IV

Kei Sakamoto

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 Summar
y 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+fat
heduc+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=samp
leset)
```

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