[Example8-7] WLS(feasible GLS)

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Example8-6 の課題を克服。weight は知らないので推定しにくく

```
load("~/計量経済学演習/R data sets for 5e/smoke.RData")
smoke<-data
```

OLS

```
(olsreg<-lm(cigs~log(income)+log(cigpric)+educ+age+I(age^2)+restaurn,
                                                              data=smoke))
```

```
##
## Call:
## lm(formula = cigs ~ log(income) + log(cigpric) + educ + age +
##     I(age^2) + restaurn, data = smoke)
##
## Coefficients:
##  (Intercept)   log(income)  log(cigpric)          educ           age
##    -3.639826      0.880268     -0.750862     -0.501498      0.770694
##     I(age^2)      restaurn
##    -0.009023     -2.825085
```

```
library(lmtest);library(car)
```

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

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

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

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

```
coeftest(olsreg,vcov=hccm)
```

```
##
## t test of coefficients:
##
##                Estimate Std. Error t value  Pr(>|t|)
## (Intercept)  -3.6398259 25.8565263 -0.1408  0.888087
## log(income)   0.8802678  0.6014119  1.4637  0.143677
```

```
## log(cigpric) -0.7508616  6.0898855 -0.1233  0.901903
## educ         -0.5014982  0.1631261 -3.0743  0.002182 **
## age           0.7706936  0.1394893  5.5251 4.456e-08 ***
## I(age^2)     -0.0090228  0.0014769 -6.1091 1.563e-09 ***
## restaurn     -2.8250847  1.0114249 -2.7932  0.005344 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

BP test(Heteroskedasticity test。実は homoskedastic かもしれないので。)

```
library(lmtest)
bptest(olsreg)

##
##  studentized Breusch-Pagan test
##
## data:  olsreg
## BP = 32.258, df = 6, p-value = 1.456e-05
```

ちゃんと hetero っぽい。

FGLS: estimation of the variance function

```
logu2 <- log(resid(olsreg)^2)
varreg<-lm(logu2~log(income)+log(cigpric)+educ+age+I(age^2)+restaurn,
                                                    data=smoke)
```

この fitted を使って weight を作る

FGLS(WLS)

```
w <- 1/exp(fitted(varreg))
(wlsreg<-lm(cigs~log(income)+log(cigpric)+educ+age+I(age^2)+restaurn,
                                          weight=w ,data=smoke))

##
## Call:
## lm(formula = cigs ~ log(income) + log(cigpric) + educ + age +
##     I(age^2) + restaurn, data = smoke, weights = w)
##
## Coefficients:
##  (Intercept)   log(income)  log(cigpric)          educ           age
##     5.635463      1.295239     -2.940312     -0.463446      0.481948
##     I(age^2)      restaurn
##    -0.005627     -3.461064

coeftest(wlsreg)
```

```
##
## t test of coefficients:
##
##                 Estimate  Std. Error t value  Pr(>|t|)
## (Intercept)   5.63546270 17.80313936  0.3165  0.751673
## log(income)   1.29523934  0.43701172  2.9639  0.003128 **
## log(cigpric) -2.94031167  4.46014462 -0.6592  0.509931
## educ         -0.46344636  0.12015869 -3.8570  0.000124 ***
## age           0.48194797  0.09680824  4.9784 7.856e-07 ***
## I(age^2)     -0.00562721  0.00093948 -5.9897 3.175e-09 ***
## restaurn     -3.46106399  0.79550504 -4.3508 1.532e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

やはり se 見れば、WLS の方が hetero-robust se 使った OLS よりも efficient なのがわかる。全体的に WLS の方が se が小さい。