

Package ‘betaMC’

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Title Monte Carlo Confidence Intervals for Standardized Regression Coefficients

Version 1.0.0

Description Generates Monte Carlo confidence intervals for standardized regression coefficients for models fitted by `lm()`.
'betaMC' combines ideas from Monte Carlo confidence intervals for the indirect effect (Preacher and Selig, 2012 <[doi:10.1080/19312458.2012.679848](https://doi.org/10.1080/19312458.2012.679848)>) and the sampling covariance matrix of regression coefficients (Dudgeon, 2017 <[doi:10.1007/s11336-017-9563-z](https://doi.org/10.1007/s11336-017-9563-z)>) to generate confidence intervals for standardized regression coefficients.

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

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

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Encoding UTF-8

LazyData true

Roxygen list(markdown = TRUE)

Depends R (>= 3.5.0)

Imports stats, 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>

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BetaMC	<i>Estimate Standardized Regression Coefficients and Generate Sampling Distributions Using the Monte Carlo Method</i>
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Description

Estimate Standardized Regression Coefficients and Generate Sampling Distributions Using the Monte Carlo Method

Usage

```
BetaMC(  
  object,  
  R = 20000L,  
  type = "hc3",  
  g1 = 1,  
  g2 = 1.5,  
  k = 0.7,  
  decomposition = "eigen",  
  pd = TRUE,  
  tol = 1e-06  
)
```

Arguments

object	Object of class lm.
R	Positive integer. Number of Monte Carlo replications.
type	Character string. Sampling covariance matrix type. Possible values are "mvn", "adf", "hc0", "hc1", "hc2", "hc3", "hc4", "hc4m", and "hc5". type = "mvn" uses the normal-theory sampling covariance matrix. type = "adf" uses the asymptotic distribution-free sampling covariance matrix. type = "hc0" through hc5 uses different versions of heteroskedasticity-consistent sampling covariance matrix.
g1	Numeric. g1 value for type = "hc4m" or type = "hc5".
g2	Numeric. g2 value for type = "hc4m".
k	Numeric. Constant for type = "hc5"

<code>decomposition</code>	Character string. Matrix decomposition of the sampling variance-covariance matrix for the data generation. If <code>decomposition = "chol"</code> , use Cholesky decomposition. If <code>decomposition = "eigen"</code> , use eigenvalue decomposition. If <code>decomposition = "svd"</code> , use singular value decomposition.
<code>pd</code>	Logical. If <code>pd = TRUE</code> , check if the sampling variance-covariance matrix is positive definite using <code>tol</code> .
<code>tol</code>	Numeric. Tolerance used for <code>pd</code> .

Details

The empirical sampling distribution of parameter estimates for the unstandardized regression model is generated using the Monte Carlo method, that is, random values of parameter estimates are sampled from the multivariate normal distribution using the estimated parameter vector as the mean vector and the specified sampling covariance matrix using the `type` argument as the covariance matrix. The standardized regression coefficients are derived from each randomly generated vector of parameters to generate the empirical sampling distribution of estimates of standardized slopes. Confidence intervals are generated by obtaining percentiles corresponding to $100(1 - \alpha)\%$ from the generated sampling distribution of standardized slopes, where α is the significance level.

Value

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

call Function call.

lm Object of class `lm`.

type Standard error type.

beta Vector of standardized slopes.

vcov Sampling covariance matrix of the standardized slopes.

thetahatstar Sampling distribution of estimates of standardized slopes.

n Sample size.

p Number of regressors.

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

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
- Preacher, K. J., & Selig, J. P. (2012). Advantages of Monte Carlo confidence intervals for indirect effects. *Communication Methods and Measures*, 6(2), 77-98. doi:10.1080/19312458.2012.679848

Examples

```

object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
out <- BetaMC(object, R = 100)
# use a large R, for example, R = 20000 for actual research
# Methods -----
print(out)
summary(out)
coef(out)
vcov(out)
confint(out, level = 0.95)

```

coef.betamc

*Standardized Regression Slopes***Description**

Standardized Regression Slopes

Usage

```

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

```

Arguments

object	Object of class betamc.
...	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)
out <- BetaMC(object, R = 100)
# use a large R, for example, R = 20000 for actual research
coef(out)

```

confint.betamc	<i>Confidence Intervals for Standardized Regression Slopes</i>
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Description

Confidence Intervals for Standardized Regression Slopes

Usage

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

Arguments

object	Object of class betamc.
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)
out <- BetaMC(object, R = 100)
# use a large R, for example, R = 20000 for actual research
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.betamc

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

Print Method for an Object of Class betamc

Usage

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

Arguments

x	Object of Class betamc.
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)
out <- BetaMC(object, R = 100)
# use a large R, for example, R = 20000 for actual research
print(out)
```

summary.betamc

Summary Method for an Object of Class betamc

Description

Summary Method for an Object of Class betamc

Usage

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

Arguments

object	Object of class betamc.
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)
out <- BetaMC(object, R = 100)
# use a large R, for example, R = 20000 for actual research
summary(out)
```

vcov.betamc

Sampling Covariance Matrix of the Standardized Regression Slopes

Description

Sampling Covariance Matrix of the Standardized Regression Slopes

Usage

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

Arguments

object	Object of class betamc.
...	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)
out <- BetaMC(object, R = 100)
# use a large R, for example, R = 20000 for actual research
vcov(out)
```


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