Chapter 7 - Multiple Regression Analysis with Qualitative Information

Thalles Quinaglia Liduares

2022-04-20

Exercise 7.2

Upload packages

```
library(wooldridge)
library(lmreg)
library(car)
```

Upload database

```
data<-wooldridge::wage2

attach(data)
```

Use the data in WAGE2.RAW for this exercise.

(i) Estimate the model

$$log(wage) = \beta_0 + \beta_1 educ + \beta_2 exper + \beta_3 tenure + \beta_4 married + \beta_5 black + \beta_6 south + \beta_7 urban + u$$

and report the results in the usual form. Holding other factors fixed, what is the approximate difference in monthly salary between blacks and nonblacks? Is this difference statistically significant?

```
summary(lm1<-lm(lwage~educ+exper+tenure+married+black+south+urban))
```

```
##
## Call:
## lm(formula = lwage ~ educ + exper + tenure + married + black +
##     south + urban)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.98069 -0.21996  0.00707  0.24288  1.22822
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  5.395497   0.113225  47.653  < 2e-16 ***
## educ         0.065431   0.006250  10.468  < 2e-16 ***
## exper        0.014043   0.003185   4.409 1.16e-05 ***
## tenure       0.011747   0.002453   4.789 1.95e-06 ***
## married      0.199417   0.039050   5.107 3.98e-07 ***
## black       -0.188350   0.037667  -5.000 6.84e-07 ***
## south       -0.090904   0.026249  -3.463 0.000558 ***
## urban        0.183912   0.026958   6.822 1.62e-11 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3655 on 927 degrees of freedom
## Multiple R-squared:  0.2526, Adjusted R-squared:  0.2469
## F-statistic: 44.75 on 7 and 927 DF,  p-value: < 2.2e-16
```

Given the estimated equation, we observe that `black` earns 18.8% less than `nonblacks`, holding other factors fixed. The difference is statistically significant at the 1% level.

(ii) Add the variables $exper^2$ and $tenure^2$ to the equation and show that they are jointly insignificant at even the 20% level.

```
tensq<-tenure*tenure

expsq<-exper*exper

summary(lm2<-lm(lwage ~ educ + exper + tenure + married + black +
    south + urban + tensq+expsq))
```

```
##
## Call:
## lm(formula = lwage ~ educ + exper + tenure + married + black +
##     south + urban + tensq + expsq)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.98236 -0.21972 -0.00036  0.24078  1.25127
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  5.3586757  0.1259143  42.558  < 2e-16 ***
## educ         0.0642761  0.0063115  10.184  < 2e-16 ***
## exper        0.0172146  0.0126138   1.365 0.172665
## tenure       0.0249291  0.0081297   3.066 0.002229 **
## married      0.1985470  0.0391103   5.077 4.65e-07 ***
## black       -0.1906636  0.0377011  -5.057 5.13e-07 ***
## south       -0.0912153  0.0262356  -3.477 0.000531 ***
## urban        0.1854241  0.0269585   6.878 1.12e-11 ***
## tensq       -0.0007964  0.0004710  -1.691 0.091188 .
## expsq       -0.0001138  0.0005319  -0.214 0.830622
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3653 on 925 degrees of freedom
## Multiple R-squared:  0.255,  Adjusted R-squared:  0.2477
## F-statistic: 35.17 on 9 and 925 DF,  p-value: < 2.2e-16
```

```
linearHypothesis(lm2, c("tensq=0","expsq=0"))
```

```
## Linear hypothesis test
##
## Hypothesis:
## tensq = 0
## expsq = 0
##
## Model 1: restricted model
## Model 2: lwage ~ educ + exper + tenure + married + black + south + urban +
##     tensq + expsq
##
##   Res.Df    RSS Df Sum of Sq      F Pr(>F)
## 1    927 123.82
## 2    925 123.42  2   0.39756 1.4898  0.226
```

Indeed, these two variables aren't jointly significant even at the 20% level.

(iii) Extend the original model to allow the return to education to depend on race and test whether the return to education does depend on race.

In progress..

(iv) Again, start with the original model, but now allow wages to differ across four groups of people: married and black, married and nonblack, single and black, and single and nonblack. What is the estimated wage differential between married blacks and married nonblacks?

In progress..