## 6.6.4 → Tail severities

→ Overview → The severities at the oldest maturity ages are often highly unstable, especially in the long-tailed lines of business. This is mainly due to thin data. In this case, we can consider combining the severities of multiple maturity ages & select a tail severity. For example, a tail severity at 60 months represents the average amount of all claims at an age of 60 months or older. By combining the severities, we hope to produce a more stable estimate.

→ Considerations when selecting a tail severity

→ Computing the tail severity is fairly straightforward. However, the decision on at which maturity we should begin to combine severity data is important. There are a few things to consider when making this choice:

- → Combine data over the ages where the results become erratic
- → Consider the influence on total projections of selecting a particular age
- → Consider the percentage of claims expected to be closed beyond the selected maturity

→ In the end, the decision of when to begin combining claims data requires actuarial judgement. We will demonstrate the process using the following example.

→ Example →

Given the following information as of December 31, 2013:

| Accident Year | Incremental Closed Claim Counts | | | |
|---|---|---|---|---|
| | 48 Months | 60 Months | 72 Months | 84 Months |
| 2007 | 30 | 40 | 30 | 10 |
| 2008 | 30 | 50 | 20 | |
| 2009 | 35 | 40 | | |
| 2010 | 35 | | | |

| Accident Year | Incremental Paid Claims in $000s | | | |
|---|---|---|---|---|
| | 48 Months | 60 Months | 72 Months | 84 Months |
| 2007 | 300 | 1,500 | 400 | 320 |
| 2008 | 350 | 300 | 900 | |
| 2009 | 300 | 1,200 | | |
| 2010 | 350 | | | |

- Inflation is 3% per year.

→ We are given incremental closed claim counts & incremental paid claim amounts. The severities can be calculated by dividing the paid claims by the closed claim counts. Furthermore, we should trend the incremental severities to a common level (AY 2013).

→ For example, AY 2007 incremental severity at 48 months trended to AY 2013 level is

$$\frac{300{,}000}{30} \times 1.03^6 = 11{,}940.52$$

| Accident Year | Incremental Severities Trended to AY2013 | | | |
|---|---|---|---|---|
| | 48 Months | 60 Months | 72 Months | 84 Months |
| 2007 | 11,940.52 | 44,776.96 | 15,920.70 | 38,209.67 |
| 2008 | 13,524.86 | 6,955.64 | 52,167.33 | |
| 2009 | 9,647.22 | 33,765.26 | | |
| 2010 | 10,927.27 | | | |

→ Notice that the severities at 60 months & 72 months vary significantly. With the information on hand, there is not a good way to select the severities for them. So, instead of selecting a severity at each maturity age, we can combine the experience of 60 months & beyond & select a tail severity:

$$\text{60-month tail severity} = \frac{40(44{,}776.96) + 50(6{,}955.64) + \cdots + 10(78{,}209.67)}{40 + 50 + 40 + 30 + 20 + 10} = 28{,}781.77$$

↘ $= \frac{\sum(\text{claim count} \times \text{trended severity})}{\sum \text{claim counts}}$

→ If we decided to combine the experience at 72 months instead:

$$\text{72-month tail severity} = \frac{70(15{,}920.70) + 70(52{,}167.33) + 10(38{,}209.67)}{70 + 70 + 10} = 31{,}717.74$$

$= \frac{\sum \text{paid claims}}{\sum \text{claim counts}}$

→ Keep in mind that the tail severities above are at AY 2013 cost levels. To use them for another accident year, trend them to that year.

→ Note: → As a rule of thumb, when there isn't a clear indication of the specific year to which the data should be trended, trend it to the most recent year for which we have data.

→ By the way, you may notice that the incremental maturities in the tables are given as singular points in time rather than a period of time. To clarify, "incremental paid claims at X months" refers to claims paid between X−12 & X months (assuming the development triangle is in years).

→ Example →

*(2.5 points)* Given the following information as of December 31, 2010:

| Accident Year | Incremental Closed Claim Counts | | |
|---|---|---|---|
| | 72 Months | 84 Months | 96 Months |
| 2003 | 2,000 | 2,000 | 1,000 |
| 2004 | 3,000 | 2,000 | |
| 2005 | 3,000 | | |

| Accident Year | Incremental Paid Claims (000s) | | |
|---|---|---|---|
| | 72 Months | 84 Months | 96 Months |
| 2003 | $20,000 | $28,000 | $25,000 |
| 2004 | $33,000 | $36,000 | |
| 2005 | $36,000 | | |

- Selected annual severity trend = 10%

(a) *(2 points)* Use the volume-weighted average to estimate the trended tail severity for maturity ages of 72 months and older.

(b) *(0.5 points)* Briefly describe two considerations in selecting the maturity age at which to combine data for estimating a tail factor.

→ a) → Start by trending the incremental paid claims to the AY 2010 level, as it is the most recent AY w/ available data. The trend rate is 10%. Trend the AY 2003 paid claims for 7 years, the AY 2004 paid claims for 6 years, & the for AY 2005 paid claims for 5 years.

| Accident Year | Incremental Paid Claims (000s) Trended to AY2010 | | |
|---|---|---|---|
| | 72 Months | 84 Months | 96 Months |
| 2003 | $20{,}000(1.10)^7 = 38{,}974.34$ | $28{,}000(1.10)^7 = 54{,}564.08$ | $25{,}000(1.10)^7 = 48{,}717.93$ |
| 2004 | $33{,}000(1.10)^6 = 58{,}461.51$ | $36{,}000(1.10)^6 = 63{,}776.20$ | |
| 2005 | $36{,}000(1.10)^5 = 57{,}978.36$ | | |

→ We are asked to calculate the 72-month tail severity, which involves combining the data at 72 months & beyond. To do this, sum the incremental paid claims. Since the paid claims are provided in thousands of dollars, multiply each by 1000. Then, divide by the total closed claim counts. The tail severity is the sum of all paid claims in the tail divided by the sum of all closed claim counts in the tail, effectively a weighted average of the severity, with claim counts as the weights.

$$\text{72-month tail severity} = \frac{1000(38{,}974.34 + 58{,}461.51 + 57{,}978.36 + 54{,}564.08 + 63{,}776.20 + 48{,}717.93)}{2000 + 3000 + 3000 + 2000 + 2000 + 1000} = 74{,}805.57$$

↘ $= \frac{\sum \text{trended paid claims}}{\sum \text{claim counts}}$

→ This approach is faster than calculating a direct weighted average, as we did in the example when we first calculated the incremental severities for each cell by dividing by the claim count. However, either method yields the same answer.

→ b) ( see notes above )