Chapter 6 - Multiple Regression Analysis: Further Issues

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Exercise 6.2

Upload packages

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

Upload database

```
data<-wooldridge::wage1

attach(data)
```

Use the data in WAGE1.RAW for this exercise.

(i) Use OLS to estimate the equation

$$log(wage) = \beta_0 + \beta_1 educ + \beta_2 exper + \beta_3 exper^2 + u$$

and report the results using the usual format.

```
summary(lm1<-lm(lwage~educ+exper+expersq))
```

```
##
## Call:
## lm(formula = lwage ~ educ + exper + expersq)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.96387 -0.29375 -0.04009  0.29497  1.30216
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.1279975  0.1059323   1.208    0.227
## educ         0.0903658  0.0074680  12.100  < 2e-16 ***
## exper        0.0410089  0.0051965   7.892 1.77e-14 ***
## expersq     -0.0007136  0.0001158  -6.164 1.42e-09 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4459 on 522 degrees of freedom
## Multiple R-squared:  0.3003, Adjusted R-squared:  0.2963
## F-statistic: 74.67 on 3 and 522 DF,  p-value: < 2.2e-16
```

The estimated equation is expressed as follows

$$\widehat{log(wage)} = 0.12 + 0.09educ + 0.04exper - 0.0007exper^2$$

All coefficients (except the intercept) are statistically significant at the 1% level.

(ii) Is $exper^2$ statistically significant at the 1% level?

Yes, as showed above.

(iii) Using the approximation

$$\%\widehat{\Delta wage} \approx 100(\hat{\beta}_2 + 2\hat{\beta}_3 exper)\Delta exper$$

find the approximate return to the fifth year of experience. What is the approximate return to the twentieth year of experience?

$$\%\widehat{\Delta wage} \approx 100(0.04 + 2 \cdot (-0.0007) \cdot 5) \cdot (5 - 4)$$

Hence, the percentual variation is equal to 3.3%. In the second case, substituing 5 by 20, we obtain a value 1.34%. So, there's a dimininshing increase in wage as experience increases.

(iv) At what value of exper does additional experience actually lower predicted log(wage)? How many people have more experience in this sample?

In this case, is necessary to derive the expression in relation to `exper` and equal to 0 to find the point of inflexion. The expression is given by

$$\frac{\widehat{\Delta wage}}{\Delta exper} = 0.04 - 2 \cdot 0.0007 \cdot exper = 0$$

$$exper^* = \frac{0.04}{2 \cdot (0.0007)} \approx 28.5$$

Thus, with approximately 28.5 years of experience, the salary return starts to decrease.