Package 'bucky'

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Type Package

Title Bucky's Archive for Data Analysis in the Social Sciences

Version 1.0.6

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Depends R (>= 3.1.0)

Imports methods, sandwich, lmtest

Suggests MASS, parallel, Amelia, mice

Enhances texreg, stargazer

URL http://github.com/atahk/bucky

Description

Provides functions for various statistical techniques commonly used in the social sciences, including functions to compute clustered robust standard errors, combine results across multiply-imputed data sets, and simplify the addition of robust and clustered robust standard errors.

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Index of help topics:

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References

Cameron, A. Colin, and Douglas L. Miller. "A Practitioner's Guide to Cluster-Robust Inference." *Journal of Human Resources* 50, no. 2 (Spring 2015): 317-372.

Little, Roderick J. A., and Donald B. Rubin. "The Analysis of Social Science Data with Missing Values." *Sociological Methods & Research* 18, no. 2-3 (November 1989): 292-326.

Rubin, Donald. B. *Multiple Imputation for Nonresponse in Surveys*. New York: John Wiley & Sons, 2004.

See Also

See also `mice`, `amelia-package`, `MIcombine`, `sandwich` and `coeftest`.

`mi.eval` *Multiple-imputation evaluation*

Description

Evaluation of an expression across multiply imputed data sets.

Usage

```
mi.eval(EXPR, robust, cluster, coef., vcov., df.=NULL,
parallel=FALSE, lazy=NULL, ...)
```

Arguments

`EXPR`	An R expression to evaluate. This expression must contain a `data` argument that specifies a list containing the imputed data sets or a an object of class `amelia`, `mids`, or `imputationList`.
`robust`	Whether to use Huber-White robust standard errors. The default is `TRUE` if `cluster` is specified and `FALSE` otherwise.
`cluster`	A vector specifying clusters for the purpose of computing clustered robust standard errors. This can be a variable inside the imputed data set. If unspecified, standard errors are not clustered. If specified, `robust` cannot be `FALSE`.
`coef.`	The function used to get a numeric vector of coefficient estimates when evaluated on an object returned from evaluating `EXPR` for each data set. The default is to use `coef`.
`vcov.`	The function that returns a numeric matrix giving the variance-covariance matrix when evaluated on an object returned from evaluating `EXPR` for each data set. The default is to use `vcovCR` if `cluster` is specified, `vcovHC` if `robust=TRUE` and `cluster` is not specified, and `vcov` otherwise.
`df.`	Either the degrees of freedom for each model or a function that calculates degrees of freedom on an object returned from evaluating `EXPR` for each data set. The default value of `NULL` uses the minimum result of applying `df.residual` it returns a numeric value when applied to the object returned by `EXPR` and this object is not of class `glm` and `Inf` otherwise.

parallel	A logical indicating whether to evaluate EXPR across data sets in parallel using mclapply. Otherwise, evaluation is done serially using lapply. NULL means to use parallel evaluation if and only if the 'parallel' package can be loaded and getOption("mc.cores",detectCores()-1L) is greater than 1.
lazy	A logical indicating whether to use lazy evaluation to avoid copying all imputed data sets into memory. When the data argument to EXPR generates the multiply imputed data set, this is generally a bad idea because it means redoing the imputation multiple times. The default value of NULL means to use lazy evaluation if and only if the data argument to EXPR is a name.
...	Any additional arguments to be passed to lapply or mclapply when evaluating EXPR across data sets.

Details

This function evaluates a R command for each of several multiply imputed data sets and combines results across data sets into a single set of estimates. This is similar to the functionality provided by with.mids but also works with multiply-imputed data sets generated by other packages like 'Amelia' as well as those from 'mice'.

For generating formatted tables of regression coefficients, the outputted objects should be compatible with the 'texreg' package. When used with lm, glm or a few other types of models, these objects are also compatible with the 'stargazer' package.

Value

An object of class mi.estimates containing the coefficient estimates, variance-covariance matrix, and related information.

See Also

See Also summary.mi.estimates, with.mids, amelia, mice, coef, vcov and df.residual.

Examples

```
if (require("Amelia")) {
    ## Load data
    data(africa)
    africa$civlib <- factor(round(africa$civlib*6), ordered=TRUE)

    ## Estimate a linear model using imputed data sets
    model0 <- lm(trade ~ log(gdp_pc), data=africa, subset=year==1973)
    summary(model0)

    ## Impute using Amelia
    a.out <- amelia(x = africa, cs = "country", ts = "year",
                    logs = "gdp_pc", ord="civlib")

    ## Estimate a linear model using imputed data sets
    model1 <- mi.eval(lm(trade ~ log(gdp_pc), data=a.out, subset=year==1973))

    ## Show estimates
```

```
    model1
    coef(model1)

    ## Show summary information
    summary(model1)

    if (require("MASS")) {
        ## Estimate an ordered logit model
        model2 <- mi.eval(polr(civlib ~ log(gdp_pc) + log(population),
                               data=a.out))
        summary(model2)

        ## Also show thresholds by including thresholds with coefficients
        model3 <- mi.eval(polr(civlib ~ log(gdp_pc) + log(population),
                               data=a.out),
                          coef=function(x) c(x$coefficients, x$zeta))
        summary(model2)
    }
}
```

`robust.summary` *Robust summary*

Description

Output summary information using robust or clustered robust standard errors.

Usage

```
## S3 method for class 'robustified'
summary(object, ...)

robust.summary(x, cluster, type, omega, ...)
```

Arguments

`object`	An object of class `robustified`, usually generated by `robustify`.
`x`	A model of class `lm`, `glm`, or any other class which contains a `call` object and methods for `estfun` and `nobs`.
`cluster`	The variable on which to cluster (if any). If this is not specified, unclustered robust standard errors using `vcovHC` are used. If this is specified, clustered robust standard errors using `vcovCR` are used.
`type`	A character string specifying the estimation type. The default is to use the defaults for `vcovHC` or `vcovCR`, depending on whether `cluster` is specified. For details, see `vcovHC` or `vcovCR`.
`omega`	A vector or a function depending on the arguments 'residuals' (the working residuals of the model), 'diaghat' (the diagonal of the corresponding hat matrix) and 'df' (the residual degrees of freedom). For details, see `vcovHC` or `vcovCR`.
`...`	Any additional arguments to be passed to `coeftest`.

Details

Both functions provide summary output with robust (Huber-White) or clustered robust standard errors based on vcovHC or vcovCR, respectively. The summary method works on objects where the type of the standard errors has already been set by robustify. The robust.summary function works on unadjusted objects. Thus, robust.summary(x,...) is a shorthand for summary(robustify(x,...)).

For robust.summary, if the cluster option is specified, clustered robust standard errors are used based on the variance-covariance matrix from vcovCR with clustering on cluster. If not, robust standard errors are used based on the variance-covariance matrix from vcovHC.

Value

An object of class summary.robustified containing a coefficients object computed using coeftest and the method attribute specifying the type of standard errors used.

See Also

See Also robustify, vcovHC, vcovCR and coeftest.

Examples

```
## With clustering
clotting <- data.frame(
    cl = 1:9,
    u = c(5,10,15,20,30,40,60,80,100),
    lot = c(118,58,42,35,27,25,21,19,18,
            69,35,26,21,18,16,13,12,12))
clot.model <- glm(lot ~ log(u), data = clotting, family = Gamma)
robust.summary(clot.model, cluster=cl)

## Without clustering
data(swiss)
model1 <- lm(Fertility ~ ., data = swiss)
robust.summary(model1)
model1r <- robustify(model1)
summary(model1r)
```

---

robustify *Robustify a model*

Description

Create a robustified object that includes robust or clustered robust standard errors.

Usage

```
robustify(x, cluster, type, omega, ...)
```

Arguments

x	A model of class lm, glm, or any other class which contains a call object and methods for estfun and nobs.
cluster	The variable on which to cluster (if any). If this is not specified, unclustered robust standard errors using vcovHC are used. If this is specified, clustered robust standard errors using vcovCR are used.
type	A character string specifying the estimation type. The default for linear models of class lm but not glm is to use "HC1" for vcovHC or "CR1" for vcovCR, depending on whether cluster is specified. For other models, the default is to use "HC" for vcovHC or "CR" for vcovCR, depending on whether cluster is specified. This mirrors the defaults used by Stata as closely as possible. For details, see vcovHC or vcovCR.
omega	A vector or a function depending on the arguments 'residuals' (the working residuals of the model), 'diaghat' (the diagonal of the corresponding hat matrix) and 'df' (the residual degrees of freedom). For details, see vcovHC or vcovCR.
...	Any additional arguments to be passed to coeftest.

Details

This function creates a robustified object containing the model, coefficients, and variance-covariance matrix based on vcovHC or vcovCR, respectively. If the cluster option is specified, the variance-covariance matrix is computed using vcovCR with clustering on cluster. If not, the variance-covariance matrix is computed using vcovHC. For generating formatted tables of regression coefficients, the outputted objects should be compatible with the 'texreg' package. When used with lm, glm or a few other types of models, these objects are also compatible with the 'stargazer' package.

Value

An object of class robustified with the method attribute specifying the type of standard errors used.

References

Cameron, A. Colin, and Douglas L. Miller. "A Practitioner's Guide to Cluster-Robust Inference." *Journal of Human Resources* 50, no. 2 (Spring 2015): 317-372.

See Also

See Also summary.robustified, vcovHC, vcovCR and coeftest.

Examples

```
## With clustering
clotting <- data.frame(
    cl = 1:9,
    u = c(5,10,15,20,30,40,60,80,100),
    lot = c(118,58,42,35,27,25,21,19,18,
            69,35,26,21,18,16,13,12,12))
```

```
clot.model <- glm(lot ~ log(u), data = clotting, family = Gamma)
robust.clot.model <- robustify(clot.model, cluster=cl)
robust.clot.model
summary(robust.clot.model)

## Without clustering
data(swiss)
model1 <- robustify(lm(Fertility ~ ., data = swiss))
model1
summary(model1)
```

`summary.mi.estimates` *Summary for multiple imputation*

Description

Output summary information for estimates computed on multiply imputed data sets.

Usage

```
## S3 method for class 'mi.estimates'
summary(object, ...)
```

Arguments

`object`	An object of class `mi.estimates`, usually computed with `mi.eval`.
`...`	Any additional arguments to be passed to `coeftest`.

Details

This function provides summary output for models estimated using multiple imputation using `mi.eval`.

Value

An object of class `summary.mi.estimates` containing a `coefficients` object of class `coeftest` and other summary information.

See Also

See Also `mi.eval` and `amelia`.

Examples

```
if (require("Amelia")) {
    data(africa)
    a.out <- amelia(x = africa, cs = "country", ts = "year", logs = "gdp_pc")

    model <- mi.eval(lm(civlib ~ log(gdp_pc), data=a.out, subset=year==1973))

    summary(model)
}
```

---

vcovCR *Clustered Robust Covariance Matrix Estimation*

Description

Robust estimation of the covariance matrix of the coefficient estimates in regression models with clustering.

Usage

```
vcovCR(x, cluster = NULL, type = c("CR", "CR0", "CR1"))
```

Arguments

x	A fitted model object.
cluster	A variable or expression giving the cluster for each observation.
type	A character string specifying the estimation type. For details see below.

Details

The default type of "CR" uses the same adjustment as 'Stata'. The values of "CR0" and "CR1" are analogous to "HC0" and "HC1", respectively, in vcovHC.

Value

A matrix containing the covariance matrix estimate with attribute type giving the type option used in estimating it.

See Also

See Also robust.summary and vcovHC.

Examples

```
clotting <- data.frame(
    cl = rep(1:2,each=9),
    u = c(5,10,15,20,30,40,60,80,100),
    lot = c(118,58,42,35,27,25,21,19,18,
            69,35,26,21,18,16,13,12,12))
clot.model <- glm(lot ~ log(u), data = clotting, family = Gamma)
vcovCR(clot.model, cluster=cl)

data(swiss)
model1 <- lm(Fertility ~ ., data = swiss)
## These should give the same answer
vcovCR(model1, cluster=1:nobs(model1), type="CR0")
sandwich::vcovHC(model1, type="HC0")
```

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