

Package ‘betaSandwich’

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Title Robust Confidence Intervals for Standardized Regression Coefficients

Version 1.0.3.9000

Description Generates robust confidence intervals for standardized regression coefficients using heteroskedasticity-consistent standard errors for models fitted by `lm()` as described in Dudgeon (2017) <[doi:10.1007/s11336-017-9563-z](https://doi.org/10.1007/s11336-017-9563-z)>.

URL <https://github.com/jeksterslab/betaSandwich>,
<https://jeksterslab.github.io/betaSandwich/>

BugReports <https://github.com/jeksterslab/betaSandwich/issues>

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BetaADF	<i>Estimate Standardized Regression Coefficients and Sampling Covariance Matrix Using the Asymptotic Distribution-Free Approach</i>
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Description

Estimate Standardized Regression Coefficients and Sampling Covariance Matrix Using the Asymptotic Distribution-Free Approach

Usage

BetaADF(object)

Arguments

object Object of class lm.

Details

Note that while the calculation in BetaADF() is different from betaDelta::BetaDelta() with type = "adf", the results are numerically equivalent. BetaADF() is appropriate when sample sizes are moderate to large (n > 250). BetaHC() is recommended in most situations.

Value

Returns an object of class betasandwich which is a list with the following elements:

- call** Function call.
- lm** Object of class lm.
- lm_process** Pre-processed object of class lm.

type Standard error type.
gamma Asymptotic covariance matrix of the sample covariance matrix.
acov Asymptotic covariance matrix of the standardized slopes.
vcov Sampling covariance matrix of the standardized slopes.
est Vector of standardized slopes.

Author(s)

Ivan Jacob Agaloos Pesigan

See Also

Other Beta Sandwich Functions: [BetaHC\(\)](#), [BetaN\(\)](#)

Examples

```
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
std <- BetaADF(object)
# Methods -----
print(std)
summary(std)
coef(std)
vcov(std)
confint(std, level = 0.95)
## Differences of standardized regression coefficients -----
out <- dif(std)
print(out)
summary(out)
coef(out)
vcov(out)
confint(out, level = 0.95)
## Multiple Correlation -----
out <- rsq(std)
print(out)
summary(out)
coef(out)
vcov(out)
confint(out, level = 0.95)
```

BetaHC

*Estimate Standardized Regression Coefficients and Robust Sampling
Covariance Matrix*

Description

Estimate Standardized Regression Coefficients and Robust Sampling Covariance Matrix

Usage

```
BetaHC(object, type = "hc3", g1 = 1, g2 = 1.5, k = 0.7)
```

Arguments

object	Object of class <code>lm</code> .
type	Character string. Correction type. Possible values are "hc0", "hc1", "hc2", "hc3", "hc4", "hc4m", and "hc5".
g1	Numeric. g1 value for type = "hc4m" or type = "hc5".
g2	Numeric. g2 value for type = "hc4m".
k	Numeric. Constant for type = "hc5"

Value

Returns an object of class `betasandwich` which is a list with the following elements:

call Function call.

lm Object of class `lm`.

lm_process Pre-processed object of class `lm`.

type Standard error type.

gamman Asymptotic covariance matrix of the sample covariance matrix assuming multivariate normal distribution.

gammahc Asymptotic covariance matrix HC adjustment.

gamma Asymptotic covariance matrix of the sample covariance matrix.

acov Asymptotic covariance matrix of the standardized slopes.

vcov Sampling covariance matrix of the standardized slopes.

est Vector of standardized slopes.

Author(s)

Ivan Jacob Agaloos Pesigan

References

Dudgeon, P. (2017). Some improvements in confidence intervals for standardized regression coefficients. *Psychometrika*, 82(4), 928–951. doi:[10.1007/s113360179563z](https://doi.org/10.1007/s113360179563z)

See Also

Other Beta Sandwich Functions: [BetaADF\(\)](#), [BetaN\(\)](#)

Examples

```

object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
std <- BetaHC(object)
# Methods -----
print(std)
summary(std)
coef(std)
vcov(std)
confint(std, level = 0.95)
## Differences of standardized regression coefficients -----
out <- dif(std)
print(out)
summary(out)
coef(out)
vcov(out)
confint(out, level = 0.95)
## Multiple Correlation -----
out <- rsq(std)
print(out)
summary(out)
coef(out)
vcov(out)
confint(out, level = 0.95)

```

BetaN

Estimate Standardized Regression Coefficients and Sampling Covariance Matrix Assuming Multivariate Normality

Description

Estimate Standardized Regression Coefficients and Sampling Covariance Matrix Assuming Multivariate Normality

Usage

```
BetaN(object)
```

Arguments

object Object of class `lm`.

Details

Note that while the calculation in `BetaN()` is different from `betaDelta::BetaDelta()` with `type = "mvn"`, the results are numerically equivalent. `BetaN()` assumes multivariate normality. `BetaHC()` is recommended in most situations.

Value

Returns an object of class `betasandwich` which is a list with the following elements:

call Function call.

lm Object of class `lm`.

lm_process Pre-processed object of class `lm`.

type Standard error type.

gamma Asymptotic covariance matrix of the sample covariance matrix.

acov Asymptotic covariance matrix of the standardized slopes.

vcov Sampling covariance matrix of the standardized slopes.

est Vector of standardized slopes.

Author(s)

Ivan Jacob Agaloos Pesigan

See Also

Other Beta Sandwich Functions: [BetaADF\(\)](#), [BetaHC\(\)](#)

Examples

```
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
std <- BetaN(object)
# Methods -----
print(std)
summary(std)
coef(std)
vcov(std)
confint(std, level = 0.95)
## Differences of standardized regression coefficients -----
out <- dif(std)
print(out)
summary(out)
coef(out)
vcov(out)
confint(out, level = 0.95)
## Multiple Correlation -----
out <- rsq(std)
print(out)
summary(out)
coef(out)
vcov(out)
confint(out, level = 0.95)
```

coef.betasandwich	<i>Standardized Regression Slopes</i>
-------------------	---------------------------------------

Description

Standardized Regression Slopes

Usage

```
## S3 method for class 'betasandwich'  
coef(object, ...)
```

Arguments

object	Object of class betasandwich.
...	additional arguments.

Value

Returns a vector of standardized regression slopes.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)  
std <- BetaHC(object)  
coef(std)
```

coef.difbetasandwich	<i>Differences of Standardized Regression Slopes</i>
----------------------	--

Description

Differences of Standardized Regression Slopes

Usage

```
## S3 method for class 'difbetasandwich'  
coef(object, ...)
```

Arguments

object	Object of class difbetasandwich.
...	additional arguments.

Value

Returns a vector of differences of standardized regression slopes.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
std <- BetaHC(object)
out <- dif(std)
coef(out)
```

coef.rsqbetasandwich *Differences of Standardized Regression Slopes*

Description

Differences of Standardized Regression Slopes

Usage

```
## S3 method for class 'rsqbetasandwich'
coef(object, ...)
```

Arguments

object	Object of class rsqbetasandwich.
...	additional arguments.

Value

Returns a vector of differences of standardized regression slopes.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
std <- BetaHC(object)
out <- rsq(std)
coef(out)
```

confint.betasandwich *Confidence Intervals for Standardized Regression Slopes*

Description

Confidence Intervals for Standardized Regression Slopes

Usage

```
## S3 method for class 'betasandwich'
confint(object, parm = NULL, level = 0.95, ...)
```

Arguments

object	Object of class betasandwich.
parm	a specification of which parameters are to be given confidence intervals, either a vector of numbers or a vector of names. If missing, all parameters are considered.
level	the confidence level required.
...	additional arguments.

Value

Returns a matrix of confidence intervals.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
std <- BetaHC(object)
confint(std, level = 0.95)
```

confint.difbetasandwich *Confidence Intervals for Differences of Standardized Regression Slopes*

Description

Confidence Intervals for Differences of Standardized Regression Slopes

Usage

```
## S3 method for class 'difbetasandwich'
confint(object, parm = NULL, level = 0.95, ...)
```

Arguments

object	Object of class difbetasandwich.
parm	a specification of which parameters are to be given confidence intervals, either a vector of numbers or a vector of names. If missing, all parameters are considered.
level	the confidence level required.
...	additional arguments.

Value

Returns a matrix of confidence intervals.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
std <- BetaHC(object)
out <- dif(std)
confint(out, level = 0.95)
```

confint.rsqbetasandwich

Confidence Intervals for Differences of Standardized Regression Slopes

Description

Confidence Intervals for Differences of Standardized Regression Slopes

Usage

```
## S3 method for class 'rsqbetasandwich'
confint(object, parm = NULL, level = 0.95, ...)
```

Arguments

<code>object</code>	Object of class <code>rsqbetasandwich</code> .
<code>parm</code>	a specification of which parameters are to be given confidence intervals, either a vector of numbers or a vector of names. If missing, all parameters are considered.
<code>level</code>	the confidence level required.
<code>...</code>	additional arguments.

Value

Returns a matrix of confidence intervals.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
std <- BetaHC(object)
out <- rsq(std)
confint(out, level = 0.95)
```

<code>dif</code>	<i>Differences of Regression Slopes</i>
------------------	---

Description

Differences of Regression Slopes

Usage

```
dif(object, ...)

## S3 method for class 'betasandwich'
dif(object, ...)
```

Arguments

<code>object</code>	Object used to select a method.
<code>...</code>	additional arguments.

Author(s)

Ivan Jacob Agaloos Pesigan

nas1982

*1982 National Academy of Sciences Doctoral Programs Data***Description**

1982 National Academy of Sciences Doctoral Programs Data

Usage

nas1982

Format

Ratings of 46 doctoral programs in psychology in the USA with the following variables:

QUALITY Program quality ratings.**NFACUL** Number of faculty members in the program.**NGRADS** Number of program graduates.**PCTSUPP** Percentage of program graduates who received support.**PCTGRT** Percent of faculty members holding research grants.**NARTIC** Number of published articles attributed to program faculty member.**PCTPUB** Percent of faculty with one or more published article.**References**

National Research Council. (1982). *An assessment of research-doctorate programs in the United States: Social and behavioral sciences*. doi:10.17226/9781. Reproduced with permission from the National Academy of Sciences, Courtesy of the National Academies Press, Washington, D.C.

print.betasandwich

*Print Method for an Object of Class betasandwich***Description**

Print Method for an Object of Class betasandwich

Usage

```
## S3 method for class 'betasandwich'
print(x, alpha = c(0.05, 0.01, 0.001), digits = 4, ...)
```

Arguments

x	Object of class betasandwich.
alpha	Significance level.
digits	Digits to print.
...	additional arguments.

Value

Returns a matrix of standardized regression slopes, standard errors, test statistics, p-values, and confidence intervals.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
std <- BetaHC(object)
print(std)
```

print.difbetasandwich *Print Method for an Object of Class difbetasandwich*

Description

Print Method for an Object of Class difbetasandwich

Usage

```
## S3 method for class 'difbetasandwich'
print(x, alpha = c(0.05, 0.01, 0.001), digits = 4, ...)
```

Arguments

x	Object of class difbetasandwich.
alpha	Significance level.
digits	Digits to print.
...	additional arguments.

Value

Returns a matrix of differences of standardized regression slopes, standard errors, test statistics, p-values, and confidence intervals.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
std <- BetaHC(object)
out <- dif(std)
print(out)
```

print.rsqbetasandwich *Print Method for an Object of Class rsqbetasandwich*

Description

Print Method for an Object of Class rsqbetasandwich

Usage

```
## S3 method for class 'rsqbetasandwich'
print(x, alpha = c(0.05, 0.01, 0.001), digits = 4, ...)
```

Arguments

x	Object of class rsqbetasandwich.
alpha	Significance level.
digits	Digits to print.
...	additional arguments.

Value

Returns a matrix of standardized regression slopes, standard errors, test statistics, p-values, and confidence intervals.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
std <- BetaHC(object)
out <- rsq(std)
print(out)
```

rsq	<i>Estimate Coefficient of Determination (R-Squared and Adjusted R-Squared) and Sampling Covariance Matrix</i>
-----	--

Description

Estimate Coefficient of Determination (R-Squared and Adjusted R-Squared) and Sampling Covariance Matrix

Usage

```
rsq(object, ...)

## S3 method for class 'betasandwich'
rsq(object, ...)
```

Arguments

object	Object used to select a method.
...	additional arguments.

Author(s)

Ivan Jacob Agaloos Pesigan

summary.betasandwich	<i>Summary Method for an Object of Class betasandwich</i>
----------------------	---

Description

Summary Method for an Object of Class betasandwich

Usage

```
## S3 method for class 'betasandwich'
summary(object, alpha = c(0.05, 0.01, 0.001), digits = 4, ...)
```

Arguments

object	Object of class betasandwich.
alpha	Significance level.
digits	Digits to print.
...	additional arguments.

Value

Returns a matrix of standardized regression slopes, standard errors, test statistics, p-values, and confidence intervals.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
std <- BetaHC(object)
summary(std)
```

```
summary.difbetasandwich
```

Summary Method for an Object of Class difbetasandwich

Description

Summary Method for an Object of Class difbetasandwich

Usage

```
## S3 method for class 'difbetasandwich'
summary(object, alpha = c(0.05, 0.01, 0.001), digits = 4, ...)
```

Arguments

object	Object of class difbetasandwich.
alpha	Significance level.
digits	Digits to print.
...	additional arguments.

Value

Returns a matrix of differences of standardized regression slopes, standard errors, test statistics, p-values, and confidence intervals.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
std <- BetaHC(object)
out <- dif(std)
summary(out)
```

`summary.rsqbetasandwich`*Summary Method for an Object of Class rsqbetasandwich*

Description

Summary Method for an Object of Class rsqbetasandwich

Usage

```
## S3 method for class 'rsqbetasandwich'  
summary(object, alpha = c(0.05, 0.01, 0.001), digits = 4, ...)
```

Arguments

<code>object</code>	Object of class rsqbetasandwich.
<code>alpha</code>	Significance level.
<code>digits</code>	Digits to print.
<code>...</code>	additional arguments.

Value

Returns a matrix of standardized regression slopes, standard errors, test statistics, p-values, and confidence intervals.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)  
std <- BetaHC(object)  
out <- rsq(std)  
summary(out)
```

vcov.betasandwich	<i>Sampling Covariance Matrix of the Standardized Regression Slopes</i>
-------------------	---

Description

Sampling Covariance Matrix of the Standardized Regression Slopes

Usage

```
## S3 method for class 'betasandwich'
vcov(object, ...)
```

Arguments

object	Object of class betasandwich.
...	additional arguments.

Value

Returns a matrix of the variance-covariance matrix of standardized slopes.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
std <- BetaHC(object)
vcov(std)
```

vcov.difbetasandwich	<i>Sampling Covariance Matrix of Differences of Standardized Regression Slopes</i>
----------------------	--

Description

Sampling Covariance Matrix of Differences of Standardized Regression Slopes

Usage

```
## S3 method for class 'difbetasandwich'
vcov(object, ...)
```

Arguments

object Object of class difbetasandwich.
 ... additional arguments.

Value

Returns a matrix of the variance-covariance matrix of differences of standardized regression slopes.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
std <- BetaHC(object)
out <- dif(std)
vcov(out)
```

vcov.rsqbetasandwich	<i>Sampling Covariance Matrix of Differences of Standardized Regression Slopes</i>
----------------------	--

Description

Sampling Covariance Matrix of Differences of Standardized Regression Slopes

Usage

```
## S3 method for class 'rsqbetasandwich'
vcov(object, ...)
```

Arguments

object Object of class rsqbetasandwich.
 ... additional arguments.

Value

Returns a matrix of the variance-covariance matrix of differences of standardized regression slopes.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
std <- BetaHC(object)
out <- rsq(std)
vcov(out)
```

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