Package 'ineqJD'

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Description Computes and decomposes Gini, Bonferroni and Zenga 2007 point and synthetic concentration indexes. Decompositions are intended: by sources, by subpopulations and by sources and subpopulations jointly. References, Zenga M. M.(2007) <doi:10.1400/209575> Zenga M. (2015) <doi:10.1400/246627> Zenga M., Valli I. (2017) <doi:1

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bonferroni *Point and synthetic Bonferroni indexes*

Description

Computes the decomposition of the Bonferroni point inequality indexes of a statistical variable Y described in the object x.

Usage

```
bonferroni(x)
```

Arguments

x	An object of class "dataProcessed". x is usually the result of dataProcessing function. More details are given in the "Details" section and dataProcessing help page.

Details

bonferroni computes the decomposition of the Bonferroni point inequality indexes from the object x of class "dataProcessed". x is usually the result of dataProcessing function.

Value

index	String denoting computed index.
decomposition	Array containing the decompositions. The dimensions of decomposition are c(g,g,r,s) where g is the number of groups, r the number of different values of Y and s the number of sources.
x	Object of class dataProcessed passed as input.

Author(s)

Alberto Arcagni, Igor Valli.

References

Zenga M., Valli I. (2017). Joint decomposition by Subpopulations and Sources of the Point and Synthetic Bonferroni Inequality Measures. Statistics and Applications, XV (2), pp. 83-120.

See Also

gini and zenga for other inequality indexes and dataProcessing for the class "dataProcessed".

Examples

```
G <- c(1, 2, 3, 1, 2, 3, 1, 1, 2, 3, 3, 3) # vector denoting group membership
X1 <- c(0, 0, 0, 500, 700, 300, 750, 1000, 500, 500, 500, 1000) # vector of the first source
X2 <- c(0, 0, 0, 500, 300, 700, 750, 500, 700, 700, 1000,600) # vector of the second source
data <- data.frame(G, X1, X2) # no sample weights are considered
x <- dataProcessing( # data preparation
  units = data[, c('X1', 'X2')],
  groups = data[, 'G'],
)

decomposition <- bonferroni(x)
decomposition
```

`dataProcessing` *Data Processing*

Description

Convert raw data to frequency distribution framework and returns cumulative sums.

Usage

```
dataProcessing(
  units,
  groups = rep("G1", nrow(as.matrix(units))),
  weights = rep(1, nrow(as.matrix(units)))
)
```

Arguments

`units`	Numeric vector of length `n` or matrix of dimension `c(n,s)` containing `s` sources referred to `n` statistical units
`groups`	Vector of length `n` of group membership. If empty only one group is considered, otherwise the number of groups `g` is defined by the number of distinct values or levels in this vector.
`weights`	Vector of lweights of length `n`. If empty uniform weights are considered.

Details

`dataProcessing` convert raw data in the frequency distribution framework with `r` distinct values of Y. In this way repeated values are removed as well as ordering issues. Moreover cumulative frequencies and cumulative sources values are evaluated in order to prepare data for inequality decompositions.

Value

`yh`	Vector of length `r` of distinct values of Y.
`Phl`	Matrix of absolute cumulative frequencies of dimension `c(r,g)`.
`Qhlk`	Array of cumulative sum of sources of dimension `c(r,g,s)`.

Author(s)

Alberto Arcagni, Igor Valli

References

Zenga M.M. (2007). Inequality curve and inequality index based on the ratios between lower and upper means. Statistica and Applicazioni, V(1), 3-27

Examples

```
G <- c(1, 2, 3, 1, 2, 3, 1, 1, 2, 3, 3, 3) # vector denoting group membership
X1 <- c(0, 0, 0, 500, 700, 300, 750, 1000, 500, 500, 500, 1000) # vector of the first source
X2 <- c(0, 0, 0, 500, 300, 700, 750, 500, 700, 700, 1000,600) # vector of the second source
data <- data.frame(G, X1, X2) # no sample weights are considered

x <- dataProcessing(
  units = data[, c('X1', 'X2')],
  groups = data[, 'G'],
)
x
```

`gini` *Point and synthetic Gini indexes*

Description

Computes point and synthetic Gini indexes on a variable Y.

Usage

```
gini(x)
```

Arguments

`x`	List containing: `'yh'`, the vector of unique values of the variable Y whose Bonferroni index is computed; `'Phl'`, the matrix of absoute cumulative frequencies; `'Qhlk'`, the matrix of cumlative sums of Y or its sources. `x` is usually the result of `dataProcessing` function. More details are given in the "Details" section and `dataProcessing` help page.

Details

`gini` compute point and synthetic Gini indexes on a variable `y`, e.g. income, on a statistical population that could be partitioned in `g` subpopultions and could be considered as sum of `c` sources, e.g. income sources.

Value

index	String denoting computed index.
decomposition	array containing the decompositions.
x	object usually of class dataProcessed passed as input.

Author(s)

Alberto Arcagni, Igor Valli.

References

Zenga M., Valli I. (2018). Joint decomposition by Subpopulations and Sources of the Point and Synthetic Gini Indexes. Statistics and Applications, XVI (1).

Examples

```
G <- c(1, 2, 3, 1, 2, 3, 1, 1, 2, 3, 3, 3) # vector denoting group membership
X1 <- c(0, 0, 0, 500, 700, 300, 750, 1000, 500, 500, 500, 1000) # vector of the first source
X2 <- c(0, 0, 0, 500, 300, 700, 750, 500, 700, 700, 1000,600) # vector of the second source
data <- data.frame(G, X1, X2) # no sample weights are considered
x <- dataProcessing( # data preparation
  units = data[, c('X1', 'X2')],
  groups = data[, 'G'],
)

decomposition <- gini(x)
decomposition
```

---

inequalityCurves *Inequality curves evaluation*

Description

Generates step-functions (see stepfun) representing inequality curves or sources/subpopulations point contributions in the decomposition x generated by functions gini, bonferroni or zenga.

Usage

```
inequalityCurves(x, ...)
## S3 method for class 'decomposition'
inequalityCurves(x, l = 1:dim(x$decomposition)[2], k = 1:dim(x$decomposition)[4], ...)
```

Arguments

x	An object of class decomposition output of functions gini, bonferroni, zenga.
l	Vector of selected subpopulations. If only one subpopulation is selected the resulting step function provides its point contributions. More than one subpopulation can be selected and contributions are cumulated. If empty all subpopulations are considered and contributions are marginalized by subpopulations.
k	Vector of selected sources. If only one source is selected the resulting step function provides its point contributions. More than one source can be selected and contributions are cumulated. If empty all sources are considered and contributions are marginalized by sources.
...	Potentially further arguments (required by the generic).

Details

By default generates step functions representing inequality curves of the whole population. If arguments l and/or k are defined, resuts are step functions representing point contributions of the selected subpopulations and/or sources.

The class of the result is "inequality_curves" that is associated to the method plot.inequality_curves for graphical representations. Such derived class hinerits the features of the "stepfun" class.

Value

An object of class "inequality_curves" hineriting the features of class "stepfun" with the following additional attributes:

index	String denoting computed index.
min, max	The range of values assumed by the function.
groups	Vector of names of the subpopulations partitioning the whole population .
sources	Vector of names of the all the sources that sum to the total variable Y.
selected_groups	Vector of names of the selected subpopulations to evaluate the point contributions.
selected_sources	Vector of names of the selected sources to evaluate the point contributions.

Author(s)

Alberto Arcagni, Igor Valli

References

Zenga M. M.(2007). Inequality Curve and Inequality Index based on the Ratios between llower and upper Means . Statistica and Applicazioni, V (1), 3-27.

Zenga M. (2015) Joint decomposition by subpopulations and sources of the point and synthetic Zenga(2007) Index I(Y). Statistica and Applicazioni, XIII (2), pp.163-195.

Zenga M., Valli I. (2017). Joint decomposition by Subpopulations and Sources of the Point and Synthetic Bonferroni Inequality Measures. Statistics and Applications, XV (2), pp. 83-120.

Zenga M., Valli I. (2018). Joint decomposition by Subpopulations and Sources of the Point and Synthetic Gini Indexes. Statistics and Applications, XVI (1).

See Also

See gini, bonferroni, zenga to obtain objects of class decomposition and see plot.inequality_curves for the graphical representation.

Examples

```
G <- c(1, 2, 3, 1, 2, 3, 1, 1, 2, 3, 3, 3) # vector denoting group membership
X1 <- c(0, 0, 0, 500, 700, 300, 750, 1000, 500, 500, 500, 1000) # vector of the first source
X2 <- c(0, 0, 0, 500, 300, 700, 750, 500, 700, 700, 1000,600) # vector of the second source
data <- data.frame(G, X1, X2) # no sample weights are considered
x <- dataProcessing( # data preparation
  units = data[, c('X1', 'X2')],
  groups = data[, 'G'],
)
decomposition <- zenga(x)

ic <- inequalityCurves(decomposition)
ic
contrib1 <- inequalityCurves(decomposition, l = 1)
contrib1
contrib12 <- inequalityCurves(decomposition, l = 1:2)
contrib12
```

---

plot.inequality_curves

Plot inequality curves

Description

Method of the generic plot for objects generated by the function inequalityCurves.

Usage

```
## S3 method for class 'inequality_curves'
plot(
  x,
  pch = 16,
  from = 0,
  to = 1,
  xlim = NULL,
  ylim = NULL,
  xaxs = "i",
  yaxs = "i",
  xlab = "p",
  ylab = NULL,
```

```
  main = attributes(x)$index,
  sub = paste0(
    "grp: ",
    paste(attributes(x)$groups, collapse = ", "),
    "; src: ",
    paste(attributes(x)$sources, collapse = ", ")
  ),
  ...
)
```

Arguments

x	Object of class "decomposition".
pch	A vector of plotting characters or symbols: see points.
from, to	The range over which the function will be plotted.
xlim	The x limits (x1, x2) of the plot. The default value, NULL, indicates that the range of the function should be used.
ylim	the y limits of the plot.
xaxs	The style of axis interval calculation to be used for the x-axis. See par for details.
yaxs	The style of axis interval calculation to be used for the y-axis. See xaxs above.
xlab	a title for the x axis: see title.
ylab	a title for the y axis: see title.
main	an overall title for the plot: see title.
sub	a sub title for the plot: see title.
...	Arguments to be passed to methods, such as graphical parameters (see par). Many methods will accept the following arguments:

Details

This method is a convenience wrapper for plotting inequality curves. Default values of the plot are modified in order to plot inequality curves in the unitary square. Moreover, the default value of the argument sub shows in the plot if the curve represents the whole inequality or a contribution.

Value

The same output of the function plot.stepfun, a list with two components:

t	abscissa (x) values, including the two outermost ones.
y	y values 'in between' the t[].

Author(s)

Alberto Arcagni, Igor Valli

References

Zenga M. M.(2007). Inequality Curve and Inequality Index based on the Ratios between llower and upper Means . Statistica and Applicazioni, V (1), 3-27.

Zenga M. (2015) Joint decomposition by subpopulations and sources of the point and synthetic Zenga(2007) Index I(Y). Statistica and Applicazioni, XIII (2), pp.163-195.

Zenga M., Valli I. (2017). Joint decomposition by Subpopulations and Sources of the Point and Synthetic Bonferroni Inequality Measures. Statistics and Applications, XV (2), pp. 83-120.

Zenga M., Valli I. (2018). Joint decomposition by Subpopulations and Sources of the Point and Synthetic Gini Indexes. Statistics and Applications, XVI (1).

See Also

plot, graphical parameters, par, plot.stepfun, inequalityCurves

Examples

```
G <- c(1, 2, 3, 1, 2, 3, 1, 1, 2, 3, 3, 3) # vector denoting group membership
X1 <- c(0, 0, 0, 500, 700, 300, 750, 1000, 500, 500, 500, 1000) # vector of the first source
X2 <- c(0, 0, 0, 500, 300, 700, 750, 500, 700, 700, 1000,600) # vector of the second source
data <- data.frame(G, X1, X2) # no sample weights are considered
x <- dataProcessing( # data preparation
  units = data[, c('X1', 'X2')],
  groups = data[, 'G'],
)
decomposition <- zenga(x)
ic <- inequalityCurves(decomposition)
contrib1 <- inequalityCurves(decomposition, l = 1)
contrib12 <- inequalityCurves(decomposition, l = 1:2)

plot(ic)
plot(contrib1, add = TRUE)
plot(contrib12, add = TRUE)
text(0.1, 1/6+0:2/3, labels = c("G1", "G2", "G3"))
```

---

summary.decomposition *Summarizing inequality decomposition*

Description

summary method for class "decomposition".

Usage

```
## S3 method for class 'decomposition'
summary(object, ...)
## S3 method for class 'summary.decomposition'
print(x, ...)
```

Arguments

object	An object of class "decomposition", usually, as result of a call to gini, bonferroni and zenga.
x	rtrtrt
...	further arguments passed to or from other methods.

Details

summary.decomposition method use

Value

index	String denoting computed index.
joint	Array of joint decompositions by sources and subpopulations.
pairs	Matrix of decompositions by subpopulations.
within	Vector of within part to the overall inequality. It denotes the part of the overall inequality derived from the inequality inside each subpopulation.
between	Vector of between part to the overall inequality. It denotes the part of the overall inequality derived from the comparison between subpopulations.
groups	Vector of subpopulations contribution to the overall inequality.
groups_sources	Matrix of subpopulations contributions for each source to the overall inequality.
sources	Vector of sources contribution to the overall inequality.
synthetic	Scalar denoting the value of the synthetic index.

Author(s)

Alberto Arcagni, Igor Valli.

References

Zenga M. M.(2007). Inequality Curve and Inequality Index based on the Ratios between llower and upper Means . Statistica and Applicazioni, V (1), 3-27.

Zenga M. (2015) Joint decomposition by subpopulations and sources of the point and synthetic Zenga(2007) Index I(Y). Statistica and Applicazioni, XIII (2), pp.163-195.

Zenga M., Valli I. (2017). Joint decomposition by Subpopulations and Sources of the Point and Synthetic Bonferroni Inequality Measures. Statistics and Applications, XV (2), pp. 83-120.

Zenga M., Valli I. (2018). Joint decomposition by Subpopulations and Sources of the Point and Synthetic Gini Indexes. Statistics and Applications, XVI (1).

See Also

gini, bonferroni, zenga, dataProcessing.

Examples

```
G <- c(1, 2, 3, 1, 2, 3, 1, 1, 2, 3, 3, 3) # vector denoting group membership
X1 <- c(0, 0, 0, 500, 700, 300, 750, 1000, 500, 500, 500, 1000) # vector of the first source
X2 <- c(0, 0, 0, 500, 300, 700, 750, 500, 700, 700, 1000,600) # vector of the second source
data <- data.frame(G, X1, X2) # no sample weights are considered
x <- dataProcessing( # data preparation
  units = data[, c('X1', 'X2')],
  groups = data[, 'G'],
)
decomposition <- zenga(x)

summary(decomposition)
```

---

zenga *Point and synthetic Zenga 2007 indexes*

Description

Computes point and synthetic Zenga 2007 indexes on a variable Y.

Usage

```
zenga(x)
```

Arguments

x	List containing: 'yh', the vector of unique values of the variable Y whose Bonferroni index is computed; 'Phl', the matrix of absoute cumulative frequencies; 'Qhlk', the matrix of cumlative sums of y or its sources. x is usually the result of dataProcessing function. More details are given in the "Details" section and dataProcessing help page.

Details

zenga compute point and synthetic Zenga 2007 indexes on a variable y, e.g. income, on a statistical population that could be partitioned in g subpopultions and could be considered as sum of c sources, e.g. income sources.

Value

index	String denoting computed index.
decomposition	Array containing the decompositions.
x	Object usually of class dataProcessed passed as input.

Author(s)

Alberto Arcagni, Igor Valli

References

Zenga M. M.(2007). Inequality Curve and Inequality Index based on the Ratios between lower and upper means . Statistica and Applicazioni, V (1), 3-27.

Zenga M. (2015) Joint decomposition by subpopulations and sources of the point and synthetic Zenga(2007) Index I(Y). Statistica and Applicazioni, XIII (2), pp.163-195.

Examples

```
G <- c(1, 2, 3, 1, 2, 3, 1, 1, 2, 3, 3, 3) # vector denoting group membership
X1 <- c(0, 0, 0, 500, 700, 300, 750, 1000, 500, 500, 500, 1000) # vector of the first source
X2 <- c(0, 0, 0, 500, 300, 700, 750, 500, 700, 700, 1000,600) # vector of the second source
data <- data.frame(G, X1, X2) # no sample weights are considered
x <- dataProcessing( # data preparation
  units = data[, c('X1', 'X2')],
  groups = data[, 'G'],
)

decomposition <- zenga(x)
decomposition
```

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