Chapter 2 - The Simple Regression Model

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Exercise 2.4

Upload of packages

```
library(wooldridge)
library(dplyr)
library(lmreg)
```

Upload of database

```
data4<-wooldridge::wage2

attach(data4)

#View(data4)
```

Use the data in WAGE2.RAW to estimate a simple regression explaining monthly salary (wage) in terms of IQ score (IQ).

(i) Find the average salary and average IQ in the sample. What is the sample standard deviation of IQ? (IQ scores are standardized so that the average in the population is 100 with a standard deviation equal to 15.)

```
ave_sal<-round(mean(wage),2)

ave_sal
```

```
## [1] 957.95
```

```
ave_iq<-round(mean(IQ),2)

ave_iq
```

```
## [1] 101.28
```

```
stand_dev<-sd(IQ)

stand_dev
```

```
## [1] 15.05264
```

The average salary is $\$957.95$ and the average IQ equal to 101.28.

(ii) Estimate a simple regression model where a one-point increase in IQ changes wage by a constant dollar amount. Use this model to find the predicted increase in wage for an increase in IQ of 15 points. Does IQ explain most of the variation in wage?

```
lm1<-lm(log(wage)~IQ, data=data4)

summary(lm1)
```

```
##
## Call:
## lm(formula = log(wage) ~ IQ, data = data4)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.09324 -0.25547  0.02261  0.27544  1.21486
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 5.8869943  0.0890206   66.13   <2e-16 ***
## IQ          0.0088072  0.0008694   10.13   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3999 on 933 degrees of freedom
## Multiple R-squared:  0.09909,    Adjusted R-squared:  0.09813
## F-statistic: 102.6 on 1 and 933 DF,  p-value: < 2.2e-16
```

Given the estimated equation, we obtain

$$log(wage) = 5.89 + 0.009 \times IQ$$

Hence,

$$log(wage) = 5.89 + 0.009 \times 15$$

$$log(wage) = 6.025\%$$

So, the return on wage is aproximately equal to 6.0% if IQ increases 15 points.

(iii) Now, estimate a model where each one-point increase in IQ has the same percentage effect on wage. If IQ increases by 15 points, what is the approximate percentage increase in predicted wage?

```
lm2<-lm(log(wage)~log(IQ), data=data4)

summary(lm2)
```

```
##
## Call:
## lm(formula = log(wage) ~ log(IQ), data = data4)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.09743 -0.24828  0.02547  0.27542  1.21110
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  2.94218    0.38409   7.660 4.64e-14 ***
## log(IQ)      0.83299    0.08334   9.995  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4005 on 933 degrees of freedom
## Multiple R-squared:  0.09672,    Adjusted R-squared:  0.09576
## F-statistic: 99.91 on 1 and 933 DF,  p-value: < 2.2e-16
```

In this case, we estimate the constant elasticity model. We observe that obtained equation is

$$log(wage) = 2.94 + 0.83 \times log(IQ)$$

Similarly, substituing in the above formula, we have

$$log(wage) = 2.94 + 0.83log(15)$$

$$log(wage) = 5.18\%$$