IV

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IV esttimatorの**R**での計算方法は**4**種類

①両辺**IV**との**covariance**とる

②手動で**1st stage** と**second stage** を実行

③コマンドの**ivreg**

④コマンドの**tsls**

```
load("~/計量経済学演習/R data sets for 5e/mroz.RData")
mroz<-data
library(AER);library(stargazer)
```

```
## Loading required package: car
```

```
## Loading required package: carData
```

```
## Loading required package: lmtest
```

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

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

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

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

```
## Loading required package: survival
```

```
##
## Please cite as:
```

```
##  Hlavac, Marek (2018). stargazer: Well-Formatted Regression and Summary Statistics Tables.
```

```
##  R package version 5.2.2. https://CRAN.R-project.org/package=stargazer
```

Extract non-missing sample

```
sampleset <- subset(mroz, !is.na(wage))
```

OLS slope parameter manually

```
with(sampleset, cov(log(wage),educ) / var(educ) )
```

```
## [1] 0.1086487
```

①IV slope parameter manually

```
with(sampleset, cov(log(wage),fatheduc) / cov(educ,fatheduc) )
```

```
## [1] 0.05917348
```

OLS automatically

```
reg.ols <-  lm(log(wage) ~ educ, data=sampleset)
```

③IV automatically

```
reg.iv <- ivreg(log(wage) ~ educ | fatheduc, data=sampleset)
```

```
stargazer(reg.ols,reg.iv, type="text")
```

```
## 
## ===================================================================
##                          Dependent variable:
##                  -----------------------------------
##                            log(wage)
##                        OLS         instrumental
##                                      variable
##                        (1)           (2)
## ------------------------------------------------------------------
## educ                  0.109***        0.059*
##                       (0.014)        (0.035)
## 
## Constant              -0.185          0.441
##                       (0.185)        (0.446)
## 
## ------------------------------------------------------------------
## Observations            428            428
## R2                     0.118          0.093
## Adjusted R2            0.116          0.091
## Residual Std. Error (df = 426)     0.680        0.689
## F Statistic         56.929*** (df = 1; 426)
## ===================================================================
## Note:                 *p<0.1; **p<0.05; ***p<0.01
```

identical estimates as manual iv (①)

Add exper and I(exper^2) to the model as exogenous regressors and motheduc as IV

②

```
### 1st stage: reduced form

stage1 <- lm(educ~exper+I(exper^2)+motheduc+fatheduc, data=sampleset)

### 2nd stage
(man.2SLS<-lm(log(wage)~fitted(stage1)+exper+I(exper^2), data=sampleset))
```

```
##
## Call:
## lm(formula = log(wage) ~ fitted(stage1) + exper + I(exper^2),
##    data = sampleset)
##
## Coefficients:
##   (Intercept)  fitted(stage1)        exper    I(exper^2)
##      0.048100       0.061397     0.044170     -0.000899
```

④Automatic 2SLS estimation

```
library(sem)
(aut.2SLS<-tsls(log(wage)~educ+exper+I(exper^2),instruments=~motheduc+fatheduc+exper+I(exper^2
),data=sampleset))
```

```
##
## Model Formula: log(wage) ~ educ + exper + I(exper^2)
##
## Instruments: ~motheduc + fatheduc + exper + I(exper^2)
##
## Coefficients:
##   (Intercept)         educ        exper    I(exper^2)
## 0.0481002982 0.0613966289 0.0441703937 -0.0008989696
```

identical estimates as ②

Test of endogeneity(exogeneity) for (endogenous)regressor (not for IV but)

```
stage2<-lm(log(wage)~educ+exper+I(exper^2)+resid(stage1),data=sampleset)
```

results including t tests

```
coeftest(stage2)
```

```
##
## t test of coefficients:
##
##              Estimate  Std. Error t value  Pr(>|t|)
## (Intercept)   0.04810030 0.39457526  0.1219 0.9030329
## educ          0.06139663 0.03098494  1.9815 0.0481824 *
## exper         0.04417039 0.01323945  3.3363 0.0009241 ***
## I(exper^2)   -0.00089897 0.00039591 -2.2706 0.0236719 *
## resid(stage1) 0.05816661 0.03480728  1.6711 0.0954406 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

null hypothesis that coef of resid(stage1) is marginally rejected at significatce level 10% , this indicates endogeneity of educ .

Test overidentifying restrictions (test of exogeneity for composit IV)

auxiliary reg(composit IV が 2nd stageのerror と相関持ってたらまずい。)

```
res.aux<-lm(resid(aut.2SLS)~exper+I(exper^2)+motheduc+fatheduc, data=sampleset)
```

Calculations for test

```
( r2 <- summary(res.aux)$r.squared )
```

```
## [1] 0.0008833444
```

```
( n <- nobs(res.aux) )
```

```
## [1] 428
```

```
( teststat <- n*r2 )
```

```
## [1] 0.3780714
```

```
( pval <- 1-pchisq(teststat,1) )
```

```
## [1] 0.5386372
```

we cannot reject exogeneity of composit IV because of p-value :0.53