Package 'betaSandwich'

February 10, 2023
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="">.</doi:10.1007>
<pre>URL https://github.com/jeksterslab/betaSandwich,</pre>
https://jeksterslab.github.io/betaSandwich/
<pre>BugReports https://github.com/jeksterslab/betaSandwich/issues</pre>
License MIT + file LICENSE
Encoding UTF-8
LazyData true
Roxygen list(markdown = TRUE)
Depends R (>= $3.5.0$)
Imports methods
Suggests knitr, rmarkdown, testthat
RoxygenNote 7.2.3
NeedsCompilation no
Author Ivan Jacob Agaloos Pesigan [aut, cre, cph] (https://orcid.org/0000-0003-4818-8420)
Maintainer Ivan Jacob Agaloos Pesigan <r.jeksterslab@gmail.com></r.jeksterslab@gmail.com>
R topics documented:
BetaADF BetaHC BetaN coef.betasandwich coef.difbetasandwich coef.rsqbetasandwich

2 BetaADF

BetaA					,	 l Sampling Cov ee Approach	vari-
Index							21
	vcov.betasandwich . vcov.difbetasandwich vcov.rsqbetasandwich		 	 		 	. 18
	summary.betasandwich summary.difbetasandw summary.rsqbetasandw	ich	 	 		 	. 16
	print.rsqbetasandwich rsq		 	 		 	. 15
	nas1982 print.betasandwich . print.difbetasandwich		 	 		 	. 12
	confint.rsqbetasandwic	h 	 	 		 	. 10
	confint.betasandwich confint.difbetasandwich						

Description

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

Usage

BetaADF(object)

Arguments

object

Object of class 1m.

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 1m.

lm_process Pre-processed object of class lm.

BetaHC 3

```
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)</pre>
# Methods -----
print(std)
summary(std)
coef(std)
vcov(std)
confint(std, level = 0.95)
## Differences of standardized regression coefficients ------
out <- dif(std)</pre>
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)
```

 ${\tt BetaHC}$

Estimate Standardized Regression Coefficients and Robust Sampling Covariance Matrix

Description

Estimate Standardized Regression Coefficients and Robust Sampling Covariance Matrix

4 BetaHC

Usage

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

Arguments

object	Object of class 1m.
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 1m.

lm_process Pre-processed object of class 1m.

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

See Also

Other Beta Sandwich Functions: BetaADF(), BetaN()

BetaN 5

Examples

```
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
std <- BetaHC(object)</pre>
# 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 1m.

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.

6 BetaN

Value

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

call Function call.

lm Object of class 1m.

lm_process Pre-processed object of class 1m.

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()

```
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)</pre>
std <- BetaN(object)</pre>
# 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 7

coef.betasandwich

Standardized Regression Slopes

Description

Standardized Regression Slopes

Usage

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

Arguments

Object of class betasandwich. object 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)</pre>
std <- BetaHC(object)</pre>
coef(std)
```

coef.difbetasandwich Differences of Standardized Regression Slopes

Description

Differences of Standardized Regression Slopes

Usage

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

Arguments

Object of class difbetasandwich. object

additional arguments.

coef.rsqbetasandwich

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)</pre>
```

coef.rsqbetasandwich Differences of Standardized Regression Slopes

Description

Differences of Standardized Regression Slopes

Usage

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

Arguments

objectObject of class rsqbetasandwich.additional arguments.

Value

Returns a vector of differences of standardized regression slopes.

Author(s)

Ivan Jacob Agaloos Pesigan

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

confint.betasandwich 9

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 consid-

ered.

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)</pre>
```

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 consid-

ered.

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)</pre>
```

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, ...)
```

dif 11

Arguments

object Object of class rsqbetasandwich.

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 consid-

ered.

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 <- rsq(std)
confint(out, level = 0.95)</pre>
```

dif

Differences of Regression Slopes

Description

Differences of Regression Slopes

Usage

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

Arguments

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

Author(s)

Ivan Jacob Agaloos Pesigan

print.betasandwich

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, ...)
```

print.difbetasandwich 13

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)</pre>
std <- BetaHC(object)</pre>
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.

print.rsqbetasandwich

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

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

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

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

rsq 15

rsq

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

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 Summary Method for an Object of Class betasandwich

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)</pre>
```

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

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

```
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

object	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

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

18 vcov.difbetasandwich

vcov.betasandwich

Sampling Covariance Matrix of the Standardized Regression Slopes

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)</pre>
```

vcov.difbetasandwich

Sampling Covariance Matrix of Differences of Standardized Regression Slopes

Description

Sampling Covariance Matrix of Differences of Standardized Regression Slopes

Usage

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

vcov.rsqbetasandwich 19

Arguments

objectObject 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)</pre>
```

vcov.rsqbetasandwich Sampling Covariance Matrix of Differences of Standardized Regression Slopes

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

20 vcov.rsqbetasandwich

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

Index

* Beta Sandwich Functions	dif, 11
BetaADF, 2	
BetaHC, 3	nas1982, <u>12</u>
BetaN, 5	print.betasandwich, 12
* betaSandwich	print.difbetasandwich, 13
BetaADF, 2	print.rsqbetasandwich, 14
BetaHC, 3	print. 13qbc tasanawien, 14
BetaN, 5	rsq, 15
* data	- D
nas1982, <u>12</u>	summary.betasandwich, 15
* methods	summary.difbetasandwich, 16
coef.betasandwich, 7	summary.rsqbetasandwich, 17
coef.difbetasandwich,7	•
<pre>coef.rsqbetasandwich, 8</pre>	vcov.betasandwich, 18
confint.betasandwich, 9	vcov.difbetasandwich, 18
confint.difbetasandwich,9	vcov.rsqbetasandwich, 19
confint.rsqbetasandwich, 10	
dif, 11	
print.betasandwich, 12	
print.difbetasandwich, 13	
print.rsqbetasandwich, 14	
rsg, 15	
summary.betasandwich, 15	
summary.difbetasandwich, 16	
summary.rsqbetasandwich, 17	
vcov.betasandwich, 18	
vcov.difbetasandwich, 18	
vcov.rsqbetasandwich, 19	
rearri aque casananzen, 19	
BetaADF, 2, 4, 6	
BetaHC, 3, 3, 6	
BetaN, 3, 4, 5	
200011, 2, 7, 2	
coef.betasandwich, 7	
coef.difbetasandwich, 7	
coef.rsqbetasandwich, 8	
confint.betasandwich, 9	
confint.difbetasandwich, 9	
confint.rsqbetasandwich, 10	