|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | APEX  Manual | | | |
| **APEX version** | **Doc version** | **Date** | **Changes and comments** | **Author** |
| 1.1.1 | 1.0 | 6th Feb 2019 | First version | K. de Braaf |
|  |  |  |  |  |
|  |  |  |  |  |

Table des matières

[2. Introduction 3](#_Toc371412)

[2.1. Context 3](#_Toc371413)

[2.2. EA process 4](#_Toc371414)

[2.3. Dependencies 5](#_Toc371415)

[2.4. Objectives 6](#_Toc371416)

[3. General principles & conventions 7](#_Toc371417)

[3.1. Methodology & scope 7](#_Toc371418)

[3.2. Date conventions 7](#_Toc371419)

[3.3. Age conventions 8](#_Toc371420)

[3.4. Data conventions 8](#_Toc371421)

[4. Data preparation 9](#_Toc371422)

[4.1. Best practices 9](#_Toc371423)

[4.2. Input Data 9](#_Toc371424)

[5. Calculation methodology 14](#_Toc371425)

[5.1. Decrement definition 14](#_Toc371426)

[5.2. Decrement estimators 16](#_Toc371427)

[5.3. Calculation engine 18](#_Toc371428)

[6. Platform guidance 25](#_Toc371429)

[6.1. Overview 25](#_Toc371430)

[6.2. Study Management 26](#_Toc371431)

[6.3. Study definition 26](#_Toc371432)

[6.4. Dataset management 30](#_Toc371433)

[6.5. Run management 35](#_Toc371434)

[6.6. Study Access Right And Validation 41](#_Toc371435)

[6.7. Table Library 42](#_Toc371436)

[7. FAQ 47](#_Toc371437)

[8. Glossary 48](#_Toc371438)

[9. Appendices 51](#_Toc371439)

[9.1. Rating Adjustment Method – Adjust Expected 51](#_Toc371440)

[9.2. Automatic Risk Amount Change 51](#_Toc371441)

# Introduction

## Context

Experience Analysis (EA), the analysis of historic experience to derive assumptions for the future, lies at the core of most actuarial functions. Assumptions on biometric risks and policyholder behavior risks are the basis for many applications and allow one to:

* Set best estimate assumptions for pricing, deal-specific or as market-wide pricing basis
* Validate reserving assumptions and trigger assumptions review if deviations are emerging
* explain sources of deviations in experience
* Investigate new risk aspects as part of R&D
* Provide a service to clients
* Support inforce-management actions

To some extent nearly all actuarial assumption setting can be considered as EA, but for the purpose of APEX the scope is limited to analysis based on individual policy data

* Allowing the direct derivation of granular assumptions (by gender, age etc)
* Involving typically a larger volume of data
* Requiring more complex data preparations and analysis

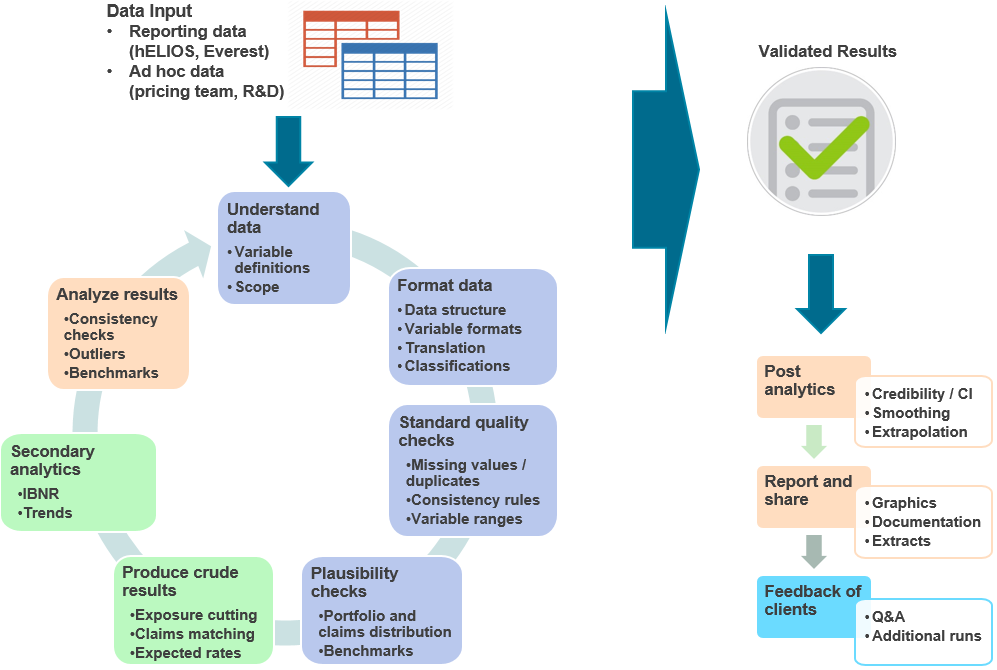
Data can be from external sources, like population or hospital statistics, but for the large majority EA is based on insurance portfolios.

The main types of outcome of an EA study are

* Standalone decrement rates (qx, ix etc.)
* Actual / Expected % (A/E or AvE), comparing the actual experience against expected experience

## EA process

The EA process includes multiple stages of data preparation, calculation and analysis. Typically, the process is highly iterative and at any stage of the data preparation or calculation, data irregularities might become apparent and trigger further investigation and potentially corrections.



Depending on the market, the responsibility of the EA Producer can include post-analytics to support final assumption setting for pricing or reserving purposes; or can be limited to the production of raw experience rates with further analysis being performed by the client (e.g. pricing actuary).

## Dependencies

EA intervenes at various stages of the life-cycle of our business, from the pricing of a deal over the reserving review(s) of the corresponding treaty to the use of its experience for market-wide pricing basis derivation.

Une image contenant capture d’écran

Description générée automatiquement

## Objectives

Based on the current situation in SGL and the EA needs identified, the key objectives of APEX have been defined as follows:

* Self-service: Increase the number of EA producers by reducing the EA investment burden for new markets and users and reducing the need for specialist tool knowledge. The ambition is to automate EA production as much as possible, increase user-friendliness of the EA process and allow actuaries without prior EA experience to perform studies.
* Increase accessibility and use of results: Provide access to the study results directly to the EA clients without the need for manual preparation and transfer of analysis results by the EA producers
* Best practice: Spread the knowledge and use of EA best practices, preferably via built-in best practice methodologies and approaches or at least via best practice guidelines
* Increase efficiency: Increase the efficiency of producing EA studies via additional functionalities and a higher level of automatization in order to reduce the production time of an EA study and free up time for activities that add more value (such as analyzing the results)
* Consistency: Increase the level of consistency in processes and approaches, assuring comparability across markets and functions and increasing the reliability and transparency of EA processes
* Increase scope: Facilitate EA on aggregated portfolios within a market and potentially across markets
* IT ownership: EA platform managed within IT ownership assuring proper IT governance, security and stability
* Data privacy by design: Ensure compliance to data privacy regulations and provide functionality to users to manage compliance to contractual limitations with respect to the use of data

# General principles & conventions

## Methodology & scope

Experience Analysis follows the usual actuarial best practices related to Modelling, Data Quality, Peer Review etc. as can be found for example in the US (Actuarial Standards of Practice) or the UK (Actuarial Profession Standards). More specific principles are outlined below.

* **Best estimate**All data modifications and calculation assumptions should be on a best estimate basis without provisions for uncertainty.   
  This assures that a consistent basis is provided to the various EA Clients and that users can add appropriate margins for uncertainty themselves based on their specific use case.  
  In case of a high level of uncertainty, for example relating to the data quality or due to a high ratio of unreported claims, the corresponding data or period should rather be excluded from the study scope.   
  The decision when to include or exclude data from the final study results is left to the judgment of the Producer.
* **Completeness**  
  The principle of APEX is to analyze a given portfolio data only once and accommodate all (current and future) EA Client needs via the same study results. The goal is to avoid the duplication of studies, assuring a single source of truth. The EA Producer should therefore include in his study any reliable information even if it’s not immediately required by the Study requester. In particular, the producer should
  + Include all decrements possible in his analysis. For example include lapse decrement wherever possible
  + Review and retain all input Dimensions of reliable quality
  + Include all slicing dimensions, whenever possible (Attained Age / Policy Duration)
  + Include the maximum observation period, even if the assumption basis setting is based on a subset of the period

At the same time, only known and reliable information should be recorded in the input file. If for example a data control is not executed because of a missing variable, then it should not be created for the pure sake of executing the control.

## Date conventions

All dates in APEX are defined with the format DD/MM/YYYY.

All dates relating to periods are considered inclusive of the day. For example, a study period covering the entire years of 2009 to 2010 is described by 01/01/2009 - 31/12/2010.

For single dates, a day is considered as end of day (11:59PM of same day), for example any event is considered end of the day and the day is therefore counted as a full exposure.

Leap-year: Dates of 29th February are accepted and the calculation engine manages leap years.

## Age conventions

APEX supports different types of age definition:

* Age Last Birthday: The most common age definition, corresponding the number of completed years lived by a person.
* Age Nearest Birthday: The age closest to the respective day, corresponding to the natural rounding of the exact age
* Age Next Birthday: Corresponds to Age Last Birthday + 1

Unless stated otherwise, “age” or “attained age” always refers the biological (exact) age, in opposition to “insurance age” which is defined as the age of the policyholder at the last policy anniversary.

In total APEX support three types of age dimensions:

* **Age\_at\_commencement**: Age at the policy commencement
* **Age\_attained**: Current age during the respective exposure period
* **Insurance\_age\_attained**: Current insurance age during the respective exposure period

Age attained and insurance age attained are not supported at the same time and a given Run will only include one or the other. If the slicing dimension **Attained Age** has not be selected, then APEX will automatically calculate **insurance\_age\_attained** based on the **age\_at\_commencement** of the policy.

As age attained corresponds to the exact age, it will only be calculated if **Date\_of\_Birth** is provided in the Input Data. If the user prefers to produce age attained based on age at commencement information, he has to provide his own (best estimate) approximation of the **Date\_of\_Birth**.

## Data conventions

For any variable in the Input Data and Result Data, missing or unknown information is represented by an empty field. No specific entry “Unknown” is foreseen. This approach has been chosen to allow a consistent representation of study results for the case of missing values in a given variable and the case of complete absence of that variable.

On the flipside any data value corresponding to “None” or 0 amounts should always be specified as such and not via an empty field.

Data variable names have been defined to accommodate the standard naming conventions of SAS:

* Maximum length of 32 characters
* The first character must be an English letter (A, B, C, . . ., Z) or underscore (\_). Subsequent characters can be letters, numeric digits (0, 1, . . ., 9), or underscores.
* Use of upper or lowercase letters.
* No blanks
* No special characters, except for the underscore

# Data preparation

## Best practices

This section is meant to provide guidance to users on general best practices related to all stages of data preparation (data exploration, data cleaning, data transformation).   
It is a section in progress, enriched progressively with experience and feedbacks provided by users, and therefore in no sense to be understood as exhaustive.

### Data exploration

* As a general principle it is recommended to perform the data exploration and execution of data controls as early in the process as possible in order to review the Original Data provided before potential distortion by applied data transformations and to avoid unnecessary iteration in data preparation and calculation.
* Perform distribution analysis on each variable and check for outliers. For date variable perform analysis across different dimensions (by month, day, day of week) to check for the use of any default values by the data provider (like using 1st January for any unknown entries)

### Data cleaning

* In case of missing data perform sensitivities with different imputation strategies to assess materiality

### Data transformation

* If data is provided in multiple slices for policies with changing sum insureds over time (e.g. due to policy indexation), the recommended practices is to aggregate all slices belonging to the same policy & insured & type of benefit such that each period is represented by a single line.
* Whenever possible, try to distinguish base from rider covers. The information can be captured with the variable **Segment\_Type**.

## Input Data

A standard data format (“Input Data”) has been defined as starting point for the calculation engine.

This facilitates the application of standard data controls and a standard calculation methodology.

The format has been developed to provide all required flexibility in covering various scenarios, among others:

* All risk & decrement types
* Data sources with combined exposure and claims info and data sources without link between exposure and claims
* Products with constant and changing sum insureds

The basic principle of the Input Data is that each line represents one constant exposure condition. Any change in exposure status or in exposure characteristics is reflected with a new data line with non-overlapping exposure periods:

* For a standard portfolio with lump-sum risk it corresponds to one line per policy
* In case of changing sum insureds, one line per sum insured is entered
* For later engines (e.g. DI) one line per policy status (incidence / reactivation / …) is entered

The key technical variables for the definition of the exposure period are:

* **Date\_of\_Begin\_Current\_Condition**: For first exposure period of a given policy/person typically corresponds to Date of Commencement. Might be later in specific situation, like missing information due to client mergers
* **Date\_of\_End\_Current\_Condition**: Date of known change in exposure condition. Leave empty in case of unchanged condition. Do not enter future dates, like expected policy maturity date
* **Status\_Begin\_Current\_Condition**: Status at begin of the exposure period
  + Active (only value for lump-sum engine)
  + Claimant (for later engines)
* **Status\_End\_Current\_Condition:** Status at the end of the exposure period in case of a change in exposure condition. Compulsory if there is a later period data line on the same ID. Leave empty if it’s the last exposure condition and there has been no known status change
  + Active: No event. Change in exposure condition due to other reasons (for example change in sum insured)
  + Dead
  + Claimant: Incidence of a claim related to the given product coverage (CI / TPD / DI/ LTC)
  + Withdrawn: Any type of policy withdrawal (lapse, cancellation etc.)
  + Expired: The termination of exposure in line with policy conditions (Maturity of policy).
  + Censored: Censored exposure information with unknown reason
  + Claimant\_Dead: In case the reason of claim is unknown and could be either “Claimant” or “Dead”, e.g. for some Accelerated CI portfolios

Do not mix status “Claimant\_Dead” and either “Claimant” or “Dead” within the same data file. Otherwise no clear allocation to the corresponding decrements will be possible

Examples for typical scenarios:

Une image contenant capture d’écran

Description générée automatiquement

In case **Date\_of\_End\_Current\_Condition** is empty, then the following variables are used to assure the exposure doesn’t exceed the policy coverage period:

* **Benefit\_End\_Date**
  + Replaces **Date\_of\_End\_Current\_Condition** if absent
* **Benefit\_Term\_Years**
  + In absence of both **Date\_of\_End\_Current\_Condition** and **Benefit\_End\_Date** then exposure is limited to **Date\_of\_commencement** + **Benefit\_Term\_Years**

### Risk type

The lump sum engine supports three risk types: Life, CI and TPD. The information on the risk type has to be provided via **Main\_Risk\_Type**.

If a Life cover has an additional acceleration benefit which is to be covered by the Study, then it needs to be provided via **Acceleration\_Risk\_Type**.

### Events

Separate variables manage the type and timing of events to provide more flexibility and cover portfolios where claim information cannot be linked to the exposure information. The key variables are:

* **Date\_of\_Event**: Events are assumed end of the respective day. For the lump-sum engine the date therefore needs to match **Date\_of\_End\_Current\_Condition**In case the date of lapse is provided as of the date of policy anniversary, the date must be changed during data preparation to one day earlier to account for the correct policy year.
* **Type\_of\_Event**: Type of event, limited to those of interest for EA. The types are consistent with **Status\_End\_Current\_Condition:**

|  |  |
| --- | --- |
| Type\_of\_Event | Status\_End\_Current\_Condition |
| Incidence | Claimant |
| Death | Dead |
| Withdrawal | Withdrawn |
| Incidence\_Death | Claimant\_Dead |
|  | Expired / Censored |

### Split file

In addition to the standard file format, where exposure and event information are both provided within the same data line(s), it is also possible to provide exposure and event information separately.   
In such case, the variable **Exposure\_or\_Event** has to be provided to indicate the nature of each data line

* “Exposure”: Data line only contains exposure information
* “Exposure + Event”: Same logic as standard file. If an exposure has an event associated then it is provided on the same data line
* “Event”: Data line only contains event information

The type of data format provided must be indicated in APEX during the upload of the dataset via the field **Data structure type** (Combined / Split).

### Amounts

Exposure Amount

* Exposure amount relevant for the given study should be provided, typically Sum Insured or Sum at Risk
* Both original (insured) and reinsured amounts can be uploaded, providing flexibility in the run setting to test both basis: **Risk\_Amount\_Insurer** and **Risk\_Amount\_Reinsurer**
* For acceleration products, the exposure amount of the accelerated benefit **must** be provided separately. The separation of exposure amounts allows flexibility for products with partial acceleration benefits:  
  **Acceleration\_Risk\_Amount\_Insurer** and **Acceleration\_Risk\_Amount\_Reinsur[[1]](#footnote-1)**

Event Amount

* Event Amount has to be provided separately from the exposure amount(s):  
  **Event\_Amount\_Insurer** and **Event\_Amount\_Reinsurer**

### Slicing dimensions

Attained age

The relevant input variable for attained age calculation and slicing is **Date\_of\_Birth**

* **Date\_of\_Birth** Is optional. However, if it is not provided, then no slicing by attained age will be possible
* In case **Age\_at\_commencement** is available, then **Date\_of\_Birth** needs to be estimated and provided by the user. No automated approximation is performed by APEX
* **Age\_at\_commencement** is only used as result dimension and supported in the same way as any other dimension input (for joining of expected & IBNR tables and result analysis)

Policy duration

The relevant input variables for policy duration age calculation and slicing are **Date\_of\_Commencement** and **Date\_of\_last\_medical\_selection**.

* Both variables are optional. However, if **Date\_of\_Commencement** it is not provided, then no slicing by policy duration will be possible
* The day of the last medical selection may differ from the date of commencement of the policy
  + In case the policy is the result of a policy conversion with no new medical underwriting, then **date\_of\_last\_medical\_selection** < **date\_of\_commencement**
  + In case a policy change requires a new medical underwriting, for example in case of sum insured increment, then **date\_of\_last\_medical\_selection** > **date\_of\_commencement**
* Whenever **date\_of\_last\_medical\_selection** is provided for a data line, then it has priority over the **date\_of\_commencement** and is used as basis for policy duration calculation

### Exposure ID

Multiple ID variables are available to allow the distinction of different exposures and the identification of data lines belonging to the same exposure:

* **Life\_ID**: technical ID to identify data lines belonging to the same person
* **Policy\_ID**: technical ID to identify data lines belonging to the same policy
* **Benefit\_ID**: benefit name to distinguish different benefits within the same policy, e.g. Life and CI
* **Retro\_Legal\_entity**: In case amount experience is analyzed by retrocession share, this variable is used as additional component in the unique ID definition

IDs only have the purpose of matching data within the bounds of EA and should never be filled with official ID’s or original policy numbers!

In summary the unique ID of an exposure is defined as **Life\_ID** + **Policy\_ID** (+ **Benefit\_ID**)   
(+ **Retro\_legal\_entity**)

**Life\_ID** and **Policy\_ID** are required for the definition of the unique ID, whereas **Benefit\_ID** and **Retro\_legal\_entity** are optional and added to the unique ID only if provided

### Banding variables

Banding variables are defined as numeric fields as the upper bound of the respective band. This allows a consistent input and aggregation across different studies, while at the same time retaining good transparency.

For example, **Benefit\_Term\_Years\_Upper\_Band** provides the banding for term duration (in years).

# Calculation methodology

## Decrement definition

A decrement is defined as the change in policy status, with the following status considered for purpose of EA:

Une image contenant objet

Description générée avec un niveau de confiance élevé

As EA is only concerned about status changes of probabilistic nature, any deterministic action e.g. due to policy terms, is not considered. In particular the maturity/ expiry is not modelled.

To provide more flexibility in the data input the status “expiry” is still accepted as a possible input but not associated with any decrement.

In addition, the status “censored” is accommodated to represent missing information on the reason for exposure termination.

As the cause of a status change may sometimes be unknown, a compromise had to be found on the granularity of the decrements defined. The principle adopted is to define the decrement at a level as granular as possible but at the same time assuring that the very large majority of portfolios has sufficient information to provide the required granularity.   
For studies on policies in claim status (Disability, LTC) it is quite common to not have information on the reason of claim termination. A split into three decrements (reactivation / claimant death / claimant withdrawal) would therefore exclude many portfolios from scope.

It was decided to define the decrement tx as the combination of all causes of claim termination. In case the cause of the termination is known, it can be captured via the variable **cause\_of\_event\_1** (Claim Death / Claim Recovery / Claim Withdrawal).

On the other hand, certain clients do not provide information on the cause of an Accelerated CI claim (CI incidence or Death). As these are however the minority and the split into ix and qx is fundamental for most EA studies, it was decided to keep them separate and introduce a dedicated decrement type ix+qx for portfolios with unknown cause of claim.

In summary the mapping of decrements to status is as follows:

|  | Status at End | | | | | |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Status at Begin | Active | Claimant | Dead | Withdrawn | Claimant\_Dead | Expired | Censored |
| Active |  | ix | qx | wx | ix+qx | *none* | *none* |
| Claimant (TBC) | tx |  | tx | tx |  | *none* | *none*/tx |

Technically the mapping is implemented as follows:

|  |  |  |
| --- | --- | --- |
| Decrement | Exposure | Event |
| qx | All exposures with **Status\_Begin\_Current\_Condition** = “Active” | All events with **Type\_of\_Event** = “Death” |
| ix | All exposures with **Status\_Begin\_Current\_Condition** = “Active” | All events with **Type\_of\_Event** = “Incidence” |
| wx | All exposures with **Status\_Begin\_Current\_Condition** = “Active” | All events with **Type\_of\_Event** = “Withdrawal” |
| ix+qx | All exposures with **Status\_Begin\_Current\_Condition** = “Active” | All events with **Type\_of\_Event** = “Incidence\_Death” |
| tx (TBC) | All exposures with **Status\_Begin\_Current\_Condition** = “Claimant” | All events with **Type\_of\_Event** = “Claim Termination” |

The input data can contain a mix of different types of products and risks (e.g. Life, Standalone CI and Accelerated CI). Depending on the chosen decrement, the calculation engine will filter the exposure to the relevant policies based on the following rules:

|  |  |
| --- | --- |
| Decrement | Risk selection |
| qx | **Main\_Risk\_Type** = “Life” |
| ix | **Main\_Risk\_Type** in  {“CI”, “TPD”, “LTC”, “DI”, “Health”}  or **Acceleration\_Risk\_Type** in  {“CI”, “TPD”, “LTC”} |
| wx | all |
| ix+qx | all |

## Decrement estimators

The two main methods for calculating exposure and estimating decrement rates used by the markets have been retained in the APEX platform:

* Central exposure for model of constant hazard rate
* Initial exposure for Balducci model.

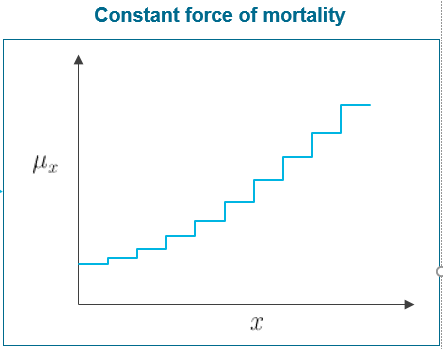
The main difference between the two methodologies is the assumption about the distribution of events in the interval [x; x+1]. Practically , the main difference between the two models is the measurement of exposure in case of an event.The following notation is used, assuming the qx decrement:

* ***x + ai***age of insured *i* at start of observation on age band [*x, x+1*[, where ***ai*** ϵ[0*, 1*[
* ***x + ti***age of insured (on age band [*x, x+1*[ ) at exit date; where ***ti*** ϵ[0*, 1*[
* ***x + bi***age of insured (on age band [*x, x+1*[ ) at end of observation period if no unpredictable exit occurred (i.e. exit other than policy termination); we always have *0 ≤ ai ≤ ti ≤ bi*where ***bi*** ϵ[0*, 1*[
* ***Di*** equals to 1 if death incurred on age band [*x, x+1*[, and equals to 0 otherwise

Model of constant hazard rate

Central exposure refers to the assumption of constant hazard rate, assuming that the force of mortality is constant between integral ages

for



)

with = = likelihood estimate of the constant force of mortality µ

and central exposure =

Balducci model

Under the Balducci assumption, the force of mortality is a decreasing function over the year of age x to (x+1)

The Balducci estimator induces a prolongation of the exposure till the next birthday in case of event:

With initial exposure Lx =

To illustrate the difference between central and initial exposure, we consider the following record:

• Date of birth: 13/04/1953

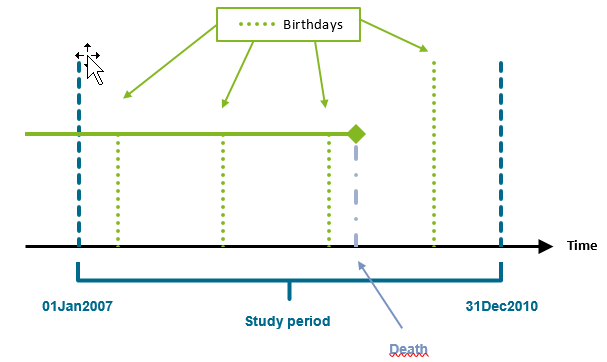
• Date\_of\_Begin\_Current\_Condition: 15/06/2004

• Status\_Begin\_Current\_Condition: ACTIVE

• Date\_of\_End\_Current\_Condition: 15/07/2009

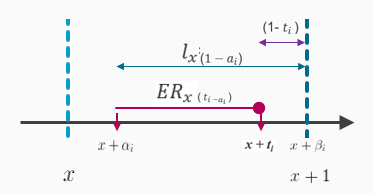
• Status\_End\_Current\_Condition: DEAD

The study goes from 01/01/2007 to 31/12/2010.



For the considered record we have the following exposures:

|  |  |  |  |
| --- | --- | --- | --- |
| *x* | *Dx* | *Lx*  *Initial exposure* | *ERx Central exposure* |
| 53 | 0 | 0.28 | 0.28 |
| 54 | 0 | 1.00 | 1.00 |
| 55 | 0 | 1.00 | 1.00 |
| 56 | 1 | 1.00 | 0.25 |



## Calculation engine

The following describes all methodologies and formulae underlying the calculation engine. The technical documentation of the engine implementation itself (in SAS) can be found in the separate document “APEX Lumpsum Engine”.

### Slicing dimensions

There are 4 possible combinations of slicing supported in APEX:

1. By **Attained Age**, **Duration** and **Calendar Year**
2. By **Duration** and **Calendar Year**
3. By **Attained Age** and **Calendar Year**
4. By **Calendar Year**

The **Calendar Year** dimension is always selected by default

In addition, the two data structure types (Combined / Split) require different treatments, leading in total to 8 separate functions in the slicing code.

From a code perspective, the main difference is between the Combined and Split file versions. The Split file has the additional variable **Exposure\_or\_Event** with the following possible values:

* EVENT: no exposure calculation, **Date\_of\_Event\_Incurred** is used for events
* EXPOSURE: only exposure is calculated
* EXPOSURE + EVENT: same approach as for combined file

Exposures and events are split by the selected slicing dimensions.

Considering the following policy:

Study period goes from **01/01/2016** to **31/12/2018**

DATE\_OF\_BIRTH: 13/02/1984

DATE\_OF\_COMMENCEMENT: 06/03/2004

DATE\_OF\_BEGIN\_CURRENT\_CONDITION: 13/02/2004

DATE\_OF\_END\_CURRENT\_CONDITION: 01/01/2019

STATUS\_BEGIN\_CURRENT\_CONDITION: Active

STATUS\_END\_CURRENT\_CONDITION: Active

The slicing by calendar year, duration year and age attained gives the following exposure lines:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Start of period | End of period | CALENDAR\_YEAR | AGE\_ATTAINED | DURATION\_YEAR | Exposure\_Count\_Initial |
| 01/01/2016 | 13/02/2016 | 2016 | 31 | 12 | 0,117486339 |
| 13/02/2016 | 06/03/2016 | 2016 | 32 | 12 | 0,06010929 |
| 06/03/2016 | 01/01/2017 | 2016 | 32 | 13 | 0,822404372 |
| 01/01/2017 | 13/02/2017 | 2017 | 32 | 13 | 0,117808219 |
| 13/02/2017 | 06/03/2017 | 2017 | 33 | 13 | 0,057534247 |
| 06/03/2017 | 01/01/2018 | 2017 | 33 | 14 | 0,824657534 |
| 01/01/2018 | 13/02/2018 | 2018 | 33 | 14 | 0,117808219 |
| 13/02/2018 | 06/03/2018 | 2018 | 34 | 14 | 0,057534247 |
| 06/03/2018 | 01/012019 | 2018 | 34 | 15 | 0,824657534 |

Attained Age is calculated in line with the definitions in [Age conventions](#_Age_conventions)

### Exposure calculation

In line with the general date conventions, **Date\_of\_Event\_Incurred /** **Date\_of\_End\_Current\_Condition** / **Study Period End Date** are counted in the exposure.

The “ACTUAL” method is the convention used to handle leap years, ACTUAL method uses the actual number of days between dates in calculating the number of years. The difference in years between two dates equal the number of days that fall in 365-day years divided by 365 plus the number of days that fall in 366-day years divided by 366.

### Start of policy exposure

Date\_of\_Commencement: equal to **Date\_of\_Last\_Medical\_Selection** if non-empty, otherwise **Date\_of\_Commencement**. (cf. [4.2 Slicing dimensions](#_Slicing_dimensions))

Exposure is afterwards limited to Observation Period chosen in Run.

### End of policy exposure

1. Firstly Term\_Date is defined as a fictive date equal to 01Jan2999 (used to technically replace missing end dates)
2. Benefit\_End\_Date is replaced with Term\_Date if missing
3. Date\_of\_End\_Current\_Condition: equal in the following order to:
   1. **Date\_of\_End\_Current\_Condition** if not missing
   2. If missing and **Benefit\_Term\_Years** and **Date\_of\_Commencement** are not missing, then equal to **Date\_of\_Commencement** + **Benefit\_Term\_Years**
   3. If missing (after applying the first rules) then set equal to Benefit\_End\_Date

Exposure is afterwards limited to Observation Period chosen in Run.

### Initial exposure

A temporary variable with the Bernoulli indicator of event is defined:

* + equal to 1 when
    - **Type\_of\_Event** equal to event associated to the decrement selected in the run (see decrement definition in the previous chapter)
    - and in case of “Split” data structure type when **Expoure\_or\_Event** variable takes value “EVENT” or “EXPOSURE + EVENT”,
  + 0 otherwise

The variable is used to extend the exposure in case of event when exposure metric corresponds to initial (Balducci assumption). It corresponds to Di in [Decrement estimators](#_Decrement_estimators).

### Exposure amounts

Exposure amounts are based on **Risk\_Amount\_Insurer** (or **Risk\_Amount\_Reinsurer**), except in case of acceleration benefits.

**Acceleration\_Risk\_Amount\_Insurer** (or **Acceleration\_Risk\_Amount\_Reinsur**) is used instead if the following conditions are met:

* Decrement = ix
* **Acceleration\_risk\_type** variable is provided in the policy file

**Acceleration\_risk\_type** for the given data line has one of following values: CI, TPD, LTC

For example, we have:

Exposure\_Amount\_Initial = Exposure\_Count\_Initial \* **X**

**X**= Acceleration\_Risk\_Amount\_Insurer if the conditions above are met

**X**= Risk\_Amount\_Insurer otherwise

Whenever a cap has been defined in the Run setting, additional results are provided based on capped exposure amounts, e.g.:

**Exposure\_amount\_initial\_capped** = **Exposure\_Count\_Initial** \* min(**X**, **Capped Amount**)

### Run options

**Rating adjustment method**: Method to adjust results according to policy loadings (extra rating)

* + The rating adjustment is only applied to decrements qx, ix and ix+qx
  + It also only applied to metrics “by count” and “by amount” and not “Loss Ratio”.
  + The formula is provided in [Appendix](#_Rating_Adjustment_Method)

**Automatic Risk Amount Change**: Exposure risk amount (Insurer or Reinsurer depending on the amount analysis basis selected in the platform) is automatically adjusted depending on rule triggered by **benefit\_change\_rate\_type** (Loan interest, Compound or Simple). The formula uses the variables **benefit\_change\_rate\_annual**, **benefit\_term\_years** and Duration year (see details of the formulas in [Appendix](#_Automatic_Risk_Amount) )

**Policy Adjustment Joint Life Lapses**: Policy adjustment is applied for decrement wx if the value selected in the platform is 0,5. In this case, if **Joint\_Life\_type** has value DUAL LIFE, FIRST TO DIE or SECOND TO DIE then a coefficient of 0,5 is applied to the event and exposure (central or initial exposure)

### Calculated dimensions

In addition to the slicing dimensions, the following additional dimensions are calculated within the engine and provided in the Result Data:

* **Insurance\_age\_attained**:
* Insurance age attained is the attained age as of the last policy anniversary and is provided as an alternative dimension to the real attained age
* Equal to **Age\_at\_Commencement** + Policy duration
* Automatically calculated if
  + **Age\_at\_Commencement** is provided in the policy file
  + **S**licing dimension **Policy duration** is selected but **Attained Age** is not
* **Duration\_year\_partial**:
* only applied for decrement wx and if **Policy duration** is selected in the slicing dimension.
* Set equal to 1 if duration year of exposure is not complete, 0 otherwise
* Reference dates are **Study Period Start Date** and **Study Period End Date**
* **Year\_of\_commencement**: Automatically calculated when **date\_of\_commencement** is provided in the policy file
* **Expected\_1\_boundary**: indicator if exposure is outside of scope of first expected base table
  + Equal to 1 if one of the following variables is strictly earlier or later than the minimum or maximum values from the first expected tables (BASIS 1)
    - AGE\_ATTAINED
    - AGE\_AT\_COMMENCEMENT
    - CALENDAR\_YEAR
    - DURATION\_YEAR
    - INSURANCE\_AGE\_ATTAINED
  + 0 otherwise (no min or max has been applied during the join with the first basis for the corresponding variables)

### IBNR

Adjustments for “Incurred But Not Reported” events can be applied to the raw results. Results are provided both with and without IBNR adjustments.

IBNR impacts the following three variables:

* Actual\_Count\_with\_IBNR, based on Actual\_Count
* Actual\_Amount\_with\_IBNR, based on Actual\_ Amount
* Actual\_Amount\_Capped\_with\_IBNR, based on Actual\_Amount\_Capped

Manual UDF

IBNR is necessarily applied by decrement and by only one of the following temporal dimensions:

* Year / Half-year / Quarter / Month.

**Duration\_Year** and all dimensions included in Input Dataset, including **Main\_Risk\_Type** and **Acceleration\_Risk\_Type** can be used to allocate UDF

The UDF can be applied in the same way for all metrics (by count and by amount) or it is possible to have **Result\_metric** as variable in the IBNR file to distinguish the UDF by count / by amount.

If variable “Result Metric” is not contained in the table then the same formula is applied to all three variables, otherwise

* Actual Count with IBNR is based on “By Count” factor
* Actual Amount with IBNR and Actual Amount with IBNR capped is based on “By Amount” factor

For all common variables between the policy and the IBNR file, it is verified that all modalities in the policy file are provided in the IBNR file. If not the run is aborted with an error message.

In the policy file, **Date\_of\_Event\_Incurred** is used to calculate the temporal dimension (either Year, Half-Year, Quarter or Month) which is used to join the IBNR factor table

Amount allocation

Dedicated process for in-force studies in the US.

Can be applied only if the “US Method” has been selected in **Expected Tables Method**. A control is implemented in the SAS code and the run is aborted if the condition is not respected.

The expected basis calibration file uploaded in the platform is checked, where only one Table Name can be set to ‘YES’ for **IBNR\_allocation\_basis** variable.

IBNR amounts are allocated by decrement, **Bucket\_ID**, **Portfolio\_Origin** and **Calendar\_Year** (currently the smallest temporal granularity of the slicing).

2 tables are uploaded in the platform:

1. IBNR amount table:

Mandatory to have one and only one of four variables (Year / Half-Year / Quarter / Month)

Mandatory to have either **IBNR\_by\_amount** or **IBNR\_by\_count**, but not both

1. IBNR allocation table:

All Everest treaties are classified by decrement, **Bucket\_ID** and **Portfolio\_Origin** , one Everest treaty can be part of several **Bucket\_ID**

By **Calendar\_Year** and decrement, for each portfolio segment (unique combination of **Bucket\_ID** and **Portfolio\_Origin** ), the IBNR amount is allocated by weighting the expected amount of each Everest treaty belonging to the portfolio segment by the total expected amount of the corresponding portfolio segment.

IBNR allocated to the treaty in portfolio segment = (expected amount of the treaty / total expected amount of all treaties) \* IBNR amount allocated per portfolio segment

### Expected basis

Default method

The base table is the reference to which the other optional tables (trend and adjustment) are joined. The adjustment and trend tables are joined one after the other, each time verifying that for all common variables between the two, all modalities from the base table are also present in the adjustment/ trend table.

An expected basis table is created with the basis rate defined as the multiplication of **rate** (base table), **trend\_adjustment** (trend table) and **adjustment** (adjustment table).

The basis table is then joined to the policy file, again verifying that for all common variables between the two, all modalities from the policy file are also present in the basis table.

If the key of joining contains one of the following variables, then minimum and maximum criteria are applied

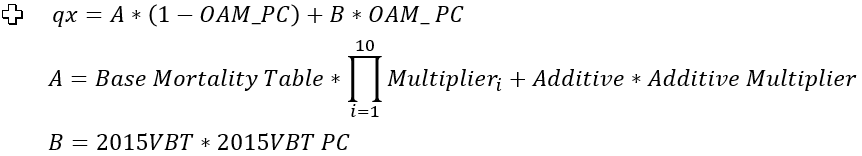
* AGE\_ATTAINED
* CALENDAR\_YEAR
* DURATION\_YEAR
* AGE\_AT\_COMMENCEMENT
* INSURANCE\_AGE\_ATTAINED

For example: max(AGE\_MIN, min(AGE\_ATTAINED, AGE\_MAX))

US method

The expected basis calibration file provides the specification for the factors used in the calculation of EV and IFRS expected, identifying:

* The number of basis, in the file each line is a basis table which is a combination of a policy table (mandatory) and a trend table (Optional)
* The multiplicative and additive factors of the formula to be used in the calculation of the rate (YES / No)



If a trend table has been specified in the calibration file, the same controls as in the expected default method are applied:

* No missing values for **Result\_metric**
* No invalid data line

In addition, the following control is applied because it could not be done in the platform (the trend table is not uploaded in the run management screen)

* all variables in the trend table must be in the input files
* modalities from the input files are not missing in the trend table

The formula is applied to the policy file, using all parameters filled with ‘YES’ in the expected calibration file. The files are joined by **policy\_id** and **duration\_year**.

In case of unmatched observation after the join, the run is aborted. That means there is missing combination of policy\_id and duration\_year in the policy table. In the US process no minimum and maximum values for duration year are defined.

For the joining of the trend table the same process as in the default method is applied.

* + Calculation of min/max of age, duration year and calendar year
  + Result metric is accepted in the trend table

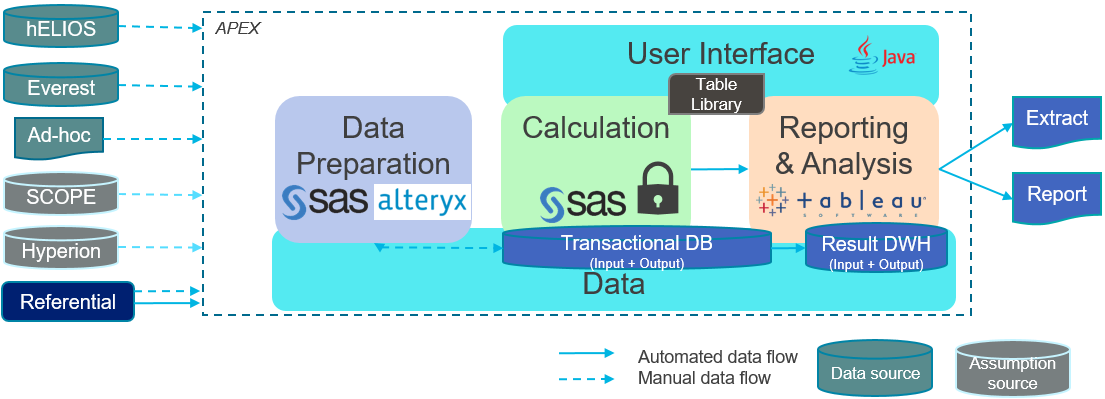
During the join, the ratings are applied (see [Run options](#_Run_options)) and the expected variables are calculated by applying the final rate which could be the same for all metrics or different (By count / By amount / Loss Ratio): Final\_rate = policy rate \* trend\_adjustment (optional) \* rating (optional)

# Platform guidance

## Overview

On a high level the process of EA can be grouped into three main building blocks:

* Data Preparation: This part covers all steps from obtaining the Original Data up to and including the preparation of cleaned and validated Input Data. It includes the data transformation into the desired structure and format, the validation of data quality via automatic checks and expert-driven plausibility checks and the correction of identified data quality issues
* Calculation: This part covers all steps for the production of Final Result Data based on chosen Input Data and parameters
* Reporting & Analysis: This part covers the analysis of given Result Data, the performance of additional analytics based on Result Data and the production of extracts and reports

The target architecture of APEX has been designed as follows:  
  


The main features are:

* Data preparation performed locally, supported with existing expert solution (SAS) and new self-service solution (Alteryx)
* Integration of EA workflow starting from input data, after cleaning and transformation into standard format
* Standardized and automated calculation engines parametrized by user
* Global result data warehouse for all users, allowing flexible analysis of all study results
* Integration of Tableau as user-friendly solution for reporting & analysis for both EA Producers and EA Clients
* Table Library to store and manage benchmark tables (industry tables, pricing/reserving assumptions

## Study Management

* New studies are created through the “+Add” button
* Opened studies are displayed as tabs and allow the user to switch easily among them. However, every unsaved work will be lost at each switch. It is advised to open studies in different browser tabs, if it is frequently needed to switch among them. A similar logic can be applied with table library.
* Existing studies are displayed in the main screen and be sorted or filtered based on their metadata:
  + Defined by the user in the study definition tab (often based on Omega)
    - Study ID: Country Code +\_Client Short Name + Study Requester + Creation Year + Index
    - Client Country
    - Client Group
    - Client Name
    - Distribution Brand (free text)
    - Treaty Number
    - Line of Business: Life, CI, DI, TPD, LTC, Health
  + Automatically defined by the platform
    - Created By: user who initially created the study
    - Study Status: In progress, Validated, Published, Cancelled, or Inactive
    - Current Status Date: date of the last status change
* The number of displayed studies is by default 20. It can be changed to 10, 20 and 50.

## Study definition

### General Information

* Compulsory fields are indicated by a \* and are required for saving the study (press on save or continue)
* Clicking on ‘Save’ will switch to the study management while keeping inputs recorded
* Clicking on ‘Continue’ will switch to the dataset management tab while keeping inputs recorded
* Clicking on ‘Delete’ will trigger a confirmation pop-up: if confirmed, the deletion of the study will then be proceeded
* For validated studies, clicking on ‘Cancel’ will trigger a confirmation pop-up: if confirmed, the study will solely be readable or editable by the producer. The study can be deleted 6 months after its cancellation.
* For cancelled studies, clicking on ‘Activate’ will trigger a confirmation pop-up, if confirmed, the study status will again be ‘validated’
* Some metadata are displayed on the top of the screen after ‘save’ or ‘continue’ have been clicked on (expect for Name of the creator and creation date which are displayed from the beginning): study ID, Current Study Status, Name of the last producer who made a modification, Number of Runs, Master Run ID, Date of Status Update

#### Study Requester

|  |  |
| --- | --- |
| Definition | Main (internal) client of Study, corresponding typically to initial requester |
| Possible values | * Pricing: Study requested to support pricing of given deal * Reserving: Study requested to support reserving of given business * Marketing: Study as a client service * R&D: Study for internal R&D purposes * Other |
| Business rules | * The field is locked once a run has been launched |
| Dependencies | * Used in Study ID definition * Used in certain rules of definition of Private Client for access rights management |

#### EA Data Source

|  |  |
| --- | --- |
| Definition | Source of the data as obtained by the EA Producer |
| Possible values | * SCOR inforce data: Data extracted from a SCOR’s inforce management system, like Everest or hELIOS * Client pricing data: Data as received directly from the external data provider (client), as part of a pricing/ tender request * Client other data: Data as received directly from the external data provider (client) for purposes other than pricing, for example to conduct a study as a client service * Other |
| Business rules | * The field is locked once the study is validated |
| Dependencies | None |

#### Study Documentation

|  |  |
| --- | --- |
| Definition | Additional documentation on the Study |
| Content | * Context, data issues and corrections, assumptions, scenarios etc. * Various formats are allowed: pdf, doc, docx, xls, xlsx, ppt, pptx, txt, rar and zip. * Several documents can be gathered in a rar or zip file. |
| Business rules | * The field is locked when the study is validated * Study documentation can be reloaded for updates: a pop-up appears to confirm the overwriting * Once a file is loaded, a cross is available to remove the attached study documentation * Once a file is loaded, it can be downloaded back by pressing on the eye is next to the pin |
| Dependencies | None |

#### Comment

|  |  |
| --- | --- |
| Definition | Free text comment on the study by the Producer |
| Content | * Short description (255 characters) of context and scope of the study |
| Business rules | None |
| Dependencies | None |

#### Observation Period

|  |  |
| --- | --- |
| Definition | Period covered by the dataset |
| Content | * Start of Observation Period: Earliest date covered by the dataset, it must be before every date of event incurred and benefit end date * End of Observation Period: Latest date covered by the dataset, it must be after every date of end current condition |
| Business rules | * The field is locked once the study is validated |
| Dependencies | * It is used in the controls 17, 18 and 19: exposure must be within this period * It includes the study period: in run management, it is the period on which the run is computed |

#### Calculation Engine

|  |  |
| --- | --- |
| Definition | The type of engine that will be used for the calculation |
| Possible values | * Lump Sum: engine that deals with events which only occur once within the whole duration of the policy * Annuity: engine that deals with events which can occur several times within the whole duration of the policy and which lead to regular payments * Medex: engine that deals with events which occurs several times within the whole duration of the policy for different risk amounts |
| Business rules | * The field is locked once a run has been launched |
| Dependencies | * The computation of runs will be executed with the chosen engine |

#### Client

|  |  |
| --- | --- |
| Definition | Name of client as defined in Omega |
| Possible values | * Based on CLISHONAM\_LD of Omega * Multiple if there are several clients * Other if the value is not in Omega |
| Business rules | * The field is locked once a dataset is validated as it is used in the data controls * The list is filtered based on the client group if selected first |
| Dependencies | * The client group and client country are then automatically determined * Treaty number is unlocked, and a list of treaty related to the chosen client is available * The control 37 checks that this client is identical to the client inscribed in the product file |

#### Client Group

|  |  |
| --- | --- |
| Definition | Name of client group as defined in Omega |
| Possible values | * Based on Ultimate (Group if empty) of Omega * Multiple if there are several client groups * Other if the value is not in Omega |
| Business rules | * The field is locked once a dataset is validated as it is used in the data controls * The field is automatically selected based on the client if selected first |
| Dependencies | * The control 37 checks that this client is identical to the client group inscribed in the product file * The list of clients is filtered based on the client group value |

#### Client Short Name

|  |  |
| --- | --- |
| Definition | Shorter name of the client for Study ID creation (3-5 letters) |
| Possible values | * Free text |
| Business rules | * The field is locked once a run has been launched |
| Dependencies | * Used in Study ID definition |

#### Distribution Brand

|  |  |
| --- | --- |
| Definition | The brand name the portfolio is distributed under |
| Possible values | * Free text |
| Business rules | * The field is locked once the study is validated |
| Dependencies | * The control 37 checks that this client is identical to the Distribution brand name inscribed in the product file |

#### Client Country

|  |  |
| --- | --- |
| Definition | Country where the client is based |
| Possible values | * Based on Country of Omega |
| Business rules | * The field is locked once a dataset is validated as it is used in the data controls |
| Dependencies | * Used in Study ID definition * The control 37 checks that this client is identical to the Client country inscribed in the product file * Used in certain rules of definition of Private Client for access rights management |

#### Treaty Number

|  |  |
| --- | --- |
| Definition | Country where the client is based |
| Possible values | * Based on ctr\_nf of Omega |
| Business rules | * The field is locked once a dataset is validated as it is used in the data controls |
| Dependencies | * The control 37 checks that this client is identical to the Treaty Number Omega inscribed in the product file |

#### Line of Business

|  |  |
| --- | --- |
| Definition | Type of risk of business |
| Possible values | * Life, CI, DI, TPD, LTC, Health |
| Business rules | * The field is locked once a dataset is validated |
| Dependencies | * None |

### Summary of edit rules

The possibility to edit input fields depends on the status of the study:

|  |  |  |  |
| --- | --- | --- | --- |
| Attribute | Existing dataset | Existing run | Study validated |
| Study Requester | Yes | No | No |
| EA Data source | Yes | Yes | No |
| Study Documentation | Yes | Yes | No |
| Start of observation period | Yes | Yes | No |
| End of observation period | Yes | Yes | No |
| Type of Calculation Engine | Yes | No | No |
| Client | No | No | No |
| Client group | No | No | No |
| Client Short Name | Yes | No | No |
| Distribution brand | Yes | Yes | No |
| Client country | No | No | No |
| Treaty Number | No | No | No |
| Comment | Yes | Yes | Yes |
| Line of Business | No | No | No |

## Dataset management

To allow easy identification of source of errors, it is recommended to include variable “data\_line” in the input file, which will then be displayed as part of the control report.

### General Information

* Dataset management tab is dedicated to uploading data and controlling it.
* The tab is available once the study definition is completed
* Run management tab is available once at least one dataset is validated and saved
* The datasets will fuel the engine for the computation of decrements. It must be distinguished from run assumptions that are determined in the run parameter tab and the table library.
* Datasets must pass technical and functional controls. Technical ones focus on data formats and functional one on the coherence of data (correct date order, variable consistency, etc.)
* Controls are either blocking or warning. Blocking means that the dataset cannot be saved nor used in a run if there is an error. Warning controls do not restrict the use of the dataset and the decision to proceed is left to the judgment of the EA Producer
* Datasets are composed of two files. The first one gathers policy information (insurer, benefit, events, etc.) and the second one deals with product information (cedent, line of business, treaty, etc.)
* Policy file:
  + Two formats are accepted, called “combined” and “split”. When benefit information and event information are found in common rows, the format is called “combined”, whereas when event information is registered separately from other information (different rows), then the format is called “split”.
  + Columns allow the user to provide details about each exposure period: insured information, premium amount, risk definition, etc.
  + The Date\_of\_Event\_Incurred matches the Date\_of\_End\_Current\_Condition.
* Product file:
  + Each line refers to a specific product
  + Columns allow the user to provide details about each product (deal, treaty, cedent, product selection / category, etc.)
  + The link between policy and product file is done with the product\_ID
* If the “delete” button is greyed out, it is because the Dataset is used in a run. The user will be able to delete the dataset only if the concerned runs are deleted.
* Users can create up to five datasets by clicking in the “+”

### Dataset Information

#### Name

|  |  |
| --- | --- |
| Definition | Name of the dataset, composed of policy and product files |
| Possible values | * Free text |
| Business rules | * It will replace “create a dataset” (tab name) once “save and continue” button is pressed * The field is locked once the dataset is used in a run or if the study is validated * Dataset names have to be unique within the same Study |
| Dependencies | * Once validated, it will appear in the **Dataset** field of the Run Management tab |

#### Extraction dates

|  |  |
| --- | --- |
| Definition | Dates at which the data was extracted by the data provider. In case of multiple file extractions, the most recent date should be provided. |
| Possible values | * Dates, not before **End of Observation Period** of Study definition |
| Business rules | * As they are often similar, each time one the two is filled, the other one is auto filled with the same value |
| Dependencies | * None |

#### Data Structure Type

|  |  |
| --- | --- |
| Definition | Format of the dataset as defined in [Split file](#_Split_file): depending whether exposure and event information is recorded in common or different rows |
| Possible values | * “Split” or “Combined” |
| Business rules | * None |
| Dependencies | * Controls and engine calculations will be adapted to the structure type of files |

#### Make data set available in Tableau

|  |  |
| --- | --- |
| Definition | A toggle switch allowing the user to make the datasets available in tableau |
| Business rules | * None |
| Dependencies | * Dataset will be integrated to the Tableau “Input Data” data source once the dataset is validated |

#### Comment

|  |  |
| --- | --- |
| Definition | Free text comment on the dataset |
| Content | * Short description (255 characters) about the dataset, data-prep and its specificities |
| Business rules | None |
| Dependencies | None |

#### Data is restricted in its use to

|  |  |
| --- | --- |
| Definition | Clients could impose restriction in the use of its data. Sometimes, they provide data but only for a specific task. |
| Possible values | * “pricing”, “reserving”, “marketing”, “R&D” |
| Business rules | * This field is so far purely informative, hence there is no rule |
| Dependencies | * None |

#### Data needs to be deleted by

|  |  |
| --- | --- |
| Definition | Time restrictions imposed by data provider (client). After a defined date, the data provided needs to be deleted. |
| Possible values | * Dates in the future |
| Business rules | * This field is so far purely informative, hence there is no rule |
| Dependencies | * None |

### Anonymization guideline

* The dataset management tab is composed of three documents related to APEX anonymization guideline:
  + Anonymization assessment summarizes the criteria and options for validating the anonymization of your data. In most cases the simplified rules outlined in the document allow the direct confirmation of anonymity, whereas in specific cases additional options for a more detailed assessment are provided (specific portfolio assessment or legal referral).
  + Portfolio specific assessment is done via an excel template that scores the granularity of the input (should be above 2). To do so, the file must be populated with national population figures for all sensitive dimension of the input file
  + EA Anonymization guideline for comprehensive information

### Dataset files

* The section is displayed once the first part (Dataset information) is completed and the “Save & Continue” button is pushed
* Before uploading the policy file the user must check the anonymization of the data and confirm its anonymity and compliance with SGL’s guideline by ticking the box “Herewith I confirm that data uploaded is conform with SCOR anonymization Guideline”.
* “Pivots” allows the user to download the dictionary of policy and product files: this is very helpful since datasets must follow a specific format. Pivots contains variable names, descriptions, types (numeric/free text/date, mandatory or not, and dimension or not), explanations of its use in the engine and an illustrative example of a policy/product file
* “File names” are based on their original names followed by the precise date of the uploading yyyy-mm-dd-hhmmss
* First preliminary controls are applied on the header of the files.
  + “Columns” indicates the number of columns with an accepted name. Click on it to display the names of those variables
  + “Missing Columns” indicates the number of compulsory columns that were not found in the file. Click on it to display the names of those variables
  + “Duplicated Columns” indicates the number of columns that were found twice or more in the file. Click on it to display the names of those variables
  + “Unknown Columns” indicates the number of columns which have an unidentifiable name based on the dictionary. Click on it to display the names of those variables. To avoid the upload of personal data and risk a breach of data protection regulations, no variable outside of the Data dictionary may be uploaded. For information not covered by existing variables in the data dictionary, the corresponding dummy variables can be used
* To proceed and execute controls, there must not be any missing, duplicated nor unknown columns

### Dataset Control

* Controls are displayed in a specific order:
  + Technical controls (format control)
  + Blocking controls with errors
  + Warning controls with errors
  + Unexecuted controls
  + Executed controls with no error
* Some controls (12, 14, 22 and 41) are based on a key composed of **Life\_ID** + **Policy\_ID** + **Benefit\_ID** + **Retro\_Legal\_Entity**. The last two ones are optional, and a partial key is built if there is at least **Life\_ID** + **Policy\_ID**
* Each control can be expended when users click on it: details are displayed. For unexecuted controls, the names of missing columns are displayed. For controls with errors, details are displayed and sometimes an additional drop-down list is available with examples (1, 2, 35, 37 and 38).
* “Save” button allows the user to save the dataset, “continue” button is only different because it leads to the next tab “run management”
* “download report” allows the user to get a pdf report of the control results
* Focus on some controls:
  + Control 10: coherence between **Age\_at\_commencement** and **Date\_of\_birth** is based on the calculation of the insured age at the **date\_of\_commencement** of the policy. It uses the **age\_at\_commencement\_definition** of the product file, since the result will defer in function of Age Last Birthday/Age Nearest Birthday/Age Next Birthday. This calculated age is then compared with the **Age\_at\_commencement** of the policy file.
  + Control 12: (status date overlap) states that for each key, the **Date\_of\_Begin\_Current\_Condition** is strictly prior the **Date\_of\_End\_Current\_Condition**. It ensures that there is no duplicate of exposure for a same key.
  + Control 18: **Date\_of\_end\_current\_condition** should always be before **End of Observation Period**. If the exposure has not ended at the time of the record, then **Status\_End\_Current\_Condition** and **Date\_Of\_End\_Current\_Condition** should be left empty. It is interpreted as an exposure till the **End of Observation Period**.
  + Control 23: Coherence of **Benefit\_Max\_Age** with **Benefit\_End\_Date** is like control 10 and based on the **Date\_of\_birth** , **Age\_at\_commencement\_definition** **benefit\_end\_date**. The age at benefit end is then compared to **benefit\_max\_age**.
  + Control 34/35: for some variables, each completed line implies that another column must be completed for this line. The control displays the names of columns that miss a value. This is caused because a value has been found in another variable. The name of the line number of this variable is displayed if the user clicks on “example”.
  + Control 40: **date\_of\_last\_medical\_selection** can be after or before **date\_of\_commencement**. It is before when the policy is extended or transferred and that no medical selection was done at that moment. It is after when a medical exam has been done e.g. due to a risk amount increase or a job change. The control checks that it is always before or always after, since in practical these two options have never been observed simultaneously

### Summary of edit rules

The possibility to edit input fields depends on the status of the dataset/ study:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute | Unvalidated dataset | Validated dataset | Dataset used in a Run | Study validated |
| Name | Yes | Yes | No | No |
| Exposure Extraction Date | Yes | Yes | Yes | No |
| Event Extraction Date | Yes | Yes | Yes | No |
| Data Structure Type | Yes | No | No | No |
| Make data set available in Tableau | Yes | Yes | Yes | Yes |
| Comment | Yes | Yes | Yes | Yes |
| Data is restricted in its use to | Yes | Yes | Yes | No |
| Data needs to be deleted by | Yes | Yes | Yes | No |

## Run management

### Dataset

|  |  |
| --- | --- |
| Definition | The engine will base its calculation on the chosen dataset |
| Possible values | Name of datasets as defined in the dataset management tab |
| Business rules | * Only validated datasets are displayed * If user changes the dataset for an existing run, all Run parameters will be reset to their default setting. A notification is displayed to the user for confirmation “All run parameters will be reset. Do you wish to change the dataset?” |
| Dependencies | Most of greyed-out rules relate to the chosen dataset (input dimensions, by count/amount analysis, loss ratio analysis, rating adjustment method, decrement, slicing) |

### Exposure Metric

|  |  |
| --- | --- |
| Definition | It defines the slicing method:   * Central refers to the assumption of constant hazard rate. A direct division of claims by exposure leads to the intensity. * Initial refers to the Balducci method that induces a prolongation of the exposure in case of event (e.g. death) till the next birthday/policy year/calendar year (depending of the leading slicing dimension). A direct division of claims by exposure leads to the annual probability. |
| Possible values | Initial or Central |
| Business rules | None |
| Dependencies | * Leading slicing dimension is only available in case of “Initial” exposure * The slicing methodology of the engine will depend of the exposure metric |

### Input dimensions

|  |  |
| --- | --- |
| Definition | List of dimensions used for the analysis (retained in the result file) |
| Possible values | * Headers of dimension variables found in the chosen dataset |
| Business rules | * None |
| Dependencies | * “Age\_at\_commencement” and “age\_at\_commencement definition” must be selected to allow the user to select an expected table with Insurance\_age\_attained * If dimensions of expected tables are not selected, the table will not be accepted * If dimensions of IBNR tables are not selected, the table will not be accepted |

### Run Description

|  |  |
| --- | --- |
| Definition | Free text comment on the study by the Producer |
| Content | * Short description (255 characters) of context and scope of the study |
| Business rules | * None |
| Dependencies | * None |

### Result Metric

|  |  |
| --- | --- |
| Definition | Tick boxes to define the metric to compute for the result file |
| Content | * This section allows the user to choose all metrics to include in the calculation with a choice among count, amount (capped) and loss ratio |
| Business rules | * **By Amount Analysis** is greyed-out if neither insurer nor reinsurer amounts is available. If Risk\_Amount\_(Re)insurer or Event\_Amount\_(Re)insurer variables have missing value, then the (Re)insurer by amount analysis is greyed-out. * When there is a value for **Acceleration\_Risk\_Type** and **Acceleration\_Risk\_Amount\_(Re)insurer** has not, then **By Amount Analysis Basis** “(Re)insurer” is greyed-out * **By amount analysis** selected by default unless required variables not available (cf. above) * **By Amount Capped** is available only if **by Amount Analysis** is available * **Loss Ratio Analysis** greyed-out rules are the same as those of **By Amount Analysis** except that **Risk\_Amount\_Insurer** is replaced by **Annual\_Premium\_Insurer** |
| Dependencies | * The engine will compute the count/ amount / loss ratio variables according to what has been chosen |

### Automatic Risk Amount Change

|  |  |
| --- | --- |
| Definition | The automatic risk amount change allows the user to register a policy in condensed way. |
| Content | E.g. 3% per year increased annuity can be registered in a single line instead of several (one line for each risk amount value, i.e. one line per year). The engine will automatically adjust amounts based on the input variables |
| Business rules | * The field is greyed-out if **Benefit\_Change\_Rate\_Type**, **Benefit\_Change\_Rate\_Annual**, **Benefit\_Change\_Frequency** or **Date\_of\_Commencement** is missing or if **By Amount Analysis** is not selected. |
| Dependencies | * The **Policy Duration** slicing becomes compulsory (checked and greyed-out) * The amount changes are based on **Benefit\_Change\_Rate\_Type**, **Benefit\_Change\_Rate\_Annual**, **Benefit\_Change\_Frequency**, **Date\_of\_Commencement** and **Benefit\_Term\_Years** |

### Rating Adjustment Method

|  |  |
| --- | --- |
| Definition | Adjustment of the exposure applied for the computation of expected\_count or expected\_amount (only applied for qx and ix) – see appendix for details |
| Content | * None: no adjustment is made * Adjust Expected: extra\_rating values in the policy file will be applied to the expected calculation |
| Business rules | If one of the following variables is in the policy file and **Date\_of\_commencement** variable is missing, then “None” is selected and greyed-out:   * Temp\_Mult\_Extra\_Rating\_1 * Temp\_Mult\_Extra\_Rating\_Term\_1 * Temp\_Add\_Extra\_Rating\_1 * Temp\_Add\_Extra\_Rating\_Term\_1 * Temp\_Mult\_Extra\_Rating\_2 * Temp\_Mult\_Extra\_Rating\_Term\_2 * Temp\_Add\_Extra\_Rating\_2 * Temp\_Add\_Extra\_Rating\_Term\_2 |
| Dependencies | * The **Policy Duration** slicing becomes compulsory (checked and greyed-out) * The extra\_rating will be applied to the expected\_count / expected\_amount according to the chosen option |

### Policy Adjustment Joint Life Lapses

|  |  |
| --- | --- |
| Definition | Method that allows to adjust the weight of joint life policies. The purpose is to avoid double counts for lapse analysis |
| Possible values | * 1: no adjustment is done * 0.5: lapse exposures and actuals are divided by two when **Joint\_Life\_Type** equals Dual Life/First to Die/Second to Die |
| Business rules | * The field is greyed-out if **Joint\_Life\_Type** variable is absent from policy file |
| Dependencies | * Lapse decrement will be based on the chosen option |

### IBNR Method

There exist two methods for IBNR tables:

* Manual UDF – IBNR is calculated based on Ultimate Development Factors. These can be defined in function of time dimension, result\_metric, decrement and any other dimension of the dictionary. It is then applied to actuals according to those dimensions.
* Amount Allocation is a dedicated method for US in-force studies, allocating aggregated IBNR amounts calculated by another department to individual results. It is composed of two files. The first file (IBNR amount) is composed of IBNR\_by\_amount / IBNR\_by\_count which are added to a specific part of the input according to the time dimension, portfolio origin, decrement and bucket id. Bucket ID is a group of treaties. They are defined in the IBNR allocation file. This allows the user to allocate each bucket amount to any number of treaties.

Controls:

* Technical controls are applied for each table. They focus on mandatory variables, correct format, empty cells, possible values.
* Functional controls depend of the table. For IBNR amount and Manual UDF, the time dimension uploaded must cover the entire study observation period and the other dimensions must be included in data and not deselected of the “input dimensions”. For IBNR Amounts table, all combinations of (Portfolio Origin & Bucket ID & Decrement) must be present in IBNR Amount Allocation table.

### Decrements

|  |  |
| --- | --- |
| Definition | It defines the risk to be studied. Depending on the use case the decrement can represent both a probability (e.g. qx) and an intensity (e.g. mux) |
| Possible values | * Qx – events of death * Ix – events of incidence (depending on type of cover) * Wx – events of withdrawal (incl. lapses) * Ix+qx – events of death or incidence when both cannot be differentiated |
| Business rules | * If there is no life coverage in the input file (Main\_Risk\_Type), then qx will not be available in the dropdown list * If there is no CI, LTC, TPD or DI in the input file (Main\_Risk\_Type or Accelerated\_Risk\_Type), then ix will not be available in the dropdown list * When ix or qx is selected, then ix\_qx is removed from the list since they should not be mixed * When ix\_qx is selected, ix and qx are removed from the list since they should not be mixed * Each run can have up to three decrements |
| Dependencies | * Only expected tables related to the chosen decrement will be available in the expected tables selection |

### Slicing Dimension

|  |  |
| --- | --- |
| Definition | Time dimensions that would be available in the result file – obtained through to a slicing procedure |
| Possible values | * Attained Age: based on the date of birth * Policy Duration: based on the date of commencement or date of last medical selection (when available) * Calendar Year: based on the date of begin/end current condition |
| Business rules | * If **Date\_of\_Birth** is missing, then **Attained Age** slicing will not be available * If **Date\_of\_Commencement** is missing, then **Policy Duration** slicing will not be available |
| Dependencies | * The input lines from the policy file will be sliced according to the chosen slicing dimensions. * Any deselected Slicing Dimension will be removed as option for **Leading Slicing Dimension** |

### Attained Age Definition

|  |  |
| --- | --- |
| Definition | Age definition applied when performing the slicing based on the date of birth |
| Possible values | * Age Last Birthday: number of years (integer) rounded down * Age Nearest Birthday: number of years (integer) rounded to the nearest * Age Next Birthday: number of years (integer) rounded up |
| Business rules | * It is greyed-out if **Attained Age** slicing dimension is not selected |
| Dependencies | * The Attained Age slicing will be based on the chosen value * If there is **Age\_attained** in an expected table, then the table will be filtered to the correct **attained\_age\_definition** |

### Leading Slicing Dimension

|  |  |
| --- | --- |
| Definition | Time slicing used to apply Balducci methodology in case of initial exposure metric. Corresponding to most relevant dimension for result analysis |
| Possible values | * Attained Age: based on the date of birth * Policy Duration: based on the date of commencement or date of last medical selection (when available) * Calendar Year: based on the date of begin/end current condition |
| Business rules | * It is greyed-out if “Central” is selected as **Exposure Metric** * If **Attained Age** Slicing is deselected, then “Attained Age” is greyed-out * If **Policy Duration** Slicing is deselected, then “Policy Duration” is greyed-out * By default “Attained Age” is selected, but if it is not available, then Policy Duration is selected, but if it is not available, then Calendar Year is selected |
| Dependencies | * Balducci procedure of the initial exposure metric will be based on the chosen slicing dimension |

### Study Period

|  |  |
| --- | --- |
| Definition | Period retained for the result file |
| Possible values | * Dates |
| Business rules | * By default, identical to observation period * It must be contained in the observation period |
| Dependencies | * It defines the limits used in the calculation of the exposure and actuals |

### Expected Tables

Default Method:

* There can be up to 10 basis each composed of at least a base table with options for trend and adjustment tables
* Dropdown list for tables selection is limited to tables where user has access right and to tables of the same type (base / adjustment / trend / calibration) and to the same decrement
* Blocking control:
  + Each dimension variable in the expected table must be in the input file and selected in input dimensions
  + For each dimension common between base and adjustment table, all values of base table must be found in adjustment table
  + For each dimension common between base and trend table, all values of base table must be found in trend table
  + For each dimension common between policy/product and base table, all values of policy/product table must be found in base table
  + If **Date\_of\_Commencement** variable is missing from Dataset, then an expected table with **Policy\_Duration** is not accepted
  + If **Date\_of\_Birth** variable is missing from Dataset, then an expected table with **Attained\_Age** is not accepted
  + If **Date\_of\_Commencement** or **Age\_at\_Commencement**, or **Age\_at\_Commencement\_Definition** is missing from Dataset, then an expected table with **Insurance\_age\_attained** is not accepted
  + Age can be defined as at most one variation of **Age\_at\_commencement**, **Age\_attained** or **Insurance\_age\_attained**. This variable must be the same for all the expected tables of the same basis (base, adjustment and trend tables).
* Warning control:
  + **Application year** should be the same for base and trend table
  + **Exposure method** should be the same among expected table
  + **Table country** of table should match **Client Country** of study
* Business Rules:
  + In case of **Insurance\_attained\_age** variable in an expected table, the **Policy Duration** slicing is selected, **Attained age** slicing is deselected and both are greyed-out
  + In case of **Age\_attained** variable in an expected table, the **Attained age** slicing is selected and greyed-out

### Actions

* “Launch run” can be pressed as soon as a dataset is selected, at least a decrement and a result metric is chosen. Each time a run is launched, parameters are saved.
* “Save” can be pressed with the same criteria. Unsaved changes of parameters will disappear at the next screen change. If a successful run is “saved”, then the results will be erased, since the parameters could have been changed and would not fit the results of the previous run.
* “Duplicate run” allows the user to create a run tab with the same run parameters
* “Delete run” is available as soon as the run is completed (not necessarily successfully). A confirmation pop-up appears and requires the user to validate the deletion.
* “Download reports” is available as soon as the run is successfully completed.
* Once saved or launched, the run will receive an ID called “run\_ID”, which can be found in the metadata (top of the screen)
* Every field can be edited, except if the study is validated. In that case, only “comment” section is still modifiable.
* There can be up to 5 runs
* As a good practice, the producer should always include as many dimensions and slicing as possible, because it is always possible to aggregate afterwards (e.g. in Tableau)
* Run status:
  + "Preparing Calculation" when the run is being set-up
  + "Calculation in progress" when the engine is processing the run
  + "Synchronizing results" when computation has ended, and results are integrated to the reporting DB
  + "Calculation error" when the engine encountered an error
  + "Error" when another type of error is encountered by the platform
  + "Aborted" when the run could not be executed

### Result File

Results files are synchronized with a separate reporting server, linked to Tableau Server from where results can be visualized as soon as the Run is finished. The result file can also be downloaded from the platform. The output format is xlsx for files with less than 1m lines and csv otherwise.

The result file includes all selected dimensions and calculated fields. For example, Actual\_Amount when “by amount analysis is selected” or Expected\_Amount\_1 when there is expected table with result metric “by amount”. For other variables added check [Calculated Dimensions](#_Calculated_dimensions)

## Study Access Right And Validation

### Access Rights

Every user is displayed in the list:

* General profile can be admin, creator or default. Creator users can create new study and modify those of their team (same scope & function, e.g. EA APAC); default users have only read access; admin users are equivalent to creator users but can, on top of that, manage access rights.
* Function refers to the role of the user team: EA, Marketing, Pricing, R&D, Reserving, Risk Management.
* Scope refers to the geographic area allocated to users.
* Scope type refers to the level of geographic area (global, regional, local)
* Study Profile qualifies the rights of users for a specific study. It can be producer, reviewer, private client, other. Producers can modify a study in progress, reviewers have read access to in progress study, private clients have read access to validated study and other have no access to the study. Private client rights are attributed by default in function of Intrinsic Characteristics (related to the User Name) and Extrinsic Characteristics (related to the study or table).
* Exceptions indicates when the producers have modified the default access right of someone.

The default rule for the private client is defined below:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Study Producer** | | | **Study Definition** | |  |
| **Function** | **Scope** | **Scope type** | **Study Requester** | **Study Country** | **Default Private Client rule** |
| Pricing | A | Local | Any | Any | (Scope A & (Marketing OR EA)) OR (Regional scope mapped to A & (Pricing OR EA OR Risk Management)) |
| Reserving | A | Local | Any | Any | (Scope A & (Marketing OR EA)) OR (Regional scope mapped to A & (Reserving OR EA)) |
| EA | A | Local | Pricing | Any | (Scope A & (Marketing OR Pricing)) OR (Regional scope mapped to A & (Pricing OR EA OR Risk Management)) |
| EA | A | Local | Reserving | Any | (Scope A & (Marketing OR Reserving)) OR (Regional scope mapped to A & (Reseving OR EA)) |
| Other | A | Local | Any | Any | none |
| Pricing | B | Regional | Any | C | (Local Scope mapped to C & (Marketing OR Pricing OR EA)) OR (Scope B & (EA OR Risk Management)) |
| Reserving | B | Regional | Any | C | (Local Scope mapped to C & (Marketing OR Reserving OR EA)) OR (Scope B & EA) |
| EA | B | Regional | Pricing | C | (Local Scope mapped to C & (Marketing OR Pricing OR EA)) OR (Scope B & (Pricing OR Risk Management)) |
| EA | B | Regional | Reserving | C | (Local Scope mapped to C & (Marketing OR Reseving OR EA)) OR (Scope B & (Reserving OR Risk Management)) |
| Other | B | Regional | Any | Any | none |
| Any | Global | Global | Any | Any | none |

## Table Library

### General Information

* The main screen allows users to search tables through several filters (table id, country, decrement, etc.)
* The “add” button is used to create new tables
* Table\_id is defined as Table country abbreviation + Decrement + Table name + Publication year + Table version
* Tables with similar name will have the table version incremented of one and previous version will have an “old” mark scribed on the screen
* To allow easy identification of source of errors, include variable “data\_line” with index in your data file
* Saved tables can be downloaded by clicking on the “eye” icon (similar to the study documentation)
* Rates should be recorded as decimal number and without “%” symbol: for example, 3% is recorded 0.03 or 0,03
* Min and max for age, duration and calendar year are displayed in the screen. During the calculation run, if a value is found outside of these ranges, the value of the upper / lower limit will be applied

### Table Name

|  |  |
| --- | --- |
| Definition | Name that specifies the table |
| Possible values | Free Text |
| Business rules | The field will be a part of the table\_id |
| Dependencies | * The table cannot be saved as long as this field is not completed * Once saved, the table name is displayed in the top of the tab instead of “table name” |

### Table Type

|  |  |
| --- | --- |
| Definition | Type of the table that will be uploaded |
| Possible values | * Base: summarizes the expected rates to be applied in function of dimensions * Adjustment: expected rates will be multiplied by the adjustment variable * Trend: similar to adjustment table, but allows the multiplier to vary by calendar year |
| Business rules | * Once selected, the upload button is no longer greyed-out |
| Dependencies | * Controls are adapted in function of the table type (compulsory variables are not always the same) * The table cannot be saved as long as this field is not completed * If the type is “base”, then **Exposure Method** becomes a mandatory field |

### Table Source

|  |  |
| --- | --- |
| Definition | Identifies if the table is from prophet or not |
| Possible values | * Prophet or manual |
| Business rules | * Set on “manual” by default |
| Dependencies | * The table cannot be saved as long as this field is not completed |

### Table Country

|  |  |
| --- | --- |
| Definition | Country which defines the geographic application of the table |
| Possible values | * List of countries from Omega |
| Business rules | * None |
| Dependencies | * The table cannot be saved as long as this field is not completed |

### Table Origin

|  |  |
| --- | --- |
| Definition | Identifies the origin of the data |
| Possible values | * Population, industry, client, SCOR, other |
| Business rules | * When “SCOR” is selected, the confidential button is by default selected as “yes” |
| Dependencies | * The table cannot be saved as long as this field is not completed |

### Decrement

|  |  |
| --- | --- |
| Definition | Defines the decrement type represented by the table |
| Possible values | * Qx, ix, wx, tx, ix+qx |
| Business rules | * None |
| Dependencies | * When a decrement is defined in the run management tab, only tables with the same (qx, ix, wx or ix+wx) can be found in the expected table selection * The table cannot be saved as long as this field is not completed |

### Exposure Method

|  |  |
| --- | --- |
| Definition | Defines the exposure method which is adapted to the table |
| Possible values | * Initial (for probability) or central (for intensity) |
| Business rules | * Field is compulsory only for “base” table |
| Dependencies | * A warning control in the expected table selection checks that it matches the exposure method of the run * The table cannot be saved as long as this field is not completed |

### Application Year

|  |  |
| --- | --- |
| Definition | Reference year to which the table is calibrated |
| Possible values | * Past years |
| Business rules | * None |
| Dependencies | * A warning control in the expected table selection checks that the application year of the trend table matches the application year of the base table * The table cannot be saved as long as this field is not completed |

### Publication Year

|  |  |
| --- | --- |
| Definition | Year during which the table has been published |
| Possible values | * Past years |
| Business rules | * None |
| Dependencies | * The table cannot be saved as long as this field is not completed |

### Confidential

|  |  |
| --- | --- |
| Definition | Defines whether the table is confidential or not |
| Possible values | * Toggle button |
| Business rules | * By default, the button is deactivated * The toggle button is activated when “Scor” is selected as Table Origin |
| Dependencies | * The confidential table cannot be selected or read by user role “other” (see access rules) |

### Inactive/active

|  |  |
| --- | --- |
| Definition | Defines whether the table is active or not |
| Possible values | * Toggle button |
| Business rules | * By default, the button is activated |
| Dependencies | * A warning will be displayed if an Inactive table is selected in run management tab (TBC) |

### Controls

All controls are blocking

* Compulsory variables, Undefined Variables, Unique variables, Correct Format are straightforward
* Unique age format: age can be defined as **Age\_Attained** or **Age\_at\_Commencement** or **Insurance\_Age\_Attained**. Only one metric can be used. Hence, the control ensures that at most one of the three possibilities is provided.
* Duplicate: there must not be two rows with the same combination of dimensions, since only one rate (adjustment or adjustment\_trend) can be applied to a policy row.
* Variable dependency: if one of the three age variables is provided, then its definition variable must also be provided (for example if there is **Age\_Attained**, then **Attained\_Age\_Definition** is compulsory).
* Missing values: some variables cannot be empty (**calendar\_year**, **Insurance\_age\_attained**, **Insurance\_age\_attained\_def**, **Age\_attained**, **Attained\_Age\_definition**, **Duration\_Year**, **Result\_Metric**, **Rate** (for base), **Adjustment** (for adj), **Calendar\_Yea**r (for trend), **Trend\_adjustment** (for trend). Other variables can be empty to take into account the case where this dimension variable is also empty in the policy / product file.
* Complete slicing dimension: for the variables provided among the three variables (age\_attained, duration\_year, calendar\_year) all combinations between their minimum and their maximum must exist for each of the other dimensions. The control ensures that all intermediate values of slicing variables can be found. Since upper and lower range values will be applied to slicing dimensions values outside the range, this control eludes combination of slicing variables that could be missed in the expected tables.

### Delete/edit expected tables

* Tables which have been used in a completed calculation run cannot be deleted
* A warning pop-up informs the user when the deletion is not possible and provides study\_id and run\_id to help the user to identify where the table has been used.
* Every field can be edited as long as the table is not used in a run (except table type); to edit a table, the user only has the modify or upload a new table and then save; once the table is used in a run, only comment can be edited

### Access rules

For table library, there are simpler rules:

* User can be Table producer, Table Consumer or Other.
* All creators and admin are producers and can create and modify tables of their team (same scope and same function)
* Table consumers and others have read access in the table library and can select the table in run management tab. However, “other” are restricted and do not have access to “confidential” tables

Table consumers are defined as below:

|  |  |  |  |
| --- | --- | --- | --- |
| **Producer** | |  |  |
| **Scope** | **Scope type** | **Table country** | **Consumer rule** |
| A | Local | *Any* | Scope A OR Regional scope mapped to A or Global |
| B | Regional | C | Local scope mapped to C or Scope B or Global |
| Global | Global | C | Local scope mapped to C or regional scope mapped to C or Global |

# FAQ

* **I spotted an error in my table uploaded to the table library but cant modify/ delete it**

If your table is locked, then most likely it has been used for a Study Run. To edit the table you first need to delete all Runs which have used this table

* **There are slight variations in my numerical results**Due to differences in numerical precision of different systems and file formats, numbers might be represented rounded for digits at several points after the decimal point. For example, when exporting from SAS to a .xlsx file, decimals are truncate to seven digits

# Glossary

|  |  |
| --- | --- |
| As-if Adjustment |  |
| Benefit | A component of the product offering to a customer that relates to one specific decrement |
| Blocking controls | Some controls are blocking and will not allow the producer to continue as long as the input is not corrected. Only inputs that has successfully passed every blocking control can be used in a run. |
| Calculation | The production of Result Data based on given Input Data and input parameters |
| Client | The Scor customer or cedent whose experience provides the basis for EA Study |
| Data Provider | The source of Original Data used as input into the EA Study. May be a Scor Global Life Client, a Scor Global Life data repository (hELIOS, Everest) or another external source |
| Data Quality Assessment | A set of parameters assigned by the EA producer for each EA Study that aims to give an objective, comparative assessment of the quality of the Input Data used as a basis for that EA Study |
| Decrement | A transition from one policy status to another that forms the basis of an EA Study |
| EA Client | For a given EA Study, any EA User who is not an EA Producer |
| EA Engine |  |
| EA Platform |  |
| EA Process | The process by which an EA Study is produced from Original Data. The process broadly includes three components: Data Preparation, Calculation and Reporting & Analysis |
| EA Producer | For a given EA Study, the EA User who has initiated the Study or who has been assigned by another EA Producer |
| EA Reporting | The end result of the EA Process for an EA Study or of the Study Analysis, being the output presented in a form that meets the needs of Scor Global Life's internal and/or external clients. It may include numerical and graphical results and reports. |
| EA Run |  |
| EA Study | The production and validation of Result Data for a specified Study Portfolio for a specified Decrement or Decrements, over a specified period, for a specified Study Purpose. |
| EA User | An individual who has been granted access to the EA Tool. User access might be given automatically to all SGL employees or might involve a manual process of granting access right by individual. In addition, depending on the final scope of the project, access right might be given to external persons outside of SCOR |
| Final Result Data | Uniquely identified Result Data representing the final result for a given EA Study |
| IBNR | An adjustment that may need to be applied to claims experience to allow for claims that have been incurred but not reported |
| Input Data | Data of the Study Portfolio cleaned and transformed into a structure and format as accepted by the respective EA Engine |
| Market | Identifies the geographical coverage of a particular EA User or EA Study. The codes used for this purpose match those presently used by Scor Global Life for management reporting purposes |
| Multi-Study Analysis | A type of Result Analysis that covers morre than one Study Portfolio and takes as its input the results of EA Studies for each of those Portfolios |
| Original Data | Experience data relating to the Study Portfolio in the form initially provided by the Data Provider |
| Personal Data | Personal Data is defined as any data relating to a living individual who can be identified from those data (or from those data combined with any other available data). |
| Private Study | A completed EA Study whose results are not designated for sharing in the Public Repository, e.g. due to confidentiality reason or due to particular risk profile or due to being outdated |
| Private EA Client | For a given Private EA Study an EA Client who is allowed to access the Result Data |
| (Data) Processing | “Processing” is wide ranging and covers all elements in the data lifecycle from creation to deletion, including obtaining, recording, holding, organizing, adapting, using, disclosing, transferring and deleting. |
| Product | The Benefit or package of Benefits that a customer contracts to purchase |
| Public Study | A completed EA Study whose results are designated for sharing in the Open Repository |
| Result Analysis | The activity of accessing & analysing results held in the Results Database for one or more EA Studies, either in progress or already completed, for a given purpose, e.g. to develop pricing assumptions or investigate result drivers as part of valuation |
| Result Data | The data output to the Results Database from the EA Process, based on a given set of Input Data and input parameters, allowing all desired types of Result Analysis by EA Clients including all relevant information on desired result metrics and result dimensions. One EA Study can include multiple versions of Result Data, one for each EA Run. |
| Results Database | A database that stores Result Data from all EA Studies that are either in progress or finalized. Results from previously completed EA Studies are retained in the Database for a specified period of time and then deleted |
| Results Repository | A subset of the Results Database containing only results for those EA Studies that have been finalized |
| Risk | In the context of an EA Study, Risk dictates the calculation engine that is used to perform the Study. It takes the following possible values:  - Life (including Accelerated CI/TPD)   - CI  - TPD  - Disability  - LTC  - Medex The relationship between Benefit and Risk will often be 1-1 but this is not always the case, as for example with Accelerated CI where Life and CI Benefits form part of the same Risk |
| Study Portfolio | Any set of experience data forming the basis for an EA Study. The scope of data chosen usually has certain consistent characteristics in line with the purpose of the EA Study, e.g. relating to one client or one type of risk or both. The Study Portfolio usually relates to insurance portfolios but may also represent other types of sources. |
| Study Purpose | The functional purpose for which an EA Study is being undertaken. Takes specified values as follows:  - Pricing, being a Study used to support the pricing of a new deal or the repricing of existing RI treaties - Inforce, being a study used to support other activities relating to the management of portfolios from existing RI treaties (eg reserving, business planning, solvency II reporting etc) - Marketing, being a study used to support internal or external marketing activity for example as a client service - R&D, being a study used to support Scor Global Life research & Development activity |
| Warning Controls | Some controls are warning, they are useful to check some fields in the datasets. They do not have any impact on the process, since it does not prevent to keep up or use the datasets for a run. |

# Appendices

## Rating Adjustment Method – Adjust Expected

Expected\_rate\_adjusted = Expected\_rate \*   
( 1 + Perm\_Mult\_Extra\_Rating\_1 + Perm\_Mult\_Extra\_Rating\_2   
+ if(duration\_year <= Temp\_Mult\_Extra\_Rating\_Term\_1; Temp\_Mult\_Extra\_Rating\_1; 0)  
+ if(duration\_year <= Temp\_Mult\_Extra\_Rating\_Term\_2; Temp\_Mult\_Extra\_Rating\_2; 0)  
)   
+ Perm\_Add\_Extra\_Rating\_1   
+ Perm\_Add\_Extra\_Rating\_2  
+ if(duration\_year <= Temp\_Add\_Extra\_Rating\_Term\_1; Temp\_Add\_Extra\_Rating\_1; 0))   
+ if(duration\_year <= Temp\_Add\_Extra\_Rating\_Term\_2; Temp\_Add\_Extra\_Rating\_2; 0))

## Automatic Risk Amount Change

Risk Amount =

case when Benefit\_Change\_Rate\_Type = 'Loan Interest' THEN

case when Benefit\_Change\_Rate = 0 THEN

case when Benefit\_Change\_Frequency = 'monthly' THEN

Risk\_Amount\_Original \* (Benefit\_Term\_Years - Duration - 0.5)/ Benefit\_Term\_Years

else case when Benefit\_Change\_Frequency = 'annual' THEN

Risk\_Amount\_Original \* (Benefit\_Term\_Years - Duration)/ Benefit\_Term\_Years

END

ELSE when Benefit\_Change\_Rate < 0 THEN

case when Benefit\_Change\_Frequency = 'monthly' THEN

Risk Amount\_Original \* (1-(1/(1+ Benefit\_Change\_Rate))\*\*(OriginalTerm-Duration-0.5))/(1-(1/(1+Benefit\_Change\_Rate))\*\*OriginalTerm)

Else case when Benefit\_Change\_Frequency = 'annual' THEN

Risk\_Amount\_Original \* (1-(1/(1+Benefit\_Change\_Rate))\*\*(OriginalTerm-Duration))/(1-(1/(1+Benefit\_Change\_Rate))\*\*OriginalTerm)

END

ELSE case when Benefit\_Change\_Rate\_Type = “Compound” THEN

Risk\_Amount\_Original \* ((1+ Benefit\_Change\_Rate)\*\*Duration)

else

ELSE case when Benefit\_Change\_Rate\_Type = “Simple” THEN

Risk\_Amount\_Original \* (1+ Benefit\_Change\_Rate\*Duration)

END

1. abbreviated as SAS only supports length of 32 characters [↑](#footnote-ref-1)