

# Package ‘betaNB’

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**Title** Nonparametric Bootstrap Confidence Intervals for Standardized Regression Coefficients and Other Effect Sizes

**Version** 1.0.0.9000

**Description** Generates nonparametric bootstrap confidence intervals (Efron & Tibshirani, 1993: <doi:10.1201/9780429246593>) for standardized regression coefficients and other effect sizes for models fitted by lm().

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

**BugReports** <https://github.com/jeksterslab/betaNB/issues>

**License** MIT + file LICENSE

**Encoding** UTF-8

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**Roxygen** list(markdown = TRUE)

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BetaNB	<i>Estimate Standardized Regression Coefficients and Generate the Corresponding Sampling Distribution Using Nonparametric Bootstrapping</i>
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**Description**

Estimate Standardized Regression Coefficients and Generate the Corresponding Sampling Distribution Using Nonparametric Bootstrapping

**Usage**

BetaNB(object)

**Arguments**

object                      Object of class mc, that is, the output of the MC() function.

**Details**

The vector of standardized regression coefficients ( $\hat{\beta}$ ) is estimated from bootstrap samples. Confidence intervals are generated by obtaining percentiles corresponding to  $100(1 - \alpha)\%$  from the generated sampling distribution of  $\hat{\beta}$ , where  $\alpha$  is the significance level.

**Value**

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

- call** Function call.
- object** The function argument object.
- thetahatstar** Sampling distribution of  $\hat{\beta}$ .
- jackknife** Jackknife estimates.
- est** Vector of estimated  $\hat{\beta}$ .
- fun** Function used ("BetaNB").

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Beta Nonparametric Bootstrap Functions: [.CI\(\)](#), [DeltaRSqNB\(\)](#), [DiffBetaNB\(\)](#), [NB\(\)](#), [PCorNB\(\)](#), [RSqNB\(\)](#), [SCorNB\(\)](#)

**Examples**

```
# Fit the regression model
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
# Generate the sampling distribution of sample covariances
# (use a large R, for example, R = 5000 for actual research)
nb <- NB(object, R = 50)
# Generate confidence intervals for standardized regression slopes
std <- BetaNB(nb)
# Methods -----
print(std)
summary(std)
coef(std)
vcov(std)
confint(std, level = 0.95)
```

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coef.betanb

*Estimated Parameter Method for an Object of Class betanb*


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**Description**

Estimated Parameter Method for an Object of Class betanb

**Usage**

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

**Arguments**

object	Object of Class betanb, that is, the output of the BetaNB(), RSqNB(), SCorNB(), DeltaRSqNB(), or PCorNB() functions.
...	additional arguments.

**Value**

Returns a vector of estimated parameters.

**Author(s)**

Ivan Jacob Agaloos Pesigan

## Examples

```
# Fit the regression model
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
# Generate bootstrap covariance matrices
# (use a large R, for example, R = 5000 for actual research)
nb <- NB(object, R = 50)
# Generate confidence intervals for standardized regression slopes
std <- BetaNB(nb)
# Method -----
coef(std)
```

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confint.betanb	<i>Confidence Intervals Method for an Object of Class betanb</i>
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## Description

Confidence Intervals Method for an Object of Class betanb

## Usage

```
## S3 method for class 'betanb'
confint(object, parm = NULL, level = 0.95, type = "pc", ...)
```

## Arguments

object	Object of Class betanb, that is, the output of the BetaNB(), RSqNB(), SCorNB(), DeltaRSqNB(), or PCorNB() functions.
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.
type	Character string. Confidence interval type, that is, type = "pc" for percentile; type = "bc" for bias corrected; type = "bca" for bias corrected and accelerated.
...	additional arguments.

## Value

Returns a matrix of confidence intervals.

## Author(s)

Ivan Jacob Agaloos Pesigan

## Examples

```
# Fit the regression model
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
# Generate bootstrap covariance matrices
# (use a large R, for example, R = 5000 for actual research)
nb <- NB(object, R = 50)
# Generate confidence intervals for standardized regression slopes
std <- BetaNB(nb)
# Method -----
confint(std, level = 0.95, type = "pc")
confint(std, level = 0.95, type = "bc")
confint(std, level = 0.95, type = "bca")
```

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DeltaRSqNB	<i>Estimate Improvement in R-Squared and Generate the Corresponding Sampling Distribution Using Nonparametric Bootstrapping</i>
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## Description

Estimate Improvement in R-Squared and Generate the Corresponding Sampling Distribution Using Nonparametric Bootstrapping

## Usage

```
DeltaRSqNB(object)
```

## Arguments

**object** Object of class mc, that is, the output of the MC() function.

## Details

The vector of improvement in R-squared ( $\Delta R^2$ ) is estimated from bootstrap samples. Confidence intervals are generated by obtaining percentiles corresponding to  $100(1 - \alpha)\%$  from the generated sampling distribution of  $\Delta R^2$ , where  $\alpha$  is the significance level.

## Value

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

**call** Function call.

**object** The function argument object.

**thetahatstar** Sampling distribution of  $\Delta R^2$ .

**vcov** Sampling variance-covariance matrix of  $\Delta R^2$ .

**est** Vector of estimated  $\Delta R^2$ .

**fun** Function used ("DeltaRSqMC").

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Beta Nonparametric Bootstrap Functions: `.CI()`, `BetaNB()`, `DiffBetaNB()`, `NB()`, `PCorNB()`, `RSqNB()`, `SCorNB()`

**Examples**

```
# Fit the regression model
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
# Generate the sampling distribution of sample covariances
# (use a large R, for example, R = 5000 for actual research)
nb <- NB(object, R = 50)
# Generate confidence intervals for improvement in R-squared
deltarsq <- DeltaRSqNB(nb)
# Methods -----
print(deltarsq)
summary(deltarsq)
coef(deltarsq)
vcov(deltarsq)
confint(deltarsq, level = 0.95)
```

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DiffBetaNB

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*Estimate Differences of Standardized Slopes and Generate the Corresponding Sampling Distribution Using Nonparametric Bootstrapping*


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**Description**

Estimate Differences of Standardized Slopes and Generate the Corresponding Sampling Distribution Using Nonparametric Bootstrapping

**Usage**

```
DiffBetaNB(object)
```

**Arguments**

`object`                      Object of class `mc`, that is, the output of the `MC()` function.

**Details**

The vector of differences of standardized regression slopes is estimated from bootstrap samples. Confidence intervals are generated by obtaining percentiles corresponding to  $100(1 - \alpha)\%$  from the generated sampling distribution of differences of standardized regression slopes, where  $\alpha$  is the significance level.

**Value**

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

**call** Function call.

**object** The function argument object.

**thetahatstar** Sampling distribution of differences of standardized regression slopes.

**vcov** Sampling variance-covariance matrix of differences of standardized regression slopes.

**est** Vector of estimated differences of standardized regression slopes.

**fun** Function used ("DiffBetaMC").

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Beta Nonparametric Bootstrap Functions: `.CI()`, `BetaNB()`, `DeltaRSqNB()`, `NB()`, `PCorNB()`, `RSqNB()`, `SCorNB()`

**Examples**

```
# Fit the regression model
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
# Generate the sampling distribution of sample covariances
# (use a large R, for example, R = 5000 for actual research)
nb <- NB(object, R = 50)
# Generate confidence intervals
# for differences of standardized regression slopes
diff <- DiffBetaNB(nb)
# Methods -----
print(diff)
summary(diff)
coef(diff)
vcov(diff)
confint(diff, 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.

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NB	<i>Generate the Sampling Distribution of Sample Covariances Using Nonparametric Bootstrapping</i>
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### Description

Generate the Sampling Distribution of Sample Covariances Using Nonparametric Bootstrapping

### Usage

```
NB(object, R = 5000, seed = NULL)
```

### Arguments

<b>object</b>	Object of class <code>lm</code> .
<b>R</b>	Positive integer. Number of bootstrap replications.
<b>seed</b>	Integer. Seed number for reproducibility.

### Value

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

**call** Function call.

**args** Function arguments.

**lm\_process** Processed `lm` object.

**thetahatstar** Sampling distribution of sample covariances.

**jackknife** Jackknife estimates.



**Author(s)**

Ivan Jacob Agaloos Pesigan

**References**

Efron, B., & Tibshirani, R. J. (1993) *An introduction to the bootstrap*. Chapman & Hall.

**See Also**

Other Beta Nonparametric Bootstrap Functions: [.CI\(\)](#), [BetaNB\(\)](#), [DeltaRSqNB\(\)](#), [DiffBetaNB\(\)](#), [PCorNB\(\)](#), [RSqNB\(\)](#), [SCorNB\(\)](#)

**Examples**

```
# Fit the regression model
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
# Generate the sampling distribution of sample covariances
# (use a large R, for example, R = 5000 for actual research)
NB(object, R = 100)
```

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PCorNB	<i>Estimate Squared Partial Correlation Coefficients and Generate the Corresponding Sampling Distribution Using Nonparametric Bootstrapping</i>
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**Description**

Estimate Squared Partial Correlation Coefficients and Generate the Corresponding Sampling Distribution Using Nonparametric Bootstrapping

**Usage**

```
PCorNB(object)
```

**Arguments**

**object**                      Object of class mc, that is, the output of the MC() function.

**Details**

The vector of squared partial correlation coefficients ( $r_p^2$ ) is estimated from bootstrap samples. Confidence intervals are generated by obtaining percentiles corresponding to  $100(1 - \alpha)\%$  from the generated sampling distribution of  $r_p^2$ , where  $\alpha$  is the significance level.

**Value**

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

**call** Function call.

**object** The function argument object.

**thetahatstar** Sampling distribution of  $r_p^2$ .

**vcov** Sampling variance-covariance matrix of  $r_p^2$ .

**est** Vector of estimated  $r_p^2$ .

**fun** Function used ("PCorMC").

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Beta Nonparametric Bootstrap Functions: [.CI\(\)](#), [BetaNB\(\)](#), [DeltaRSqNB\(\)](#), [DiffBetaNB\(\)](#), [NB\(\)](#), [RSqNB\(\)](#), [SCorNB\(\)](#)

**Examples**

```
# Fit the regression model
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
# Generate the sampling distribution of sample covariances
# (use a large R, for example, R = 5000 for actual research)
nb <- NB(object, R = 50)
# Generate confidence intervals for standardized regression slopes
rp <- PCorNB(nb)
# Methods -----
print(rp)
summary(rp)
coef(rp)
vcov(rp)
confint(rp, level = 0.95)
```

---

print.betanb

---

*Print Method for an Object of Class betanb*


---

**Description**

Print Method for an Object of Class betanb

**Usage**

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

**Arguments**

x	Object of Class betanb, that is, the output of the BetaNB(), RSqNB(), SCorNB(), DeltaRSqNB(), or PCorNB() functions.
alpha	Significance level.
type	Charater string. Confidence interval type, that is, type = "pc" for percentile; type = "bc" for bias corrected; type = "bca" for bias corrected and accelerated.
digits	Digits to print.
...	additional arguments.

**Value**

Prints a matrix of estimates, standard errors, number of bootstrap replications, and confidence intervals.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**Examples**

```
# Fit the regression model
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
# Generate bootstrap covariance matrices
# (use a large R, for example, R = 5000 for actual research)
nb <- NB(object, R = 50)
# Generate confidence intervals for standardized regression slopes
std <- BetaNB(nb)
# Method -----
print(std, type = "pc")
print(std, type = "bc")
print(std, type = "bca")
```

---

print.nb

---

*Print Method for an Object of Class nb*


---

**Description**

Print Method for an Object of Class nb

**Usage**

```
## S3 method for class 'nb'
print(x, ...)
```

**Arguments**

x	Object of Class nb.
...	additional arguments.

**Value**

Prints the first six bootstrap covariance matrices.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**Examples**

```
# Fit the regression model
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
# Generate bootstrap covariance matrices
# (use a large R, for example, R = 5000 for actual research)
nb <- NB(object, R = 50)
print(nb)
```

---

RSqNB

*Estimate Multiple Correlation Coefficients (R-Squared and Adjusted R-Squared) and Generate the Corresponding Sampling Distribution Using Nonparametric Bootstrapping*

---

**Description**

Estimate Multiple Correlation Coefficients (R-Squared and Adjusted R-Squared) and Generate the Corresponding Sampling Distribution Using Nonparametric Bootstrapping

**Usage**

RSqNB(object)

**Arguments**

**object** Object of class mc, that is, the output of the MC() function.

**Details**

R-squared ( $R^2$ ) and adjusted R-squared ( $\bar{R}^2$ ) is estimated from bootstrap samples. Confidence intervals are generated by obtaining percentiles corresponding to  $100(1 - \alpha)\%$  from the generated sampling distribution of  $R^2$  and  $\bar{R}^2$ , where  $\alpha$  is the significance level.

**Value**

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

**call** Function call.

**object** The function argument object.

**thetahatstar** Sampling distribution of  $R^2$  and  $\bar{R}^2$ .

**vcov** Sampling variance-covariance matrix of  $R^2$  and  $\bar{R}^2$ .  
**est** Vector of estimated  $R^2$  and  $\bar{R}^2$ .  
**fun** Function used ("RSqMC").

### Author(s)

Ivan Jacob Agaloos Pesigan

### See Also

Other Beta Nonparametric Bootstrap Functions: [.CI\(\)](#), [BetaNB\(\)](#), [DeltaRSqNB\(\)](#), [DiffBetaNB\(\)](#), [NB\(\)](#), [PCorNB\(\)](#), [SCorNB\(\)](#)

### Examples

```
# Fit the regression model
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
# Generate the sampling distribution of sample covariances
# (use a large R, for example, R = 5000 for actual research)
nb <- NB(object, R = 50)
# Generate confidence intervals for standardized regression slopes
rsq <- RSqNB(nb)
# Methods -----
print(rsq)
summary(rsq)
coef(rsq)
vcov(rsq)
confint(rsq, level = 0.95)
```

---

SCorNB

*Estimate Semipartial Correlation Coefficients and Generate the Corresponding Sampling Distribution Using Nonparametric Bootstrapping*

---

### Description

Estimate Semipartial Correlation Coefficients and Generate the Corresponding Sampling Distribution Using Nonparametric Bootstrapping

### Usage

```
SCorNB(object)
```

### Arguments

**object** Object of class `mc`, that is, the output of the `MC()` function.

## Details

The vector of semipartial correlation coefficients ( $r_s$ ) is estimated from bootstrap samples. Confidence intervals are generated by obtaining percentiles corresponding to  $100(1 - \alpha)\%$  from the generated sampling distribution of  $r_s$ , where  $\alpha$  is the significance level.

## Value

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

**call** Function call.

**object** The function argument object.

**thetahatstar** Sampling distribution of  $r_s$ .

**vcov** Sampling variance-covariance matrix of  $r_s$ .

**est** Vector of estimated  $r_s$ .

**fun** Function used ("SCorMC").

## Author(s)

Ivan Jacob Agaloos Pesigan

## See Also

Other Beta Nonparametric Bootstrap Functions: [.CI\(\)](#), [BetaNB\(\)](#), [DeltaRSqNB\(\)](#), [DiffBetaNB\(\)](#), [NB\(\)](#), [PCorNB\(\)](#), [RSqNB\(\)](#)

## Examples

```
# Fit the regression model
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
# Generate the sampling distribution of sample covariances
# (use a large R, for example, R = 5000 for actual research)
nb <- NB(object, R = 50)
# Generate confidence intervals for standardized regression slopes
rs <- SCorNB(nb)
# Methods -----
print(rs)
summary(rs)
coef(rs)
vcov(rs)
confint(rs, level = 0.95)
```

---

summary.betanb	<i>Summary Method for an Object of Class betanb</i>
----------------	---

---

**Description**

Summary Method for an Object of Class betanb

**Usage**

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

**Arguments**

object	Object of Class betanb, that is, the output of the BetaNB(), RSqNB(), SCorNB(), DeltaRSqNB(), or PCorNB() functions.
alpha	Significance level.
type	Character string. Confidence interval type, that is, type = "pc" for percentile; type = "bc" for bias corrected; type = "bca" for bias corrected and accelerated.
digits	Digits to print.
...	additional arguments.

**Value**

Returns a matrix of estimates, standard errors, number of bootstrap replications, and confidence intervals.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**Examples**

```
# Fit the regression model
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
# Generate bootstrap covariance matrices
# (use a large R, for example, R = 5000 for actual research)
nb <- NB(object, R = 50)
# Generate confidence intervals for standardized regression slopes
std <- BetaNB(nb)
# Method -----
summary(std, type = "pc")
summary(std, type = "bc")
summary(std, type = "bca")
```

---

vcov.betanb	<i>Sampling Variance-Covariance Matrix Method for an Object of Class betanb</i>
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---

**Description**

Sampling Variance-Covariance Matrix Method for an Object of Class betanb

**Usage**

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

**Arguments**

object	Object of Class betanb, that is, the output of the BetaNB(), RSqNB(), SCorNB(), DeltaRSqNB(), or PCorNB() functions.
...	additional arguments.

**Value**

Returns the variance-covariance matrix of estimates.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**Examples**

```
# Fit the regression model
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
# Generate bootstrap covariance matrices
# (use a large R, for example, R = 5000 for actual research)
nb <- NB(object, R = 50)
# Generate confidence intervals for standardized regression slopes
std <- BetaNB(nb)
# Method -----
vcov(std)
```



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