

betaMC: Staging

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Staging...

1 Monte Carlo Simulation

```
# Fit the regression model
object <- lm(QUALITY ~ NARTIC + PCTGRT + PCTSUPP, data = nas1982)
# Generate the sampling distribution of parameter estimates
mc <- MC(object, R = 20000, type = "mvn", seed = 42)
mc

#> Call:
#> MC(object = object, R = 20000, type = "mvn", seed = 42)
#> The first set of simulated parameter estimates
#> and model-implied covariance matrix.
#>
#> $coef
#> [1] 0.08346190 0.21294152 0.07933498
#>
#> $sigmasq
#> [1] 24.97154
#>
#> $vechsigmacapx
#> [1] 4828.3804 711.1341 611.5568 326.3624 289.0632 705.0508
#>
#> $sigmacapx
#>      [,1]      [,2]      [,3]
#> [1,] 4828.3804 711.1341 611.5568
#> [2,] 711.1341 326.3624 289.0632
#> [3,] 611.5568 289.0632 705.0508
#>
#> $sigmayx
#> [1] 120.9845
#>
#> $sigmayx
#> [1] 602.9336 151.7815 168.5304
#>
```

```
#> $sigmacap
#>      [,1]      [,2]      [,3]      [,4]
#> [1,] 120.9845 602.9336 151.7815 168.5304
#> [2,] 602.9336 4828.3804 711.1341 611.5568
#> [3,] 151.7815 711.1341 326.3624 289.0632
#> [4,] 168.5304 611.5568 289.0632 705.0508
#>
#> $pd
#> [1] TRUE
```

2 Standardized Regression Slopes

```
out <- BetaMC(mc)
# Methods -----
print(out)

#> Call:
#> BetaMC(object = mc)
#>
#> Standardized regression slopes
#> type = "mvn"
#>      est      se      R 0.05%  0.5%  2.5% 97.5% 99.5% 99.95%
#> NARTIC 0.4951 0.0756 20000 0.2360 0.2907 0.3380 0.6345 0.6808 0.7239
#> PCTGRT 0.3915 0.0768 20000 0.1451 0.1942 0.2378 0.5385 0.5867 0.6555
#> PCTSUPP 0.2632 0.0746 20000 0.0219 0.0777 0.1196 0.4112 0.4647 0.5146

summary(out)

#> Call:
#> BetaMC(object = mc)
#>
#> Standardized regression slopes
#> type = "mvn"
#>      est      se      R 0.05%  0.5%  2.5% 97.5% 99.5% 99.95%
#> NARTIC 0.4951 0.0756 20000 0.2360 0.2907 0.3380 0.6345 0.6808 0.7239
#> PCTGRT 0.3915 0.0768 20000 0.1451 0.1942 0.2378 0.5385 0.5867 0.6555
#> PCTSUPP 0.2632 0.0746 20000 0.0219 0.0777 0.1196 0.4112 0.4647 0.5146

coef(out)

#>      NARTIC      PCTGRT      PCTSUPP
#> 0.4951451 0.3914887 0.2632477

vcov(out)
```

```

#>           NARTIC      PCTGRT      PCTSUPP
#> NARTIC    0.005718765 -0.003289746 -0.002082071
#> PCTGRT   -0.003289746  0.005896966 -0.001762606
#> PCTSUPP  -0.002082071 -0.001762606  0.005572518

confint(out)

#>           2.5%      97.5%
#> NARTIC    0.3379751 0.6345051
#> PCTGRT    0.2378427 0.5385436
#> PCTSUPP   0.1196242 0.4112122

```

3 Multiple Correlation

```

out <- RSqMC(mc)
# Methods -----
print(out)

#> Call:
#> RSqMC(object = mc)
#>
#> R-squared and adjusted R-squared
#> type = "mvn"
#>      est      se      R 0.05%   0.5%   2.5%  97.5%  99.5% 99.95%
#> rsq 0.8045 0.0558 20000 0.5137 0.6014 0.6619 0.8795 0.8989 0.9223
#> adj 0.7906 0.0598 20000 0.4790 0.5729 0.6377 0.8709 0.8917 0.9168

summary(out)

#> Call:
#> RSqMC(object = mc)
#>
#> R-squared and adjusted R-squared
#> type = "mvn"
#>      est      se      R 0.05%   0.5%   2.5%  97.5%  99.5% 99.95%
#> rsq 0.8045 0.0558 20000 0.5137 0.6014 0.6619 0.8795 0.8989 0.9223
#> adj 0.7906 0.0598 20000 0.4790 0.5729 0.6377 0.8709 0.8917 0.9168

coef(out)

#>      rsq      adj
#> 0.8045263 0.7905638

vcov(out)

```

```
#>          rsq          adj
#> rsq 0.003111195 0.003333423
#> adj 0.003333423 0.003571525

confint(out)

#>          2.5%          97.5%
#> rsq 0.6618778 0.8794873
#> adj 0.6377262 0.8708793
```

4 Semipartial Correlation

```
out <- SCorMC(mc)
# Methods -----
print(out)

#> Call:
#> SCorMC(object = mc)
#>
#> Semipartial correlations
#> type = "mvn"
#>      est      se      R 0.05%   0.5%   2.5%  97.5%  99.5% 99.95%
#> NARTIC  0.4312 0.0772 20000 0.1688 0.2263 0.2702 0.5710 0.6270 0.6982
#> PCTGRT  0.3430 0.0739 20000 0.1167 0.1582 0.1945 0.4835 0.5362 0.6090
#> PCTSUPP 0.2385 0.0697 20000 0.0198 0.0681 0.1034 0.3772 0.4289 0.4823

summary(out)

#> Call:
#> SCorMC(object = mc)
#>
#> Semipartial correlations
#> type = "mvn"
#>      est      se      R 0.05%   0.5%   2.5%  97.5%  99.5% 99.95%
#> NARTIC  0.4312 0.0772 20000 0.1688 0.2263 0.2702 0.5710 0.6270 0.6982
#> PCTGRT  0.3430 0.0739 20000 0.1167 0.1582 0.1945 0.4835 0.5362 0.6090
#> PCTSUPP 0.2385 0.0697 20000 0.0198 0.0681 0.1034 0.3772 0.4289 0.4823

coef(out)

#>      NARTIC      PCTGRT      PCTSUPP
#> 0.4311525 0.3430075 0.2384789

vcov(out)
```

```
#>           NARTIC           PCTGRT           PCTSUPP
#> NARTIC    0.0059571212 -0.0012405254 -0.0008602859
#> PCTGRT   -0.0012405254  0.0054632721 -0.0007883791
#> PCTSUPP  -0.0008602859 -0.0007883791  0.0048514618

confint(out)

#>           2.5%           97.5%
#> NARTIC    0.2702204 0.5710152
#> PCTGRT    0.1945471 0.4835241
#> PCTSUPP   0.1033972 0.3772442
```

5 Improvement in R-Squared

```
out <- DeltaRSqMC(mc)
# Methods -----
print(out)

#> Call:
#> DeltaRSqMC(object = mc)
#>
#> Improvement in R-squared
#> type = "mvn"
#>           est           se           R 0.05%  0.5%  2.5% 97.5% 99.5% 99.95%
#> NARTIC    0.1859 0.0656 20000 0.0285 0.0512 0.0730 0.3261 0.3931 0.4875
#> PCTGRT    0.1177 0.0509 20000 0.0136 0.0250 0.0378 0.2338 0.2875 0.3708
#> PCTSUPP   0.0569 0.0341 20000 0.0004 0.0046 0.0107 0.1423 0.1840 0.2326

summary(out)

#> Call:
#> DeltaRSqMC(object = mc)
#>
#> Improvement in R-squared
#> type = "mvn"
#>           est           se           R 0.05%  0.5%  2.5% 97.5% 99.5% 99.95%
#> NARTIC    0.1859 0.0656 20000 0.0285 0.0512 0.0730 0.3261 0.3931 0.4875
#> PCTGRT    0.1177 0.0509 20000 0.0136 0.0250 0.0378 0.2338 0.2875 0.3708
#> PCTSUPP   0.0569 0.0341 20000 0.0004 0.0046 0.0107 0.1423 0.1840 0.2326

coef(out)

#>           NARTIC           PCTGRT           PCTSUPP
#> 0.1858925 0.1176542 0.0568722
```

```
vcov(out)

#>               NARTIC          PCTGRT          PCTSUPP
#> NARTIC    0.0043003753 -0.0007143576 -0.0003388994
#> PCTGRT   -0.0007143576  0.0025955660 -0.0002420022
#> PCTSUPP  -0.0003388994 -0.0002420022  0.0011657847

confint(out)

#>               2.5%          97.5%
#> NARTIC    0.07301909 0.3260584
#> PCTGRT    0.03784859 0.2337955
#> PCTSUPP   0.01069099 0.1423132
```

6 Squared Partial Correlation

```
out <- PCorMC(mc)
# Methods -----
print(out)

#> Call:
#> PCorMC(object = mc)
#>
#> Squared partial correlations
#> type = "mvn"
#>      est      se      R 0.05%   0.5%   2.5%  97.5%  99.5% 99.95%
#> NARTIC  0.4874 0.1048 20000 0.1076 0.1833 0.2429 0.6521 0.7059 0.7755
#> PCTGRT  0.3757 0.1067 20000 0.0567 0.1008 0.1481 0.5601 0.6192 0.6918
#> PCTSUPP 0.2254 0.0989 20000 0.0018 0.0219 0.0481 0.4289 0.5023 0.5842

summary(out)

#> Call:
#> PCorMC(object = mc)
#>
#> Squared partial correlations
#> type = "mvn"
#>      est      se      R 0.05%   0.5%   2.5%  97.5%  99.5% 99.95%
#> NARTIC  0.4874 0.1048 20000 0.1076 0.1833 0.2429 0.6521 0.7059 0.7755
#> PCTGRT  0.3757 0.1067 20000 0.0567 0.1008 0.1481 0.5601 0.6192 0.6918
#> PCTSUPP 0.2254 0.0989 20000 0.0018 0.0219 0.0481 0.4289 0.5023 0.5842

coef(out)

#>      NARTIC      PCTGRT      PCTSUPP
#> 0.4874382 0.3757383 0.2253739
```

```
vcov(out)

#>                NARTIC                PCTGRT                PCTSUPP
#> NARTIC  0.0109862401  5.821000e-04  3.703318e-04
#> PCTGRT  0.0005821000  1.138699e-02 -3.894856e-06
#> PCTSUPP 0.0003703318 -3.894856e-06  9.789182e-03

confint(out)

#>                2.5%                97.5%
#> NARTIC  0.24292530  0.6520529
#> PCTGRT  0.14807900  0.5601023
#> PCTSUPP 0.04809429  0.4289230
```

7 Differences of Standardized Slopes

```
out <- DiffBetaMC(mc)
# Methods -----
print(out)

#> Call:
#> DiffBetaMC(object = mc)
#>
#> Differences of standardized regression slopes
#> type = "mvn"
#>               est      se      R  0.05%   0.5%   2.5%  97.5%  99.5%  99.95%
#> NARTIC-PCTGRT  0.1037 0.1349 20000 -0.3517 -0.2541 -0.1631 0.3631 0.4388 0.5249
#> NARTIC-PCTSUPP 0.2319 0.1243 20000 -0.1918 -0.1020 -0.0209 0.4661 0.5344 0.6143
#> PCTGRT-PCTSUPP 0.1282 0.1225 20000 -0.2754 -0.1905 -0.1152 0.3678 0.4418 0.5339

summary(out)

#> Call:
#> DiffBetaMC(object = mc)
#>
#> Differences of standardized regression slopes
#> type = "mvn"
#>               est      se      R  0.05%   0.5%   2.5%  97.5%  99.5%  99.95%
#> NARTIC-PCTGRT  0.1037 0.1349 20000 -0.3517 -0.2541 -0.1631 0.3631 0.4388 0.5249
#> NARTIC-PCTSUPP 0.2319 0.1243 20000 -0.1918 -0.1020 -0.0209 0.4661 0.5344 0.6143
#> PCTGRT-PCTSUPP 0.1282 0.1225 20000 -0.2754 -0.1905 -0.1152 0.3678 0.4418 0.5339

coef(out)

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

```
vcov(out)

#>                NARTIC-PCTGRT NARTIC-PCTSUPP PCTGRT-PCTSUPP
#> NARTIC-PCTGRT    0.018195223    0.009327976   -0.008867247
#> NARTIC-PCTSUPP    0.009327976    0.015455426    0.006127449
#> PCTGRT-PCTSUPP   -0.008867247    0.006127449    0.014994697

confint(out)

#>                2.5%      97.5%
#> NARTIC-PCTGRT  -0.16312374 0.3630659
#> NARTIC-PCTSUPP -0.02094497 0.4660850
#> PCTGRT-PCTSUPP -0.11516287 0.3678390
```

References

R Core Team. (2023). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. Vienna, Austria. <https://www.R-project.org/>