Package 'MortalityGaps'

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Type Package

Title The Double-Gap Life Expectancy Forecasting Model

Version 1.0.0

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Description Life expectancy is highly correlated over time among countries and between males and females. These associations can be used to improve forecasts. Here we have implemented a method for forecasting female life expectancy based on analysis of the gap between female life expectancy in a country compared with the record level of female life expectancy in the world. Second, to forecast male life expectancy, the gap between male life expectancy and female life expectancy in a country is analysed. We named this method the Double-Gap model. For a detailed description of the method see Pascariu et al. (2017). <doi:10.1016/j.insmatheco.2017.09.011>.

License GPL-3

LazyData TRUE

Depends R (>= 3.1.2)

Imports forecast, MASS, crch, pbapply

Suggests knitr, rmarkdown, testthat, covr

RoxygenNote 6.0.1

VignetteBuilder knitr

URL https://github.com/mpascariu/MortalityGaps

BugReports https://github.com/mpascariu/MortalityGaps/issues

NeedsCompilation no

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`DoubleGap` *Fit the DoubleGap Life Expectancy Forecasting Model*

Description

Fit a DoubleGap model for forecasting life expectancy. The method combines separate forecasts to obtain joint male and female life expectancies that are coherent with a best-practice trend. See the entire description and mathematical formulation of the model in Pascariu et. al (2017).

Usage

```
DoubleGap(DF, DM, age, country, years, arima.order = NULL, drift = NULL,
  tau = NULL, A = NULL)
```

Arguments

`DF`	data.frame containing life expectancy records for females. The table must contain the following 4 columns: country, year, age, ex.
`DM`	data.frame containing life expectancy records for males. The table must have the same format and dimensions as `DF`.
`age`	Indicate the age for which the model to be fitted. Assuming `DF` and `DM` contain recods for different ages, this argument it is used to subset the data. If you want to fit the model for age 0, add age = 0. Type: scalar.
`country`	Indicate for which contry you want to fit the model. The country name or code must exist in `DF` and `DM`. Type: character.
`years`	Period of time to be used. Type: numeric vector.
`arima.order`	A specification of the the ARIMA model to be used in fitting the best-practice gap. The ARIMA order is country specific. The three integer components (p, d, q) are the AR order, the degree of differencing, and the MA order. Format: numerical vector of length 3. If `arima.order = NULL` the function conducts a search over possible models according to AIC. See `auto.arima` for details.
`drift`	Indicate whether the ARIMA model should include a linear drift term or not. Type: logical value. If `drift = NULL`, it will be estimate automatically.
`tau`	The level of female life expectancy at which the sex-gap is expected to stop widening and to start narrowing. If `NULL` then the model will run an algorithm to find it.
`A`	The level of female life expectancy where we assume no further change in the sex-gap. If `NULL` the model will estimate it.

Value

The output is of "DoubleGap" class with the components:

input	List with arguments provided in input. Saved for convenience.
call	Short information about the model.
coefficients	Estimated coefficients.
fitted.values	Fitted values of the selected model.
observed.values	Country specific observed values.
model.parts	Object containing detailed results of the fitted model.
residuals	Deviance residuals.

Author(s)

Marius D. Pascariu

References

Pascariu M.D., Canudas-Romo V. and Vaupel W.J. 2017. The double-gap life expectancy forecasting model. Insurance: Mathematics and Economics Volume 78, January 2018, Pages 339-350.

See Also

predict.DoubleGap

Examples

```
# Input data ----------------------------------
# Collection of life expectancies for female populations
exF <- MortalityGaps.data$exF
# Life expectancy for male populations
exM <- MortalityGaps.data$exM

# Example 1 -----------------------------------------------
# Fit DG model at age 0 for Australia using data from 1950 to 2014
M0 <- DoubleGap(DF = exF,
                DM = exM,
                age = 0,
                country = "AUS",
                years = 1950:2014)
M0
summary(M0)
ls(M0)

# Forecast life expectancy in Australia until 2030
P0 <- predict(M0, h = 16)
P0
# Plot the results
plot(P0)
```

```
## Not run:
# Example 2 ---------------------------------------------
# Fit DG model at age 0 for Sweden. Provide details about models.
# Reproduce published results in the article.
M1 <- DoubleGap(DF = exF,
                DM = exM,
                age = 0,
                country = "SWE",
                years = 1950:2014,
                arima.order = c(2, 1, 1),
                drift = TRUE,
                tau = 75,
                A = 86)
summary(M1)
# Predict model
P1 <- predict(M1, h = 36)
plot(P1)

# Example 3 ---------------------------------------------
# Fit DG model for USA at age 65.
M2 <- DoubleGap(DF = exF,
                DM = exM,
                age = 65,
                country = "USA",
                years = 1950:2014,
                arima.order = c(0, 1, 0),
                drift = FALSE,
                tau = 15,
                A = 24)
summary(M2)
# Predict model
P2 <- predict(M2, h = 36)
plot(P2)

## End(Not run)
```

`MortalityGaps.data` *DATA - for testing purposes*

Description

Dataset containing records of life expectancy at birth and at age 65 for female and male populations living in 38 countries between 1950 and 2014. This dataset is used in Pascariu et. al (2017) article. The data is provided in the package for testing purposes and to ensure the reproducibility of the results and figures published in the article. By the time you are using it, it may be outdated. Download actual demographic data free of charge from Human Mortality Database. Once a username and a password is created on the website the MortalityLaws R package can be used to extract data directly into your R console.

Usage

```
MortalityGaps.data
```

Format

An object of class `MortalityGaps.data` of length 2.

Source

Human Mortality Database

`plot.predict.DoubleGap` *Generic Plot Function for Class predict.DoubleGap*

Description

Generic Plot Function for Class predict.DoubleGap

Usage

```
## S3 method for class 'predict.DoubleGap'
plot(x, show.legend = TRUE, ylim = NULL,
  asp = 1.8, xlab = "\nYear", ylab = "\nLife Expectancy Level", ...)
```

Arguments

`x`	An object of class `predict.DoubleGap`
`show.legend`	Logical. Indicate whether to display the legend or not. Default: TRUE.
`ylim`	Numeric vectors of length 2, giving the x and y coordinates ranges.
`asp`	Numeric, giving the aspect ratio y/x.
`xlab`	A title for the x axis: see `title`.
`ylab`	A title for the y axis: see `title`.
`...`	Further graphical parameters as in `par`.

Author(s)

Marius D. Pascariu

See Also

`DoubleGap`

Examples

```
# Complete examples are provided in help page of the DoubleGap function.
```

predict.DoubleGap *Generic Predict Function for Class* DoubleGap

Description

Predict DoubleGap model

Usage

```
## S3 method for class 'DoubleGap'
predict(object, h, iter = 500, ci = c(0.8, 0.95), ...)
```

Arguments

object	An object of class DoubleGap.
h	Number of periods for forecasting.
iter	Number of iterations. Default: 500
ci	Confidence levels. Default: c(0.8, 0.95)
...	Additional arguments affecting the predictions produced.

Value

A list containing predicted value of best-practice life expectancy, best-practice gap, sex gap, and forecast life expectancy for females and males (together with prediction intervals).

Author(s)

Marius D. Pascariu

See Also

DoubleGap

Examples

```
# Complete examples are provided in help page of the DoubleGap function.
```

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