

# Package ‘betaSandwich’

February 6, 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](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>

**License** MIT + file LICENSE

**Encoding** UTF-8

**LazyData** true

**Roxygen** list(markdown = TRUE)

**Depends** R (>= 3.5.0)

**Imports** methods

**Suggests** knitr, rmarkdown, testthat, betaDelta

**RoxygenNote** 7.2.3

**NeedsCompilation** no

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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)
```

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BetaHC	<i>Estimate Standardized Regression Coefficients and Robust Sampling Covariance Matrix</i>
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**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.  
**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)
```

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BetaN	<i>Estimate Standardized Regression Coefficients and Sampling Covariance Matrix Assuming Multivariate Normality</i>
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### 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)
```

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coef.betasandwich

*Standardized Regression Slopes*

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**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)
```

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coef.difbetasandwich    *Differences of Standardized Regression Slopes*

---

**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)
```

---

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)
```



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dif	<i>Differences of Regression Slopes</i>
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**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

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nas1982	<i>1982 National Academy of Sciences Doctoral Programs Data</i>
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**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.

**NEACUL** 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.

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print.betasandwich	<i>Print Method for an Object of Class betasandwich</i>
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## 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 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)
```

---

summary.betasandwich *Summary Method for an Object of Class betasandwich*

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**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 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)
```

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vcov.betasandwich

*Sampling Covariance Matrix of the Standardized Regression Slopes*

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**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)
```

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vcov.difbetasandwich	<i>Sampling Covariance Matrix of Differences of Standardized Regression Slopes</i>
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**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)
```

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