Escuela Superior de Física y Matemáticas

ECONOMETRÍA

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Actividad 4

Diciembre 2020

Ejercicios

ACTIVIDAD

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```r
library(lmtest)
library(sandwich)
library(car)
```

1. La función de demanda de un bien depende del precio (p_t) y el ingreso (y_t)

$$q_t = \beta_0 + \beta_1 p_t + \beta_2 y_t + u_t$$

Sin embargo, un investigador omite la variable ingreso y estima el modelo

$$q_t = \beta_0 + \beta_1 p_t + u_t$$

demostrar que si $cov(p_t, y_t) \neq 0$, el estimador β_1 es sesgado.

Demostración:

Tenemos que:

$$q_t - \bar{q} = \beta_1(p_t - \bar{q}) + u_t - \bar{u}$$

$$\sum(p_t - \bar{p})(q_t - \bar{q}) = \sum(p_t - \bar{p})[\beta_1(p_t - \bar{p}) + u_t - \bar{u}] = \beta_1 \sum(p_t - \bar{p})^2 + \sum(p_t - \bar{p})(u_t - \bar{u})$$

De lo anterior

$$\sum(p_t - \bar{p})(u_t - \bar{u}) = \sum(p_t - \bar{p})u_t - \sum(p_t - \bar{p})\bar{u} = \sum(p_t - \bar{p})u_t$$

$$\longrightarrow \sum(p_t - \bar{p})\bar{u} = 0$$

$$\sum(p_t - \bar{p})(q_t - \bar{q}) = \beta_1 \sum(p_t - \bar{p})^2 + \sum(p_t - \bar{p})u_t$$

Ahora, tenemos que:

$$cov(p_t, y_t) \neq 0$$

$$\hat{\beta} = \frac{\sum(p_t - \bar{p})(q_t - \bar{q})}{\sum(p_t - \bar{p})^2} = \frac{\beta_1 \sum(p_t - \bar{p})^2 + \sum(p_t - \bar{p})u_t^*}{\sum(p_t - \bar{p})^2}$$

$$Con$$

$$u_t^* = u_t + \sum(y_t - \bar{y})$$

Desarrollando,

$$\hat{\beta} = \beta_1 + \frac{\sum(p_t - \bar{p})u_t}{\sum(p_t - \bar{p})^2} + \frac{\sum(p_t - \bar{p})(y_t - \bar{y})}{\sum(p_t - \bar{p})^2}$$

Ahora, calculando el valor esperado de $\hat{\beta}$ obtenemos,

$$E[\hat{\beta}] = E[\beta_1] + E[\frac{\sum(p_t - \bar{p})u_t}{\sum(p_t - \bar{p})^2}] + E[\frac{\sum(p_t - \bar{p})(y_t - \bar{y})}{\sum(p_t - \bar{p})^2}]$$

donde

$$E[\frac{\frac{\sum(p_t-\bar{p})u_t}{n}}{\frac{\sum(p_t-\bar{p})^2}{n}}] = 0 \qquad E[\frac{\frac{\sum(p_t-\bar{p})(y_t-\bar{y})}{n}}{\frac{\sum(p_t-\bar{p})^2}{n}}] \neq 0$$

$$\longrightarrow E[\hat{\beta}] \neq E[\beta_1]$$

$\therefore \beta_1$ **Es sesgado**

2. Considerar el modelo de regresión lineal

$$y_i = \alpha + \beta x_i + u_i$$

suponer que c_1 y c_2 constantes con $c_2 \neq 0$ tal que

$$c_i y_i = \alpha + \beta c_2 x_i + u_i$$

demostrar que

$$\alpha^* = c_1\hat{\alpha} \qquad \beta^* = \frac{c_1}{c_2}\hat{\beta}$$

Demostración: Sabemos que

$$\hat{\alpha} = \bar{Y} - \hat{\beta}\bar{X}$$
$$\hat{\beta} = \frac{\sum(x_i - \bar{X})(y_i - \bar{Y})}{\sum(x_i - \bar{X})^2}$$

Sean

$$Y_i^* = c_1 Y_i \qquad X_i^* = c_2 X_i$$

entonces

$$\bar{Y}^* = \frac{\sum(Y_i^*)}{n}$$
$$\bar{X}^* = \frac{\sum(X_i^*)}{n}$$

Sustituyendo, tenemos que:

$$\beta^* = \frac{\sum(c_2x_i - c_2\bar{X})(c_1y_i - c_1\bar{Y})}{\sum(c_2x_i - c_2\bar{X})^2} = c_1c_2\frac{\sum(x_i - \bar{X})(y_i - \bar{Y})}{\sum c_2^2(x_i - \bar{X})^2} = \frac{c_1}{c_2}\frac{\sum(x_i - \bar{X})(y_i - \bar{Y})}{\sum(x_i - \bar{X})^2}$$

$$\therefore \beta^* = \frac{c_1}{c_2}\hat{\beta}$$

Ahora,

$$\alpha = \bar{Y} - \beta\bar{X}$$
$$\alpha^* = \bar{Y^*} - \beta^*\bar{X^*}$$

Sustituyendo

$$\alpha^* = c_1\bar{Y} - \frac{c_1}{c_2}\hat{\beta}c_2\bar{X} = c_1(\bar{Y} - \hat{\beta}\bar{X})$$

$$\therefore \alpha^* = c_1\hat{\alpha}$$

3. Comprobar que:

$$F = \frac{\frac{SRC_r - SRC_{nr}}{q}}{\frac{SRC_{nr}}{n-k}} = \frac{\frac{R^2_{nr} - R^2_r}{q}}{\frac{1-R^2_{nr}}{n-k}}$$

Solución:

$$\text{Por definición tenemos}$$
$$R^2 = 1 - \frac{SRC}{STC}$$
$$\text{Entonces, } R^2_{nr} \text{ no restringida es:}$$
$$R^2_{nr} = 1 - \frac{SRC_{nr}}{STC}$$
$$1 - R^2_{nr} = \frac{SRC_{nr}}{STC}$$
$$R^2_r \text{ restringida es:}$$
$$R^2_r = 1 - \frac{SRC_r}{STC}$$
$$\text{Sustituyendo, tenemos que:}$$
$$F = \frac{\frac{R^2_{nr} - R^2_r}{q}}{\frac{1-R^2_{nr}}{n-k}}$$
$$F = \frac{\frac{\frac{SRC_r}{STC} - \frac{SRC_{nr}}{STC}}{q}}{\frac{1-\frac{SRC_{nr}}{STC}}{n-k}}$$
$$\therefore F = \frac{\frac{SRC_r - SRC_{nr}}{q}}{\frac{SRC_{nr}}{n-k}}$$

4. Sea el modelo de regresión lineal

$$y_i = \beta_0 + \beta_1 x_{xi} + \beta_2 x_{i2} + \beta_3 x_{i3} + u_i$$

donde y se distribuye normalmente con media $\mu = 2$ y varianza unitaria $\sigma = 1$, x_i como una binomial con probabilidad $p = 0.5$ y $x = 5$, x_2 exponencial con $\lambda = 1$ y x_3 como Poisson con media . El tamaño de muestra es $n = 200$

```
y <-c(rnorm(200,2,1))
x.1 <-c(rbinom(200,5,0.5))
x.2 <-c(rexp(200,1))
x.3 <-c(rpois(200,4))
```

```
datos <- data.frame(y,x.1,x.2,x.3)
```

4.1. Calcular residuales $(\hat{e}_x)$de la regresión de x_{i1} sobre x_{i2} y x_{i2}

```
ols.x <- lm(x.1 ~ x.2 + x.3)
e.x <- residuals(ols.x)^2;e.x
```

```
##          1          2          3          4          5          6          7 
## 2.21849642 6.52159510 2.43026522 2.46566622 0.38703330 0.26845447 0.18597761 
##          8          9         10         11         12         13         14 
## 0.22592283 0.13357160 2.69495161 2.48427955 0.16066759 0.20848219 2.32685479 
##         15         16         17         18         19         20         21 
## 0.26647142 1.89183165 0.19299089 0.36001830 0.26747104 2.15048071 0.15025568 
##         22         23         24         25         26         27         28 
## 0.36323992 0.17002471 0.14757246 0.14813681 0.23374052 0.13120817 0.20576143 
##         29         30         31         32         33         34         35 
## 0.30220338 0.33572104 0.24774141 2.65739796 2.40711298 0.36330897 0.27357437 
##         36         37         38         39         40         41         42 
## 2.29458563 1.97783289 0.35529161 0.23041049 0.15872863 0.29807867 1.76398280 
##         43         44         45         46         47         48         49 
## 5.77193284 2.10050477 2.25564188 0.32209894 0.39906781 5.51558978 2.07021143 
##         50         51         52         53         54         55         56 
## 0.37097357 2.02430146 2.15411557 0.42261002 0.29228307 1.89903714 0.14617450 
##         57         58         59         60         61         62         63 
## 0.32866511 5.73232088 0.32113939 0.41598932 1.92295692 5.43701802 0.27423550 
##         64         65         66         67         68         69         70 
## 0.25174104 0.27128265 1.90687737 0.08701917 2.63564528 2.46826892 1.85117348 
##         71         72         73         74         75         76         77 
## 0.24132736 0.22251875 0.24965494 0.17207560 0.30730565 2.38968401 0.38473049 
##         78         79         80         81         82         83         84 
## 0.34574819 0.30585081 2.00272437 0.32455347 0.35775022 6.59360214 0.14466826 
##         85         86         87         88         89         90         91 
## 0.45453963 2.39375769 2.08859712 2.25404550 0.17969523 1.85162923 0.31308131 
##         92         93         94         95         96         97         98 
## 0.17748360 6.36279823 0.38020526 2.66431181 0.17181522 2.09412175 0.38112525 
##         99        100        101        102        103        104        105 
## 0.41051920 0.12870638 0.13222149 2.09374701 0.37672640 0.37418845 0.35168448 
##        106        107        108        109        110        111        112 
## 5.69962691 0.25799055 0.20817215 0.16578842 2.10776929 0.32346064 0.27758682 
##        113        114        115        116        117        118        119 
## 0.33876566 0.32438434 2.64274284 0.20488051 2.51838482 2.60823975 2.14312921 
##        120        121        122        123        124        125        126 
## 2.76208268 0.44553200 0.19916057 0.16551041 6.07986326 0.11378443 0.15389707 
##        127        128        129        130        131        132        133 
## 2.46259818 2.46028383 0.27210642 0.23715307 0.13623275 2.09874015 2.21097152 
##        134        135        136        137        138        139        140 
## 5.65052807 2.12463825 2.03461389 1.89927832 2.47979839 0.21305852 0.33007517 
##        141        142        143        144        145        146        147 
## 2.26034355 0.31430902 0.20935961 0.12996495 0.19331171 0.26508148 0.28537963 
##        148        149        150        151        152        153        154 
## 0.36963006 0.29317914 0.33606233 2.15330797 0.21263255 0.37447137 5.91060435 
##        155        156        157        158        159        160        161 
## 0.38054788 0.16396378 0.20558322 5.44146384 0.17702608 0.21715145 0.17221492 
##        162        163        164        165        166        167        168 
## 0.33197573 0.49504691 0.19664796 2.56540832 0.16021068 2.36357516 2.19749383 
##        169        170        171        172        173        174        175 
## 0.22281252 0.24701313 0.23192612 0.39337000 2.46979438 0.32094704 0.15714317 
##        176        177        178        179        180        181        182 
## 0.17054590 2.80866996 0.20296393 1.94532082 0.21144435 0.22759125 0.11846856 
##        183        184        185        186        187        188        189 
## 0.30248593 0.39620999 2.15295103 0.39470485 1.97681752 0.52501053 0.15729694 
```

```
##        190        191        192        193        194        195        196
## 0.14985502 0.29584925 6.26405201 0.25338219 2.65701733 0.07164753 0.32129269
##        197        198        199        200
## 2.68347341 0.23868269 0.33047257 0.26471809
```

4.2. Calcular residuales ($\hat{e}_y$)de la regresión de y_i sobre x_{i2} y x_{i2}

```
ols.y <- lm(y ~ x.2 + x.3)
e.y <- residuals(ols.y)^2;e.y

##            1            2            3            4            5            6
## 1.351767e-01 6.426220e+00 2.872198e-02 3.688512e-01 1.264929e-01 8.674842e-01
##            7            8            9           10           11           12
## 1.120487e-01 6.128770e-03 7.733907e-03 1.151530e+00 6.689019e+00 2.970896e-05
##           13           14           15           16           17           18
## 1.762539e+00 1.906814e-01 1.156017e+00 8.987426e-01 3.560336e+00 1.259671e+00
##           19           20           21           22           23           24
## 9.619026e-02 3.757483e-03 1.246661e+00 1.095899e+00 3.605784e-03 6.671477e-01
##           25           26           27           28           29           30
## 2.072071e-01 2.844733e+00 7.313362e-01 1.219667e-01 7.242227e-02 2.749755e-02
##           31           32           33           34           35           36
## 3.621613e-02 5.637983e-01 1.295855e-02 4.254769e-03 3.034144e-01 1.986497e-01
##           37           38           39           40           41           42
## 3.791247e-03 1.026231e-02 4.337090e-02 8.073256e-01 1.441775e+00 1.370308e-02
##           43           44           45           46           47           48
## 2.813457e-01 1.639196e+00 1.067291e+00 2.288652e-01 9.675867e-02 1.126133e-02
##           49           50           51           52           53           54
## 3.653280e+00 3.795599e-01 3.946809e-04 1.029865e-01 5.639325e-01 1.692329e-01
##           55           56           57           58           59           60
## 1.265635e+00 3.060843e+00 8.156764e-01 4.943213e-02 7.607675e-03 1.215579e+00
##           61           62           63           64           65           66
## 1.061399e-01 1.926577e+00 1.292977e+00 5.958578e-02 1.710682e-01 9.829013e-02
##           67           68           69           70           71           72
## 5.483859e+00 1.550518e+00 1.249121e+00 1.781687e+00 2.042075e-02 8.904017e-02
##           73           74           75           76           77           78
## 6.484120e-02 6.500926e-01 2.030891e-04 4.619888e-01 6.102199e-01 1.251730e+00
##           79           80           81           82           83           84
## 7.797541e-01 6.717942e-01 2.139642e-02 4.590462e+00 9.314334e-01 2.304643e-01
##           85           86           87           88           89           90
## 1.157998e-02 2.115733e-01 8.707146e+00 5.361704e-01 5.187986e-01 2.773028e-04
##           91           92           93           94           95           96
## 3.347593e-03 4.808961e-02 1.358805e-05 1.901455e-01 5.229694e-01 2.254686e-02
##           97           98           99          100          101          102
## 1.099091e+00 1.037371e+00 5.673460e-01 3.693105e+00 9.040918e-01 4.468107e-01
##          103          104          105          106          107          108
## 2.805925e-01 7.803889e-01 1.433935e-01 5.952625e-01 5.470768e-01 8.344472e-02
##          109          110          111          112          113          114
## 1.541570e-01 4.984818e-01 5.056430e-02 7.645051e-01 7.216842e-01 2.445695e+00
##          115          116          117          118          119          120
## 9.944126e-01 1.683748e+00 7.480305e-01 2.446847e-01 1.969550e-02 1.074107e-01
##          121          122          123          124          125          126
## 3.021078e-01 2.323403e-02 1.356012e+00 1.148420e+00 1.425273e-01 2.133519e-02
##          127          128          129          130          131          132
```

```
## 2.375935e+00 1.983927e+00 3.133862e-02 2.540646e+00 6.973838e-02 1.711508e+00
##          133          134          135          136          137          138
## 4.115045e-01 5.843521e-01 8.639186e-01 1.976134e-03 1.566525e+00 1.540899e-01
##          139          140          141          142          143          144
## 3.004177e-01 9.968096e-02 7.504884e-01 3.898487e+00 1.982275e+00 4.759495e-01
##          145          146          147          148          149          150
## 1.056062e-01 1.467230e-01 7.220037e-02 3.433438e-01 9.543030e-02 5.894106e-01
##          151          152          153          154          155          156
## 1.119870e-02 4.661184e-02 2.599018e-01 1.077967e+00 2.241865e+00 4.473509e-01
##          157          158          159          160          161          162
## 3.570476e-01 2.782347e-02 2.595015e-02 1.205242e-02 1.457540e-01 4.087104e-01
##          163          164          165          166          167          168
## 1.779847e+00 1.845868e-04 3.426665e-01 3.257303e-01 9.975183e-01 8.401636e-01
##          169          170          171          172          173          174
## 3.600969e-01 3.199800e-03 5.273256e-01 1.533519e-02 1.050612e-01 3.864404e+00
##          175          176          177          178          179          180
## 2.243812e-01 5.975089e-01 7.055129e-01 5.703166e+00 2.562092e+00 1.171093e+00
##          181          182          183          184          185          186
## 6.149895e-01 2.596267e-01 5.581925e-01 7.972989e-01 1.744210e+00 1.710037e-01
##          187          188          189          190          191          192
## 2.746643e-01 3.996553e-01 9.402720e-01 1.895392e+00 4.395681e-02 9.572891e-01
##          193          194          195          196          197          198
## 3.181510e-01 4.444374e-01 1.404415e-01 1.067173e+00 5.282157e-02 5.320478e-01
##          199          200
## 2.336680e-02 9.746698e-01
```

4.3. Calcular la regresión de $\hat{e}_y$ contra $\hat{e}_x$

```
ols.yx <- lm(e.y ~ e.x);ols.yx

##
## Call:
## lm(formula = e.y ~ e.x)
##
## Coefficients:
## (Intercept)          e.x
##     0.73513      0.07332
```

5. El siguiente modelo explica el peso de un niño al nacer en términos de distintos factores.

$$bwght_i = \beta_0 + \beta_1 cigs_i + \beta_2 parity_i + \beta_3 faminc_i + \beta_4 motheduc_i + \beta_5 fatheduc_i + u_i$$

donde *bwght* es el peso en libras, *cigs* número promedio de cigarros fumados por la madre durante el embarazo, *parity* orden de nacimiento del niño, *faminc* ingreso anual de la familia, *motheduc* y *fatheduc* años de escolaridad de la madre y el padre, respectivamente.
Utilizar la base de dato *bwght.RData* y observar que *motheduc* y *fatheduc* tienen datos no disponibles

```r
load("C:/Users/81799/Downloads/bwght.RData")
```

5.1. Estimar el modelo y explicar los resultados.

```r
bwght <- data$bwght;
cigs <- data$cigs
parity <- data$parity
faminc <- data$faminc
motheduc <- data$motheduc
fatheduc <- data$fatheduc
datos <- data.frame(bwght, cigs, parity, faminc , motheduc , fatheduc)
ols <- lm(bwght ~cigs + parity + faminc + motheduc + fatheduc  , data = datos); ols

##
## Call:
## lm(formula = bwght ~ cigs + parity + faminc + motheduc + fatheduc,
##     data = datos)
##
## Coefficients:
## (Intercept)         cigs       parity       faminc     motheduc     fatheduc
##   114.52433     -0.59594      1.78760      0.05604     -0.37045      0.47239
```

Los resultados obtenidos nos dicen que la cantidad de cigarros fumados por la madre durante el embarazo, e inclusive datos que parecieran que no influyen en el peso del niño como: años de escolaridad de la madre y padre, ingreso anual de la familia, influye en el peso.

```r
linearHypothesis( ols, c(" motheduc = 0", "fatheduc = 0"),white.adjust="hc1", test = "F" )

## Linear hypothesis test
##
## Hypothesis:
## motheduc = 0
## fatheduc = 0
##
## Model 1: restricted model
## Model 2: bwght ~ cigs + parity + faminc + motheduc + fatheduc
##
## Note: Coefficient covariance matrix supplied.
##
##   Res.Df Df    F Pr(>F)
## 1   1187
## 2   1185  2 1.64 0.1944

qf(c(0.005,0.995),2,Inf) #valor critico al 99%

## [1] 0.005012542 5.298317367

qf(c(0.025,0.975),2,Inf) #valor critico al 95%

## [1] 0.02531781 3.68887945
```

$$H_0 : \beta_4 = \beta_5 = 0$$
$$H_a : \beta_4 \neq 0 \beta_5 \neq 0$$

Como el estadístico F está dentro de la región de aceptación, entonces se acepta la hipótesis nula hasta con un 99 % de confiabilidad. Es decir, podemos omitir las variables *motheduc y fatheduc* en la regresión.

5.2. Comprobar la hipótesis del inciso anterior con errores homocedásticos y en términos de OLS restringidos y no restringidos

```
#R^2 no restringida
R2.nr <- summary(ols)$r.squared; R2.nr

## [1] 0.03874818

#R^2 Restringida
ols.r <- lm( bwght ~ cigs + parity + faminc , data= datos )
R2.r <- summary(ols.r)$r.squared; R2.r

## [1] 0.03480006

F.homo <- ( (R2.nr - R2.r) / 2) / ( (1 - R2.nr) / (1388 - 4)); F.homo

## [1] 2.842233

qf(c(0.005, 0.995), 2, Inf) #confiabilidad al 99%

## [1] 0.005012542 5.298317367

qf(c(0.025, 0.975), 2, Inf) #confiabilidad al 95% de probabilidad

## [1] 0.02531781 3.68887945

pf(F.homo, 2, Inf, lower.tail = F) #p value F

## [1] 0.05829533
```

Al hacer las pruebas de hipótesis para un nivel de significancia de $\alpha = 0.05$ y $\alpha = 0.01$ podemos observar que tenemos un $p - value = 0.05805638$, el cual es mayor a los dos valores de α, por lo tanto, podemos decir que la escolaridad de los padres no influye en el peso del niño.

6. Utilizar base de datos Growth.RData, excluir a Malta

```
load("C:/Users/81799/Downloads/Growth.RData")
```

```
tradeshare <- Growth[Growth$country_name != "Malta" , 5 ]
growth <- Growth[Growth$country_name != "Malta" , 2 ]
yearsschool <- Growth[Growth$country_name != "Malta" , 6 ]
rev_coups <- Growth[Growth$country_name != "Malta" , 7 ]
assasinations <- Growth[Growth$country_name != "Malta" , 8 ]
rgdp60 <- Growth[Growth$country_name != "Malta" , 4 ]
sinmalta <- data.frame(tradeshare,growth,yearsschool,rev_coups,assasinations,rgdp60)
```

6.1. Estimar regresión de: *Growth* contra *TradeShare*

```r
ols <- lm(growth~tradeshare , data = sinmalta); ols
```

```
##
## Call:
## lm(formula = growth ~ tradeshare, data = sinmalta)
##
## Coefficients:
## (Intercept)   tradeshare
##      0.9574       1.6809
```

6.1.1. Intervalo de confianza

```r
e.2 <- residuals(ols)^2
n <-length(e.2)
desvio.x <-(sinmalta$tradeshare-mean(sinmalta$tradeshare))^2
var.b <-(n/(n-2))*(sum(desvio.x*e.2)/(sum(desvio.x)^2))
sd.b <- sqrt(var.b)
s2.e <- sum(e.2)/(n-2) #sigma
b.var.homo <- s2.e/(sum(desvio.x))
b.sd.homo <- sqrt(b.var.homo)
cbind(inf=ols$coef[2]-1.96*b.sd.homo,sup=ols$coef[2]+1.96*b.sd.homo)
```

```
##                   inf      sup
## tradeshare -0.2543256 3.616135
```

6.1.2. ¿Es estadísticamente significativo el coeficiente al 5 % ?

```r
coeftest(ols,vcov=vcovHC, type="const")
```

```
##
## t test of coefficients:
##
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.95741    0.58037  1.6496  0.10407
## tradeshare   1.68090    0.98736  1.7024  0.09369 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Como el p-value es $> .05$

```r
t.homo <- ols$coef[2]/b.sd.homo
p.value.homo <- 2*pnorm(-abs (t.homo));p.value.homo
```

```
## tradeshare
## 0.08867682
```

Entonces, **No es estadísticamente significativo**

6.1.3. Estimar regresión de: *Growth* contra *yearsschool*

```r
ols <- lm(growth~yearsschool , data = sinmalta); ols
```

```
##
## Call:
## lm(formula = growth ~ yearsschool, data = sinmalta)
##
## Coefficients:
## (Intercept)  yearsschool
##      0.9608       0.2294
```

6.1.4. Estimar regresión de: *Growth* contra *RevCoups*

```r
ols <- lm(growth~rev_coups , data = sinmalta); ols
```

```
##
## Call:
## lm(formula = growth ~ rev_coups, data = sinmalta)
##
## Coefficients:
## (Intercept)    rev_coups
##       2.240       -2.183
```

6.1.5. Estimar regresión de: *Growth* contra *assasinations*

```r
ols <- lm(growth~assasinations , data = sinmalta); ols
```

```
##
## Call:
## lm(formula = growth ~ assasinations, data = sinmalta)
##
## Coefficients:
##   (Intercept)  assasinations
##        2.0095        -0.4981
```

6.1.6. Estimar regresión de: *Growth* contra *rgdp60*

```r
ols <- lm(growth~rgdp60 , data = sinmalta); ols
```

```
##
## Call:
## lm(formula = growth ~ rgdp60, data = sinmalta)
##
## Coefficients:
## (Intercept)       rgdp60
##   1.655e+00    6.834e-05
```

6.2. Comprobar si en conjunto las variable *Tradeshare, YearsSchool,RevCoups y Assasinations*deben excluirse de la regresión , utilizar homocedástico y heterocedástico, de forma manual y por linea de comando

```r
ols.sm<- lm(growth ~ tradeshare+yearsschool+rev_coups+rgdp60+assasinations, data =sinmalta);ols.
```

```
##
## Call:
## lm(formula = growth ~ tradeshare + yearsschool + rev_coups +
##     rgdp60 + assasinations, data = sinmalta)
##
## Coefficients:
##   (Intercept)     tradeshare    yearsschool      rev_coups         rgdp60
##     0.6268915      1.3408193      0.5642445     -2.1504256     -0.0004613
## assasinations
##     0.3225844
```

```r
#Regresión
R<- matrix(c(0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1),4);R
```

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

```r
r<- matrix(c(0,0,0,0),4);r
```

```
##      [,1]
## [1,]    0
## [2,]    0
## [3,]    0
## [4,]    0
```

```r
beta <- matrix(c(ols.sm$coef[2],ols.sm$coef[3],ols.sm$coef[4],ols.sm$coef[5],ols.sm$coef[6]), 5)
```

```
##               [,1]
## [1,]  1.3408193056
## [2,]  0.5642445298
## [3,] -2.1504255629
## [4,] -0.0004612893
## [5,]  0.3225844278
```

```r
q <- nrow(R); q
```

```
## [1] 4
```

```r
vcov.hete <- vcovHC(ols.sm, type="HC1")[2:6, 2:6]; vcov.hete
```

```
##                  tradeshare   yearsschool     rev_coups        rgdp60
## tradeshare    7.779040e-01  2.478589e-02  2.153272e-02  9.600657e-06
## yearsschool   2.478589e-02  1.676783e-02  2.226988e-02 -1.198361e-05
## rev_coups     2.153272e-02  2.226988e-02  7.649269e-01  1.182347e-08
## rgdp60        9.600657e-06 -1.198361e-05  1.182347e-08  1.476112e-08
## assasinations 1.782535e-01  2.242549e-03 -1.593797e-01  9.681170e-06
##               assasinations
## tradeshare     1.782535e-01
## yearsschool    2.242549e-03
## rev_coups     -1.593797e-01
## rgdp60         9.681170e-06
## assasinations  1.446644e-01
```

```r
F.hete <- (t(R%*%beta-r)%*%solve(R%*%vcov.hete%*%t(R))%*%(R%*%beta-r))/q;F.hete

##          [,1]
## [1,] 8.184027

pf(F.hete,q,Inf,lower.tail=F) #p value F

##              [,1]
## [1,] 1.352683e-06
```

6.2.1. Linea de comando-Heterocedástico

```r
linearHypothesis(ols.sm,c("yearsschool = 0", "rev_coups = 0",
"assasinations= 0", "rgdp60 = 0"),white.adjust="hc1",test="F")

## Linear hypothesis test
##
## Hypothesis:
## yearsschool = 0
## rev_coups = 0
## assasinations = 0
## rgdp60 = 0
##
## Model 1: restricted model
## Model 2: growth ~ tradeshare + yearsschool + rev_coups + rgdp60 + assasinations
##
## Note: Coefficient covariance matrix supplied.
##
##   Res.Df Df     F    Pr(>F)
## 1     62
## 2     58  4 8.184 2.649e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Es estadísticamente significativo

6.2.2. Forma manual-homocedástico

```r
R2.nr <- summary(ols.sm)$r.squared; R2.nr

## [1] 0.2911211

ols.r <- lm(growth ~ tradeshare , data=sinmalta)
R2.r <- summary(ols.r)$r.squared; R2.r

## [1] 0.04465809

F.homo <- ((R2.nr-R2.r)/(q)) / ((1-R2.nr) /(65-q)); F.homo

## [1] 5.30212

pf(F.homo, q, 61, lower.tail = F) #P-value

## [1] 0.0009895877
```

6.2.3. Linea de comando -Homocedástico

```
linearHypothesis(ols.sm, c("yearsschool = 0", "rev_coups = 0",
"assasinations= 0", "rgdp60 = 0"), test="F")

## Linear hypothesis test
##
## Hypothesis:
## yearsschool = 0
## rev_coups = 0
## assasinations = 0
## rgdp60 = 0
##
## Model 1: restricted model
## Model 2: growth ~ tradeshare + yearsschool + rev_coups + rgdp60 + assasinations
##
##   Res.Df    RSS Df Sum of Sq      F   Pr(>F)
## 1     62 198.53
## 2     58 147.31  4    51.217 5.0414 0.001481 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

6.3. Verificar si las variables *tradeshare* y *yearsschool* tienen el mismo coeficiente,utilizar robustosa a la heterocedasticidad, en forma manual y comprobar por linea de comando.

forma manual-heterocedástico

```
ols.ty <-lm(growth ~ tradeshare+yearsschool, data =sinmalta)
linearHypothesis(ols.ty , c(" tradeshare = 0", "yearsschool= 0"),white.adjust="hc1",test="F")

## Linear hypothesis test
##
## Hypothesis:
## tradeshare = 0
## yearsschool = 0
##
## Model 1: restricted model
## Model 2: growth ~ tradeshare + yearsschool
##
## Note: Coefficient covariance matrix supplied.
##
##   Res.Df Df     F Pr(>F)
## 1     63
## 2     61  2 6.399  0.003 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Forma manual-homocedástico

```
linearHypothesis(ols.ty , c(" tradeshare = 0", "yearsschool= 0"), test="F")

## Linear hypothesis test
##
```

```
## Hypothesis:
## tradeshare = 0
## yearsschool = 0
##
## Model 1: restricted model
## Model 2: growth ~ tradeshare + yearsschool
##
##   Res.Df    RSS Df Sum of Sq     F   Pr(>F)
## 1     63 207.81
## 2     61 174.43  2    33.376 5.836 0.004796 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

6.4. ¿Son significativas en forma global todas las variables? Deducir el estadítico con línea de comando y comprobar a apertir de modelo restringido y no restringido.

6.4.1. R^2 del modelo no restringido:

```
R2.nr <- summary(ols.sm)$r.squared; R2.nr

## [1] 0.2911211
```

6.4.2. Modelo restringido

```
ols.R <- lm(growth ~ 1 , data=sinmalta)
R2.R <- summary(ols.R)$r.squared; R2.R; R2.R

## [1] 0
## [1] 0

F.su <- ((R2.nr-R2.R)/(3)) / ((1-R2.nr) /(420-4)); F.su

## [1] 56.94737
```