HW6-Econometrics

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```
library(gmm)
```

```
## Loading required package: sandwich
```

```
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.1 --
```

```
## v ggplot2 3.3.5     v purrr   0.3.4
## v tibble  3.1.6     v dplyr   1.0.8
## v tidyr   1.2.0     v stringr 1.4.0
## v readr   2.1.2     v forcats 0.5.1
```

```
## Warning: package 'tidyr' was built under R version 4.0.5
```

```
## Warning: package 'readr' was built under R version 4.0.5
```

```
## Warning: package 'dplyr' was built under R version 4.0.5
```

```
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
mauro <- read_csv("mauro1995.csv")
```

```
## Rows: 57 Columns: 7
```

```
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## dbl (7): gr6085, gdp60, gpop6085, elf, sec60, ptrade, corruption
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
head(mauro)
```

```
## # A tibble: 6 x 7
##    gr6085 gdp60 gpop6085   elf sec60 ptrade corruption
##     <dbl> <dbl>    <dbl> <dbl> <dbl>  <dbl>      <dbl>
## 1 0.00481  3.09  0.0157     31  0.32   5.6        7.66
## 2 0.0214   5.18  0.0171     32  0.51   4.07      10
## 3 0.0331   3.91  0.00278    13  0.5   36.6        8
## 4 0.0319   4.38  0.00311    55  0.69  52.5        9.75
## 5 0.0352   1.31  0.0250      7  0.11   3.03       5.75
## 6 0.0279   6.07  0.0139     75  0.52   4.97      10
```

```
attach(mauro)
```

1. State assumptions to ensure that the structural model is identified.

- $E(u) = 0$,
- $E(ux_i) = 0$
- It's full rank.

b and c. Estimations and find the moment conditions.

Source function in the files of gfunction.R, and qderivfungmm.R.

```
source('~/Dropbox/My Mac (Wei's MacBook Air)/Downloads/PhD-Coursework/22Spring/Econometrics/My_solution_
source('~/Dropbox/My Mac (Wei's MacBook Air)/Downloads/PhD-Coursework/22Spring/Econometrics/My_solution_
```

```
#Below is the codes for question b and c, i met some bugs while compiling these
#code. especially in optim function. In the example code from prof. Shaw, he
#used fn=qfunctiongmm, but we don't have this function file, and i don't know
#what's it meaning, so i changed it to fn=gfunction. However, the error is
#Error in x%*% theta: non-conformable arguments..In order to compile this
#r-markdown file successfully, i have to comment this r block.
# N=length(gr6085)
# u=rnorm(N)
# X1=cbind(gdp60,gpop6085,sec60,corruption)
# Z1=X1
# ksi=solve((1/N)*t(Z1)%*%Z1)
# #thetah=cbind(0,0,-0.5,0.01,0)
# #Fix below later
# o = optim(cbind(0,0,0,-0.5,0),fn=gfunction,x=X1,y=corruption,z1=Z1,method="BFGS")
# b=o$par
# out1=qderivfungmm(y,x,z1,t(b),ksi)
# ksi=solve(out1$Lambda)
# o = optim(cbind(0,0,0),fn=gfunction,x=X1,y=y,z1=Z1,ksi=ksi,method="BFGS")
# b=o$par
# out1=qderivfungmm(y,x,z1,t(b),ksi)
# Avarhat=out1$Avar
# se=diag(Avarhat)^(1/2)
# t=b/se# For question c to test the null hypothesis
```

d: Now use ptrade as an IV.

The moment condition for gmm of ptrade as an iv is that $E(ptrade_i z) = 0$.

If ptrade is valide, the first state of F-stat should be larger than 10. And ptrade is not relevant to residual in the second stage.

e: Compute the F-stat and test is it strong.

```
ols_first_stage <- lm(corruption~gdp60+gpop6085+sec60+ptrade)
summary(ols_first_stage)
```

```
##
## Call:
## lm(formula = corruption ~ gdp60 + gpop6085 + sec60 + ptrade)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.4521 -0.9007  0.2235  0.8863  3.7889
```

```
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  2.95231    1.07140   2.756 0.008059 **
## gdp60        0.70490    0.18082   3.898 0.000279 ***
## gpop6085    27.47422   32.51655   0.845 0.402021
## sec60        3.69776    1.67592   2.206 0.031796 *
## ptrade       0.03764    0.01533   2.455 0.017450 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.564 on 52 degrees of freedom
## Multiple R-squared:  0.6357, Adjusted R-squared:  0.6077
## F-statistic: 22.69 on 4 and 52 DF,  p-value: 6.938e-11
```

The $F - stat = 2.455^2 = 6.03 < 10$, so the F-stat is not strong. And ptrade is not a good iv.

```
library(ivreg)
two_stage_1 <- ivreg(gr6085~gdp60+gpop6085+sec60+corruption|gdp60+gpop6085+sec60+corruption)
summary(two_stage_1)
```

```
##
## Call:
## ivreg(formula = gr6085 ~ gdp60 + gpop6085 + sec60 + corruption |
##     gdp60 + gpop6085 + sec60 + corruption)
##
## Residuals:
##        Min         1Q     Median         3Q        Max
## -0.0339862 -0.0098151  0.0002852  0.0083845  0.0360072
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.019266   0.011411   1.688 0.097312 .
## gdp60       -0.007215   0.002015  -3.580 0.000754 ***
## gpop6085    -0.398654   0.327491  -1.217 0.228987
## sec60        0.030932   0.017640   1.754 0.085407 .
## corruption   0.003144   0.001321   2.380 0.021031 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.01574 on 52 degrees of freedom
## Multiple R-Squared: 0.2635,  Adjusted R-squared: 0.2069
## Wald test: 4.652 on 4 and 52 DF,  p-value: 0.002761
```

f Use ptrade and elf as our new ivs.

```
first_stage_2 <- lm(corruption~gdp60+gpop6085+sec60+elf+ptrade)
summary(first_stage_2)
```

```
##
## Call:
## lm(formula = corruption ~ gdp60 + gpop6085 + sec60 + elf + ptrade)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
```

```
## -3.2112 -0.8007  0.0843  0.8408  3.7461
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  3.00953    1.06441   2.827 0.006689 **
## gdp60        0.76632    0.18534   4.135 0.000133 ***
## gpop6085    45.96295   35.14174   1.308 0.196762
## sec60        3.45013    1.67401   2.061 0.044420 *
## elf         -0.01142    0.00858  -1.331 0.189222
## ptrade       0.03356    0.01552   2.162 0.035359 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.552 on 51 degrees of freedom
## Multiple R-squared:  0.6479, Adjusted R-squared:  0.6134
## F-statistic: 18.77 on 5 and 51 DF,  p-value: 1.537e-10
```

```
two_stage_2 <- ivreg(gr6085~gdp60+gpop6085+sec60+corruption|gdp60+gpop6085+sec60+ptrade+elf)
summary(two_stage_2)
```

```
##
## Call:
## ivreg(formula = gr6085 ~ gdp60 + gpop6085 + sec60 + corruption |
##     gdp60 + gpop6085 + sec60 + ptrade + elf)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.029493 -0.010735 -0.000228  0.011161  0.043005
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.004567   0.018372   0.249  0.80466
## gdp60       -0.009829   0.003257  -3.018  0.00393 **
## gpop6085    -0.482045   0.362496  -1.330  0.18939
## sec60        0.014767   0.024248   0.609  0.54518
## corruption   0.007068   0.003904   1.810  0.07600 .
##
## Diagnostic tests:
##                  df1 df2 statistic p-value
## Weak instruments   2  51     3.945  0.0255 *
## Wu-Hausman         1  51     1.374  0.2465
## Sargan             1  NA     0.740  0.3895
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.01702 on 52 degrees of freedom
## Multiple R-Squared: 0.1386,  Adjusted R-squared: 0.07234
## Wald test: 3.586 on 4 and 52 DF,  p-value: 0.01175
```

Now, we can see based on these two methods, first on the first stage of 2sls, F-stat are still less than 10. On the other hand, the coefficient of 2sls is not statistically significant. Based on these reasons, the IVs are not strong.