Package 'dineq'

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Type Package

Title Decomposition of (Income) Inequality

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Description Decomposition of (income) inequality by population sub groups.
For a decomposition on a single variable the mean log deviation can be used
(see Mookherjee Shorrocks (1982) <DOI:10.2307/2232673>).
For a decomposition on multiple variables a regression based technique can be
used (see Fields (2003) <DOI:10.1016/s0147-9121(03)22001-x>).
Recentered influence function regression for marginal effects of the (income
or wealth) distribution (see Firpo et al. (2009) <DOI:10.3982/ECTA6822>).
Some extensions to inequality functions to handle weights and/or missings.

Depends R (>= 2.10)

Imports boot (>= 1.3-20), Hmisc (>= 4.0-3)

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Contents

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dineq_change_rb   *Decomposition of the change in inequality*

Description

Decomposition of the change in (income) inequality into multiple characteristics, divided by a price and a quantity effect.

Usage

```
dineq_change_rb(formula1, weights1 = NULL, data1, formula2, weights2 = NULL,
  data2)
```

Arguments

formula1	an object of class "formula" (or one that can be coerced to that class) for the first year/dataset: a symbolic description of the model to be fitted in the ordinary least squares regression.
weights1	an optional vector of weights to be used in the fitting process. Should be NULL or a numeric vector. Should be inside selected data frame in the function and between quotation marks.
data1	a data frame containing the variables for the first year/dataset in the model.
formula2	an object of class "formula" (or one that can be coerced to that class) for the first year/dataset: a symbolic description of the model to be fitted in the ordinary least squares regression.
weights2	an optional vector of weights to be used in the fitting process. Should be NULL or a numeric vector. Should be inside selected data frame in the function and between quotation marks.
data2	a data frame containing the variables for the first year/dataset in the model.

Details

This function uses a multivariate regression-based decomposition method. Multiple characteristics can be added to the function in order to calculate the contribution of each individual variable (including the residual) to the change of the inequality. For instance socio-economic, demographic and geographic characteristics (such as age, household composition, gender, region, education) of the household or the individual can be added.

The change decomposition is divided into a price and a quantity effect for each characteristic. The quantity effect is caused by changes in the relative size of subgroups (for instance: a higher percentage of elderly households). The price effect is caused by a change in the influence of the characteristic on the dependent variable (for instance a higher income for the elderly households).

It uses a logarithmic transformation of the values of the dependent variable. Therefore it cannot handle negative or zero values. Those are excluded from the computation in this function.

The decomposition can only be used on the variance of log income.

The main difference with the decomposition of the change of the mean log deviation is that multiple characteristics can be analyzed at the same time. While the decomposition function only analyze one characteristic at the same time.

The function uses two datasets for both years to compare. Pay attention that characteristics should be the same (although can be named differently) and in the same order in the formula.

Value

a list with the results of the decomposition and the parts used for the decomposition, containing the following components:

attention   optional note on the difference in the input.

variance_logincome

>   the values of the variance of log income of both years/datasets and difference between both.

decomposition_inequality

>   the (relative) decomposition of the inequality of both years/datasets into the different variables. See function 'rb_decomp'.

decomposition_change_absolute

>   decomposition of the change in the variance of log income into the different variables and residual split into price and quantity effects. Adds up to the absolute change in variance of log income.

decomposition_change_relative

>   decomposition of the change in the variance of log income into the different variables and residual split into price and quantity effects. Adds up to 100 percent.

notes   number of zero or negative observations in both data sets/years. The function uses a logarithmic transformation of x as input for the regression. Therefore these observations are deleted from the analysis

References

Yun, M.-S. (2006) Earnings Inequality in USA, 1969–99: Comparing Inequality Using Earnings Equations, *Review of Income and Wealth*, 52 (1): p. 127–144.

Fields, G. (2003) Accounting for income inequality and its change: a new method, with application to the distribution of earnings in the United States, *Research in Labor Economics*, 22, p. 1–38.

Brewer M., and L. Wren-Lewis (2016) Accounting for Changes in Income Inequality: Decomposition Analyses for the UK, 1978–2008. *Oxford Bulletin of economics and statistics*, 78 (3), p. 289-322,

See Also

dineq_rb

Examples

```
#Decomposition of the change in income inequality into 4 variables using the Mexican Income
#data set
data(mex_inc_2008)
inequality_change <- dineq_change_rb(formula1=income~hh_structure+education+domicile_size+age_cat,
weights1="factor",data1=mex_inc_2008, formula2=income~hh_structure+education+
domicile_size+age_cat, weights2="factor",data2=mex_inc_2016)

#selection of output: change in variance of log income decomposed in variables split into price
#and quantity effect and residual.
inequality_change["decomposition_change_absolute"]

#selection of output: relatieve change in variance of log income decomposed in variables split
#into price and quantity effect and residual. Because of negative change in variance of log
#income, the negative contributuon of education (quantity) becomes a positive number.
inequality_change["decomposition_change_relative"]
```

---

dineq_rb   *Regression-based decomposition of inequality*

Description

Decomposition of (income) inequality into multiple characteristics. A regression-based decomposition method is used.

Usage

```
dineq_rb(formula, weights = NULL, data)
```

Arguments

formula	an object of class "formula" (or one that can be coerced to that class): a symbolic description of the model to be fitted in the ordinary least squares regression.
weights	an optional vector of weights to be used in the fitting process. Should be NULL or a numeric vector. Should be inside selected data frame in the function and between quotation marks.
data	a data frame containing the variables in the model.

Details

This function uses a multivariate regression-based decomposition method. Multiple variables can be added to the function in order to calculate the contribution of each individual variable (including the residual) to the inequality. For instance socio-economic, demographic and geographic characteristics (such as age, household composition, gender, region, education) of the household or the individual can be added.

This decomposition can be used on a broad range of inequality measure, like Gini, Theil, mean log deviation, Atkinson index and variance of log income.

It uses a logarithmic transformation of the values of the dependent variable. Therefore it cannot handle negative or zero values. Those are excluded from the computation in this function.

The main difference with the decomposition of the mean log deviation or Gini coefficient is that multiple characteristics can be analyzed at the same time. While the other decomposition functions only analyze one characteristic at the same time.

Value

a list with the results of the decomposition, containing the following components:

inequality_measures
        the values of 4 inequality measures: gini, mean log deviation, theil and variance of log income

decomposition_inequality
        the (relative) decomposition of the inequality into the different variables

regression_results
        results of the ols regression which is used to make the decomposition of inequality

note
        number of zero or negative observations. The function uses a logarithmic transformation of x as input for the regression. Therefore these observations are deleted from the analysis

References

Fields, G. S. (2003). 'Accounting for income inequality and its change: a new method, with application to the distribution of earnings in the United States', *Research in Labor Economics*, 22, p. 1–38.

Brewer M., and L. Wren-Lewis (2016) Accounting for Changes in Income Inequality: Decomposition Analyses for the UK, 1978–2008. *Oxford Bulletin of economics and statistics*, 78 (3), p. 289-322,

See Also

dineq_change_rb

Examples

```
#Decomposition of the income inequality into 4 variables using Mexican Income data set:
data(mex_inc_2008)
```

```
inequality_decomp <- dineq_rb(income~hh_structure+education+domicile_size+age_cat,
weights="factor", data=mex_inc_2008)

#selection of the output: decomposition of the inequality into the contribution of the
#different variables and residual (adds up to 100 percent)
inequality_decomp["decomposition_inequality"]
```

---

gini.wtd	*Gini coefficient*

Description

Returns the (optional weighted) Gini coefficient for a vector.

Usage

```
gini.wtd(x, weights = NULL)
```

Arguments

x	a numeric vector containing at least non-negative elements.
weights	an optional vector of weights of x to be used in the computation of the Gini coefficient. Should be NULL or a numeric vector.

Details

The Gini coefficient is a measure of inequality among values of a distribution. The most used single measure for income inequality. The coefficient can theoretically range between 0 and 1, with 1 being the highest possible inequality (for instance: 1 person in a society has all income; the others none). But coefficients that are negative or greater than 1 are also possible because of negative values in the distribution. Compared to other measures of inequality, the Gini coefficient is especially sensitive for changes in the middle of the distribution.

Extension of the gini function in reldist package in order to handle missings.

Value

The value of the Gini coefficient.

Source

Handcock, M. (2016), Relative Distribution Methods. Version 1.6-6. Project home page at http://www.stat.ucla.edu/~handcoc

References

Haughton, J. and S. Khandker. (2009) *Handbook on poverty and inequality*, Washington, DC: World Bank.

Cowell F. (2000) Measurement of Inequality. In Atkinson A. and Bourguignon F. (eds.) *Handbook of Income Distribution*. Amsterdam: Elsevier, p. 87-166.

Examples

```
#calculate Gini coefficient using Mexican Income data set
data(mex_inc_2008)

#unweighted Gini coefficient:
gini.wtd(mex_inc_2008$income)

#weighted Gini coefficient:
gini.wtd(x=mex_inc_2008$income, weights=mex_inc_2008$factor)
```

---

gini_decomp	*Decomposition of the Gini coefficient*

Description

Decomposes the Gini coefficient into population subgroups. Distinction is made by between and within group inequality and an overlap (interaction) term.

Usage

```
gini_decomp(x, z, weights = NULL)
```

Arguments

x	a numeric vector containing at least non-negative elements.
z	a factor containing the population sub groups.
weights	an optional vector of weights of x to be used in the computation of the decomposition. Should be NULL or a numeric vector.

Details

The decomposition of the Gini coefficient by between and within group inequality. In most cases there is an overlap of the distribution of both groups. Consequence is that between and within group inequality doesn't add up to the total Gini coefficient. In those cases there is an overlap term. Also referred to as interaction effect.

Within group inequality is calculated by using the Gini coefficient for each sub group. Between group inequality by using the gini coefficient of the average of both sub groups.

Value

a list with the results of the decomposition and the parts used for the decomposition, containing the following components:

gini_decomp	a list containing the decomposition: gini_total (value of the gini coefficient of x), gini_within (value of within-group inequality), gini_between (value of between-group inequality) and gini_overlap (value of overlap in inequality)

gini_group   a list containing gini_group (the gini coefficients of the different subgroups) and
                  gini_group_contribution(the contribution of the subgroups to the total within-
                  group inequality: adds up to gini_within)

gini_decomp   a list containing the means of x: mean_total (value of the mean of x of all
                  subgroups combined) and mean_group (value of the mean of x of the individual
                  subgroups) inequality) and gini_between (value of between-group inequality)

share_groups   the distribution of the subgroups z

share_income_groups

                  the distribution of vector x by subgroups z

number_cases   a list containing the number of cases in total, by subgroup (weighted and un-
                  weighted): n_unweighted (total number of unweighted x), n_weighted (total
                  number of weighted x), n_group_unweighted (number of unweighted x by sub-
                  group z), n_group_unweighted (number of weighted x by subgroup z)

References

Mookherjee, D. and A. Shorrocks (1982) A decomposition analysis of the trend in UK income
inequality, *Economic Journal*, 92 (368), p. 886-902.

Cowell F. (2000) Measurement of Inequality. In Atkinson A. and Bourguignon F. (eds.) *Handbook
of Income Distribution*. Amsterdam: Elsevier, p. 87-166.

See Also

mld_decomp

Examples

```
#Decomposition of the gini coefficient by level of education using Mexican Income data set
data(mex_inc_2008)
education_decomp <- gini_decomp(x=mex_inc_2008$income,z=mex_inc_2008$education,
weights=mex_inc_2008$factor)

#complete output
education_decomp

#Selected output: decomposition into between- and within-group inequality and overlap (interaction)
education_decomp["gini_decomp"]
```

---

mex_inc_2008   *Mexican income data 2008*

Description

Selection of Mexican income (survey) data and household characteristic for 2008. Extracted from
ENIGH (Household Income and Expenditure Survey).

Usage

```
data(mex_inc_2008)
```

Format

A data frame containing 5000 observations and 8 variables (a selection from the original).

hh_number Household ID.

factor Population inflating weights.

income Household income.

hh_structure Household structure, factor with levels unipersonal, nuclear, ampliado, compuesto and coresidente.

education Highest achieved education of the head of the household, factor with levels Sin instruccion, Preescolar, Primaria incompleta, Primaria completa, Secundaria incompleta, Secundaria completa, Preparatoria incompleta, Preparatoria completa, Profesional incompleta, Profesional completa, Posgrado.

domicile_size Population of domicile, factor with levels <2500, 2500-15000, 15000-100000, >100000.

age age (integer) of the head of the household.

age_cat age (categorical) of the head of the household , factor with levels <25, 25-34, 35-44, 45-54, 55-64, 65-74, >=75.

Details

This data set is a selecion of the original dataset of the National Institute of Statistics and Geography in Mexico (INEGI). The original contains 29468 observations and 129 variables with information on the income and household characteristics in Mexico. This selection is only meant to be used as a calculation example for the functions in this package. Results will not represent the correct information on the Mexican situation.

Source

http://en.www.inegi.org.mx/proyectos/enchogares/regulares/enigh/nc/2008/default.html, the whole data set can be obtained here.

References

INEGI (2009), *ENIGH 2008 Nueva construcción. Ingresos y gastos de los hogares*, Aguascalientes: INEGI.

---

mex_inc_2016   *Mexican income data 2016*

Description

Selection of Mexican income (survey) data and household characteristic for 2016. Extracted from ENIGH (Household Income and Expenditure Survey).

Usage

```
data(mex_inc_2016)
```

Format

A data frame containing 5000 observations and 8 variables (a selection from the original).

hh_number Household ID.

factor Population inflating weights.

income Household income.

hh_structure Household structure, factor with levels unipersonal, nuclear, ampliado, compuesto and coresidente.

education Highest achieved education of the head of the household, factor with levels Sin instruccion, Preescolar, Primaria incompleta, Primaria completa, Secundaria incompleta, Secundaria completa, Preparatoria incompleta, Preparatoria completa, Profesional incompleta, Profesional completa, Posgrado.

domicile_size Population of domicile, factor with levels <2500, 2500-15000, 15000-100000, >100000.

age age (integer) of the head of the household.

age_cat age (categorical) of the head of the household , factor with levels <25, 25-34, 35-44, 45-54, 55-64, 65-74, >=75.

Details

This data set is a selecion of the original dataset of the National Institute of Statistics and Geography in Mexico (INEGI). The original contains 70311 observations and 127 variables with information on the income and household characteristics in Mexico. This selection is only meant to be used as a calculation example for the functions in this package. Results will not represent the correct information on the Mexican situation.

Source

http://en.www.inegi.org.mx/proyectos/enchogares/regulares/enigh/nc/2016/default.html, the whole data set can be obtained here.

References

INEGI (2017), *Encuesta Nacional de Ingresos y Gastos de los Hogares 2016. ENIGH. Nueva serie. Temas, categorías y variables*, Aguascalientes: INEGI.

---

mld.wtd   *Mean log deviation*

Description

Returns the (optional weighted) mean log deviation for a vector.

Usage

```
mld.wtd(x, weights = NULL)
```

Arguments

x   a numeric vector containing at least non-negative elements.

weights   an optional vector of weights of x to be used in the computation of the mean log
             deviation. Should be NULL or a numeric vector.

Details

The mean log deviation is a measure of inequality among values of a distribution. It is a member
of the Generalized Entropy Measures. Also referred to as GE(0). A value of zero is the lowest
possible inequality. The measure does not have an upper bound for the highest inequality. It uses a
logarithmic transformation of the values of the distribution. Therefore it cannot handle negative or
zero values. Those are excluded from the computation in this function. The mean log deviation is
more sensitive for changes in the lower tail of the distribution.

Extension of the calcGEI function in IC2 package in order to handle missings.

Value

the value of the mean log deviation index.

Source

Plat, D. (2012). IC2: Inequality and Concentration Indices and Curves. R package version 1.0-1.
https://CRAN.R-project.org/package=IC2

References

Haughton, J. and S. Khandker. (2009) *Handbook on poverty and inequality*, Washington, DC:
World Bank.

Cowell F. (2000) Measurement of Inequality. In Atkinson A. and Bourguignon F. (eds.) *Handbook
of Income Distribution*. Amsterdam: Elsevier, p. 87-166.

Examples

```
#calculate mean log deviation using Mexican Income data set
data(mex_inc_2008)

#unweighted mean log deviation:
mld.wtd(mex_inc_2008$income)

#weighted mean log deviation:
mld.wtd(x=mex_inc_2008$income, weights=mex_inc_2008$factor)
```

---

mld_change   *Decomposition of the change of the mean log deviation*

Description

Decomposes the change of the mean log deviation between two years/data sets into population subgroups.

Usage

```
mld_change(x1, z1, weights1 = NULL, x2, z2, weights2 = NULL)
```

Arguments

x1	a numeric vector for the first year/dataset containing at least non-negative elements.
z1	a factor for the first year/dataset containing the population subgroups.
weights1	an optional vector of weights of x for the first year/dataset to be used in the computation of the decomposition. Should be NULL or a numeric vector.
x2	a numeric vector for the second year/dataset containing at least non-negative elements.
z2	a factor for the second year/dataset containing the population subgroups.
weights2	an optional vector of weights of x for the second year/dataset to be used in the computation of the decomposition. Should be NULL or a numeric vector.

Details

The change of the mean log deviation can be decomposed into three components: inequality changes between and within groups and changes in the relative sizes of the groups. The change of between group inequality is measures by a change in the relative income of the subgroups. The change of within group inequality by adding up all changes in mean log deviation within the subgroups. And the contribution of changes in relative population size effects the change on both the within and between group components. For the relative contributions those two are added together.

This method is introduced by Mookherjee and Shorrocks. It is an accurate approximation of the exact decomposition. It uses a logarithmic transformation of the values of the distribution. Therefore it cannot handle negative or zero values. Those are excluded from the computation in this function.

Value

a list with the results of the decomposition and the parts used for the decomposition, containing the following components:

mld_data1 the value of the mean log deviation index of x for the first year/dataset, and the decomposition into within-group and between-group inequality

mld_data2 the value of the mean log deviation index of x for the second year/dataset, and the decomposition into within-group and between-group inequality

mld_difference the difference between the mean log deviation and the decomposition between the second and first year/dataset

absolute_contributions_difference

decomposition of the absolute change in inequality into: within group changes, group size changes (split into the effect of within and between group components) and between group changes.

relative_contributions_difference

decomposition of the change in inequality into relatieve contributions of: within group changes, group size changes and between group changes. Adds up to 100 percent (or -100 percent for negative change)

note number of zero or negative observations in both datasets. The mean log deviation uses a logarithmic transformation of x. Therefore these observations are deleted from the analysis

References

Mookherjee, D. and A. Shorrocks (1982) A decomposition analysis of the trend in UK income inequality, *Economic Journal*, 92 (368), p. 886-902.

Brewer M., and L. Wren-Lewis (2016) Accounting for Changes in Income Inequality: Decomposition Analyses for the UK, 1978–2008. *Oxford Bulletin of economics and statistics*, 78 (3), p. 289-322,

See Also

mld_decomp

Examples

```
#Decomposition of the change in mean log deviation by level of eduction using
#Mexican Income data set
data(mex_inc_2008)

change_education <- mld_change(x1=mex_inc_2008$income, z1=mex_inc_2008$education,
weights1=mex_inc_2008$factor, x2=mex_inc_2016$income, z2=mex_inc_2016$education,
weights2=mex_inc_2016$factor)

#selection of the output: decomposition of the change into within- and between-group
#contribution and change in de size of groups (adds up to 100 percent)
change_education["relative_contributions_difference"]
```

---

mld_decomp   *Decomposition of the mean log deviation*

Description

Decomposes the mean log deviation into non overlapping population subgroups. Distinction is made by between and within group inequality.

Usage

```
mld_decomp(x, z, weights = NULL)
```

Arguments

x	a numeric vector containing at least non-negative elements.
z	a factor containing the population subgroups.
weights	an optional vector of weights of x to be used in the computation of the decomposition. Should be NULL or a numeric vector.

Details

The decomposition of the mean log deviation by between and within group inequality. Within group inequality is calculated by using the mean log deviation for each sub group. Between group inequality by the mean log deviation of the average of both sub groups.

It uses a logarithmic transformation of the values of the distribution. Therefore it cannot handle negative or zero values. Those are excluded from the computation in this function.

Based on calcGEI function in IC2 package. Handles missings.

Value

a list with the results of the decomposition and the parts used for the decomposition, containing the following components:

mld_decomp	a list containing the decomposition: mld_total (value of the mean log deviation index of x) mld_within (value of within-group inequality) and mld_between (value of between-group inequality)
mld_group	a list containing mld_group (the mean log deviations of the different subgroups) and mld_group_contribution(the contribution of the subgroups to the total within-group inequality: adds up to mld_within)
mld_decomp	a list containing the means of x: mean_total (value of the mean of x of all subgroups combined) and mean_group (value of the mean of x of the individual subgroups) inequality) and mld_between (value of between-group inequality)
share_groups	the distribution of the subgroups z
share_income_groups	
	the distribution of vector x by subgroups z

number_cases	a list containing the number of cases in total, by subgroup (weighted and un-weighted): n_unweighted (total number of unweighted x), n_weighted (total number of weighted x), n_group_unweighted (number of unweighted x by sub-group z), n_group_unweighted (number of weighted x by subgroup z)
note	number of zero or negative observations. The mean log deviation uses a loga-rithmic transformation of x. Therefore these observations are deleted from the analysis

Source

Plat, D. (2012). IC2: Inequality and Concentration Indices and Curves. R package version 1.0-1.
https://CRAN.R-project.org/package=IC2

References

Mookherjee, D. and A. Shorrocks (1982) A decomposition analysis of the trend in UK income inequality, *Economic Journal*, 92 (368), p. 886-902.

Brewer M., and L. Wren-Lewis (2016) Accounting for Changes in Income Inequality: Decomposition Analyses for the UK, 1978–2008. *Oxford Bulletin of economics and statistics*, 78 (3), p. 289-322,

Haughton, J. and S. Khandker. (2009) *Handbook on poverty and inequality*, Washington, DC: World Bank.

See Also

mld_change gini_decomp

Examples

```
#Decomposition of mean log deviation by level of education using Mexican Income data set
data(mex_inc_2008)
education_decomp <- mld_decomp(x=mex_inc_2008$income,z=mex_inc_2008$education,
weights=mex_inc_2008$factor)

#complete output
education_decomp

#Selected output: decomposition into between- and within-group inequality
education_decomp["mld_decomp"]
```

---

ntiles.wtd	*Weighted tiles*

Description

Breaks input vector into n groups. Returns the (optional weighted) tile of an individual observation in vector x.

Usage

```
ntiles.wtd(x, n, weights = NULL)
```

Arguments

x	a numeric vector for which the quantiles are computed. Missing values are left as missing.
n	the number of desired sub groups to break vector x into.
weights	an optional vector of weights of x to be used in the computation of the tiles. Should be NULL or a numeric vector.

Details

Breaks vector x into n sub groups. The main difference with other tile functions (for instance ntile from dplyr) is that those functions break up vector x in exact equal size sub groups. Observations with the same value can end up in different tiles. In this function, observations with the same value always end up in the same tile, therefore sub groups may have different sizes. Especially when the weights argument is used. For a weighted tile function with the same group size, see for instance weighted_ntile from the grattan package.

When using a short-length vector (compared to the number of tiles) or with high variance weights, output may be different than anticipated.

Value

A vector of integers corresponding to the quantiles of vector x.

Examples

```
#Break up the income variable in the Mexican Income data set into 10 groups (tiles)
data(mex_inc_2008)

#unweighted tiles:
q <- ntiles.wtd(x=mex_inc_2008$income, n=10)

#weighted tiles:
qw <- ntiles.wtd(x=mex_inc_2008$income, n=10, weights=mex_inc_2008$factor)
```

---

polar.wtd   *Polarization index*

Description

Returns the (possibly weighted) polarization index for a vector. The Wolfson index of bipolarization is used.

A bipolarized (income) distribution has fewer observations in the middle and more in lower and/or higher part of the distribution. The regular measures of inequality (like the gini coefficient) does not give information about the polarization of the distribution. This Polarization index computes the level of bipolarization of the distribution. The concept is closely related to the Lorenz curve and therefore the scalar measure is also related to the Gini coefficient. A lower number means a lower level of polarization.

Extension of the polar.aff function in affluence-index package. Option of weighting the index is included.

Usage

```
polar.wtd(x, weights = NULL)
```

Arguments

x   a numeric vector.

weights   an optional vector of weights of x to be used in the computation of the Polarization index. Should be NULL or a numeric vector.

Value

The value of the Wolfson polarization index.

Source

Wolny-Dominiak, A. and A. Saczewska-Piotrowska (2017). affluenceIndex: Affluence Indices. R package version 1.0. https://CRAN.R-project.org/package=affluenceIndex

References

Wolfson M. (1994) When inequalities diverge, *The American Economic Review*, 84, p. 353-358.

Schmidt, A. (2002) Statistical Measurement of Income Polarization. A Cross-National, *Berlin 10th International conference on panel data.*

Examples

```
#calculate Polarization Index using Mexican Income data set
data(mex_inc_2008)

#unweighted Polarization Index:
polar.wtd(mex_inc_2008$income)

#weighted Polarization Index:
polar.wtd(x=mex_inc_2008$income, weights=mex_inc_2008$factor)
```

---

rif   *Recentered influence function (RIF)*

Description

Returns the (optional weighted) recentered influence function of a distributional statistic.

Usage

```
rif(x, weights = NULL, method = "quantile", quantile = 0.5,
  kernel = "gaussian")
```

Arguments

x	a numeric vector for which the recentered influence function is computed.
weights	an optional vector of weights of x to be used in the computation of the recentered influence function. Should be NULL or a numeric vector.
method	the distribution statistic for which the recentered influence function is estimated. Options are "quantile", "gini" and "variance". Default is "quantile".
quantile	quantile to be used when method "quantile" is selected. Must be a numeric between 0 and 1. Default is 0.5 (median). Only a single quantile can be selected.
kernel	a character giving the smoothing kernel to be used in method "quantile". Options are "gaussian", "rectangular", "triangular", "epanechnikov", "biweight", "cosine" or "optcosine". Default is "gaussian".

Details

The RIF can be used as input for a RIF regression approach. RIF regressions are mostly used to estimate the marginal effect of covariates on distributional statistics of income or wealth.

The RIF is calculated by adding the distributional statistic (quantile, gini or variance) to the influence function. RIF is a numeric vector where each element corresponds to a particular individual's influence on the distributional statistic.

Value

A numeric vector of the recentered influence function of the selected distributional statistic.

References

Firpo, S., N. Fortin and T. Lemieux (2009) Unconditional quantile regressions. *Econometrica*, 77(3), p. 953-973.

Heckley G, U.-G. Gerdtham U-G and G. Kjellsson (2016) A general method for decomposing the causes of socioeconomic inequality in health. *Journal of Health Economics*,48, p. 89–106.

Pereira, J. and A. Galego (2016) The drivers of wage inequality across Europe, a recentered influence function regression approach, *10th Annual Meeting of the Portuguese Economic Journal*, University of Evora.

See Also

[rifr](#)

Examples

```
data(mex_inc_2008)

#Recentered influence funtion of 20th quantile
rif_q20 <- rif(x=mex_inc_2008$income, weights=mex_inc_2008$factor, method="quantile",
quantile=0.2)

#Recentered influence funtion of the gini coefficient
rif_gini <- rif(x=mex_inc_2008$income, weights=mex_inc_2008$factor, method="gini")
```

rifr	*Recentered influence function regression (RIF Regression)*

Description

Recentered influence function regression of a distributional statistic.

Usage

```
rifr(formula, data, weights = NULL, method = "quantile", quantile = 0.5,
  kernel = "gaussian")
```

Arguments

formula	an object of class "formula" (or one that can be coerced to that class): a symbolic description of the model to be fitted in the RIF regression.
data	a data frame containing the variables and weights of the model.
weights	an optional vector of weights of x to be used in the computation of the recentered influence function. Should be NULL or a numeric vector. Should be inside selected data frame in the function and between quotation marks.
method	the distribution statistic for which the recentered influence function is estimated. Options are "quantile", "gini" and "variance". Default is "quantile".
quantile	quantile to be used when method "quantile" is selected. Must be a numeric between 0 and 1. Default is 0.5 (median). Multiple quantiles can be used.
kernel	a character giving the smoothing kernel to be used in method "quantile". Options are "gaussian", "rectangular", "triangular", "epanechnikov", "biweight", "cosine" or "optcosine". Default is "gaussian".

Details

RIF Regressions can be used to estimate the marginal effects of covariates on distributional statistics (such as quantiles, gini and variance). It is based on the recentered influence function of a statistic. The transformed RIF is used as the dependent variable in an ordinary least squares regression. RIF regressions are mostly used to estimate the marginal effect of covariates on distributional statistics of income or wealth.

Value

A list containing the results of the RIF regression.

coefficients	the coefficient estimates.
SE	the coefficient standard error.
t	the coefficient t-value.
p	the coefficient p-value.
adjusted_r2	the adjusted r-squares.

References

Firpo, S., N. Fortin and T. Lemieux (2009) Unconditional quantile regressions. *Econometrica*, 77(3), p. 953-973.

Heckley G, U.-G. Gerdtham U-G and G. Kjellsson (2016) A general method for decomposing the causes of socioeconomic inequality in health. *Journal of Health Economics*,48, p. 89–106.

Pereira, J. and A. Galego (2016) The drivers of wage inequality across Europe, a recentered influence function regression approach, *10th Annual Meeting of the Portuguese Economic Journal*, University of Evora.

See Also

rif rifrSE

Examples

```
data(mex_inc_2008)

#Recentered influence funtion of each decile
rifr_q <- rifr(income~hh_structure+education, data=mex_inc_2008, weights="factor",
method="quantile", quantile=seq(0.1,0.9,0.1), kernel="gaussian")

#Recentered influence funtion of the gini coefficient
rifr_gini <- rifr(income~hh_structure+education, data=mex_inc_2008, weights="factor",
method="gini")
```

---

rifrSE   *Inference of recentered influence function regression (RIF regression)*

Description

Inference of a RIF Regression using a bootstrap method.

Usage

```
rifrSE(formula, data, weights = NULL, method = "quantile", quantile = 0.5,
  kernel = "gaussian", Nboot = 100, confidence = 0.95)
```

Arguments

formula	an object of class "formula" (or one that can be coerced to that class): a symbolic description of the model to be fitted in the RIF regression.
data	a data frame containing the variables and weights of the model.
weights	an optional vector of weights of x to be used in the computation of the recentered influence function. Should be NULL or a numeric vector. Should be inside selected data frame in the function and between quotation marks.
method	the distribution statistic for which the recentered influence function is estimated. Options are "quantile", "gini" and "variance". Default is "quantile".
quantile	quantile to be used when method "quantile" is selected. Must be a numeric between 0 and 1. Default is 0.5 (median). Only a single quantile can be used.
kernel	a character giving the smoothing kernel to be used in method "quantile". Options are "gaussian", "rectangular", "triangular", "epanechnikov", "biweight", "cosine" or "optcosine". Default is "gaussian".
Nboot	the number of bootstrap replicates. Default is 100.
confidence	significance level for estimation of the confidence interval of the fitted model. Default is 0.95.

Details

RIF Regressions can be used to estimate the marginal effects of covariates on distributional statistics (such as quantiles, gini and variance). It is based on the recentered influence function of a statistic. The transformed RIF is used as the dependent variable in an ordinary least squares regression. RIF regressions are mostly used to estimate the marginal effect of covariates on distributional statistics of income or wealth.

The standard errors, confidence intervals and Z- and P-values are calculated by using a standard bootstrap method (from boot package).

Value

A data frame containing the results of the RIF regression.

Coef	estimated coefficients of the original (non bootstrapped) RIF regression
lower	lower bound of confidence interval of estimated coefficient
upper	upper bound of confidence interval of estimated coefficient
SE	standard error
Z Value	Z value
P Value	P value
Signif	Significance codes of P: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

References

Firpo, S., N. Fortin and T. Lemieux (2009) Unconditional quantile regressions. *Econometrica*, 77(3), p. 953-973.

Heckley G, U.-G. Gerdtham U-G and G. Kjellsson (2016) A general method for decomposing the causes of socioeconomic inequality in health. *Journal of Health Economics*, 48, p. 89–106.

Pereira, J. and A. Galego (2016) The drivers of wage inequality across Europe, a recentered influence function regression approach, *10th Annual Meeting of the Portuguese Economic Journal*, University of Evora.

See Also

rif rifr

Examples

```
data(mex_inc_2008)

#Recentered influence funtion of 20th quantile
rifr_q <- rifrSE(income~hh_structure+education, data=mex_inc_2008, weights="factor",
method="quantile", quantile=0.2, kernel="gaussian", Nboot=100, confidence=0.95)

#Recentered influence funtion of the gini coefficient
rifr_gini <- rifrSE(income~hh_structure+education, data=mex_inc_2008, weights="factor",
method="gini", Nboot=100, confidence=0.95)
```

```
theil.wtd                    Theil index
```

Description

Returns the (optional weighted) Theil index for a vector.

Usage

```
theil.wtd(x, weights = NULL)
```

Arguments

x   a numeric vector containing at least non-negative elements.

weights   an optional vector of weights of x to be used in the computation of the Theil index. Should be NULL or a numeric vector.

Details

The Theil index is a measure of inequality among values of a distribution. It is a member of the Generalized Entropy Measures. Also referred to as GE(1). The index can have a value between 0 and ln N (the logarithm of the number of values), with 0 being the lowest possible inequality. It uses a logarithmic transformation of the values of the distribution. Therefore it cannot handle negative or zero values. Those are excluded from the computation in this function. The Theil Index is more sensitive for changes in the upper tail of the distribution.

Extension of the calcGEI function in IC2 package in order to handle missings.

Value

The value of the Theil index.

Source

Plat, D. (2012). IC2: Inequality and Concentration Indices and Curves. R package version 1.0-1. https://CRAN.R-project.org/package=IC2

References

Haughton, J. and S. Khandker. (2009) *Handbook on poverty and inequality*, Washington, DC: World Bank.

Cowell F. (2000) Measurement of Inequality. In Atkinson A. and Bourguignon F. (eds.) *Handbook of Income Distribution*. Amsterdam: Elsevier, p. 87-166.

Examples

```
#calculate Theil Index using Mexican Income data set
data(mex_inc_2008)

#unweighted Theil Index:
theil.wtd(mex_inc_2008$income)

#weighted Theil Index:
theil.wtd(x=mex_inc_2008$income, weights=mex_inc_2008$factor)
```

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