\text{Historical Avg EP at CRL}} \\ &= \frac{857}{850} \\ &\approx 1.0082 \end{aligned}$$

→ 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 3/1/2019, a duration of 7 years, & an annual trend of -2% is selected, the projected trend factor is calculated as:

$$\text{Projected trend factor} = (1 - 0.02)^7 = 0.949$$

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

→ Example 6

→ Two-step trending

You are given the following information:		
Calendar Year	Any Premium Written	Any Premium Incurred Loss
2016	340	344
2017	360	355
2018	365	351

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

Period: 7/1/2018 to 1/1/2019
Duration: 4/1/2018 to 1/1/2019

→ Original solution

→ Since we are trending EP using two-step trending, there are 2 possible approaches. for the first step, we can either adjust each historical period until it is equal with 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 avg trend to forecast EP.

→ If 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 the data when it is given in the coming. So, we'll start by solving w/ this approach.

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

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

Calendar Year	Current Trend Factor
2016	394 / 340 = 1.1588
2017	394 / 360 = 1.0944
2018	394 / 365 = 1.0234

→ Then, the projected trend period is from the midpoint of 04/2018 (the latest time period) to the midpoint of the future policy period when premium is written. So, the trend period is from 1/1/2018 to 7/1/2019, which is 1.625 years. The projected trend factor for each year is:

$$(1.0234)^{1.625} = 1.0492$$

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

$$\text{Total trend factor} = \text{Current trend factor} \times \text{Projected trend factor}$$

Calendar Year	Total Trend Factor
2016	1.1588 (1.0492) = 1.2158
2017	1.0944 (1.0492) = 1.1483
2018	1.0234 (1.0492) = 1.0737

→ Alternative solution 1

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

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

Calendar Year	Current Trend Factor
2016	387 / 340 = 1.1382
2017	387 / 360 = 1.0750
2018	387 / 365 = 1.0052

→ The projected trend period is from the midpoint of 04/2018 to the midpoint of the future policy period when premium is earned. Since the future policy period is from 1/1/2018 to 7/1/2019, premium will be earned from May/June to 10/18/2019. So, the trend period is from 1/1/2018 to 7/1/2019, which is 2.125 years. The projected trend factor for each year is:

$$(1.0052)^{2.125} = 1.0268$$

→ Finally, each year's total trend factor is:

Calendar Year	Total Trend Factor
2016	1.1382 (1.0268) = 1.2120
2017	1.0750 (1.0268) = 1.1447
2018	1.0052 (1.0268) = 1.0704

→ Alternative solution 2

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

Calendar Year	Annual % Change
2017	365 - 344 = 1.610%
2018	391 - 365 = 7.12%

$$\text{Current trend} = \frac{0.0161 + 0.0712}{2} = 0.0616$$

→ Since we're using up data to trend EP, we trend from the earliest written date on 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, premiums earned in 2016 is from policies written between 1/1/2015 & 1/1/2016. Therefore, the minimum relevant historical period is January 1 of that year.

→ The latest date used is from 2018, so the midpoint of the latest time period is 7/1/2018. In addition, the future average written date is 7/1/2019.

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 factors we've previously covered: anomalies, rate & benefit changes, & developments. up to this point, we've examined each of these types individually & in isolation from trending. now, we'll explore how trending interacts w/ each of them & consider their combined effect.

→ Anomalies → before trending has data, any extraordinary losses should be removed or adjusted, or the loss trends should be selected based on fair limits liability.

→ Developments → each development loss will result in a significant increase in frequency & severity, while large losses with typically only repeat severity since they tend to be individual claims. If catastrophe or large losses cannot be avoided, trends should not 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 collect data for rate or benefit changes before determining trends. for instance, assume that a court ruling results in an increase of 10% for all expense loss payments after a specific date. In that case, the data will show a positive severity trend until all claim payments are under the court ruling.

→ 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 those same changes. otherwise, the effects of the changes will be taken into account twice.

→ Development → There is a well-known misnomer called the overlapping, which states that developing & trending will double count the effect of inflation + other market changes.

→ 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	OL Trended EP	Trended Ultimate Incurred Loss
2016	100	90	134.98	104.19
2017	120	80	155.75	97.02
2018	125	75	130	94.5
Total	345	245	420.73	295.71

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

→ Now, let's calculate the trended ultimate incurred loss for each year.

→ First, calculate the trended ultimate incurred loss for each year using the formula: $\text{Trended Ultimate Incurred Loss} = \text{Incurred Loss} \times \text{Current Trend Factor}$

→ For 2016: $90 \times 1.1382 = 104.19$

→ For 2017: $80 \times 1.0750 = 85.00$

→ For 2018: $75 \times 1.0052 = 75.84$

→ Finally, calculate the total trended ultimate incurred loss: $\text{Total Trended Ultimate Incurred Loss} = \sum \text{Trended Ultimate Incurred Loss}$