Package 'betaDelta'

February 4, 2023

Title Confidence Intervals for Standardized Regression Coefficients

Version 1.0.0.9000

Description Generates confidence intervals for standardized regression coefficients using delta method standard errors for models fitted by lm() as described in Yuan and Chan (2011) <doi:10.1007/s11336-011-9224-6> and Jones and Waller (2015) <doi:10.1007/s11336-013-9380-y>.

URL https://github.com/jeksterslab/betaDelta, https://jeksterslab.github.io/betaDelta/

BugReports https://github.com/jeksterslab/betaDelta/issues

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Encoding UTF-8

LazyData true

Roxygen list(markdown = TRUE)

Depends R (>= 3.5.0)

Imports methods, numDeriv

Suggests knitr, rmarkdown, testthat, betaSandwich

RoxygenNote 7.2.3

NeedsCompilation no

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R topics documented:

`BetaDelta` *Estimate Standardized Regression Coefficients and Sampling Covariance Matrix*

Description

Estimate Standardized Regression Coefficients and Sampling Covariance Matrix

Usage

```
BetaDelta(object, type = "mvn")
```

Arguments

`object`	Object of class `lm`.
`type`	Character string. If `type = "mvn"`, use the multivariate normal-theory approach. If `type = "adf"`, use the asymptotic distribution-free approach.

Value

Returns an object of class `betadelta` 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.

est Vector of standardized slopes.

vcov Sampling covariance matrix of the standardized slopes.

acov Asymptotic covariance matrix of the standardized slopes.

n Sample size.

p Number of regressors.

df $n - p - 1$ degrees of freedom.

Author(s)

Ivan Jacob Agaloos Pesigan

References

Jones, J. A., & Waller, N. G. (2015). The normal-theory and asymptotic distribution-free (ADF) covariance matrix of standardized regression coefficients: Theoretical extensions and finite sample behavior. *Psychometrika*, *80*(2), 365–378. doi:10.1007/s113360139380y

Yuan, K.-H., & Chan, W. (2011). Biases and standard errors of standardized regression coefficients. *Psychometrika*, *76*(4), 670–690. doi:10.1007/s1133601192246

See Also

Other Beta Delta Functions: `dif.betadelta()`, `dif()`, `rsq.betadelta()`, `rsq()`

Examples

```
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
std <- BetaDelta(object)
# Methods -----------------------------------------------------
print(std)
summary(std)
coef(std)
vcov(std)
confint(std, level = 0.95)
```

`coef.betadelta` *Standardized Regression Slopes*

Description

Standardized Regression Slopes

Usage

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

Arguments

`object`	Object of class `betadelta`.
`...`	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 <- BetaDelta(object)
coef(std)
```

---

coef.difbetadelta *Differences of Standardized Regression Slopes*

Description

Differences of Standardized Regression Slopes

Usage

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

Arguments

object	Object of class difbetadelta.
...	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 <- BetaDelta(object)
out <- dif(std)
coef(out)
```

coef.rsqbetadelta *R-Squared and Adjusted R-Squared*

Description

R-Squared and Adjusted R-Squared

Usage

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

Arguments

object	Object of class rsqrdelta.
...	additional arguments.

Value

Returns a vector of R-squared and adjusted R-squared.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

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

confint.betadelta *Confidence Intervals for Standardized Regression Slopes*

Description

Confidence Intervals for Standardized Regression Slopes

Usage

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

Arguments

object	Object of class betadelta.
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 <- BetaDelta(object)
confint(std, level = 0.95)
```

---

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

Description

Confidence Intervals for Differences of Standardized Regression Slopes

Usage

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

Arguments

object	Object of class difbetadelta.
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 <- BetaDelta(object)
out <- dif(std)
confint(out, level = 0.95)
```

---

confint.rsqbetadelta *Confidence Intervals for R-Squared and Adjusted R-Squared*

Description

Confidence Intervals for R-Squared and Adjusted R-Squared

Usage

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

Arguments

object	Object of class rsqrdelta.
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 <- BetaDelta(object)
out <- rsq(std)
confint(out, level = 0.95)
```

dif *Differences of Standardized Regression Slopes*

Description

Differences of Standardized Regression Slopes

Usage

```
dif(object)
```

Arguments

object	Object used to select a method.

Author(s)

Ivan Jacob Agaloos Pesigan

See Also

Other Beta Delta Functions: BetaDelta(), dif.betadelta(), rsq.betadelta(), rsq()

dif.betadelta *Differences of Standardized Regression Slopes*

Description

Differences of Standardized Regression Slopes

Usage

```
## S3 method for class 'betadelta'
dif(object)
```

Arguments

object	Object of class betadelta.

Value

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

call Function call.

betadelta Object of class betadelta.

est Vector of differences of standardized regression slopes.

vcov Sampling covariance matrix of differences of standardized slopes.

acov Asymptotic covariance matrix of differences of standardized slopes.

Author(s)

Ivan Jacob Agaloos Pesigan

See Also

Other Beta Delta Functions: `BetaDelta()`, `dif()`, `rsq.betadelta()`, `rsq()`

Examples

```
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
std <- BetaDelta(object)
out <- dif(std)
# Methods ------------------------------------------------------
print(out)
summary(out)
coef(out)
vcov(out)
confint(out, level = 0.95)
```

---

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.betadelta *Print Method for an Object of Class* betadelta

Description

Print Method for an Object of Class betadelta

Usage

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

Arguments

x	Object of class betadelta.
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 <- BetaDelta(object)
print(std)
```

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

Description

Print Method for an Object of Class difbetadelta

Usage

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

Arguments

x	Object of class difbetadelta.
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 <- BetaDelta(object)
out <- dif(std)
print(out)
```

---

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

---

Description

Print Method for an Object of Class rsqbetadelta

Usage

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

Arguments

x	Object of class rsqbetadelta.
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 <- BetaDelta(object)
out <- rsq(std)
print(out)
```

`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)
```

Arguments

`object`	Object used to select a method.

Author(s)

Ivan Jacob Agaloos Pesigan

See Also

Other Beta Delta Functions: `BetaDelta()`, `dif.betadelta()`, `dif()`, `rsq.betadelta()`

`rsq.betadelta` *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

```
## S3 method for class 'betadelta'
rsq(object)
```

Arguments

`object`	Object of class `betadelta`.

Value

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

betadelta Object of class `betadelta`.

est R-squared (R^2) and adjusted R-squared ($\bar{R}^2$).

vcov Sampling covariance matrix of R-squared (R^2) and adjusted R-squared ($\bar{R}^2$).

acov Asymptotic covariance matrix of R-squared (R^2) and adjusted R-squared ($\bar{R}^2$).

Author(s)

Ivan Jacob Agaloos Pesigan

See Also

Other Beta Delta Functions: `BetaDelta()`, `dif.betadelta()`, `dif()`, `rsq()`

Examples

```
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
std <- BetaDelta(object)
out <- rsq(std)
# Methods -----------------------------------------------------
print(out)
summary(out)
coef(out)
vcov(out)
confint(out, level = 0.95)
```

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

Description

Summary Method for an Object of Class betadelta

Usage

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

Arguments

object	Object of class betadelta.
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 <- BetaDelta(object)
summary(std)
```

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

Description

Summary Method for an Object of Class difbetadelta

Usage

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

Arguments

object	Object of class difbetadelta.
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 <- BetaDelta(object)
out <- dif(std)
summary(out)
```

---

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

---

Description

Summary Method for an Object of Class rsqbetadelta

Usage

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

Arguments

object	Object of class rsqbetadelta.
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 <- BetaDelta(object)
out <- rsq(std)
summary(out)
```

---

vcov.betadelta *Sampling Covariance Matrix of the Standardized Regression Slopes*

Description

Sampling Covariance Matrix of the Standardized Regression Slopes

Usage

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

Arguments

object	Object of class betadelta.
...	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 <- BetaDelta(object)
vcov(std)
```

vcov.difbetadelta *Sampling Covariance Matrix of Differences of Standardized Regression Slopes*

Description

Sampling Covariance Matrix of Differences of Standardized Regression Slopes

Usage

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

Arguments

object	Object of class difbetadelta.
...	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 <- BetaDelta(object)
out <- dif(std)
vcov(out)
```

vcov.rsqbetadelta *Sampling Covariance Matrix of R-Squared and Adjusted R-Squared*

Description

Sampling Covariance Matrix of R-Squared and Adjusted R-Squared

Usage

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

Arguments

`object`	Object of class `rsqbetadelta`.
`...`	additional arguments.

Value

Returns a matrix of the variance-covariance matrix of R-squared and adjusted R-squared.

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

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

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