Package ‘vardpoor’

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Type Package

Title Variance Estimation for Sample Surveys by the Ultimate Cluster Method

Version 0.20.0

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Depends R (>= 3.2.3)

Imports foreach, data.table (>= 1.12.6), MASS, stats, utils, stringr, surveyplanning, laeken

Maintainer Juris Breidaks <rcsb@csb.gov.lv>

Description Generation of domain variables, linearization of several nonlinear population statistics (the ratio of two totals, weighted income percentile, relative median income ratio, at-risk-of-poverty rate, at-risk-of-poverty threshold, Gini coefficient, gender pay gap, the aggregate replacement ratio, the relative median income ratio, median income below at-risk-of-poverty gap, income quintile share ratio, relative median at-risk-of-poverty gap), computation of regression residuals in case of weight calibration, variance estimation of sample surveys by the ultimate cluster method (Hansen, Hurwitz and Madow, Theory, vol. I: Methods and Applications; vol. II: Theory, 1953, New York: John Wiley and Sons), variance estimation for longitudinal, cross-sectional measures and measures of change for single and multistage stage cluster sampling designs (Berger, Y. G., 2015, <doi:10.1111/rssb.12116>). Several other precision measures are derived - standard error, the coefficient of variation, the margin of error, confidence interval, design effect.

URL https://csblatvia.github.io/vardpoor/

BugReports https://github.com/CSBLatvia/vardpoor/issues/

License EUPL

Encoding UTF-8

Repository CRAN

NeedsCompilation yes

LazyData true

RoxygenNote 7.1.0
The function computes extra variables for domain estimation. Each unique D row defines a domain. Extra variables are computed for each Y variable.
domain

Usage

\texttt{domain(Y, D, dataset = NULL, checking = TRUE)}

Arguments

\textbf{Y} \hspace{1cm} \text{Matrix of study variables. Any object convertible to data.table with numeric values, NA values are not allowed. Object convertible to data.table or variable names as character, column numbers.}

\textbf{D} \hspace{1cm} \text{Matrix of domain variables. Any object convertible to data.table. The number of rows of D must match the number of rows of Y. Duplicated names are not allowed. Object convertible to data.table or variable names as character, column numbers.}

\textbf{dataset} \hspace{1cm} \text{Optional survey data object convertible to data.table.}

\textbf{checking} \hspace{1cm} \text{Optional variable if this variable is TRUE, then function checks data preparation errors, otherwise not checked. This variable by default is TRUE.}

Value

\texttt{numeric data.table} containing extra variables for domain estimation.

References


See Also

vardom, vardomh

Examples

### Example 0

\texttt{domain(Y = 1, D = "A")}

### Example 1

\texttt{Y1 <- as.matrix(1:10)}
\texttt{colnames(Y1) <- "Y1"}
\texttt{D1 <- as.matrix(rep(1, 10))}
\texttt{colnames(D1) <- "D1"}
\texttt{domain(Y = Y1, D = D1)}

### Example 2

\texttt{Y <- matrix(1:20, 10, 2)}
\texttt{colnames(Y) <- paste0("Y", 1:2)}
\texttt{D <- matrix(rep(1:2, each = 5), 10, 1)}
\texttt{colnames(D) <- "D"}
incPercentile

Estimation of weighted percentiles

Description

The function computes the estimates of weighted percentiles.

Usage

incPercentile(
  Y,
  weights = NULL,
  sort = NULL,
  Dom = NULL,
  period = NULL,
  k = c(20, 80),
  dataset = NULL,
  checking = TRUE
)

Arguments

Y
  Study variable (for example equalized disposable income). One dimensional object convertible to one-column data.table or variable name as character, column number.

weights
  Optional weight variable. One dimensional object convert to one-column data.table or variable name as character, column number.

sort
  Optional variable to be used as tie-breaker for sorting. One dimensional object convertible to one-column data.table or variable name as character, column number.
lin.ratio

Description

Computes linearized variable for the ratio estimator.

Usage

lin.ratio(
  Y,
  Z,
  weight,
  Dom = NULL,
  dataset = NULL,
)

Value

A data.table containing the estimates of weighted income percentiles specified by k.

References


See Also

linarpt, linarpr, linqsr

Examples

library("laeken")
data("eusilc")
incPercentile(Y = "eqIncome", weights = "rb050", Dom = "db040", dataset = eusilc)
lin.ratio

percentratio = 1,
checking = TRUE
)

Arguments

Y Matrix of numerator variables. Any object convertible to data.table with numeric values, NA values are not allowed.

Z Matrix of denominator variables. Any object convertible to data.table with numeric values, NA values are not allowed.

weight Weight variable. One dimensional object convertible to one-column data.table.

Dom Optional variables used to define population domains. If supplied, the linearized variables are computed for each domain. An object convertible to data.table.

dataset Optional survey data object convertible to data.table.

percentratio Positive integer value. All linearized variables are multiplied with percentratio value, by default - 1.

checking Optional variable if this variable is TRUE, then function checks data preparation errors, otherwise not checked. This variable by default is TRUE.

Value

The function returns the data.table of the linearized variables for the ratio estimator.

References


See Also
domain, vardom, vardomh, vardcros, vardchanges, vardannual

Examples

library("data.table")
Y <- data.table(Y = rchisq(10, 3))
Z <- data.table(Z = rchisq(10, 3))
weights <- rep(Z, 10)
data.table(Y, Z, weights,
V1 = lin.ratio(Y, Z, weights, percentratio = 1),
V10 = lin.ratio(Y, Z, weights, percentratio = 10),
V100 = lin.ratio(Y, Z, weights, percentratio = 100))
linarpr

Description

Estimates the at-risk-of-poverty rate (defined as the proportion of persons with equalized disposable income below at-risk-of-poverty threshold) and computes linearized variable for variance estimation.

Usage

linarpr(
  Y,
  id = NULL,
  weight = NULL,
  Y_thres = NULL,
  wght_thres = NULL,
  sort = NULL,
  Dom = NULL,
  period = NULL,
  dataset = NULL,
  percentage = 60,
  order_quant = 50,
  var_name = "lin_arpr",
  checking = TRUE
)

Arguments

Y
  Study variable (for example equalized disposable income). One dimensional object convertible to one-column data.table or variable name as character, column number).

id
  Optional variable for unit ID codes. One dimensional object convertible to one-column data.table or variable name as character, column number or logical vector).

weight
  Optional weight variable. One dimensional object convertible to one-column data.table or variable name as character, column number or logical vector).

Y_thres
  Variable (for example equalized disposable income) used for computation and linearization of poverty threshold. One dimensional object convertible to one-column data.table or variable name as character, column number. Variable specified for inc is used as income_thres if income_thres is not defined.

wght_thres
  Weight variable used for computation and linearization of poverty threshold. One dimensional object convertible to one-column data.table or variable name as character, column number or logical vector. Variable specified for weight is used as wght_thres if wght_thres is not defined.
sort Optional variable to be used as tie-breaker for sorting. One dimensional object convertible to one-column data.table or variable name as character, column number.

Dom Optional variables used to define population domains. If supplied, linearization of at-risk-of-poverty threshold is done for each domain. An object convertible to data.table or variable names as character vector, column numbers as numeric vector.

period Optional variable for survey period. If supplied, linearization of at-risk-of-poverty threshold is done for each survey period. Object convertible to data.table or variable names as character, column numbers as numeric vector.

dataset Optional survey data object convertible to data.table.

percentage A numeric value in range \([0, 100]\) for \(p\) in the formula for at-risk-of-poverty threshold computation:

\[
\frac{p}{100} \cdot Z_{\alpha}.
\]

For example, to compute at-risk-of-poverty threshold equal to 60% of some income quantile, \(p\) should be set equal to 60.

order_quant A numeric value in range \([0, 100]\) for \(\alpha\) in the formula for at-risk-of-poverty threshold computation:

\[
\frac{p}{100} \cdot Z_{\alpha}.
\]

For example, to compute at-risk-of-poverty threshold equal to some percentage of median income, \(\alpha\) should be set equal to 50.

var_name A character specifying the name of the linearized variable.

checking Optional variable if this variable is TRUE, then function checks data preparation errors, otherwise not checked. This variable by default is TRUE.

Details

The implementation strictly follows the Eurostat definition.

Value

A list with four objects are returned:

- quantile - a data.table containing the estimated value of the quintile used for at-risk-of-poverty threshold estimation.
- threshold - a data.table containing the estimated at-risk-of-poverty threshold.
- value - a data.table containing the estimated at-risk-of-poverty rate (in percentage).
- lin - a data.table containing the linearized variables of the at-risk-of-poverty rate (in percentage).
References


See Also

`linarpt`, `varpoord`, `vardcrospoor`, `vardchangespoor`

Examples

```r
library("data.table")
library("laeken")
data("eusilc")
dataset1 <- data.table(IDd = paste0("V", 1 : nrow(eusilc)), eusilc)

# Full population
d <- linarpr(Y = "eqIncome", id = "IDd",
              weight = "rb050", Dom = NULL,
              dataset = dataset1, percentage = 60,
              order_quant = 50L)
d$value

## Not run:
# By domains
dd <- linarpr(Y = "eqIncome", id = "IDd",
              weight = "rb050", Dom = "db040",
              dataset = dataset1, percentage = 60,
              order_quant = 50L)
dd
## End(Not run)
```

**linarpt**

*Linearization of at-risk-of-poverty threshold*

**Description**

Estimates the at-risk-of-poverty threshold (defined as percentage (usually 60%) of equalised disposable income after social transfers quantile (usually median)) and computes linearized variable for variance estimation.
Usage

linarpt(
  Y,
  id = NULL,
  weight = NULL,
  sort = NULL,
  Dom = NULL,
  period = NULL,
  dataset = NULL,
  percentage = 60,
  order_quant = 50,
  var_name = "lin_arpt",
  checking = TRUE
)

Arguments

Y Study variable (for example equalised disposable income after social transfers). One dimensional object convertible to one-column data.table or variable name as character, column number.

id Optional variable for unit ID codes. One dimensional object convertible to one-column data.table or variable name as character, column number.

weight Optional weight variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

sort Optional variable to be used as tie-breaker for sorting. One dimensional object convertible to one-column data.table or variable name as character, column number.

Dom Optional variables used to define population domains. If supplied, linearization of at-risk-of-poverty threshold is done for each domain. An object convertible to data.table or variable names as character vector, column numbers as numeric vector.

period Optional variable for survey period. If supplied, linearization of at-risk-of-poverty threshold is done for each survey period. Object convertible to data.table or variable names as character, column numbers as numeric vector.

dataset Optional survey data object convertible to data.table.

percentage A numeric value in range \([0, 100]\) for \(p\) in the formula for at-risk-of-poverty threshold computation:

\[
\frac{p}{100} \cdot Z_{\frac{\alpha}{100}}.
\]

For example, to compute poverty threshold equal to 60% of some income quantile, \(p\) should be set equal to 60.

order_quant A numeric value in range \([0, 100]\) for \(\alpha\) in the formula for at-risk-of-poverty threshold computation:

\[
\frac{p}{100} \cdot Z_{\frac{\alpha}{100}}.
\]

For example, to compute poverty threshold equal to some percentage of median income, \(\alpha\) should be set equal to 50.
linarpt

var_name
A character specifying the name of the linearized variable.

checking
Optional variable if this variable is TRUE, then function checks data preparation errors, otherwise not checked. This variable by default is TRUE.

Details
The implementation strictly follows the Eurostat definition.

Value
A list with three objects are returned:

- quantile - a data.table containing the estimated value of the quintile used for at-risk-of-poverty threshold estimation.
- value - a data.table containing the estimated at-risk-of-poverty threshold (in percentage).
- lin - a data.table containing the linearized variables of the at-risk-of-poverty threshold (in percentage).

References

See Also
linarpr, incPercentile, varpoord, vardcrospoor, vardchangespoor

Examples
library("data.table")
library("laeken")
data("eusilc")
dataset1 <- data.table(IDd = paste0("V", 1 : nrow(eusilc)), eusilc)

# Full population
d1 <- linarpt(Y = "eqIncome", id = "IDd", weight = "rb050", Dom = NULL, dataset = dataset1, percentage = 60, order_quant = 50L)
d1$value

## Not run:
# By domains
linarr

Linearization of the aggregate replacement ratio

Description

Estimates the aggregate replacement ratio (defined as the gross median individual pension income of the population aged 65-74 relative to the gross median individual earnings from work of the population aged 50-59, excluding other social benefits) and computes linearized variable for variance estimation.

Usage

```r
linarr(
  Y,
  Y_den,
  id = NULL,
  age,
  pl085,
  month_at_work,
  weight = NULL,
  sort = NULL,
  Dom = NULL,
  period = NULL,
  dataset = NULL,
  order_quant = 50,
  var_name = "lin_arr",
  checking = TRUE
)
```

Arguments

- **Y**: Numerator variable (for gross pension income). One dimensional object convertible to one-column `data.table` or variable name as character, column number.
- **Y_den**: Denominator variable (for example gross individual earnings). One dimensional object convertible to one-column `data.table` or variable name as character, column number.
- **id**: Optional variable for unit ID codes. One dimensional object convertible to one-column `data.table` or variable name as character, column number.
linarr

age  Age variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

pl085 Retirement variable (Number of months spent in retirement or early retirement). One dimensional object convertible to one-column data.table or variable name as character, column number.

month_at_work  Variable for total number of month at work (sum of the number of months spent at full-time work as employee, number of months spent at part-time work as employee, number of months spent at full-time work as self-employed (including family worker), number of months spent at part-time work as self-employed (including family worker)). One dimensional object convertible to one-column data.table or variable name as character, column number.

weight  Optional weight variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

sort  Optional variable to be used as tie-breaker for sorting. One dimensional object convertible to one-column data.table or variable name as character, column number.

Dom  Optional variables used to define population domains. If supplied, linearization of at-risk-of-poverty threshold is done for each domain. An object convertible to data.table or variable names as character vector, column numbers as numeric vector.

period  Optional variable for survey period. If supplied, linearization of at-risk-of-poverty threshold is done for each survey period. Object convertible to data.table or variable names as character, column numbers as numeric vector.

dataset  Optional survey data object convertible to data.table.

order_quant  A numeric value in range \([0, 100]\) for \(\alpha\) in the formula \(\frac{p}{100} \cdot Z_{\alpha} \) for at-risk-of-poverty threshold computation:

\[
\frac{p}{100} \cdot Z_{\alpha}.
\]

For example, to compute at-risk-of-poverty threshold equal to some percentage of median income, \(\alpha\) should be set equal to 50.

var_name  A character specifying the name of the linearized variable.

checking  Optional variable if this variable is TRUE, then function checks data preparation errors, otherwise not checked. This variable by default is TRUE.

Details

The implementation strictly follows the Eurostat definition.

Value

A list with four objects are returned:

- value - a data.table containing the estimated the aggregate replacement ratio.
- lin - a data.table containing the linearized variables of the aggregate replacement ratio.
References


See Also

varpoord, vardcrospoor, vardchangespoor

Examples

```r
library("data.table")
library("laeken")
data("eusilc")
dataset1 <- data.table(IDd = paste0("V", 1 : nrow(eusilc)), eusilc)
dataset1$pl085 <- 12 * trunc(runif(nrow(dataset1), 0, 2))
dataset1$month_at_work <- 12 * trunc(runif(nrow(dataset1), 0, 2))

# Full population
d <- linarr(Y = "eqIncome", Y_den = "eqIncome",
id = "IDd", age = "age",
pl085 = "pl085", month_at_work = "month_at_work",
weight = "rb050", Dom = NULL,
dataset = dataset1, order_quant = 50L)
d$value

## Not run:
# By domains
dd <- linarr(Y = "eqIncome", Y_den = "eqIncome",
id = "IDd", age = "age",
pl085 = "pl085", month_at_work = "month_at_work",
weight = "rb050", Dom = "db040",
dataset = dataset1, order_quant = 50L)

dd
## End(Not run)
```

lingini  Linearization of the GINI coefficient I

Description

Estimate the Gini coefficient, which is a measure for inequality, and its linearization.
Usage

lingini(
  Y,
  id = NULL,
  weight = NULL,
  sort = NULL,
  Dom = NULL,
  period = NULL,
  dataset = NULL,
  var_name = "lin_gini",
  checking = TRUE
)

Arguments

Y Study variable (for example equalized disposable income). One dimensional object convertible to one-column data.table or variable name as character, column number.

id Optional variable for unit ID codes. One dimensional object convertible to one-column data.table or variable name as character, column number.

weight Optional weight variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

sort Optional variable to be used as tie-breaker for sorting. One dimensional object convertible to one-column data.table or variable name as character, column number.

Dom Optional variables used to define population domains. If supplied, linearization of the GINI is done for each domain. An object convertible to data.table or variable names as character vector, column numbers.

period Optional variable for survey period. If supplied, linearization of the GINI is done for each time period. Object convertible to data.table or variable names as character, column numbers.

dataset Optional survey data object convertible to data.table.

var_name A character specifying the name of the linearized variable.

checking Optional variable if this variable is TRUE, then function checks data preparation errors, otherwise not checked. This variable by default is TRUE.

return A list with two objects are returned by the function:

• value - a data.table containing the estimated Gini coefficients (in percentage) by G. Osier and Eurostat.
• lin - a data.table containing the linearized variables of the Gini coefficients (in percentage) by G. Osier.

References


See Also

lingini2, linqsr, varpoord, vardcrospropoor, vardchangespropoor

Examples

```r
library("laeken")
library("data.table")
data("eusilc")
dataset1 <- data.table(IDd = paste0("V", 1 : nrow(eusilc)), eusilc)[1 : 3,]

# Full population
dat1 <- lingini(Y = "eqIncome", id = "IDd",
                weight = "rb050", dataset = dataset1)
dat1$value

## Not run:
# By domains
dat2 <- lingini(Y = "eqIncome", id = "IDd", weight = "rb050",
                Dom = c("db040"), dataset = dataset1)
dat2$value

## End(Not run)
```

---

**lingini2**  
*Linearization of the GINI coefficient II*

**Description**

Estimate the Gini coefficient, which is a measure for inequality, and its linearization.

**Usage**

```r
lingini2(Y, 
id = NULL, 
weight = NULL, 
sort = NULL, 
Dom = NULL, 
period = NULL, 
dataset = NULL)```

var_name = "lin_gini2",
  checking = TRUE
)

Arguments

Y Study variable (for example equalized disposable income). One dimensional object convertible to one-column data.table or variable name as character, column number.

id Optional variable for unit ID codes. One dimensional object convertible to one-column data.table or variable name as character, column number.

weight Optional weight variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

sort Optional variable to be used as tie-breaker for sorting. One dimensional object convertible to one-column data.table or variable name as character, column number.

Dom Optional variables used to define population domains. If supplied, linearization of the GINI is done for each domain. An object convertible to data.table or variable names as character vector, column numbers.

period Optional variable for survey period. If supplied, linearization of the GINI is done for each time period. Object convertible to data.table or variable names as character, column numbers.

dataset Optional survey data object convertible to data.table.

var_name A character specifying the name of the linearized variable.

checking Optional variable if this variable is TRUE, then function checks data preparation errors, otherwise not checked. This variable by default is TRUE.

Value

A list with two objects are returned by the function:

- value - a data.table containing the estimated Gini coefficients (in percentage) by Langel and Tille (2012) and Eurostat.
- lin - a data.table containing the linearized variables of the Gini coefficients (in percentage) by Langel and Tille (2012).

References


See Also

lingini, linqsr, varpoord, vardcrosopoor, vardchangespoor

Examples

```r
library("data.table")
library("laeken")
data("eusilc")
dataset1 <- data.table(IDd = paste0("V", 1 : nrow(eusilc)), eusilc)

# Full population
dat1 <- lingini2(Y = "eqIncome", id = "IDd",
          weight = "rb050", dataset = dataset1)
dat1$value

## Not run:
# By domains
# By domains
dat2 <- lingini2(Y = "eqIncome", id = "IDd",
          weight = "rb050", Dom = c("db040"),
          dataset = dataset1)
dat2$value
## End(Not run)
```

---

**lingpg**

*Linearization of the gender pay (wage) gap.*

**Description**

Estimation of gender pay (wage) gap and computation of linearized variables for variance estimation.

**Usage**

```r
lingpg(
  Y,
  gender = NULL,
  id = NULL,
  weight = NULL,
  sort = NULL,
  Dom = NULL,
  period = NULL,
)```
\begin{verbatim}
 dataset = NULL,
 var_name = "lin_gpg",
 checking = TRUE
)

Arguments

\textbf{Y} \hspace{2cm} Study variable (for example the gross hourly earning). One dimensional object
convertible to one-column \texttt{data.table} or variable name as character, column
number.

\textbf{gender} \hspace{2cm} Numerical variable for gender, where 1 is for males, but 2 is for females. One
dimensional object convertible to one-column \texttt{data.table} or variable name as character, column
number.

\textbf{id} \hspace{2cm} Optional variable for unit ID codes. One dimensional object convertible to one-
column \texttt{data.table} or variable name as character, column number.

\textbf{weight} \hspace{2cm} Optional weight variable. One dimensional object convertible to one-column
\texttt{data.table} or variable name as character, column number.

\textbf{sort} \hspace{2cm} Optional variable to be used as tie-breaker for sorting. One dimensional object
convertible to one-column \texttt{data.table} or variable name as character, column number.

\textbf{Dom} \hspace{2cm} Optional variables used to define population domains. If supplied, estimation
and linearization of gender pay (wage) gap is done for each domain. An ob-
ject convertible to \texttt{data.table} or variable names as character vector, column
numbers.

\textbf{period} \hspace{2cm} Optional variable for survey period. If supplied, estimation and linearization
of gender pay (wage) gap is done for each time period. Object convertible to
\texttt{data.table} or variable names as character, column numbers.

\textbf{dataset} \hspace{2cm} Optional survey data object convertible to \texttt{data.table}.

\textbf{var_name} \hspace{2cm} A character specifying the name of the linearized variable.

\textbf{checking} \hspace{2cm} Optional variable if this variable is TRUE, then function checks data preparation
errors, otherwise not checked. This variable by default is TRUE.

Value

A list with two objects are returned:

\begin{itemize}
  \item \textbf{value} - a \texttt{data.table} containing the estimated gender pay (wage) gap (in percentage).
  \item \textbf{lin} - a \texttt{data.table} containing the linearized variables of the gender pay (wage) gap (in
  percentage) for variance estimation.
\end{itemize}

References

indicators based on EU-SILC; the gender pay gap. \textit{EU-SILC 131-rev/04}, Eurostat.
\textit{Journal of the European Survey Research Association}, Vol.3, No.3, pp. 167-195, ISSN 1864-3361,

See Also

linqsr, lingini, varpoord, vardcrospoor, vardchangespoor

Examples

library("data.table")
library("laeken")
data("ses")
dataset1 <- data.table(ID = paste0("V", 1 : nrow(ses)), ses)
setnames(dataset1, "sex", "sexf")
dataset1[sexf == "male", sex:= 1]
dataset1[sexf == "female", sex:= 2]

# Full population
gpgs1 <- lingpg(Y = "earningsHour", gender = "sex",
             id = "ID", weight = "weights",
             dataset = dataset1)
gpgs1$value

## Not run:
# Domains by education
gpgs2 <- lingpg(Y = "earningsHour", gender = "sex",
             id = "ID", weight = "weights",
             Dom = "education", dataset = dataset1)
gpgs2$value

# Sort variable
gpgs3 <- lingpg(Y = "earningsHour", gender = "sex",
             id = "ID", weight = "weights",
             sort = "ID", Dom = "education",
             dataset = dataset1)
gpgs3$value

# Two survey periods
dataset1[, year := 2010]
dataset2 <- copy(dataset1)
dataset2[, year := 2011]
dataset1 <- rbind(dataset1, dataset2)
gpgs4 <- lingpg(Y = "earningsHour", gender = "sex",
             id = "ID", weight = "weights",
             sort = "ID", Dom = "education",
             period = "year", dataset = dataset1)
gpgs4$value

names(gpgs4$lin)

## End(Not run)
linpoormed

**Linearization of the median income of individuals below the At Risk of Poverty Threshold**

**Description**

Estimation of the median income of individuals below At Risk of Poverty Threshold and computation of linearized variable for variance estimation. The At Risk of Poverty Threshold is estimated for the whole population always. The median income is estimated for the whole population or for each domain.

**Usage**

linpoormed(
    Y,
    id = NULL,
    weight = NULL,
    sort = NULL,
    Dom = NULL,
    period = NULL,
    dataset = NULL,
    percentage = 60,
    order_quant = 50,
    var_name = "lin_poormed",
    checking = TRUE
)

**Arguments**

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>Study variable (for example equalized disposable income). One dimensional object convertible to one-column data.table or variable name as character, column number.</td>
</tr>
<tr>
<td>id</td>
<td>Optional variable for unit ID codes. One dimensional object convertible to one-column data.table or variable name as character, column number.</td>
</tr>
<tr>
<td>weight</td>
<td>Optional weight variable. One dimensional object convertible to one-column data.table or variable name as character, column number.</td>
</tr>
<tr>
<td>sort</td>
<td>Optional variable to be used as tie-breaker for sorting. One dimensional object convertible to one-column data.table or variable name as character, column number.</td>
</tr>
<tr>
<td>Dom</td>
<td>Optional variables used to define population domains. If supplied, linearization of the median income of persons below a poverty threshold is done for each domain. An object convertible to data.table or variable names as character vector, column numbers.</td>
</tr>
</tbody>
</table>
period  Optional variable for survey period. If supplied, linearization of the median income of persons below a poverty threshold is done for each time period. Object convertible to data.table or variable names as character, column numbers.

dataset  Optional survey data object convertible to data.table.

percentage  A numeric value in range $[0, 100]$ for $p$ in the formula for poverty threshold computation:

$$\frac{p}{100} \cdot Z_{\alpha_{\text{lin}}}.$$  

For example, to compute poverty threshold equal to 60% of some income quantile, $p$ should be set equal to 60.

order_quant  A numeric value in range $[0, 100]$ for $\alpha$ in the formula for poverty threshold computation:

$$\frac{p}{100} \cdot Z_{\alpha_{\text{lin}}}.$$  

For example, to compute poverty threshold equal to some percentage of median income, $\alpha$ should be set equal to 50.

var_name  A character specifying the name of the linearized variable.

checking  Optional variable if this variable is TRUE, then function checks data preparation errors, otherwise not checked. This variable by default is TRUE.

Value

A list with two objects are returned by the function:

- `value` - a data.table containing the estimated median income of individuals below the At Risk of Poverty Threshold.
- `lin` - a data.table containing the linearized variables of the median income below the At Risk of Poverty Threshold.

References


See Also

`linarpt`, `linrmpg`, `varpoord`, `vardcrossoor`, `vardchangespoor`
linqsr

Examples

library("laeken")
library("data.table")
data("eusilc")
dataset1 <- data.table(IDd = paste0("V", 1 : nrow(eusilc)), eusilc)

# Full population
D <- linpoormed(Y = "eqIncome", id = "IDd",
                 weight = "rb050", Dom = NULL,
                 dataset = dataset1, percentage = 60,
                 order_quant = 50L)

## Not run:
# Domains by location of household
dd <- linpoormed(Y = "eqIncome", id = "IDd",
                 weight = "rb050", Dom = NULL,
                 dataset = dataset1, percentage = 60,
                 order_quant = 50L)

dd
## End(Not run)

linqsr

Linearization of the Quintile Share Ratio

Description

Estimate the Quintile Share Ratio, which is defined as the ratio of the sum of equalized disposable income received by the top 20% to the sum of equalized disposable income received by the bottom 20%, and its linearization.

Usage

linqsr(
  Y,
  id = NULL,
  weight = NULL,
  sort = NULL,
  Dom = NULL,
  period = NULL,
  dataset = NULL,
  alpha = 20,
  var_name = "lin_qsr",
  checking = TRUE
)
Arguments

Y  Study variable (for example equalized disposable income). One dimensional object convertible to one-column data.table or variable name as character, column number.

id  Optional variable for unit ID codes. One dimensional object convertible to one-column data.table or variable name as character, column number.

weight  Optional weight variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

sort  Optional variable to be used as tie-breaker for sorting. One dimensional object convertible to one-column data.table or variable name as character, column number.

Dom  Optional variables used to define population domains. If supplied, linearization of the income quintile share ratio is done for each domain. An object convertible to data.table or variable names as character vector, column numbers.

period  Optional variable for survey period. If supplied, linearization of the income quintile share ratio is done for each time period. Object convertible to data.table or variable names as character, column numbers.

dataset  Optional survey data object convertible to data.table.

alpha  a numeric value in range [0, 100] for the order of the Quintile Share Ratio.

var_name  A character specifying the name of the linearized variable.

checking  Optional variable if this variable is TRUE, then function checks data preparation errors, otherwise not checked. This variable by default is TRUE.

Value

A list with two objects are returned by the function:

- value - a data.table containing the estimated Quintile Share Ratio by G. Osier and Eurostat papers.
- lin - a data.table containing the linearized variables of the Quintile Share Ratio by G. Osier paper.

References


See Also

incPercentile, varpoord, vardcrospoor, vardchangespoor
linrmir

Examples

```r
library("data.table")
library("laeken")
data("eusilc")
dataset1 <- data.table(IDd = paste0("V", 1:nrow(eusilc)), eusilc)

# Full population
dd <- linqsr(Y = "eqIncome", id = "IDd",
              weight = "rb050", Dom = NULL,
              dataset = dataset1, alpha = 20)
dd$value

## Not run:
# By domains
dd <- linqsr(Y = "eqIncome", id = "IDd",
              weight = "rb050", Dom = "db040",
              dataset = dataset1, alpha = 20)
dd$value
## End(Not run)
```

linrmir  

**Linearization of the relative median income ratio**

Description

Estimates the relative median income ratio (defined as the ratio of the median equivalised disposable income of people aged above age to the median equivalised disposable income of those aged below 65) and computes linearized variable for variance estimation.

Usage

```r
linrmir(
  Y,
  id = NULL,
  age,
  weight = NULL,
  sort = NULL,
  Dom = NULL,
  period = NULL,
  dataset = NULL,
  order_quant = 50,
  var_name = "lin_rmir",
  checking = TRUE
)
```
Arguments

Y
Study variable (for example equalized disposable income). One dimensional object convertible to one-column \texttt{data.table} or variable name as character, column number.

id
Optional variable for unit ID codes. One dimensional object convertible to one-column \texttt{data.table} or variable name as character, column number.

age
Age variable. One dimensional object convertible to one-column \texttt{data.table} or variable name as character, column number.

weight
Optional weight variable. One dimensional object convertible to one-column \texttt{data.table} or variable name as character, column number.

sort
Optional variable to be used as tie-breaker for sorting. One dimensional object convertible to one-column \texttt{data.table} or variable name as character, column number.

Dom
Optional variables used to define population domains. If supplied, linearization of at-risk-of-poverty threshold is done for each domain. An object convertible to \texttt{data.table} or variable names as character vector, column numbers as numeric vector.

period
Optional variable for survey period. If supplied, linearization of at-risk-of-poverty threshold is done for each survey period. Object convertible to \texttt{data.table} or variable names as character, column numbers as numeric vector.

dataset
Optional survey data object convertible to \texttt{data.table}.

order_quant
A numeric value in range \([0, 100]\) for \(\alpha\) in the formula for at-risk-of-poverty threshold computation:
\[
\frac{p}{100} \cdot Z_{\frac{\alpha}{100}}.
\]
For example, to compute the relative median income ratio to some percentage of median income, \(\alpha\) should be set equal to 50.

var_name
A character specifying the name of the linearized variable.

checking
Optional variable if this variable is TRUE, then function checks data preparation errors, otherwise not checked. This variable by default is TRUE.

Details

The implementation strictly follows the Eurostat definition.

Value

A list with four objects are returned:

- value - a \texttt{data.table} containing the estimated relative median income ratio.
- lin - a \texttt{data.table} containing the linearized variables of the relative median income ratio.
**linrmpg**

**linearization of the relative median at-risk-of-poverty gap**

**Description**

Estimate the relative median at-risk-of-poverty gap, which is defined as the relative difference between the median equalized disposable income of persons below the At Risk of Poverty Threshold and the At Risk of Poverty Threshold itself (expressed as a percentage of the at-risk-of-poverty threshold) and its linearization.

**Usage**

```r
linrmpg(
  Y,
  id = NULL,
```

**References**


**See Also**

`varpoord`, `vardcrospoor`, `vardchangespoor`

**Examples**

```r
library("laeken")
library("data.table")
data("eusilc")
dataset1 <- data.table(IDd = paste0("V", 1 : nrow(eusilc)), eusilc)

# Full population
d <- linrmir(Y = "eqIncome", id = "IDd", age = "age",
              weight = "rb050", Dom = NULL,
              dataset = dataset1, order_quant = 50L)

## Not run:
# By domains
dd <- linrmir(Y = "eqIncome", id = "IDd", age = "age",
              weight = "rb050", Dom = "db040",
              dataset = dataset1, order_quant = 50L)

## End(Not run)
```
weight = NULL, 
sort = NULL, 
Dom = NULL, 
period = NULL, 
dataset = NULL, 
percentage = 60, 
order_quant = 50, 
var_name = "lin_rmpg", 
checking = TRUE 
)

Arguments

Y  Study variable (for example equalized disposable income). One dimensional 
object convertible to one-column data.table or variable name as character, 
column number.

id  Optional variable for unit ID codes. One dimensional object convertible to one- 
column data.table or variable name as character, column number.

weight  Optional weight variable. One dimensional object convertible to one-column 
data.table or variable name as character, column number.

sort  Optional variable to be used as tie-breaker for sorting. One dimensional object 
convertible to one-column data.table or variable name as character, column 
number.

Dom  Optional variables used to define population domains. If supplied, linearization 
of the relative median at-risk-of-poverty gap is done for each domain. An ob- 
ject convertible to data.table or variable names as character vector, column 
numbers.

period  Optional variable for survey period. If supplied, linearization of the relative 
median at-risk-of-poverty gap is done for each time period. Object convertible 
to data.table or variable names as character, column numbers.

dataset  Optional survey data object convertible to data.table.

percentage  A numeric value in range \([0, 100]\) for \(p\) in the formula for poverty threshold 
computation:

\[
\frac{p}{100} \cdot Z_{\frac{\alpha}{100}}.
\]

For example, to compute poverty threshold equal to 60% of some income quant-
tile, \(p\) should be set equal to 60.

order_quant  A numeric value in range \([0, 100]\) for \(\alpha\) in the formula for poverty threshold 
computation:

\[
\frac{p}{100} \cdot Z_{\frac{\alpha}{100}}.
\]

For example, to compute poverty threshold equal to some percentage of median 
income, \(\alpha\) should be set equal to 50.

var_name  A character specifying the name of the linearized variable.

checking  Optional variable if this variable is TRUE, then function checks data preparation 
errors, otherwise not checked. This variable by default is TRUE.

return A list with two objects are returned by the function:
• value - a data.table containing the estimated relative median at-risk-of-poverty gap (in percentage).
• lin - a data.table containing the linearized variables of the relative median at-risk-of-poverty gap (in percentage).

References


See Also

`linarpt, linarpr, linpoormed, varpoord, vardcrospoor, vardchangespoor`

Examples

```r
library("data.table")
library("laeken")
data("eusilc")
dataset1 <- data.table(IDd = paste0("V", 1 : nrow(eusilc)), eusilc)

# Full population
d <- linrmpg(Y = "eqIncome", id = "IDd",
              weight = "rb050", Dom = NULL,
              dataset = dataset1, percentage = 60,
              order_quant = 50L)
d$value
d$threshold

## Not run:
# By domains
dd <- linrmpg(Y = "eqIncome", id = "IDd",
              weight = "rb050", Dom = "db040",
              dataset = dataset1, percentage = 60,
              order_quant = 50L)

# End(Not run)
```
residual_est

Residual estimation of calibration

Description
Computes the estimation residuals of calibration.

Usage
residual_est(Y, X, weight, q, dataset = NULL, checking = TRUE)

Arguments
Y
Matrix of the variable of interest.
X
Matrix of the auxiliary variables for the calibration estimator. This is the matrix of the sample calibration variables.
weight
Weight variable. One dimensional object convertible to one-column data.frame.
q
Variable of the positive values accounting for heteroscedasticity. One dimensional object convertible to one-column data.frame.
dataset
Optional survey data object convertible to data.table.
checking
Optional variable if this variable is TRUE, then function checks data preparation errors, otherwise not checked. This variable by default is TRUE.

Details
The function implements the following estimator:

\[ e_k = Y_k - X_k' \hat{B} \]

where

\[ \hat{B} = \left( \sum_s weight_k q_k X_k X_k' \right)^{-1} \left( \sum_s weight_k q_k X_k Y_k \right) \]

Value
A list with objects are returned by the function:

- residuals - a numeric data.table containing the estimated residuals of calibration.
- betas - a numeric data.table containing the estimated coefficients of calibration.

References
vardannual

Variance estimation for measures of annual net change or annual for single and multistage stage cluster sampling designs

Description

Computes the variance estimation for measures of annual net change or annual for single and multistage stage cluster sampling designs.

Usage

vardannual(
  Y, 
  H, 
  PSU, 
  w_final, 
  ID_level1, 
  ID_level2, 
  Dom = NULL, 
  Z = NULL, 
  gender = NULL, 
  country = NULL, 
  years, 
  subperiods, 
  dataset = NULL, 
  year1 = NULL, 
  year2 = NULL, 
)
X = NULL,
countryX = NULL,
yearsX = NULL,
subperiodsX = NULL,
X_ID_level1 = NULL,
ind_gr = NULL,
g = NULL,
q = NULL,
datasetX = NULL,
frate = 0,
percntratio = 1,
use.estVar = FALSE,
use.gender = FALSE,
confidence = 0.95,
method = "cros"
)

Arguments

Y Variables of interest. Object convertible to data.table or variable names as character, column numbers.

H The unit stratum variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

PSU Primary sampling unit variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

w_final Weight variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

ID_level1 Variable for level1 ID codes. One dimensional object convertible to one-column data.table or variable name as character, column number.

Dom Optional variables used to define population domains. If supplied, variables are calculated for each domain. An object convertible to data.table or variable names as character vector, column numbers.

Z Optional variables of denominator for ratio estimation. If supplied, the ratio estimation is computed. Object convertible to data.table or variable names as character, column numbers. This variable is NULL by default.

gender Numerical variable for gender, where 1 is for males, but 2 is for females. One dimensional object convertible to one-column data.table or variable name as character, column number.

country Variable for the survey countries. The values for each country are computed independently. Object convertible to data.table or variable names as character, column numbers.

years Variable for the all survey years. The values for each year are computed independently. Object convertible to data.table or variable names as character, column numbers.

subperiods Variable for the all survey subperiods. The values for each subperiod are computed independently. Object convertible to data.table or variable names as character, column numbers.
The vector of years from variable **years** describes the first year for measures of annual net change.

The vector of years from variable **periods** describes the second year for measures of annual net change.

**X**

Optional matrix of the auxiliary variables for the calibration estimator. Object convertible to `data.table` or variable names as character, column numbers.

**countryX**

Optional variable for the survey countries. The values for each country are computed independently. Object convertible to `data.table` or variable names as character, column numbers.

**yearsX**

Variable of the all survey years. If supplied, residual estimation of calibration is done independently for each time period. Object convertible to `data.table` or variable names as character, column numbers.

**subperiodsX**

Variable for the all survey subperiods. If supplied, residual estimation of calibration is done independently for each time period. Object convertible to `data.table` or variable names as character, column numbers.

**X_ID_level1**

Variable for level1 ID codes. One dimensional object convertible to one-column `data.table` or variable name as character, column number.

**ind_gr**

Optional variable by which divided independently X matrix of the auxiliary variables for the calibration. One dimensional object convertible to one-column `data.table` or variable name as character, column number.

**g**

Optional variable of the g weights. One dimensional object convertible to one-column `data.table` or variable name as character, column number.

**q**

Variable of the positive values accounting for heteroscedasticity. One dimensional object convertible to one-column `data.table` or variable name as character, column number.

**datasetX**

Optional survey data object in household level convertible to `data.table`.

**frate**

Positive numeric value. Sampling rate in percentage, by default - 0.

**percentratio**

Positive numeric value. All linearized variables are multiplied with `percentratio` value, by default - 1.

**use.estVar**

Logical value. If value is `TRUE`, then R function `estVar` is used for the estimation of covariance matrix of the residuals. If value is `FALSE`, then R function `estVar` is not used for the estimation of covariance matrix of the residuals.

**use.gender**

Logical value. If value is `TRUE`, then subperiods is defined together with `gender`.

**confidence**

Optional; either a positive value for confidence interval. This variable by default is 0.95.

**method**

Character value; value 'cros' is for measures of annual or value 'netchanges' is for measures of annual net change. This variable by default is netchanges.

**ID_level2**

Optional variable for unit ID codes. One dimensional object convertible to one-column `data.table` or variable name as character, column number.

**dataset**

Optional survey data object convertible to `data.table`.
Value

A list with objects are returned by the function:

- `crossectional_results` - a data.table containing:
  - `year` - survey years,
  - `subperiods` - survey subperiods,
  - `country` - survey countries,
  - `Dom` - optional variable of the population domains,
  - `namesY` - variable with names of variables of interest,
  - `namesZ` - optional variable with names of denominator for ratio estimation,
  - `sample_size` - the sample size (in numbers of individuals),
  - `pop_size` - the population size (in numbers of individuals),
  - `total` - the estimated totals,
  - `variance` - the estimated variance of cross-sectional or longitudinal measures,
  - `sd_w` - the estimated weighted variance of simple random sample,
  - `sd_nw` - the estimated variance estimation of simple random sample,
  - `pop` - the population size (in numbers of households),
  - `sampl_siz` - the sample size (in numbers of households),
  - `stderr_w` - the estimated weighted standard error of simple random sample,
  - `stderr_nw` - the estimated standard error of simple random sample,
  - `se` - the estimated standard error of cross-sectional or longitudinal,
  - `rse` - the estimated relative standard error (coefficient of variation),
  - `cv` - the estimated relative standard error (coefficient of variation) in percentage,
  - `absolute_margin_of_error` - the estimated absolute margin of error,
  - `relative_margin_of_error` - the estimated relative margin of error,
  - `CI_lower` - the estimated confidence interval lower bound,
  - `CI_upper` - the estimated confidence interval upper bound,
  - `confidence_level` - the positive value for confidence interval.

- `crossectional_var_grad` - a data.table containing:
  - `year` - survey years,
  - `subperiods` - survey subperiods,
  - `country` - survey countries,
  - `Dom` - optional variable of the population domains,
  - `namesY` - variable with names of variables of interest,
  - `namesZ` - optional variable with names of denominator for ratio estimation,
  - `grad` - the estimated gradient,
  - `var` - the estimated a design-based variance.

- `vardchanges_grad_var` - a data.table containing:
  - `year_1` - survey years of years1,
  - `subperiods_1` - survey subperiods of years1,
  - `year_2` - survey years of years2,
  - `subperiods_2` - survey subperiods of years2,
  - `country` - survey countries,
  - `Dom` - optional variable of the population domains,
  - `namesY` - variable with names of variables of interest,
  - `namesZ` - optional variable with names of denominator for ratio estimation,
  - `nams` - gradient names, numerator (num) and denominator (den), for each year,
  - `grad` - the estimated gradient,
cros_var - the estimated a design-based variance.

- **vardchanges_rh** - a data.table containing:
  - year - survey years of years for crossectional estimates,
  - subperiods - survey subperiods of years for crossectional estimates,
  - year_1 - survey years of years1,
  - subperiods_1 - survey subperiods of years1,
  - year_2 - survey years of years2,
  - subperiods_2 - survey subperiods of years2,
  - country - survey countries,
  - Dom - optional variable of the population domains,
  - namesY - variable with names of variables of interest,
  - namesZ - optional variable with names of denominator for ratio estimation,
  - nams - gradient names, numerator (num) and denominator (den), for each year,
  - rho - the estimated correlation matrix.

- **vardchanges_var_tau** - a data.table containing:
  - year_1 - survey years of years1,
  - subperiods_1 - survey subperiods of years1,
  - year_2 - survey years of years2,
  - subperiods_2 - survey subperiods of years2,
  - country - survey countries,
  - Dom - optional variable of the population domains,
  - namesY - variable with names of variables of interest,
  - namesZ - optional variable with names of denominator for ratio estimation,
  - nams - gradient names, numerator (num) and denominator (den), for each year,
  - var_tau - the estimated covariance matrix.

- **vardchanges_results** - a data.table containing:
  - year - survey years of years for measures of annual,
  - subperiods - survey subperiods of years for measures of annual,
  - year_1 - survey years of years1 for measures of annual net change,
  - subperiods_1 - survey subperiods of years1 for measures of annual net change,
  - year_2 - survey years of years2 for measures of annual net change,
  - subperiods_2 - survey subperiods of years2 for measures of annual net change,
  - country - survey countries,
  - Dom - optional variable of the population domains,
  - namesY - variable with names of variables of interest,
  - namesZ - optional variable with names of denominator for ratio estimation,
  - estim_1 - the estimated value for period1,
  - estim_2 - the estimated value for period2,
  - estim - the estimated value,
  - var - the estimated variance,
  - se - the estimated standard error,
  - CI_lower - the estimated confidence interval lower bound,
  - CI_upper - the estimated confidence interval upper bound,
  - confidence_level - the positive value for confidence interval,
  - significant - is the the difference significant

- **X_annual** - a data.table containing:
  - year - survey years of years for measures of annual,
  - year_1 - survey years of years1 for measures of annual net change,
year_2 - survey years of years2 for measures of annual net change,
period - period1 and period2 together,
country - survey countries,
Dom - optional variable of the population domains,
namesY - variable with names of variables of interest,
namesZ - optional variable with names of denominator for ratio estimation,
cros_se - the estimated cross-sectional standard error.

• A_matrix - a data.table containing:
  year - survey years of years1 for measures of annual,
  year_1 - survey years of years1 for measures of annual net change,
  year_2 - survey years of years2 for measures of annual net change,
  country - survey countries,
  Dom - optional variable of the population domains,
  namesY - variable with names of variables of interest,
  namesZ - optional variable with names of denominator for ratio estimation,
  cols - the estimated matrix_A columns,
  matrix_A - the estimated matrix A.

• annual_sum - a data.table containing:
  year - survey years,
  country - survey countries,
  Dom - optional variable of the population domains,
  namesY - variable with names of variables of interest,
  namesZ - optional variable with names of denominator for ratio estimation,
  totalY - the estimated value of variables of interest for period1,
  totalZ - optional the estimated value of denominator for period2,
  estim - the estimated value for year.

• annual_results - a data.table containing:
  year - survey years of years for measures of annual,
  year_1 - survey years of years1 for measures of annual net change,
  year_2 - survey years of years2 for measures of annual net change,
  country - survey countries,
  Dom - optional variable of the population domains,
  namesY - variable with names of variables of interest,
  namesZ - optional variable with names of denominator for ratio estimation,
  estim_1 - the estimated value for period1 for measures of annual net change,
  estim_2 - the estimated value for period2 for measures of annual net change,
  estim - the estimated value,
  var - the estimated variance,
  se - the estimated standard error,
  rse - the estimated relative standard error (coefficient of variation),
  cv - the estimated relative standard error (coefficient of variation) in percentage,
  absolute_margin_of_error - the estimated absolute margin of error for period1 for measures of annual,
  relative_margin_of_error - the estimated relative margin of error in percentage for measures of annual,
  CI_lower - the estimated confidence interval lower bound,
  CI_upper - the estimated confidence interval upper bound,
  confidence_level - the positive value for confidence interval,
significant - is the the difference significant

References


See Also
domain, vardcros, vardchanges, vardbootstr

Examples

```r
### Example
library("laeken")
library("data.table")
data("eusilc")
set.seed(1)
eusilc1 <- eusilc[1 : 20,]
set.seed(1)
dataset1 <- data.table(rbind(eusilc1, eusilc1),
  year = c(rep(2010, nrow(eusilc1)),
  rep(2011, nrow(eusilc1))))
dataset1[, country:= "AT"]
dataset1[, half:= .I - 2 * trunc((.I - 1) / 2)]
dataset1[, quarter:= .I - 4 * trunc((.I - 1) / 4)]
dataset1[age < 0, age:= 0]
PSU <- dataset1[, .N, keyby = "db030"][, N:= NULL]
PSU[, PSU:= trunc(runif(nrow(PSU), 0, 5))]}
dataset1 <- merge(dataset1, PSU, all = TRUE, by = "db030")
PSU <- eusilc <- NULL
dataset1[, strata := c("XXXX")]
dataset1[, employed := trunc(runif(nrow(dataset1), 0, 2))]}
dataset1[, unemployed := trunc(runif(nrow(dataset1), 0, 2))]}
dataset1[, labour_force := employed + unemployed]
dataset1[, id lv2 := paste0("V", .I)]
result <- vardannual(Y = "employed", H = "strata,
```
PSU = "PSU", w_final = "rb050",
ID_level1 = "db030", ID_level2 = "id_lv2",
Dom = NULL, Z = NULL, years = "year",
subperiods = "half", dataset = dataset1,
percentratio = 100, confidence = 0.95,
method = "cros")

## Not run:
result2 <- vardannual(Y = "employed", H = "strata",
PSU = "PSU", w_final = "rb050",
ID_level1 = "db030", ID_level2 = "id_lv2",
Dom = NULL, Z = NULL, country = "country",
years = "year", subperiods = "quarter",
dataset = dataset1, year1 = 2010, year2 = 2011,
percentratio = 100, confidence = 0.95,
method = "netchanges")

result2

result3 <- vardannual(Y = "unemployed", H = "strata",
PSU = "PSU", w_final = "rb050",
ID_level1 = "db030", ID_level2 = "id_lv2",
Dom = NULL, Z = NULL, country = "country",
years = "year", subperiods = "quarter",
dataset = dataset1, year1 = 2010, year2 = 2011,
percentratio = 100, confidence = 0.95,
method = "netchanges")

result3

## End(Not run)

---

**vardbootstr**

Variance estimation for measures of annual net change or annual for single stratified sampling designs

**Description**

Computes the variance estimation for measures of annual net change or annual for single stratified sampling designs.

**Usage**

```r
vardbootstr(
  boots_count = 500,
  Y,
  H,
  PSU,
  w_final,
  ID_level1,
```

---
Z = NULL,
Dom = NULL,
dh = 1,
fpc,
dataset = NULL,
years,
subperiods = NULL,
year1 = NULL,
year2 = NULL,
percentratio = 100,
confidence = 0.95,
method = "cros"
)

Arguments

boots_count  Positive numeric value. Number of replicates, by default - 100
Y  Variables of interest. Object convertible to data.table or variable names as character, column numbers.
H  The unit stratum variable. One dimensional object convertible to one-column data.table or variable name as character, column number.
PSU  Primary sampling unit variable. One dimensional object convertible to one-column data.table or variable name as character, column number.
w_final  Weight variable. One dimensional object convertible to one-column data.table or variable name as character, column number.
ID_level1  Variable for unit ID codes. One dimensional object convertible to one-column data.table or variable name as character, column number.
Z  Optional variables of denominator for ratio estimation. If supplied, the ratio estimation is computed. Object convertible to data.table or variable names as character, column numbers. This variable is NULL by default.
Dom  Optional variables used to define population domains. If supplied, variables are calculated for each domain. An object convertible to data.table or variable name as character vector, column numbers.
dh  \( n_h - m_h \), where \( n_h \) is the stratum size and \( m_h \) the number of units sampled with replacement. By default, \( dh=1 \) (HFCN recommendation)
fpc  Variable for the finite population correction (sampling rate = \( n_h/N_h \)). Default = 0.
dataset  Optional survey data object convertible to data.table.
years  Variable for the all survey years. The values for each year are computed independently. Object convertible to data.table or variable names as character, column numbers.
subperiods  Variable for the all survey subperiods. The values for each subperiod are computed independently. Object convertible to data.table or variable names as character, column numbers.
The vector of years from variable `years1` describes the first year for measures of annual net change.

The vector of years from variable `years2` describes the second year for measures of annual net change.

Positive numeric value. All linearized variables are multiplied with `percentratio` value, by default - 1.

optional; either a positive value for confidence interval. This variable by default is 0.95.

character value; value 'cros' is for measures of annual or value 'netchanges' is for measures of annual net change. This variable by default is netchanges.

Value

A list with objects are returned by the function:

- `crossectional_results` - a data.table containing:
  - `year` - survey years,
  - `subperiods` - survey subperiods,
  - `variable` - names of variables of interest,
  - `Dom` - optional variable of the population domains,
  - `estim` - the estimated value,
  - `var` - the estimated variance of cross-sectional and longitudinal measures,
  - `sd_w` - the estimated weighted variance of simple random sample,
  - `se` - the estimated standard error of cross-sectional or longitudinal,
  - `rse` - the estimated relative standard error (coefficient of variation),
  - `cv` - the estimated relative standard error (coefficient of variation) in percentage,
  - `absolute_margin_of_error` - the estimated absolute margin of error,
  - `relative_margin_of_error` - the estimated relative margin of error,
  - `CI_lower` - the estimated confidence interval lower bound,
  - `CI_upper` - the estimated confidence interval upper bound,
  - `confidence_level` - the positive value for confidence interval.

- `annual_results` - a data.table containing:
  - `year_1` - survey years of `years1` for measures of annual net change,
  - `year_2` - survey years of `years2` for measures of annual net change,
  - `Dom` - optional variable of the population domains,
  - `variable` - names of variables of interest,
  - `estim_2` - the estimated value for period2 for measures of annual net change,
  - `estim_1` - the estimated value for period1 for measures of annual net change,
  - `estim` - the estimated value,
  - `var` - the estimated variance,
  - `se` - the estimated standard error,
  - `rse` - the estimated relative standard error (coefficient of variation),
  - `cv` - the estimated relative standard error (coefficient of variation) in percentage,
  - `absolute_margin_of_error` - the estimated absolute margin of error for measures of annual,
  - `relative_margin_of_error` - the estimated relative margin of error in percentage for measures of annual,
  - `CI_lower` - the estimated confidence interval lower bound,
CI_upper - the estimated confidence interval upper bound,
confidence_level - the positive value for confidence interval,
significant - is the the difference significant

@references Guillaume OSIER, Virginie RAYMOND, (2015), Development of methodology for
the estimate of variance of annual net changes for LFS-based indicators. Deliverable 1 - Short
document with derivation of the methodology.

See Also
vardchanges, vardannual

Examples

```R
### Example
library("laeken")
library("data.table")
data("eusilc")
set.seed(1)
eusilc1 <- eusilc[1 : 20,]
set.seed(1)
dataset1 <- data.table(rbind(eusilc1, eusilc1),
                      year = c(rep(2010, nrow(eusilc1)),
                      rep(2011, nrow(eusilc1))))
dataset1[, half:= .I - 2 * trunc((.I - 1) / 2)]
dataset1[, quarter:= .I - 4 * trunc((.I - 1) / 4)]
dataset1[age < 0, age:= 0]
PSU <- dataset1[, .N, keyby = "db030", keyby = NULL]
PSU[, PSU:= trunc(runif(nrow(PSU), 0, 5))]
dataset1 <- merge(dataset1, PSU, all = TRUE, by = "db030")
PSU <- eusilc <- NULL
dataset1[, strata := c("XXXX")]
dataset1[, employed := trunc(runif(nrow(dataset1), 0, 2))]
dataset1[, id_lv2 := paste0("V", .I)]
dataset1[, fpc := 0]
## Not run:
result <- vardbootstr(boots_count = 500, H = "employed", H = "strata",
                      PSU = "PSU", w_final = "rb050", ID_level1 = "ids",
                      Z = NULL, Dom = NULL, dh = 1, fpc = "fpc",
                      dataset = dataset1, years = "year",
                      subperiods = "half", year1 = 2010,
                      year = 2011, percentratio = 100,
                      confidence = 0.95, method = "netchanges")
result
## End(Not run)
```
Variance estimation for measures of change for single and multistage stage cluster sampling designs

Description
Computes the variance estimation for measures of change for single and multistage stage cluster sampling designs.

Usage
vardchanges(
  Y,
  H,
  PSU,
  w_final,
  ID_level1,
  ID_level2,
  Dom = NULL,
  Z = NULL,
  gender = NULL,
  country = NULL,
  period,
  dataset = NULL,
  period1,
  period2,
  X = NULL,
  countryX = NULL,
  periodX = NULL,
  X_ID_level1 = NULL,
  ind_gr = NULL,
  g = NULL,
  q = NULL,
  datasetX = NULL,
  linratio = FALSE,
  percentratio = 1,
  use.estVar = FALSE,
  outp_res = FALSE,
  confidence = 0.95,
  change_type = "absolute",
  checking = TRUE
)

Arguments

Y Variables of interest. Object convertible to data.table or variable names as character, column numbers.
H
The unit stratum variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

PSU
Primary sampling unit variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

w_final
Weight variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

ID_level1
Variable for level1 ID codes. One dimensional object convertible to one-column data.table or variable name as character, column number.

ID_level2
Optional variable for unit ID codes. One dimensional object convertible to one-column data.table or variable name as character, column number.

Dom
Optional variables used to define population domains. If supplied, variables are calculated for each domain. An object convertible to data.table or variable names as character vector, column numbers.

Z
Optional variables of denominator for ratio estimation. If supplied, the ratio estimation is computed. Object convertible to data.table or variable names as character, column numbers. This variable is NULL by default.

gender
Numerical variable for gender, where 1 is for males, but 2 is for females. One dimensional object convertible to one-column data.table or variable name as character, column number.

country
Variable for the survey countries. The values for each country are computed independently. Object convertible to data.table or variable names as character, column numbers.

period
Variable for the all survey periods. The values for each period are computed independently. Object convertible to data.table or variable names as character, column numbers.

dataset
Optional survey data object convertible to data.table.

period1
The vector of periods from variable periods describes the first period.

period2
The vector of periods from variable periods describes the second period.

X
Optional matrix of the auxiliary variables for the calibration estimator. Object convertible to data.table or variable names as character, column numbers.

countryX
Optional variable for the survey countries. The values for each country are computed independently. Object convertible to data.table or variable names as character, column numbers.

periodX
Optional variable of the all survey periods. If supplied, residual estimation of calibration is done independently for each time period. Object convertible to data.table or variable names as character, column numbers.

X_ID_level1
Variable for level1 ID codes. One dimensional object convertible to one-column data.table or variable name as character, column number.

ind_gr
Optional variable by which divided independently X matrix of the auxiliary variables for the calibration. One dimensional object convertible to one-column data.table or variable name as character, column number.

g
Optional variable of the g weights. One dimensional object convertible to one-column data.table or variable name as character, column number.
q Variable of the positive values accounting for heteroscedasticity. One dimensional object convertible to one-column \texttt{data.table} or variable name as character, column number.

datasetX Optional survey data object in household level convertible to \texttt{data.table}.

linratio Logical value. If value is \texttt{TRUE}, then the linearized variables for the ratio estimator is used for variance estimation. If value is \texttt{FALSE}, then the gradients is used for variance estimation.

percentratio Positive numeric value. All linearized variables are multiplied with \texttt{percentratio} value, by default - 1.

use.estVar Logical value. If value is \texttt{TRUE}, then \texttt{R} function \texttt{estVar} is used for the estimation of covariance matrix of the residuals. If value is \texttt{FALSE}, then \texttt{R} function \texttt{estVar} is not used for the estimation of covariance matrix of the residuals.

outp_res Logical value. If \texttt{TRUE} estimated residuals of calibration will be printed out.

confidence optional; either a positive value for confidence interval. This variable by default is 0.95.

change_type character value net changes type - absolute or relative.

checking Optional variable if this variable is \texttt{TRUE}, then function checks data preparation errors, otherwise not checked. This variable by default is \texttt{TRUE}.

Value

A list with objects are returned by the function:

- \texttt{res_out} - a \texttt{data.table} containing the estimated residuals of calibration with ID\_level1 and PSU by periods and countries (if available).
- \texttt{crossectional_results} - a \texttt{data.table} containing:
  - \texttt{period} - survey periods,
  - \texttt{country} - survey countries,
  - \texttt{Dom} - optional variable of the population domains,
  - \texttt{namesY} - variable with names of variables of interest,
  - \texttt{namesZ} - optional variable with names of denominator for ratio estimation,
  - \texttt{sample\_size} - the sample size (in numbers of individuals),
  - \texttt{pop\_size} - the population size (in numbers of individuals),
  - \texttt{total} - the estimated totals,
  - \texttt{variance} - the estimated variance of cross-sectional or longitudinal measures,
  - \texttt{sd\_w} - the estimated weighted variance of simple random sample,
  - \texttt{sd\_nw} - the estimated variance estimation of simple random sample,
  - \texttt{pop} - the population size (in numbers of households),
  - \texttt{samp1\_size} - the sample size (in numbers of households),
  - \texttt{stderr\_w} - the estimated weighted standard error of simple random sample,
  - \texttt{stderr\_nw} - the estimated standard error of simple random sample,
  - \texttt{se} - the estimated standard error of cross-sectional or longitudinal,
  - \texttt{rse} - the estimated relative standard error (coefficient of variation),
  - \texttt{cv} - the estimated relative standard error (coefficient of variation) in percentage,
  - \texttt{absolute\_margin\_of\_error} - the estimated absolute margin of error,
  - \texttt{relative\_margin\_of\_error} - the estimated relative margin of error,
• vardchanges - the estimated variance.

References

Guillaume Osier, Yves Berger, Tim Goedeme, (2013), Standard error estimation for the EU-SILC indicators of poverty and social exclusion, Eurostat Methodologies and Working papers, URL


See Also
domain, vardcros, vardchangespoor

Examples

### Example

```r
library("data.table")
library("laeken")
data("eusilc")
set.seed(1)
eusilc1 <- eusilc[1:40,]
set.seed(1)
dataset1 <- data.table(rbind(eusilc1, eusilc1),
                          year = c(rep(2010, nrow(eusilc1)),
                                  rep(2011, nrow(eusilc1))))
dataset1[age < 0, age := 0]
PSU <- dataset1[, .N, keyby = "db030"][, N := NULL]
PSU[, PSU := trunc(runif(nrow(PSU), 0, 5))]
dataset1 <- merge(dataset1, PSU, all = TRUE, by = "db030")
PSU <- eusilc <- NULL
dataset1[, strata := c("XXXX")]
dataset1[, t_pov := trunc(runif(nrow(dataset1), 0, 2))]
dataset1[, exp := 1]

# At-risk-of-poverty (AROP)
dataset1[, pov := ifelse (t_pov == 1, 1, 0)]
dataset1[, id_lev2 := paste0("V", .I)]

result <- vardchanges(Y = "pov", H = "strata",
                       PSU = "PSU", w_final = "rb050",
                       ID_level1 = "db030", ID_level2 = "id_lev2",
                       Dom = NULL, Z = NULL, period = "year",
                       dataset = dataset1, period1 = 2010,
                       period2 = 2011, change_type = "absolute")

result
```

# Not run:
data("eusilc")
dataset1 <- data.table(rbind(eusilc, eusilc),
  year = c(rep(2010, nrow(eusilc)),
           rep(2011, nrow(eusilc))))

dataset1[age < 0, age := 0]
PSU <- dataset1[, .N, keyby = "db030"], N := NULL]
PSU[, PSU := trunc(runif(nrow(PSU), 0, 100))]

dataset1 <- merge(dataset1, PSU, all = TRUE, by = "db030"
PSU <- eusilc <- NULL
dataset1[, strata := "XXXX"]

dataset1[, t_pov := trunc(runif(nrow(dataset1), 0, 2))]
dataset1[, t_dep := trunc(runif(nrow(dataset1), 0, 2))]
dataset1[, t_lwi := trunc(runif(nrow(dataset1), 0, 2))]
dataset1[, exp := 1]
dataset1[, exp2 := 1 * (age < 60)]

# At-risk-of-poverty (AROP)
dataset1[, pov := ifelse (t_pov == 1, 1, 0)]

# Severe material deprivation (DEP)
dataset1[, dep := ifelse (t_dep == 1, 1, 0)]

# Low work intensity (LWI)
dataset1[, lwi := ifelse (t_lwi == 1, 1, 0)]

# At-risk-of-poverty or social exclusion (AROPE)
dataset1[, arope := ifelse (pov == 1 | dep == 1 | lwi == 1, 1, 0)]
dataset1[, dom := 1]
dataset1[, id_lev2 := .I]

result <- vardchanges(Y = c("pov", "dep", "lwi", "arope"),
  H = "strata", PSU = "PSU", w_final = "rb050",
  ID_level1 = "db030", ID_level2 = "id_lev2",
  Dom = "rb090", Z = NULL, period = "year",
  dataset = dataset1, period1 = 2010,
  period2 = 2011, change_type = "absolute")

result

### End(Not run)
Usage

vardchangespoor(
  Y,
  age = NULL,
  pl085 = NULL,
  month_at_work = NULL,
  Y_den = NULL,
  Y_thres = NULL,
  wght_thres = NULL,
  H,
  PSU,
  w_final,
  ID_level1,
  ID_level2,
  Dom = NULL,
  country = NULL,
  period,
  sort = NULL,
  period1,
  period2,
  gender = NULL,
  dataset = NULL,
  X = NULL,
  countryX = NULL,
  periodX = NULL,
  X_ID_level1 = NULL,
  ind_gr = NULL,
  g = NULL,
  q = NULL,
  datasetX = NULL,
  percentage = 60,
  order_quant = 50,
  alpha = 20,
  use.estVar = FALSE,
  confidence = 0.95,
  outp_lin = FALSE,
  outp_res = FALSE,
  type = "linrmpg",
  change_type = "absolute"
)

Arguments

Y  Study variable (for example equalized disposable income or gross pension income). One dimensional object convertible to one-column data.table or variable name as character, column number.

age Age variable. One dimensional object convertible to one-column data.table or variable name as character, column number.
p1085  Retirement variable (Number of months spent in retirement or early retirement). One dimensional object convertible to one-column data.table or variable name as character, column number.

month_at_work Variable for total number of month at work (sum of the number of months spent at full-time work as employee, number of months spent at part-time work as employee, number of months spent at full-time work as self-employed (including family worker), number of months spent at part-time work as self-employed (including family worker)). One dimensional object convertible to one-column data.table or variable name as character, column number.

Y_den  Denominator variable (for example gross individual earnings). One dimensional object convertible to one-column data.table or variable name as character, column number.

Y_thres Variable (for example equalized disposable income) used for computation and linearization of poverty threshold. One dimensional object convertible to one-column data.table or variable name as character, column number. Variable specified for inc is used as income_thres if income_thres is not defined.

wght_thres Weight variable used for computation and linearization of poverty threshold. One dimensional object convertible to one-column data.table or variable name as character, column number. Variable specified for weight is used as wght_thres if wght_thres is not defined.

H  The unit stratum variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

PSU  Primary sampling unit variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

w_final Weight variable. One dimensional object convertible to one-column data.table or variable name as character, column number or logical vector with only one TRUE value (length of the vector has to be the same as the column count of dataset).

ID_level1 Variable for level1 ID codes. One dimensional object convertible to one-column data.table or variable name as character, column number.

ID_level2 Optional variable for unit ID codes. One dimensional object convertible to one-column data.table or variable name as character, column number.

Dom Optional variables used to define population domains. If supplied, variables are calculated for each domain. An object convertible to data.table or variable names as character vector, column numbers.

country Variable for the survey countries. The values for each country are computed independently. Object convertible to data.table or variable names as character, column numbers.

period Variable for the all survey periods. The values for each period are computed independently. Object convertible to data.table or variable names as character, column numbers.

sort Optional variable to be used as tie-breaker for sorting. One dimensional object convertible to one-column data.table or variable name as character, column number.
period1: The vector from variable period describes the first period.
period2: The vector from variable period describes the second period.
gender: Numerical variable for gender, where 1 is for males, but 2 is for females. One dimensional object convertible to one-column data.table or variable name as character, column number.
dataset: Optional survey data object convertible to data.frame.
X: Optional matrix of the auxiliary variables for the calibration estimator. Object convertible to data.table or variable names as character, column numbers.
countryX: Optional variable for the survey countries. The values for each country are computed independently. Object convertible to data.table or variable names as character, column numbers.
periodX: Optional variable of the survey periods and countries. If supplied, residual estimation of calibration is done independently for each time period. Object convertible to data.table or variable names as character, column numbers.
X_ID_level1: Variable for level1 ID codes. One dimensional object convertible to one-column data.table or variable name as character, column number.
ind_gr: Optional variable by which divided independently X matrix of the auxiliary variables for the calibration. One dimensional object convertible to one-column data.table or variable name as character, column number.
g: Optional variable of the g weights. One dimensional object convertible to one-column data.table or variable name as character, column number.
q: Variable of the positive values accounting for heteroscedasticity. One dimensional object convertible to one-column data.table or variable name as character, column number.
datasetX: Optional survey data object in household level convertible to data.table.
percentage: A numeric value in range $[0, 100]$ for $p$ in the formula for poverty threshold computation:
$$
\frac{p}{100} \cdot Z_{\frac{\alpha}{100}}.
$$
For example, to compute poverty threshold equal to 60% of some income quantile, $p$ should be set equal to 60.
order_quant: A numeric value in range $[0, 100]$ for $\alpha$ in the formula for poverty threshold computation:
$$
\frac{p}{100} \cdot Z_{\frac{\alpha}{100}}.
$$
For example, to compute poverty threshold equal to some percentage of median income, $\alpha$ should be set equal to 50.
alpha: a numeric value in range $[0, 100]$ for the order of the income quantile share ratio (in percentage).
use.estVar: Logical value. If value is TRUE, then R function estVar is used for the estimation of covariance matrix of the residuals. If value is FALSE, then R function estVar is not used for the estimation of covariance matrix of the residuals.
confidence: optional; either a positive value for confidence interval. This variable by default is 0.95.
outp_lin Logical value. If TRUE linearized values of the ratio estimator will be printed out.
outp_res Logical value. If TRUE estimated residuals of calibration will be printed out.
type a character vector (of length one unless several.ok is TRUE), example "linarpr","linarpt","lingpg","linpoormed","linrmpg","lingini","lingini2","linqp","linarr","linr-mir","all_choices".
change_type character value net changes type - absolute or relative.

Value
A list with objects are returned by the function:

- cros_lin_out - a data.table containing the linearized values of the ratio estimator with ID_level2 and PSU by periods and countries (if available).
- cros_res_out - a data.table containing the estimated residuals of calibration with ID_level1 and PSU by periods and countries (if available).
- crossectional_results - a data.table containing:
  period - survey periods,
  country - survey countries,
  Dom - optional variable of the population domains,
  type - type variable,
  count_respondents - the count of respondents,
  pop_size - the population size (in numbers of individuals),
  estim - the estimated value,
  se - the estimated standard error,
  var - the estimated variance,
  rse - the estimated relative standard error (coefficient of variation),
  cv - the estimated relative standard error (coefficient of variation) in percentage.
- changes_results - a data.table containing:
  period - survey periods,
  country - survey countries,
  Dom - optional variable of the population domains,
  type - type variable,
  estim_1 - the estimated value for period1,
  estim_2 - the estimated value for period2,
  estim - the estimated value,
  se - the estimated standard error,
  var - the estimated variance,
  rse - the estimated relative standard error (coefficient of variation),
  cv - the estimated relative standard error (coefficient of variation) in percentage.

References

See Also
domain, vardchanges, vardcros, vardcrospoor

Examples

```r
### Example
library("laeken")
library("data.table")
data(eusilc)
set.seed(1)
dataset1 <- data.table(rbind(eusilc, eusilc),
year = c(rep(2010, nrow(eusilc)),
rep(2011, nrow(eusilc))),
country = c(rep("AT", nrow(eusilc)),
rep("AT", nrow(eusilc))))
dataset1[age < 0, age := 0]
PSU <- dataset1[, .N, keyby = "db030"[, , N := NULL]
PSU[, PSU := trunc(runif(nrow(PSU), 0, 100000))
PSU$inc <- runif(nrow(PSU), 20, 100000)
dataset1 <- merge(dataset1, PSU, all = TRUE, by = "db030")
PSU <- eusilc <- NULL
dataset1[, strata := c("XXXX")]
dataset1$pl085 <- 12 * trunc(runif(nrow(dataset1), 0, 2))
dataset1$month_at_work <- 12 * trunc(runif(nrow(dataset1), 0, 2))
dataset1[, id_l2 := paste0("V", .I)]
result <- vardchangespoor(Y = "inc", age = "age",
pl085 = "pl085", month_at_work = "month_at_work",
Y_den = "inc", Y_thres = "inc",
wght_thres = "rb050", H = "strata",
PSU = "PSU", w_final="rb050",
ID_level1 = "db030", ID_level2 = "id_l2",
Dom = c("rb090"), country = "country",
period = "year", sort = NULL,
period1 = c(2010, 2011),
period2 = c(2011, 2010),
gender = NULL, dataset = dataset1,
percentage = 60, order_quant = 50L,
alpha = 20, confidence = 0.95,
type = "linrmpg")
result
```
**Variances for Annual Net Change or Annual for Single Stratified Sampling Designs**

**Description**

Computes the variance estimation for measures of annual net change or annual for single stratified sampling designs.

**Usage**

```r
vardchangstrs(
  Y,  
  H,  
  PSU,  
  w_final,  
  Dom = NULL,  
  periods = NULL,  
  dataset,  
  periods1,  
  periods2,  
  in_sample,  
  in_frame,  
  confidence = 0.95,  
  percentratio = 1
)
```

**Arguments**

- **Y**
  - Variables of interest. Object convertible to `data.table` or variable names as character, column numbers.

- **H**
  - The unit stratum variable. One dimensional object convertible to one-column `data.table` or variable name as character, column number.

- **PSU**
  - Primary sampling unit variable. One dimensional object convertible to one-column `data.table` or variable name as character, column number.

- **w_final**
  - Weight variable. One dimensional object convertible to one-column `data.table` or variable name as character, column number.

- **Dom**
  - Optional variables used to define population domains. If supplied, variables are calculated for each domain. An object convertible to `data.table` or variable names as character vector, column numbers.

- **periods**
  - Variable for the all survey periods. The values for each period are computed independently. Object convertible to `data.table` or variable names as character, column numbers.

- **dataset**
  - Optional survey data object convertible to `data.table`.
periods1  The vector of periods from variable periods describes the first period for measures of change.

periods2  The vector of periods from variable periods describes the second period for measures of change.

in_sample  Sample variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

in_frame  Frame variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

confidence  optional; either a positive value for confidence interval. This variable by default is 0.95.

percentratio  Positive numeric value. All linearized variables are multiplied with percentratio value, by default - 1.

Value

A list with objects are returned by the function:

- crossectional_results - a data.table containing:
  year - survey years,
  subperiods - survey subperiods,
  variable - names of variables of interest,
  Dom - optional variable of the population domains,
  estim - the estimated value,
  var - the estimated variance of cross-sectional and longitudinal measures,
  sd_w - the estimated weighted variance of simple random sample,
  se - the estimated standard error of cross-sectional or longitudinal,
  rse - the estimated relative standard error (coefficient of variation),
  cv - the estimated relative standard error (coefficient of variation) in percentage,
  absolute_margin_of_error - the estimated absolute margin of error,
  relative_margin_of_error - the estimated relative margin of error,
  CI_lower - the estimated confidence interval lower bound,
  CI_upper - the estimated confidence interval upper bound,
  confidence_level - the positive value for confidence interval.

- annual_results - a data.table containing: year_1 - survey years of years1 for measures of annual net change,
  year_2 - survey years of years2 for measures of annual net change,
  Dom - optional variable of the population domains,
  variable - names of variables of interest,
  estim_2 - the estimated value for period2 for measures of annual net change,
  estim_1 - the estimated value for period1 for measures of annual net change,
  estim - the estimated value,
  var - the estimated variance,
  se - the estimated standard error,
  rse - the estimated relative standard error (coefficient of variation),
  cv - the estimated relative standard error (coefficient of variation) in percentage,
  absolute_margin_of_error - the estimated absolute margin of error for period1 for measures of annual,
relative_margin_of_error - the estimated relative margin of error in percentage for measures of annual,
CI_lower - the estimated confidence interval lower bound,
CI_upper - the estimated confidence interval upper bound,
confidence_level - the positive value for confidence interval,
significant - is the the difference significant

References

See Also
vardchanges, vardannual

Examples

```r
library("data.table")
library("laeken")

### Example
data("eusilc")
set.seed(1)
eusilc1 <- eusilc[1 : 20,]
set.seed(1)
dataset1 <- data.table(rbind(eusilc1, eusilc1),
    year = c(rep(2010, nrow(eusilc1)),
    rep(2011, nrow(eusilc1))))
dataset1[, half:= .I - 2 * trunc((.I - 1) / 2)]
dataset1[, quarter:= .I - 4 * trunc((.I - 1) / 4)]
dataset1[age < 0, age:= 0]
PSU <- dataset1[, .N, keyby = "db030"][, N:= NULL]
PSU[, PSU:= trunc(runif(nrow(PSU), 0, 5))]
dataset1 <- merge(dataset1, PSU, all = TRUE, by = "db030")
PSU <- eusilc <- NULL
dataset1[, strata := c("XXXX")]
dataset1[, employed := trunc(runif(nrow(dataset1), 0, 2))]
dataset1[, id_lv2 := paste0("V", .I)]
dataset1[, fpc := 0]

## Not run:
result <- vardbootstr(boots_count = 500, = "employed", H = "strata",
    PSU = "PSU", w_final = "rb050", ID_level1 = "ids",
    Z = NULL, Dom = NULL, dh = 1, fpc = "fpc",
    dataset = dataset1, years = "year",
    subperiods = "half", year1 = 2010,
    year = 2011, percentratio = 100,
    confidence = 0.95, method = "netchanges")
result
```
## End(Not run)

---

**vardcros**

**Variance estimation for cross-sectional, longitudinal measures for single and multistage stage cluster sampling designs**

### Description

Computes the variance estimation for cross-sectional and longitudinal measures for any stage cluster sampling designs.

### Usage

```r
vardcros(
  Y,
  H,
  PSU,
  w_final,
  ID_level1,
  ID_level2,
  Dom = NULL,
  Z = NULL,
  gender = NULL,
  country = NULL,
  period,
  dataset = NULL,
  X = NULL,
  countryX = NULL,
  periodX = NULL,
  X_ID_level1 = NULL,
  ind_gr = NULL,
  g = NULL,
  q = NULL,
  datasetX = NULL,
  linratio = FALSE,
  percentratio = 1,
  use.estVar = FALSE,
  ID_level1_max = TRUE,
  outp_res = FALSE,
  withperiod = TRUE,
  netchanges = TRUE,
  confidence = 0.95,
  checking = TRUE
)
```
Arguments

Y
Variables of interest. Object convertible to data.table or variable names as character, column numbers.

H
The unit stratum variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

PSU
Primary sampling unit variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

w_final
Weight variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

ID_level1
Variable for level1 ID codes. One dimensional object convertible to one-column data.table or variable name as character, column number.

ID_level2
Optional variable for unit ID codes. One dimensional object convertible to one-column data.table or variable name as character, column number.

Dom
Optional variables used to define population domains. If supplied, variables are calculated for each domain. An object convertible to data.table or variable names as character vector, column numbers.

Z
Optional variables of denominator for ratio estimation. If supplied, the ratio estimation is computed. Object convertible to data.table or variable names as character, column numbers. This variable is NULL by default.

gender
Numerical variable for gender, where 1 is for males, but 2 is for females. One dimensional object convertible to one-column data.table or variable name as character, column number.

country
Variable for the survey countries. The values for each country are computed independently. Object convertible to data.table or variable names as character, column numbers.

period
Variable for the survey periods. The values for each period are computed independently. Object convertible to data.table or variable names as character, column numbers.

dataset
Optional survey data object convertible to data.table.

X
Optional matrix of the auxiliary variables for the calibration estimator. Object convertible to data.table or variable names as character, column numbers.

countryX
Optional variable for the survey countries. The values for each country are computed independently. Object convertible to data.table or variable names as character, column numbers.

periodX
Optional variable of the survey periods and countries. If supplied, residual estimation of calibration is done independently for each time period. Object convertible to data.table or variable names as character, column numbers.

X_ID_level1
Variable for level1 ID codes. One dimensional object convertible to one-column data.table or variable name as character, column number.

ind_gr
Optional variable by which divided independently X matrix of the auxiliary variables for the calibration. One dimensional object convertible to one-column data.table or variable name as character, column number.
Optional variable of the \textit{g} weights. One dimensional object convertible to one-column \texttt{data.table} or variable name as character, column number.

\texttt{q} Variable of the positive values accounting for heteroscedasticity. One dimensional object convertible to one-column \texttt{data.table} or variable name as character, column number.

\texttt{datasetX} Optional survey data object in household level convertible to \texttt{data.table}.

\texttt{linratio} Logical value. If value is \texttt{TRUE}, then the linearized variables for the ratio estimator is used for variance estimation. If value is \texttt{FALSE}, then the gradients is used for variance estimation.

\texttt{percentratio} Positive numeric value. All linearized variables are multiplied with \texttt{percentratio} value, by default - 1.

\texttt{use\_estVar} Logical value. If value is \texttt{TRUE}, then \textit{R} function \texttt{estVar} is used for the estimation of covariance matrix of the residuals. If value is \texttt{FALSE}, then \textit{R} function \texttt{estVar} is not used for the estimation of covariance matrix of the residuals.

\texttt{ID\_level1\_max} Logical value. If value is \texttt{TRUE}, then the size of sample for variance under simple random sampling is taken as maximum value of size in \texttt{ID\_level1}. If value is \texttt{FALSE}, then the size of sample for variance under simple random sampling is taken as count of \texttt{ID\_level2} in \texttt{ID\_level1}.

\texttt{outp\_res} Logical value. If \texttt{TRUE} estimated residuals of calibration will be printed out.

\texttt{withperiod} Logical value. If \texttt{TRUE} is value, the results is with period, if \texttt{FALSE}, without period.

\texttt{netchanges} Logical value. If value is \texttt{TRUE}, then produce two objects: the first object is aggregation of weighted data by period (if available), country, strata and PSU, the second object is an estimation for \textit{Y}, the variance, gradient for numerator and denominator by country and period (if available). If value is \texttt{FALSE}, then both objects containing \texttt{NULL}.

\texttt{confidence} Optional positive value for confidence interval. This variable by default is 0.95.

\texttt{checking} Optional variable if this variable is \texttt{TRUE}, then function checks data preparation errors, otherwise not checked. This variable by default is \texttt{TRUE}.

\section*{Value}

A list with four objects are returned by the function:

- \texttt{res\_out} - a \texttt{data.table} containing the estimated residuals of calibration with \texttt{ID\_level1} and PSU.
- \texttt{data\_net\_changes} - a \texttt{data.table} containing aggregation of weighted data by period (if available) and countries (if available), country, strata, PSU.
- \texttt{var\_grad} - a \texttt{data.table} containing estimation for \textit{Y}, the variance, gradient for numerator and denominator by period, country (if available) and population domains (if available).
- \texttt{results} A \texttt{data.table} containing:
  - \texttt{period} - survey periods,
  - \texttt{country} - survey countries (if available),
  - \texttt{Dom} - optional variable of the population domains,
  - \texttt{namesY} - names of variables of interest,
namesZ - optional variable for names of denominator for ratio estimation,
sample_size - the sample size (in numbers of individuals),
pop_size - the population size (in numbers of individuals),
total - the estimated totals,
variance - the estimated variance of cross-sectional or longitudinal measures,
sd_w - the estimated weighted variance of simple random sample,
sd_nw - the estimated variance estimation of simple random sample,
pop - the population size (in numbers of households),
sampl_siz - the sample size (in numbers of households),
stderr_w - the estimated weighted standard error of simple random sample,
stderr_nw - the estimated standard error of simple random sample,
se - the estimated standard error of cross-sectional or longitudinal,
rse - the estimated relative standard error (coefficient of variation),
cv - the estimated relative standard error (coefficient of variation) in percentage,
absolute_margin_of_error - the estimated absolute margin of error,
relative_margin_of_error - the estimated relative margin of error,
CI_lower - the estimated confidence interval lower bound,
CI_upper - the estimated confidence interval upper bound,
confidence_level - the positive value for confidence interval.

References


See Also
domain, lin.ratio

Examples

library("data.table")
library("laeken")

# Example 1
data(eusilc)
set.seed(1)
dataset1 <- data.table(eusilc)
dataset1[, year := 2010]
dataset1[, country := "AT"]
dataset1[age < 0, age := 0]
PSU <- dataset1[, .N, keyby = "db030"][, N := NULL]
PSU[, PSU := trunc(runif(nrow(PSU), 0, 100))]
dataset1 <- merge(dataset1, PSU, by = "db030", all = TRUE)
PSU <- eusilc <- 0
dataset1[, strata := "XXXX"]
dataset1[, t_pov := trunc(runif(nrow(dataset1), 0, 2))]
dataset1[, t_dep := trunc(runif(nrow(dataset1), 0, 2))]
dataset1[, t_lwi := trunc(runif(nrow(dataset1), 0, 2))]
dataset1[, exp := 1]
dataset1[, exp2 := 1 * (age < 60)]
# At-risk-of-poverty (AROP)
dataset1[, pov := ifelse (t_pov == 1, 1, 0)]

# Severe material deprivation (DEP)
dataset1[, dep := ifelse (t_dep == 1, 1, 0)]

# Low work intensity (LWI)
dataset1[, lwi := ifelse (t_lwi == 1 & exp2 == 1, 1, 0)]

# At-risk-of-poverty or social exclusion (AROPE)
dataset1[, arope := ifelse (pov == 1 | dep == 1 | lwi == 1, 1, 0)]
result11 <- vardcros(Y="arope", H = "strata",
    PSU = "PSU", w_final = "rb050",
    ID_level1 = "db030", ID_level2 = "rb030",
    Dom = "rb090", Z = NULL, country = "country",
    period = "year", dataset = dataset1,
    linratio = FALSE, withperiod = TRUE,
    netchanges = TRUE, confidence = .95)

## Not run:
# Example 2
data(eusilc)
set.seed(1)
dataset1 <- data.table(rbind(eusilc, eusilc),
    year = c(rep(2010, nrow(eusilc)),
        rep(2011, nrow(eusilc))))
dataset1[, country := "AT"]
dataset1[age < 0, age := 0]
PSU <- dataset1[, .N, keyby = "db030"][, N := NULL]
PSU[, PSU := trunc(runif(nrow(PSU), 0, 100))]
dataset1 <- merge(dataset1, PSU, by = "db030", all = TRUE)
PSU <- eusilc <- 0
dataset1[, strata := "XXXX"]
dataset1[, strata := as.character(strata)]
dataset1[, t_pov := trunc(runif(nrow(dataset1), 0, 2))]
dataset1[, t_dep := trunc(runif(nrow(dataset1), 0, 2))]
dataset1[, t_lwi := trunc(runif(nrow(dataset1), 0, 2))]
dataset1[, exp := 1]
dataset1[, exp2 := 1 * (age < 60)]
# At-risk-of-poverty (AROP)
dataframe[, pov := ifelse(t_pov == 1, 1, 0)]

# Severe material deprivation (DEP)
dataframe[, dep := ifelse(t_dep == 1, 1, 0)]

# Low work intensity (LWI)
dataframe[, lwi := ifelse(t_lwi == 1 & exp2 == 1, 1, 0)]

# At-risk-of-poverty or social exclusion (AROPE)
dataframe[, arope := ifelse(pov == 1 | dep == 1 | lwi == 1, 1, 0)]

result11 <- vardcros(Y = c("pov", "dep", "arope"),
                      H = "strata", PSU = "PSU", w_final = "rb050",
                      ID_level1 = "db030", ID_level2 = "rb030",
                      Dom = "rb090", Z = NULL, country = "country",
                      period = "year", dataset = dataframe,
                      linratio = FALSE, withperiod = TRUE,
                      netchanges = TRUE, confidence = .95)

dataframe2 <- dataframe[exp2 == 1]
result12 <- vardcros(Y = c("lwi"), H = "strata",
                      PSU = "PSU", w_final = "rb050",
                      ID_level1 = "db030", ID_level2 = "rb030",
                      Dom = "rb090", Z = NULL,
                      country = "country", period = "year",
                      dataset = dataframe2, linratio = FALSE,
                      withperiod = TRUE, netchanges = TRUE,
                      confidence = .95)

### Example 3

data(eusilc)
set.seed(1)
year <- 2011
dataframe1 <- data.table(rbind(eusilc, eusilc, eusilc, eusilc),
                         rb010 = c(rep(2008, nrow(eusilc)),
                                  rep(2009, nrow(eusilc)),
                                  rep(2010, nrow(eusilc)),
                                  rep(2011, nrow(eusilc))))
dataframe1[, rb020 := "AT"]
dataframe1[, u := 1]
dataframe1[age < 0, age := 0]
dataframe1[, strata := "XXXX"]
PSU <- dataframe1[, .N, keyby = "db030"], N:=NULL
PSU[, PSU := trunc(runif(nrow(PSU), 0, 100))]
dataframe <- merge(dataframe, PSU, by = "db030", all = TRUE)
thes <- data.table(rb020 = as.character(rep("AT", 4)),
                   thes = c(11406, 11931, 12371, 12791),
                   rb010 = 2008 : 2011)
dataframe1 <- merge(dataframe1, thes, all.x = TRUE, by = c("rb010", "rb020"))
dataframe1[is.na(u), u := 0]
dataframe1 <- dataframe1[u == 1]
# T3
T3 <- dataset1[rb010 == year - 3]
T3[, strata := strata]
T3[, PSU1 := PSU]
T3[, w1 := rb050]
T3[, inc1 := eqIncome]
T3[, rb110_1 := db030]
T3[, pov1 := inc1 <= thres1]
T3 <- T3[, c("rb020", "rb030", "strata", "PSU", "inc1", "pov1"), with = FALSE]

# T2
T2 <- dataset1[rb010 == year - 2]
T2[, strata2 := strata]
T2[, PSU2 := PSU]
T2[, w2 := rb050]
T2[, inc2 := eqIncome]
T2[, rb110_2 := db030]
setnames(T2, "thres", "thres2")
T2[, pov2 := inc2 <= thres2]
T2 <- T2[, c("rb020", "rb030", "strata2", "PSU2", "inc2", "pov2"), with = FALSE]

# T1
T1 <- dataset1[rb010 == year - 1]
T1[, strata3 := strata]
T1[, PSU3 := PSU]
T1[, w3 := rb050]
T1[, inc3 := eqIncome]
T1[, rb110_3 := db030]
setnames(T1, "thres", "thres3")
T1[, pov3 := inc3 <= thres3]
T1 <- T1[, c("rb020", "rb030", "strata3", "PSU3", "inc3", "pov3"), with = FALSE]

# T0
T0 <- dataset1[rb010 == year]
T0[, PSU4 := PSU]
T0[, strata4 := strata]
T0[, w4 := rb050]
T0[, inc4 := eqIncome]
T0[, rb110_4 := db030]
setnames(T0, "thres", "thres4")
T0[, pov4 := inc4 <= thres4]
T0 <- T0[, c("rb020", "rb030", "strata4", "PSU4", "w4", "inc4", "pov4"), with = FALSE]
apv <- merge(T3, T2, all = TRUE, by = c("rb020", "rb030"))
apv <- merge(apv, T1, all = TRUE, by = c("rb020", "rb030"))
apv <- merge(apv, T0, all = TRUE, by = c("rb020", "rb030"))
apv <- apv[(!is.na(inc1)) & (!is.na(inc2)) & (!is.na(inc3)) & (!is.na(inc4))]
apv[, ppr := ifelse(((pov4 == 1) & ((pov1 == 1 & pov2 == 1 & pov3 == 1) | (pov1 == 1 & pov2 == 1 & pov3 == 0) | (pov1 == 1 & pov2 == 0 & pov3 == 1) | (pov1 == 0 & pov2 ==1 & pov3 == 1))), 1, 0)]
result20 <- vardcros(Y = "ppr", H = "strata", PSU = "PSU",
                      w_final = "w4", ID_level1="rb030",
                      ID_level2 = "rb030", Dom = NULL,
                      Z = NULL, country = "rb020",
                      period = NULL, dataset = apv,
                      linratio = FALSE,
                      withperiod = FALSE,
                      netchanges = FALSE,
                      confidence = .95)
result20
## End(Not run)

---

Variance estimation for cross-sectional, longitudinal measures for indicators on social exclusion and poverty

### Description
Computes the variance estimation for cross-sectional and longitudinal measures for indicators on social exclusion and poverty.

### Usage
```r
crosstest <- vardcros(Y, age = NULL,
                       pl085 = NULL,
                       month_at_work = NULL,
                       Y_den = NULL,
                       Y_thres = NULL,
                       wght_thres = NULL,
                       H, PSU,
                       w_final,
                       ID_level1,
                       ID_level2,
                       Dom = NULL,
                       country = NULL,
                       period,
                       sort = NULL,
                       linratio = FALSE,
                       withperiod = FALSE,
                       netchanges = FALSE,
                       confidence = .95)
```
gender = NULL,
dataset = NULL,
X = NULL,
countryX = NULL,
periodX = NULL,
X_ID_level1 = NULL,
ind_gr = NULL,
g = NULL,
q = NULL,
datasetX = NULL,
percentage = 60,
order_quant = 50,
alpha = 20,
use.estVar = FALSE,
withperiod = TRUE,
netchanges = TRUE,
confidence = 0.95,
outp_lin = FALSE,
outp_res = FALSE,
type = "linrmpg",
checking = TRUE
)

Arguments

Y  Variables of interest. Object convertible to data.table or variable names as character, column numbers.
age  Age variable. One dimensional object convertible to one-column data.table or variable name as character, column number.
pl085  Retirement variable (Number of months spent in retirement or early retirement). One dimensional object convertible to one-column data.table or variable name as character, column number.
month_at_work  Variable for total number of month at work (sum of the number of months spent at full-time work as employee, number of months spent at part-time work as employee, number of months spent at full-time work as self-employed (including family worker), number of months spent at part-time work as self-employed (including family worker)). One dimensional object convertible to one-column data.table or variable name as character, column number.
Y_den  Denominator variable (for example gross individual earnings). One dimensional object convertible to one-column data.table or variable name as character, column number.
Y_thres  Variable (for example equalized disposable income) used for computation and linearization of poverty threshold. One dimensional object convertible to one-column data.table or variable name as character, column number or logical vector with only one TRUE value (length of the vector has to be the same as the column count of dataset). Variable specified for inc is used as income_thres if income_thres is not defined.
**wght_thres**  
Weight variable used for computation and linearization of poverty threshold. One dimensional object convertible to one-column `data.table` or variable name as character, column number. Variable specified for `weight` is used as `wght_thres` if `wght_thres` is not defined.

**H**  
The unit stratum variable. One dimensional object convertible to one-column `data.table` or variable name as character, column number.

**PSU**  
Primary sampling unit variable. One dimensional object convertible to one-column `data.table` or variable name as character, column number.

**w_final**  
Weight variable. One dimensional object convertible to one-column `data.table` or variable name as character, column number.

**ID_level1**  
Variable for level1 ID codes. One dimensional object convertible to one-column `data.table` or variable name as character, column number.

**ID_level2**  
Optional variable for unit ID codes. One dimensional object convertible to one-column `data.table` or variable name as character, column number.

**Dom**  
Optional variables used to define population domains. If supplied, variables are calculated for each domain. An object convertible to `data.table` or variable names as character vector, column numbers.

**country**  
Variable for the survey countries. The values for each country are computed independently. Object convertible to `data.table` or variable names as character, column numbers.

**period**  
Variable for the survey periods. The values for each period are computed independently. Object convertible to `data.table` or variable names as character, column numbers.

**sort**  
Optional variable to be used as tie-breaker for sorting. One dimensional object convertible to one-column `data.table` or variable name as character, column number.

**gender**  
Numerical variable for gender, where 1 is for males, but 2 is for females. One dimensional object convertible to one-column `data.table` or variable name as character, column number.

**dataset**  
Optional survey data object convertible to `data.table`.

**X**  
Optional matrix of the auxiliary variables for the calibration estimator. Object convertible to `data.table` or variable names as character, column numbers.

**countryX**  
Optional variable for the survey countries. The values for each country are computed independently. Object convertible to `data.table` or variable names as character, column numbers.

**periodX**  
Optional variable of the survey periods and countries. If supplied, residual estimation of calibration is done independently for each time period. Object convertible to `data.table` or variable names as character, column numbers.

**X_ID_level1**  
Variable for level1 ID codes. One dimensional object convertible to one-column `data.table` or variable name as character, column number.

**g**  
Optional variable of the g weights. One dimensional object convertible to one-column `data.table` or variable name as character, column number.
q Variable of the positive values accounting for heteroscedasticity. One dimensional object convertible to one-column data.table or variable name as character, column number.

datasetX Optional survey data object in household level convertible to data.table.

percentage A numeric value in range $[0, 100]$ for $p$ in the formula for poverty threshold computation:

$$\frac{p}{100} \cdot Z_{\frac{\alpha}{100}}.$$ For example, to compute poverty threshold equal to 60% of some income quantile, $p$ should be set equal to 60.

order_quant A numeric value in range $[0, 100]$ for $\alpha$ in the formula for poverty threshold computation:

$$\frac{p}{100} \cdot Z_{\frac{\alpha}{100}}.$$ For example, to compute poverty threshold equal to some percentage of median income, $\alpha$ should be set equal to 50.

alpha a numeric value in range $[0, 100]$ for the order of the income quantile share ratio (in percentage).

withperiod Logical value. If TRUE is value, the results is with period, if FALSE, without period.

netchanges Logical value. If value is TRUE, then produce two objects: the first object is aggregation of weighted data by period (if available), country, strata and PSU, the second object is an estimation for $Y$, the variance, gradient for numerator and denominator by country and period (if available). If value is FALSE, then both objects containing NULL.

confidence Optional positive value for confidence interval. This variable by default is 0.95.

outp_lin Logical value. If TRUE linearized values of the ratio estimator will be printed out.

outp_res Logical value. If TRUE estimated residuals of calibration will be printed out.

type a character vector (of length one unless several.ok is TRUE), example "linarpr", "linarpt", "lingpg", "linpoormed", "linrmpg", "lingini", "lingini2", "linqsr", "linarr", "linr-mir".

checking Optional variable if this variable is TRUE, then function checks data preparation errors, otherwise not checked. This variable by default is TRUE.

ind_gr Optional variable by which divided independently $X$ matrix of the auxiliary variables for the calibration. One dimensional object convertible to one-column data.table or variable name as character, column number.

use.estVar Logical value. If value is TRUE, then R function estVar is used for the estimation of covariance matrix of the residuals. If value is FALSE, then R function estVar is not used for the estimation of covariance matrix of the residuals.

Value

A list with objects are returned by the function:
• **lin_out** - a data.table containing the linearized values of the ratio estimator with ID_level2 and PSU.

• **res_out** - a data.table containing the estimated residuals of calibration with ID_level1 and PSU.

• **data_net_changes** - a data.table containing aggregation of weighted data by period (if available), country, strata, PSU.

• **results** - a data.table containing:
  - **period** - survey periods,
  - **country** - survey countries,
  - **Dom** - optional variable of the population domains,
  - **type** - type variable,
  - **count_respondents** - the count of respondents,
  - **pop_size** - the population size (in numbers of individuals),
  - **estim** - the estimated value,
  - **se** - the estimated standard error,
  - **var** - the estimated variance,
  - **rse** - the estimated relative standard error (coefficient of variation),
  - **cv** - the estimated relative standard error (coefficient of variation) in percentage.

References


See Also

linrmir, linarr, vardchanges

Examples

```r
library("data.table")
library("laeken")
data(eusilc)
set.seed(1)
dataset1 <- data.table(rbind(eusilc, eusilc),
  year = c(rep(2010, nrow(eusilc)),
  rep(2011, nrow(eusilc))))
dataset1[age < 0, age := 0]
PSU <- dataset1[, .N, keyby = "db030"][, N := NULL]
PSU[, PSU := trunc(runif(nrow(PSU), 0, 100))]
PSU$inc <- runif(nrow(PSU), 20, 100000)
```
dataset1 <- merge(dataset1, PSU, all = TRUE, by = "db030")
PSU <- eusilc <- NULL
dataset1[, strata := "XXXX"]
dataset1[, strata := as.character(strata)]
dataset1$pl085 <- 12 * trunc(runif(nrow(dataset1), 0, 2))
dataset1$month_at_work <- 12 * trunc(runif(nrow(dataset1), 0, 2))
dataset1[, id_l2 := paste0("V", .I)]

result <- vardcrospspo(Y = "inc", age = "age",
pi085 = "pi085",
month_at_work = "month_at_work",
Y_den = "inc", Y_thres = "inc",
wght_thres = "rb050",
H = "strata", PSU = "PSU",
w_final = "rb050", ID_level1 = "db030",
ID_level2 = "id_12",
Dom = c("rb090", "db040"),
country = NULL, period = "year",
sort = NULL, gender = NULL,
dataset = dataset1,
percentage = 60,
order_quant = 50L,
alpha = 20,
confidence = 0.95,
type = "linrmpg")

## Not run:
result2 <- vardcrospspo(Y = "inc", age = "age",
pi085 = "pi085",
month_at_work = "month_at_work",
Y_den = "inc", Y_thres = "inc",
wght_thres = "rb050",
H = "strata", PSU = "PSU",
w_final = "rb050", ID_level1 = "db030",
ID_level2 = "id_12",
Dom = c("rb090", "db040"),
period = "year", sort = NULL,
gender = NULL, dataset = dataset1,
percentage = 60,
order_quant = 50L,
alpha = 20,
confidence = 0.95,
type = "linrmpg")

result2
## End(Not run)

vardom

Variance estimation of the sample surveys in domain by the ultimate cluster method
Description

Computes the variance estimation of the sample surveys in domain by the ultimate cluster method.

Usage

vardom(
  Y,
  H,
  PSU,
  w_final,
  id = NULL,
  Dom = NULL,
  period = NULL,
  PSU_sort = NULL,
  N_h = NULL,
  fh_zero = FALSE,
  PSU_level = TRUE,
  Z = NULL,
  X = NULL,
  ind_gr = NULL,
  g = NULL,
  q = NULL,
  dataset = NULL,
  confidence = 0.95,
  percentratio = 1,
  outp_lin = FALSE,
  outp_res = FALSE
)

Arguments

Y Variables of interest. Object convertible to data.table or variable names as character, column numbers.

H The unit stratum variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

PSU Primary sampling unit variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

w_final Weight variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

id Optional variable for unit ID codes. One dimensional object convertible to one-column data.table or variable name as character, column number.

Dom Optional variables used to define population domains. If supplied, variables of interest are calculated for each domain. An object convertible to data.table or variable names as character vector, column numbers.

period Optional variable for survey period. If supplied, residual estimation of calibration is done independently for each time period. One dimensional object convertible to one-column data.table.
PSU_sort
optional; if PSU_sort is defined, then variance is calculated for systematic sample.

N_h
Number of primary sampling units in population for each stratum (and period if period is not NULL). If N_h = NULL and fh_zero = FALSE (default), N_h is estimated from sample data as sum of weights (w_final) in each stratum (and period if period is not NULL). Optional for single-stage sampling design as it will be estimated from sample data. Recommended for multi-stage sampling design as N_h can not be correctly estimated from the sample data in this case. If N_h is not used in case of multi-stage sampling design (for example, because this information is not available), it is advisable to set fh_zero = TRUE. If period is NULL. A two-column matrix with rows for each stratum. The first column should contain stratum code. The second column - the number of primary sampling units in the population of each stratum. If period is not NULL. A three-column matrix with rows for each intersection of strata and period. The first column should contain period. The second column should contain stratum code. The third column - the number of primary sampling units in the population of each stratum and period.

fh_zero
by default FALSE; fh is calculated as division of n_h and N_h in each strata, if true, fh value is zero in each strata.

PSU_level
by default TRUE; if PSU_level is true, in each strata fh is calculated as division of count of PSU in sample (n_h) and count of PSU in frame(N_h). if PSU_level is false, in each strata fh is calculated as division of count of units in sample (n_h) and count of units in frame(N_h), which calculated as sum of weights.

Z
Optional variables of denominator for ratio estimation. Object convertible to data.table or variable names as character, column numbers.

X
Optional matrix of the auxiliary variables for the calibration estimator. Object convertible to data.table or variable names as character, column numbers.

ind_gr
Optional variable by which divided independently X matrix of the auxiliary variables for the calibration. One dimensional object convertible to one-column data.table or variable name as character, column number.

g
Optional variable of the g weights. One dimensional object convertible to one-column data.table or variable name as character, column number.

q
Variable of the positive values accounting for heteroscedasticity. One dimensional object convertible to one-column data.table or variable name as character, column number.

dataset
Optional survey data object convertible to data.table.

certainty
Optional positive value for confidence interval. This variable by default is 0.95.

percentratio
Positive numeric value. All linearized variables are multiplied with percentratio value, by default - 1.

outp_lin
Logical value. If TRUE linearized values of the ratio estimator will be printed out.

outp_res
Logical value. If TRUE estimated residuals of calibration will be printed out.
Value

A list with objects is returned by the function:

- \texttt{lin\_out} - a \texttt{data.table} containing the linearized values of the ratio estimator with id and PSU.
- \texttt{res\_out} - a \texttt{data.table} containing the estimated residuals of calibration with id and PSU.
- \texttt{betas} - a numeric \texttt{data.table} containing the estimated coefficients of calibration.
- \texttt{all\_result} - a \texttt{data.table}, which containing variables: \texttt{variable} - names of variables of interest, \texttt{Dom} - optional variable of the population domains, \texttt{period} - optional variable of the survey periods, \texttt{respondent\_count} - the count of respondents, \texttt{pop\_size} - the estimated size of population, \texttt{n\_nonzero} - the count of respondents, who answers are larger than zero, \texttt{estim} - the estimated value, \texttt{var} - the estimated variance, \texttt{se} - the estimated standard error, \texttt{rse} - the estimated relative standard error (coefficient of variation), \texttt{cv} - the estimated relative standard error (coefficient of variation) in percentage, \texttt{absolute\_margin\_of\_error} - the estimated absolute margin of error, \texttt{relative\_margin\_of\_error} - the estimated relative margin of error in percentage, \texttt{CI\_lower} - the estimated confidence interval lower bound, \texttt{CI\_upper} - the estimated confidence interval upper bound, \texttt{confidence\_level} - the positive value for confidence interval, \texttt{S2\_y\_HT} - the estimated variance of the y variable in case of total or the estimated variance of the linearised variable in case of the ratio of two totals using non-calibrated weights, \texttt{S2\_y\_ca} - the estimated variance of the y variable in case of total or the estimated variance of the linearised variable in case of the ratio of two totals using calibrated weights, \texttt{S2\_res} - the estimated variance of the regression residuals, \texttt{var\_srs\_HT} - the estimated variance of the HT estimator under SRS, \texttt{var\_cur\_HT} - the estimated variance of the HT estimator under current design, \texttt{var\_srs\_ca} - the estimated variance of the calibrated estimator under SRS, \texttt{deff\_sam} - the estimated design effect of sample design, \texttt{deff\_est} - the estimated design effect of estimator, \texttt{deff} - the overall estimated design effect of sample design and estimator, \texttt{n\_eff} - the effective sample size.

@details Calculate variance estimation in domains based on book of Hansen, Hurwitz and Madow.
@references Morris H. Hansen, William N. Hurwitz, William G. Madow, (1953), Sample survey methods and theory Volume I Methods and applications, 257-258, Wiley.
Guillaume Osier and Emilio Di Meglio. The linearisation approach implemented by Eurostat for the first wave of EU-SILC: what could be done from the second wave onwards? 2012


See Also
domain, lin.ratio, residual_est, vardomh, var_srs, variance_est, variance_othstr

Examples

```r
library("data.table")
library("laeken")
data(eusilc)
dataset1 <- data.table(IDd = paste0("V", 1:nrow(eusilc)), eusilc)

aa <- vardom(Y = "eqIncome", H = "db040", PSU = "db030",
               w_final = "rb050", id = "rb030", Dom = "db040",
               period = NULL, N_h = NULL, Z = NULL,
               X = NULL, g = NULL, q = NULL, dataset = dataset1,
               confidence = .95, percentratio = 100,
               outp_lin = TRUE, outp_res = TRUE)
```

**vardomh**

Variance estimation for sample surveys in domain for one or two stage surveys by the ultimate cluster method

**Description**

Computes the variance estimation in domain for ID_level1.

**Usage**

```r
vardomh(
  Y,
  H,
  PSU,
  w_final,
  ID_level1,
  ID_level2,
  Dom = NULL,
  period = NULL,
```
vandomh

N_h = NULL,
PSU_sort = NULL,
fh_zero = FALSE,
PSU_level = TRUE,
Z = NULL,
dataset = NULL,
X = NULL,
periodX = NULL,
X_ID_level1 = NULL,
ind_gr = NULL,
g = NULL,
q = NULL,
datasetX = NULL,
confidence = 0.95,
percentratio = 1,
outp_lin = FALSE,
outp_res = FALSE
)

Arguments

Y Variables of interest. Object convertible to data.table or variable names as character, column numbers.
H The unit stratum variable. One dimensional object convertible to one-column data.table or variable name as character, column number.
PSU Primary sampling unit variable. One dimensional object convertible to one-column data.table or variable name as character, column number.
w_final Weight variable. One dimensional object convertible to one-column data.table or variable name as character, column number.
ID_level1 Variable for level1 ID codes. One dimensional object convertible to one-column data.table or variable name as character, column number.
ID_level2 Variable for unit ID codes. One dimensional object convertible to one-column data.table or variable name as character, column number.
Dom Optional variables used to define population domains. If supplied, values are calculated for each domain. An object convertible to data.table or variable names as character vector, column numbers.
period Optional variable for the survey periods. If supplied, the values for each period are computed independently. Object convertible to data.table or variable names as character, column numbers.
N_h Number of primary sampling units in population for each stratum (and period if period is not NULL). If N_h = NULL and fh_zero = FALSE (default), N_h is estimated from sample data as sum of weights (w_final) in each stratum (and period if period is not NULL) Optional for single-stage sampling design as it will be estimated from sample data. Recommended for multi-stage sampling design as N_h can not be correctly estimated from the sample data in this case. If N_h is not used in case of multi-stage sampling design (for example, because this
information is not available), it is advisable to set fh_zero = TRUE. If period is NULL. A two-column data object convertible to data.table with rows for each stratum. The first column should contain stratum code. The second column - the number of primary sampling units in the population of each stratum. If period is not NULL. A three-column data object convertible to data.table with rows for each intersection of strata and period. The first column should contain period. The second column should contain stratum code. The third column - the number of primary sampling units in the population of each stratum and period.

PSU_sort optional; if PSU_sort is defined, then variance is calculated for systematic sample.

fh_zero by default FALSE; fh is calculated as division of n_h and N_h in each strata, if true, fh value is zero in each strata.

PSU_level by default TRUE; if PSU_level is true, in each strata fh is calculated as division of count of PSU in sample (n_h) and count of PSU in frame (N_h). If PSU_level is false, in each strata fh is calculated as division of count of units in sample (n_h) and count of units in frame (N_h), which calculated as sum of weights.

Z Optional variables of denominator for ratio estimation. Object convertible to data.table or variable names as character, column numbers or logical vector (length of the vector has to be the same as the column count of dataset).

dataset Optional survey data object convertible to data.table.

X Optional matrix of the auxiliary variables for the calibration estimator. Object convertible to data.table or variable names as character, column numbers.

periodX Optional variable of the survey periods. If supplied, residual estimation of calibration is done independently for each time period. Object convertible to data.table or variable names as character, column numbers.

X_ID_level1 Optional variable for level1 ID codes. One dimensional object convertible to one-column data.table or variable name as character, column number.

ind_gr Optional variable by which divided independently X matrix of the auxiliary variables for the calibration. One dimensional object convertible to one-column data.table or variable name as character, column number.

g Optional variable of the g weights. One dimensional object convertible to one-column data.table or variable name as character, column number.

q Variable of the positive values accounting for heteroscedasticity. One dimensional object convertible to one-column data.table or variable name as character, column number.

datasetX Optional survey data object in level1 convertible to data.table.

confidence Optional positive value for confidence interval. This variable by default is 0.95.

percentratio Positive numeric value. All linearized variables are multiplied with percentratio value, by default - 1.

outp_lin Logical value. If TRUE linearized values of the ratio estimator will be printed out.

outp_res Logical value. If TRUE estimated residuals of calibration will be printed out.
Details

Calculate variance estimation in domains for household surveys based on book of Hansen, Hurwitz and Madow.

Value

A list with objects are returned by the function:

- `lin_out` A `data.table` containing the linearized values of the ratio estimator with ID_level2 and PSU.
- `res_out` A `data.table` containing the estimated residuals of calibration with ID_level1 and PSU.
- `betas` A numeric `data.table` containing the estimated coefficients of calibration.
- `all_result` A `data.table`, which containing variables: variable - names of variables of interest, Dom - optional variable of the population domains, period - optional variable of the survey periods, respondent_count - the count of respondents, pop_size - the estimated size of population, n_nonzero - the count of respondents, who answers are larger than zero, estim - the estimated value, var - the estimated variance, se - the estimated standard error, rse - the estimated relative standard error (coefficient of variation), cv - the estimated relative standard error (coefficient of variation) in percentage, absolute_margin_of_error - the estimated absolute margin of error, relative_margin_of_error - the estimated relative margin of error in percentage, CI_lower - the estimated confidence interval lower bound, CI_upper - the estimated confidence interval upper bound, confidence_level - the positive value for confidence interval, S2_y_HT - the estimated variance of the y variable in case of total or the estimated variance of the linearised variable in case of the ratio of two totals using non-calibrated weights, S2_y_ca - the estimated variance of the y variable in case of total or the estimated variance of the linearised variable in case of the ratio of two totals using calibrated weights, S2_res - the estimated variance of the regression residuals, var_srs_HT - the estimated variance of the HT estimator under SRS for household, var_cur_HT - the estimated variance of the HT estimator under current design for household, var_srs_ca - the estimated variance of the calibrated estimator under SRS for household, deff_sam - the estimated design effect of sample design for household, deff_est - the estimated design effect of estimator for household, deff - the overall estimated design effect of sample design and estimator for household.

References

Guillaume Osier and Emilio Di Meglio. The linearisation approach implemented by Eurostat for
the first wave of EU-SILC: what could be done from the second wave onwards? 2012
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Eurostat Methodologies and Working papers, Handbook on precision requirements and variance esti-
mation for ESS household surveys, 2013, URL http://ec.europa.eu/eurostat/documents/
3859598/5927001/KS-RA-13-029-EN.PDF.
and other related sampling issues in EU-SILC, URL https://ec.europa.eu/eurostat/cros/
content/handbook-standard-error-estimation-and-other-related-sampling-issues-ver-29072013_en
Jean-Claude Deville (1999). Variance estimation for complex statistics and estimators: lineariza-
c.ca/pub/12-001-x/1999002/article/4882-eng.pdf.

See Also
domain, lin.ratio, residual_est, var_srs, variance_est

Examples

library("data.table")
library("laeken")
data("eusilc")
dataset1 <- data.table(IDd = paste0("V", 1 : nrow(eusilc)), eusilc)
aa <- vardomh(Y = "eqIncome", H = "db040", PSU = "db030",
w_final = "rb050", ID_level1 = "db030",
ID_level2 = "rb030", Dom = "db040", period = NULL,
N_h = NULL, Z = NULL, dataset = dataset1, X = NULL,
X_ID_level1 = NULL, g = NULL, q = NULL,
datasetX = NULL, confidence = 0.95, percentratio = 1,
outp_lin = TRUE, outp_res = TRUE)
## Not run:
dataset2 <- copy(dataset1)
dataset1$period <- 1
dataset2$period <- 2
dataset1 <- data.table(rbind(dataset1, dataset2))
# by default without using fh_zero (finite population correction)
aa2 <- vardomh(Y = "eqIncome", H = "db040", PSU = "db030",
w_final = "rb050", ID_level1 = "db030",
ID_level2 = "rb030", Dom = "db040", period = "period",
N_h = NULL, Z = NULL, dataset = dataset1,
X = NULL, X_ID_level1 = NULL,
g = NULL, q = NULL, datasetX = NULL,
confidence = .95, percentratio = 1,
outp_lin = TRUE, outp_res = TRUE)
aa2
# without using fh_zero (finite population correction)

```r
aa3 <- vardomh(Y = "eqIncome", H = "db040", PSU = "db030",
                w_final = "rb050", ID_level1 = "db030",
                ID_level2 = "rb030", Dom = "db040",
                period = "period", N_h = NULL, fh_zero = FALSE,
                Z = NULL, dataset = dataset1, X = NULL,
                X_ID_level1 = NULL, g = NULL, q = NULL,
                datasetX = NULL, confidence = .95,
                percentratio = 1, outp_lin = TRUE,
                outp_res = TRUE)
aa3
```

# with using fh_zero (finite population correction)

```r
aa4 <- vardomh(Y = "eqIncome", H = "db040", PSU = "db030",
                w_final = "rb050", ID_level1 = "db030",
                ID_level2 = "rb030", Dom = "db040",
                period = "period", N_h = NULL, fh_zero = TRUE,
                Z = NULL, dataset = dataset1,
                X = NULL, X_ID_level1 = NULL,
                g = NULL, q = NULL, datasetX = NULL,
                confidence = .95, percentratio = 1,
                outp_lin = TRUE, outp_res = TRUE)
aa4
```

## End(Not run)

---

**Variance estimation for sample surveys in domain by the two stratification**

**Description**

Computes the variance estimation for sample surveys in domain by the two stratification.

**Usage**

```r
vardom_othstr(
  Y,  
  H,  
  H2,  
  PSU,  
  w_final,  
  id = NULL,  
  Dom = NULL,  
  period = NULL,  
  N_h = NULL,  
  N_h2 = NULL,  
  Z = NULL,  
)```
X = NULL,
ind_gr = NULL,
g = NULL,
q = NULL,
dataset = NULL,
confidence = 0.95,
percentratio = 1,
outp_lin = FALSE,
outp_res = FALSE
)

Arguments

Y
Variables of interest. Object convertible to data.table or variable names as character, column numbers.

H
The unit stratum variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

H2
The unit new stratum variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

PSU
Primary sampling unit variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

w_final
Weight variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

id
Optional variable for unit ID codes. One dimensional object convertible to one-column data.table or variable name as character, column number.

Dom
Optional variables used to define population domains. If supplied, linearization of the at-risk-of-poverty rate is done for each domain. An object convertible to data.table or variable names as character vector, column numbers.

period
Optional variable for survey period. If supplied, residual estimation of calibration is done independently for each time period. One dimensional object convertible to one-column data.table.

N_h
optional data object convertible to data.table. If period is supplied, the time period is at the beginning of the object and after time period in the object is stratum. If period is not supplied, the first column in the object is stratum. In the last column is the total of the population in each stratum.

N_h2
optional data object convertible to data.table. If period is supplied, the time period is at the beginning of the object and after time period in the object is new stratum. If period is not supplied, the first column in the object is new stratum. In the last column is the total of the population in each stratum.

Z
optional variables of denominator for ratio estimation. Object convertible to data.table or variable names as character, column numbers.

X
Optional matrix of the auxiliary variables for the calibration estimator. Object convertible to data.table or variable names as character, column numbers.

ind_gr
Optional variable by which divided independently X matrix of the auxiliary variables for the calibration. One dimensional object convertible to one-column data.table or variable name as character, column number.
g  Optional variable of the g weights. One dimensional object convertible to one-column data.table or variable name as character, column number.

q  Variable of the positive values accounting for heteroscedasticity. One dimensional object convertible to one-column data.table or variable name as character, column number.

dataset  Optional survey data object convertible to data.table.

confidence  Optional positive value for confidence interval. This variable by default is 0.95.

outp_lin  Logical value. If TRUE linearized values of the ratio estimator will be printed out.

outp_res  Logical value. If TRUE estimated residuals of calibration will be printed out.

percentratio  Positive numeric value. All linearized variables are multiplied with percentratio value, by default - 1.

Value

A list with objects are returned by the function:

- lin_out - a data.table containing the linearized values of the ratio estimator with id and PSU.
- res_out - a data.table containing the estimated residuals of calibration with id and PSU.
- betas - a numeric data.table containing the estimated coefficients of calibration.
- s2g - a data.table containing the $s^2g$ value.
- all_result - a data.table, which containing variables:
  - respondent_count - the count of respondents,
  - pop_size - the estimated size of population,
  - n_nonzero - the count of respondents, who answers are larger than zero,
  - estim - the estimated value,
  - var - the estimated variance,
  - se - the estimated standard error,
  - rse - the estimated relative standard error (coefficient of variation),
  - cv - the estimated relative standard error (coefficient of variation) in percentage,
  - absolute_margin_of_error - the estimated absolute margin of error,
  - relative_margin_of_error - the estimated relative margin of error in percentage,
  - CI_lower - the estimated confidence interval lower bound,
  - CI_upper - the estimated confidence interval upper bound,
  - confidence_level - the positive value for confidence interval,
  - var_srs_HT - the estimated variance of the HT estimator under SRS,
  - var_cur_HT - the estimated variance of the HT estimator under current design,
  - var_srs_ca - the estimated variance of the calibrated estimator under SRS,
  - deff_sam - the estimated design effect of sample design,
  - deff_est - the estimated design effect of estimator,
  - deff - the overall estimated design effect of sample design and estimator.
References


See Also

domain, lin.ratio, residual_est, vardomh, var_srs, variance_est, variance_othstr

Examples

library("laeken")
library("data.table")
data("eusilc")

# Example 1
eusilc1 <- eusilc[1:1000, ]
dataset1 <- data.table(IDd = paste0("V", 1:nrow(eusilc1)), eusilc1)
dataset1[, db040_2 := get("db040")]
N_h2 <- dataset1[, sum(rb050, na.rm = FALSE), keyby = "db040_2"]

aa <- vardom_othstr(Y = "eqIncome", H = "db040", H2 = "db040_2",
                PSU = "db030", w_final = "rb050", id = "rb030",
                Dom = "db040", period = NULL, N_h = NULL,
                N_h2 = N_h2, Z = NULL, X = NULL, g = NULL,
                q = NULL, dataset = dataset1, confidence = .95,
                outp_lin = TRUE, outp_res = TRUE)

## Not run:
# Example 2
dataset1 <- data.table(IDd = 1:nrow(eusilc), eusilc)
dataset1[, db040_2 := get("db040")]
N_h2 <- dataset1[, sum(rb050, na.rm = FALSE), keyby = "db040_2"]

aa <- vardom_othstr(Y = "eqIncome", H = "db040", H2 = "db040_2",
                PSU = "db030", w_final = "rb050", id = "rb030",
                Dom = "db040", period = NULL, N_h2 = N_h2,
                Z = NULL, X = NULL, g = NULL, dataset = dataset1,
                q = NULL, confidence = .95, outp_lin = TRUE,
                outp_res = TRUE)

aa

## End(Not run)
Variance estimation for sample surveys by the ultimate cluster method

Description
Computes the variance estimation by the ultimate cluster method.

Usage

```r
variance_est(
  Y,
  H,
  PSU,
  w_final,
  N_h = NULL,
  fh_zero = FALSE,
  PSU_level = TRUE,
  PSU_sort = NULL,
  period = NULL,
  dataset = NULL,
  msg = "",
  checking = TRUE
)
```

Arguments

- **Y**: Variables of interest. Object convertible to `data.table` or variable names as character, column numbers.
- **H**: The unit stratum variable. One dimensional object convertible to one-column `data.table` or variable name as character, column number.
- **PSU**: Primary sampling unit variable. One dimensional object convertible to one-column `data.table` or variable name as character, column number.
- **w_final**: Weight variable. One dimensional object convertible to one-column `data.table` or variable name as character, column number.
- **N_h**: Number of primary sampling units in population for each stratum (and period if `period` is not NULL). If `N_h` is `NULL` and `fh_zero = FALSE` (default), `N_h` is estimated from sample data as sum of weights (`w_final`) in each stratum (and period if `period` is not NULL). Optional for single-stage sampling design as it will be estimated from sample data. Recommended for multi-stage sampling design as `N_h` can not be correctly estimated from the sample data in this case. If `N_h` is not used in case of multi-stage sampling design (for example, because this information is not available), it is advisable to set `fh_zero = TRUE`. If `period` is `NULL`. A two-column matrix with rows for each stratum. The first column should contain stratum code. The second column - the number of primary sampling units in the population of each stratum. If `period` is not `NULL`. A three-column matrix with rows for each intersection of strata and period. The first column...
should contain period. The second column should contain stratum code. The third column - the number of primary sampling units in the population of each stratum and period.

fh_zero by default FALSE; fh is calculated as division of n_h and N_h in each strata, if true, fh value is zero in each strata.

PSU_level by default TRUE; if PSU_level is true, in each strata fh is calculated as division of count of PSU in sample (n_h) and count of PSU in frame (N_h), if PSU_level is false, in each strata fh is calculated as division of count of units in sample (n_h) and count of units in frame (N_h), which calculated as sum of weights.

PSU_sort optional; if PSU_sort is defined, then variance is calculated for systematic sample.

period Optional variable for the survey periods. If supplied, the values for each period are computed independently. Object convertible to data.table or variable names as character, column numbers.

dataset an optional name of the individual dataset data.table.

msg an optional printed text, when function print error.

checking Optional variable if this variable is TRUE, then function checks data preparation errors, otherwise not checked. This variable by default is TRUE.

Details

If we assume that \( n_h \geq 2 \) for all \( h \), that is, two or more PSUs are selected from each stratum, then the variance of \( \hat{\theta} \) can be estimated from the variation among the estimated PSU totals of the variable \( Z \):

\[
\hat{V}(\hat{\theta}) = \sum_{h=1}^{H} (1 - f_h) \frac{n_h}{n_h - 1} \sum_{i=1}^{n_h} (z_{hi\bullet} - \bar{z}_{h\bullet\bullet})^2,
\]

where

- \( \bullet z_{hi\bullet} = \sum_{j=1}^{m_{hi}} \omega_{hij} z_{hij} \)
- \( \bar{z}_{h\bullet\bullet} = \frac{\left( \sum_{i=1}^{n_h} z_{hi\bullet} \right)}{n_h} \)
- \( f_h \) is the sampling fraction of PSUs within stratum
- \( h \) is the stratum number, with a total of H strata
- \( i \) is the primary sampling unit (PSU) number within stratum \( h \), with a total of \( n_h \) PSUs
- \( j \) is the household number within cluster \( i \) of stratum \( h \), with a total of \( m_{hi} \) household
- \( w_{hij} \) is the sampling weight for household \( j \) in PSU \( i \) of stratum \( h \)
- \( z_{hij} \) denotes the observed value of the analysis variable \( z \) for household \( j \) in PSU \( i \) of stratum \( h \)

Value

a data.table containing the values of the variance estimation by totals.
References

Morris H. Hansen, William N. Hurwitz, William G. Madow, (1953), Sample survey methods and
to Volume I Methods and applications, 257-258, Wiley.
Guillaume Osier and Emilio Di Meglio. The linearisation approach implemented by Eurostat for
the first wave of EU-SILC: what could be done from the second onwards? 2012
Eurostat Methodologies and Working papers, Standard error estimation for the EU-SILC indicators
3859598/5927001/KS-RA-13-029-EN.PDF.
and other related sampling issues in EU-SILC, URL https://ec.europa.eu/eurostat/cros/
content/handbook-standard-error-estimation-and-other-related-sampling-issues-ver-29072013_en
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mation for ESS household surveys, 2013, URL http://ec.europa.eu/eurostat/documents/
3859598/5927001/KS-RA-13-029-EN.PDF.

See Also
domain, lin.ratio, linarpr, linarpt, lingini, lingini2, lingpg, linpoormed, linqsr, linrmpg,
residual_est, vardom, vardomh, varpoord, variance_othstr

Examples

Ys <- rchisq(10, 3)
w <- rep(2, 10)
PSU <- 1 : length(Ys)
H <- rep("Strata_1", 10)

# by default without using fh_zero (finite population correction)
variance_est(Y = Ys, H = H, PSU = PSU, w_final = w)

## Not run:
# without using fh_zero (finite population correction)
variance_est(Y = Ys, H = H, PSU = PSU, w_final = w, fh_zero = FALSE)

# with using fh_zero (finite population correction)
variance_est(Y = Ys, H = H, PSU = PSU, w_final = w, fh_zero = TRUE)

## End(Not run)

---

variance_othstr Variance estimation for sample surveys by the new stratification

Description

Computes s2g and the variance estimation by the new stratification.
Usage

```
variance_othstr(  
    Y,  
    H,  
    H2,  
    w_final,  
    N_h = NULL,  
    N_h2,  
    period = NULL,  
    dataset = NULL,  
    checking = TRUE
)
```

Arguments

**Y** Variables of interest. Object convertible to data.table or variable names as character, column numbers or logical vector with only one TRUE value (length of the vector has to be the same as the column count of dataset).

**H** The unit stratum variable. One dimensional object convertible to one-column data.table or variable name as character, column number or logical vector with only one TRUE value (length of the vector has to be the same as the column count of dataset).

**H2** The unit new stratum variable. One dimensional object convertible to one-column data.table or variable name as character, column number or logical vector with only one TRUE value (length of the vector has to be the same as the column count of dataset).

**w_final** Weight variable. One dimensional object convertible to one-column data.table or variable name as character, column number or logical vector with only one TRUE value (length of the vector has to be the same as the column count of dataset).

**N_h** optional; either a data.frame giving the first column - stratum, but the second column - the total of the population in each stratum.

**N_h2** optional; either a data.frame giving the first column - new stratum, but the second column - the total of the population in each new stratum.

**period** Optional variable for the survey periods. If supplied, the values for each period are computed independently. One dimensional object convertible to one-column data.table or variable name as character, column number or logical vector with only one TRUE value (length of the vector has to be the same as the column count of dataset).

**dataset** Optional survey data object convertible to data.table.

**checking** Optional variable if this variable is TRUE, then function checks data preparation errors, otherwise not checked. This variable by default is TRUE.
Details

It is possible to compute population size $M_g$ from sampling frame. The standard deviation of $g$-th stratum is

$$S_g^2 = \frac{1}{M_g - 1} \sum_{k=1}^{M_g} (y_{gk} - \hat{Y}_g)^2 = \frac{1}{M_g - 1} \sum_{k=1}^{M_g} y_{gk}^2 - \frac{M_g}{M_g - 1} \hat{Y}_g^2$$

where $\sum_{k=1}^{M_g} y_{gk}^2$ and $\hat{Y}_g^2$ have to be estimated to estimate $S_g^2$. Estimate of $\sum_{k=1}^{M_g} y_{gk}^2$ is $\sum_{h=1}^{H} \sum_{n_h}^{n_h} \sum_{i=1}^{n_h} y_{ht}^2 z_{hi}$, where

$$z_{hi} = \begin{cases} 0, & h_i \notin \theta_g \\ 1, & h_i \in \theta_g \end{cases}$$

$\theta_g$ is the index group of successfully surveyed units belonging to $g$-th stratum. Estimate of $\hat{Y}_g^2$ is

$$\hat{Y}_g^2 = \left( \frac{\hat{Y}_g}{M_g} \right)^2 - \text{Var} \left( \hat{Y} \right)$$

$$\hat{Y}_g = \frac{\hat{Y}_g}{M_g} \sum_{h=1}^{H} \frac{N_h}{n_h} \sum_{i=1}^{n_h} y_{hi} z_{hi}$$

So the estimate of $S_g^2$ is

$$s_g^2 = \frac{1}{M_g - 1} \sum_{h=1}^{H} \frac{N_h}{n_h} \sum_{i=1}^{n_h} y_{hi}^2 z_{hi} - \frac{M_g}{M_g - 1} \left( \frac{1}{M_g} \sum_{h=1}^{H} \frac{N_h}{n_h} \sum_{i=1}^{n_h} y_{hi} z_{hi} \right)^2$$

$$- \frac{M_g}{M_g - 1} \left( \frac{1}{M_g} \sum_{h=1}^{H} \frac{N_h}{n_h} \sum_{i=1}^{n_h} y_{hi}^2 z_{hi} \right) - \frac{1}{M_g} \sum_{h=1}^{H} \sum_{n_h}^{n_h} \sum_{i=1}^{n_h} \left( y_{hi} z_{hi} - \frac{1}{n_h} \sum_{t=1}^{n_h} y_{ht} z_{ht} \right)^2$$

Two conditions have to realize to estimate $S_g^2$ : $n_h > 1, \forall g$ and $\theta_g \neq 0, \forall g$.

Variance of $\hat{Y}$ is

$$\text{Var} \left( \hat{Y} \right) = \sum_{g=1}^{G} M_g^2 \left( \frac{1}{m_g} - \frac{1}{M_g} \right) S_g^2$$

Estimate of $\text{Var} \left( \hat{Y} \right)$ is

$$\text{Var} \left( \hat{Y} \right) = \sum_{g=1}^{G} M_g^2 \left( \frac{1}{m_g} - \frac{1}{M_g} \right) s_g^2$$

Value

A list with objects are returned by the function:

- betas A numeric data.table containing the estimated coefficients of calibration.
- s2g A data.table containing the s^2g value.
- var_est A data.table containing the values of the variance estimation.
References


See Also

domain, lin.ratio, linarpr, linarpt, lingini, lingini2, lingpg, linpoormed, linqsr, linrmpg, residual_est, vardom, vardom_othstr, vardomh, varpoord

Examples

```
library("data.table")
Y <- data.table(matrix(runif(50) * 5, ncol = 5))

H <- data.table(H = as.integer(trunc(5 * runif(10))))
H2 <- data.table(H2 = as.integer(trunc(3 * runif(10))))

N_h <- data.table(matrix(0 : 4, 5, 1))
setnames(N_h, names(N_h), "H")
N_h[, sk:= 10]

N_h2 <- data.table(matrix(0 : 2, 3, 1))
setnames(N_h2, names(N_h2), "H2")
N_h2[, sk2:= 4]

w_final <- rep(2, 10)

vo <- variance_othstr(Y = Y, H = H, H2 = H2,
w_final = w_final,
N_h = N_h, N_h2 = N_h2,
period = NULL,
dataset = NULL)

vo
```

```
---

```r
varpoord  
Estimation of the variance and deff for sample surveys for indicators on social exclusion and poverty
```

Description

Computes the estimation of the variance for indicators on social exclusion and poverty.

Usage

```
varpoord(
  Y,
  w_final,
  age = NULL,
)```
plo85 = NULL,
month_at_work = NULL,
Y_den = NULL,
Y_thres = NULL,
wght_thres = NULL,
ID_level1,
ID_level2 = NULL,
H,
PSU,
N_h,
PSU_sort = NULL,
fh_zero = FALSE,
PSU_level = TRUE,
sort = NULL,
Dom = NULL,
period = NULL,
gender = NULL,
dataset = NULL,
X = NULL,
periodX = NULL,
X_ID_level1 = NULL,
ind_gr = NULL,
g = NULL,
q = NULL,
datasetX = NULL,
percentage = 60,
order_quant = 50,
alpha = 20,
confidence = 0.95,
outp_lin = FALSE,
outp_res = FALSE,
type = "linrmpg"
)

Arguments

Y

Study variable (for example equalized disposable income or gross pension income). One dimensional object convertible to one-column data.table or variable name as character, column number.

w_final

Weight variable. One dimensional object convertible to one-column data.table or variable name as character, column number.

age

Age variable. One dimensional object convertible to one-column data.frame or variable name as character, column number.

plo85

Retirement variable (Number of months spent in retirement or early retirement). One dimensional object convertible to one-column data.table or variable name as character, column number.

Y_den

Denominator variable (for example gross individual earnings). One dimensional object convertible to one-column data.table or variable name as character,
column number.

\textbf{Y\_thres} Variable (for example equalized disposable income) used for computation and linearization of poverty threshold. One dimensional object convertible to one-column data\_table or variable name as character, column number. Variable specified for inc is used as income\_thres if income\_thres is not defined.

\textbf{wght\_thres} Weight variable used for computation and linearization of poverty threshold. One dimensional object convertible to one-column data\_table or variable name as character, column number. Variable specified for weight is used as wght\_thres if wght\_thres is not defined.

\textbf{ID\_level1} Variable for level1 ID codes. One dimensional object convertible to one-column data\_table or variable name as character, column number.

\textbf{ID\_level2} Optional variable for unit ID codes. One dimensional object convertible to one-column data\_table or variable name as character, column number.

\textbf{H} The unit stratum variable. One dimensional object convertible to one-column data\_table or variable name as character, column number.

\textbf{PSU} Primary sampling unit variable. One dimensional object convertible to one-column data\_table or variable name as character, column number.

\textbf{N\_h} Number of primary sampling units in population for each stratum (and period if period is not NULL). If \texttt{N\_h = NULL} and \texttt{fh\_zero = FALSE} (default), \texttt{N\_h} is estimated from sample data as sum of weights (\texttt{w\_final}) in each stratum (and period if period is not NULL). Optional for single-stage sampling design as it will be estimated from sample data. Recommended for multi-stage sampling design as \texttt{N\_h} can not be correctly estimated from the sample data in this case. If \texttt{N\_h} is not used in case of multi-stage sampling design (for example, because this information is not available), it is advisable to set \texttt{fh\_zero = TRUE}. If \texttt{period is not NULL}. A two-column data object convertible to data\_table with rows for each stratum. The first column should contain stratum code. The second column - the number of primary sampling units in the population of each stratum. If \texttt{period is NULL}. A three-column data object convertible to data\_table with rows for each intersection of strata and period. The first column should contain period. The second column should contain stratum code. The third column - the number of primary sampling units in the population of each stratum and period.

\textbf{PSU\_sort} optional; if PSU\_sort is defined, then variance is calculated for systematic sample.

\textbf{fh\_zero} by default FALSE; fh is calculated as division of n\_h and N\_h in each strata, if true, fh value is zero in each strata.

\textbf{PSU\_level} by default TRUE; if PSU\_level is true, in each strata fh is calculated as division of count of PSU in sample (n\_h) and count of PSU in frame(N\_h), if PSU\_level is false, in each strata fh is calculated as division of count of units in sample (n\_h) and count of units in frame(N\_h), which calculated as sum of weights.

\textbf{sort} Optional variable to be used as tie-breaker for sorting. One dimensional object convertible to one-column data\_table or variable name as character, column number.

\textbf{Dom} Optional variables used to define population domains. If supplied, variables is calculated for each domain. An object convertible to data\_table or variable name as character vector, column numbers.
period

Optional variable for survey period. If supplied, variables is calculated for each time period. Object convertible to `data.frame` or variable names as character, column numbers.

gender

Numerical variable for gender, where 1 is for males, but 2 is for females. One dimensional object convertible to one-column `data.frame` or variable name as character, column number.

dataset

Optional survey data object convertible to `data.frame`.

X

Optional matrix of the auxiliary variables for the calibration estimator. Object convertible to `data.frame` or variable names as character, column numbers.

periodX

Optional variable of the survey periods. If supplied, residual estimation of calibration is done independently for each time period. Object convertible to `data.frame` or variable names as character, column numbers.

X_ID_level1

Variable for level1 ID codes. One dimensional object convertible to one-column `data.frame` or variable name as character, column number.

ind_gr

Optional variable by which divided independently X matrix of the auxiliary variables for the calibration. One dimensional object convertible to one-column `data.frame` or variable name as character, column number.

g

Optional variable of the g weights. One dimensional object convertible to one-column `data.frame` or variable name as character, column number.

q

Variable of the positive values accounting for heteroscedasticity. One dimensional object convertible to one-column `data.frame` or variable name as character, column number.

datasetX

Optional survey data object in household level convertible to `data.frame`.

percentage

A numeric value in range \([0, 100]\) for \(p\) in the formula for poverty threshold computation:

\[
\frac{p}{100} \cdot Z_{\frac{\alpha}{100}}.
\]

For example, to compute poverty threshold equal to 60% of some income quantile, \(p\) should be set equal to 60.

order_quant

A numeric value in range \([0, 100]\) for \(\alpha\) in the formula for poverty threshold computation:

\[
\frac{p}{100} \cdot Z_{\frac{\alpha}{100}}.
\]

For example, to compute poverty threshold equal to some percentage of median income, \(\alpha\) should be set equal to 50.

alpha

A numeric value in range \([0, 100]\) for the order of the income quantile share ratio (in percentage).

confidence

Optional positive value for confidence interval. This variable by default is 0.95.

outp_lin

Logical value. If TRUE linearized values of the ratio estimator will be printed out.

outp_res

Logical value. If TRUE estimated residuals of calibration will be printed out.

type

A character vector (of length one unless several.ok is TRUE), example "linarp","linarpt", "lingpg", "linpoormed", "linrmrg", "lingini", "lingini2", "linqsr", "linarr", "linmir".
month_at_work  Variable for total number of month at work (sum of the number of months spent at full-time work as employee, number of months spent at part-time work as employee, number of months spent at full-time work as self-employed (including family worker), number of months spent at part-time work as self-employed (including family worker)). One dimensional object convertible to one-column data.table or variable name as character, column number.

Value
A list with objects are returned by the function:

- lin_out - a data.table containing the linearized values of the ratio estimator with ID_level2 and PSU.
- res_out - a data.table containing the estimated residuals of calibration with ID_level1 and PSU.
- betas - a numeric data.table containing the estimated coefficients of calibration.
- all_result - a data.table, which containing variables:
  respondent_count - the count of respondents,
  pop_size - the estimated size of population,
  n_nonzero - the count of respondents, who answers are larger than zero,
  value - the estimated value,
  var - the estimated variance,
  se - the estimated standard error,
  rse - the estimated relative standard error (coefficient of variation),
  cv - the estimated relative standard error (coefficient of variation) in percentage,
  absolute_margin_of_error - the estimated absolute margin of error,
  relative_margin_of_error - the estimated relative margin of error in percentage,
  CI_lower - the estimated confidence interval lower bound,
  CI_upper - the estimated confidence interval upper bound,
  confidence_level - the positive value for confidence interval,
  S2_y_HT - the estimated variance of the y variable in case of total or the estimated variance of the linearised variable in case of the ratio of two totals using non-calibrated weights,
  S2_y_ca - the estimated variance of the y variable in case of total or the estimated variance of the linearised variable in case of the ratio of two totals using calibrated weights,
  S2_res - the estimated variance of the regression residuals,
  var_srs_HT - the estimated variance of the HT estimator under SRS for household,
  var_cur_HT - the estimated variance of the HT estimator under current design for household,
  var_srs_ca - the estimated variance of the calibrated estimator under SRS for household,
  deff_sam - the estimated design effect of sample design for household,
  deff_est - the estimated design effect of estimator for household,
  deff - the overall estimated design effect of sample design and estimator for household

References
Guillaume Osier and Emilio Di Meglio. The linearisation approach implemented by Eurostat for the first wave of EU-SILC: what could be done from the second wave onwards? 2012

See Also
vardom, vardomh, linarpt

Examples

```r
library("data.table")
library("laeken")
data("eusilc")
dataset <- data.table(IDd = paste0("V", 1: nrow(eusilc)), eusilc)
dataset1 <- dataset[1:1000]

#use dataset1 by default without using fh_zero (finite population correction)
aa <- varpoord(Y = "eqIncome", w_final = "rb050",
                Y_thres = NULL, wght_thres = NULL,
                ID_level1 = "db030", ID_level2 = "IDd",
                H = "db040", PSU = "rb030", N_h = NULL,
                sort = NULL, Dom = NULL,
                gender = NULL, X = NULL,
                X_ID_level1 = NULL, g = NULL,
                q = NULL, datasetX = NULL,
                dataset = dataset1, percentage = 60,
                order_quant = 50L, alpha = 20,
```
The estimation of the simple random sampling.

Description

Computes the estimation of the simple random sampling.

Usage

```r
var_srs(Y, w = rep(1, length(Y)))
```
Arguments

\textit{Y} 

The variables of interest.

\textit{w} 

Weight variable. One dimensional object convertible to one-column \texttt{data.frame}.

Value

A list with objects are returned by the function:

- \texttt{S2p} - a \texttt{data.table} containing the values of the variance estimation of the population.
- \texttt{varsrs} - a \texttt{data.table} containing the values of the variance estimation of the simple random sampling.

References


See Also

\texttt{vardom, vardomh, varpoord}

Examples

\begin{verbatim}
Ys <- matrix(rchisq(10, 3), 10, 1)
ws <- c(rep(2, 5), rep(3, 5))
var_srs(Ys, ws)
\end{verbatim}
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