Factor smoothing on exhibits

OVERVIEW

In certain scenarios smoothing can result in a more stable reserve estimate, such as age-to-age factor triangles where there is an erratic development pattern. Smoothing is also useful when applied where data is limited or unreliable.

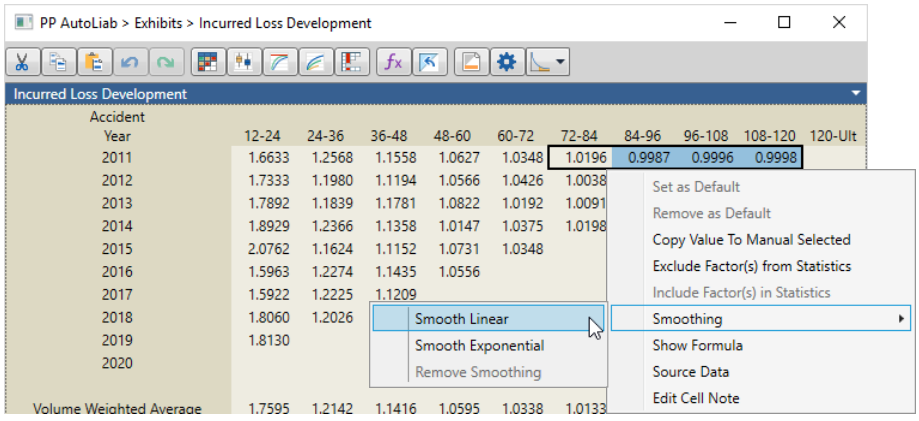
In any of your Arius exhibits you can apply smoothing using a ***linear*** or an ***exponential*** smoothing algorithm. Either smoothing algorithm can be applied to triangles at the top of your exhibits or to the Default row on exhibits with **Selected** rows.

HOW TO APPLY SMOOTHING

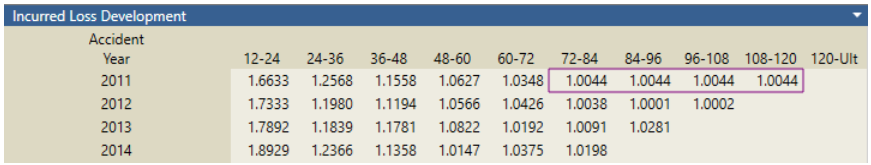
Note that smoothing can be applied to any type of exhibit (e.g., development, ratio, average, other).

1. In your exhibit select two or more contiguous factors on a row in the calculated triangle or in the Default row.
   - Note that the Default row tail factor/final cell cannot be selected for smoothing.
2. Right-click on these factors and choose **Smoothing**, then choose **Smooth Linear** or **Smooth Exponential**.
   - If your selection includes the final cell of the Default row, less than 2 factors, or cells that are not from the calculated triangle or Default row, then these choices will appear greyed-out and will be unavailable.
3. Purple borders are displayed around the set of smoothed factors.
   - When smoothing factors in the exhibit's triangle, these smoothed factors are used in the calculation of applicable statistics rows on the exhibit.
   - When smoothing factors in the Default row, these factors will become your **Selected** factors (unless an over-riding factor is entered into the Manual Selected row).

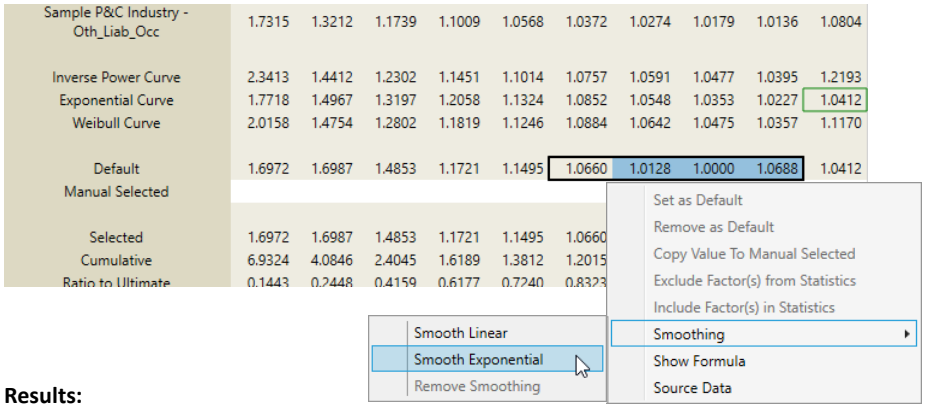
Example 1: Linear smoothing - applied to age-to-age factors



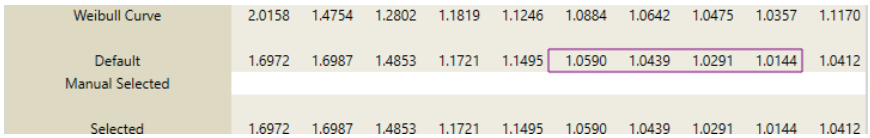
Results:



Example 2: Exponential smoothing - applied to Default row factors



Results:



HOW TO REMOVE SMOOTHING

To remove smoothing from your factors, right-click on any factor in the set of smoothed factors within the purple border and choose **Remove Smoothing**. This will remove all smoothing from the set of contiguous smoothed factors and remove the purple border.

NOTE: If the structure of your file is modified to remove exposure and/or development periods, resulting in the removal of a factor or factors which were included in a contiguous set of smoothed factors, then smoothing is removed from the entire group of contiguous factors in the set.

THE ALGORITHMS

Linear Smoothing

X = Product of highlighted factors = 1.0196 x .9987 x .9996 x .9998 = 1.0177

N = Number of highlighted factors = 4

Z = Replacement factors = X ^ (1/N) = 1.0044

Exponential Smoothing

X = Product of highlighted factors = 1.0660 x 1.0128 x 1.000 x 1.0688 = 1.1539

N = Number of highlighted factors = 4

M = Number of Interpolation Units = N x (N+1)/2 = 10

Z_N = X^(1/M) = 1.0144

Z_M = Z_N x Z_M+1 (M from 1 to N-1) = 1.0590 1.0439 1.0291 1.0144

These algorithms can also be understood as follows:

Let LDF_i represent the empirical (incremental) LDFs, and let LDF_i^S represent the smoothed (incremental) LDF for development period i. Suppose you want to smooth development periods i through $i+n$.

Linear Smoothing:

$$X = \prod_{j=i}^{n} LDF_j\,; \quad LDF_i^S = X^{\frac{1}{n}}$$

Exponential Smoothing:

$$X = \prod_{j=i}^{n} LDF_j\,; \quad M = n \times \frac{n+1}{2}; \quad LDF_{i+n}^S = X^{\frac{1}{M}}; \quad LDF_{i+n-1}^S = LDF_{i+n}^S * X^{\frac{1}{M}}$$

For all development periods k outside of i to $i+n$, $LDF_i^S = LDF_i$.