

Neyman

```
setwd(dirname(rstudioapi::getActiveDocumentContext()$path))
df <- read_dta("dataverse_files/AER merged.dta")
df <- na.omit(df)

treated <- df %>% filter(treatment == 1)
control <- df %>% filter(treatment == 0)

# Input: Two treatment groups
# Function that returns:
#   (1) difference in means estimator
#   (2) estimate of variance
#   (3) p-value as a list
neyman <- function(Y1, Y0){
  est <- mean(Y1) - mean(Y0)

  n1 <- length(Y1)
  n0 <- length(Y0)
  var1 <- var(Y1)
  var0 <- var(Y0)
  est_var <- var1/n1 + var0/n0

  pval <- 2 * pnorm(abs(est/sqrt(est_var)), lower.tail=FALSE)
  out <- list("est" = est, "se" = sqrt(est_var), "p" = pval)

  return(out)
}
```

Outcome: amount

```
# Treatment vs. control -----
```

```
neyman(treated$amount, control$amount)
```

```
## $est  
## [1] 0.1828991  
##  
## $se  
## [1] 0.08320044  
##  
## $p  
## [1] 0.0279281
```

```
# Match ratio -----
```

```
## 1:1
```

```
neyman(treated$amount[treated$ratio == 1], control$amount)
```

```
## $est  
## [1] 0.1226974  
##  
## $se  
## [1] 0.1123439  
##  
## $p  
## [1] 0.2747634
```

```
## 2:1
```

```
neyman(treated$amount[treated$ratio == 2], control$amount)
```

```
## $est  
## [1] 0.2563545  
##  
## $se  
## [1] 0.1150728  
##  
## $p  
## [1] 0.02589656
```

```
## 3:1
```

```
neyman(treated$amount[treated$ratio == 3], control$amount)
```

```
## $est  
## [1] 0.1701284  
##  
## $se  
## [1] 0.1045112  
##  
## $p  
## [1] 0.1035573
```

```
# Threshold -----
```

```
## $25k
```

```
neyman(treated$amount[treated$size == 1], control$amount)
```

```
## $est  
## [1] 0.2862921  
##  
## $se  
## [1] 0.1328482  
##  
## $p  
## [1] 0.03115933
```

```
## $50k
```

```
neyman(treated$amount[treated$size == 2], control$amount)
```

```
## $est  
## [1] 0.1041568  
##  
## $se  
## [1] 0.1162334  
##  
## $p  
## [1] 0.3701992
```

```
## $100k
```

```
neyman(treated$amount[treated$size == 3], control$amount)
```

```
## $est  
## [1] 0.1064115  
##  
## $se  
## [1] 0.1082822  
##  
## $p  
## [1] 0.3257433
```

```
# Example amount -----
```

```
# Low
```

```
neyman(treated$amount[treated$ask == 1], control$amount)
```

```
## $est  
## [1] 0.154777  
##  
## $se  
## [1] 0.1073161  
##  
## $p  
## [1] 0.1492309
```

```
# Med
```

```
neyman(treated$amount[treated$ask == 2], control$amount)
```

```
## $est  
## [1] 0.2039597  
##  
## $se  
## [1] 0.1151514
```

```
##
## $p
## [1] 0.07652228

# High
neyman(treated$amount[treated$ask == 3], control$amount)

## $est
## [1] 0.1899811
##
## $se
## [1] 0.109537
##
## $p
## [1] 0.08284679
```

Covariates

```
# Blue vs. red -----

# Blue
neyman(treated$amount[treated$blue0==1], control$amount[control$blue0==1])

## $est
## [1] 0.02784326
##
## $se
## [1] 0.1055755
##
## $p
## [1] 0.7919891

# Red
neyman(treated$amount[treated$red0==1], control$amount[control$red0==1])

## $est
## [1] 0.4162072
##
## $se
## [1] 0.1344993
##
## $p
## [1] 0.001971494

# Donated in 2005 -----

# Donated
neyman(treated$amount[treated$dormant==0], control$amount[control$dormant==0])

## $est
## [1] 0.2322365
##
## $se
## [1] 0.1402614
##
```

```
## $p
## [1] 0.09777442
# Did not donate
neyman(treated$amount[treated$dormant==1], control$amount[control$dormant==1])

## $est
## [1] 0.1387725
##
## $se
## [1] 0.09403898
##
## $p
## [1] 0.1400267
```

Outcome: gave

```
# Treatment vs. control -----
```

```
neyman(treated$gave, control$gave)
```

```
## $est
## [1] 0.004852237
##
## $se
## [1] 0.001351028
##
## $p
## [1] 0.0003287626
```

```
# Match ratio -----
```

```
## 1:1
neyman(treated$gave[treated$ratio == 1], control$gave)
```

```
## $est
## [1] 0.003222787
##
## $se
## [1] 0.001756789
##
## $p
## [1] 0.06658334
```

```
## 2:1
neyman(treated$gave[treated$ratio == 2], control$gave)
```

```
## $est
## [1] 0.005402297
##
## $se
## [1] 0.001817126
##
## $p
## [1] 0.002949138
```

```
## 3:1
neyman(treated$gave[treated$ratio == 3], control$gave)
```

```
## $est
## [1] 0.005935811
##
## $se
## [1] 0.001826898
##
## $p
## [1] 0.001157624
```

```
# Threshold -----
```

```
## $25k
```

```
neyman(treated$gave[treated$size == 1], control$gave)
```

```
## $est  
## [1] 0.004098063  
##  
## $se  
## [1] 0.00196563  
##  
## $p  
## [1] 0.037082
```

```
## $50k
```

```
neyman(treated$gave[treated$size == 2], control$gave)
```

```
## $est  
## [1] 0.005099885  
##  
## $se  
## [1] 0.001995842  
##  
## $p  
## [1] 0.01061102
```

```
## $100k
```

```
neyman(treated$gave[treated$size == 3], control$gave)
```

```
## $est  
## [1] 0.004859129  
##  
## $se  
## [1] 0.001988947  
##  
## $p  
## [1] 0.01456305
```

```
# Example amount -----
```

```
# Low
```

```
neyman(treated$gave[treated$ask == 1], control$gave)
```

```
## $est  
## [1] 0.004515571  
##  
## $se  
## [1] 0.00179146  
##  
## $p  
## [1] 0.01171519
```

```
# Med
```

```
neyman(treated$gave[treated$ask == 2], control$gave)
```

```
## $est  
## [1] 0.004622976  
##  
## $se  
## [1] 0.001794511
```

```
##
## $p
## [1] 0.009989961
# High
neyman(treated$gave[treated$ask == 3], control$gave)

## $est
## [1] 0.005418873
##
## $se
## [1] 0.001815451
##
## $p
## [1] 0.00283705
```

Covariates

```
# Blue vs. red -----

# Blue
neyman(treated$gave[treated$blue0==1], control$gave[control$blue0==1])

## $est
## [1] 0.001480127
##
## $se
## [1] 0.001782172
##
## $p
## [1] 0.4062458

# Red
neyman(treated$gave[treated$red0==1], control$gave[control$red0==1])

## $est
## [1] 0.009965256
##
## $se
## [1] 0.002056955
##
## $p
## [1] 1.268262e-06

# Donated in 2005 -----

# Donated
neyman(treated$gave[treated$dormant==0], control$gave[control$dormant==0])

## $est
## [1] 0.006830274
##
## $se
## [1] 0.002406985
##
```



```
## $p
## [1] 0.004544143
# Did not donate
neyman(treated$gave[treated$dormant==1], control$gave[control$dormant==1])

## $est
## [1] 0.003067295
##
## $se
## [1] 0.001342301
##
## $p
## [1] 0.02230687
```