# 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>.

**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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## R topics documented:

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

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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 *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 `lm`. |
| `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

## 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` *Estimate Standardized Regression Coefficients and Sampling Covariance Matrix Assuming Multivariate Normality*

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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)
```

---

# coef.betasandwich *Standardized Regression Slopes*

---

## 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 *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)
```

## 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

## 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 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

### 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)
```

---

## 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)
```

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, ...)
```

## 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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