

betaNB: Staging

Ivan Jacob Agaloos Pesigan

1 Nonparametric Bootstrap

```
# Fit the regression model
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
# Generate the sampling distribution of parameter estimates
nb <- NB(object, R = 5000, seed = 42)
nb

#> Call:
#> NB(object = object, R = 5000, seed = 42)
#>
#> The first six bootstrap covariance matrices.
#>
#> [[1]]
#>      [,1]      [,2]      [,3]      [,4]
#> [1,]  97.04348  514.4937 115.03478 125.08116
#> [2,]  514.49372 4900.3981 375.35942 487.32754
#> [3,]  115.03478  375.3594 317.98116  88.87826
#> [4,]  125.08116  487.3275  88.87826 439.31594
#>
#> [[2]]
#>      [,1]      [,2]      [,3]      [,4]
#> [1,]  96.77729  438.0208 150.0053 120.5614
#> [2,]  438.02077 2765.3957 717.5937 332.0618
#> [3,]  150.00531  717.5937 354.0082 183.7362
#> [4,]  120.56135  332.0618 183.7362 546.9082
#>
#> [[3]]
#>      [,1]      [,2]      [,3]      [,4]
#> [1,] 102.8217  511.7792 129.5329 120.3367
#> [2,]  511.7792 3625.2179 587.6459 523.8565
#> [3,]  129.5329  587.6459 309.1773 167.8256
#> [4,]  120.3367  523.8565 167.8256 625.9097
#>
#> [[4]]
#>      [,1]      [,2]      [,3]      [,4]
```

```

#> [1,] 82.33285 339.3754 96.54444 112.8150
#> [2,] 339.37536 2498.2768 347.41111 446.5638
#> [3,] 96.54444 347.4111 251.50000 54.3000
#> [4,] 112.81498 446.5638 54.30000 514.0469
#>
#> [[5]]
#>      [,1]      [,2]      [,3]      [,4]
#> [1,] 110.0638 534.9053 112.6522 143.8106
#> [2,] 534.9053 4417.8551 459.5488 442.7990
#> [3,] 112.6522 459.5488 236.1609 129.9531
#> [4,] 143.8106 442.7990 129.9531 471.6314
#>
#> [[6]]
#>      [,1]      [,2]      [,3]      [,4]
#> [1,] 97.08599 454.7082 95.74493 152.0319
#> [2,] 454.70821 3918.8971 301.21159 589.1541
#> [3,] 95.74493 301.2116 254.26473 140.9614
#> [4,] 152.03188 589.1541 140.96135 509.1715

```

2 Standardized Regression Slopes

```

out <- BetaNB(nb)
# Methods -----
print(out)

#> Call:
#> BetaNB(object = nb)
#>
#> Standardized regression slopes
#> type = "pc"
#>      est      se      R 0.05%   0.5%   2.5% 97.5% 99.5% 99.95%
#> NARTIC  0.4951 0.0726 5000 0.2441 0.3093 0.3547 0.6375 0.6819 0.7321
#> PCTGRT  0.3915 0.0772 5000 0.1214 0.1778 0.2376 0.5361 0.5775 0.6152
#> PCTSUPP 0.2632 0.0803 5000 0.0066 0.0511 0.0990 0.4212 0.4750 0.5286

summary(out)

#> Call:
#> BetaNB(object = nb)
#>
#> Standardized regression slopes
#> type = "pc"
#>      est      se      R 0.05%   0.5%   2.5% 97.5% 99.5% 99.95%
#> NARTIC  0.4951 0.0726 5000 0.2441 0.3093 0.3547 0.6375 0.6819 0.7321

```

```

#> PCTGRT  0.3915 0.0772 5000 0.1214 0.1778 0.2376 0.5361 0.5775 0.6152
#> PCTSUPP 0.2632 0.0803 5000 0.0066 0.0511 0.0990 0.4212 0.4750 0.5286

coef(out)

#>      NARTIC      PCTGRT      PCTSUPP
#> 0.4951451 0.3914887 0.2632477

vcov(out)

#>           NARTIC          PCTGRT          PCTSUPP
#> NARTIC    0.005268034 -0.003102040 -0.002081206
#> PCTGRT   -0.003102040  0.005954444 -0.002045653
#> PCTSUPP  -0.002081206 -0.002045653  0.006442560

confint(out)

#>           2.5 %    97.5 %
#> NARTIC  0.35474953 0.6375091
#> PCTGRT  0.23760468 0.5360844
#> PCTSUPP 0.09900934 0.4212143

# BC
type <- "bc"
print(out, type = type)

#> Call:
#> BetaNB(object = nb)
#>
#> Standardized regression slopes
#> type = "bc"
#>      est      se      R 0.05%  0.5%  2.5% 97.5% 99.5% 99.95%
#> NARTIC  0.4951 0.0726 5000 0.2438 0.3091 0.3547 0.6369 0.6817 0.7320
#> PCTGRT  0.3915 0.0772 5000 0.1249 0.1826 0.2405 0.5384 0.5795 0.6169
#> PCTSUPP 0.2632 0.0803 5000 0.0089 0.0540 0.1031 0.4240 0.4777 0.5327

summary(out, type = type)

#> Call:
#> BetaNB(object = nb)
#>
#> Standardized regression slopes
#> type = "bc"
#>      est      se      R 0.05%  0.5%  2.5% 97.5% 99.5% 99.95%
#> NARTIC  0.4951 0.0726 5000 0.2438 0.3091 0.3547 0.6369 0.6817 0.7320
#> PCTGRT  0.3915 0.0772 5000 0.1249 0.1826 0.2405 0.5384 0.5795 0.6169
#> PCTSUPP 0.2632 0.0803 5000 0.0089 0.0540 0.1031 0.4240 0.4777 0.5327

confint(out, type = type)

```

```

#>           2.5 %    97.5 %
#> NARTIC  0.3547172 0.6368863
#> PCTGRT  0.2404685 0.5383768
#> PCTSUPP 0.1030980 0.4240169

# BCA
type <- "bca"
print(out, type = type)

#> Call:
#> BetaNB(object = nb)
#>
#> Standardized regression slopes
#> type = "bca"
#>      est      se    R   0.05%   0.5%   2.5%  97.5%  99.5% 99.95%
#> NARTIC  0.4951 0.0726 5000  0.2496 0.3101 0.3553 0.6382 0.6856 0.7329
#> PCTGRT  0.3915 0.0772 5000  0.1314 0.1958 0.2471 0.5431 0.5868 0.6202
#> PCTSUPP 0.2632 0.0803 5000 -0.0015 0.0422 0.0943 0.4154 0.4668 0.5177

summary(out, type = type)

#> Call:
#> BetaNB(object = nb)
#>
#> Standardized regression slopes
#> type = "bca"
#>      est      se    R   0.05%   0.5%   2.5%  97.5%  99.5% 99.95%
#> NARTIC  0.4951 0.0726 5000  0.2496 0.3101 0.3553 0.6382 0.6856 0.7329
#> PCTGRT  0.3915 0.0772 5000  0.1314 0.1958 0.2471 0.5431 0.5868 0.6202
#> PCTSUPP 0.2632 0.0803 5000 -0.0015 0.0422 0.0943 0.4154 0.4668 0.5177

confint(out, type = type)

#>           2.5 %    97.5 %
#> NARTIC  0.35525193 0.6382449
#> PCTGRT  0.24713690 0.5431299
#> PCTSUPP 0.09432445 0.4153595

```

3 Multiple Correlation

```

out <- RSqNB(nb)
# Methods -----
print(out)

#> Call:

```

```

#> RSqNB(object = nb)
#>
#> R-squared and adjusted R-squared
#> type = "pc"
#>      est      se      R  0.05%   0.5%   2.5%  97.5%  99.5% 99.95%
#> rsq 0.8045 0.0520 5000 0.5904 0.6535 0.6956 0.8983 0.9167 0.9309
#> adj 0.7906 0.0557 5000 0.5612 0.6288 0.6738 0.8910 0.9108 0.9260

summary(out)

#> Call:
#> RSqNB(object = nb)
#>
#> R-squared and adjusted R-squared
#> type = "pc"
#>      est      se      R  0.05%   0.5%   2.5%  97.5%  99.5% 99.95%
#> rsq 0.8045 0.0520 5000 0.5904 0.6535 0.6956 0.8983 0.9167 0.9309
#> adj 0.7906 0.0557 5000 0.5612 0.6288 0.6738 0.8910 0.9108 0.9260

coef(out)

#>      rsq      adj
#> 0.8045263 0.7905638

vcov(out)

#>      rsq      adj
#> rsq 0.002703578 0.002896691
#> adj 0.002896691 0.003103597

confint(out)

#>      2.5 %    97.5 %
#> rsq 0.6955557 0.8982632
#> adj 0.6738096 0.8909963

# BC
type <- "bc"
print(out, type = type)

#> Call:
#> RSqNB(object = nb)
#>
#> R-squared and adjusted R-squared
#> type = "bc"
#>      est      se      R  0.05%   0.5%   2.5%  97.5%  99.5% 99.95%
#> rsq 0.8045 0.0520 5000 0.5722 0.6137 0.6615 0.8816 0.9019 0.9207
#> adj 0.7906 0.0557 5000 0.5417 0.5861 0.6373 0.8731 0.8949 0.9150

```

```

summary(out, type = type)

#> Call:
#> RSqNB(object = nb)
#>
#> R-squared and adjusted R-squared
#> type = "bc"
#>      est      se    R 0.05%  0.5%  2.5% 97.5% 99.5% 99.95%
#> rsq 0.8045 0.0520 5000 0.5722 0.6137 0.6615 0.8816 0.9019 0.9207
#> adj 0.7906 0.0557 5000 0.5417 0.5861 0.6373 0.8731 0.8949 0.9150

confint(out, type = type)

#>      2.5 %    97.5 %
#> rsq 0.6614820 0.8815902
#> adj 0.6373022 0.8731323

# BCA
type <- "bca"
print(out, type = type)

#> Call:
#> RSqNB(object = nb)
#>
#> R-squared and adjusted R-squared
#> type = "bca"
#>      est      se    R 0.05%  0.5%  2.5% 97.5% 99.5% 99.95%
#> rsq 0.8045 0.0520 5000 0.5694 0.5984 0.6542 0.8794 0.9000 0.9188
#> adj 0.7906 0.0557 5000 0.5386 0.5697 0.6295 0.8708 0.8928 0.9130

summary(out, type = type)

#> Call:
#> RSqNB(object = nb)
#>
#> R-squared and adjusted R-squared
#> type = "bca"
#>      est      se    R 0.05%  0.5%  2.5% 97.5% 99.5% 99.95%
#> rsq 0.8045 0.0520 5000 0.5694 0.5984 0.6542 0.8794 0.9000 0.9188
#> adj 0.7906 0.0557 5000 0.5386 0.5697 0.6295 0.8708 0.8928 0.9130

confint(out, type = type)

#>      2.5 %    97.5 %
#> rsq 0.6541939 0.8793935
#> adj 0.6294935 0.8707787

```

4 Semipartial Correlation

```
out <- SCorNB(nb)
# Methods -----
print(out)

#> Call:
#> SCorNB(object = nb)
#>
#> Semipartial correlations
#> type = "pc"
#>      est      se      R 0.05%   0.5%   2.5% 97.5% 99.5% 99.95%
#> NARTIC  0.4312 0.0697 5000 0.1811 0.2434 0.2862 0.5603 0.6022 0.6452
#> PCTGRT  0.3430 0.0732 5000 0.0822 0.1381 0.1879 0.4718 0.5110 0.5446
#> PCTSUPP 0.2385 0.0719 5000 0.0059 0.0439 0.0883 0.3741 0.4328 0.4861

summary(out)

#> Call:
#> SCorNB(object = nb)
#>
#> Semipartial correlations
#> type = "pc"
#>      est      se      R 0.05%   0.5%   2.5% 97.5% 99.5% 99.95%
#> NARTIC  0.4312 0.0697 5000 0.1811 0.2434 0.2862 0.5603 0.6022 0.6452
#> PCTGRT  0.3430 0.0732 5000 0.0822 0.1381 0.1879 0.4718 0.5110 0.5446
#> PCTSUPP 0.2385 0.0719 5000 0.0059 0.0439 0.0883 0.3741 0.4328 0.4861

coef(out)

#>      NARTIC      PCTGRT      PCTSUPP
#> 0.4311525 0.3430075 0.2384789

vcov(out)

#>      NARTIC      PCTGRT      PCTSUPP
#> NARTIC  0.0048562212 -0.0003604504 -0.0007925723
#> PCTGRT -0.0003604504  0.0053542102 -0.0008889246
#> PCTSUPP -0.0007925723 -0.0008889246  0.0051712579

confint(out)

#>      2.5 %      97.5 %
#> NARTIC  0.28617410 0.5603102
#> PCTGRT  0.18791454 0.4718219
#> PCTSUPP 0.08829442 0.3741490
```

```

# BC
type <- "bc"
print(out, type = type)

#> Call:
#> SCorNB(object = nb)
#>
#> Semipartial correlations
#> type = "bc"
#>
#>      est      se      R 0.05%   0.5%   2.5%  97.5%  99.5% 99.95%
#> NARTIC  0.4312 0.0697 5000 0.2118 0.2571 0.3030 0.5760 0.6187 0.6526
#> PCTGRT  0.3430 0.0732 5000 0.0938 0.1557 0.2067 0.4906 0.5260 0.5640
#> PCTSUPP 0.2385 0.0719 5000 0.0141 0.0620 0.1016 0.3897 0.4411 0.4904

summary(out, type = type)

#> Call:
#> SCorNB(object = nb)
#>
#> Semipartial correlations
#> type = "bc"
#>
#>      est      se      R 0.05%   0.5%   2.5%  97.5%  99.5% 99.95%
#> NARTIC  0.4312 0.0697 5000 0.2118 0.2571 0.3030 0.5760 0.6187 0.6526
#> PCTGRT  0.3430 0.0732 5000 0.0938 0.1557 0.2067 0.4906 0.5260 0.5640
#> PCTSUPP 0.2385 0.0719 5000 0.0141 0.0620 0.1016 0.3897 0.4411 0.4904

confint(out, type = type)

#>
#>      2.5 %      97.5 %
#> NARTIC  0.3029651 0.5760427
#> PCTGRT  0.2066771 0.4905997
#> PCTSUPP 0.1015725 0.3896895

# BCA
type <- "bca"
print(out, type = type)

#> Call:
#> SCorNB(object = nb)
#>
#> Semipartial correlations
#> type = "bca"
#>
#>      est      se      R 0.05%   0.5%   2.5%  97.5%  99.5% 99.95%
#> NARTIC  0.4312 0.0697 5000 0.2324 0.2730 0.3098 0.5822 0.6276 0.6907
#> PCTGRT  0.3430 0.0732 5000 0.1324 0.1736 0.2164 0.5044 0.5411 0.5912
#> PCTSUPP 0.2385 0.0719 5000 0.0074 0.0583 0.0988 0.3834 0.4373 0.4870

summary(out, type = type)

```



```

#> Call:
#> SCorNB(object = nb)
#>
#> Semipartial correlations
#> type = "bca"
#>           est      se    R 0.05%  0.5%  2.5% 97.5% 99.5% 99.95%
#> NARTIC  0.4312 0.0697 5000 0.2324 0.2730 0.3098 0.5822 0.6276 0.6907
#> PCTGRT  0.3430 0.0732 5000 0.1324 0.1736 0.2164 0.5044 0.5411 0.5912
#> PCTSUPP 0.2385 0.0719 5000 0.0074 0.0583 0.0988 0.3834 0.4373 0.4870

confint(out, type = type)

#>           2.5 %    97.5 %
#> NARTIC  0.30981084 0.5822361
#> PCTGRT  0.21639788 0.5043734
#> PCTSUPP 0.09876342 0.3833609

```

5 Improvement in R-Squared

```

out <- DeltaRSqNB(nb)
# Methods -----
print(out)

#> Call:
#> DeltaRSqNB(object = nb)
#>
#> Improvement in R-squared
#> type = "pc"
#>           est      se    R 0.05%  0.5%  2.5% 97.5% 99.5% 99.95%
#> NARTIC  0.1859 0.0591 5000 0.0330 0.0593 0.0819 0.3139 0.3627 0.4163
#> PCTGRT  0.1177 0.0488 5000 0.0068 0.0191 0.0353 0.2226 0.2611 0.2966
#> PCTSUPP 0.0569 0.0345 5000 0.0001 0.0019 0.0078 0.1400 0.1873 0.2363

summary(out)

#> Call:
#> DeltaRSqNB(object = nb)
#>
#> Improvement in R-squared
#> type = "pc"
#>           est      se    R 0.05%  0.5%  2.5% 97.5% 99.5% 99.95%
#> NARTIC  0.1859 0.0591 5000 0.0330 0.0593 0.0819 0.3139 0.3627 0.4163
#> PCTGRT  0.1177 0.0488 5000 0.0068 0.0191 0.0353 0.2226 0.2611 0.2966
#> PCTSUPP 0.0569 0.0345 5000 0.0001 0.0019 0.0078 0.1400 0.1873 0.2363

```

```

coef(out)

#>      NARTIC      PCTGRT      PCTSUPP
#> 0.1858925 0.1176542 0.0568722

vcov(out)

#>              NARTIC              PCTGRT              PCTSUPP
#> NARTIC    0.0034939228 -0.0002017845 -0.0003124283
#> PCTGRT   -0.0002017845  0.0023767669 -0.0002684031
#> PCTSUPP  -0.0003124283 -0.0002684031  0.0011876677

confint(out)

#>              2.5 %      97.5 %
#> NARTIC    0.081895616 0.3139475
#> PCTGRT    0.035311877 0.2226159
#> PCTSUPP   0.007795905 0.1399875

# BC
type <- "bc"
print(out, type = type)

#> Call:
#> DeltaRSqNB(object = nb)
#>
#> Improvement in R-squared
#> type = "bc"
#>      est      se      R 0.05%  0.5%  2.5% 97.5% 99.5% 99.95%
#> NARTIC  0.1859 0.0591 5000 0.0448 0.0661 0.0918 0.3318 0.3828 0.4259
#> PCTGRT  0.1177 0.0488 5000 0.0088 0.0242 0.0427 0.2407 0.2767 0.3181
#> PCTSUPP 0.0569 0.0345 5000 0.0003 0.0038 0.0103 0.1519 0.1946 0.2405

summary(out, type = type)

#> Call:
#> DeltaRSqNB(object = nb)
#>
#> Improvement in R-squared
#> type = "bc"
#>      est      se      R 0.05%  0.5%  2.5% 97.5% 99.5% 99.95%
#> NARTIC  0.1859 0.0591 5000 0.0448 0.0661 0.0918 0.3318 0.3828 0.4259
#> PCTGRT  0.1177 0.0488 5000 0.0088 0.0242 0.0427 0.2407 0.2767 0.3181
#> PCTSUPP 0.0569 0.0345 5000 0.0003 0.0038 0.0103 0.1519 0.1946 0.2405

confint(out, type = type)

```

```

#>           2.5 %    97.5 %
#> NARTIC  0.09178787 0.3318252
#> PCTGRT  0.04271545 0.2406887
#> PCTSUPP 0.01031698 0.1518579

# BCA
type <- "bca"
print(out, type = type)

#> Call:
#> DeltaRSqNB(object = nb)
#>
#> Improvement in R-squared
#> type = "bca"
#>      est      se    R 0.05%   0.5%   2.5%  97.5%  99.5% 99.95%
#> NARTIC  0.1859 0.0591 5000 0.0533 0.0742 0.0952 0.3381 0.3906 0.4739
#> PCTGRT  0.1177 0.0488 5000 0.0172 0.0296 0.0465 0.2534 0.2912 0.3487
#> PCTSUPP 0.0569 0.0345 5000 0.0001 0.0023 0.0092 0.1447 0.1877 0.2342

summary(out, type = type)

#> Call:
#> DeltaRSqNB(object = nb)
#>
#> Improvement in R-squared
#> type = "bca"
#>      est      se    R 0.05%   0.5%   2.5%  97.5%  99.5% 99.95%
#> NARTIC  0.1859 0.0591 5000 0.0533 0.0742 0.0952 0.3381 0.3906 0.4739
#> PCTGRT  0.1177 0.0488 5000 0.0172 0.0296 0.0465 0.2534 0.2912 0.3487
#> PCTSUPP 0.0569 0.0345 5000 0.0001 0.0023 0.0092 0.1447 0.1877 0.2342

confint(out, type = type)

#>           2.5 %    97.5 %
#> NARTIC  0.095203799 0.3380701
#> PCTGRT  0.046485260 0.2534445
#> PCTSUPP 0.009180325 0.1447309

```

6 Squared Partial Correlation

```

out <- PCorNB(nb)
# Methods -----
print(out)

#> Call:

```

```

#> PCorNB(object = nb)
#>
#> Squared partial correlations
#> type = "pc"
#>      est      se      R 0.05%   0.5%   2.5% 97.5% 99.5% 99.95%
#> NARTIC  0.4874 0.0977 5000 0.1361 0.2237 0.2897 0.6674 0.7153 0.7619
#> PCTGRT  0.3757 0.1089 5000 0.0268 0.0955 0.1572 0.5859 0.6475 0.6807
#> PCTSUPP 0.2254 0.1154 5000 0.0005 0.0114 0.0372 0.4815 0.5427 0.6569

summary(out)

#> Call:
#> PCorNB(object = nb)
#>
#> Squared partial correlations
#> type = "pc"
#>      est      se      R 0.05%   0.5%   2.5% 97.5% 99.5% 99.95%
#> NARTIC  0.4874 0.0977 5000 0.1361 0.2237 0.2897 0.6674 0.7153 0.7619
#> PCTGRT  0.3757 0.1089 5000 0.0268 0.0955 0.1572 0.5859 0.6475 0.6807
#> PCTSUPP 0.2254 0.1154 5000 0.0005 0.0114 0.0372 0.4815 0.5427 0.6569

coef(out)

#>      NARTIC      PCTGRT      PCTSUPP
#> 0.4874382 0.3757383 0.2253739

vcov(out)

#>      NARTIC      PCTGRT      PCTSUPP
#> NARTIC  0.009554750 0.0016974995 0.0018369608
#> PCTGRT  0.001697500 0.0118688386 0.0009118789
#> PCTSUPP 0.001836961 0.0009118789 0.0133272387

confint(out)

#>      2.5 %      97.5 %
#> NARTIC  0.28970911 0.6673671
#> PCTGRT  0.15718899 0.5859494
#> PCTSUPP 0.03722526 0.4814563

# BC
type <- "bc"
print(out, type = type)

#> Call:
#> PCorNB(object = nb)
#>
#> Squared partial correlations

```

```

#> type = "bc"
#>           est      se    R 0.05%   0.5%   2.5% 97.5% 99.5% 99.95%
#> NARTIC  0.4874 0.0977 5000 0.1087 0.2012 0.2736 0.6573 0.7059 0.7595
#> PCTGRT  0.3757 0.1089 5000 0.0245 0.0912 0.1519 0.5786 0.6405 0.6783
#> PCTSUPP 0.2254 0.1154 5000 0.0005 0.0103 0.0348 0.4778 0.5416 0.6540

summary(out, type = type)

#> Call:
#> PCorNB(object = nb)
#>
#> Squared partial correlations
#> type = "bc"
#>           est      se    R 0.05%   0.5%   2.5% 97.5% 99.5% 99.95%
#> NARTIC  0.4874 0.0977 5000 0.1087 0.2012 0.2736 0.6573 0.7059 0.7595
#> PCTGRT  0.3757 0.1089 5000 0.0245 0.0912 0.1519 0.5786 0.6405 0.6783
#> PCTSUPP 0.2254 0.1154 5000 0.0005 0.0103 0.0348 0.4778 0.5416 0.6540

confint(out, type = type)

#>           2.5 %    97.5 %
#> NARTIC  0.27359945 0.6572683
#> PCTGRT  0.15191839 0.5785730
#> PCTSUPP 0.03476088 0.4777814

# BCA
type <- "bca"
print(out, type = type)

#> Call:
#> PCorNB(object = nb)
#>
#> Squared partial correlations
#> type = "bca"
#>           est      se    R 0.05%   0.5%   2.5% 97.5% 99.5% 99.95%
#> NARTIC  0.4874 0.0977 5000 0.1090 0.2028 0.2743 0.6573 0.7072 0.7597
#> PCTGRT  0.3757 0.1089 5000 0.0319 0.0960 0.1568 0.5848 0.6524 0.6842
#> PCTSUPP 0.2254 0.1154 5000 0.0000 0.0016 0.0230 0.4495 0.5099 0.5695

summary(out, type = type)

#> Call:
#> PCorNB(object = nb)
#>
#> Squared partial correlations
#> type = "bca"
#>           est      se    R 0.05%   0.5%   2.5% 97.5% 99.5% 99.95%
#> NARTIC  0.4874 0.0977 5000 0.1090 0.2028 0.2743 0.6573 0.7072 0.7597
#> PCTGRT  0.3757 0.1089 5000 0.0319 0.0960 0.1568 0.5848 0.6524 0.6842
#> PCTSUPP 0.2254 0.1154 5000 0.0000 0.0016 0.0230 0.4495 0.5099 0.5695

```

```

confint(out, type = type)

#>           2.5 %    97.5 %
#> NARTIC  0.27428623 0.6572964
#> PCTGRT  0.15681501 0.5847693
#> PCTSUPP 0.02303264 0.4495330

```

7 Differences of Standardized Slopes

```

out <- DiffBetaNB(nb)
# Methods -----
print(out)

#> Call:
#> DiffBetaNB(object = nb)
#>
#> Differences of standardized regression slopes
#> type = "pc"
#>           est      se    R  0.05%   0.5%   2.5%  97.5%  99.5% 99.95%
#> NARTIC-PCTGRT  0.1037 0.1320 5000 -0.2873 -0.2208 -0.1483 0.3665 0.4579 0.6077
#> NARTIC-PCTSUPP 0.2319 0.1260 5000 -0.2250 -0.0968 -0.0146 0.4876 0.5538 0.6639
#> PCTGRT-PCTSUPP 0.1282 0.1284 5000 -0.2678 -0.2015 -0.1229 0.3833 0.4645 0.5499

summary(out)

#> Call:
#> DiffBetaNB(object = nb)
#>
#> Differences of standardized regression slopes
#> type = "pc"
#>           est      se    R  0.05%   0.5%   2.5%  97.5%  99.5% 99.95%
#> NARTIC-PCTGRT  0.1037 0.1320 5000 -0.2873 -0.2208 -0.1483 0.3665 0.4579 0.6077
#> NARTIC-PCTSUPP 0.2319 0.1260 5000 -0.2250 -0.0968 -0.0146 0.4876 0.5538 0.6639
#> PCTGRT-PCTSUPP 0.1282 0.1284 5000 -0.2678 -0.2015 -0.1229 0.3833 0.4645 0.5499

coef(out)

#>   NARTIC-PCTGRT NARTIC-PCTSUPP PCTGRT-PCTSUPP
#>      0.1036564      0.2318974      0.1282410

vcov(out)

#>           NARTIC-PCTGRT NARTIC-PCTSUPP PCTGRT-PCTSUPP
#> NARTIC-PCTGRT  0.017426558  0.008405627 -0.009020932
#> NARTIC-PCTSUPP  0.008405627  0.015873006  0.007467379
#> PCTGRT-PCTSUPP -0.009020932  0.007467379  0.016488311

```

```

confint(out)

#>               2.5 %    97.5 %
#> NARTIC-PCTGRT  -0.14833650 0.3665133
#> NARTIC-PCTSUPP -0.01464467 0.4876167
#> PCTGRT-PCTSUPP -0.12292275 0.3832955

# BC
type <- "bc"
print(out, type = type)

#> Call:
#> DiffBetaNB(object = nb)
#>
#> Differences of standardized regression slopes
#> type = "bc"
#>           est      se    R  0.05%   0.5%   2.5%  97.5%  99.5% 99.95%
#> NARTIC-PCTGRT  0.1037 0.1320 5000 -0.2887 -0.2260 -0.1501 0.3658 0.4501 0.6055
#> NARTIC-PCTSUPP 0.2319 0.1260 5000 -0.2448 -0.1024 -0.0189 0.4840 0.5524 0.6541
#> PCTGRT-PCTSUPP 0.1282 0.1284 5000 -0.2614 -0.1985 -0.1184 0.3856 0.4654 0.5517

summary(out, type = type)

#> Call:
#> DiffBetaNB(object = nb)
#>
#> Differences of standardized regression slopes
#> type = "bc"
#>           est      se    R  0.05%   0.5%   2.5%  97.5%  99.5% 99.95%
#> NARTIC-PCTGRT  0.1037 0.1320 5000 -0.2887 -0.2260 -0.1501 0.3658 0.4501 0.6055
#> NARTIC-PCTSUPP 0.2319 0.1260 5000 -0.2448 -0.1024 -0.0189 0.4840 0.5524 0.6541
#> PCTGRT-PCTSUPP 0.1282 0.1284 5000 -0.2614 -0.1985 -0.1184 0.3856 0.4654 0.5517

confint(out, type = type)

#>               2.5 %    97.5 %
#> NARTIC-PCTGRT  -0.15013031 0.3658146
#> NARTIC-PCTSUPP -0.01893604 0.4840001
#> PCTGRT-PCTSUPP -0.11840182 0.3855893

# BCA
type <- "bca"
print(out, type = type)

#> Call:
#> DiffBetaNB(object = nb)
#>
#> Differences of standardized regression slopes

```

```

#> type = "bca"
#>
#>      est      se      R   0.05%    0.5%    2.5%   97.5%   99.5%  99.95%
#> NARTIC-PCTGRT  0.1037 0.1320 5000 -0.2913 -0.2269 -0.1517 0.3648 0.4478 0.6008
#> NARTIC-PCTSUPP 0.2319 0.1260 5000 -0.2647 -0.1079 -0.0205 0.4803 0.5517 0.6458
#> PCTGRT-PCTSUPP 0.1282 0.1284 5000 -0.2366 -0.1788 -0.1065 0.4027 0.4871 0.5609

summary(out, type = type)

#> Call:
#> DiffBetaNB(object = nb)
#>
#> Differences of standardized regression slopes
#> type = "bca"
#>
#>      est      se      R   0.05%    0.5%    2.5%   97.5%   99.5%  99.95%
#> NARTIC-PCTGRT  0.1037 0.1320 5000 -0.2913 -0.2269 -0.1517 0.3648 0.4478 0.6008
#> NARTIC-PCTSUPP 0.2319 0.1260 5000 -0.2647 -0.1079 -0.0205 0.4803 0.5517 0.6458
#> PCTGRT-PCTSUPP 0.1282 0.1284 5000 -0.2366 -0.1788 -0.1065 0.4027 0.4871 0.5609

confint(out, type = type)

#>
#>      2.5 %    97.5 %
#> NARTIC-PCTGRT -0.15166140 0.3648251
#> NARTIC-PCTSUPP -0.02052482 0.4802540
#> PCTGRT-PCTSUPP -0.10651395 0.4027032

```

References

R Core Team. (2025). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. Vienna, Austria. <https://www.R-project.org/>