

# Package ‘betaNB’

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**Title** Bootstrap for Regression Effect Sizes

**Version** 1.0.7

**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

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**Imports** stats

**Suggests** knitr, rmarkdown, testthat, betaDelta, betaSandwich, betaMC

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## Contents

BetaNB	2
coef.betanb	4
confint.betanb	4
DeltaRSqNB	5
DiffBetaNB	7
nas1982	8
NB	9
PCorNB	10
print.betanb	12
print.nb	12
RSqNB	13
SCorNB	15
summary.betanb	16
vcov.betanb	17
<b>Index</b>	<b>18</b>

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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, 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>
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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 <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>
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**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)
```

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`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)

```

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nas1982

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*1982 National Academy of Sciences Doctoral Programs Data*


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**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 = 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)
```

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

### 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

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

**Value**

Returns the variance-covariance matrix of estimates.

**Author(s)**

Ivan Jacob Agaloos Pesigan

# Index

## \* **Beta Nonparametric Bootstrap Functions**

- BetaNB, 2
  - DeltaRSqNB, 5
  - DiffBetaNB, 7
  - NB, 9
  - PCorNB, 10
  - RSqNB, 13
  - SCorNB, 15
- ## \* **betaNB**
- BetaNB, 2
  - DeltaRSqNB, 5
  - DiffBetaNB, 7
  - NB, 9
  - PCorNB, 10
  - RSqNB, 13
  - SCorNB, 15
- ## \* **data**
- nas1982, 8
- ## \* **deltarsq**
- DeltaRSqNB, 5
- ## \* **diff**
- DiffBetaNB, 7
- ## \* **methods**
- coef.betanb, 4
  - confint.betanb, 4
  - print.betanb, 12
  - print.nb, 12
  - summary.betanb, 16
  - vcov.betanb, 17
- ## \* **nb**
- NB, 9
- ## \* **pcor**
- PCorNB, 10
- ## \* **rsq**
- RSqNB, 13
- ## \* **scor**
- SCorNB, 15
- ## \* **std**
- BetaNB, 2

- BetaNB, 2
- BetaNB(), 6, 7, 9, 11, 14, 15
- coef.betanb, 4
- confint.betanb, 4
- DeltaRSqNB, 5
- DeltaRSqNB(), 3, 7, 9, 11, 14, 15
- DiffBetaNB, 7
- DiffBetaNB(), 3, 6, 9, 11, 14, 15
- nas1982, 8
- NB, 9
- NB(), 3, 6, 7, 11, 14, 15
- PCorNB, 10
- PCorNB(), 3, 6, 7, 9, 14, 15
- print.betanb, 12
- print.nb, 12
- RSqNB, 13
- RSqNB(), 3, 6, 7, 9, 11, 15
- SCorNB, 15
- SCorNB(), 3, 6, 7, 9, 11, 14
- summary.betanb, 16
- vcov.betanb, 17