PS6_Econometrics

Isha

12/1/2021

```
library(haven)
Growth <- read_dta("Growth.dta")
##1a
#running regression
reg1 <- lm(growth ~ rgdp60 + tradeshare + yearsschool + rev_coups + assasinations, da
ta = Growth)
summary(reg1)
```

```
##
## Call:
## lm(formula = growth ~ rgdp60 + tradeshare + yearsschool + rev_coups +
##     assasinations, data = Growth)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.6329 -0.9437 -0.0538  0.7567  5.1548
##
## Coefficients:
##                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.4897603  0.6895996   0.710 0.480372
## rgdp60        -0.0004693  0.0001482  -3.167 0.002441 **
## tradeshare     1.5616957  0.7579475   2.060 0.043776 *
## yearsschool    0.5748461  0.1393379   4.126 0.000118 ***
## rev_coups     -2.1575029  1.1102915  -1.943 0.056769 .
## assasinations  0.3540784  0.4773943   0.742 0.461218
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.582 on 59 degrees of freedom
## Multiple R-squared:  0.3589, Adjusted R-squared:  0.3045
## F-statistic: 6.605 on 5 and 59 DF,  p-value: 6.065e-05
```

```
#build R'
Rprime <- cbind(0, 0, 1, -1, 0, 0)
#1x6 R' matrix
Rprime
```

```
##      [,1] [,2] [,3] [,4] [,5] [,6]
## [1,]    0    0    1   -1    0    0
```

```
#build q
q <- cbind(0)
q
```

```
##      [,1]
## [1,]    0
```

```
#1x1 q matrix

#F-test numerator

b_hat <- reg1$coefficients
Rbq <- Rprime %*% b_hat - q
X <- cbind(1, data.matrix(Growth[, -c(1,2)]))
XX_inv <- solve(t(X) %*% X)
num <- (t(Rbq) %*% solve(Rprime %*% XX_inv %*% t(Rprime)) %*% Rbq) / 1
num
```

```
##          [,1]
## [1,] 3.850016
```

```
#F-test denominator

e <- reg1$residuals
e
```

```
##            1            2            3            4            5            6
##  0.712777877  0.438147907  1.027130581  1.546183648  0.483944497  0.464612484
##            7            8            9           10           11           12
##  0.840661252  0.275706383 -1.350235445 -0.887314055 -0.591169181  1.095649775
##           13           14           15           16           17           18
##  0.977461144  1.364749567 -3.632865182 -1.135992839  0.756717747  1.974435698
##           19           20           21           22           23           24
## -3.483876333 -0.943653664  0.026431952 -0.053847489  0.019431318 -1.831183402
##           25           26           27           28           29           30
## -0.481546862 -0.264127276 -0.069827366  5.154800029 -0.100264751 -0.632520134
##           31           32           33           34           35           36
## -1.476336202 -1.197849482  2.848980885 -0.297358866 -2.179319351  0.003185655
##           37           38           39           40           41           42
##  1.163366948 -1.802028744  0.513305945  1.816681708 -0.633980402 -0.290869114
##           43           44           45           46           47           48
## -1.090584822  2.464691075 -0.639908121  0.617400586 -1.002311875 -2.334336413
##           49           50           51           52           53           54
##  1.065241304 -0.803464573  0.677464879 -1.661308712  0.034412506  3.700055092
##           55           56           57           58           59           60
## -1.126017595 -0.614225687 -0.159324154 -0.697830490 -1.997730403  0.230822048
##           61           62           63           64           65
##  2.011675398  1.279987538 -1.290440622  0.713567927  0.453968249
## attr(,"format.stata")
## [1] "%9.0g"
```

```
ss <- (t(e)%*%e) / (nrow(Growth) - 5)
ss
```

```
##          [,1]
## [1,] 2.461276
```

```
#F-test:
F_stat <- num/ss
F_stat
```

```
##          [,1]
## [1,] 1.564236
```

```
##1b)

#build R':

  Rprime2_row1<- cbind(0, 0, 1, 0, 0, 0)
  Rprime2_row2 <- cbind(0, 0, 0, 0, 1, 0)
  Rprime2_row3 <- cbind(0, 0, 0, 0, 0, 1)
  Rprime2 <- rbind(Rprime2_row1, Rprime2_row2, Rprime2_row3)
##3x6 R' matrix

  R2 <- t(Rprime2)

#build q

  q2 <- rbind(0, 0, 0)
  #3x1 q matrix

#build F-test numerator

  b_hat2 <- reg1$coefficients
  Rbq2 <- Rprime2 %*% b_hat2 - q2
  X2 <- cbind(1, data.matrix(Growth[, -c(1,2)]))
  XX_inv2 <- solve(t(X2) %*% X2)
  num2 <- (t(Rbq2) %*% solve(Rprime2 %*% XX_inv2 %*% t(Rprime2)) %*% Rbq2) / 3
  num2
```

```
##          [,1]
## [1,] 8.836748
```

```
#build F-test denominator

  e <- reg1$residuals
  ss <- (t(e)%*%e) / (nrow(Growth) - 6)
  ss
```

```
##          [,1]
## [1,] 2.502993
```

```
#F-test:
 F_stat2 <- num2/ss
 F_stat2
```

```
##          [,1]
## [1,] 3.530473
```

```
library(haven)
caschool <- read_dta("caschool.dta")
##4a)
reg2 <- lm(testscr ~ str + el_pct + meal_pct + comp_stu, data = caschool)
reg2
```

```
##
## Call:
## lm(formula = testscr ~ str + el_pct + meal_pct + comp_stu, data = caschool)
##
## Coefficients:
## (Intercept)          str       el_pct     meal_pct     comp_stu
##    694.2714      -0.8354      -0.1116      -0.5446      17.6634
```

```
#4b)
install.packages("lmtest")
```

```
## Installing package into '/cloud/lib/x86_64-pc-linux-gnu-library/4.1'
## (as 'lib' is unspecified)
```

```
install.packages("sandwich")
```

```
## Installing package into '/cloud/lib/x86_64-pc-linux-gnu-library/4.1'
## (as 'lib' is unspecified)
```

```
library(lmtest)
```

```
## Loading required package: zoo
```

```
##
## Attaching package: 'zoo'
```

```
## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric
```

```
library(sandwich)
reg2_robust <- coeftest(reg2, vcov = vcovHC(reg2, type = "HC0"))
reg2_robust
```

```
##
## t test of coefficients:
##
##               Estimate Std. Error  t value  Pr(>|t|)
## (Intercept) 694.271398   6.146900 112.9466 < 2.2e-16 ***
## str          -0.835397   0.277285  -3.0128 0.0027473 **
## el_pct       -0.111604   0.032406  -3.4440 0.0006316 ***
## meal_pct     -0.544644   0.024049 -22.6474 < 2.2e-16 ***
## comp_stu     17.663399   8.144975   2.1686 0.0306785 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##4c)

#get sigma squared

e2 <- reg2$residuals
eeprime <- (e2 %*% t(e2))
omega <- eeprime * diag(420)
dim(eeprime)
```

```
## [1] 420 420
```

```
#solve for X
caschoolX <- (caschool[c("str", "el_pct", "meal_pct", "comp_stu")])
n <- nrow(caschool)
ones <- matrix(1, nrow = n, ncol=1)
caschoolX <- cbind(ones, caschoolX)
dim(caschoolX)
```

```
## [1] 420   5
```

```
caschoolX <- as.matrix(caschoolX)

caschoolXprimeX <- t(caschoolX) %*% caschoolX
caschoolXX_inv <- solve(caschoolXprimeX)
dim(caschoolXX_inv)
```

```
## [1] 5 5
```

```
var_OLS <- caschoolXX_inv %*% t(caschoolX) %*% omega %*% caschoolX %*% caschoolXX_inv
var_OLS
```

```
##                 ones          str        el_pct      meal_pct     comp_stu
## ones       37.78438392 -1.652272229  0.0365670702 -0.0501777276 -22.76552070
## str        -1.65227223  0.076887187 -0.0016248453  0.0014798342   0.63064752
## el_pct      0.03656707 -0.001624845  0.0010501167 -0.0005495602   0.02291822
## meal_pct   -0.05017773  0.001479834 -0.0005495602  0.0005783450   0.02036925
## comp_stu -22.76552070  0.630647516  0.0229182163  0.0203692484  66.34061583
```