The Generalized Cape Cod Method in Arius
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Arius includes several variations of the Cape Cod method to help project ultimate losses, ultimate ALAE, or ultimate Salvage & Subrogation (S&S). The methods vary based on the selection of the exposure base (i.e., exposures, ultimate premiums, ultimate claims, or ultimate loss) and the known cumulative data (i.e., paid loss, incurred loss, paid ALAE, incurred ALAE, or S&S received). Because all the variations are similar, the text below is limited to describing the case of the Generalized Cape Cod Using Exposures and Paid Loss.

Whenever an appropriate exposure base has been identified, you can rely on a loss reserving method that is a blend between the loss development method and an exposure-based expected loss method. The most common of these blended methods are the Bornhuetter-Ferguson and Cape Cod methods. The two methods are very similar in that an ultimate loss (or ALAE or S&S) is projected based on expected loss rate (or loss ratio, ALAE ratio, or S&S to loss, etc.) estimates. These estimates are then modified to the extent paid losses (or incurred loss, paid ALAE, S&S received, etc.) to date differ from what would have been expected based on the selected development pattern.

The Cape Cod method differs from the Bornhuetter-Ferguson method in the calculation of the expected loss rate estimates. Instead of externally-derived expected loss rate estimates, the Cape Cod method bases its expected loss rate estimates on a weighted average of the trended developed loss rate for all selected exposure periods combined. The weights are based on a three-dimensional weighting scheme:

1. they are proportional to exposures for those periods selected to be included in the calculation;
2. they are proportional to percentage developed or the ratio to ultimate; and
3. they are inversely proportional to the “distance” from the exposure period in question (accomplished through use of a decay ratio).

To demonstrate via a formula, the expected loss rate in Column (12) of method #64, entitled Generalized Cape Cod Using Exposures and Paid Loss, is calculated as follows:

\[
Exp(LR_i) = \frac{\sum_j TL_j \times (E_j \times EPW_j \times RTU_j) \times D^{i-j}}{\sum_j (E_j \times EPW_j \times RTU_j) \times D^{i-j}}
\]

where

\(Exp(LR)\) = expected loss rate estimate for exposure period i

\(TL_j\) = trended cumulative loss

\(E_j\) = on-level exposures for exposure period j

\(EPW_j\) = weight given to exposure period j (0 = exclude or 1 = include)

\(RTU_j\) = ratio to ultimate for exposure period j (or 1/loss development factor to ultimate)

\(D\) = decay ratio (0 < D ≤ 1)
Aside from exposures, the ratio to ultimate which will be derived from your selected development pattern, and cumulative paid losses to date, the method generally requires four additional inputs:

- Exposure adjustment index,
- Trend index,
- Exposure period weights, and
- Decay ratio.

**EXPOSURE (OR PREMIUM) ADJUSTMENT INDEX**

Prior to arriving at the trended developed loss rate in Column (9), the exposure measure needs to be adjusted for changes in risk profile via the Exposure (or Premium) Adjustment Index in Column (3). The factors to be applied should correspond to an index such as 1.05 or 0.95. As mentioned above, the exposure base used in the Cape Cod methods vary and include ratemaking exposures (e.g., payroll, sales, or car-years), ultimate premiums, and ultimate claims. An ultimate loss is also used when projecting ultimate ALAE and ultimate Salvage & Subrogation.

If ratemaking exposures are used, adjustments need to be made for any change to the risk profile that would affect the expected loss rate. These changes could include:

- number of risks,
- average size of risks,
- policy-limiting factors (limits, deductibles and net retentions),
- class of business (including territory and state),
- underwriting standards (including loss control and risk management initiatives),
- claims adjustment procedures (changes in philosophy, treatment of incidents),
- inflation, and
- external factors (e.g., benefit level changes).

For example, if ratemaking exposures are used as the exposure base, they should first be converted to a base class-equivalent basis to account for any changes in the class mix.

If premiums are used, adjustments need to be made for changes in rate level adequacy. Premiums have certain advantages over exposures when the mix of business by class, territory or limit has changed as long as these items are priced correctly. There is also the danger, when using premiums, of being unable to measure changes other than manual rate changes (e.g., changes in the average schedule debit or credit).

All else being equal, the exposure base requiring the fewest adjustments is typically the best choice because additional adjustments can add imprecision to the process. In most situations, this would be ultimate claims or ultimate losses in the case of projecting ultimate ALAE and Salvage & Subrogation.

Alternatively, losses can also be adjusted to reflect the changes in risk profile in the same manner as trend adjustments.
TRENDS INDEX

Prior to arriving at the trended developed loss rate in Column (9), losses need be adjusted to a common severity and/or frequency level via a Trend Index in Column (8). The Trend Index to be applied should correspond to an index such as 1.05 or 1.10. For example, an annual 5.0% severity trend over the last 5 years would correspond to an array of indexes such as (1.276, 1.216, 1.158, 1.103, 1.050, 1.000). This array will then get applied to the cumulative losses in Column (5).

If ultimate claims are used, losses should be adjusted for severity differences by size of risk, by limits and deductibles, by class/state mix of business, and for changes in underwriting standards and claims adjustment procedures.

If premiums or ratemaking exposures are used, losses should be further adjusted for changes in frequency.

Note that before expected losses can be calculated for each exposure period, the trend adjustments are reversed and the losses are detrended in Column (13) so that each period's losses are at its actual, as opposed to common level.

EXPOSURE PERIOD WEIGHTS

The Exposure Period Weight array allows you to exclude certain exposure periods. The weights to be applied should be 0 (meaning to exclude) or 1 (meaning to include). It is likely this feature will be applied to periods with zero or few exposures or to the more recent exposure periods where the development method results are not as credible.

DECAY RATIO

The Decay Ratio can vary between 0 and 1. At one extreme (where D = 1), all the expected loss rates are set to the same value derived from an overall weighted average based on just the exposures and the ratio to ultimate. This is basically the same as the traditional or standard Cape Cod method. At the other extreme (where D = 0), the expected loss rates will vary for each exposure period and be identical to the loss rates derived from the development method calculated ultimates. Varying the decay ratio between 0 and 1 will determine the amount of “smoothing” to apply to the individual trended developed loss rates. For example, a decay ratio of 0.75 applies a weight of 1.00 to the period in question, a weight of (.75) to the two immediate surrounding periods, a weight of (.75)^2 to the next immediate surrounding periods, and so on. In general, as your confidence in the development method increases, you probably want to apply less weight to the surrounding periods, and therefore smaller decay ratios should be used.

You only need to enter one decay ratio for the entire method. You will enter this into the first row of the Decay Ratio input vector, by selecting the Decay Ratio column in the method and pressing the Source Data button.
For more detailed information on this method, please refer to “Using Best Practices to Determine a Best Reserve Estimate”, by Paul Struzzieri, FCAS and Paul Hussian, FCAS, available from the Casualty Actuarial Society website.