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Title Estimation in Dual Frame Surveys

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Description Point and interval estimation in dual frame surveys. In contrast
to classic sampling theory, where only one sampling frame is considered,
dual frame methodology assumes that there are two frames available for
sampling and that, overall, they cover the entire target population. Then,
two probability samples (one from each frame) are drawn and information
collected is suitably combined to get estimators of the parameter of
interest.

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Imports sampling, MASS, nnet

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Contents

BKA   *Bankier-Kalton-Anderson estimator*

Description

Produces estimates for population total and mean using the Bankier-Kalton-Anderson estimator from survey data obtained from a dual frame sampling design. Confidence intervals are also computed, if required.

Usage

```
BKA(ysA, ysB, pi_A, pi_B, pik_ab_B, pik_ba_A, domains_A, domains_B,
conf_level = NULL)
```

Arguments

ysA	A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x c containing information about variable(s) of interest from s_A.
ysB	A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x c containing information about variable(s) of interest from s_B.
pi_A	A numeric vector of length n_A or a square numeric matrix of dimension n_A containing first order or first and second order inclusion probabilities for units included in s_A.
pi_B	A numeric vector of length n_B or a square numeric matrix of dimension n_B containing first order or first and second order inclusion probabilities for units included in s_B.
pik_ab_B	A numeric vector of size n_A containing first order inclusion probabilities according to sampling design in frame B for units belonging to overlap domain that have been selected in s_A.
pik_ba_A	A numeric vector of size n_B containing first order inclusion probabilities according to sampling design in frame A for units belonging to overlap domain that have been selected in s_B.
domains_A	A character vector of size n_A indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domains_B	A character vector of size n_B indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
conf_level	(Optional) A numeric value indicating the confidence level for the confidence intervals, if desired.

Details

BKA estimator of population total is given by

$$\hat{Y}_{BKA} = \sum_{i \in s_A} \tilde{d}_i^A y_i + \sum_{i \in s_B} \tilde{d}_i^B y_i$$

where $\tilde{d}_i^A = \begin{cases} d_i^A & \text{if } i \in a \\ (1/d_i^A + 1/d_i^B)^{-1} & \text{if } i \in ab \end{cases}$ and $\tilde{d}_i^B = \begin{cases} d_i^B & \text{if } i \in b \\ (1/d_i^A + 1/d_i^B)^{-1} & \text{if } i \in ba \end{cases}$ being d_i^A and d_i^B the design weights, obtained as the inverse of the first order inclusion probabilities, that is, $d_i^A = 1/\pi_i^A$ and $d_i^B = 1/\pi_i^B$.

To estimate variance of this estimator, one uses following approach proposed by Rao and Skinner (1996)

$$\hat{V}(\hat{Y}_{BKA}) = \hat{V}(\sum_{i \in s_A} \tilde{z}_i^A) + \hat{V}(\sum_{i \in s_B} \tilde{z}_i^B)$$

with $\tilde{z}_i^A = \delta_i(a)y_i + (1 - \delta_i(a))y_i\pi_i^A/(\pi_i^A + \pi_i^B)$ and $\tilde{z}_i^B = \delta_i(b)y_i + (1 - \delta_i(b))y_i\pi_i^B/(\pi_i^A + \pi_i^B)$, being $\delta_i(a)$ and $\delta_i(b)$ the indicator variables for domain a and domain b, respectively. If both first

and second order probabilities are known, variances and covariances involved in calculation of $\hat{\beta}$ and $\hat{V}(\hat{Y}_{FB})$ are estimated using functions VarHT and CovHT, respectively. If only first order probabilities are known, variances are estimated using Deville's method and covariances are estimated using following expression

$$\widehat{Cov}(\hat{X}, \hat{Y}) = \frac{\hat{V}(X + Y) - \hat{V}(X) - \hat{V}(Y)}{2}$$

Value

BKA returns an object of class "EstimatorDF" which is a list with, at least, the following components:

Call   the matched call.

Est   total and mean estimation for main variable(s).

VarEst   variance estimation for main variable(s).

If parameter conf_level is different from NULL, object includes component

ConfInt   total and mean estimation and confidence intervals for main variables(s).

In addition, components TotDomEst and MeanDomEst are available when estimator is based on estimators of the domains. Component Param shows value of parameters involded in calculation of the estimator (if any). By default, only Est component (or ConfInt component, if parameter conf_level is different from NULL) is shown. It is possible to access to all the components of the objects by using function summary.

References

Bankier, M. D. (1986) *Estimators Based on Several Stratified Samples With Applications to Multiple Frame Surveys*. Journal of the American Statistical Association, Vol. 81, 1074 - 1079.

Kalton, G. and Anderson, D. W. (1986) *Sampling Rare Populations*. Journal of the Royal Statistical Society, Ser. A, Vol. 149, 65 - 82.

Rao, J. N. K. and Skinner, C. J. (1996) *Estimation in Dual Frame Surveys with Complex Designs*. Proceedings of the Survey Method Section, Statistical Society of Canada, 63 - 68.

Skinner, C. J. and Rao, J. N. K. (1996) *Estimation in Dual Frame Surveys with Complex Designs*. Journal of the American Statistical Association, Vol. 91, 433, 349 - 356.

See Also

JackBKA

Examples

```
data(DatA)
data(DatB)
data(PiklA)
data(PiklB)

#Let calculate BKA estimator for population total for variable Leisure
BKA(DatA$Lei, DatB$Lei, PiklA, PiklB, DatA$ProbB, DatB$ProbA,
```

```
DatA$Domain, DatB$Domain)

#Now, let calculate BKA estimator and a 90% confidence interval for population
#total for variable Feeding considering only first order inclusion probabilities
BKA(DatA$Feed, DatB$Feed, DatA$ProbA, DatB$ProbB, DatA$ProbB,
DatB$ProbA, DatA$Domain, DatB$Domain, 0.90)
```

CalDF   *DF calibration estimator*

Description

Produces estimates for population totals and means using the DF calibration estimator from survey data obtained from a dual frame sampling design. Confidence intervals are also computed, if required.

Usage

```
CalDF(ysA, ysB, pi_A, pi_B, domains_A, domains_B, N_A = NULL, N_B = NULL,
N_ab = NULL, xsAFrameA = NULL, xsBFrameA = NULL, xsAFrameB = NULL, xsBFrameB = NULL,
xsT = NULL, XA = NULL, XB = NULL, X = NULL, met = "linear", conf_level = NULL)
```

Arguments

ysA	A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x c containing information about variable(s) of interest from s_A.
ysB	A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x c containing information about variable(s) of interest from s_B.
pi_A	A numeric vector of length n_A or a square numeric matrix of dimension n_A containing first order or first and second order inclusion probabilities for units included in s_A.
pi_B	A numeric vector of length n_B or a square numeric matrix of dimension n_B containing first order or first and second order inclusion probabilities for units included in s_B.
domains_A	A character vector of length n_A indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domains_B	A character vector of length n_B indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
N_A	(Optional) A numeric value indicating the size of frame A.
N_B	(Optional) A numeric value indicating the size of frame B.
N_ab	(Optional) A numeric value indicating the size of the overlap domain.
xsAFrameA	(Optional) A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x m_A, with m_A the number of auxiliary variables in frame A, containing auxiliary information in frame A for units included in s_A.

xsBFrameA	(Optional) A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x m_A, with m_A the number of auxiliary variables in frame A, containing auxiliary information in frame A for units included in s_B. For units in domain b, these values are 0.
xsAFrameB	(Optional) A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x m_B, with m_B the number of auxiliary variables in frame B, containing auxiliary information in frame B for units included in s_A. For units in domain a, these values are 0.
xsBFrameB	(Optional) A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x m_B, with m_B the number of auxiliary variables in frame B, containing auxiliary information in frame B for units included in s_B.
xsT	(Optional) A numeric vector of length n or a numeric matrix or data frame of dimensions n x m_T, with m_T the number of auxiliary variables in both frames, containing auxiliary information for all units in the entire sample $s = s_A \cup s_B$.
XA	(Optional) A numeric value or vector of length m_A, with m_A the number of auxiliary variables in frame A, indicating the population totals for the auxiliary variables considered in frame A.
XB	(Optional) A numeric value or vector of length m_B, with m_B the number of auxiliary variables in frame B, indicating the population totals for the auxiliary variables considered in frame B.
X	(Optional) A numeric value or vector of length m_T, with m_T the number of auxiliary variables in both frames, indicating the population totals for the auxiliary variables considered in both frames.
met	(Optional) A character vector indicating the distance that must be used in calibration process. Possible values are "linear", "raking" and "logit". Default is "linear".
conf_level	(Optional) A numeric value indicating the confidence level for the confidence intervals, if desired.

Details

DF calibration estimator of population total is given by

$$\hat{Y}_{CalDF} = \hat{Y}_a + \hat{\eta}\hat{Y}_{ab} + \hat{Y}_b + (1 - \hat{\eta})\hat{Y}_{ba}$$

where $\hat{Y}_a = \sum_{i \in s_a} \tilde{d}_i y_i, \hat{Y}_{ab} = \sum_{i \in s_{ab}} \tilde{d}_i y_i, \hat{Y}_b = \sum_{i \in s_b} \tilde{d}_i y_i$ and $\hat{Y}_{ba} = \sum_{i \in s_{ba}} \tilde{d}_i y_i$, with $\tilde{d}_i$ calibration weights which are calculated having into account a different set of constraints, depending on the case. For instance, if N_A, N_B and N_{ab} are all known and no other auxiliary information is available, calibration constraints are

$$\sum_{i \in s_a} \tilde{d}_i = N_a, \sum_{i \in s_{ab}} \tilde{d}_i = N_{ab}, \sum_{i \in s_{ba}} \tilde{d}_i = N_{ba}, \sum_{i \in s_b} \tilde{d}_i = N_b$$

Optimal value for $\hat{\eta}$ to minimice variance of the estimator is given by $\hat{V}(\hat{N}_{ba})/(\hat{V}(\hat{N}_{ab}) + \hat{V}(\hat{N}_{ba}))$. If both first and second order probabilities are known, variances are estimated using function VarHT. If only first order probabilities are known, variances are estimated using Deville's method.

Function covers following scenarios:

- There is not any additional auxiliary variable
  - N_A, N_B and N_{ab} unknown
  - N_A and N_B known and N_{ab} unknown
  - N_{ab} known and N_A and N_B unknown
  - N_A, N_B and N_{ab} known
- At least, information about one additional auxiliary variable is available
  - N_A and N_B known and N_{ab} unknown
  - N_{ab} known and N_A and N_B unknown
  - N_A, N_B and N_{ab} known

To obtain an estimator of the variance for this estimator, one can use Deville's expression

$$\hat{V}(\hat{Y}_{CalDF}) = \frac{1}{1 - \sum_{k \in s} a_k^2} \sum_{k \in s} (1 - \pi_k) \left(\frac{e_k}{\pi_k} - \sum_{l \in s} a_l \frac{e_l}{\pi_l} \right)^2$$

where $a_k = (1 - \pi_k) / \sum_{l \in s} (1 - \pi_l)$ and e_k are the residuals of the regression with auxiliary variables as regressors.

Value

`CalDF` returns an object of class "EstimatorDF" which is a list with, at least, the following components:

Call	the matched call.
Est	total and mean estimation for main variable(s).
VarEst	variance estimation for main variable(s).

If parameter `conf_level` is different from NULL, object includes component

ConfInt	total and mean estimation and confidence intervals for main variables(s).

In addition, components TotDomEst and MeanDomEst are available when estimator is based on estimators of the domains. Component Param shows value of parameters involded in calculation of the estimator (if any). By default, only Est component (or ConfInt component, if parameter conf_level is different from NULL) is shown. It is possible to access to all the components of the objects by using function summary.

References

Ranalli, M. G., Arcos, A., Rueda, M. and Teodoro, A. (2013) *Calibration estimation in dual frame surveys*. arXiv:1312.0761 [stat.ME]

Deville, J. C., Sarndal, C. E. (1992) *Calibration estimators in survey sampling*. Journal of the American Statistical Association, 87, 376 - 382

See Also

[JackCalDF](#)

Examples

```
data(DatA)
data(DatB)
data(PiklA)
data(PiklB)

#Let calculate DF calibration estimator for variable Feeding, without
#considering any auxiliary information
CalDF(DatA$Feed, DatB$Feed, PiklA, PiklB, DatA$Domain, DatB$Domain)

#Now, let calculate DF calibration estimator for variable Clothing when the frame
#sizes and the overlap domain size are known
CalDF(DatA$Clo, DatB$Clo, PiklA, PiklB, DatA$Domain, DatB$Domain,
N_A = 1735, N_B = 1191, N_ab = 601)

#Finally, let calculate DF calibration estimator and a 90% confidence interval
#for population total for variable Feeding, considering Income as auxiliary variable in
#frame A and Metres2 as auxiliary variable in frame B and with frame sizes and overlap
#domain size known.
CalDF(DatA$Feed, DatB$Feed, PiklA, PiklB, DatA$Domain, DatB$Domain,
N_A = 1735, N_B =  1191, N_ab = 601, xsAFrameA = DatA$Inc, xsBFrameA = DatB$Inc,
xsAFrameB = DatA$M2, xsBFrameB = DatB$M2, XA = 4300260, XB = 176553,
conf_level = 0.90)
```

CalSF   *SF calibration estimator*

Description

Produces estimates for population totals and means using the SF calibration estimator from survey data obtained from a dual frame sampling design. Confidence intervals are also computed, if required.

Usage

```
CalSF(ysA, ysB, pi_A, pi_B, pik_ab_B, pik_ba_A, domains_A, domains_B, N_A = NULL,
N_B = NULL, N_ab = NULL, xsAFrameA = NULL, xsBFrameA = NULL, xsAFrameB = NULL,
xsBFrameB = NULL, xsT = NULL, XA = NULL, XB = NULL, X = NULL, met = "linear",
conf_level = NULL)
```

Arguments

ysA	A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x c containing information about variable(s) of interest from s_A.
ysB	A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x c containing information about variable(s) of interest from s_B.
pi_A	A numeric vector of length n_A or a square numeric matrix of dimension n_A containing first order or first and second order inclusion probabilities for units included in s_A.

pi_B	A numeric vector of length n_B or a square numeric matrix of dimension n_B containing first order or first and second order inclusion probabilities for units included in s_B.
pik_ab_B	A numeric vector of size n_A containing first order inclusion probabilities according to sampling desing in frame B for units belonging to overlap domain that have been selected in s_A.
pik_ba_A	A numeric vector of size n_B containing first order inclusion probabilities according to sampling desing in frame A for units belonging to overlap domain that have been selected in s_B.
domains_A	A character vector of size n_A indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domains_B	A character vector of size n_B indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
N_A	(Optional) A numeric value indicating the size of frame A
N_B	(Optional) A numeric value indicating the size of frame B
N_ab	(Optional) A numeric value indicating the size of the overlap domain
xsAFrameA	(Optional) A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x m_A, with m_A the number of auxiliary variables in frame A, containing auxiliary information in frame A for units included in s_A.
xsBFrameA	(Optional) A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x m_A, with m_A the number of auxiliary variables in frame A, containing auxiliary information in frame A for units included in s_B. For units in domain b, these values are 0.
xsAFrameB	(Optional) A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x m_B, with m_B the number of auxiliary variables in frame B, containing auxiliary information in frame B for units included in s_A. For units in domain a, these values are 0.
xsBFrameB	(Optional) A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x m_B, with m_B the number of auxiliary variables in frame B, containing auxiliary information in frame B for units included in s_B.
xsT	(Optional) A numeric vector of length n or a numeric matrix or data frame of dimensions n x m_T, with m_T the number of auxiliary variables in both frames, containing auxiliary information for all units in the entire sample $s = s_A \cup s_B$.
XA	(Optional) A numeric value or vector of length m_A, with m_A the number of auxiliary variables in frame A, indicating the population totals for the auxiliary variables considered in frame A.
XB	(Optional) A numeric value or vector of length m_B, with m_B the number of auxiliary variables in frame B, indicating the population totals for the auxiliary variables considered in frame B.
X	(Optional) A numeric value or vector of length m_T, with m_T the number of auxiliary variables in both frames, indicating the population totals for the auxiliary variables considered in both frames.
met	(Optional) A character vector indicating the distance that must be used in calibration process. Possible values are "linear", "raking" and "logit". Default is "linear".

conf_level   (Optional) A numeric value indicating the confidence level for the confidence
                  intervals, if desired.

Details

SF calibration estimator of population total is given by

$$\hat{Y}_{CalSF} = \hat{Y}_a + \hat{Y}_{ab} + \hat{Y}_b$$

where $\hat{Y}_a = \sum_{i \in s_a} \tilde{d}_i y_i$, $\hat{Y}_{ab} = \sum_{i \in (s_{ab} \cup s_{ba})} \tilde{d}_i y_i$ and $\hat{Y}_b = \sum_{i \in s_b} \tilde{d}_i y_i$, with $\tilde{d}_i$ calibration
weights which are calculated having into account a different set of constraints, depending on the
case. For instance, if N_A, N_B and N_{ab} are known and no other auxiliary information is available,
calibration constraints are

$$\sum_{i \in s_a} \tilde{d}_i = N_a, \quad \sum_{i \in s_{ab} \cup s_{ba}} \tilde{d}_i = N_{ab}, \quad \sum_{i \in s_{ba}} \tilde{d}_i = N_{ba}$$

Function covers following scenarios:

- There is not any additional auxiliary variable
    - N_A, N_B and N_{ab} unknown
    - N_{ab} known and N_A and N_B unknown
    - N_A and N_B known and N_{ab} unknown
    - N_A, N_B and N_{ab} known
- At least, information about one additional auxiliary variable is available
    - N_{ab} known and N_A and N_B unknown
    - N_A and N_B known and N_{ab} unknown
    - N_A, N_B and N_{ab} known

To obtain an estimator of the variance for this estimator, one can use Deville's expression

$$\hat{V}(\hat{Y}_{CalSF}) = \frac{1}{1 - \sum_{k \in s} a_k^2} \sum_{k \in s} (1 - \pi_k) \left(\frac{e_k}{\pi_k} - \sum_{l \in s} a_l \frac{e_l}{\pi_l} \right)^2$$

where $a_k = (1 - \pi_k) / \sum_{l \in s} (1 - \pi_l)$ and e_k are the residuals of the regression with auxiliary
variables as regressors.

Value

CalSF returns an object of class "EstimatorDF" which is a list with, at least, the following compo-
nents:

Call   the matched call.

Est   total and mean estimation for main variable(s).

VarEst   variance estimation for main variable(s).

If parameter conf_level is different from NULL, object includes component

ConfInt   total and mean estimation and confidence intervals for main variables(s).

In addition, components `TotDomEst` and `MeanDomEst` are available when estimator is based on estimators of the domains. Component `Param` shows value of parameters involded in calculation of the estimator (if any). By default, only `Est` component (or `ConfInt` component, if parameter `conf_level` is different from `NULL`) is shown. It is possible to access to all the components of the objects by using function `summary`.

References

Ranalli, M. G., Arcos, A., Rueda, M. and Teodoro, A. (2013) *Calibration estimation in dual frame surveys*. arXiv:1312.0761 [stat.ME]

Deville, J. C., Sarndal, C. E. (1992) *Calibration estimators in survey sampling.* Journal of the American Statistical Association, 87, 376 - 382

See Also

JackCalSF

Examples

```
data(DatA)
data(DatB)
data(PiklA)
data(PiklB)

#Let calculate SF calibration estimator for variable Clothing, without
#considering any auxiliary information
CalSF(DatA$Clo, DatB$Clo, PiklA, PiklB, DatA$ProbB, DatB$ProbA,
DatA$Domain, DatB$Domain)

#Now, let calculate SF calibration estimator for variable Leisure when the frame
#sizes and the overlap domain size are known
CalSF(DatA$Lei, DatB$Lei, PiklA, PiklB, DatA$ProbB, DatB$ProbA, DatA$Domain,
DatB$Domain, N_A = 1735, N_B = 1191, N_ab = 601)

#Finally, let calculate SF calibration estimator and a 90% confidence interval
#for population total for variable Feeding, considering Income and Metres2 as auxiliary
#variables and with frame sizes and overlap domain size known.
CalSF(DatA$Feed, DatB$Feed, PiklA, PiklB, DatA$ProbB, DatB$ProbA, DatA$Domain,
DatB$Domain, N_A = 1735, N_B =  1191, N_ab = 601, xsAFrameA = DatA$Inc,
xsBFrameA = DatB$Inc, xsAFrameB = DatA$M2, xsBFrameB = DatB$M2,
XA = 4300260, XB = 176553, conf_level = 0.90)
```

Compare	*Summary of estimators*

Description

Returns all possible estimators that can be computed according to the information provided

Usage

```
Compare(ysA, ysB, pi_A, pi_B, domains_A, domains_B, pik_ab_B = NULL, pik_ba_A = NULL,
N_A = NULL, N_B = NULL, N_ab = NULL, xsAFrameA = NULL, xsBFrameA = NULL,
xsAFrameB = NULL, xsBFrameB = NULL, XA = NULL, XB = NULL, met = "linear",
conf_level = NULL)
```

Arguments

ysA	A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x c containing information about variable(s) of interest from s_A.
ysB	A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x c containing information about variable(s) of interest from s_B.
pi_A	A numeric vector of length n_A or a square numeric matrix of dimension n_A containing first order or first and second order inclusion probabilities for units included in s_A.
pi_B	A numeric vector of length n_B or a square numeric matrix of dimension n_B containing first order or first and second order inclusion probabilities for units included in s_B.
domains_A	A character vector of length n_A indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domains_B	A character vector of length n_B indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
pik_ab_B	(Optional) A numeric vector of size n_A containing first order inclusion probabilities according to sampling desing in frame B for units belonging to overlap domain that have been selected in s_A.
pik_ba_A	(Optional) A numeric vector of size n_B containing first order inclusion probabilities according to sampling desing in frame A for units belonging to overlap domain that have been selected in s_B.
N_A	(Optional) A numeric value indicating the size of frame A.
N_B	(Optional) A numeric value indicating the size of frame B.
N_ab	(Optional) A numeric value indicating the size of the overlap domain.
xsAFrameA	(Optional) A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x m_A, with m_A the number of auxiliary variables in frame A, containing auxiliary information in frame A for units included in s_A.
xsBFrameA	(Optional) A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x m_A, with m_A the number of auxiliary variables in frame A, containing auxiliary information in frame A for units included in s_B. For units in domain b, these values are 0.
xsAFrameB	(Optional) A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x m_B, with m_B the number of auxiliary variables in frame B, containing auxiliary information in frame B for units included in s_A. For units in domain a, these values are 0.
xsBFrameB	(Optional) A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x m_B, with m_B the number of auxiliary variables in frame B, containing auxiliary information in frame B for units included in s_B.

XA	(Optional) A numeric value or vector of length m_A, with m_A the number of auxiliary variables in frame A, indicating the population totals for the auxiliary variables considered in frame A.
XB	(Optional) A numeric value or vector of length m_B, with m_B the number of auxiliary variables in frame B, indicating the population totals for the auxiliary variables considered in frame B.
met	(Optional) A character vector indicating the distance that must be used in calibration process. Possible values are "linear", "raking" and "logit". Default is "linear".
conf_level	(Optional) A numeric value indicating the confidence level for the confidence intervals, if desired.

Examples

```
data(DatA)
data(DatB)
data(PiklA)
data(PiklB)

Compare(DatA$Feed, DatB$Feed, PiklA, PiklB, DatA$Domain, DatB$Domain)
```

CovHT	*Covariance estimator between two Horvitz - Thompson estimators*

Description

Computes the covariance estimator between two Horvitz - Thompson estimators of population total from survey data obtained from a single stage sampling design

Usage

```
CovHT(y, x, pikl)
```

Arguments

y	A numeric vector of size n containing information about first variable of interest in the sample
x	A numeric vector of size n containing information about second variable of interest in the sample
pikl	A square numeric matrix of dimension n containing first and second order inclusion probabilities for units included in the sample

Details

Covariance estimator between two Horvitz - Thompson estimators of population total is given by

$$\hat{Cov}(\hat{Y}_{HT}, \hat{X}_{HT}) = \sum_{k \in s} \sum_{l \in s} \frac{\pi_{kl} - \pi_k \pi_l}{\pi_{kl}} \frac{y_k}{\pi_k} \frac{x_l}{\pi_l}$$

Value

A numeric value representing covariance estimator between two Horvitz - Thompson estimators for population total for considered values

References

Horvitz, D. G. and Thompson, D. J. (1952) *A generalization of sampling without replacement from a finite universe.* Journal of the American Statistical Association, 47, 663 - 685 @references Sarndal, C. E., Swensson, B. and Wretman, J. (1992) *Model Assisted Survey Sampling.* Springer-Verlag. New York.

See Also

HT VarHT

Examples

```
##########   Example 1   ##########
Indicators <- c(1, 2, 3, 4, 5)
X <- c(13, 18, 20, 14, 9)
Y <- c(2, 0.5, 1.2, 3.3, 2)
#Let draw two simple random samples without replacement of size 2
s <- sample(Indicators, 2)
sX <- X[s]
sY <- Y[s]
#Now, let calculate the associated probability matrix with first and
#second order inclusion probabilities
Ps <- matrix(c(0.4,0.2, 0.2,0.4), 2, 2)
CovHT(sX, sY, Ps)

##########   Example 2   ##########
data(DatA)
attach(DatA)
data(PiklA)
#Let calculate Horvitz - Thompson estimator for total of variable Clothing in Frame A.
HT(Clo, ProbA)
#Let calculate Horvitz - Thompson estimator for total of variable Feeding in Frame A.
HT(Feed, ProbA)
#And now, let compute the covariance between the previous estimators
CovHT(Clo, Feed, PiklA)
```

Dat	*Joint sample database*

Description

This dataset contains some variables coming from a real dual frame survey conducted in 2013 in Andalusia (Spain) by a scientific institute specialized in social topics. With this dataset it is intented to show how to properly split a joint dual frame sample into subsamples, so functions of Frame2 can be used.

Usage

```
Dat
```

Format

Drawnby Indicates whether individual was selected in the landline sample(1) or in the cell phone sample(2).

Stratum Indicates the stratum each individual belongs to. For individuals selected in cell phone sample, value of this variable is `NA`.

Opinion Response of the individual to the question: Do you think that immigrants currently living in Andalusia are quite a lot? 1 represents "yes" and 0 represents "no".

Landline Indicates whether individual has a landline (1) or not (0).

Cell Indicates whether individual has a cell phone(1) or not(0).

ProbLandline First order inclusion probability of reaching the individual by landline.

ProbCell First order inclusion probability of reaching the individual by cell phone.

Income Monthly income (in euros) of the individual.

Details

The survey was based on two frames: a landline frame and a cell phone frame. Landline frame was stratified by province and simple random sampling without replacement was considered in cell phone frame. The size of the whole sample was $n = 2402$. Total of the variable Income in the whole population is $X_{Income} = 12686232063$.

Examples

```
data(Dat)
attach(Dat)

#We are going to split dataset Dat into two new datasets, each
#one corresponding to a frame: frame containing individuals
#using landline and frame containing individuals using cell phone.

FrameLandline <- Dat[Landline == 1,]
FrameCell <- Dat[Cell == 1,]

#Equally, we can split the original dataset in three new different
#datasets, each one corresponding to one domain: first domain containing
#individuals using only landline, second domain containing individuals
#using only cell phone and the third domain containing individuals
#using both landline and cell phone.

DomainLandline <- Dat[Landline == 1 & Cell == 0,]
DomainCell <- Dat[Landline == 0 & Cell == 1,]
DomainBoth <- Dat[Landline == 1 & Cell == 1,]

#From the domain datasets, we can build frame datasets
```

```
FrameLandline <- rbind(DomainLandline, DomainBoth)
FrameCell <- rbind(DomainCell, DomainBoth)
```

DatA	*Database of household expenses for frame A*

Description

This dataset contains some variables regarding household expenses for a sample of 105 households selected from a list of landline phones (let say, frame A) in a particular city in a specific month.

Usage

```
DatA
```

Format

Domain A string indicating the domain each household belongs to. Possible values are "a" if household belongs to domain a or "ab" if household belongs to overlap domain.

Feed Feeding expenses (in euros) at the househould

Clo Clothing expenses (in euros) at the household

Lei Leisure expenses (in euros) at the household

Inc Household income (in euros). Values for this variable are only available for households included in frame A. For households included in domain b, value of this variable is set to 0.

Tax Household municipal taxes (in euros) paid. Values for this variable are only available for households included in frame A. For households included in domain b, value of this variable is set to 0.

M2 Square meters of the house. Values for this variable are only available for households included in frame B. For households included in domain a, value of this variable is set to 0.

Size Household size. Values for this variable are only available for households included in frame B. For households included in domain a, value of this variable is set to 0.

ProbA First order inclusion probability in frame A. This probability is 0 for households included in domain b.

ProbB First order inclusion probability in frame B. This probability is 0 for households included in domain a.

Stratum A numeric value indicating the stratum each household belongs to.

Details

The sample, of size $n_A = 105$, has been drawn from a population of $N_A = 1735$ households with landline phone according to a stratified random sampling. Population units were divided in 6 different strata. Population sizes of these strata are $N_A^h = (727, 375, 113, 186, 115, 219)$. $N_{ab} = 601$ of the households composing the population have, also, mobile phone. On the other hand, frame totals for auxiliary variables in this frame are $X_{Income}^A = 4300260$ and $X_{Taxes}^A = 215577$.

See Also

[PiklA](#)

Examples

```
data(DatA)
attach(DatA)
#Let perform a brief descriptive analysis for the three main variables
param <- data.frame(Feed, Clo, Lei)
summary (param)
hist (Feed)
hist (Clo)
hist (Lei)
```

DatB   *Database of household expenses for frame B*

Description

This dataset contains some variables regarding household expenses for a sample of 135 households selected from a list of mobile phones (let say, frame B) in a particular city in a specific month.

Usage

DatB

Format

Domain A string indicating the domain each household belongs to. Possible values are "b" if household belongs to domain b or "ba" if household belongs to overlap domain.

Feed Feeding expenses (in euros) at the househould

Clo Clothing expenses (in euros) at the household

Lei Leisure expenses (in euros) at the household

Inc Household income (in euros). Values for this variable are only available for households included in frame A. For households included in domain b, value of this variable is set to 0.

Tax Household municipal taxes (in euros) paid. Values for this variable are only available for households included in frame A. For households included in domain b, value of this variable is set to 0.

M2 Square meters of the house. Values for this variable are only available for households included in frame B. For households included in domain a, value of this variable is set to 0.

Size Household size. Values for this variable are only available for households included in frame B. For households included in domain a, value of this variable is set to 0.

ProbA First order inclusion probability in frame A. This probability is 0 for households included in domain b.

ProbB First order inclusion probability in frame B. This probability is 0 for households included in domain a.

Details

The sample, of size $n_B = 135$, has been drawn from a population of $N_B = 1191$ households with mobile phone according to a simple random sampling without replacement design. $N_{ab} = 601$ of these households have, also, landline phone. On the other hand, frame totals for auxiliary variables in this frame are $X^B_{Metres2} = 176553$ and $X^B_{Size} = 3529$

See Also

PiklB

Examples

```
data(DatB)
attach(DatB)
#Let perform a brief descriptive analysis for the three main variables
param <- data.frame(Feed, Clo, Lei)
summary (param)
hist (Feed)
hist (Clo)
hist (Lei)
```

DatMA   *Database of students' program choice for frame A*

Description

This dataset contains some variables regarding the program choice for a sample of 180 students included in the sampling frame A.

Usage

```
DatMA
```

Format

Id_Pop An integer from 1 to N, with N the number of students in the whole population, identifying the student within the population.

Id_Frame An integer from 1 to N_A, with N_A the number of students in the frame, identifying the student within the frame.

Prog A factor with three categories (academic, general and vocation) indicating the program choice of the student.

Ses An ordinal factor with three categories (low, middle and high) indicating the socio-economical status of the student.

Read A number indicating the mark of the student in a reading test.

Write A number indicating the mark of the student in a writing test.

Sch_Size A number indicating the size of the school the students belongs to.

Domain A string indicating the domain each student belongs to. Possible values are "a" if student belongs to domain a or "ab" if student belongs to overlap domain.

ProbA First order inclusion probability in frame A.

ProbB First order inclusion probability in frame B. This probability is 0 for students included in domain a.

Details

The sample, of size $n_A = 180$, has been drawn from a population of $N_A = 5500$ students according to a proportional-to-size sampling desing according to the size of the school. So, students attending bigger schools have a higher probability of being selected in the sample. $N_{ab} = 2000$ of the students composing the population belongs also to frame B.

See Also

DatPopM

Examples

```
data(DatMA)
attach(DatMA)
#Let perform a brief descriptive analysis for the main variable
summary (Prog)
#And let do the same for the numerical auxiliary variables Read and Write
summary(Read)
summary(Write)
```

DatMB   *Database of students' program choice for frame B*

Description

This dataset contains some variables regarding the program choice for a sample of 232 students included in the sampling frame B.

Usage

```
DatMB
```

Format

Id_Pop An integer from 1 to N, with N the number of students in the whole population, identifying the student within the population.

Id_Frame An integer from 1 to N_B, with N_B the number of students in the frame, identifying the student within the frame.

Prog A factor with three categories (academic, general and vocation) indicating the program choice of the student.

Ses An ordinal factor with three categories (low, middle and high) indicating the socio-economical status of the student.

Read A number indicating the mark of the student in a reading test.

Write A number indicating the mark of the student in a writing test.

Sch_Size A number indicating the size of the school the students belongs to.

Domain A string indicating the domain each student belongs to. Possible values are "b" if student belongs to domain b or "ba" if student belongs to overlap domain.

ProbA First order inclusion probability in frame A. This probability is 0 for students included in domain b.

ProbB First order inclusion probability in frame B.

Details

The sample, of size $n_B = 232$, has been drawn from a population of $N_B = 6500$ students according to a simple random sampling design. $N_{ab} = 2000$ of the students composing the population belongs also to frame A.

See Also

DatPopM

Examples

```
data(DatMB)
attach(DatMB)
#Let perform a brief descriptive analysis for the main variable
summary (Prog)
#And let do the same for the numerical auxiliary variables Read and Write
summary(Read)
summary(Write)
```

DatPopM   *Database of auxiliary information for the whole population of students*

Description

This dataset contains population information about the auxiliary variables of the population of students

Usage

DatPopM

Format

Ses An ordinal factor with three categories (low, middle and high) indicating the socio-economical status of the student.

Read A number indicating the mark of the student in a reading test.

Write A number indicating the mark of the student in a writing test.

Domain A string indicating the domain each student belongs to. Possible values are "a" if student belongs to domain a, "b" if student belongs to domain b or "ab" if student belongs to overlap domain.

Details

The population size is $N = 10000$.

See Also

[DatMA DatMB](#)

Examples

```
data(DatPopM)
attach(DatPopM)
#Let perform a brief descriptive analysis for the three auxiliary variables
summary (Ses)
summary(Read)
summary(Write)
```

Domains   *Domains*

Description

Given a main vector, an auxiliary one and a value of the latter, identifies positions of the auxiliary vector corresponding to values other than the given one. Then, turns zero values of the main vector corresponding to these positions.

Usage

```
Domains (y, domains, value)
```

Arguments

y	A numeric main vector of size n
domains	A numeric/character/logic auxiliary vector of size n
value	A value of the auxiliary vector

Value

A numeric vector, copy of y, with some values turned zero depending on values of domains and value

Examples

```
##########   Example 1   ##########
U <- c(13, 18, 20, 14, 9)
#Let build an auxiliary vector indicating whether values in U are above or below the mean.
aux <- c("Below", "Above", "Above", "Below", "Below")
#Now, only values below the mean remain, the other ones are turned zero.
Domains (U, aux, "Below")

##########   Example 2   ##########
data(DatA)
attach(DatA)
#Let calculate total feeding expenses corresponding to households in domain a.
sum (Domains (Feed, Domain, "a"))
```

FB   *Fuller-Burmeister estimator*

Description

Produces estimates for population totals and means using the Fuller - Burmeister estimator from survey data obtained from a dual frame sampling desing. Confidence intervals are also computed, if required.

Usage

```
FB(ysA, ysB, pi_A, pi_B, domains_A, domains_B, conf_level = NULL)
```

Arguments

ysA	A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x c containing information about variable of interest from s_A.
ysB	A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x c containing information about variable of interest from s_B.
pi_A	A numeric vector of length n_A or a square numeric matrix of dimension n_A containing first order or first and second order inclusion probabilities for units included in s_A.
pi_B	A numeric vector of length n_B or a square numeric matrix of dimension n_B containing first order or first and second order inclusion probabilities for units included in s_B.
domains_A	A character vector of size n_A indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".

domains_B   A character vector of size n_B indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".

conf_level   (Optional) A numeric value indicating the confidence level for the confidence intervals.

Details

Fuller-Burmeister estimator of population total is given by

$$\hat{Y}_{FB} = \hat{Y}_a^A + \hat{\beta}_1 \hat{Y}_{ab}^A + (1 - \hat{\beta}_1)\hat{Y}_{ab}^B + \hat{Y}_b^B + \hat{\beta}_2(\hat{N}_{ab}^A - \hat{N}_{ab}^B)$$

where optimal values for $\hat{\beta}$ to minimize variance of the estimator are:

$$\left(\begin{array}{c} \hat{\beta}_1 \\ \hat{\beta}_2 \end{array} \right) = - \left(\begin{array}{cc} \hat{V}(\hat{Y}_{ab}^A - \hat{Y}_{ab}^B) & \widehat{Cov}(\hat{Y}_{ab}^A - \hat{Y}_{ab}^B, \hat{N}_{ab}^A - \hat{N}_{ab}^B) \\ \widehat{Cov}(\hat{Y}_{ab}^A - \hat{Y}_{ab}^B, \hat{N}_{ab}^A - \hat{N}_{ab}^B) & \hat{V}(\hat{N}_{ab}^A - \hat{N}_{ab}^B) \end{array} \right)^{-1} \times$$

$$\left(\begin{array}{c} \widehat{Cov}(\hat{Y}_a^A + \hat{Y}_b^B + \hat{Y}_{ab}^B, \hat{Y}_{ab}^A - \hat{Y}_{ab}^B) \\ \widehat{Cov}(\hat{Y}_a^A + \hat{Y}_b^B + \hat{Y}_{ab}^B, \hat{N}_{ab}^A - \hat{N}_{ab}^B) \end{array} \right)$$

Due to Fuller-Burmeister estimator is not defined for estimating population sizes, estimation of the mean is computed as $\hat{Y}_{FB}/\hat{N}_H$, where $\hat{N}_H$ is the estimation of the population size using Hartley estimator. Estimated variance for the Fuller-Burmeister estimator can be obtained through expression

$$\hat{V}(\hat{Y}_{FB}) = \hat{V}(\hat{Y}_a^A) + \hat{V}(\hat{Y}^B) + \hat{\beta}_1[\widehat{Cov}(\hat{Y}_a^A, \hat{Y}_{ab}^A) - \widehat{Cov}(\hat{Y}^B, \hat{Y}_{ab}^B)]$$

$$+ \hat{\beta}_2[\widehat{Cov}(\hat{Y}_a^A, \hat{N}_{ab}^A) - \widehat{Cov}(\hat{Y}^B, \hat{N}_{ab}^B)]$$

If both first and second order probabilities are known, variances and covariances involved in calculation of $\hat{\beta}$ and $\hat{V}(\hat{Y}_{FB})$ are estimated using functions VarHT and CovHT, respectively. If only first order probabilities are known, variances are estimated using Deville's method and covariances are estimated using following expression

$$\widehat{Cov}(\hat{X}, \hat{Y}) = \frac{\hat{V}(X + Y) - \hat{V}(X) - \hat{V}(Y)}{2}$$

Value

FB returns an object of class "EstimatorDF" which is a list with, at least, the following components:

Call   the matched call.

Est   total and mean estimation for main variable(s).

VarEst   variance estimation for main variable(s).

If parameter conf_level is different from NULL, object includes component

ConfInt   total and mean estimation and confidence intervals for main variables(s).

In addition, components TotDomEst and MeanDomEst are available when estimator is based on estimators of the domains. Component Param shows value of parameters involded in calculation of the estimator (if any). By default, only Est component (or ConfInt component, if parameter conf_level is different from NULL) is shown. It is possible to access to all the components of the objects by using function summary.

References

Fuller, W.A. and Burmeister, L.F. (1972). *Estimation for Samples Selected From Two Overlapping Frames* ASA Proceedings of the Social Statistics Sections, 245 - 249.

See Also

[Hartley JackFB]

Examples

```
data(DatA)
data(DatB)
data(PiklA)
data(PiklB)

#Let calculate Fuller-Burmeister estimator for variable Clothing
FB(DatA$Clo, DatB$Clo, PiklA, PiklB, DatA$Domain, DatB$Domain)

#Now, let calculate Fuller-Burmeister estimator and a 90% confidence interval
#for variable Leisure, considering only first order inclusion probabilities
FB(DatA$Lei, DatB$Lei, DatA$ProbA, DatB$ProbB, DatA$Domain,
DatB$Domain, 0.90)
```

Hartley   *Hartley estimator*

Description

Produces estimates for population totals and means using Hartley estimator from survey data obtained from a dual frame sampling design. Confidence intervals are also computed, if required.

Usage

```
Hartley(ysA, ysB, pi_A, pi_B, domains_A, domains_B, conf_level = NULL)
```

Arguments

ysA	A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x c containing information about variable of interest from s_A.
ysB	A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x c containing information about variable of interest from s_B.
pi_A	A numeric vector of length n_A or a square numeric matrix of dimension n_A containing first order or first and second order inclusion probabilities for units included in s_A.
pi_B	A numeric vector of length n_B or a square numeric matrix of dimension n_B containing first order or first and second order inclusion probabilities for units included in s_B.

domains_A   A character vector of size n_A indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".

domains_B   A character vector of size n_B indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".

conf_level   (Optional) A numeric value indicating the confidence level for the confidence intervals.

Details

Hartley estimator of population total is given by

$$\hat{Y}_H = \hat{Y}_a^A + \hat{\theta}\hat{Y}_{ab}^A + (1 - \hat{\theta})\hat{Y}_{ab}^B + \hat{Y}_b^B$$

where $\hat{\theta} \in [0, 1]$. Optimum value for $\hat{\theta}$ to minimize variance of the estimator is

$$\hat{\theta}_{opt} = \frac{\hat{V}(\hat{Y}_{ab}^B) + \widehat{Cov}(\hat{Y}_b^B, \hat{Y}_{ab}^B) - \widehat{Cov}(\hat{Y}_a^A, \hat{Y}_{ab}^A)}{\hat{V}(\hat{Y}_{ab}^A) + \hat{V}(\hat{Y}_{ab}^B)}$$

Taking into account the independence between s_A and s_B, an estimator for the variance of the Hartley estimator can be obtained as follows:

$$\hat{V}(\hat{Y}_H) = \hat{V}(\hat{Y}_a^A + \hat{\theta}\hat{Y}_{ab}^A) + \hat{V}((1 - \hat{\theta})\hat{Y}_{ab}^B + \hat{Y}_b^B)$$

If both first and second order probabilities are known, variances and covariances involved in calculation of $\hat{\theta}_{opt}$ and $\hat{V}(\hat{Y}_H)$ are estimated using functions VarHT and CovHT, respectively. If only first order probabilities are known, variances are estimated using Deville's method and covariances are estimated using following expression

$$\widehat{Cov}(\hat{X}, \hat{Y}) = \frac{\hat{V}(X + Y) - \hat{V}(X) - \hat{V}(Y)}{2}$$

Value

Hartley returns an object of class "EstimatorDF" which is a list with, at least, the following components:

Call   the matched call.

Est   total and mean estimation for main variable(s).

VarEst   variance estimation for main variable(s).

If parameter conf_level is different from NULL, object includes component

ConfInt   total and mean estimation and confidence intervals for main variables(s).

In addition, components TotDomEst and MeanDomEst are available when estimator is based on estimators of the domains. Component Param shows value of parameters involded in calculation of the estimator (if any). By default, only Est component (or ConfInt component, if parameter conf_level is different from NULL) is shown. It is possible to access to all the components of the objects by using function summary.

References

Hartley, H. O. (1962) *Multiple Frames Surveys.* Proceedings of the American Statistical Association, Social Statistics Sections, 203 - 206.

Hartley, H. O. (1974) *Multiple frame methodology and selected applications.* Sankhya C, Vol. 36, 99 - 118.

See Also

JackHartley

Examples

```
data(DatA)
data(DatB)
data(PiklA)
data(PiklB)

#Let calculate Hartley estimator for variable Feeding
Hartley(DatA$Feed, DatB$Feed, PiklA, PiklB, DatA$Domain, DatB$Domain)

#Now, let calculate Hartley estimator and a 90% confidence interval
#for variable Leisure, considering only first order inclusion probabilities
Hartley(DatA$Lei, DatB$Lei, DatA$ProbA, DatB$ProbB, DatA$Domain,
DatB$Domain, 0.90)
```

HT   *Horvitz - Thompson estimator*

Description

Computes the Horvitz - Thompson estimator

Usage

```
HT(y, pik)
```

Arguments

y	A numeric vector of size n containing information about variable of interest
pik	A numeric vector of size n containing first order inclusion probabilities for units included in y

Details

Horvitz - Thompson estimator of population total is given by

$$\hat{Y}_{HT} = \sum_{k \in s} \frac{y_k}{\pi_k}$$

Value

A numeric value representing Horvitz - Thompson estimator for population total for considered values

References

Horvitz, D. G. and Thompson, D. J. (1952) *A generalization of sampling without replacement from a finite universe.* Journal of the American Statistical Association, 47, 663 - 685

See Also

[VarHT](#)

Examples

```
##########   Example 1   ##########
U <- c(13, 18, 20, 14, 9)
#A simple random sample of size 2 without replacement is drawn from population
s <- sample(U, 2)
ps <- c(0.4, 0.4)
HT(s, ps)

##########   Example 2   ##########
data(DatA)
attach(DatA)
#Let estimate population total for variable Feeding in frame A
HT(Feed, ProbA)
```

JackBKA   *Confidence intervals for Bankier-Kalton-Anderson estimator based on jackknife method*

Description

Calculates confidence intervals for Bankier-Kalton-Anderson estimator using jackknife procedure

Usage

```
JackBKA(ysA, ysB, piA, piB, pik_ab_B, pik_ba_A, domainsA, domainsB,
conf_level, sdA = "srs", sdB = "srs", strA = NULL, strB = NULL, clusA = NULL,
clusB = NULL, fcpA = FALSE, fcpB = FALSE)
```

Arguments

ysA   A numeric vector of length nA or a numeric matrix or data frame of dimensions nA x c containing information about variable of interest from s_A.

ysB   A numeric vector of length nB or a numeric matrix or data frame of dimensions nB x c containing information about variable of interest from s_B.

piA	A numeric vector of length nA or a square numeric matrix of dimension nA containing first order or first and second order inclusion probabilities for units included in s_A.
piB	A numeric vector of length nB or a square numeric matrix of dimension nB containing first order or first and second order inclusion probabilities for units included in s_B.
pik_ab_B	A numeric vector of size nA containing first order inclusion probabilities according to sampling design in frame B for units belonging to overlap domain that have been selected in s_A.
pik_ba_A	A numeric vector of size nB containing first order inclusion probabilities according to sampling design in frame A for units belonging to overlap domain that have been selected in s_B.
domainsA	A character vector of size nA indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domainsB	A character vector of size nB indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
conf_level	A numeric value indicating the confidence level for the confidence intervals.
sdA	(Optional) A character vector indicating the sampling design considered in frame A. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".
sdB	(Optional) A character vector indicating the sampling design considered in frame B. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".
strA	(Optional) A numeric vector indicating the stratum each unit in frame A belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame A.
strB	(Optional) A numeric vector indicating the stratum each unit in frame B belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame B.
clusA	(Optional) A numeric vector indicating the cluster each unit in frame A belongs to, if a cluster sampling or a stratified cluster sampling has been considered in frame A.
clusB	(Optional) A numeric vector indicating the cluster each unit in frame B belongs to, if a cluster sampling or a stratified cluster sampling has been considered in frame B.
fcpA	(Optional) A logic value indicating if a finite population correction factor should be considered in frame A. Default is FALSE.
fcpB	(Optional) A logic value indicating if a finite population correction factor should be considered in frame B. Default is FALSE.

Details

Let suppose a non stratified sampling design in frame A and a stratified sampling design in frame B where frame has been divided into L strata and a sample of size n_{Bl} from the N_{Bl} composing the l-th stratum is selected In this context, jackknife variance estimator of a estimator $\hat{Y}_c$ is given by

$$v_J(\hat{Y}_c) = \frac{n_A - 1}{n_A} \sum_{i \in s_A} (\hat{Y}_c^A(i) - \overline{Y}_c^A)^2 + \sum_{l=1}^{L} \frac{n_{Bl} - 1}{n_{Bl}} \sum_{i \in s_{Bl}} (\hat{Y}_c^B(lj) - \overline{Y}_c^{Bl})^2$$

with $\hat{Y}_c^A(i)$ the value of estimator $\hat{Y}_c$ after dropping $i-th$ unit from ysA and $\overline{Y}_c^A$ the mean of values $\hat{Y}_c^A(i)$. Similarly, $\hat{Y}_c^B(lj)$ is the value taken by $\hat{Y}_c$ after dropping j-th unit of l-th from sample ysB and $\overline{Y}_c^{Bl}$ is the mean of values $\hat{Y}_c^B(lj)$. If needed, a finite population correction factor can be included in frames by replacing $\hat{Y}_c^A(i)$ or $\hat{Y}_c^B(lj)$ with $\hat{Y}_c^{A*}(i) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_A}(\hat{Y}_c^A(i) - \hat{Y}_c)$ or $\hat{Y}_c^{B*}(lj) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_B}(\hat{Y}_c^B(lj) - \hat{Y}_c)$, where $\overline{\pi}_A = \sum_{i \in s_A} \pi_{iA}/nA$ and $\overline{\pi}_B = \sum_{j \in s_B} \pi_{jB}/nB$ A confidence interval for any parameter of interest, Y can be calculated, then, using the pivotal method.

Value

A numeric matrix containing estimations of population total and population mean and their corresponding confidence intervals obtained through jackknife method.

References

Wolter, K. M. (2007) *Introduction to Variance Estimation.* 2nd Edition. Springer, Inc., New York.

See Also

BKA

Examples

```
data(DatA)
data(DatB)

#Let obtain a 95% jackknife confidence interval for variable Clothing,
#supposing a stratified sampling in frame A and a simple random sampling without
#replacement  in frame B with no finite population correction factor in any frame.
JackBKA(DatA$Feed, DatB$Feed, DatA$ProbA, DatB$ProbB, DatA$ProbB,
DatB$ProbA, DatA$Domain, DatB$Domain, 0.95, "str", "srs",
strA = DatA$Stratum)

#Let check how interval estimation varies when a finite
#population correction factor is considered in both frames.
JackBKA(DatA$Feed, DatB$Feed, DatA$ProbA, DatB$ProbB, DatA$ProbB,
DatB$ProbA, DatA$Domain, DatB$Domain, 0.95, "str", "srs",
strA = DatA$Stratum, fcpA = TRUE, fcpB = TRUE)
```

| JackCalDF | *Confidence intervals for dual frame calibration estimator based on jackknife method* |

Description

Calculates confidence intervals for dual frame calibration estimator using jackknife procedure

Usage

```
JackCalDF(ysA, ysB, piA, piB, domainsA, domainsB, N_A = NULL, N_B = NULL,
N_ab = NULL, xsAFrameA = NULL, xsBFrameA = NULL, xsAFrameB = NULL,
xsBFrameB = NULL, xsT = NULL, XA = NULL, XB = NULL, X = NULL, met = "linear",
conf_level, sdA = "srs", sdB = "srs", strA = NULL, strB = NULL, clusA = NULL,
clusB = NULL, fcpA = FALSE, fcpB = FALSE)
```

Arguments

ysA	A numeric vector of length nA or a numeric matrix or data frame of dimensions nA x c containing information about variable of interest from s_A.
ysB	A numeric vector of length nB or a numeric matrix or data frame of dimensions nB x c containing information about variable of interest from s_B.
piA	A numeric vector of length nA or a square numeric matrix of dimension nA containing first order or first and second order inclusion probabilities for units included in s_A.
piB	A numeric vector of length nB or a square numeric matrix of dimension nB containing first order or first and second order inclusion probabilities for units included in s_B.
domainsA	A character vector of size nA indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domainsB	A character vector of size nB indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
N_A	(Optional) A numeric value indicating the size of frame A
N_B	(Optional) A numeric value indicating the size of frame B
N_ab	(Optional) A numeric value indicating the size of the overlap domain
xsAFrameA	(Optional) A numeric vector of length nA or a numeric matrix or data frame of dimensions nA x m_A, with m_A the number of auxiliary variables in frame A, containing auxiliary information in frame A for units included in s_A.
xsBFrameA	(Optional) A numeric vector of length nB or a numeric matrix or data frame of dimensions nB x m_A, with m_A the number of auxiliary variables in frame A, containing auxiliary information in frame A for units included in s_B. For units in domain b, these values are 0.

xsAFrameB	(Optional) A numeric vector of length nA or a numeric matrix or data frame of dimensions nA x m_B, with m_B the number of auxiliary variables in frame B, containing auxiliary information in frame B for units included in s_A. For units in domain a, these values are 0.
xsBFrameB	(Optional) A numeric vector of length nB or a numeric matrix or data frame of dimensions nB x m_B, with m_B the number of auxiliary variables in frame B, containing auxiliary information in frame B for units included in s_B.
xsT	(Optional) A numeric vector of length n or a numeric matrix or data frame of dimensions n x m_T, with m_T the number of auxiliary variables in both frames, containing auxiliary information for all units in the entire sample $s = s_A \cup s_B$.
XA	(Optional) A numeric value or vector of length m_A, with m_A the number of auxiliary variables in frame A, indicating the population totals for the auxiliary variables considered in frame A.
XB	(Optional) A numeric value or vector of length m_B, with m_B the number of auxiliary variables in frame B, indicating the population totals for the auxiliary variables considered in frame B.
X	(Optional) A numeric value or vector of length m_T, with m_T the number of auxiliary variables in both frames, indicating the population totals for the auxiliary variables considered in both frames.
met	(Optional) A character vector indicating the distance that must be used in calibration process. Possible values are "linear", "raking" and "logit". Default is "linear".
conf_level	A numeric value indicating the confidence level for the confidence intervals.
sdA	(Optional) A character vector indicating the sampling design considered in frame A. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".
sdB	(Optional) A character vector indicating the sampling design considered in frame B. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".
strA	(Optional) A numeric vector indicating the stratum each unit in frame A belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame A.
strB	(Optional) A numeric vector indicating the stratum each unit in frame B belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame B.
clusA	(Optional) A numeric vector indicating the cluster each unit in frame A belongs to, if a cluster sampling or a stratified cluster sampling has been considered in frame A.
clusB	(Optional) A numeric vector indicating the cluster each unit in frame B belongs to, if a cluster sampling or a stratified cluster sampling has been considered in frame B.

fcpA   (Optional) A logic value indicating if a finite population correction factor should
                        be considered in frame A. Default is FALSE.

fcpB   (Optional) A logic value indicating if a finite population correction factor should
                        be considered in frame B. Default is FALSE.

Details

Let suppose a non stratified sampling design in frame A and a stratified sampling design in frame B
where frame has been divided into L strata and a sample of size n_{Bl} from the N_{Bl} composing the
l-th stratum is selected In this context, jackknife variance estimator of a estimator $\hat{Y}_c$ is given by

$$v_J(\hat{Y}_c) = \frac{n_A - 1}{n_A} \sum_{i \in s_A} (\hat{Y}_c^A(i) - \overline{Y}_c^A)^2 + \sum_{l=1}^{L} \frac{n_{Bl} - 1}{n_{Bl}} \sum_{i \in s_{Bl}} (\hat{Y}_c^B(lj) - \overline{Y}_c^{Bl})^2$$

with $\hat{Y}_c^A(i)$ the value of estimator $\hat{Y}_c$ after dropping $i - th$ unit from ysA and $\overline{Y}_c^A$ the mean of values
$\hat{Y}_c^A(i)$. Similarly, $\hat{Y}_c^B(lj)$ is the value taken by $\hat{Y}_c$ after dropping j-th unit of l-th from sample ysB
and $\overline{Y}_c^{Bl}$ is the mean of values $\hat{Y}_c^B(lj)$. If needed, a finite population correction factor can be
included in frames by replacing $\hat{Y}_c^A(i)$ or $\hat{Y}_c^B(lj)$ with $\hat{Y}_c^{A*}(i) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_A}(\hat{Y}_c^A(i) - \hat{Y}_c)$ or
$\hat{Y}_c^{B*}(lj) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_B}(\hat{Y}_c^B(lj) - \hat{Y}_c)$, where $\overline{\pi}_A = \sum_{i \in s_A} \pi_{iA}/nA$ and $\overline{\pi}_B = \sum_{j \in s_A} \pi_{jB}/nB$
A confidence interval for any parameter of interest, Y can be calculated, then, using the pivotal
method.

Value

A numeric matrix containing estimations of population total and population mean and their corre-
sponding confidence intervals obtained through jackknife method.

References

Wolter, K. M. (2007) *Introduction to Variance Estimation.* 2nd Edition. Springer, Inc., New York.

See Also

CalDF

Examples

```
data(DatA)
data(DatB)

#Let obtain a 95% jackknife confidence interval for variable Clothing,
#with frame sizes and overlap domain size known, supposing a stratified
#sampling in frame A and a simple random sampling without replacement
#in frame B with no finite population correction factor in any frame.
JackCalDF(DatA$Clo, DatB$Clo, DatA$ProbA, DatB$ProbB,
DatA$Domain, DatB$Domain, N_A = 1735, N_B = 1191, N_ab = 601, conf_level = 0.95,
sdA = "str", sdB = "srs", strA = DatA$Stratum)

#Finally, let consider a finite population correction factor in both frames.
JackCalDF(DatA$Clo, DatB$Clo, DatA$ProbA, DatB$ProbB,
```

```
DatA$Domain, DatB$Domain, N_A = 1735, N_B = 1191, N_ab = 601, conf_level = 0.95,
sdA = "str", sdB = "srs", strA = DatA$Stratum, fcpA = TRUE, fcpB = TRUE)
```

JackCalSF	*Confidence intervals for SF calibration estimator based on jackknife method*

Description

Produces estimates for variance of SF calibration estimator using Jackknife procedure

Usage

```
JackCalSF(ysA, ysB, piA, piB, pik_ab_B, pik_ba_A, domainsA, domainsB,
N_A = NULL, N_B = NULL, N_ab = NULL, xsAFrameA = NULL, xsBFrameA = NULL,
xsAFrameB = NULL, xsBFrameB = NULL, xsT = NULL, XA = NULL, XB = NULL,
X = NULL, met = "linear", conf_level, sdA = "srs", sdB = "srs", strA = NULL,
strB = NULL, clusA = NULL, clusB = NULL, fcpA = FALSE, fcpB = FALSE)
```

Arguments

ysA	A numeric vector of length nA or a numeric matrix or data frame of dimensions nA x c containing information about variable of interest from s_A.
ysB	A numeric vector of length nB or a numeric matrix or data frame of dimensions nB x c containing information about variable of interest from s_B.
piA	A numeric vector of length nA or a square numeric matrix of dimension nA containing first order or first and second order inclusion probabilities for units included in s_A.
piB	A numeric vector of length nB or a square numeric matrix of dimension nB containing first order or first and second order inclusion probabilities for units included in s_B.
pik_ab_B	A numeric vector of size nA containing first order inclusion probabilities according to sampling desing in frame B for units belonging to overlap domain that have been selected in s_A.
pik_ba_A	A numeric vector of size nB containing first order inclusion probabilities according to sampling desing in frame A for units belonging to overlap domain that have been selected in s_B.
domainsA	A character vector of size nA indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domainsB	A character vector of size nB indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
N_A	(Optional) A numeric value indicating the size of frame A
N_B	(Optional) A numeric value indicating the size of frame B
N_ab	(Optional) A numeric value indicating the size of the overlap domain

xsAFrameA	(Optional) A numeric vector of length nA or a numeric matrix or data frame of dimensions nA x m_A, with m_A the number of auxiliary variables in frame A, containing auxiliary information in frame A for units included in s_A.
xsBFrameA	(Optional) A numeric vector of length nB or a numeric matrix or data frame of dimensions nB x m_A, with m_A the number of auxiliary variables in frame A, containing auxiliary information in frame A for units included in s_B. For units in domain b, these values are 0.
xsAFrameB	(Optional) A numeric vector of length nA or a numeric matrix or data frame of dimensions nA x m_B, with m_B the number of auxiliary variables in frame B, containing auxiliary information in frame B for units included in s_A. For units in domain a, these values are 0.
xsBFrameB	(Optional) A numeric vector of length nB or a numeric matrix or data frame of dimensions nB x m_B, with m_B the number of auxiliary variables in frame B, containing auxiliary information in frame B for units included in s_B.
xsT	(Optional) A numeric vector of length n or a numeric matrix or data frame of dimensions n x m_T, with m_T the number of auxiliary variables in both frames, containing auxiliary information for all units in the entire sample $s = s_A \cup s_B$.
XA	(Optional) A numeric value or vector of length m_A, with m_A the number of auxiliary variables in frame A, indicating the population totals for the auxiliary variables considered in frame A.
XB	(Optional) A numeric value or vector of length m_B, with m_B the number of auxiliary variables in frame B, indicating the population totals for the auxiliary variables considered in frame B.
X	(Optional) A numeric value or vector of length m_T, with m_T the number of auxiliary variables in both frames, indicating the population totals for the auxiliary variables considered in both frames.
met	(Optional) A character vector indicating the distance that must be used in calibration process. Possible values are "linear", "raking" and "logit". Default is "linear".
conf_level	A numeric value indicating the confidence level for the confidence intervals.
sdA	(Optional) A character vector indicating the sampling design considered in frame A. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".
sdB	(Optional) A character vector indicating the sampling design considered in frame B. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".
strA	(Optional) A numeric vector indicating the stratum each unit in frame A belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame A.
strB	(Optional) A numeric vector indicating the stratum each unit in frame B belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame B.

clusA   (Optional) A numeric vector indicating the cluster each unit in frame A belongs
             to, if a cluster sampling or a stratified cluster sampling has been considered in
             frame A.

clusB   (Optional) A numeric vector indicating the cluster each unit in frame B belongs
             to, if a cluster sampling or a stratified cluster sampling has been considered in
             frame B.

fcpA   (Optional) A logic value indicating if a finite population correction factor should
             be considered in frame A. Default is FALSE.

fcpB   (Optional) A logic value indicating if a finite population correction factor should
             be considered in frame B. Default is FALSE.

Details

Let suppose a non stratified sampling design in frame A and a stratified sampling design in frame B
where frame has been divided into L strata and a sample of size n_{Bl} from the N_{Bl} composing the
l-th stratum is selected In this context, jackknife variance estimator of a estimator $\hat{Y}_c$ is given by

$$v_J(\hat{Y}_c) = \frac{n_A - 1}{n_A} \sum_{i \in s_A} (\hat{Y}_c^A(i) - \overline{Y}_c^A)^2 + \sum_{l=1}^{L} \frac{n_{Bl} - 1}{n_{Bl}} \sum_{i \in s_{Bl}} (\hat{Y}_c^B(lj) - \overline{Y}_c^{Bl})^2$$

with $\hat{Y}_c^A(i)$ the value of estimator $\hat{Y}_c$ after dropping $i - th$ unit from ysA and $\overline{Y}_c^A$ the mean of values
$\hat{Y}_c^A(i)$. Similarly, $\hat{Y}_c^B(lj)$ is the value taken by $\hat{Y}_c$ after dropping j-th unit of l-th from sample ysB
and $\overline{Y}_c^{Bl}$ is the mean of values $\hat{Y}_c^B(lj)$. If needed, a finite population correction factor can be
included in frames by replacing $\hat{Y}_c^A(i)$ or $\hat{Y}_c^B(lj)$ with $\hat{Y}_c^{A*}(i) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_A}(\hat{Y}_c^A(i) - \hat{Y}_c)$ or
$\hat{Y}_c^{B*}(lj) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_B}(\hat{Y}_c^B(lj) - \hat{Y}_c)$, where $\overline{\pi}_A = \sum_{i \in s_A} \pi_{iA}/nA$ and $\overline{\pi}_B = \sum_{j \in s_B} \pi_{jB}/nB$
A confidence interval for any parameter of interest, Y can be calculated, then, using the pivotal
method.

Value

A numeric matrix containing estimations of population total and population mean and their corre-
sponding confidence intervals obtained through jackknife method.

References

Wolter, K. M. (2007) *Introduction to Variance Estimation.* 2nd Edition. Springer, Inc., New York.

See Also

CalSF

Examples

```
data(DatA)
data(DatB)

#Let obtain a 95% jackknife confidence interval for variable Clothing,
#with frame sizes and overlap domain size known, supposing a stratified
```

```
#sampling in frame A and a simple random sampling without replacement
#in frame B with no finite population correction factor in any frame
JackCalSF(DatA$Clo, DatB$Clo, DatA$ProbA, DatB$ProbB,
DatA$ProbB, DatB$ProbA, DatA$Domain, DatB$Domain, N_A = 1735,
N_B = 1191, N_ab = 601, conf_level = 0.95, sdA = "str", sdB = "srs",
strA = DatA$Stratum)
```

JackFB	*Confidence intervals for Fuller-Burmeister estimator based on jack-knife method*

Description

Calculates confidence intervals for Fuller-Burmeister estimator using jackknife procedure

Usage

```
JackFB(ysA, ysB, piA, piB, domainsA, domains_B, conf_level, sdA = "srs",
sdB = "srs", strA = NULL, strB = NULL, clusA = NULL, clusB = NULL, fcpA = FALSE,
fcpB = FALSE)
```

Arguments

ysA	A numeric vector of length nA or a numeric matrix or data frame of dimensions nA x c containing information about variable of interest from s_A.
ysB	A numeric vector of length nB or a numeric matrix or data frame of dimensions nB x c containing information about variable of interest from s_B.
piA	A numeric vector of length nA or a square numeric matrix of dimension nA containing first order or first and second order inclusion probabilities for units included in s_A.
piB	A numeric vector of length nB or a square numeric matrix of dimension nB containing first order or first and second order inclusion probabilities for units included in s_B.
domainsA	A character vector of size nA indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domains_B	A character vector of size nB indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
conf_level	A numeric value indicating the confidence level for the confidence intervals.
sdA	(Optional) A character vector indicating the sampling design considered in frame A. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".

sdB	(Optional) A character vector indicating the sampling design considered in frame B. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".
strA	(Optional) A numeric vector indicating the stratum each unit in frame A belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame A.
strB	(Optional) A numeric vector indicating the stratum each unit in frame B belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame B.
clusA	(Optional) A numeric vector indicating the cluster each unit in frame A belongs to, if a cluster sampling or a stratified cluster sampling has been considered in frame A.
clusB	(Optional) A numeric vector indicating the cluster each unit in frame B belongs to, if a cluster sampling or a stratified cluster sampling has been considered in frame B.
fcpA	(Optional) A logic value indicating if a finite population correction factor should be considered in frame A. Default is FALSE.
fcpB	(Optional) A logic value indicating if a finite population correction factor should be considered in frame B. Default is FALSE.

Details

Let suppose a non stratified sampling design in frame A and a stratified sampling design in frame B where frame has been divided into L strata and a sample of size n_{Bl} from the N_{Bl} composing the l-th stratum is selected In this context, jackknife variance estimator of a estimator $\hat{Y}_c$ is given by

$$v_J(\hat{Y}_c) = \frac{n_A - 1}{n_A} \sum_{i \in s_A} (\hat{Y}_c^A(i) - \overline{Y}_c^A)^2 + \sum_{l=1}^{L} \frac{n_{Bl} - 1}{n_{Bl}} \sum_{i \in s_{Bl}} (\hat{Y}_c^B(lj) - \overline{Y}_c^{Bl})^2$$

with $\hat{Y}_c^A(i)$ the value of estimator $\hat{Y}_c$ after dropping $i-th$ unit from ysA and $\overline{Y}_c^A$ the mean of values $\hat{Y}_c^A(i)$. Similarly, $\hat{Y}_c^B(lj)$ is the value taken by $\hat{Y}_c$ after dropping j-th unit of l-th from sample ysB and $\overline{Y}_c^{Bl}$ is the mean of values $\hat{Y}_c^B(lj)$. If needed, a finite population correction factor can be included in frames by replacing $\hat{Y}_c^A(i)$ or $\hat{Y}_c^B(lj)$ with $\hat{Y}_c^{A*}(i) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_A}(\hat{Y}_c^A(i) - \hat{Y}_c)$ or $\hat{Y}_c^{B*}(lj) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_B}(\hat{Y}_c^B(lj) - \hat{Y}_c)$, where $\overline{\pi}_A = \sum_{i \in s_A} \pi_{iA}/nA$ and $\overline{\pi}_B = \sum_{j \in s_B} \pi_{jB}/nB$ A confidence interval for any parameter of interest, Y can be calculated, then, using the pivotal method.

Value

A numeric matrix containing estimations of population total and population mean and their corresponding confidence intervals obtained through jackknife method.

References

Wolter, K. M. (2007) *Introduction to Variance Estimation.* 2nd Edition. Springer, Inc., New York.

See Also

[FB](#)

Examples

```
data(DatA)
data(DatB)

#Let obtain a 95% jackknife confidence interval for variable Clothing,
#supposing a stratified sampling in frame A and a simple random sampling
#without replacement in frame B with no finite population correction factor
#in any frame.
JackFB(DatA$Clo, DatB$Clo, DatA$ProbA, DatB$ProbB, DatA$Domain,
DatB$Domain, 0.95, "str", "srs", strA = DatA$Stratum)

#Let check how interval estimation varies when a finite
#population correction factor is considered in both frames.
JackFB(DatA$Clo, DatB$Clo, DatA$ProbA, DatB$ProbB, DatA$Domain,
DatB$Domain, 0.95, "str", "srs", strA = DatA$Stratum,
fcpA = TRUE, fcpB = TRUE)
```

JackHartley	*Confidence intervals for Hartley estimator based on jackknife method*

Description

Calculates confidence intervals for Hartley estimator using jackknife procedure

Usage

```
JackHartley(ysA, ysB, piA, piB, domainsA, domainsB, conf_level, sdA = "srs",
sdB = "srs", strA = NULL, strB = NULL, clusA = NULL, clusB = NULL, fcpA = FALSE,
fcpB = FALSE)
```

Arguments

ysA	A numeric vector of length nA or a numeric matrix or data frame of dimensions nA x c containing information about variable of interest from s_A.
ysB	A numeric vector of length nB or a numeric matrix or data frame of dimensions nB x c containing information about variable of interest from s_B.
piA	A numeric vector of length nA or a square numeric matrix of dimension nA containing first order or first and second order inclusion probabilities for units included in s_A.
piB	A numeric vector of length nB or a square numeric matrix of dimension nB containing first order or first and second order inclusion probabilities for units included in s_B.

domainsA	A character vector of size nA indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domainsB	A character vector of size nB indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
conf_level	A numeric value indicating the confidence level for the confidence intervals.
sdA	(Optional) A character vector indicating the sampling design considered in frame A. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".
sdB	(Optional) A character vector indicating the sampling design considered in frame B. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".
strA	(Optional) A numeric vector indicating the stratum each unit in frame A belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame A.
strB	(Optional) A numeric vector indicating the stratum each unit in frame B belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame B.
clusA	(Optional) A numeric vector indicating the cluster each unit in frame A belongs to, if a cluster sampling or a stratified cluster sampling has been considered in frame A.
clusB	(Optional) A numeric vector indicating the cluster each unit in frame B belongs to, if a cluster sampling or a stratified cluster sampling has been considered in frame B.
fcpA	(Optional) A logic value indicating if a finite population correction factor should be considered in frame A. Default is FALSE.
fcpB	(Optional) A logic value indicating if a finite population correction factor should be considered in frame B. Default is FALSE.

Details

Let suppose a non stratified sampling design in frame A and a stratified sampling design in frame B where frame has been divided into L strata and a sample of size n_{Bl} from the N_{Bl} composing the l-th stratum is selected In this context, jackknife variance estimator of a estimator $\hat{Y}_c$ is given by

$$v_J(\hat{Y}_c) = \frac{n_A - 1}{n_A} \sum_{i \in s_A} (\hat{Y}_c^A(i) - \overline{Y}_c^A)^2 + \sum_{l=1}^{L} \frac{n_{Bl} - 1}{n_{Bl}} \sum_{i \in s_{Bl}} (\hat{Y}_c^B(lj) - \overline{Y}_c^{Bl})^2$$

with $\hat{Y}_c^A(i)$ the value of estimator $\hat{Y}_c$ after dropping $i - th$ unit from ysA and $\overline{Y}_c^A$ the mean of values $\hat{Y}_c^A(i)$. Similarly, $\hat{Y}_c^B(lj)$ is the value taken by $\hat{Y}_c$ after dropping j-th unit of l-th from sample ysB and $\overline{Y}_c^{Bl}$ is the mean of values $\hat{Y}_c^B(lj)$. If needed, a finite population correction factor can be included in frames by replacing $\hat{Y}_c^A(i)$ or $\hat{Y}_c^B(lj)$ with $\hat{Y}_c^{A*}(i) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_A}(\hat{Y}_c^A(i) - \hat{Y}_c)$ or

$\hat{Y}_c^{B*}(lj) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_B}(\hat{Y}_c^B(lj) - \hat{Y}_c)$, where $\overline{\pi}_A = \sum_{i \in s_A} \pi_{iA}/nA$ and $\overline{\pi}_B = \sum_{j \in s_B} \pi_{jB}/nB$

A confidence interval for any parameter of interest, Y can be calculated, then, using the pivotal method.

Value

A numeric matrix containing estimations of population total and population mean and their corresponding confidence intervals obtained through jackknife method.

References

Wolter, K. M. (2007) *Introduction to Variance Estimation.* 2nd Edition. Springer, Inc., New York.

See Also

[Hartley](#)

Examples

```
data(DatA)
data(DatB)

#Let obtain a 95% jackknife confidence interval for variable Feeding,
#supposing a stratified sampling in frame A and a simple random sampling
#without replacement in frame B with no finite population correction
#factor in any frame.
JackHartley(DatA$Feed, DatB$Feed, DatA$ProbA, DatB$ProbB, DatA$Domain,
DatB$Domain, 0.95, "str", "srs", strA = DatA$Stratum)

#Let check how interval estimation varies when a finite
#population correction factor is considered in both frames.
JackHartley(DatA$Feed, DatB$Feed, DatA$ProbA, DatB$ProbB, DatA$Domain,
DatB$Domain, 0.95, "str", "srs", strA = DatA$Stratum, fcpA = TRUE,
fcpB = TRUE)
```

JackMLCDF   *Confidence intervals for MLCDF estimator based on jackknife method*

Description

Calculates confidence intervals for MLCDF estimator using jackknife procedure

Usage

```
JackMLCDF (ysA, ysB, pik_A, pik_B, domains_A, domains_B, xsA, xsB, xA, xB, ind_samA,
ind_samB, ind_domA, ind_domB, N, N_ab = NULL, met = "linear", conf_level, sdA = "srs",
sdB = "srs", strA = NULL, strB = NULL, clusA = NULL, clusB = NULL, fcpA = FALSE,
fcpB = FALSE)
```

Arguments

ysA	A data frame containing information about one or more factors, each one of dimension n_A, collected from s_A.
ysB	A data frame containing information about one or more factors, each one of dimension n_B, collected from s_B.
pik_A	A numeric vector of length n_A containing first order inclusion probabilities for units included in s_A.
pik_B	A numeric vector of length n_B containing first order inclusion probabilities for units included in s_B.
domains_A	A character vector of size n_A indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domains_B	A character vector of size n_B indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
xsA	A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x m, with m the number of auxiliary variables, containing auxiliary information in frame A for units included in s_A.
xsB	A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x m, with m the number of auxiliary variables, containing auxiliary information in frame B for units included in s_B.
xA	A numeric vector or length N_A or a numeric matrix or data frame of dimensions N_A x m_A, with m_A the number of auxiliary variables in frame A, containing auxiliary information for the units in frame A.
xB	A numeric vector or length N_B or a numeric matrix or data frame of dimensions N_B x m_B, with m_B the number of auxiliary variables in frame B, containing auxiliary information for the units in frame B.
ind_samA	A numeric vector of length n_A containing the identificators of units of the frame A (from 1 to N_A) that belongs to s_A.
ind_samB	A numeric vector of length n_B containing the identificators of units of the frame B (from 1 to N_B) that belongs to s_B.
ind_domA	A character vector of length N_A indicating the domain each unit from frame A belongs to. Possible values are "a" and "ab".
ind_domB	A character vector of length N_B indicating the domain each unit from frame B belongs to. Possible values are "b" and "ba".
N	A numeric value indicating the size of the population.
N_ab	(Optional) A numeric value indicating the size of the overlap domain
met	(Optional) A character vector indicating the distance that must be used in calibration process. Possible values are "linear", "raking" and "logit". Default is "linear".
conf_level	A numeric value indicating the confidence level for the confidence intervals.
sdA	(Optional) A character vector indicating the sampling design considered in frame A. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".

sdB	(Optional) A character vector indicating the sampling design considered in frame B. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".
strA	(Optional) A numeric vector indicating the stratum each unit in frame A belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame A.
strB	(Optional) A numeric vector indicating the stratum each unit in frame B belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame B.
clusA	(Optional) A numeric vector indicating the cluster each unit in frame A belongs to, if a cluster sampling or a stratified cluster sampling has been considered in frame A.
clusB	(Optional) A numeric vector indicating the cluster each unit in frame B belongs to, if a cluster sampling or a stratified cluster sampling has been considered in frame B.
fcpA	(Optional) A logic value indicating if a finite population correction factor should be considered in frame A. Default is FALSE.
fcpB	(Optional) A logic value indicating if a finite population correction factor should be considered in frame B. Default is FALSE.

Details

Let suppose a non stratified sampling design in frame A and a stratified sampling design in frame B where frame has been divided into L strata and a sample of size n_{Bl} from the N_{Bl} composing the l-th stratum is selected In this context, jackknife variance estimator of a estimator $\hat{Y}_c$ is given by

$$v_J(\hat{Y}_c) = \frac{n_A - 1}{n_A} \sum_{i \in s_A} (\hat{Y}_c^A(i) - \overline{Y}_c^A)^2 + \sum_{l=1}^{L} \frac{n_{Bl} - 1}{n_{Bl}} \sum_{i \in s_{Bl}} (\hat{Y}_c^B(lj) - \overline{Y}_c^{Bl})^2$$

with $\hat{Y}_c^A(i)$ the value of estimator $\hat{Y}_c$ after dropping $i - th$ unit from ysA and $\overline{Y}_c^A$ the mean of values $\hat{Y}_c^A(i)$. Similarly, $\hat{Y}_c^B(lj)$ is the value taken by $\hat{Y}_c$ after dropping j-th unit of l-th from sample ysB and $\overline{Y}_c^{Bl}$ is the mean of values $\hat{Y}_c^B(lj)$. If needed, a finite population correction factor can be included in frames by replacing $\hat{Y}_c^A(i)$ or $\hat{Y}_c^B(lj)$ with $\hat{Y}_c^{A*}(i) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_A}(\hat{Y}_c^A(i) - \hat{Y}_c)$ or $\hat{Y}_c^{B*}(lj) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_B}(\hat{Y}_c^B(lj) - \hat{Y}_c)$, where $\overline{\pi}_A = \sum_{i \in s_A} \pi_{iA}/nA$ and $\overline{\pi}_B = \sum_{j \in s_B} \pi_{jB}/nB$ A confidence interval for any parameter of interest, Y can be calculated, then, using the pivotal method.

Value

A numeric matrix containing estimations of population total and population mean and their corresponding confidence intervals obtained through jackknife method.

References

Molina, D., Rueda, M., Arcos, A. and Ranalli, M. G. (2015) *Multinomial logistic estimation in dual frame surveys* Statistics and Operations Research Transactions (SORT). To be printed.

Wolter, K. M. (2007) *Introduction to Variance Estimation.* 2nd Edition. Springer, Inc., New York.

See Also

MLCDF

Examples

```
data(DatMA)
data(DatMB)
data(DatPopM)

N <- nrow(DatPopM)
levels(DatPopM$Domain) <- c(levels(DatPopM$Domain), "ba")
DatPopMA <- subset(DatPopM, DatPopM$Domain == "a" | DatPopM$Domain == "ab", stringAsFactors = FALSE)
DatPopMB <- subset(DatPopM, DatPopM$Domain == "b" | DatPopM$Domain == "ab", stringAsFactors = FALSE)
DatPopMB[DatPopMB$Domain == "ab",]$Domain <- "ba"


#Let obtain a 95% jackknife confidence interval for variable Feeding,
#supposing a pps sampling in frame A and a simple random sampling
#without replacement in frame B with no finite population correction
#factor in any frame.
JackMLCDF(DatMA$Prog, DatMB$Prog, DatMA$ProbA, DatMB$ProbB, DatMA$Domain,
DatMB$Domain, DatMA$Read, DatMB$Read, DatPopMA$Read, DatPopMB$Read,
DatMA$Id_Frame, DatMB$Id_Frame, DatPopMA$Domain, DatPopMB$Domain, N,
conf_level = 0.95, sdA = "pps", sdB = "srs")
```

JackMLCDW	*Confidence intervals for MLCDW estimator based on jackknife method*

Description

Calculates confidence intervals for MLCDW estimator using jackknife procedure

Usage

```
JackMLCDW (ysA, ysB, pik_A, pik_B, domains_A, domains_B, xsA, xsB, x,
 ind_sam, N_A, N_B, N_ab = NULL, met = "linear", conf_level, sdA = "srs",
 sdB = "srs", strA = NULL, strB = NULL, clusA = NULL, clusB = NULL,
 fcpA = FALSE, fcpB = FALSE)
```

Arguments

ysA	A data frame containing information about one or more factors, each one of dimension n_A, collected from s_A.
ysB	A data frame containing information about one or more factors, each one of dimension n_B, collected from s_B.
pik_A	A numeric vector of length n_A containing first order inclusion probabilities for units included in s_A.
pik_B	A numeric vector of length n_B containing first order inclusion probabilities for units included in s_B.
domains_A	A character vector of size n_A indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domains_B	A character vector of size n_B indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
xsA	A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x m, with m the number of auxiliary variables, containing auxiliary information in frame A for units included in s_A.
xsB	A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x m, with m the number of auxiliary variables, containing auxiliary information in frame B for units included in s_B.
x	A numeric vector or length N or a numeric matrix or data frame of dimensions N x m, with m the number of auxiliary variables, containing auxiliary information for every unit in the population.
ind_sam	A numeric vector of length $n = n_A + n_B$ containing the identificators of units of the population (from 1 to N) that belongs to s_A or s_B
N_A	A numeric value indicating the size of frame A
N_B	A numeric value indicating the size of frame B
N_ab	(Optional) A numeric value indicating the size of the overlap domain
met	(Optional) A character vector indicating the distance that must be used in calibration process. Possible values are "linear", "raking" and "logit". Default is "linear".
conf_level	A numeric value indicating the confidence level for the confidence intervals.
sdA	(Optional) A character vector indicating the sampling design considered in frame A. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".
sdB	(Optional) A character vector indicating the sampling design considered in frame B. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".
strA	(Optional) A numeric vector indicating the stratum each unit in frame A belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame A.

strB	(Optional) A numeric vector indicating the stratum each unit in frame B belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame B.
clusA	(Optional) A numeric vector indicating the cluster each unit in frame A belongs to, if a cluster sampling or a stratified cluster sampling has been considered in frame A.
clusB	(Optional) A numeric vector indicating the cluster each unit in frame B belongs to, if a cluster sampling or a stratified cluster sampling has been considered in frame B.
fcpA	(Optional) A logic value indicating if a finite population correction factor should be considered in frame A. Default is FALSE.
fcpB	(Optional) A logic value indicating if a finite population correction factor should be considered in frame B. Default is FALSE.

Details

Let suppose a non stratified sampling design in frame A and a stratified sampling design in frame B where frame has been divided into L strata and a sample of size n_{Bl} from the N_{Bl} composing the l-th stratum is selected In this context, jackknife variance estimator of an estimator $\hat{Y}_c$ is given by

$$v_J(\hat{Y}_c) = \frac{n_A - 1}{n_A} \sum_{i \in s_A} (\hat{Y}_c^A(i) - \overline{Y}_c^A)^2 + \sum_{l=1}^{L} \frac{n_{Bl} - 1}{n_{Bl}} \sum_{i \in s_{Bl}} (\hat{Y}_c^B(lj) - \overline{Y}_c^{Bl})^2$$

with $\hat{Y}_c^A(i)$ the value of estimator $\hat{Y}_c$ after dropping $i-th$ unit from ysA and $\overline{Y}_c^A$ the mean of values $\hat{Y}_c^A(i)$. Similarly, $\hat{Y}_c^B(lj)$ is the value taken by $\hat{Y}_c$ after dropping j-th unit of l-th from sample ysB and $\overline{Y}_c^{Bl}$ is the mean of values $\hat{Y}_c^B(lj)$. If needed, a finite population correction factor can be included in frames by replacing $\hat{Y}_c^A(i)$ or $\hat{Y}_c^B(lj)$ with $\hat{Y}_c^{A*}(i) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_A}(\hat{Y}_c^A(i) - \hat{Y}_c)$ or $\hat{Y}_c^{B*}(lj) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_B}(\hat{Y}_c^B(lj) - \hat{Y}_c)$, where $\overline{\pi}_A = \sum_{i \in s_A} \pi_{iA}/nA$ and $\overline{\pi}_B = \sum_{j \in s_B} \pi_{jB}/nB$ A confidence interval for any parameter of interest, Y can be calculated, then, using the pivotal method.

Value

A numeric matrix containing estimations of population total and population mean and their corresponding confidence intervals obtained through jackknife method.

References

Molina, D., Rueda, M., Arcos, A. and Ranalli, M. G. (2015) *Multinomial logistic estimation in dual frame surveys* Statistics and Operations Research Transactions (SORT). To be printed.

Wolter, K. M. (2007) *Introduction to Variance Estimation.* 2nd Edition. Springer, Inc., New York.

See Also

[MLCDW]

Examples

```
data(DatMA)
data(DatMB)
data(DatPopM)

IndSample <- c(DatMA$Id_Pop, DatMB$Id_Pop)
N_FrameA <- nrow(DatPopM[DatPopM$Domain == "a" | DatPopM$Domain == "ab",])
N_FrameB <- nrow(DatPopM[DatPopM$Domain == "b" | DatPopM$Domain == "ab",])


#Let obtain a 95% jackknife confidence interval for variable Feeding,
#supposing a pps sampling in frame A and a simple random sampling
#without replacement in frame B with no finite population correction
#factor in any frame.
JackMLCDW(DatMA$Prog, DatMB$Prog, DatMA$ProbA, DatMB$ProbB, DatMA$Domain,
DatMB$Domain, DatMA$Read, DatMB$Read, DatPopM$Read, IndSample, N_FrameA,
N_FrameB, conf_level = 0.95, sdA = "pps", sdB = "srs")
```

JackMLCSW   *Confidence intervals for MLCSW estimator based on jackknife method*

Description

Calculates confidence intervals for MLCSW estimator using jackknife procedure

Usage

```
JackMLCSW (ysA, ysB, pik_A, pik_B, pik_ab_B, pik_ba_A, domains_A,
 domains_B, xsA, xsB, x, ind_sam, N_A, N_B, N_ab = NULL, met = "linear",
 conf_level, sdA = "srs", sdB = "srs", strA = NULL, strB = NULL, clusA = NULL,
 clusB = NULL, fcpA = FALSE, fcpB = FALSE)
```

Arguments

ysA	A data frame containing information about one or more factors, each one of dimension n_A, collected from s_A.
ysB	A data frame containing information about one or more factors, each one of dimension n_B, collected from s_B.
pik_A	A numeric vector of length n_A containing first order inclusion probabilities for units included in s_A.
pik_B	A numeric vector of length n_B containing first order inclusion probabilities for units included in s_B.
pik_ab_B	A numeric vector of size n_A containing first order inclusion probabilities according to sampling design in frame B for units belonging to overlap domain that have been selected in s_A.

pik_ba_A	A numeric vector of size n_B containing first order inclusion probabilities according to sampling design in frame A for units belonging to overlap domain that have been selected in s_B.
domains_A	A character vector of size n_A indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domains_B	A character vector of size n_B indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
xsA	A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x m, with m the number of auxiliary variables, containing auxiliary information in frame A for units included in s_A.
xsB	A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x m, with m the number of auxiliary variables, containing auxiliary information in frame B for units included in s_B.
x	A numeric vector or length N or a numeric matrix or data frame of dimensions N x m, with m the number of auxiliary variables, containing auxiliary information for every unit in the population.
ind_sam	A numeric vector of length $n = n_A + n_B$ containing the identificators of units of the population (from 1 to N) that belongs to s_A or s_B
N_A	A numeric value indicating the size of frame A
N_B	A numeric value indicating the size of frame B
N_ab	(Optional) A numeric value indicating the size of the overlap domain
met	(Optional) A character vector indicating the distance that must be used in calibration process. Possible values are "linear", "raking" and "logit". Default is "linear".
conf_level	A numeric value indicating the confidence level for the confidence intervals.
sdA	(Optional) A character vector indicating the sampling design considered in frame A. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".
sdB	(Optional) A character vector indicating the sampling design considered in frame B. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".
strA	(Optional) A numeric vector indicating the stratum each unit in frame A belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame A.
strB	(Optional) A numeric vector indicating the stratum each unit in frame B belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame B.
clusA	(Optional) A numeric vector indicating the cluster each unit in frame A belongs to, if a cluster sampling or a stratified cluster sampling has been considered in frame A.

clusB   (Optional) A numeric vector indicating the cluster each unit in frame B belongs to, if a cluster sampling or a stratified cluster sampling has been considered in frame B.

fcpA   (Optional) A logic value indicating if a finite population correction factor should be considered in frame A. Default is FALSE.

fcpB   (Optional) A logic value indicating if a finite population correction factor should be considered in frame B. Default is FALSE.

Details

Let suppose a non stratified sampling design in frame A and a stratified sampling design in frame B where frame has been divided into L strata and a sample of size n_{Bl} from the N_{Bl} composing the l-th stratum is selected In this context, jackknife variance estimator of an estimator $\hat{Y}_c$ is given by

$$v_J(\hat{Y}_c) = \frac{n_A - 1}{n_A} \sum_{i \in s_A} (\hat{Y}_c^A(i) - \overline{Y}_c^A)^2 + \sum_{l=1}^{L} \frac{n_{Bl} - 1}{n_{Bl}} \sum_{i \in s_{Bl}} (\hat{Y}_c^B(lj) - \overline{Y}_c^{Bl})^2$$

with $\hat{Y}_c^A(i)$ the value of estimator $\hat{Y}_c$ after dropping $i-th$ unit from ysA and $\overline{Y}_c^A$ the mean of values $\hat{Y}_c^A(i)$. Similarly, $\hat{Y}_c^B(lj)$ is the value taken by $\hat{Y}_c$ after dropping j-th unit of l-th from sample ysB and $\overline{Y}_c^{Bl}$ is the mean of values $\hat{Y}_c^B(lj)$. If needed, a finite population correction factor can be included in frames by replacing $\hat{Y}_c^A(i)$ or $\hat{Y}_c^B(lj)$ with $\hat{Y}_c^{A*}(i) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_A}(\hat{Y}_c^A(i) - \hat{Y}_c)$ or $\hat{Y}_c^{B*}(lj) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_B}(\hat{Y}_c^B(lj) - \hat{Y}_c)$, where $\overline{\pi}_A = \sum_{i \in s_A} \pi_{iA}/nA$ and $\overline{\pi}_B = \sum_{j \in s_B} \pi_{jB}/nB$ A confidence interval for any parameter of interest, Y can be calculated, then, using the pivotal method.

Value

A numeric matrix containing estimations of population total and population mean and their corresponding confidence intervals obtained through jackknife method.

References

Molina, D., Rueda, M., Arcos, A. and Ranalli, M. G. (2015) *Multinomial logistic estimation in dual frame surveys* Statistics and Operations Research Transactions (SORT). To be printed.

Wolter, K. M. (2007) *Introduction to Variance Estimation.* 2nd Edition. Springer, Inc., New York.

See Also

MLCSW

Examples

```
data(DatMA)
data(DatMB)
data(DatPopM)

IndSample <- c(DatMA$Id_Pop, DatMB$Id_Pop)
N_FrameA <- nrow(DatPopM[DatPopM$Domain == "a" | DatPopM$Domain == "ab",])
```

```
N_FrameB <- nrow(DatPopM[DatPopM$Domain == "b" | DatPopM$Domain == "ab",])


#Let obtain a 95% jackknife confidence interval for variable Feeding,
#supposing a pps sampling in frame A and a simple random sampling
#without replacement in frame B with no finite population correction
#factor in any frame.
JackMLCSW(DatMA$Prog, DatMB$Prog, DatMA$ProbA, DatMB$ProbB, DatMA$ProbB,
DatMB$ProbA, DatMA$Domain, DatMB$Domain, DatMA$Read, DatMB$Read, DatPopM$Read,
IndSample, N_FrameA, N_FrameB, conf_level = 0.95, sdA = "pps", sdB = "srs")
```

JackMLDF   *Confidence intervals for MLDF estimator based on jackknife method*

Description

Calculates confidence intervals for MLDF estimator using jackknife procedure

Usage

```
JackMLDF (ysA, ysB, pik_A, pik_B, domains_A, domains_B, xsA, xsB, xA, xB, ind_samA,
ind_samB, ind_domA, ind_domB, N, conf_level, sdA = "srs", sdB = "srs", strA = NULL,
strB = NULL, clusA = NULL, clusB = NULL, fcpA = FALSE, fcpB = FALSE)
```

Arguments

ysA	A data frame containing information about one or more factors, each one of dimension n_A, collected from s_A.
ysB	A data frame containing information about one or more factors, each one of dimension n_B, collected from s_B.
pik_A	A numeric vector of length n_A containing first order inclusion probabilities for units included in s_A.
pik_B	A numeric vector of length n_B containing first order inclusion probabilities for units included in s_B.
domains_A	A character vector of size n_A indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domains_B	A character vector of size n_B indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
xsA	A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x m, with m the number of auxiliary variables, containing auxiliary information in frame A for units included in s_A.
xsB	A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x m, with m the number of auxiliary variables, containing auxiliary information in frame B for units included in s_B.

xA	A numeric vector or length N_A or a numeric matrix or data frame of dimensions N_A x m_A, with m_A the number of auxiliary variables in frame A, containing auxiliary information for the units in frame A.
xB	A numeric vector or length N_B or a numeric matrix or data frame of dimensions N_B x m_B, with m_B the number of auxiliary variables in frame B, containing auxiliary information for the units in frame B.
ind_samA	A numeric vector of length n_A containing the identificators of units of the frame A (from 1 to N_A) that belongs to s_A.
ind_samB	A numeric vector of length n_B containing the identificators of units of the frame B (from 1 to N_B) that belongs to s_B.
ind_domA	A character vector of length N_A indicating the domain each unit from frame A belongs to. Possible values are "a" and "ab".
ind_domB	A character vector of length N_B indicating the domain each unit from frame B belongs to. Possible values are "b" and "ba".
N	A numeric value indicating the size of the population.
conf_level	A numeric value indicating the confidence level for the confidence intervals.
sdA	(Optional) A character vector indicating the sampling design considered in frame A. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".
sdB	(Optional) A character vector indicating the sampling design considered in frame B. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".
strA	(Optional) A numeric vector indicating the stratum each unit in frame A belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame A.
strB	(Optional) A numeric vector indicating the stratum each unit in frame B belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame B.
clusA	(Optional) A numeric vector indicating the cluster each unit in frame A belongs to, if a cluster sampling or a stratified cluster sampling has been considered in frame A.
clusB	(Optional) A numeric vector indicating the cluster each unit in frame B belongs to, if a cluster sampling or a stratified cluster sampling has been considered in frame B.
fcpA	(Optional) A logic value indicating if a finite population correction factor should be considered in frame A. Default is FALSE.
fcpB	(Optional) A logic value indicating if a finite population correction factor should be considered in frame B. Default is FALSE.

Details

Let suppose a non stratified sampling design in frame A and a stratified sampling design in frame B where frame has been divided into L strata and a sample of size n_{Bl} from the N_{Bl} composing the l-th stratum is selected In this context, jackknife variance estimator of a estimator $\hat{Y}_c$ is given by

$$v_J(\hat{Y}_c) = \frac{n_A - 1}{n_A} \sum_{i \in s_A} (\hat{Y}_c^A(i) - \overline{Y}_c^A)^2 + \sum_{l=1}^{L} \frac{n_{Bl} - 1}{n_{Bl}} \sum_{i \in s_{Bl}} (\hat{Y}_c^B(lj) - \overline{Y}_c^{Bl})^2$$

with $\hat{Y}_c^A(i)$ the value of estimator $\hat{Y}_c$ after dropping $i-th$ unit from ysA and $\overline{Y}_c^A$ the mean of values $\hat{Y}_c^A(i)$. Similarly, $\hat{Y}_c^B(lj)$ is the value taken by $\hat{Y}_c$ after dropping j-th unit of l-th from sample ysB and $\overline{Y}_c^{Bl}$ is the mean of values $\hat{Y}_c^B(lj)$. If needed, a finite population correction factor can be included in frames by replacing $\hat{Y}_c^A(i)$ or $\hat{Y}_c^B(lj)$ with $\hat{Y}_c^{A*}(i) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_A}(\hat{Y}_c^A(i) - \hat{Y}_c)$ or $\hat{Y}_c^{B*}(lj) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_B}(\hat{Y}_c^B(lj) - \hat{Y}_c)$, where $\overline{\pi}_A = \sum_{i \in s_A} \pi_{iA}/nA$ and $\overline{\pi}_B = \sum_{j \in s_B} \pi_{jB}/nB$ A confidence interval for any parameter of interest, Y can be calculated, then, using the pivotal method.

Value

A numeric matrix containing estimations of population total and population mean and their corresponding confidence intervals obtained through jackknife method.

References

Molina, D., Rueda, M., Arcos, A. and Ranalli, M. G. (2015) *Multinomial logistic estimation in dual frame surveys* Statistics and Operations Research Transactions (SORT). To be printed.

Wolter, K. M. (2007) *Introduction to Variance Estimation.* 2nd Edition. Springer, Inc., New York.

See Also

MLDF

Examples

```
data(DatMA)
data(DatMB)
data(DatPopM)

N <- nrow(DatPopM)
levels(DatPopM$Domain) <- c(levels(DatPopM$Domain), "ba")
DatPopMA <- subset(DatPopM, DatPopM$Domain == "a" | DatPopM$Domain == "ab", stringAsFactors = FALSE)
DatPopMB <- subset(DatPopM, DatPopM$Domain == "b" | DatPopM$Domain == "ab", stringAsFactors = FALSE)
DatPopMB[DatPopMB$Domain == "ab",]$Domain <- "ba"


#Let obtain a 95% jackknife confidence interval for variable Feeding,
#supposing a pps sampling in frame A and a simple random sampling
#without replacement in frame B with no finite population correction
#factor in any frame.
JackMLDF(DatMA$Prog, DatMB$Prog, DatMA$ProbA, DatMB$ProbB, DatMA$Domain,
```

```
DatMB$Domain, DatMA$Read, DatMB$Read, DatPopMA$Read, DatPopMB$Read,
DatMA$Id_Frame, DatMB$Id_Frame, DatPopMA$Domain, DatPopMB$Domain, N, 0.95,
"pps", "srs")
```

JackMLDW   *Confidence intervals for MLDW estimator based on jackknife method*

Description

Calculates confidence intervals for MLDW estimator using jackknife procedure

Usage

```
JackMLDW (ysA, ysB, pik_A, pik_B, domains_A, domains_B, xsA, xsB, x,
ind_sam, conf_level, sdA = "srs", sdB = "srs", strA = NULL, strB = NULL,
clusA = NULL, clusB = NULL, fcpA = FALSE, fcpB = FALSE)
```

Arguments

ysA	A data frame containing information about one or more factors, each one of dimension n_A, collected from s_A.
ysB	A data frame containing information about one or more factors, each one of dimension n_B, collected from s_B.
pik_A	A numeric vector of length n_A containing first order inclusion probabilities for units included in s_A.
pik_B	A numeric vector of length n_B containing first order inclusion probabilities for units included in s_B.
domains_A	A character vector of size n_A indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domains_B	A character vector of size n_B indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
xsA	A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x m, with m the number of auxiliary variables, containing auxiliary information in frame A for units included in s_A.
xsB	A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x m, with m the number of auxiliary variables, containing auxiliary information in frame B for units included in s_B.
x	A numeric vector or length N or a numeric matrix or data frame of dimensions N x m, with m the number of auxiliary variables, containing auxiliary information for every unit in the population.
ind_sam	A numeric vector of length $n = n_A + n_B$ containing the identificators of units of the population (from 1 to N) that belongs to s_A or s_B
conf_level	A numeric value indicating the confidence level for the confidence intervals.

sdA   (Optional) A character vector indicating the sampling design considered in frame
                   A. Possible values are "srs" (simple random sampling without replacement),
                   "pps" (probabilities proportional to size sampling), "str" (stratified sampling),
                   "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is
                   "srs".

sdB   (Optional) A character vector indicating the sampling design considered in frame
                   B. Possible values are "srs" (simple random sampling without replacement),
                   "pps" (probabilities proportional to size sampling), "str" (stratified sampling),
                   "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is
                   "srs".

strA   (Optional) A numeric vector indicating the stratum each unit in frame A belongs
                   to, if a stratified sampling or a stratified cluster sampling has been considered in
                   frame A.

strB   (Optional) A numeric vector indicating the stratum each unit in frame B belongs
                   to, if a stratified sampling or a stratified cluster sampling has been considered in
                   frame B.

clusA   (Optional) A numeric vector indicating the cluster each unit in frame A belongs
                   to, if a cluster sampling or a stratified cluster sampling has been considered in
                   frame A.

clusB   (Optional) A numeric vector indicating the cluster each unit in frame B belongs
                   to, if a cluster sampling or a stratified cluster sampling has been considered in
                   frame B.

fcpA   (Optional) A logic value indicating if a finite population correction factor should
                   be considered in frame A. Default is FALSE.

fcpB   (Optional) A logic value indicating if a finite population correction factor should
                   be considered in frame B. Default is FALSE.

Details

Let suppose a non stratified sampling design in frame A and a stratified sampling design in frame B
where frame has been divided into L strata and a sample of size n_{Bl} from the N_{Bl} composing the
l-th stratum is selected In this context, jackknife variance estimator of a estimator $\hat{Y}_c$ is given by

$$v_J(\hat{Y}_c) = \frac{n_A - 1}{n_A} \sum_{i \in s_A} (\hat{Y}_c^A(i) - \overline{Y}_c^A)^2 + \sum_{l=1}^{L} \frac{n_{Bl} - 1}{n_{Bl}} \sum_{i \in s_{Bl}} (\hat{Y}_c^B(lj) - \overline{Y}_c^{Bl})^2$$

with $\hat{Y}_c^A(i)$ the value of estimator $\hat{Y}_c$ after dropping $i-th$ unit from ysA and $\overline{Y}_c^A$ the mean of values
$\hat{Y}_c^A(i)$. Similarly, $\hat{Y}_c^B(lj)$ is the value taken by $\hat{Y}_c$ after dropping j-th unit of l-th from sample ysB
and $\overline{Y}_c^{Bl}$ is the mean of values $\hat{Y}_c^B(lj)$. If needed, a finite population correction factor can be
included in frames by replacing $\hat{Y}_c^A(i)$ or $\hat{Y}_c^B(lj)$ with $\hat{Y}_c^{A*}(i) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_A}(\hat{Y}_c^A(i) - \hat{Y}_c)$ or
$\hat{Y}_c^{B*}(lj) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_B}(\hat{Y}_c^B(lj) - \hat{Y}_c)$, where $\overline{\pi}_A = \sum_{i \in s_A} \pi_{iA}/nA$ and $\overline{\pi}_B = \sum_{j \in s_B} \pi_{jB}/nB$
A confidence interval for any parameter of interest, Y can be calculated, then, using the pivotal
method.

Value

A numeric matrix containing estimations of population total and population mean and their corre-
sponding confidence intervals obtained through jackknife method.

References

Molina, D., Rueda, M., Arcos, A. and Ranalli, M. G. (2015) *Multinomial logistic estimation in dual frame surveys* Statistics and Operations Research Transactions (SORT). To be printed.

Wolter, K. M. (2007) *Introduction to Variance Estimation.* 2nd Edition. Springer, Inc., New York.

See Also

[MLDW](#)

Examples

```
data(DatMA)
data(DatMB)
data(DatPopM)

IndSample <- c(DatMA$Id_Pop, DatMB$Id_Pop)


#Let obtain a 95% jackknife confidence interval for variable Feeding,
#supposing a pps sampling in frame A and a simple random sampling
#without replacement in frame B with no finite population correction
#factor in any frame.
JackMLDW(DatMA$Prog, DatMB$Prog, DatMA$ProbA, DatMB$ProbB, DatMA$Domain,
DatMB$Domain, DatMA$Read, DatMB$Read, DatPopM$Read, IndSample, 0.95,
"pps", "srs")
```

JackMLSW   *Confidence intervals for MLSW estimator based on jackknife method*

Description

Calculates confidence intervals for MLSW estimator using jackknife procedure

Usage

```
JackMLSW (ysA, ysB, pik_A, pik_B, pik_ab_B, pik_ba_A, domains_A,
 domains_B, xsA, xsB, x, ind_sam, conf_level, sdA = "srs", sdB = "srs",
 strA = NULL, strB = NULL, clusA = NULL, clusB = NULL, fcpA = FALSE, fcpB = FALSE)
```

Arguments

ysA	A data frame containing information about one or more factors, each one of dimension n_A, collected from s_A.
ysB	A data frame containing information about one or more factors, each one of dimension n_B, collected from s_B.
pik_A	A numeric vector of length n_A containing first order inclusion probabilities for units included in s_A.

pik_B	A numeric vector of length n_B containing first order inclusion probabilities for units included in s_B.
pik_ab_B	A numeric vector of size n_A containing first order inclusion probabilities according to sampling design in frame B for units belonging to overlap domain that have been selected in s_A.
pik_ba_A	A numeric vector of size n_B containing first order inclusion probabilities according to sampling design in frame A for units belonging to overlap domain that have been selected in s_B.
domains_A	A character vector of size n_A indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domains_B	A character vector of size n_B indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
xsA	A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x m, with m the number of auxiliary variables, containing auxiliary information in frame A for units included in s_A.
xsB	A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x m, with m the number of auxiliary variables, containing auxiliary information in frame B for units included in s_B.
x	A numeric vector or length N or a numeric matrix or data frame of dimensions N x m, with m the number of auxiliary variables, containing auxiliary information for every unit in the population.
ind_sam	A numeric vector of length $n = n_A + n_B$ containing the identificators of units of the population (from 1 to N) that belongs to s_A or s_B
conf_level	A numeric value indicating the confidence level for the confidence intervals.
sdA	(Optional) A character vector indicating the sampling design considered in frame A. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".
sdB	(Optional) A character vector indicating the sampling design considered in frame B. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".
strA	(Optional) A numeric vector indicating the stratum each unit in frame A belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame A.
strB	(Optional) A numeric vector indicating the stratum each unit in frame B belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame B.
clusA	(Optional) A numeric vector indicating the cluster each unit in frame A belongs to, if a cluster sampling or a stratified cluster sampling has been considered in frame A.

clusB	(Optional) A numeric vector indicating the cluster each unit in frame B belongs to, if a cluster sampling or a stratified cluster sampling has been considered in frame B.
fcpA	(Optional) A logic value indicating if a finite population correction factor should be considered in frame A. Default is FALSE.
fcpB	(Optional) A logic value indicating if a finite population correction factor should be considered in frame B. Default is FALSE.

Details

Let suppose a non stratified sampling design in frame A and a stratified sampling design in frame B where frame has been divided into L strata and a sample of size n_{Bl} from the N_{Bl} composing the l-th stratum is selected In this context, jackknife variance estimator of a estimator $\hat{Y}_c$ is given by

$$v_J(\hat{Y}_c) = \frac{n_A - 1}{n_A} \sum_{i \in s_A} (\hat{Y}_c^A(i) - \overline{Y}_c^A)^2 + \sum_{l=1}^{L} \frac{n_{Bl} - 1}{n_{Bl}} \sum_{i \in s_{Bl}} (\hat{Y}_c^B(lj) - \overline{Y}_c^{Bl})^2$$

with $\hat{Y}_c^A(i)$ the value of estimator $\hat{Y}_c$ after dropping $i - th$ unit from ysA and $\overline{Y}_c^A$ the mean of values $\hat{Y}_c^A(i)$. Similarly, $\hat{Y}_c^B(lj)$ is the value taken by $\hat{Y}_c$ after dropping j-th unit of l-th from sample ysB and $\overline{Y}_c^{Bl}$ is the mean of values $\hat{Y}_c^B(lj)$. If needed, a finite population correction factor can be included in frames by replacing $\hat{Y}_c^A(i)$ or $\hat{Y}_c^B(lj)$ with $\hat{Y}_c^{A*}(i) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_A}(\hat{Y}_c^A(i) - \hat{Y}_c)$ or $\hat{Y}_c^{B*}(lj) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_B}(\hat{Y}_c^B(lj) - \hat{Y}_c)$, where $\overline{\pi}_A = \sum_{i \in s_A} \pi_{iA}/nA$ and $\overline{\pi}_B = \sum_{j \in s_B} \pi_{jB}/nB$ A confidence interval for any parameter of interest, Y can be calculated, then, using the pivotal method.

Value

A numeric matrix containing estimations of population total and population mean and their corresponding confidence intervals obtained through jackknife method.

References

Molina, D., Rueda, M., Arcos, A. and Ranalli, M. G. (2015) *Multinomial logistic estimation in dual frame surveys* Statistics and Operations Research Transactions (SORT). To be printed.

Wolter, K. M. (2007) *Introduction to Variance Estimation.* 2nd Edition. Springer, Inc., New York.

See Also

MLSW

Examples

```
data(DatMA)
data(DatMB)
data(DatPopM)

IndSample <- c(DatMA$Id_Pop, DatMB$Id_Pop)
```

```
#Let obtain a 95% jackknife confidence interval for variable Feeding,
#supposing a pps sampling in frame A and a simple random sampling
#without replacement in frame B with no finite population correction
#factor in any frame.
JackMLSW(DatMA$Prog, DatMB$Prog, DatMA$ProbA, DatMB$ProbB, DatMA$ProbB,
DatMB$ProbA, DatMA$Domain, DatMB$Domain, DatMA$Read, DatMB$Read, DatPopM$Read,
IndSample, 0.95, "pps", "srs")
```

JackPEL *Confidence intervals for the pseudo empirical likelihood estimator based on jackknife method*

Description

Calculates confidence intervals for pseudo empirical likelihood estimator using jackknife procedure

Usage

```
JackPEL(ysA, ysB, piA, piB, domainsA, domainsB, N_A = NULL, N_B = NULL,
N_ab = NULL, xsAFrameA = NULL, xsBFrameA = NULL, xsAFrameB = NULL, xsBFrameB = NULL,
XA = NULL, XB = NULL, conf_level, sdA = "srs", sdB = "srs", strA = NULL, strB = NULL,
clusA = NULL,clusB = NULL, fcpA = FALSE, fcpB = FALSE)
```

Arguments

ysA	A numeric vector of length nA or a numeric matrix or data frame of dimensions nA x c containing information about variable of interest from s_A.
ysB	A numeric vector of length nB or a numeric matrix or data frame of dimensions nB x c containing information about variable of interest from s_B.
piA	A numeric vector of length nA or a square numeric matrix of dimension nA containing first order or first and second order inclusion probabilities for units included in s_A.
piB	A numeric vector of length nB or a square numeric matrix of dimension nB containing first order or first and second order inclusion probabilities for units included in s_B.
domainsA	A character vector of size nA indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domainsB	A character vector of size nB indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
N_A	(Optional) A numeric value indicating the size of frame A
N_B	(Optional) A numeric value indicating the size of frame B
N_ab	(Optional) A numeric value indicating the size of the overlap domain

xsAFrameA	(Optional) A numeric vector of length nA or a numeric matrix or data frame of dimensions nA x m_A, with m_A the number of auxiliary variables in frame A, containing auxiliary information in frame A for units included in s_A.
xsBFrameA	(Optional) A numeric vector of length nB or a numeric matrix or data frame of dimensions nB x m_A, with m_A the number of auxiliary variables in frame A, containing auxiliary information in frame A for units included in s_B. For units in domain b, these values are 0.
xsAFrameB	(Optional) A numeric vector of length nA or a numeric matrix or data frame of dimensions nA x m_B, with m_B the number of auxiliary variables in frame B, containing auxiliary information in frame B for units included in s_A. For units in domain a, these values are 0.
xsBFrameB	(Optional) A numeric vector of length nB or a numeric matrix or data frame of dimensions nB x m_B, with m_B the number of auxiliary variables in frame B, containing auxiliary information in frame B for units included in s_B.
XA	(Optional) A numeric value or vector of length m_A, with m_A the number of auxiliary variables in frame A, indicating the population totals for the auxiliary variables considered in frame A.
XB	(Optional) A numeric value or vector of length m_B, with m_B the number of auxiliary variables in frame B, indicating the population totals for the auxiliary variables considered in frame B.
conf_level	A numeric value indicating the confidence level for the confidence intervals.
sdA	(Optional) A character vector indicating the sampling design considered in frame A. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".
sdB	(Optional) A character vector indicating the sampling design considered in frame B. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".
strA	(Optional) A numeric vector indicating the stratum each unit in frame A belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame A.
strB	(Optional) A numeric vector indicating the stratum each unit in frame B belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame B.
clusA	(Optional) A numeric vector indicating the cluster each unit in frame A belongs to, if a cluster sampling or a stratified cluster sampling has been considered in frame A.
clusB	(Optional) A numeric vector indicating the cluster each unit in frame B belongs to, if a cluster sampling or a stratified cluster sampling has been considered in frame B.
fcpA	(Optional) A logic value indicating if a finite population correction factor should be considered in frame A. Default is FALSE.

fcpB   (Optional) A logic value indicating if a finite population correction factor should be considered in frame B. Default is FALSE.

Details

Let suppose a non stratified sampling design in frame A and a stratified sampling design in frame B where frame has been divided into L strata and a sample of size n_{Bl} from the N_{Bl} composing the l-th stratum is selected In this context, jackknife variance estimator of a estimator $\hat{Y}_c$ is given by

$$v_J(\hat{Y}_c) = \frac{n_A - 1}{n_A} \sum_{i \in s_A} (\hat{Y}_c^A(i) - \overline{Y}_c^A)^2 + \sum_{l=1}^{L} \frac{n_{Bl} - 1}{n_{Bl}} \sum_{i \in s_{Bl}} (\hat{Y}_c^B(lj) - \overline{Y}_c^{Bl})^2$$

with $\hat{Y}_c^A(i)$ the value of estimator $\hat{Y}_c$ after dropping $i - th$ unit from ysA and $\overline{Y}_c^A$ the mean of values $\hat{Y}_c^A(i)$. Similarly, $\hat{Y}_c^B(lj)$ is the value taken by $\hat{Y}_c$ after dropping j-th unit of l-th from sample ysB and $\overline{Y}_c^{Bl}$ is the mean of values $\hat{Y}_c^B(lj)$. If needed, a finite population correction factor can be included in frames by replacing $\hat{Y}_c^A(i)$ or $\hat{Y}_c^B(lj)$ with $\hat{Y}_c^{A*}(i) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_A}(\hat{Y}_c^A(i) - \hat{Y}_c)$ or $\hat{Y}_c^{B*}(lj) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_B}(\hat{Y}_c^B(lj) - \hat{Y}_c)$, where $\overline{\pi}_A = \sum_{i \in s_A} \pi_{iA}/nA$ and $\overline{\pi}_B = \sum_{j \in s_B} \pi_{jB}/nB$ A confidence interval for any parameter of interest, Y can be calculated, then, using the pivotal method.

Value

A numeric matrix containing estimations of population total and population mean and their corresponding confidence intervals obtained through jackknife method.

References

Wolter, K. M. (2007) *Introduction to Variance Estimation.* 2nd Edition. Springer, Inc., New York.

See Also

[PEL](#)

JackPML   *Confidence intervals for the pseudo maximum likelihood estimator based on jackknife method*

Description

Calculates confidence intervals for pseudo maximum likelihood estimator using jackknife procedure

Usage

```
JackPML(ysA, ysB, piA, piB, domainsA, domainsB, N_A, N_B, conf_level,
sdA = "srs", sdB = "srs", strA = NULL, strB = NULL, clusA = NULL, clusB = NULL,
fcpA = FALSE, fcpB = FALSE)
```

Arguments

ysA	A numeric vector of length nA or a numeric matrix or data frame of dimensions nA x c containing information about variable of interest from s_A.
ysB	A numeric vector of length nB or a numeric matrix or data frame of dimensions nB x c containing information about variable of interest from s_B.
piA	A numeric vector of length nA or a square numeric matrix of dimension nA containing first order or first and second order inclusion probabilities for units included in s_A.
piB	A numeric vector of length nB or a square numeric matrix of dimension nB containing first order or first and second order inclusion probabilities for units included in s_B.
domainsA	A character vector of size nA indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domainsB	A character vector of size nB indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
N_A	A numeric value indicating the size of frame A
N_B	A numeric value indicating the size of frame B
conf_level	A numeric value indicating the confidence level for the confidence intervals.
sdA	(Optional) A character vector indicating the sampling design considered in frame A. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".
sdB	(Optional) A character vector indicating the sampling design considered in frame B. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".
strA	(Optional) A numeric vector indicating the stratum each unit in frame A belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame A.
strB	(Optional) A numeric vector indicating the stratum each unit in frame B belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame B.
clusA	(Optional) A numeric vector indicating the cluster each unit in frame A belongs to, if a cluster sampling or a stratified cluster sampling has been considered in frame A.
clusB	(Optional) A numeric vector indicating the cluster each unit in frame B belongs to, if a cluster sampling or a stratified cluster sampling has been considered in frame B.
fcpA	(Optional) A logic value indicating if a finite population correction factor should be considered in frame A. Default is FALSE.
fcpB	(Optional) A logic value indicating if a finite population correction factor should be considered in frame B. Default is FALSE.

Details

Let suppose a non stratified sampling design in frame A and a stratified sampling design in frame B where frame has been divided into L strata and a sample of size n_{Bl} from the N_{Bl} composing the l-th stratum is selected In this context, jackknife variance estimator of a estimator $\hat{Y}_c$ is given by

$$v_J(\hat{Y}_c) = \frac{n_A - 1}{n_A} \sum_{i \in s_A} (\hat{Y}_c^A(i) - \overline{Y}_c^A)^2 + \sum_{l=1}^{L} \frac{n_{Bl} - 1}{n_{Bl}} \sum_{i \in s_{Bl}} (\hat{Y}_c^B(lj) - \overline{Y}_c^{Bl})^2$$

with $\hat{Y}_c^A(i)$ the value of estimator $\hat{Y}_c$ after dropping $i - th$ unit from ysA and $\overline{Y}_c^A$ the mean of values $\hat{Y}_c^A(i)$. Similarly, $\hat{Y}_c^B(lj)$ is the value taken by $\hat{Y}_c$ after dropping j-th unit of l-th from sample ysB and $\overline{Y}_c^{Bl}$ is the mean of values $\hat{Y}_c^B(lj)$. If needed, a finite population correction factor can be included in frames by replacing $\hat{Y}_c^A(i)$ or $\hat{Y}_c^B(lj)$ with $\hat{Y}_c^{A*}(i) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_A}(\hat{Y}_c^A(i) - \hat{Y}_c)$ or $\hat{Y}_c^{B*}(lj) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_B}(\hat{Y}_c^B(lj) - \hat{Y}_c)$, where $\overline{\pi}_A = \sum_{i \in s_A} \pi_{iA}/nA$ and $\overline{\pi}_B = \sum_{j \in s_B} \pi_{jB}/nB$ A confidence interval for any parameter of interest, Y can be calculated, then, using the pivotal method.

Value

A numeric matrix containing estimations of population total and population mean and their corresponding confidence intervals obtained through jackknife method.

References

Wolter, K. M. (2007) *Introduction to Variance Estimation.* 2nd Edition. Springer, Inc., New York.

See Also

PML

Examples

```
data(DatA)
data(DatB)

#Let obtain a 95% jackknife confidence interval for variable Leisure,
#supposing a stratified sampling in frame A and a simple random sampling
#without replacement in frame B with no finite population correction
#factor in any frame.
JackPML(DatA$Lei, DatB$Lei, DatA$ProbA, DatB$ProbB, DatA$Domain,
DatB$Domain, 1735, 1191, 0.95, "str", "srs", strA = DatA$Stratum)

#Let check how interval estimation varies when a finite
#population correction factor is considered in both frames.
JackPML(DatA$Lei, DatB$Lei, DatA$ProbA, DatB$ProbB, DatA$Domain,
DatB$Domain, 1735, 1191, 0.95, "str", "srs", strA = DatA$Stratum,
fcpA = TRUE, fcpB = TRUE)
```

JackSFRR	*Confidence intervals for raking ratio estimator based on jackknife method*

Description

Calculates confidence intervals for raking ratio estimator using jackknife procedure

Usage

```
JackSFRR(ysA, ysB, piA, piB, pik_ab_B, pik_ba_A, domainsA, domainsB, N_A,
N_B, conf_level, sdA = "srs", sdB = "srs", strA = NULL, strB = NULL, clusA = NULL,
clusB = NULL, fcpA = FALSE, fcpB = FALSE)
```

Arguments

ysA	A numeric vector of length nA or a numeric matrix or data frame of dimensions nA x c containing information about variable of interest from s_A.
ysB	A numeric vector of length nB or a numeric matrix or data frame of dimensions nB x c containing information about variable of interest from s_B.
piA	A numeric vector of length nA or a square numeric matrix of dimension nA containing first order or first and second order inclusion probabilities for units included in s_A.
piB	A numeric vector of length nB or a square numeric matrix of dimension nB containing first order or first and second order inclusion probabilities for units included in s_B.
pik_ab_B	A numeric vector of size nA containing first order inclusion probabilities according to sampling desing in frame B for units belonging to overlap domain that have been selected in s_A.
pik_ba_A	A numeric vector of size nB containing first order inclusion probabilities according to sampling desing in frame A for units belonging to overlap domain that have been selected in s_B.
domainsA	A character vector of size nA indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domainsB	A character vector of size nB indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
N_A	A numeric value indicating the size of frame A
N_B	A numeric value indicating the size of frame B
conf_level	A numeric value indicating the confidence level for the confidence intervals.
sdA	(Optional) A character vector indicating the sampling design considered in frame A. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".

sdB	(Optional) A character vector indicating the sampling design considered in frame B. Possible values are "srs" (simple random sampling without replacement), "pps" (probabilities proportional to size sampling), "str" (stratified sampling), "clu" (cluster sampling) and "strclu" (stratified cluster sampling). Default is "srs".
strA	(Optional) A numeric vector indicating the stratum each unit in frame A belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame A.
strB	(Optional) A numeric vector indicating the stratum each unit in frame B belongs to, if a stratified sampling or a stratified cluster sampling has been considered in frame B.
clusA	(Optional) A numeric vector indicating the cluster each unit in frame A belongs to, if a cluster sampling or a stratified cluster sampling has been considered in frame A.
clusB	(Optional) A numeric vector indicating the cluster each unit in frame B belongs to, if a cluster sampling or a stratified cluster sampling has been considered in frame B.
fcpA	(Optional) A logic value indicating if a finite population correction factor should be considered in frame A. Default is FALSE.
fcpB	(Optional) A logic value indicating if a finite population correction factor should be considered in frame B. Default is FALSE.

Details

Let suppose a non stratified sampling design in frame A and a stratified sampling design in frame B where frame has been divided into L strata and a sample of size n_{Bl} from the N_{Bl} composing the l-th stratum is selected In this context, jackknife variance estimator of a estimator $\hat{Y}_c$ is given by

$$v_J(\hat{Y}_c) = \frac{n_A - 1}{n_A} \sum_{i \in s_A} (\hat{Y}_c^A(i) - \overline{Y}_c^A)^2 + \sum_{l=1}^{L} \frac{n_{Bl} - 1}{n_{Bl}} \sum_{i \in s_{Bl}} (\hat{Y}_c^B(lj) - \overline{Y}_c^{Bl})^2$$

with $\hat{Y}_c^A(i)$ the value of estimator $\hat{Y}_c$ after dropping $i-th$ unit from ysA and $\overline{Y}_c^A$ the mean of values $\hat{Y}_c^A(i)$. Similarly, $\hat{Y}_c^B(lj)$ is the value taken by $\hat{Y}_c$ after dropping j-th unit of l-th from sample ysB and $\overline{Y}_c^{Bl}$ is the mean of values $\hat{Y}_c^B(lj)$. If needed, a finite population correction factor can be included in frames by replacing $\hat{Y}_c^A(i)$ or $\hat{Y}_c^B(lj)$ with $\hat{Y}_c^{A*}(i) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_A}(\hat{Y}_c^A(i) - \hat{Y}_c)$ or $\hat{Y}_c^{B*}(lj) = \hat{Y}_c + \sqrt{1 - \overline{\pi}_B}(\hat{Y}_c^B(lj) - \hat{Y}_c)$, where $\overline{\pi}_A = \sum_{i \in s_A} \pi_{iA}/nA$ and $\overline{\pi}_B = \sum_{j \in s_B} \pi_{jB}/nB$ A confidence interval for any parameter of interest, Y can be calculated, then, using the pivotal method.

Value

A numeric matrix containing estimations of population total and population mean and their corresponding confidence intervals obtained through jackknife method.

References

Wolter, K. M. (2007) *Introduction to Variance Estimation.* 2nd Edition. Springer, Inc., New York.

See Also

SFRR

Examples

```
data(DatA)
data(DatB)

#Let obtain a 95% jackknife confidence interval for variable Leisure,
#supposing a stratified sampling in frame A and a simple random sampling
#without replacement in frame B with no finite population correction
#factor in any frame.
JackSFRR(DatA$Lei, DatB$Lei, DatA$ProbA, DatB$ProbB, DatA$ProbB,
DatB$ProbA, DatA$Domain, DatB$Domain, 1735, 1191, 0.95, "str", "srs",
strA = DatA$Stratum)

#Let check how interval estimation varies when a finite
#population correction factor is considered in both frames.
JackSFRR(DatA$Lei, DatB$Lei, DatA$ProbA, DatB$ProbB, DatA$ProbB,
DatB$ProbA, DatA$Domain, DatB$Domain, 1735, 1191, 0.95, "str", "srs",
strA = DatA$Stratum, fcpA = TRUE, fcpB = TRUE)
```

MLCDF	*Multinomial logistic calibration estimator under dual frame approach with auxiliary information from each frame*

Description

Produces estimates for class totals and proportions using multinomial logistic regression from survey data obtained from a dual frame sampling design using a model calibrated dual frame approach with a possibly different set of auxiliary variables for each frame. Confidence intervals are also computed, if required.

Usage

```
MLCDF (ysA, ysB, pik_A, pik_B, domains_A, domains_B, xsA, xsB, xA, xB, ind_samA,
  ind_samB, ind_domA, ind_domB, N, N_ab = NULL, met = "linear", conf_level = NULL)
```

Arguments

ysA	A data frame containing information about one or more factors, each one of dimension n_A, collected from s_A.
ysB	A data frame containing information about one or more factors, each one of dimension n_B, collected from s_B.
pik_A	A numeric vector of length n_A containing first order inclusion probabilities for units included in s_A.
pik_B	A numeric vector of length n_B containing first order inclusion probabilities for units included in s_B.

domains_A	A character vector of size n_A indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domains_B	A character vector of size n_B indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
xsA	A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x m_A, with m_A the number of auxiliary variables in frame A, containing auxiliary information in frame A for units included in s_A.
xsB	A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x m_B, with m_B the number of auxiliary variables in frame B, containing auxiliary information in frame B for units included in s_B.
xA	A numeric vector or length N_A or a numeric matrix or data frame of dimensions N_A x m_A, with m_A the number of auxiliary variables in frame A, containing auxiliary information for the units in frame A.
xB	A numeric vector or length N_B or a numeric matrix or data frame of dimensions N_B x m_B, with m_B the number of auxiliary variables in frame B, containing auxiliary information for the units in frame B.
ind_samA	A numeric vector of length n_A containing the identificators of units of the frame A (from 1 to N_A) that belongs to s_A.
ind_samB	A numeric vector of length n_B containing the identificators of units of the frame B (from 1 to N_B) that belongs to s_B.
ind_domA	A character vector of length N_A indicating the domain each unit from frame A belongs to. Possible values are "a" and "ab".
ind_domB	A character vector of length N_B indicating the domain each unit from frame B belongs to. Possible values are "b" and "ba".
N	A numeric value indicating the size of the population.
N_ab	(Optional) A numeric value indicating the size of the overlap domain
met	(Optional) A character vector indicating the distance that must be used in calibration process. Possible values are "linear", "raking" and "logit". Default is "linear".
conf_level	(Optional) A numeric value indicating the confidence level for the confidence intervals, if desired.

Details

Multinomial logistic calibration estimator in dual frame using auxiliary information from each frame for a proportion is given by

$$\hat{P}_{MLCi}^{DF} = \frac{1}{N} \left(\sum_{k \in s_A \cup s_B} w_k^{\circ} z_{ki} \right), \quad i = 1, ..., m$$

with m the number of categories of the response variable, z_i the indicator variable for the i-th category of the response variable, and w° calibration weights which are calculated having into account a different set of constraints, depending on the case. For instance, if N_A, N_B and N_{ab} are known, calibration constraints are

$$\sum_{k \in s_a} w_k^{\circ} = N_a, \sum_{k \in s_{ab}} w_k^{\circ} = \eta N_{ab}, \sum_{k \in s_{ba}} w_k^{\circ} = (1 - \eta)N_{ab} \sum_{k \in s_b} w_k^{\circ} = N_b,$$

$$\sum_{k \in s_A} w_k^{\circ} p_{ki}^A = \sum_{k \in U_a} p_{ki}^A + \eta \sum_{k \in U_{ab}} p_{ki}^A$$

and

$$\sum_{k \in s_B} w_k^{\circ} p_{ki}^B = \sum_{k \in U_b} p_{ki}^B + (1 - \eta) \sum_{k \in U_{ba}} p_{ki}^B$$

with $\eta \in (0, 1)$ and

$$p_{ki}^A = \frac{exp(x_k^{'} \beta_i^A)}{\sum_{r=1}^m exp(x_k^{'} \beta_r^A)},$$

being β_i^A the maximum likelihood parameters of the multinomial logistic model considering original design weights d^A. p_{ki}^B can be defined similarly.

Value

MLCDF returns an object of class "MultEstimatorDF" which is a list with, at least, the following components:

Call   the matched call.

Est   class frequencies and proportions estimations for main variable(s).

References

Molina, D., Rueda, M., Arcos, A. and Ranalli, M. G. (2015) *Multinomial logistic estimation in dual frame surveys* Statistics and Operations Research Transactions (SORT). To be printed.

See Also

JackMLCDF

Examples

```
data(DatMA)
data(DatMB)
data(DatPopM)

N <- nrow(DatPopM)
levels(DatPopM$Domain) <- c(levels(DatPopM$Domain), "ba")
DatPopMA <- subset(DatPopM, DatPopM$Domain == "a" | DatPopM$Domain == "ab", stringAsFactors = FALSE)
DatPopMB <- subset(DatPopM, DatPopM$Domain == "b" | DatPopM$Domain == "ab", stringAsFactors = FALSE)
DatPopMB[DatPopMB$Domain == "ab",]$Domain <- "ba"

#Let calculate proportions of categories of variable Prog using MLCDF estimator
#using Read as auxiliary variable
MLCDF(DatMA$Prog, DatMB$Prog, DatMA$ProbA, DatMB$ProbB, DatMA$Domain, DatMB$Domain,
DatMA$Read, DatMB$Read, DatPopMA$Read, DatPopMB$Read, DatMA$Id_Frame, DatMB$Id_Frame,
DatPopMA$Domain, DatPopMB$Domain, N)

#Let obtain 95% confidence intervals together with the estimations
MLCDF(DatMA$Prog, DatMB$Prog, DatMA$ProbA, DatMB$ProbB, DatMA$Domain, DatMB$Domain,
DatMA$Read, DatMB$Read, DatPopMA$Read, DatPopMB$Read, DatMA$Id_Frame, DatMB$Id_Frame,
DatPopMA$Domain, DatPopMB$Domain, N, conf_level = 0.95)
```

MLCDW   *Multinomial logistic calibration estimator under dual frame approach*
                         with auxiliary information from the whole population

---

Description

Produces estimates for class totals and proportions using multinomial logistic regression from survey data obtained from a dual frame sampling design using a model calibrated dual frame approach with auxiliary information from the whole population. Confidence intervals are also computed, if required.

Usage

```
MLCDW (ysA, ysB, pik_A, pik_B, domains_A, domains_B, xsA, xsB, x, ind_sam, N_A,
 N_B, N_ab = NULL, met = "linear", conf_level = NULL)
```

Arguments

ysA	A data frame containing information about one or more factors, each one of dimension n_A, collected from s_A.
ysB	A data frame containing information about one or more factors, each one of dimension n_B, collected from s_B.
pik_A	A numeric vector of length n_A containing first order inclusion probabilities for units included in s_A.
pik_B	A numeric vector of length n_B containing first order inclusion probabilities for units included in s_B.
domains_A	A character vector of size n_A indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domains_B	A character vector of size n_B indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
xsA	A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x m, with m the number of auxiliary variables, containing auxiliary information in frame A for units included in s_A.
xsB	A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x m, with m the number of auxiliary variables, containing auxiliary information in frame B for units included in s_B.
x	A numeric vector or length N or a numeric matrix or data frame of dimensions N x m, with m the number of auxiliary variables, containing auxiliary information for every unit in the population.
ind_sam	A numeric vector of length $n = n_A + n_B$ containing the identificators of units of the population (from 1 to N) that belongs to s_A or s_B
N_A	A numeric value indicating the size of frame A
N_B	A numeric value indicating the size of frame B

N_ab	(Optional) A numeric value indicating the size of the overlap domain
met	(Optional) A character vector indicating the distance that must be used in calibration process. Possible values are "linear", "raking" and "logit". Default is "linear".
conf_level	(Optional) A numeric value indicating the confidence level for the confidence intervals, if desired.

Details

Multinomial logistic calibration estimator in dual frame using auxiliary information from the whole population for a proportion is given by

$$\hat{P}^{DW}_{MLCi} = \frac{1}{N}\left(\sum_{k\in s_A\cup s_B} w_k^{\circ} z_{ki}\right), \quad i = 1,...,m$$

with m the number of categories of the response variable, z_i the indicator variable for the i-th category of the response variable, and w° calibration weights which are calculated having into account a different set of constraints, depending on the case. For instance, if N_A, N_B and N_{ab} are known, calibration constraints are

$$\sum_{k\in s_a} w_k^{\circ} = N_a, \sum_{k\in s_{ab}} w_k^{\circ} = \eta N_{ab}, \sum_{k\in s_{ba}} w_k^{\circ} = (1-\eta)N_{ab}, \sum_{k\in s_b} w_k^{\circ} = N_b$$

and

$$\sum_{k\in s_A\cup s_B} w_k^{\circ} p_{ki}^{\circ} = \sum_{k\in U} p_{ki}^{\circ}$$

with $\eta \in (0,1)$ and

$$p_{ki}^{\circ} = \frac{exp(x_k^{'}\beta_i^{\circ})}{\sum_{r=1}^m exp(x_k^{'}\beta_r^{\circ})},$$

being β_i° the maximum likelihood parameters of the multinomial logistic model considering weights

$$d_k^{\circ} = \begin{cases} d_k^A & \text{if } k \in a \\ \eta d_k^A & \text{if } k \in ab \\ (1-\eta)d_k^B & \text{if } k \in ba \\ d_k^B & \text{if } k \in b \end{cases}.$$

Value

`MLCDW` returns an object of class "MultEstimatorDF" which is a list with, at least, the following components:

Call	the matched call.
Est	class frequencies and proportions estimations for main variable(s).

References

Molina, D., Rueda, M., Arcos, A. and Ranalli, M. G. (2015) *Multinomial logistic estimation in dual frame surveys* Statistics and Operations Research Transactions (SORT). To be printed.

See Also

[JackMLCDW](#)

Examples

```
data(DatMA)
data(DatMB)
data(DatPopM)

IndSample <- c(DatMA$Id_Pop, DatMB$Id_Pop)
N_FrameA <- nrow(DatPopM[DatPopM$Domain == "a" | DatPopM$Domain == "ab",])
N_FrameB <- nrow(DatPopM[DatPopM$Domain == "b" | DatPopM$Domain == "ab",])
N_Domainab <- nrow(DatPopM[DatPopM$Domain == "ab",])
#Let calculate proportions of categories of variable Prog using MLCDW estimator
#using Read as auxiliary variable
MLCDW(DatMA$Prog, DatMB$Prog, DatMA$ProbA, DatMB$ProbB, DatMA$Domain, DatMB$Domain,
DatMA$Read, DatMB$Read, DatPopM$Read, IndSample, N_FrameA, N_FrameB)

#Now, let suppose that the overlap domian size is known
MLCDW(DatMA$Prog, DatMB$Prog, DatMA$ProbA, DatMB$ProbB, DatMA$Domain, DatMB$Domain,
DatMA$Read, DatMB$Read, DatPopM$Read, IndSample, N_FrameA, N_FrameB, N_Domainab)

#Let obtain 95% confidence intervals together with the estimations
MLCDW(DatMA$Prog, DatMB$Prog, DatMA$ProbA, DatMB$ProbB, DatMA$Domain, DatMB$Domain,
DatMA$Read, DatMB$Read, DatPopM$Read, IndSample, N_FrameA, N_FrameB, N_Domainab,
conf_level = 0.95)
```

MLCSW	*Multinomial logistic calibration estimator under single frame approach with auxiliary information from the whole population*

Description

Produces estimates for class totals and proportions using multinomial logistic regression from survey data obtained from a dual frame sampling design using a model calibrated single frame approach with auxiliary information from the whole population. Confidence intervals are also computed, if required.

Usage

```
MLCSW (ysA, ysB, pik_A, pik_B, pik_ab_B, pik_ba_A, domains_A, domains_B, xsA, xsB,
 x, ind_sam, N_A, N_B, N_ab = NULL, met = "linear", conf_level = NULL)
```

Arguments

ysA	A data frame containing information about one or more factors, each one of dimension n_A, collected from s_A.
ysB	A data frame containing information about one or more factors, each one of dimension n_B, collected from s_B.

pik_A	A numeric vector of length n_A containing first order inclusion probabilities for units included in s_A.
pik_B	A numeric vector of length n_B containing first order inclusion probabilities for units included in s_B.
pik_ab_B	A numeric vector of size n_A containing first order inclusion probabilities according to sampling design in frame B for units belonging to overlap domain that have been selected in s_A.
pik_ba_A	A numeric vector of size n_B containing first order inclusion probabilities according to sampling design in frame A for units belonging to overlap domain that have been selected in s_B.
domains_A	A character vector of size n_A indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domains_B	A character vector of size n_B indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
xsA	A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x m, with m the number of auxiliary variables, containing auxiliary information in frame A for units included in s_A.
xsB	A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x m, with m the number of auxiliary variables, containing auxiliary information in frame B for units included in s_B.
x	A numeric vector or length N or a numeric matrix or data frame of dimensions N x m, with m the number of auxiliary variables, containing auxiliary information for every unit in the population.
ind_sam	A numeric vector of length $n = n_A + n_B$ containing the identificators of units of the population (from 1 to N) that belongs to s_A or s_B
N_A	A numeric value indicating the size of frame A
N_B	A numeric value indicating the size of frame B
N_ab	(Optional) A numeric value indicating the size of the overlap domain
met	(Optional) A character vector indicating the distance that must be used in calibration process. Possible values are "linear", "raking" and "logit". Default is "linear".
conf_level	(Optional) A numeric value indicating the confidence level for the confidence intervals, if desired.

Details

Multinomial logistic calibration estimator in single frame using auxiliary information from the whole population for a proportion is given by

$$\hat{P}_{MLCi}^{SW} = \frac{1}{N} \left(\sum_{k \in s_A \cup s_B} \tilde{w}_k z_{ki} \right) \quad i = 1, ..., m$$

with m the number of categories of the response variable, z_i the indicator variable for the i-th category of the response variable, and $\tilde{w}$ calibration weights which are calculated having into account

a different set of constraints, depending on the case. For instance, if N_A, N_B and N_{ab} are known, calibration constraints are

$$\sum_{k \in s_a} \tilde{w}_k = N_a, \quad \sum_{k \in s_{ab} \cup s_{ba}} \tilde{w}_k = N_{ab}, \quad \sum_{k \in s_{ba}} \tilde{w}_k = N_{ba}$$

and

$$\sum_{k \in s_A \cup s_B} \tilde{w}_k \tilde{p}_{ki} = \sum_{k \in U} \tilde{p}_{ki}$$

with

$$\tilde{p}_{ki} = \frac{exp(x'_k \tilde{\beta}_i)}{\sum_{r=1}^{m} exp(x'_k \tilde{\beta}_r)},$$

being $\tilde{\beta}_i$ the maximum likelihood parameters of the multinomial logistic model considering weights

$$\tilde{d}_k = \begin{cases} d_k^A & \text{if } k \in a \\ (1/d_k^A + 1/d_k^B)^{-1} & \text{if } k \in ab \cup ba \\ d_k^B & \text{if } k \in b \end{cases}.$$

Value

`MLCSW` returns an object of class "MultEstimatorDF" which is a list with, at least, the following components:

`Call`	the matched call.
`Est`	class frequencies and proportions estimations for main variable(s).

References

Molina, D., Rueda, M., Arcos, A. and Ranalli, M. G. (2015) *Multinomial logistic estimation in dual frame surveys* Statistics and Operations Research Transactions (SORT). To be printed.

See Also

JackMLCSW

Examples

```
data(DatMA)
data(DatMB)
data(DatPopM)

IndSample <- c(DatMA$Id_Pop, DatMB$Id_Pop)
N_FrameA <- nrow(DatPopM[DatPopM$Domain == "a" | DatPopM$Domain == "ab",])
N_FrameB <- nrow(DatPopM[DatPopM$Domain == "b" | DatPopM$Domain == "ab",])
N_Domainab <- nrow(DatPopM[DatPopM$Domain == "ab",])
#Let calculate proportions of categories of variable Prog using MLCSW estimator
#using Read as auxiliary variable
MLCSW(DatMA$Prog, DatMB$Prog, DatMA$ProbA, DatMB$ProbB, DatMA$ProbB, DatMB$ProbA,
DatMA$Domain, DatMB$Domain, DatMA$Read, DatMB$Read, DatPopM$Read, IndSample, N_FrameA,
N_FrameB)
```

```
#Now, let suppose that the overlap domian size is known
MLCSW(DatMA$Prog, DatMB$Prog, DatMA$ProbA, DatMB$ProbB, DatMA$ProbB, DatMB$ProbA,
DatMA$Domain, DatMB$Domain, DatMA$Read, DatMB$Read, DatPopM$Read, IndSample, N_FrameA,
N_FrameB, N_Domainab)

#Let obtain 95% confidence intervals together with the estimations
MLCSW(DatMA$Prog, DatMB$Prog, DatMA$ProbA, DatMB$ProbB, DatMA$ProbB, DatMB$ProbA,
DatMA$Domain, DatMB$Domain, DatMA$Read, DatMB$Read, DatPopM$Read, IndSample, N_FrameA,
N_FrameB, N_Domainab, conf_level = 0.95)
```

MLDF   *Multinomial logistic estimator under dual frame approach with auxiliary information from each frame*

Description

Produces estimates for class totals and proportions using multinomial logistic regression from survey data obtained from a dual frame sampling design using a model assisted approach with a possibly different set of auxiliary variables for each frame. Confidence intervals are also computed, if required.

Usage

```
MLDF (ysA, ysB, pik_A, pik_B, domains_A, domains_B, xsA, xsB, xA, xB, ind_samA,
  ind_samB, ind_domA, ind_domB, N, conf_level = NULL)
```

Arguments

ysA	A data frame containing information about one or more factors, each one of dimension n_A, collected from s_A.
ysB	A data frame containing information about one or more factors, each one of dimension n_B, collected from s_B.
pik_A	A numeric vector of length n_A containing first order inclusion probabilities for units included in s_A.
pik_B	A numeric vector of length n_B containing first order inclusion probabilities for units included in s_B.
domains_A	A character vector of size n_A indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domains_B	A character vector of size n_B indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
xsA	A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x m_A, with m_A the number of auxiliary variables in frame A, containing auxiliary information in frame A for units included in s_A.
xsB	A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x m_B, with m_B the number of auxiliary variables in frame B, containing auxiliary information in frame B for units included in s_B.

xA	A numeric vector or length N_A or a numeric matrix or data frame of dimensions N_A x m_A, with m_A the number of auxiliary variables in frame A, containing auxiliary information for the units in frame A.
xB	A numeric vector or length N_B or a numeric matrix or data frame of dimensions N_B x m_B, with m_B the number of auxiliary variables in frame B, containing auxiliary information for the units in frame B.
ind_samA	A numeric vector of length n_A containing the identificators of units of the frame A (from 1 to N_A) that belongs to s_A.
ind_samB	A numeric vector of length n_B containing the identificators of units of the frame B (from 1 to N_B) that belongs to s_B.
ind_domA	A character vector of length N_A indicating the domain each unit from frame A belongs to. Possible values are "a" and "ab".
ind_domB	A character vector of length N_B indicating the domain each unit from frame B belongs to. Possible values are "b" and "ba".
N	A numeric value indicating the size of the population.
conf_level	(Optional) A numeric value indicating the confidence level for the confidence intervals, if desired.

Details

Multinomial logistic estimator in dual frame using auxiliary information from each frame for a proportion is given by

$$\hat{P}_{MLi}^{DF} = \frac{1}{N} \left(\sum_{k \in U_a} p_{ki}^A + \eta \sum_{k \in U_{ab}} p_{ki}^A + (1 - \eta) \sum_{k \in U_{ba}} p_{ki}^B + \sum_{k \in U_b} p_{ki}^B \right.$$

$$+ \sum_{k \in s_a} d_k^A (z_{ki} - p_{ki}^A) + \eta \sum_{k \in s_{ab}} d_k^A (z_{ki} - p_{ki}^A)$$

$$\left. + (1 - \eta) \sum_{k \in s_{ba}} d_k^B (z_{ki} - p_{ki}^B) + \sum_{k \in s_b} d_k^B (z_{ki} - p_{ki}^B) \right), \quad i = 1, ..., m$$

with $\eta \in (0, 1)$, m the number of categories of the response variable, z_i the indicator variable for the i-th category of the response variable, d^A and d^B the design weights for each frame, defined as the inverse of the first order inclusion probabilities and

$$p_{ki}^A = \frac{exp(x_k' \beta_i^A)}{\sum_{r=1}^m exp(x_k' \beta_r^A)},$$

being β_i^A the maximum likelihood parameters of the multinomial logistic model considering weights d^A. p_{ki}^B can be defined similarly.

Value

MLDF returns an object of class "MultEstimatorDF" which is a list with, at least, the following components:

Call	the matched call.
Est	class frequencies and proportions estimations for main variable(s).

References

Molina, D., Rueda, M., Arcos, A. and Ranalli, M. G. (2015) *Multinomial logistic estimation in dual frame surveys* Statistics and Operations Research Transactions (SORT). To be printed.

Lehtonen, R. and Veijanen, A. (1998) *On multinomial logistic generalizaed regression estimators* Technical report 22, Department of Statistics, University of Jyvaskyla.

See Also

JackMLDF

Examples

```
data(DatMA)
data(DatMB)
data(DatPopM)

N <- nrow(DatPopM)
levels(DatPopM$Domain) <- c(levels(DatPopM$Domain), "ba")
DatPopMA <- subset(DatPopM, DatPopM$Domain == "a" | DatPopM$Domain == "ab", stringAsFactors = FALSE)
DatPopMB <- subset(DatPopM, DatPopM$Domain == "b" | DatPopM$Domain == "ab", stringAsFactors = FALSE)
DatPopMB[DatPopMB$Domain == "ab",]$Domain <- "ba"

#Let calculate proportions of categories of variable Prog using MLDF estimator
#using Read as auxiliary variable
MLDF(DatMA$Prog, DatMB$Prog, DatMA$ProbA, DatMB$ProbB, DatMA$Domain, DatMB$Domain,
DatMA$Read, DatMB$Read, DatPopMA$Read, DatPopMB$Read, DatMA$Id_Frame, DatMB$Id_Frame,
DatPopMA$Domain, DatPopMB$Domain, N)

#Let obtain 95% confidence intervals together with the estimations
MLDF(DatMA$Prog, DatMB$Prog, DatMA$ProbA, DatMB$ProbB, DatMA$Domain, DatMB$Domain,
DatMA$Read, DatMB$Read, DatPopMA$Read, DatPopMB$Read, DatMA$Id_Frame, DatMB$Id_Frame,
DatPopMA$Domain, DatPopMB$Domain, N, conf_level = 0.95)
```

MLDW   *Multinomial logistic estimator under dual frame approach with auxiliary information from the whole population*

Description

Produces estimates for class totals and proportions using multinomial logistic regression from survey data obtained from a dual frame sampling design using a dual frame model assisted approach. Confidence intervals are also computed, if required.

Usage

```
MLDW (ysA, ysB, pik_A, pik_B, domains_A, domains_B, xsA, xsB, x, ind_sam,
 conf_level = NULL)
```

Arguments

ysA	A data frame containing information about one or more factors, each one of dimension n_A, collected from s_A.
ysB	A data frame containing information about one or more factors, each one of dimension n_B, collected from s_B.
pik_A	A numeric vector of length n_A containing first order inclusion probabilities for units included in s_A.
pik_B	A numeric vector of length n_B containing first order inclusion probabilities for units included in s_B.
domains_A	A character vector of size n_A indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domains_B	A character vector of size n_B indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
xsA	A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x m, with m the number of auxiliary variables, containing auxiliary information in frame A for units included in s_A.
xsB	A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x m, with m the number of auxiliary variables, containing auxiliary information in frame B for units included in s_B.
x	A numeric vector or length N or a numeric matrix or data frame of dimensions N x m, with m the number of auxiliary variables, containing auxiliary information for every unit in the population.
ind_sam	A numeric vector of length $n = n_A + n_B$ containing the identificators of units of the population (from 1 to N) that belongs to s_A or s_B
conf_level	(Optional) A numeric value indicating the confidence level for the confidence intervals, if desired.

Details

Multinomial logistic estimator in dual frame using auxiliary information from the whole population for a proportion is given by

$$\hat{P}_{MLi}^{DW} = \frac{1}{N}(\sum_{k \in U} p_{ki}^{\circ} + \sum_{k \in s} d_k^{\circ}(z_{ki} - p_{ki}^{\circ})) \quad i = 1, ..., m$$

with m the number of categories of the response variable, z_i the indicator variable for the i-th category of the response variable, $d_k^{\circ} = \begin{cases} d_k^A & \text{if } k \in a \\ \eta d_k^A & \text{if } k \in ab \\ (1 - \eta)d_k^B & \text{if } k \in ba \\ d_k^B & \text{if } k \in b \end{cases}$ with $\eta \in (0, 1)$ and

$$p_{ki}^{\circ} = \frac{exp(x_k^{'}\beta_i^{\circ})}{\sum_{r=1}^{m} exp(x_k^{'}\beta_r^{\circ})},$$

being β_i° the maximum likelihood parameters of the multinomial logistic model considering the weights d°.

Value

MLDW returns an object of class "MultEstimatorDF" which is a list with, at least, the following components:

Call   the matched call.

Est   class frequencies and proportions estimations for main variable(s).

References

Molina, D., Rueda, M., Arcos, A. and Ranalli, M. G. (2015) *Multinomial logistic estimation in dual frame surveys* Statistics and Operations Research Transactions (SORT). To be printed.

Lehtonen, R. and Veijanen, A. (1998) *On multinomial logistic generalizaed regression estimators* Technical report 22, Department of Statistics, University of Jyvaskyla.

See Also

[JackMLDW](#)

Examples

```
data(DatMA)
data(DatMB)
data(DatPopM)

IndSample <- c(DatMA$Id_Pop, DatMB$Id_Pop)
#Let calculate proportions of categories of variable Prog using MLDW estimator
#using Read as auxiliary variable
MLDW(DatMA$Prog, DatMB$Prog, DatMA$ProbA, DatMB$ProbB, DatMA$Domain, DatMB$Domain,
DatMA$Read, DatMB$Read, DatPopM$Read, IndSample)

#Let obtain 95% confidence intervals together with the estimations
MLDW(DatMA$Prog, DatMB$Prog, DatMA$ProbA, DatMB$ProbB, DatMA$Domain, DatMB$Domain,
DatMA$Read, DatMB$Read, DatPopM$Read, IndSample, 0.95)
```

MLSW   *Multinomial logistic estimator under single frame approach with aux-iliary information from the whole population*

Description

Produces estimates for class totals and proportions using multinomial logistic regression from survey data obtained from a dual frame sampling design with the same set of auxiliary variables for the whole population. Confidence intervals are also computed, if required.

Usage

```
MLSW (ysA, ysB, pik_A, pik_B, pik_ab_B, pik_ba_A, domains_A, domains_B, xsA, xsB,
x, ind_sam, conf_level = NULL)
```

Arguments

ysA	A data frame containing information about one or more factors, each one of dimension n_A, collected from s_A.
ysB	A data frame containing information about one or more factors, each one of dimension n_B, collected from s_B.
pik_A	A numeric vector of length n_A containing first order inclusion probabilities for units included in s_A.
pik_B	A numeric vector of length n_B containing first order inclusion probabilities for units included in s_B.
pik_ab_B	A numeric vector of size n_A containing first order inclusion probabilities according to sampling design in frame B for units belonging to overlap domain that have been selected in s_A.
pik_ba_A	A numeric vector of size n_B containing first order inclusion probabilities according to sampling design in frame A for units belonging to overlap domain that have been selected in s_B.
domains_A	A character vector of size n_A indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domains_B	A character vector of size n_B indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
xsA	A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x m, with m the number of auxiliary variables, containing auxiliary information in frame A for units included in s_A.
xsB	A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x m, with m the number of auxiliary variables, containing auxiliary information in frame B for units included in s_B.
x	A numeric vector or length N or a numeric matrix or data frame of dimensions N x m, with m the number of auxiliary variables, containing auxiliary information for every unit in the population.
ind_sam	A numeric vector of length $n = n_A + n_B$ containing the identificators of units of the population (from 1 to N) that belongs to s_A or s_B
conf_level	(Optional) A numeric value indicating the confidence level for the confidence intervals, if desired.

Details

Multinomial logistic estimator in single frame using auxiliary information from the whole population for a proportion is given by

$$\hat{P}_{MLi}^{SW} = \frac{1}{N}\left(\sum_{k \in U} \tilde{p}_{ki} + \sum_{k \in s} \tilde{d}_k(z_{ki} - \tilde{p}_{ki})\right) \quad i = 1, ..., m$$

with m the number of categories of the response variable, z_i the indicator variable for the i-th category of the response variable, $\tilde{d}_k = \begin{cases} d_k^A & \text{if } k \in a \\ (1/d_k^A + 1/d_k^B)^{-1} & \text{if } k \in ab \cup ba \\ d_k^B & \text{if } k \in b \end{cases}$ and

$$\tilde{p}_{ki} = \frac{exp(x_k^{'}\tilde{\beta}_i)}{\sum_{r=1}^{m} exp(x_k^{'}\tilde{\beta}_r)},$$

being $\tilde{\beta}_i$ the maximum likelihood parameters of the multinomial logistic model considering weights $\tilde{d}$.

Value

PMLSW returns an object of class "MultEstimatorDF" which is a list with, at least, the following components:

Call   the matched call.

Est   class frequencies and proportions estimations for main variable(s).

References

Molina, D., Rueda, M., Arcos, A. and Ranalli, M. G. (2015) *Multinomial logistic estimation in dual frame surveys* Statistics and Operations Research Transactions (SORT). To be printed.

Lehtonen, R. and Veijanen, A. (1998) *On multinomial logistic generalizaed regression estimators* Technical report 22, Department of Statistics, University of Jyvaskyla.

See Also

JackMLSW

Examples

```
data(DatMA)
data(DatMB)
data(DatPopM)

IndSample <- c(DatMA$Id_Pop, DatMB$Id_Pop)
#Let calculate proportions of categories of variable Prog using MLSW estimator
#using Read as auxiliary variable
MLSW(DatMA$Prog, DatMB$Prog, DatMA$ProbA, DatMB$ProbB, DatMA$ProbB, DatMB$ProbA,
DatMA$Domain, DatMB$Domain, DatMA$Read, DatMB$Read, DatPopM$Read, IndSample)

#Let obtain 95% confidence intervals together with the estimations
MLSW(DatMA$Prog, DatMB$Prog, DatMA$ProbA, DatMB$ProbB, DatMA$ProbB, DatMB$ProbA,
DatMA$Domain, DatMB$Domain, DatMA$Read, DatMB$Read, DatPopM$Read, IndSample,
conf_level = 0.95)
```

PEL	*Pseudo empirical likelihood estimator*

Description

Produces estimates for population totals using the pseudo empirical likelihood estimator from survey data obtained from a dual frame sampling design. Confidence intervals for the population total are also computed, if required.

Usage

```
PEL(ysA, ysB, pi_A, pi_B, domains_A, domains_B, N_A = NULL, N_B = NULL,
N_ab = NULL, xsAFrameA = NULL, xsBFrameA = NULL, xsAFrameB = NULL, xsBFrameB = NULL,
XA = NULL, XB = NULL, conf_level = NULL)
```

Arguments

ysA	A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x c containing information about variable(s) of interest from s_A.
ysB	A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x c containing information about variable(s) of interest from s_B.
pi_A	A numeric vector of length n_A or a square numeric matrix of dimension n_A containing first order or first and second order inclusion probabilities for units included in s_A.
pi_B	A numeric vector of length n_B or a square numeric matrix of dimension n_B containing first order or first and second order inclusion probabilities for units included in s_B.
domains_A	A character vector of size n_A indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domains_B	A character vector of size n_B indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
N_A	(Optional) A numeric value indicating the size of frame A.
N_B	(Optional) A numeric value indicating the size of frame B.
N_ab	(Optional) A numeric value indicating the size of the overlap domain.
xsAFrameA	(Optional) A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x m_A, with m_A the number of auxiliary variables in frame A, containing auxiliary information in frame A for units included in s_A.
xsBFrameA	(Optional) A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x m_A, with m_A the number of auxiliary variables in frame A, containing auxiliary information in frame A for units included in s_B. For units in domain b, these values are 0.
xsAFrameB	(Optional) A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x m_B, with m_B the number of auxiliary variables in frame B, containing auxiliary information in frame B for units included in s_A. For units in domain a, these values are 0.

xsBFrameB	(Optional) A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x m_B, with m_B the number of auxiliary variables in frame B, containing auxiliary information in frame B for units included in s_B.
XA	(Optional) A numeric value or vector of length m_A, with m_A the number of auxiliary variables in frame A, indicating the population totals for the auxiliary variables considered in frame A.
XB	(Optional) A numeric value or vector of length m_B, with m_B the number of auxiliary variables in frame B, indicating the population totals for the auxiliary variables considered in frame B.
conf_level	(Optional) A numeric value indicating the confidence level for the confidence intervals, if desired.

Details

Pseudo empirical likelihood estimator for the population mean is computed as

$$\hat{\bar{Y}}_{PEL} = \frac{N_a}{N}\hat{\bar{Y}}_a + \frac{\eta N_{ab}}{N}\hat{\bar{Y}}_{ab}^A + \frac{(1-\eta)N_{ab}}{N}\hat{\bar{Y}}_{ab}^B + \frac{N_b}{N}\hat{\bar{Y}}_b$$

where $\hat{\bar{Y}}_a = \sum_{k \in s_a} \hat{p}_{ak}y_k$, $\hat{\bar{Y}}_{ab} = \sum_{k \in s_{ab}^A} \hat{p}_{abk}^A y_k$, $\hat{\bar{Y}}_{ab}^B = \sum_{k \in s_{ab}^B} \hat{p}_{abk}^B y_k$ and $\hat{\bar{Y}}_b = \sum_{k \in s_b} \hat{p}_{bk}y_k$ with $\hat{p}_{ak}, \hat{p}_{abk}^A, \hat{p}_{abk}^B$ and $\hat{p}_{bk}$ the weights resulting of applying the pseudo empirical likelihood procedure to a determined function under a determined set of constraints, depending on the case. Furthermore, $\eta \in (0,1)$. In this case, N_A, N_B and N_{ab} have been supposed known and no additional auxiliary variables have been considered. This is not happening in some cases. Function covers following scenarios:

- There is not any additional auxiliary variable
  - N_A, N_B and N_{ab} unknown
  - N_A and N_B known and N_{ab} unknown
  - N_A, N_B and N_{ab} known
- At least, one additional auxiliary variable is available
  - N_A and N_B known and N_{ab} unknown
  - N_A, N_B and N_{ab} known

Explicit variance of this estimator is not easy to obtain. Instead, confidence intervals can be computed through the bi-section method. This method constructs intervals in the form $\{\theta | r_{ns}(\theta) < \chi_1^2(\alpha)\}$, where $\chi_1^2(\alpha)$ is the $1 - \alpha$ quantile from a χ^2 distribution with one degree of freedom and $r_{ns}(\theta)$ represents the so called pseudo empirical log likelihood ratio statistic, which can be obtained as a difference of two pseudo empirical likelihood functions.

Value

PEL returns an object of class "EstimatorDF" which is a list with, at least, the following components:

Call	the matched call.
Est	total and mean estimation for main variable(s).
VarEst	variance estimation for main variable(s).

If parameter `conf_level` is different from NULL, object includes component

ConfInt   total and mean estimation and confidence intervals for main variables(s).

In addition, components `TotDomEst` and `MeanDomEst` are available when estimator is based on estimators of the domains. Component `Param` shows value of parameters involded in calculation of the estimator (if any). By default, only `Est` component (or `ConfInt` component, if parameter `conf_level` is different from NULL) is shown. It is possible to access to all the components of the objects by using function `summary`.

References

Rao, J. N. K. and Wu, C. (2010) *Pseudo Empirical Likelihood Inference for Multiple Frame Surveys*. Journal of the American Statistical Association, 105, 1494 - 1503.

Wu, C. (2005) *Algorithms and R codes for the pseudo empirical likelihood methods in survey sampling*. Survey Methodology, Vol. 31, 2, pp. 239 - 243.

See Also

JackPEL

Examples

```
data(DatA)
data(DatB)
data(PiklA)
data(PiklB)

#Let calculate pseudo empirical likelihood estimator for variable Feeding, without
#considering any auxiliary information
PEL(DatA$Feed, DatB$Feed, PiklA, PiklB, DatA$Domain, DatB$Domain)

#Now, let calculate pseudo empirical estimator for variable Clothing when the frame
#sizes and the overlap domain size are known
PEL(DatA$Clo, DatB$Clo, PiklA, PiklB, DatA$Domain, DatB$Domain,
N_A = 1735, N_B = 1191, N_ab = 601)

#Finally, let calculate pseudo empirical likelihood estimator and a 90% confidence interval
#for population total for variable Feeding, considering Income and Metres2 as auxiliary
#variables and with frame sizes and overlap domain size known.
PEL(DatA$Feed, DatB$Feed, PiklA, PiklB, DatA$Domain, DatB$Domain,
N_A = 1735, N_B =  1191, N_ab = 601, xsAFrameA = DatA$Inc, xsBFrameA = DatB$Inc,
xsAFrameB = DatA$M2, xsBFrameB = DatB$M2, XA = 4300260, XB = 176553,
conf_level = 0.90)
```

PiklA	*Matrix of inclusion probabilities for units selected in sample from frame A*

Description

This dataset consists of a square matrix of dimension 105 with the first and second order inclusion probabilities for the units included in sample s_A, which has been drawn from a population of size $N_A = 1735$ according to a stratified random sampling with population strata sizes $N_A^h = (727, 375, 113, 186, 115, 219)$

Usage

```
PiklA
```

See Also

[DatA](#)

Examples

```
data(PiklA)
#Let choose the submatrix of inclusion probabilities for the first 5 units sA.
PiklA[1:5, 1:5]
#Now, let select only the first order inclusion probabilities
diag(PiklA)
```

PiklB	*Matrix of inclusion probabilities for units selected in sample from frame B*

Description

This dataset consists of a square matrix of dimension 135 with the first and second order inclusion probabilities for the units included in s_B, which has been drawn from a population of size $N_B = 1191$ according to a simple random sampling without replacement.

Usage

```
PiklB
```

See Also

[DatB](#)

Examples

```
data(PiklB)
#Let choose the submatrix of inclusion probabilities for the first 5 units in sB.
PiklB[1:5, 1:5]
#Now, let select the first order inclusion probabilities
diag(PiklB)
```

PML   *Pseudo Maximum Likelihood estimator*

Description

Produces estimates for population totals and means using PML estimator from survey data obtained from a dual frame sampling design. Confidence intervals are also computed, if required.

Usage

```
PML(ysA, ysB, pi_A, pi_B, domains_A, domains_B, N_A, N_B, conf_level = NULL)
```

Arguments

ysA	A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x c containing information about variable of interest from s_A.
ysB	A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x c containing information about variable of interest from s_B.
pi_A	A numeric vector of length n_A or a square numeric matrix of dimension n_A containing first order or first and second order inclusion probabilities for units included in s_A.
pi_B	A numeric vector of length n_B or a square numeric matrix of dimension n_B containing first order or first and second order inclusion probabilities for units included in s_B.
domains_A	A character vector of size n_A indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domains_B	A character vector of size n_B indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
N_A	A numeric value indicating the size of frame A
N_B	A numeric value indicating the size of frame B
conf_level	(Optional) A numeric value indicating the confidence level for the confidence intervals, if desired.

Details

Pseudo Maximum Likelihood estimator of population total is given by

$$\hat{Y}_{PML}(\hat{\theta}) = \frac{N_A - \hat{N}_{ab,PML}}{\hat{N}_a}\hat{Y}_a^A + \frac{N_B - \hat{N}_{ab,PML}}{\hat{N}_b}\hat{Y}_b^B + \frac{\hat{N}_{ab,PML}}{\hat{\theta}\hat{N}_{ab}^A + (1-\hat{\theta})\hat{N}_{ab}^B}[\hat{\theta}\hat{Y}_{ab}^A + (1-\hat{\theta})\hat{Y}_{ab}^B]$$

where $\hat{\theta} \in [0,1]$ and $\hat{N}_{ab,PML}$ is the smaller of the roots of the quadratic equation

$$[\hat{\theta}/N_B + (1-\hat{\theta})/N_A]x^2 - [1 + \hat{\theta}\hat{N}_{ab}^A/N_B + (1-\hat{\theta})\hat{N}_{ab}^B/N_A]x + \hat{\theta}\hat{N}_{ab}^A + (1-\hat{\theta})\hat{N}_{ab}^B = 0.$$

Optimal value for $\hat{\theta}$ is $\frac{\hat{N}_a N_B \hat{V}(\hat{N}_{ab}^B)}{\hat{N}_a N_B \hat{V}(\hat{N}_{ab}^B) + \hat{N}_b N_A \hat{V}(\hat{N}_{ab}^A)}$. Variance is estimated according to following expression

$$\hat{V}(\hat{Y}_{PML}(\hat{\theta})) = \hat{V}\left(\sum_{i \in s_A} \tilde{z}_i^A\right) + \hat{V}\left(\sum_{i \in s_B} \tilde{z}_i^B\right)$$

where, $\tilde{z}_i^A = y_i - \frac{\hat{Y}_a}{\hat{N}_a}$ if $i \in a$ and $\tilde{z}_i^A = \hat{\gamma}_{opt}(y_i - \frac{\hat{Y}_a}{\hat{N}_a}) + \hat{\lambda}\hat{\phi}$ if $i \in ab$ with

$$\hat{\gamma}_{opt} = \frac{\hat{N}_a N_B \hat{V}(\hat{N}_{ab}^B)}{\hat{N}_a N_B \hat{V}(\hat{N}_{ab}^B) + \hat{N}_b + N_A + \hat{V}(\hat{N}_{ab}^A)}$$

$$\hat{\lambda} = \frac{n_A/N_A \hat{Y}_{ab}^A + n_B/N_B \hat{Y}_{ab}^B}{n_A/N_A \hat{N}_{ab}^A + n_B/N_B \hat{N}_{ab}^B} - \frac{\hat{Y}_a}{\hat{N}_a} - \frac{\hat{Y}_b}{\hat{N}_b}$$

$$\hat{\phi} = \frac{n_A \hat{N}_b}{n_A \hat{N}_b + n_B \hat{N}_a}$$

Similarly, we define $\tilde{z}_i^B = y_i - \frac{\hat{Y}_b}{\hat{N}_b}$ if $i \in b$ and $\tilde{z}_i^B = (1 - \hat{\gamma}_{opt})(y_i - \frac{\hat{Y}_{ba}}{\hat{N}_{ab}}) + \hat{\lambda}(1 - \hat{\phi})$ if $i \in ba$

Value

PML returns an object of class "EstimatorDF" which is a list with, at least, the following components:

Call	the matched call.
Est	total and mean estimation for main variable(s).
VarEst	variance estimation for main variable(s).

If parameter conf_level is different from NULL, object includes component

ConfInt	total and mean estimation and confidence intervals for main variables(s).

In addition, components TotDomEst and MeanDomEst are available when estimator is based on estimators of the domains. Component Param shows value of parameters involded in calculation of the estimator (if any). By default, only Est component (or ConfInt component, if parameter conf_level is different from NULL) is shown. It is possible to access to all the components of the objects by using function summary.

References

Skinner, C. J. and Rao, J. N. K. (1996) *Estimation in Dual Frame Surveys with Complex Designs*. Journal of the American Statistical Association, Vol. 91, 433, 349 - 356.

Examples

```
data(DatA)
data(DatB)
data(PiklA)
data(PiklB)

#Let calculate Pseudo Maximum Likelihood estimator for population total for variable Clothing
PML(DatA$Clo, DatB$Clo, PiklA, PiklB, DatA$Domain, DatB$Domain,
N_A = 1735, N_B = 1191)

#Now, let calculate Pseudo Maximum Likelihood estimator for population total for variable
#Feeding, using first order inclusion probabilities
PML(DatA$Feed, DatB$Feed, DatA$ProbA, DatB$ProbB, DatA$Domain, DatB$Domain,
N_A = 1735, N_B = 1191)

#Finally, let calculate Pseudo Maximum Likelihood estimator and a 90% confidence interval for
#population total for variable Leisure
PML(DatA$Lei, DatB$Lei, PiklA, PiklB, DatA$Domain, DatB$Domain,
N_A = 1735, N_B = 1191, 0.90)
```

SFRR   *Raking ratio estimator*

Description

Produces estimates for population total and mean using the raking ratio estimator from survey data obtained from a dual frame sampling desing. Confidence intervals are also computed, if required.

Usage

```
SFRR(ysA, ysB, pi_A, pi_B, pik_ab_B, pik_ba_A, domains_A, domains_B, N_A, N_B,
conf_level = NULL)
```

Arguments

ysA	A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x c containing information about variable of interest from s_A.
ysB	A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x c containing information about variable of interest from s_B.
pi_A	A numeric vector of length n_A or a square numeric matrix of dimension n_A containing first order or first and second order inclusion probabilities for units included in s_A.
pi_B	A numeric vector of length n_B or a square numeric matrix of dimension n_B containing first order or first and second order inclusion probabilities for units included in s_B.
pik_ab_B	A numeric vector of size n_A containing first order inclusion probabilities according to sampling desing in frame B for units belonging to overlap domain that have been selected in s_A.

pik_ba_A	A numeric vector of size n_B containing first order inclusion probabilities according to sampling desing in frame A for units belonging to overlap domain that have been selected in s_A.
domains_A	A character vector of size n_A indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domains_B	A character vector of size n_B indicating the domain each unit from s_A belongs to. Possible values are "b" and "ba".
N_A	A numeric value indicating the size of frame A
N_B	A numeric value indicating the size of frame B
conf_level	(Optional) A numeric value indicating the confidence level for the confidence intervals, if desired.

Details

Raking ratio estimator of population total is given by

$$\hat{Y}_{SFRR} = \frac{N_A - \hat{N}_{ab,rake}}{\hat{N}_a^A} \hat{Y}_a^A + \frac{N_B - \hat{N}_{ab,rake}}{\hat{N}_b^B} \hat{Y}_b^B + \frac{\hat{N}_{ab,rake}}{\hat{N}_{abS}} \hat{Y}_{abS}$$

where $\hat{Y}_{abS} = \sum_{i \in s_{ab}^A} \tilde{d}_i^A y_i + \sum_{i \in s_{ab}^B} \tilde{d}_i^B y_i$, $\hat{N}_{abS} = \sum_{i \in s_{ab}^A} \tilde{d}_i^A + \sum_{i \in s_{ab}^B} \tilde{d}_i^B$ and $\hat{N}_{ab,rake}$ is the smallest root of the quadratic equation $\hat{N}_{ab,rake} x^2 - [\hat{N}_{ab,rake}(N_A + N_B) + \hat{N}_{aS} \hat{N}_{bS}] x + \hat{N}_{ab,rake} N_A N_B = 0$, with $\hat{N}_{aS} = \sum_{s_a^A} \tilde{d}_i^B$ and $\hat{N}_{bS} = \sum_{s_b^B} \tilde{d}_i^B$. Weights $\tilde{d}_i^A$ and $\tilde{d}_i^B$ are obtained as follows $\tilde{d}_i^A = \begin{cases} d_i^A & \text{if } i \in a \\ (1/d_i^A + 1/d_i^B)^{-1} & \text{if } i \in ab \end{cases}$ and $\tilde{d}_i^B = \begin{cases} d_i^B & \text{if } i \in b \\ (1/d_i^A + 1/d_i^B)^{-1} & \text{if } i \in ba \end{cases}$ being d_i^A and d_i^B the design weights, obtained as the inverse of the first order inclusion probabilities, that is $d_i^A = 1/\pi_i^A$ and $d_i^B = 1/\pi_i^B$.

To obtain an estimator of the variance for this estimator, one has taken into account that raking ratio estimator coincides with SF calibration estimator when frame sizes are known and "raking" method is used. So, one can use here Deville's expression to calculate an estimator for the variance of the raking ratio estimator

$$\hat{V}(\hat{Y}_{SFRR}) = \frac{1}{1 - \sum_{k \in s} a_k^2} \sum_{k \in s} (1 - \pi_k) \left(\frac{e_k}{\pi_k} - \sum_{l \in s} a_l \frac{e_l}{\pi_l} \right)^2$$

where $a_k = (1 - \pi_k) / \sum_{l \in s} (1 - \pi_l)$ and e_k are the residuals of the regression with auxiliary variables as regressors.

Value

SFRR returns an object of class "EstimatorDF" which is a list with, at least, the following components:

Call	the matched call.
Est	total and mean estimation for main variable(s).
VarEst	variance estimation for main variable(s).

If parameter `conf_level` is different from `NULL`, object includes component

ConfInt   total and mean estimation and confidence intervals for main variables(s).

In addition, components `TotDomEst` and `MeanDomEst` are available when estimator is based on estimators of the domains. Component `Param` shows value of parameters involded in calculation of the estimator (if any). By default, only `Est` component (or `ConfInt` component, if parameter `conf_level` is different from `NULL`) is shown. It is possible to access to all the components of the objects by using function `summary`.

References

Lohr, S. and Rao, J.N.K. (2000). *Inference in Dual Frame Surveys*. Journal of the American Statistical Association, Vol. 95, 271 - 280.

Rao, J.N.K. and Skinner, C.J. (1996). *Estimation in Dual Frame Surveys with Complex Designs*. Proceedings of the Survey Method Section, Statistical Society of Canada, 63 - 68.

Skinner, C.J. and Rao J.N.K. (1996). *Estimation in Dual Frame Surveys with Complex Designs*. Journal of the American Statistical Association, Vol. 91, 443, 349 - 356.

Skinner, C.J. (1991). *On the Efficiency of Raking Ratio Estimation for Multiple Frame Surveys*. Journal of the American Statistical Association, Vol. 86, 779 - 784.

See Also

JackSFRR

Examples

```
data(DatA)
data(DatB)
data(PiklA)
data(PiklB)

#Let calculate raking ratio estimator for population total for variable Clothing
SFRR(DatA$Clo, DatB$Clo, PiklA, PiklB, DatA$ProbB, DatB$ProbA, DatA$Domain,
DatB$Domain, 1735, 1191)

#Now, let calculate raking ratio estimator and a 90% confidence interval for
#population total for variable Feeding, considering only first order inclusion probabilities
SFRR(DatA$Feed, DatB$Feed, DatA$ProbA, DatB$ProbB, DatA$ProbB, DatB$ProbA,
DatA$Domain, DatB$Domain, 1735, 1191, 0.90)
```

VarHT   *Variance estimator of Horvitz - Thompson estimator*

Description

Computes the variance estimator of Horvitz - Thompson estimator of population total

Usage

```
VarHT(y, pikl)
```

Arguments

y	A numeric vector of size n containing information about variable of interest
pikl	A square numeric matrix of dimension n containing first and second order inclusion probabilities for units included in y

Details

Variance estimator of Horvitz - Thompson estimator of population total is given by

$$\hat{Var}(\hat{Y}_{HT}) = \sum_{k \in s} \frac{y_k^2}{\pi_k^2}(1 - \pi_k) + \sum_{k \in s}\sum_{l \in s, l \neq k} \frac{y_k y_l}{\pi_k \pi_l} \frac{\pi_{kl} - \pi_k \pi_l}{\pi_{kl}}$$

Value

A numeric value representing variance estimator of Horvitz - Thompson estimator for population total for considered values

References

Horvitz, D. G. and Thompson, D. J. (1952) *A generalization of sampling without replacement from a finite universe.* Journal of the American Statistical Association, 47, 663 - 685

Sarndal, C. E., Swensson, B. and Wretman, J. (1992) *Model Assisted Survey Sampling.* Springer-Verlag. New York.

See Also

HT CovHT

Examples

```
##########   Example 1   ##########
U <- c(13, 18, 20, 14, 9)
#A simple random sample of size 2 without replacement is drawn from population
s <- sample(U, 2)
#Horvitz - Thompson estimator of population total is calculated.
ps <- c(0.4, 0.4)
HT(s, ps)
#Now, we calculate variance estimator of the Horvitz - Thompson estimator.
Ps <- matrix(c(0.4,0.1, 0.1,0.4), 2 ,2)
VarHT(s, Ps)

##########   Example 2   ##########
data(DatA)
attach(DatA)
data(PiklA)
```

```
#Let calculate Horvitz - Thompson estimator for total of variable Clothing in Frame A.
HT(Clo, ProbA)
#And now, let compute the variance of the previous estimator
VarHT(Clo, PiklA)
```

WeightsCalDF   *g-weights for the dual frame calibration estimator*

Description

Computes the g-weights for the dual frame calibration estimator.

Usage

```
WeightsCalDF(ysA, ysB, pi_A, pi_B, domains_A, domains_B, N_A = NULL, N_B = NULL,
N_ab = NULL, xsAFrameA = NULL, xsBFrameA = NULL, xsAFrameB = NULL, xsBFrameB = NULL,
xsT = NULL, XA = NULL, XB = NULL, X = NULL, met = "linear")
```

Arguments

ysA	A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x c containing information about variable(s) of interest from s_A.
ysB	A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x c containing information about variable(s) of interest from s_B.
pi_A	A numeric vector of length n_A or a square numeric matrix of dimension n_A containing first order or first and second order inclusion probabilities for units included in s_A.
pi_B	A numeric vector of length n_B or a square numeric matrix of dimension n_B containing first order or first and second order inclusion probabilities for units included in s_B.
domains_A	A character vector of length n_A indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domains_B	A character vector of length n_B indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
N_A	(Optional) A numeric value indicating the size of frame A.
N_B	(Optional) A numeric value indicating the size of frame B.
N_ab	(Optional) A numeric value indicating the size of the overlap domain.
xsAFrameA	(Optional) A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x m_A, with m_A the number of auxiliary variables in frame A, containing auxiliary information in frame A for units included in s_A.
xsBFrameA	(Optional) A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x m_A, with m_A the number of auxiliary variables in frame A, containing auxiliary information in frame A for units included in s_B. For units in domain b, these values are 0.

xsAFrameB   (Optional) A numeric vector of length n_A or a numeric matrix or data frame of
                   dimensions n_A x m_B, with m_B the number of auxiliary variables in frame B,
                   containing auxiliary information in frame B for units included in s_A. For units
                   in domain a, these values are 0.

xsBFrameB   (Optional) A numeric vector of length n_B or a numeric matrix or data frame of
                   dimensions n_B x m_B, with m_B the number of auxiliary variables in frame B,
                   containing auxiliary information in frame B for units included in s_B.

xsT   (Optional) A numeric vector of length n or a numeric matrix or data frame of
                   dimensions n x m_T, with m_T the number of auxiliary variables in both frames,
                   containing auxiliary information for all units in the entire sample $s = s_A \cup s_B$.

XA   (Optional) A numeric value or vector of length m_A, with m_A the number of
                   auxiliary variables in frame A, indicating the population totals for the auxiliary
                   variables considered in frame A.

XB   (Optional) A numeric value or vector of length m_B, with m_B the number of
                   auxiliary variables in frame B, indicating the population totals for the auxiliary
                   variables considered in frame B.

X   (Optional) A numeric value or vector of length m_T, with m_T the number of aux-
                   iliary variables in both frames, indicating the population totals for the auxiliary
                   variables considered in both frames.

met   (Optional) A character vector indicating the distance that must be used in cal-
                   ibration process. Possible values are "linear", "raking" and "logit". Default is
                   "linear".

Details

Function provides g-weights in following scenarios:

- There is not any additional auxiliary variable
    - N_A, N_B and N_{ab} unknown
    - N_{ab} known and N_A and N_B unknown
    - N_A and N_B known and N_{ab} unknown
    - N_A, N_B and N_{ab} known
- At least, one additional auxiliary variable is available
    - N_{ab} known and N_A and N_B unknown
    - N_A and N_B known and N_{ab} unknown
    - N_A, N_B and N_{ab} known

Value

A numeric vector containing the g-weights for the dual frame calibration estimator.

References

Ranalli, M. G., Arcos, A., Rueda, M. and Teodoro, A. (2013) *Calibration estimationn in dual frame surveys*. arXiv:1312.0761 [stat.ME]

Deville, J. C., S\"arndal, C. E. (1992) *Calibration estimators in survey sampling.* Journal of the American Statistical Association, 87, 376 - 382

Examples

```
data(DatA)
data(DatB)
data(PiklA)
data(PiklB)

#Let calculate g-weights for the dual frame calibration estimator for variable Feeding,
#without considering any auxiliary information
WeightsCalDF(DatA$Feed, DatB$Feed, PiklA, PiklB, DatA$Domain, DatB$Domain)

#Now, let calculate g-weights for the dual frame calibration estimator for variable Clothing
#when the frame sizes and the overlap domain size are known
WeightsCalDF(DatA$Clo, DatB$Clo, PiklA, PiklB, DatA$Domain, DatB$Domain,
N_A = 1735, N_B = 1191, N_ab = 601)

#Finally, let calculate g-weights for the dual frame calibration estimator
#for variable Feeding, considering Income as auxiliary variable in frame A
#and Metres2 as auxiliary variable in frame B and with frame sizes and overlap
#domain size known.
WeightsCalDF(DatA$Feed, DatB$Feed, PiklA, PiklB, DatA$Domain, DatB$Domain,
N_A = 1735, N_B =  1191, N_ab = 601, xsAFrameA = DatA$Inc, xsBFrameA = DatB$Inc,
xsAFrameB = DatA$M2, xsBFrameB = DatB$M2, XA = 4300260, XB = 176553)
```

WeightsCalSF	*g-weights for the SF calibration estimator*

Description

Computes the g-weights for the SF calibration estimator.

Usage

```
WeightsCalSF(ysA, ysB, pi_A, pi_B, pik_ab_B, pik_ba_A, domains_A, domains_B,
N_A = NULL, N_B = NULL, N_ab = NULL, xsAFrameA = NULL, xsBFrameA = NULL,
xsAFrameB = NULL, xsBFrameB = NULL, xsT = NULL, XA = NULL, XB = NULL, X = NULL,
met = "linear")
```

Arguments

ysA	A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x c containing information about variable(s) of interest from s_A.
ysB	A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x c containing information about variable(s) of interest from s_A.
pi_A	A numeric vector of length n_A or a square numeric matrix of dimension n_A containing first order or first and second order inclusion probabilities for units included in s_A.

pi_B	A numeric vector of length n_B or a square numeric matrix of dimension n_B containing first order or first and second order inclusion probabilities for units included in s_B.
pik_ab_B	A numeric vector of size n_A containing first order inclusion probabilities according to sampling desing in frame B for units belonging to overlap domain that have been selected in s_A.
pik_ba_A	A numeric vector of size n_B containing first order inclusion probabilities according to sampling desing in frame A for units belonging to overlap domain that have been selected in s_B.
domains_A	A character vector of size n_A indicating the domain each unit from s_A belongs to. Possible values are "a" and "ab".
domains_B	A character vector of size n_B indicating the domain each unit from s_B belongs to. Possible values are "b" and "ba".
N_A	(Optional) A numeric value indicating the size of frame A
N_B	(Optional) A numeric value indicating the size of frame B
N_ab	(Optional) A numeric value indicating the size of the overlap domain
xsAFrameA	(Optional) A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x m_A, with m_A the number of auxiliary variables in frame A, containing auxiliary information in frame A for units included in s_A.
xsBFrameA	(Optional) A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x m_A, with m_A the number of auxiliary variables in frame A, containing auxiliary information in frame A for units included in s_B. For units in domain b, these values are 0.
xsAFrameB	(Optional) A numeric vector of length n_A or a numeric matrix or data frame of dimensions n_A x m_B, with m_B the number of auxiliary variables in frame B, containing auxiliary information in frame B for units included in s_A. For units in domain a, these values are 0.
xsBFrameB	(Optional) A numeric vector of length n_B or a numeric matrix or data frame of dimensions n_B x m_B, with m_B the number of auxiliary variables in frame B, containing auxiliary information in frame B for units included in s_B.
xsT	(Optional) A numeric vector of length n or a numeric matrix or data frame of dimensions n x m_T, with m_T the number of auxiliary variables in both frames, containing auxiliary information for all units in the entire sample $s = s_A \cup s_B$.
XA	(Optional) A numeric value or vector of length m_A, with m_A the number of auxiliary variables in frame A, indicating the population totals for the auxiliary variables considered in frame A.
XB	(Optional) A numeric value or vector of length m_B, with m_B the number of auxiliary variables in frame B, indicating the population totals for the auxiliary variables considered in frame B.
X	(Optional) A numeric value or vector of length m_T, with m_T the number of auxiliary variables in both frames, indicating the population totals for the auxiliary variables considered in both frames.
met	(Optional) A character vector indicating the distance that must be used in calibration process. Possible values are "linear", "raking" and "logit". Default is "linear".

Details

Function provides g-weights in following scenarios:

- There is not any additional auxiliary variable

    - N_A, N_B and N_{ab} unknown
    - N_{ab} known and N_A and N_B unknown
    - N_A and N_B known and N_{ab} unknown
    - N_A, N_B and N_{ab} known

- At least, one additional auxiliary variable is available

    - N_{ab} known and N_A and N_B unknown
    - N_A and N_B known and N_{ab} unknown
    - N_A, N_B and N_{ab} known

Value

A numeric vector containing the g-weights for the SF calibration estimator.

References

Ranalli, M. G., Arcos, A., Rueda, M. and Teodoro, A. (2013) *Calibration estimationn in dual frame surveys.* arXiv:1312.0761 [stat.ME]

Deville, J. C., S\"arndal, C. E. (1992) *Calibration estimators in survey sampling.* Journal of the American Statistical Association, 87, 376 - 382

Examples

```
data(DatA)
data(DatB)
data(PiklA)
data(PiklB)

#Let calculate g-weights for the SF calibration estimator for variable Clothing,
#without considering any auxiliary information
WeightsCalSF(DatA$Clo, DatB$Clo, PiklA, PiklB, DatA$ProbB, DatB$ProbA,
DatA$Domain, DatB$Domain)

#Now, let calculate g-weights for the SF calibration estimator for variable Leisure
#when the frame sizes and the overlap domain size are known
WeightsCalSF(DatA$Lei, DatB$Lei, PiklA, PiklB, DatA$ProbB, DatB$ProbA,
DatA$Domain, DatB$Domain, N_A = 1735, N_B = 1191, N_ab = 601)

#Finally, let calculate g-weights for the SF calibration estimator
#for variable Feeding, considering Income and Metres2 as auxiliary
#variables and with frame sizes and overlap domain size known.
WeightsCalSF(DatA$Feed, DatB$Feed, PiklA, PiklB, DatA$ProbB, DatB$ProbA,
DatA$Domain, DatB$Domain, N_A = 1735, N_B =  1191, N_ab = 601, xsAFrameA = DatA$Inc,
xsBFrameA = DatB$Inc, xsAFrameB = DatA$M2, xsBFrameB = DatB$M2,
XA = 4300260, XB = 176553)
```

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