

# Package ‘betaNB’

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**Title** Bootstrap for Regression Effect Sizes

**Version** 1.0.6

**Description** Generates nonparametric bootstrap confidence intervals (Efron and Tibshirani, 1993: <[doi:10.1201/9780429246593](https://doi.org/10.1201/9780429246593)>) for standardized regression coefficients (beta) and other effect sizes, including multiple correlation, semipartial correlations, improvement in R-squared, squared partial correlations, and differences in standardized regression coefficients, 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

**LazyData** true

**Depends** R (>= 3.5.0)

**Imports** stats

**Suggests** knitr, rmarkdown, testthat

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**NeedsCompilation** no

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

---

### Description

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

### Usage

```
BetaNB(object, alpha = c(0.05, 0.01, 0.001))
```

### Arguments

|        |   |
|--------|---|
| object | Object of class nb, that is, the output of the NB() function. |
| alpha  | Numeric vector. Significance level $\alpha$ .                 |

### 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.

**args** Function arguments.

**thetahatstar** Sampling distribution of  $\hat{\beta}$ .

**jackknife** Jackknife estimates.

**vcov** Sampling variance-covariance matrix of  $\hat{\beta}$ .

**est** Vector of estimated  $\hat{\beta}$ .

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

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

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

**Examples**

```
# Data -----
data("nas1982", package = "betaNB")

# Fit Model in lm -----
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)

# NB -----
nb <- NB(
  object,
  R = 100, # use a large value e.g., 5000L for actual research
  seed = 0508
)

# BetaNB -----
out <- BetaNB(nb, alpha = 0.05)

## Methods -----
print(out)
summary(out)
coef(out)
vcov(out)
confint(out, level = 0.95)
```

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|             |   |
|-------------|---|
| coef.betanb | <i>Estimated Parameter Method for an Object of Class betanb</i> |
|-------------|---|

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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(), PCorNB(), or DiffBetaNB() functions. |
| ...    | additional arguments.  |

**Value**

Returns a vector of estimated parameters.

**Author(s)**

Ivan Jacob Agaloos Pesigan

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|                |  |
|----------------|--|
| confint.betanb | <i>Confidence Intervals Method for an Object of Class betanb</i> |
|----------------|--|

---

**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 <code>betanb</code> , that is, the output of the <code>BetaNB()</code> , <code>RSqNB()</code> , <code>SCorNB()</code> , <code>DeltaRSqNB()</code> , <code>PCorNB()</code> , or <code>DiffBetaNB()</code> 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, <code>type = "pc"</code> for percentile; <code>type = "bc"</code> for bias corrected; <code>type = "bca"</code> for bias corrected and accelerated.                            |
| ...    | additional arguments.   |

**Value**

Returns a matrix of confidence intervals.

**Author(s)**

Ivan Jacob Agaloos Pesigan

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

---

**Description**

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

**Usage**

```
DeltaRSqNB(object, alpha = c(0.05, 0.01, 0.001))
```

**Arguments**

|        |  |
|--------|--|
| object | Object of class <code>nb</code> , that is, the output of the <code>NB()</code> function. |
| alpha  | Numeric vector. Significance level $\alpha$ .  |

**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.

**args** Function arguments.

**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 ("DeltaRSqNB").

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

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

**Examples**

```
# Data -----
data("nas1982", package = "betanb")

# Fit Model in lm -----
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)

# NB -----
nb <- NB(
  object,
  R = 100, # use a large value e.g., 5000L for actual research
  seed = 0508
)

# DeltaRSqNB -----
out <- DeltaRSqNB(nb, alpha = 0.05)

## Methods -----
print(out)
summary(out)
coef(out)
vcov(out)
confint(out, level = 0.95)
```

DiffBetaNB

---

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

---

**Description**

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

**Usage**

```
DiffBetaNB(object, alpha = c(0.05, 0.01, 0.001))
```

**Arguments**

**object** Object of class nb, that is, the output of the NB() function.  
**alpha** Numeric vector. Significance level  $\alpha$ .

**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.

**args** Function arguments.

**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 ("DiffBetaNB").

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

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

**Examples**

```

# Data -----
data("nas1982", package = "betaNB")

# Fit Model in lm -----
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)

# NB -----
nb <- NB(
  object,
  R = 100, # use a large value e.g., 5000L for actual research
  seed = 0508
)

# DiffBetaNB -----
out <- DiffBetaNB(nb, alpha = 0.05)

## 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.

---

|    |   |
|----|---|
| NB | <i>Generate the Sampling Distribution of Sample Covariances Using Nonparametric Bootstrapping</i> |
|----|---|

---

## Description

Generate the Sampling Distribution of Sample Covariances Using Nonparametric Bootstrapping

## Usage

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

## Arguments

|        |   |
|--------|---|
| object | Object of class <code>lm</code> .                   |
| R      | Positive integer. Number of bootstrap replications. |
| seed   | 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: [BetaNB\(\)](#), [DeltaRSqNB\(\)](#), [DiffBetaNB\(\)](#), [PCorNB\(\)](#), [RSqNB\(\)](#), [SCorNB\(\)](#)

**Examples**

```

# Data -----
data("nas1982", package = "betaNB")

# Fit Model in lm -----
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)

# NB -----
nb <- NB(
  object,
  R = 100, # use a large value e.g., 20000L for actual research
  seed = 0508
)
nb
# The `nb` object can be passed as the first argument
# to the following functions
# - BetaNB
# - DeltaRSqNB
# - DiffBetaNB
# - PCorNB
# - RSqNB
# - SCorNB

```

PCorNB

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

**Description**

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

**Usage**

```
PCorNB(object, alpha = c(0.05, 0.01, 0.001))
```

**Arguments**

**object**            Object of class nb, that is, the output of the NB() function.  
**alpha**            Numeric vector. Significance level  $\alpha$ .

**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.

**args** Function arguments.

**thetahatstar** Sampling distribution of  $\hat{\gamma}_p^2$ .

**vcov** Sampling variance-covariance matrix of  $\hat{\gamma}_p^2$ .

**est** Vector of estimated  $\hat{\gamma}_p^2$ .

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

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

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

**Examples**

```
# Data -----
data("nas1982", package = "betaNB")

# Fit Model in lm -----
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)

# NB -----
nb <- NB(
  object,
  R = 100, # use a large value e.g., 5000L for actual research
  seed = 0508
)

# PCorNB -----
out <- PCorNB(nb, alpha = 0.05)

## Methods -----
print(out)
summary(out)
coef(out)
vcov(out)
confint(out, 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 = NULL, type = "pc", digits = 4, ...)
```

### Arguments

|        |   |
|--------|---|
| x      | Object of Class betanb, that is, the output of the BetaNB(), RSqNB(), SCorNB(), DeltaRSqNB(), PCorNB(), or DiffBetaNB() functions.                                |
| alpha  | Numeric vector. Significance level $\alpha$ . If alpha = NULL, use the argument alpha used in x.  |
| 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

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

### Author(s)

Ivan Jacob Agaloos Pesigan

---

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**

```
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
nb <- NB(object, R = 100)
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, alpha = c(0.05, 0.01, 0.001))
```

**Arguments**

object                Object of class nb, that is, the output of the NB() function.  
 alpha                Numeric vector. Significance level  $\alpha$ .

**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.

**args** Function arguments.

**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 ("RSqNB").

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

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

**Examples**

```
# Data -----
data("nas1982", package = "betaNB")

# Fit Model in lm -----
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)

# NB -----
nb <- NB(
  object,
  R = 100, # use a large value e.g., 5000L for actual research
  seed = 0508
)

# RSqNB -----
out <- RSqNB(nb, alpha = 0.05)

## Methods -----
print(out)
summary(out)
coef(out)
vcov(out)
confint(out, level = 0.95)
```

---

|        |   |
|--------|---|
| SCorNB | <i>Estimate Semipartial Correlation Coefficients and Generate the Corresponding Sampling Distribution Using Nonparametric Bootstrapping</i> |
|--------|---|

---

**Description**

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

**Usage**

```
SCorNB(object, alpha = c(0.05, 0.01, 0.001))
```

**Arguments**

|        |   |
|--------|---|
| object | Object of class nb, that is, the output of the NB() function. |
| alpha  | Numeric vector. Significance level $\alpha$ .                 |

**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.
- args** Function arguments.
- thetahatstar** Sampling distribution of  $r_s$ .
- vcov** Sampling variance-covariance matrix of  $r_s$ .
- est** Vector of estimated  $r_s$ .
- fun** Function used ("SCorNB").

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

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

**Examples**

```

# Data -----
data("nas1982", package = "betaNB")

# Fit Model in lm -----
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)

# NB -----
nb <- NB(
  object,
  R = 100, # use a large value e.g., 5000L for actual research
  seed = 0508
)

# SCorNB -----
out <- SCorNB(nb, alpha = 0.05)

## Methods -----
print(out)
summary(out)
coef(out)
vcov(out)
confint(out, level = 0.95)

```

summary.betanb

*Summary Method for an Object of Class betanb***Description**

Summary Method for an Object of Class betanb

**Usage**

```

## S3 method for class 'betanb'
summary(object, alpha = NULL, type = "pc", digits = 4, ...)

```

**Arguments**

|        |   |
|--------|---|
| object | Object of Class betanb, that is, the output of the BetaNB(), RSqNB(), SCorNB(), DeltaRSqNB(), PCorNB(), or DiffBetaNB() functions.                                |
| alpha  | Numeric vector. Significance level $\alpha$ . If alpha = NULL, use the argument alpha used in object.   |
| 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

---

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

---

**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(), PCorNB(), or DiffBetaNB() functions. |
| ...    | additional arguments.  |

**Value**

Returns the variance-covariance matrix of estimates.

**Author(s)**

Ivan Jacob Agaloos Pesigan

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