Package 'Compind'

June 27, 2016

Type Package

Title Composite Indicators Functions

Version 1.1.2

Date 2016-06-21

Author Francesco Vidoli, Elisa Fusco

Maintainer Francesco Vidoli <fvidoli@gmail.com>

Description Contains several functions to enhance approaches to the Composite Indicators methods, focusing, in particular, on the normalisation and weighting-aggregation steps.

Depends Benchmarking, psych, boot

Imports Hmisc, MASS, GPArotation, lpSolve, nonparaeff

License GPL-3

Suggests R.rsp

VignetteBuilder R.rsp

NeedsCompilation no

Repository CRAN

Date/Publication 2016-06-27 13:07:48

R topics documented:

Compind-package 2
ci_bod 3
ci_bod_dir 5
ci_bod_var_w 6
ci_bod_vrs 7
ci_factor 8
ci_mean_geom 10
ci_mean_min 11
ci_mpi 12
ci_rbod 13
ci_rbod_dir 14
ci_wroclaw 15

EU_2020 17
EU_NUTS1 18
normalise_ci 19

Index **21**

`Compind-package` *Composite Indicators - Compind*

Description

Compind package contains functions to enhance several approaches to the Composite Indicators (CIs) methods, focusing, in particular, on the normalisation and weighting-aggregation steps.

Details

Package:	Compind
Type:	Package
Version:	0.1
Date:	2014-01-01
Depends:	Benchmarking, Hmisc, MASS, ggplot2, psych, GPArotation, lpSolve, nonparaeff, boot
License:	GPL-3
Built:	R 3.0.2; ; 2014-02-06 13:14:40 UTC; unix

Index:

`Compind-package`	`Composite Indicators - Compind`
`EU_2020`	`Europe 2020 indicators`
`EU_NUTS1`	`EU NUTS1 Transportation data`
`ci_bod`	`Benefit of the Doubt approach (BoD)`
`ci_bod_dir`	`Directional Benefit of the Doubt (D-BoD) model`
`ci_bod_var_w`	`Variance weighted Benefit of the Doubt approach (BoD variance weighted)`
`ci_factor`	`Weighting method based on Factor Analysis`
`ci_mean_geom`	`Weighting method based on geometric aggregation`
`ci_mpi`	`Mazziotta-Pareto Index (MPI) method`
`ci_rbod`	`Robust Benefit of the Doubt approach (RBoD)`
`ci_rbod_dir`	`Directional Robust Benefit of the Doubt approach (D-RBoD)`
`ci_wroclaw`	`Wroclaw Taxonomic Method`
`normalise_ci`	`Normalisation and polarity functions`
`plot_influent`	`Plot influents units in terms of horizontal mean and variability`

Author(s)

Francesco Vidoli, Elisa Fusco Maintainer: Francesco Vidoli <fvidoli@gmail.com>

References

Daraio, C., Simar, L. "*Introducing environmental variables in nonparametric frontier models: a probabilistic approach*", Journal of productivity analysis, 2005, 24(1), 93?121.

Fusco E., "*Enhancing non compensatory composite indicators: A directional proposal*", 2013, unpublished.

OECD, "*Handbook on constructing composite indicators: methodology and user guide*", 2008.

Mazziotta C., Mazziotta M., Pareto A., Vidoli F., "*La sintesi di indicatori territoriali di dotazione infrastrutturale: metodi di costruzione e procedure di ponderazione a confronto*", Rivista di Economia e Statistica del territorio, n.1, 2010.

Melyn W. and Moesen W.W., "*Towards a synthetic indicator of macroeconomic performance: unequal weighting when limited information is available*", Public Economic research Paper 17, CES, KU Leuven, 1991.

Simar L., Vanhems A., "*Probabilistic characterization of directional distances and their robust versions*", Journal of Econometrics, 2012, 166(2), 342?354.

UNESCO, "*Social indicators: problems of definition and of selection*", Paris 1974.

Vidoli F., Fusco E., Mazziotta C., "*Non-compensability in composite indicators: a robust directional frontier method*", Social Indicators Research, Springer Netherlands.

Vidoli F., Mazziotta C., "*Robust weighted composite indicators by means of frontier methods with an application to European infrastructure endowment*", Statistica Applicata, Italian Journal of Applied Statistics, 2013.

`ci_bod` *Benefit of the Doubt approach (BoD)*

Description

Benefit of the Doubt approach (BoD) is the application of Data Envelopment Analysis (DEA) to the field of composite indicators. It was originally proposed by Melyn and Moesen (1991) to evaluate macroeconomic performance.

Usage

```
ci_bod(x,indic_col)
```

Arguments

`x`	A data.frame containing simple indicators.
`indic_col`	A numeric list indicating the positions of the simple indicators.

Value

An object of class "CI". This is a list containing the following elements:

`ci_bod_est`	Composite indicator estimated values.
`ci_method`	Method used; for this function ci_method="bod".
`ci_bod_weights`	Raw weights assigned to the simple indicators (Dual values - prices - in the DUAL Dea formulation).

Author(s)

Vidoli F.

References

OECD, *Handbook on constructing composite indicators: methodology and user guide*, 2008.

Melyn W. and Moesen W.W., "*Towards a synthetic indicator of macroeconomic performance: unequal weighting when limited information is available*", Public Economic research Paper 17, CES, KU Leuven, 1991.

Witte, K. D., Rogge, N. "*Accounting for exogenous influences in a benevolent performance evaluation of teachers*". Tech. rept. Working Paper Series ces0913, Katholieke Universiteit Leuven, Centrum voor Economische Studien, 2009.

See Also

`ci_bod_dir`,`ci_rbod`

Examples

```
i1 <- seq(0.3, 0.5, len = 100) - rnorm (100, 0.2, 0.03)
i2 <- seq(0.3, 1, len = 100)   - rnorm (100, 0.2, 0.03)
Indic = data.frame(i1, i2)
CI = ci_bod(Indic)
 # validating BoD score
w = CI$ci_bod_weights
Indic[,1]*w[,1] + Indic[,2]*w[,2]


data(EU_NUTS1)
data_norm = normalise_ci(EU_NUTS1,c(2:3),polarity = c("POS","POS"), method=2)
CI = ci_bod(data_norm$ci_norm,c(1:2))
```

ci_bod_dir *Directional Benefit of the Doubt (D-BoD) model*

Description

Directional Benefit of the Doubt (D-BoD) model enhance non-compensatory property by introducing directional penalties in a standard BoD model in order to consider the preference structure among simple indicators.

Usage

```
ci_bod_dir(x, indic_col, dir)
```

Arguments

x	A data.frame containing score of the simple indicators.
indic_col	Simple indicators column number.
dir	Main direction. For example you can set the average rates of substitution.

Value

An object of class "CI". This is a list containing the following elements:

ci_bod_dir_est	Composite indicator estimated values.
ci_method	Method used; for this function ci_method="bod_dir".

Author(s)

Vidoli F., Fusco E.

References

Fusco E., *Enhancing non compensatory composite indicators: A directional proposal*, 2013, unpublished

See Also

ci_bod, ci_rbod

Examples

```
i1 <- seq(0.3, 0.5, len = 100) - rnorm (100, 0.2, 0.03)
i2 <- seq(0.3, 1, len = 100)   - rnorm (100, 0.2, 0.03)
Indic = data.frame(i1, i2)
CI = ci_bod_dir(Indic,dir=c(1,1))

data(EU_NUTS1)
data_norm = normalise_ci(EU_NUTS1,c(2:3),polarity = c("POS","POS"), method=2)
CI = ci_bod_dir(data_norm$ci_norm,c(1:2),dir=c(1,0.5))
```

`ci_bod_var_w` *Variance weighted Benefit of the Doubt approach (BoD variance weighted)*

Description

Variance weighted Benefit of the Doubt approach (BoD variance weighted) is a particular form of BoD method with additional information in the optimization problem. In particular it has been added weight constraints (in form of an Assurance region type I (AR I)) endogenously determined in order to take into account the ratio of the vertical variability of each simple indicator relative to one another.

Usage

```
ci_bod_var_w(x,indic_col,boot_rep = 5000)
```

Arguments

`x`	A data.frame containing score of the simple indicators.
`indic_col`	Simple indicators column number.
`boot_rep`	The number of bootstrap replicates (default=5000) for the estimates of the non-parametric bootstrap (first order normal approximation) confidence intervals for the variances of the simple indicators.

Details

For more informations about the estimation of the confidence interval for the variances, please see function *boot.ci*, package *boot*.

Value

An object of class "CI". This is a list containing the following elements:

`ci_bod_var_w_est`	Composite indicator estimated values.
`ci_method`	Method used; for this function ci_method="bod_var_w".

Author(s)

Vidoli F.

References

Vidoli F., Mazziotta C., "*Robust weighted composite indicators by means of frontier methods with an application to European infrastructure endowment*", Statistica Applicata, Italian Journal of Applied Statistics, 2013.

See Also

ci_bod, ci_rbod

Examples

```
i1 <- seq(0.3, 0.5, len = 100) - rnorm (100, 0.2, 0.03)
i2 <- seq(0.3, 1, len = 100)   - rnorm (100, 0.2, 0.03)
Indic = data.frame(i1, i2)
CI = ci_bod_var_w(Indic)
```

---

ci_bod_vrs *Benefit of the Doubt approach (BoD) VRS*

Description

Benefit of the Doubt approach (BoD) is the application of Data Envelopment Analysis (DEA) to the field of composite indicators. It was originally proposed by Melyn and Moesen (1991) to evaluate macroeconomic performance.

Usage

```
ci_bod_vrs(x,indic_col)
```

Arguments

x	A data.frame containing simple indicators.
indic_col	A numeric list indicating the positions of the simple indicators.

Value

An object of class "CI". This is a list containing the following elements:

ci_bod_vrs_est	Composite indicator estimated values.
ci_method	Method used; for this function ci_method="bod_vrs".
ci_bod_vrs_weights	Raw weights assigned to the simple indicators (Dual values - prices - in the DUAL Dea formulation).

Author(s)

Vidoli F.

References

OECD, *Handbook on constructing composite indicators: methodology and user guide*, 2008.

Melyn W. and Moesen W.W., "*Towards a synthetic indicator of macroeconomic performance: unequal weighting when limited information is available*", Public Economic research Paper 17, CES, KU Leuven, 1991.

Witte, K. D., Rogge, N. "*Accounting for exogenous influences in a benevolent performance evaluation of teachers*". Tech. rept. Working Paper Series ces0913, Katholieke Universiteit Leuven, Centrum voor Economische Studien, 2009.

See Also

ci_bod,ci_rbod

Examples

```
i1 <- seq(0.3, 0.5, len = 100) - rnorm (100, 0.2, 0.03)
i2 <- seq(0.3, 1, len = 100)   - rnorm (100, 0.2, 0.03)
Indic = data.frame(i1, i2)
CI = ci_bod_vrs(Indic)
 # validating BoD score
w = CI$ci_bod__vrs_weights
Indic[,1]*w[,1] + Indic[,2]*w[,2]


data(EU_NUTS1)
data_norm = normalise_ci(EU_NUTS1,c(2:3),polarity = c("POS","POS"), method=2)
CI = ci_bod_vrs(data_norm$ci_norm,c(1:2))
```

---

ci_factor *Weighting method based on Factor Analysis*

Description

Factor analysis groups together collinear simple indicators to estimate a composite indicator that captures as much as possible of the information common to individual indicators.

Usage

```
ci_factor(x,indic_col,method="ONE",dim)
```

Arguments

x	A data.frame containing score of the simple indicators.
indic_col	Simple indicators column number.

method	If method = "ONE" (default) the composite indicator estimated values are equal to first component scores; if method = "ALL" the composite indicator estimated values are equal to component score multiplied by its proportion variance; if method = "CH" it can be choose the number of the component to take into account.
dim	Number of chosen component (if method = "CH", default is 3).

Value

An object of class "CI". This is a list containing the following elements:

ci_factor_est	Composite indicator estimated values.
loadings_fact	Variance explained by principal factors (in percentage terms).
ci_method	Method used; for this function ci_method="factor".

Author(s)

Vidoli F.

References

OECD, *Handbook on constructing composite indicators: methodology and user guide*, 2008

See Also

ci_bod, ci_mpi

Examples

```
i1 <- seq(0.3, 0.5, len = 100) - rnorm (100, 0.2, 0.03)
i2 <- seq(0.3, 1, len = 100)   - rnorm (100, 0.2, 0.03)
Indic = data.frame(i1, i2)
CI = ci_factor(Indic)

data(EU_NUTS1)
CI = ci_factor(EU_NUTS1,c(2:3), method="ALL")

data(EU_2020)
data_norm = normalise_ci(EU_2020,c(47:51),polarity = c("POS","POS","POS","POS","POS"), method=2)
CI3 = ci_factor(data_norm$ci_norm,c(1:5),method="CH", dim=3)
```

`ci_mean_geom` *Weighting method based on geometric aggregation*

Description

Geometric aggregation lets to bypass the full compensability hypothesis using geometric mean.

Usage

```
ci_mean_geom(x, indic_col, na.rm=TRUE)
```

Arguments

`x`	A data.frame containing simple indicators.
`indic_col`	Simple indicators column number.
`na.rm`	Remove NA values before processing; default is TRUE.

Value

An object of class "CI". This is a list containing the following elements:

`ci_mean_geom_est`	Composite indicator estimated values.
`ci_method`	Method used; for this function ci_method="mean_geom".

Author(s)

Vidoli F.

References

OECD, *Handbook on constructing composite indicators: methodology and user guide*, 2008.

See Also

`ci_bod`, `ci_factor`

Examples

```
i1 <- seq(0.3, 0.5, len = 100) - rnorm (100, 0.2, 0.03)
i2 <- seq(0.3, 1, len = 100)   - rnorm (100, 0.2, 0.03)
Indic = data.frame(i1, i2)
CI = ci_mean_geom(Indic)

data(EU_NUTS1)
CI = ci_mean_geom(EU_NUTS1,c(2:3))
```

ci_mean_min *Mean-Min Function*

Description

The Mean-Min Function (MMF) is an intermediate case between arithmetic mean, according to which no unbalance is penalized, and min function, according to which the penalization is maximum. It depends on two parameters that are respectively related to the intensity of penalization of unbalance (α) and intensity of complementarity (β) among indicators.

Usage

```
ci_mean_min(x, indic_col, alpha, beta)
```

Arguments

x	A data.frame containing simple indicators.
indic_col	Simple indicators column number.
alpha	The intensity of penalisation of unbalance among indicators, $0 \leq \alpha \leq 1$
beta	The intensity of complementarity among indicators, $\beta \geq 0$

Value

An object of class "CI". This is a list containing the following elements:

ci_mean_min_est	Composite indicator estimated values.
ci_method	Method used; for this function ci_method="mean_min".

Author(s)

Vidoli F.

References

Casadio Tarabusi, E., & Guarini, G. (2013) "*An unbalance adjustment method for development indicators*", Social indicators research, 112(1), 19-45.

See Also

ci_mpi, normalise_ci

Examples

```
data(EU_NUTS1)
data_norm = normalise_ci(EU_NUTS1,c(2:3),c("NEG","POS"),method=2)
CI = ci_mean_min(data_norm$ci_norm, alpha=0.5, beta=1)
```

`ci_mpi` *Mazziotta-Pareto Index (MPI) method*

Description

Mazziotta-Pareto Index (MPI) is a non-linear composite index method which transforms a set of individual indicators in standardized variables and summarizes them using an arithmetic mean adjusted by a "penalty" coefficient related to the variability of each unit (method of the coefficient of variation penalty).

Usage

```
ci_mpi(x, indic_col, penalty="POS")
```

Arguments

`x`	A data.frame containing simple indicators.
`indic_col`	Simple indicators column number.
`penalty`	Penalty direction; Use "POS" (default) in case of 'increasing' or 'positive' composite index (e.g., well-being index)), "NEG" in case of 'decreasing' or 'negative' composite index (e.g., poverty index).

Value

An object of class "CI". This is a list containing the following elements:

`ci_mpi_est`	Composite indicator estimated values.
`ci_method`	Method used; for this function ci_method="mpi".

Author(s)

Vidoli F.

References

De Muro P., Mazziotta M., Pareto A. (2011), "*Composite Indices of Development and Poverty: An Application to MDGs*", Social Indicators Research, Volume 104, Number 1, pp. 1-18.

See Also

`ci_bod`, `normalise_ci`

Examples

```
data(EU_NUTS1)

# Please, pay attention. MPI can be calculated only with two standardizations methods:
# Classic MPI - method=1, z.mean=100 and z.std=10
# Correct MPI - method=2
# For more info, please see references.

data_norm = normalise_ci(EU_NUTS1,c(2:3),c("NEG","POS"),method=1,z.mean=100, z.std=10)
CI = ci_mpi(data_norm$ci_norm, penalty="NEG")

data(EU_NUTS1)
CI = ci_mpi(EU_NUTS1,c(2:3),penalty="NEG")
```

---

ci_rbod *Robust Benefit of the Doubt approach (RBoD)*

Description

Robust Benefit of the Doubt approach (RBoD) is the robust version of the BoD method. It is based on the concept of the expected minimum input function of order-*m* so "*in place of looking for the lower boundary of the support of F, as was typically the case for the full-frontier (DEA or FDH), the order-m efficiency score can be viewed as the expectation of the maximal score, when compared to m units randomly drawn from the population of units presenting a greater level of simple indicators*", Daraio and Simar (2005).

Usage

```
ci_rbod(x,indic_col,M,B)
```

Arguments

x	A data.frame containing score of the simple indicators.
indic_col	Simple indicators column number.
M	The number of elements in each of the bootstrapped samples.
B	The number of bootstrap replicates.

Value

An object of class "CI". This is a list containing the following elements:

ci_rbod_est	Composite indicator estimated values.
ci_method	Method used; for this function ci_method="rbod".

Author(s)

Vidoli F.

References

Daraio, C., Simar, L. "*Introducing environmental variables in nonparametric frontier models: a probabilistic approach*", Journal of productivity analysis, 2005, 24(1), 93 - 121.

Vidoli F., Mazziotta C., "*Robust weighted composite indicators by means of frontier methods with an application to European infrastructure endowment*", Statistica Applicata, Italian Journal of Applied Statistics, 2013.

See Also

ci_bod, ci_bod_var_w

Examples

```
i1 <- seq(0.3, 0.5, len = 100) - rnorm (100, 0.2, 0.03)
i2 <- seq(0.3, 1, len = 100)   - rnorm (100, 0.2, 0.03)
Indic = data.frame(i1, i2)
CI = ci_rbod(Indic,B=10)

data(EU_NUTS1)
data_norm = normalise_ci(EU_NUTS1,c(2:3),polarity = c("POS","POS"), method=2)
CI = ci_rbod(data_norm$ci_norm,c(1:2),M=10,B=20)
```

---

ci_rbod_dir *Directional Robust Benefit of the Doubt approach (D-RBoD)*

Description

Directional Robust Benefit of the Doubt approach (D-RBoD) is the directional robust version of the BoD method.

Usage

```
ci_rbod_dir(x,indic_col,M,B,dir)
```

Arguments

x	A data.frame containing score of the simple indicators.
indic_col	Simple indicators column number.
M	The number of elements in each of the bootstrapped samples.
B	The number of bootstap replicates.
dir	Main direction. For example you can set the average rates of substitution.

Value

An object of class "CI". This is a list containing the following elements:

`ci_rbod_dir_est`
: Composite indicator estimated values.

`ci_method`
: Method used; for this function ci_method="rbod_dir".

Author(s)

Fusco E., Vidoli F.

References

Daraio C., Simar L., "*Introducing environmental variables in nonparametric frontier models: a probabilistic approach*", Journal of productivity analysis, 2005, 24(1), 93 121.

Simar L., Vanhems A., "*Probabilistic characterization of directional distances and their robust versions*", Journal of Econometrics, 2012, 166(2), 342 354.

Vidoli F., Fusco E., Mazziotta C., "*Non-compensability in composite indicators: a robust directional frontier method*", Social Indicators Research, Springer Netherlands.

See Also

`ci_bod`, `ci_rbod`

Examples

```
data(EU_NUTS1)
data_norm = normalise_ci(EU_NUTS1,c(2:3),polarity = c("POS","POS"), method=2)
CI = ci_rbod_dir(data_norm$ci_norm, c(1:2), M = 25, B = 50, c(1,0.1))
```

---

ci_wroclaw *Wroclaw Taxonomic Method*

Description

Wroclaw taxonomy method (also known as the dendric method), originally developed at the University of Wroclaw, is based on the distance from a theoretical unit characterized by the best performance for all indicators considered; the composite indicator is therefore based on the sum of euclidean distances from the ideal unit and normalized by a measure of variability of these distance (mean + 2*std).

Usage

```
ci_wroclaw(x,indic_col)
```

Arguments

x	A data.frame containing simple indicators.
indic_col	Simple indicators column number.

Details

Please pay attention that *ci_wroclaw_est* is the distance from the "ideal" unit; so, units with higher values for the simple indicators get lower values of composite indicator.

Value

An object of class "CI". This is a list containing the following elements:

ci_wroclaw_est	Composite indicator estimated values.
ci_method	Method used; for this function ci_method="wroclaw".

Author(s)

Vidoli F.

References

UNESCO, "*Social indicators: problems of definition and of selection*", Paris 1974.

Mazziotta C., Mazziotta M., Pareto A., Vidoli F., "*La sintesi di indicatori territoriali di dotazione infrastrutturale: metodi di costruzione e procedure di ponderazione a confronto*", Rivista di Economia e Statistica del territorio, n.1, 2010.

See Also

ci_bod, ci_mpi

Examples

```
i1 <- seq(0.3, 0.5, len = 100) - rnorm (100, 0.2, 0.03)
i2 <- seq(0.3, 1, len = 100)   - rnorm (100, 0.2, 0.03)
Indic = data.frame(i1, i2)
CI = ci_wroclaw(Indic)

data(EU_NUTS1)
CI = ci_wroclaw(EU_NUTS1,c(2:3))

data(EU_2020)
data_selez = EU_2020[,c(1,22,191)]
data_norm = normalise_ci(data_selez,c(2:3),c("POS","NEG"),method=3)
ci_wroclaw(data_norm$ci_norm,c(1:2))
```

EU_2020 *Europe 2020 indicators*

Description

Europe 2020, a strategy for jobs and smart, sustainable and inclusive growth, is based on five EU headline targets which are currently measured by eight headline indicators, Headline indicators, Eurostat, year 1990-2012 (Last update: 21/11/2013).

For more info, please see http://ec.europa.eu/europe2020/index_en.htm.

Usage

```
data(EU_2020)
```

Format

EU_2020 is a dataset with 30 observations and 12 indicators (190 indicator per year).

geo EU-Member States including EU (28 countries) and EU (27 countries) row.

employXXXX Employment rate - age group 20-64, year XXXX (1992-2012).

perc_GDPXXXX Gross domestic expenditure on R&D (GERD), year XXXX (1990-2012).

gas_emissXXXX Greenhouse gas emissions - base year 1990, year XXXX (1990-2011).

share_renXXXX Share of renewable energy in gross final energy consumption, year XXXX (2004-2011).

prim_enerXXXX Primary energy consumption, year XXXX (1990-2011).

final_energyXXXX Final energy consumption, year XXXX (1990-2011).

final_energyXXXX Early leavers from education and training - Perc. of the population aged 18-24 with at most lower secondary education and not in further education or training, year XXXX (1992-2012).

tertiaryXXXX Tertiary educational attainment - age group 30-34, year XXXX (2000-2012).

risk_povertyXXXX People at risk of poverty or social exclusion - 1000 persons Perc. of total population, year XXXX (2004-2012).

low_workXXXX People living in households with very low work intensity - 1000 persons Perc. of total population, year XXXX (2004-2012).

risk_povertyXXXX People at risk of poverty after social transfers - 1000 persons Perc. of total population, year XXXX (2003-2012).

deprivedXXXX Severely materially deprived people - 1000 persons Perc. of total population, year XXXX (2003-2012).

Author(s)

Vidoli F.

References

http://ec.europa.eu/europe2020/index_en.htm

Examples

```
data(EU_2020)
```

EU_NUTS1 *EU NUTS1 Transportation data*

Description

Eurostat regional transport statistics (reg_tran) data, year 2012.

For more info, please see http://ec.europa.eu/eurostat/data/browse-statistics-by-theme.

Usage

```
data(EU_NUTS1)
```

Format

EU_NUTS1 is a dataset with 34 observations and two indicators describing transportation infrastructure endowment of the main (in terms of population and GDP) European NUTS1 regions: France, Germany, Italy, Spain (United Kingdom has been omitted, due to lack of data concerning railways).

roads Calculated as (2 * Motorways - Kilometres per 1000 km2 + Other roads - Kilometres per 1000 km2)/3

trains Calculated as (2 *Railway lines double+Electrified railway lines)/3

Author(s)

Vidoli F.

References

Vidoli F., Mazziotta C., "*Robust weighted composite indicators by means of frontier methods with an application to European infrastructure endowment*", Statistica Applicata, Italian Journal of Applied Statistics, 2013.

Examples

```
data(EU_NUTS1)
```

`normalise_ci` *Normalisation and polarity functions*

Description

This function lets to normalise simple indicators according to the polarity of each one.

Usage

```
normalise_ci(x, indic_col, polarity, method=1, z.mean=0, z.std=1, ties.method ="average")
```

Arguments

`x`	A data frame containing simple indicators.
`indic_col`	Simple indicators column number.

`method`	Normalisation methods:
	• **1** (default) = standardization or z-scores using the following formulation:
	$$z_{ij} = z.mean \pm \frac{x_{ij} - M_{x_j}}{S_{x_j}} \cdot z.std$$
	where $\pm$ depends on *polarity* parameter and *z.mean* and *z.std* represent the shifting parameters.
	• **2** = Min-max method using the following formulation:
	if *polarity*="POS":
	$$\frac{x - min(x)}{max(x) - min(x)}$$
	if *polarity*="NEG":
	$$\frac{max(x) - x}{max(x) - min(x)}$$
	• **3** = Ranking method. If *polarity*="POS" ranking is increasing, while if *polarity*="NEG" ranking is decreasing.

`polarity`	Polarity vector: "POS" = positive, "NEG" = negative. The polarity of a individual indicator is the sign of the relationship between the indicator and the phenomenon to be measured (e.g., in a well-being index, "GDP per capita" has 'positive' polarity and "Unemployment rate" has 'negative' polarity).
`z.mean`	If method=1, Average shifting parameter. Default is 0.
`z.std`	If method=1, Standard deviation expansion parameter. Default is 1.
`ties.method`	If method=3, A character string specifying how ties are treated, see `rank` for details. Default is "average".

Value

`ci_norm`	A data.frame containing normalised score of the choosen simple indicators.
`norm_method`	Normalisation method used.

Author(s)

Vidoli F.

References

OECD, "*Handbook on constructing composite indicators: methodology and user guide*", 2008, pag.30.

See Also

ci_bod, ci_mpi

Examples

```
data(EU_NUTS1)

# Standard z-scores normalisation #
data_norm = normalise_ci(EU_NUTS1,c(2:3),c("NEG","POS"),method=1,z.mean=0, z.std=1)
summary(data_norm$ci_norm)

# Normalisation for MPI index #
data_norm = normalise_ci(EU_NUTS1,c(2:3),c("NEG","POS"),method=1,z.mean=100, z.std=10)
summary(data_norm$ci_norm)

data_norm = normalise_ci(EU_NUTS1,c(2:3),c("NEG","POS"),method=2)
summary(data_norm$ci_norm)
```

Index

ci_bod, 3, *5*, *7–10*, *12*, *14–16*, *20*
ci_bod_dir, *4*, 5
ci_bod_var_w, 6, *14*
ci_bod_vrs, 7
ci_factor, 8, *10*
ci_mean_geom, 10
ci_mean_min, 11
ci_mpi, *9*, *11*, 12, *16*, *20*
ci_rbod, *4, 5*, *7, 8*, 13, *15*
ci_rbod_dir, 14
ci_wroclaw, 15
Compind-package, 2

EU_2020, 17
EU_NUTS1, 18

normalise_ci, *11, 12*, 19

rank, *19*