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Description Build experience life tables.

License GPL (>= 2)

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`ELT-package` *ELT - A package to build Experience Life Tables*

Description

Collection of functions that can be used following a pre-established procedure to build and validate actuarial life tables.

Details

Package:	ELT
Type:	Package
Version:	1.6
Date:	2016-04-10
License:	GNU
Depends:	locfit,lattice,latticeExtra,xlsx

The package is meant to be used following a pre-established procedure.

See the reference for more info.

Please notice that the package includes the following internal functions:

.BeforeAfterCompletion(); .ComparisonFitsMethods(); .ComparisonFitsMethodsLog(); .ComparisonResidualsMethods(); .ComparisonResidualsMethods(); .ComparisonTrendsMethods(); .CompletionDG2005(); .CompLevel1(); .CompLevel2(); .CompLevel3(); .DevFct(); .ExportHistoryInExcel(); .ExportPeriodicLifeExpinExcel(); .ExportSingleIndiciesinExcel(); .ExportValidationL1inExcel(); .ExportValidationL2inExcel(); .FctCohortLifeExp5(); .FctPerLifeExp(); .FctSingleIndices(); .FitPopsAfterCompletionLog(); .FittedDxtAndConfInt(); .GetCritLevel1(); .GetCritLevel2(); .GetCV(); .GetFitSim(); .GetHistory(); .GetQtiles(); .GetRelDisp(); .GetSimExp(); .PlotCrit(); .PlotCritChoice();

.PlotDIntConf(); .PlotExpQtle(); .PlotFittedYear(); .PlotFittedYearLog(); .PlotMethod(); .PlotParamCompletion(); .PlotPerExp(); .PlotRelDisp(); .PlotRes(); .ResFct(); .SimDxt(); .ValidationLevel3(); .WarningInvalidAge() .

These functions can be accessed with the prefix ELT::: using the following syntax: ELT:::[name of the function] . For example : ELT:::.GetHistory(). See technical note II1291-15 (http://www.ressources-actuarielles.net/gtmortalite) for the arguments and examples of the functions.

References

Tomas, J. , Planchet, F. , Prospective mortality tables and portfolio experience, Chapter 9 in Computational Actuarial Science, *with R ; Arthur Charpentier Editor, Chapman, 2014*

Tomas, J. , Planchet, F. , Constructing entity specific prospective mortality table : adjustment to a reference, Les cahiers de recherche de l'ISFA, *2013(13), pp.1-31, 2013.*

Tomas, J. , Planchet, F. , Construction d'une table de mortalite par positionnement : Mode d'emploi, Institut des Actuaires, Rapport technique II1291-15, *pp. 1-27, 2013*

Tomas, J. , Planchet, F. , Criteres de Validation : Aspects Methodologiques, Institut des Actuaires, Rapport technique II1291-14, *pp. 1-31, 2013*

Tomas, J. , Planchet, F. , Methodes de positionnement : Aspects Methodologiques, Institut des Actuaires, Rapport technique II1291-12, *pp. 1-12, 2013*

Denuit, M. and Goderniaux, A. C. (2005). Closing and projecting life tables using log-linear models. Bulletin of the Swiss Association of Actuaries, *(1), 29-48*

http://www.ressources-actuarielles.net/gtmortalite *for data and exemple codes.*

Examples

```
## Not run:
data(MyPortfolio)
data(ReferenceMale)
data(ReferenceFemale)

## ------------------------------------------------------------------------ ##
##  Initialize Age variables                                                ##
## ------------------------------------------------------------------------ ##

AgeRange <- 30:90
AgeCrit <- 30:90
AgeRef <- 30:95

History <- ReadHistory(MyPortfolio = MyPortfolio, DateBegObs = "1996/01/01",
DateEndObs = "2007/12/31", DateFormat = "

MyData <- AddReference(History = History, ReferenceMale = ReferenceMale,
ReferenceFemale = ReferenceFemale)

## ######################################################################## ##
## METHOD 1 ############################################################### ##
## ######################################################################## ##

## ------------------------------------------------------------------------ ##
```

```
##  Execute method 1                                                        ##
## ------------------------------------------------------------------------ ##

OutputMethod1 <- Method1(MyData = MyData, AgeRange = AgeRange,  Plot = T)

## ------------------------------------------------------------------------ ##
##  Validate method 1 by the 1st level citeria                              ##
## ------------------------------------------------------------------------ ##

## ---------- Execute 1st level citeria.

ValidationLevel1Method1 <- ValidationLevel1(OutputMethod = OutputMethod1, MyData = MyData,
 AgeCrit = AgeCrit, ValCrit = 0.05, Plot = T, Excel = T)

## ---------- If the criterions corresponding to the 1st level are not
## ---------- satisfied, we can modify the age range used to compute the SMR
## ---------- and reexecute
## ---------- OutputMethod1 <- Method1(...)
## ---------- and
## ---------- ValidationLevel1Method1 <- ValidationLevel1(...).
## ---------- If the criterions corresponding to the 1st level are still not
## ---------- satisfied, we turn to the method 2, and it is useless to
## ---------- pursue the completion of the table and the validation.
## ---------- If the criterions are satisfied, we continue the validation with
## ---------- the criterions corresponding to the 2nd level.
## ---------- We can also turn to method 3 or 4 to improve the fit at a cost
## ---------- of a somewhat greeter complexity.

## ------------------------------------------------------------------------ ##
##  Validate method 1 by the 2nd level citeria                              ##
## ------------------------------------------------------------------------ ##

## ---------- Execute 2nd level criterions

ValidationLevel2Method1 <- ValidationLevel2(OutputMethod = OutputMethod1, MyData = MyData,
 AgeCrit = AgeCrit, ValCrit = 0.05, Excel = T)

## ---------- If the criterions corresponding to the 2nd level are not satisfied
## ---------- we turn to the method 2 and it is useless to pursue the
## ---------- completion of the table and the validation.
## ---------- If the criterions are satisfied, we continue the validation with
## ---------- the completion of the table and the criterions corresponding to
## ---------- the 3rd level.

## ------------------------------------------------------------------------ ##
##  Completion Method 1                                                     ##
## ------------------------------------------------------------------------ ##

## ---------- Age range for the selection of the optimal starting age.

AgeRangeOptMale <- AgeRangeOptFemale <-  c(80, 80)

## ---------- In theory, we could select the optimal starting age, however
```

```
## ---------- the optimal starting age can vary a lot with the calendar years
## ---------- leading to a relatively irregular surface. In practice, we
## ---------- select then a fixed age for the whole years.

## ---------- Starting age for which the fitted probabilities of the death are
## ---------- replaced by the values obtained from the completion model.

BegAgeCompMale <- BegAgeCompFemale <- 85

## ---------- We check if the completion is smoothed with graphical
## ---------- diagnostics.

CompletionMethod1 <- CompletionA(OutputMethod = OutputMethod1, MyData = MyData,
 AgeRangeOptMale = AgeRangeOptMale, AgeRangeOptFemale = AgeRangeOptFemale,
 BegAgeCompMale = BegAgeCompMale, BegAgeCompFemale = BegAgeCompFemale, ShowPlot = T)

## ---------- If the completion is not satisfying, we modify the values
## ---------- AgeRangeOpt and BegAgeComp, and we repeat the previous script
## ---------- CompletionA()
## ---------- If the completion is satisfying, we execute

FinalMethod1 <- CompletionB(ModCompletion = CompletionMethod1, OutputMethod = OutputMethod1,
 MyData = MyData, Plot = T, Excel = T)

## ------------------------------------------------------------------------ ##
##  Validate method 1 by the 3rd level citeria                              ##
## ------------------------------------------------------------------------ ##

## ---------- Execute 3rd level criterions

ValidationLevel3Method1 <- ValidationLevel3(FinalMethod = FinalMethod1, MyData = MyData,
 Plot = T, Excel = T)

## ------------------------------------------------------------------------ ##
##  Coef Varition, Conf int. and rel. disp. of fitted per. life exp.        ##
## ------------------------------------------------------------------------ ##

## ---------- Compute the coefficient of variation, confidence intervals and
## ---------- relative dispersion of the fitted perdiodic life expectancies

DispersionMethod1 <- Dispersion(FinalMethod = FinalMethod1, MyData = MyData, Plot = T,NbSim = 10)

## ######################################################################## ##
## METHOD 2 ############################################################### ##
## ######################################################################## ##

## ------------------------------------------------------------------------ ##
##  Execute method 2                                                        ##
## ------------------------------------------------------------------------ ##

OutputMethod2 <- Method2(MyData = MyData, AgeRange = AgeRange, Plot = T)

## ------------------------------------------------------------------------ ##
```

```
##  Validate method 2 by the 1st level citeria                            ##
## ---------------------------------------------------------------------- ##

## ---------- Execute 1st level citeria.

ValidationLevel1Method2 <- ValidationLevel1(OutputMethod = OutputMethod2, MyData = MyData,
 AgeCrit = AgeCrit, ValCrit = 0.05, Plot = T, Excel = T)

## ---------- If the criterions corresponding to the 1st level are not
## ---------- satisfied, we turn to the method 3, and it is useless to
## ---------- pursue the completion of the table and the validation.
## ---------- If the criterions are satisfied, we continue the validation with
## ---------- the criterions corresponding to the 2nd level.
## ---------- We can also turn to method 4 to improve the fit at a cost
## ---------- of a somewhat greeter complexity.

## ---------------------------------------------------------------------- ##
##  Validate method 2 by the 2nd level citeria                            ##
## ---------------------------------------------------------------------- ##

## ---------- Execute 2nd level criterions

ValidationLevel2Method2 <- ValidationLevel2(OutputMethod = OutputMethod2, AgeCrit = AgeCrit,
 ValCrit = 0.05, MyData = MyData, Excel = T)

## ---------- If the criterions corresponding to the 2nd level are not satisfied
## ---------- we turn to the method 3 and it is useless to pursue the
## ---------- completion of the table and the validation.
## ---------- If the criterions are satisfied, we continue the validation with
## ---------- the completion of the table and the criterions corresponding to
## ---------- the 3rd level.

## ---------------------------------------------------------------------- ##
##  Completion Method 2                                                   ##
## ---------------------------------------------------------------------- ##

## ---------- We check if the completion is smoothed with graphical
## ---------- diqgnostics.

CompletionMethod2 <- CompletionA(OutputMethod = OutputMethod2, MyData = MyData,
 AgeRangeOptMale = AgeRangeOptMale, AgeRangeOptFemale = AgeRangeOptFemale,
BegAgeCompMale = BegAgeCompMale, BegAgeCompFemale = BegAgeCompFemale, ShowPlot = T)

## ---------- If the completion is not satisfying, we modify the values
## ---------- AgeRangeOpt and BegAgeComp, and we repeat the previous script
## ---------- CompletionA()
## ---------- If the completion is satisfying, we execute

FinalMethod2 <- CompletionB(ModCompletion = CompletionMethod2, OutputMethod = OutputMethod2,
 MyData = MyData, Plot = T, Excel = T)

## ---------------------------------------------------------------------- ##
##  Validate method 2 by the 3rd level citeria                            ##
```

```
## ------------------------------------------------------------------------ ##

## ---------- Execute 3rd level criterions

ValidationLevel3Method2 <- ValidationLevel3(FinalMethod = FinalMethod2, MyData = MyData,
 Plot = T, Excel = T)

## ------------------------------------------------------------------------ ##
##  Coef Varition, Conf int. and rel. disp. of fitted per. life exp.        ##
## ------------------------------------------------------------------------ ##

## ---------- Compute the coefficient of variation, confidence intervals and
## ---------- relative dispersion of the fitted perdiodic life expectancies

DispersionMethod2 <- Dispersion(FinalMethod = FinalMethod2, MyData = MyData, Plot = T, NbSim = 10)

## ######################################################################## ##
## METHOD 3 ############################################################### ##
## ######################################################################## ##

## ------------------------------------------------------------------------ ##
##  Execute method 3                                                        ##
## ------------------------------------------------------------------------ ##

OutputMethod3 <- Method3(MyData = MyData, AgeRange = AgeRange, Plot = T)

## ------------------------------------------------------------------------ ##
##  Validate method 3 by the 1st level citeria                              ##
## ------------------------------------------------------------------------ ##

## ---------- Execute 1st level citeria.

ValidationLevel1Method3 <- ValidationLevel1(OutputMethod = OutputMethod3, MyData = MyData,
 AgeCrit = AgeCrit, ValCrit = 0.05, Plot = T, Excel = T)

## ---------- If the criterions corresponding to the 1st level are not
## ---------- satisfied, we turn to the method 4, and it is useless to
## ---------- pursue the completion of the table and the validation.
## ---------- If the criterions are satisfied, we continue the validation with
## ---------- the criterions corresponding to the 2nd level.

## ------------------------------------------------------------------------ ##
##  Validate method 3 by the 2nd level citeria                              ##
## ------------------------------------------------------------------------ ##

## ---------- Execute 2nd level criterions

ValidationLevel2Method3 <- ValidationLevel2(OutputMethod = OutputMethod3, MyData = MyData,
 AgeCrit = AgeCrit, ValCrit = 0.05, Excel = T)

## ---------- If the criterions corresponding to the 2nd level are not satisfied
## ---------- we turn to the method 4 and it is useless to pursue the
## ---------- completion of the table and the validation.
```

```
## ---------- If the criterions are satisfied, we continue the validation with
## ---------- the completion of the table and the criterions corresponding to
## ---------- the 3rd level.

## ------------------------------------------------------------------------ ##
##  Completion Method 3                                                     ##
## ------------------------------------------------------------------------ ##

## ---------- We check if the completion is smoothed with graphical
## ---------- diqgnostics.

CompletionMethod3 <- CompletionA(OutputMethod = OutputMethod3, MyData = MyData,
AgeRangeOptMale = AgeRangeOptMale, AgeRangeOptFemale = AgeRangeOptFemale,
 BegAgeCompMale = BegAgeCompMale, BegAgeCompFemale = BegAgeCompFemale, ShowPlot = T)

## ---------- If the completion is not satisfying, we modify the values
## ---------- AgeRangeOpt and BegAgeComp, and we repeat the previous script
## ---------- CompletionA()
## ---------- If the completion is satisfying, we execute

FinalMethod3 <- CompletionB(ModCompletion = CompletionMethod3, OutputMethod = OutputMethod3,
MyData = MyData, Plot = T, Excel = T)

## ------------------------------------------------------------------------ ##
##  Validate method 3 by the 3rd level citeria                              ##
## ------------------------------------------------------------------------ ##

## ---------- Execute 3rd level criterions

ValidationLevel3Method3 <- ValidationLevel3(FinalMethod = FinalMethod3, MyData = MyData,
 Plot = T, Excel = T)

## ------------------------------------------------------------------------ ##
##  Coef Varition, Conf int. and rel. disp. of fitted per. life exp.        ##
## ------------------------------------------------------------------------ ##

## ---------- Compute the coefficient of variation, confidence intervals and
## ---------- relative dispersion of the fitted perdiodic life expectancies

DispersionMethod3 <- Dispersion(FinalMethod = FinalMethod3, MyData = MyData, Plot = T, NbSim = 10)

## ######################################################################## ##
## METHOD 4 ############################################################### ##
## ######################################################################## ##

## ------------------------------------------------------------------------ ##
##  Execute method 4                                                        ##
## ------------------------------------------------------------------------ ##

## ---------- Execute method 4 first part.

OutputMethod4PartOne <- Method4A(MyData = MyData, AgeRange = AgeRange, AgeCrit = AgeCrit,
 ShowPlot = T)
```

```
## ---------- Select the optimal smoothing parameters.

## ---------- Execute method 4 second part.

OutputMethod4 <- Method4B(PartOne, MyData = MyData, OptMale = c(1, 16),
 OptFemale = c(1, 14), Plot = T)

## ------------------------------------------------------------------------ ##
##  Validate method 4 by the 1st level citeria                              ##
## ------------------------------------------------------------------------ ##

## ---------- Execute 1st level citeria.

ValidationLevel1Method4 <- ValidationLevel1(OutputMethod = OutputMethod4, MyData = MyData,
 AgeCrit = AgeCrit, ValCrit = 0.05, Plot = T, Excel = T)

## ---------- If the criterions corresponding to the 1st level are not
## ---------- satisfied, we turn to the method 4, and it is useless to
## ---------- pursue the completion of the table and the validation.
## ---------- If the criterions are satisfied, we continue the validation with
## ---------- the criterions corresponding to the 2nd level.

## ------------------------------------------------------------------------ ##
##  Validate method 4 by the 2nd level citeria                              ##
## ------------------------------------------------------------------------ ##

## ---------- Execute 2nd level criterions

ValidationLevel2Method4 <- ValidationLevel2(OutputMethod = OutputMethod4, MyData = MyData,
 AgeCrit = AgeCrit, ValCrit = 0.05, Excel = T)

## ---------- If the criterions corresponding to the 2nd level are not satisfied
## ---------- we turn to the method 4 and it is useless to pursue the
## ---------- completion of the table and the validation.
## ---------- If the criterions are satisfied, we continue the validation with
## ---------- the completion of the table and the criterions corresponding to
## ---------- the 3rd level.

## ------------------------------------------------------------------------ ##
##  Completion Method 4                                                     ##
## ------------------------------------------------------------------------ ##

## ---------- We check if the completion is smoothed with graphical
## ---------- diqgnostics.

CompletionMethod4 <- CompletionA(OutputMethod = OutputMethod4, MyData = MyData,
 AgeRangeOptMale = AgeRangeOptMale, AgeRangeOptFemale = AgeRangeOptFemale,
BegAgeCompMale = BegAgeCompMale, BegAgeCompFemale = BegAgeCompFemale, ShowPlot = T)

## ---------- If the completion is not satisfying, we modify the values
## ---------- AgeRangeOpt and BegAgeComp, and we repeat the previous script
## ---------- CompletionA()
```

```
## ---------- If the completion is satisfying, we execute

FinalMethod4 <- CompletionB(ModCompletion = CompletionMethod4, OutputMethod = OutputMethod4,
 MyData = MyData, Plot = T, Excel = T)

## ------------------------------------------------------------------------ ##
##  Validate method 4 by the 3rd level citeria                              ##
## ------------------------------------------------------------------------ ##

## ---------- Execute 3rd level criterions

ValidationLevel3Method4 <- ValidationLevel3(FinalMethod = FinalMethod4, MyData = MyData,
Plot = T, Excel = T)

## ------------------------------------------------------------------------ ##
##  Coef Varition, Conf int. and rel. disp. of fitted per. life exp.        ##
## ------------------------------------------------------------------------ ##

## ---------- Set the number of simulations

## ---------- Compute the coefficient of variation, confidence intervals and
## ---------- relative dispersion of the fitted perdiodic life expectancies

DispersionMethod4 <- Dispersion(FinalMethod = FinalMethod4, MyData = MyData, Plot = T, NbSim = 10)

## ######################################################################## ##
## COMPARISON OF THE METHODS ############################################## ##
## ######################################################################## ##

## ---------- Once we have fitted the data with a number of methods, we can
## ---------- compare them. In the following, we compare the fitted
## ---------- probabilities of death in original and log scale, the
## ---------- residuals, the fitted deaths as well as the coherence of the
## ---------- extrapolated mortality trends

## ---------- You can change the color vector for comparison, color need to
## ---------- be in html format

## ---------- Store the output into a list

ListOutputs <- list(OutputMethod1, OutputMethod2, OutputMethod3, OutputMethod4)
ListValidationLevel1 <- list(ValidationLevel1Method1, ValidationLevel1Method2,
 ValidationLevel1Method3, ValidationLevel1Method4)
ListValidationLevel2 <- list(ValidationLevel2Method1, ValidationLevel2Method2,
 ValidationLevel2Method3, ValidationLevel2Method4)
ListValidationLevel3 <- list(ValidationLevel3Method1, ValidationLevel3Method2,
 ValidationLevel3Method3, ValidationLevel3Method4)

ComparisonsMethodsLevels123 <- ComparisonMethods(ListOutputs, ListValidationLevel1,
 ListValidationLevel2, ListValidationLevel3, MyData = MyData, Plot = T, AgeCrit = AgeCrit)


## End(Not run)
```

AddReference *AddReference function.*

Description

This function imports reference tables.

Usage

```
AddReference(History, ReferenceMale = NULL, ReferenceFemale = NULL)
```

Arguments

History	History as returned by the ReadHistory function.
ReferenceMale	data.frame representing the reference table. See data(ReferenceMale) for the format.
ReferenceFemale	data.frame representing the reference table. See data(ReferenceFemale) for the format.

ComparisonMethods *ComparisonMethods function*

Description

This function compares two or several methods using the three groups of criteria from the validation process.

Usage

```
ComparisonMethods(ListOutputs, ListValidationLevel1, ListValidationLevel2,
  ListValidationLevel3, MyData = MyData, Plot = F,
  ColorComp = c("#FF6590", "#309BFF", "#AD79FC", "#3CAB5F"),
  LtyComp = rep(1, 4), AgeCrit)
```

Arguments

ListOutputs	For the comparisons of n methods, a list of n elements containing the returned value of the functions Methodn().
ListValidationLevel1	For the comparisons of n methods, a list of n elements containing the returned value of the function ValidationLevel1() for each of the n methods.
ListValidationLevel2	For the comparisons of n methods, a list of n elements containing the returned value of the function ValidationLevel2() for each of the n methods.

`ListValidationLevel3`
: For the comparisons of n methods, a list of n elements containing the returned value of the function ValidationLevel3() for each of the n methods.

`MyData`
: The list returned by the AddReference() function.

`Plot`
: If set to TRUE, a sub-directory will be created in the working directory. This sub-directory will contains png plots corresponding to the smoothed surface.

`ColorComp`
: The color that will be used for the plots (HTML notation). For the comparisons of n methods, ColorComp is a vector of length n.

`LtyComp`
: Vector of parameters (length n) for the lty plot parameter.

`AgeCrit`
: Age range for the comparison of adjusted mortality and observed mortality.

`CompletionA` *CompletionA function*

Description

This function executes the first part of table closure using Denuit and Goderniaux (2005)

Usage

```
CompletionA(OutputMethod, MyData, AgeRangeOptMale, AgeRangeOptFemale,
  BegAgeCompMale, BegAgeCompFemale, Color = MyData$Param$Color,
  ShowPlot = T)
```

Arguments

`OutputMethod`
: The list returned by one of these functions : Method1(), Method2(), Method3() or Method4B().

`MyData`
: The list returned by the AddReference() function.

`AgeRangeOptMale`
: Age range from which the optimal starting age is selected for males

`AgeRangeOptFemale`
: Age range from which the optimal starting age is selected for females

`BegAgeCompMale`
: For ages after BegAgeCompMale, observed death probabilitiy is replaced by the model output.

`BegAgeCompFemale`
: For ages after BegAgeCompFemale, observed death probabilitiy is replaced by the model output.

`Color`
: The color that will be used for the plots (HTML notation).

`ShowPlot`
: If true, create graphics comparing Before/After the completion create graphics of the completed surfaces.

CompletionB *CompletionB function*

Description

This function executes the second part of table closure

Usage

```
CompletionB(ModCompletion, OutputMethod, MyData, Color = MyData$Param$Color,
  Plot = F, Excel = F)
```

Arguments

ModCompletion	Output of the function CompletionA().
OutputMethod	The list returned by one of these functions : Method1(), Method2(), Method3() or Method4B().
MyData	The list returned by the AddReference() function.
Color	The color that will be used for the plots (HTML notation).
Plot	If true, create graphics.
Excel	If true, create Excel files.

Dispersion *Dispersion function*

Description

This function allows to calculate confidence intervals for period life expectancies.

Usage

```
Dispersion(FinalMethod, MyData, NbSim, CompletionTable = T, Plot = F,
  Color = MyData$Param$Color)
```

Arguments

FinalMethod	The list returned by the CompletionB() function.
MyData	The list returned by the AddReference() function.
NbSim	The number of simulations for the Dispersion.
CompletionTable	If TRUE, apply completion
Plot	If set to TRUE, a sub-directory will be created in the working directory. This sub-directory will contains png plots describing the validation analysis.
Color	The color that will be used for the plots (HTML notation).

FctMethod1 *FctMethod1 function*

Description

FctMethod1() is an alternative to Method1(). It allows to process the smoothing without using a "Data" object and by defining all the needed parameters independently.

Usage

```
FctMethod1(d, e, qref, x1, x2, t1, t2)
```

Arguments

d	Number of deaths.
e	Exposure to risk.
qref	Mortality rates in Reference Table.
x1	Age range used for calculation.
x2	Age range of reference table.
t1	Calendar years used for the calculation. It corresponds to the common years among observations and the reference table.
t2	Calendar years of the reference.

FctMethod2 *FctMethod2 function*

Description

FctMethod2() is an alternative to Method2(). It allows to process the smoothing without using a "Data" object and by defining all the needed parameters independently.

Usage

```
FctMethod2(d, e, qref, x1, x2, t1, t2)
```

Arguments

d	Number of deaths.
e	Exposure to risk.
qref	Mortality rates in Reference Table.
x1	Age range used for calculation.
x2	Age range of reference table.
t1	Calendar years used for the calculation. It corresponds to the common years among observations and the reference table.
t2	Calendar years of the reference.

FctMethod3 *FctMethod3 function*

Description

FctMethod3() is an alternative to Method3(). It allows to process the smoothing without using a "Data" object and by defining all the needed parameters independently.

Usage

```
FctMethod3(d, e, qref, x1, x2, t1, t2)
```

Arguments

d	Number of deaths.
e	Exposure to risk.
qref	Mortality rates in Reference Table.
x1	Age range used for calculation.
x2	Age range of reference table.
t1	Calendar years used for the calculation. It corresponds to the common years among observations and the reference table.
t2	Calendar years of the reference.

FctMethod4_1stPart *FctMethod4_1stPart function*

Description

FctMethod4_1stPart() is an alternative to Method4A(). It allows to process the smoothing without using a "Data" object and by defining all the needed parameters independently.

Usage

```
FctMethod4_1stPart(d, e, qref, x1, x2, t1)
```

Arguments

d	Number of deaths.
e	Exposure to risk.
qref	Mortality rates in Reference Table.
x1	Age range used for calculation.
x2	Age range of reference table.
t1	Calendar years used for the calculation. It corresponds to the common years among observations and the reference table.

FctMethod4_2ndPart *FctMethod4_2ndPart function*

Description

FctMethod4_2ndPart() is an alternative to Method4B(). It allows to process the smoothing without using a "Data" object and by defining all the needed parameters independently.

Usage

```
FctMethod4_2ndPart(d, e, qref, x1, x2, t1, t2, P.Opt, h.Opt)
```

Arguments

d	Number of deaths.
e	Exposure to risk.
qref	Mortality rates in Reference Table.
x1	Age range used for calculation.
x2	Age range of reference table.
t1	Calendar years used for the calculation. It corresponds to the common years among observations and the reference table.
t2	Calendar years of the reference table.
P.Opt	Degree of approximation.
h.Opt	Window width.

Method1 *Method1 function*

Description

This function fits the Qxt using method 1 (SMR method, see reference).

Usage

```
Method1(MyData, AgeRange, Plot = F, Color = MyData$Param$Color)
```

Arguments

MyData	The list returned by the AddReference() function.
AgeRange	Age range used for the calculation of the SMR.
Plot	If set to TRUE, a sub-directory will be created in the working directory. This sub-directory will contains png plots corresponding to the smoothed surface.
Color	The color that will be used for the plots (HTML notation).

Method2 *Method2 function*

Description

This function fits the Qxt using method 2 (two parameters relational method, see reference).

Usage

```
Method2(MyData, AgeRange, Plot = F, Color = MyData$Param$Color)
```

Arguments

MyData	The list returned by the AddReference() function.
AgeRange	Age range used for the calculation of the parameters.
Plot	If set to TRUE, a sub-directory will be created in the working directory. This sub-directory will contains png plots corresponding to the smoothed surface.
Color	The color that will be used for the plots (HTML notation).

Method3 *Method3 function*

Description

This function fits the Qxt using method 3 (Poisson GLM, see reference).

Usage

```
Method3(MyData, AgeRange, Plot = F, Color = MyData$Param$Color)
```

Arguments

MyData	The list returned by the AddReference() function.
AgeRange	Age range used for the calculation of the parameters of the Poisson model.
Plot	If set to TRUE, a sub-directory will be created in the working directory. This sub-directory will contains png plots corresponding to the smoothed surface.
Color	The color that will be used for the plots (HTML notation).

Method4A *Method4A function*

Description

This function fits the Qxt using method 4 (first step) (non-parametric smoothing, see reference).

Usage

```
Method4A(MyData, AgeRange, AgeCrit, ShowPlot = F)
```

Arguments

MyData	The list returned by the AddReference() function.
AgeRange	Age range used for the construction of the life table.
AgeCrit	Age range for the comparison of adjusted mortality and observed mortality.
ShowPlot	AIC plots and plots allowing to judge about the fit.

Method4B *Method4B function*

Description

This function fits the Qxt using method 4 (second step) (non-parametric smoothing, see reference).

Usage

```
Method4B(PartOne, MyData, OptMale, OptFemale, Plot = F, ShowPlot = F,
  Color = MyData$Param$Color)
```

Arguments

PartOne	The list returned by the Method4A() function.
MyData	The list returned by the AddReference() function.
OptMale	Optimal smoothing parameters, obtained from the graphics generated by Method4A() for the male population.
OptFemale	Optimal smoothing parameters, obtained from the graphics generated by Method4A() for the female population.
Plot	If set to TRUE, a sub-directory will be created in the working directory. This sub-directory will contains png plots corresponding to the smoothed surface.
ShowPlot	If true, show plots.
Color	The color that will be used for the plots (HTML notation).

MyPortfolio *MyPortfolio used for the exemple.*

Description

Artificial Portfolio data exemple.

Usage

```
data(MyPortfolio)
```

Examples

```
data(MyPortfolio)
```

NoCompletion *NoCompletion function*

Description

This function allows to keep the adjustment used by the locating method for high ages (for methods 1, 2 or 3).

Usage

```
NoCompletion(OutputMethod, MyData, Color = MyData$Param$Color, Plot = F,
  Excel = F)
```

Arguments

OutputMethod	The list returned by one of these functions : Method1(), Method2(), Method3() or Method4B().
MyData	The list returned by the AddReference() function.
Color	The color that will be used for the plots (HTML notation).
Plot	If TRUE, final mortality surfaces will be saved in Results/Graphics/FinalTables
Excel	If TRUE, final tables will be saved in Results/Excel/FinalTables.xlsx

ReadHistory *readHistory function*

Description

This function reads a data.frame and calculates exposure and number of deaths. This is the first function the user must call to build a mortality table.

Usage

```
ReadHistory(MyPortfolio, DateBegObs, DateEndObs, DateFormat, Plot = F,
  Color = "#A4072E", Excel = F)
```

Arguments

MyPortfolio	MyPortfolio is a data.frame of 6 columns as follows : -Id : Id for the line ; -Gender : Male or Female ; -DateOfBirth : aaaa/mm/jj ; -DateIn : aaaa/mm/jj ; -DateOut : aaaa/mm/jj ; -Status : "other" or "deceased".
DateBegObs	Date for the beginning of the observations.
DateEndObs	Date for the end of the observations.
DateFormat	Date format as expected by the as.Date R function.
Plot	If set to TRUE, a sub-directory will be created in the working directory. This sub-directory will contains png plots corresponding to the smoothed surface.
Color	The color that will be used for the plots (HTML notation).
Excel	If set to TRUE, a sub-directory will be created in the working directory. This sub-directory will contains excel files corresponding to the smoothed surface.

ReferenceFemale *ReferenceFemale used for the exemple.*

Description

This data corresponds to an adjusted version of the French national demographic projections INSEE 2060 for the female population.

Usage

```
data(ReferenceFemale)
```

Examples

```
data(ReferenceFemale)
```

ReferenceMale *ReferenceMale used for the exemple.*

Description

This data corresponds to an adjusted version of the French national demographic projections INSEE 2060 for the male population.

Usage

```
data(ReferenceMale)
```

Examples

```
data(ReferenceMale)
```

SurfacePlot *SurfacePlot function*

Description

Allows to plot a surface.

Usage

```
SurfacePlot(xx, zexpr, mainexpr, axis, cc)
```

Arguments

xx	data as matrix.
zexpr	Title of z axis.
mainexpr	Name for the graphic.
axis	c(min(abscissa), max(abscissa), min(ordinate), max(ordinate)).
cc	Color.

ValidationLevel1 *ValidationLevel1 function*

Description

This function performs the first level of validation on the returned value of one of these functions : Method1(), Method2(), Method3() or Method4B().

Usage

```
ValidationLevel1(OutputMethod, MyData, ValCrit, AgeCrit, Plot = F,
  Color = MyData$Param$Color, Excel = F)
```

Arguments

OutputMethod	The list returned by one of these functions : Method1(), Method2(), Method3() or Method4B().
MyData	The list returned by the AddReference() function.
ValCrit	Critical value for the comparison of adjusted mortality and observed mortality.
AgeCrit	Age range for the comparison of adjusted mortality and observed mortality.
Plot	If set to TRUE, a sub-directory will be created in the working directory. This sub-directory will contains png plots describing the validation analysis.
Color	The color that will be used for the plots (HTML notation).
Excel	If set to TRUE, a sub-directory will be created in the working directory. This sub-directory will contains excel files describing the validation analysis.

ValidationLevel2 *ValidationLevel2 function*

Description

This function performs the second level of validation on the returned value of one of these functions : Method1(), Method2(), Method3() or Method4B() (see reference).

Usage

```
ValidationLevel2(OutputMethod, MyData, ValCrit, AgeCrit, Excel = F)
```

Arguments

OutputMethod	The list returned by one of these functions : Method1(), Method2(), Method3() or Method4B().
MyData	The list returned by the AddReference() function.
ValCrit	Critical value for the comparison of adjusted mortality and observed mortality.
AgeCrit	Age range for the comparison of adjusted mortality and observed mortality.
Excel	If set to TRUE, a sub-directory will be created in the working directory. This sub-directory will contains excel files describing the validation analysis.

ValidationLevel3 *ValidationLevel3 function*

Description

This function performs the third level of validation on the returned value of one of these functions : Method1(), Method2(), Method3() or Method4B().

Usage

```
ValidationLevel3(FinalMethod, MyData, Plot = F, Color = MyData$Param$Color,
  Excel = F)
```

Arguments

FinalMethod	The list returned by the CompletionB() function.
MyData	The list returned by the AddReference() function.
Plot	If set to TRUE, a sub-directory will be created in the working directory. This sub-directory will contains png plots describing the validation analysis.
Color	The color that will be used for the plots (HTML notation).
Excel	If set to TRUE, a sub-directory will be created in the working directory. This sub-directory will contains excel files describing the validation analysis.

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