

Chapter 5 - OLS Asymptotics

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Exercise 5.1

Upload packages

```
library(wooldridge)
library(lmreg)
library(lmtest)
```

Upload database

```
data<-wooldridge::wage1

attach(data)
```

Use the data in WAGE1.RAW for this exercise.

(i) Estimate the equation

$$wage = \beta_0 + \beta_1 educ + \beta_2 exper + \beta_3 tenure + u$$

Save the residuals and plot a histogram.

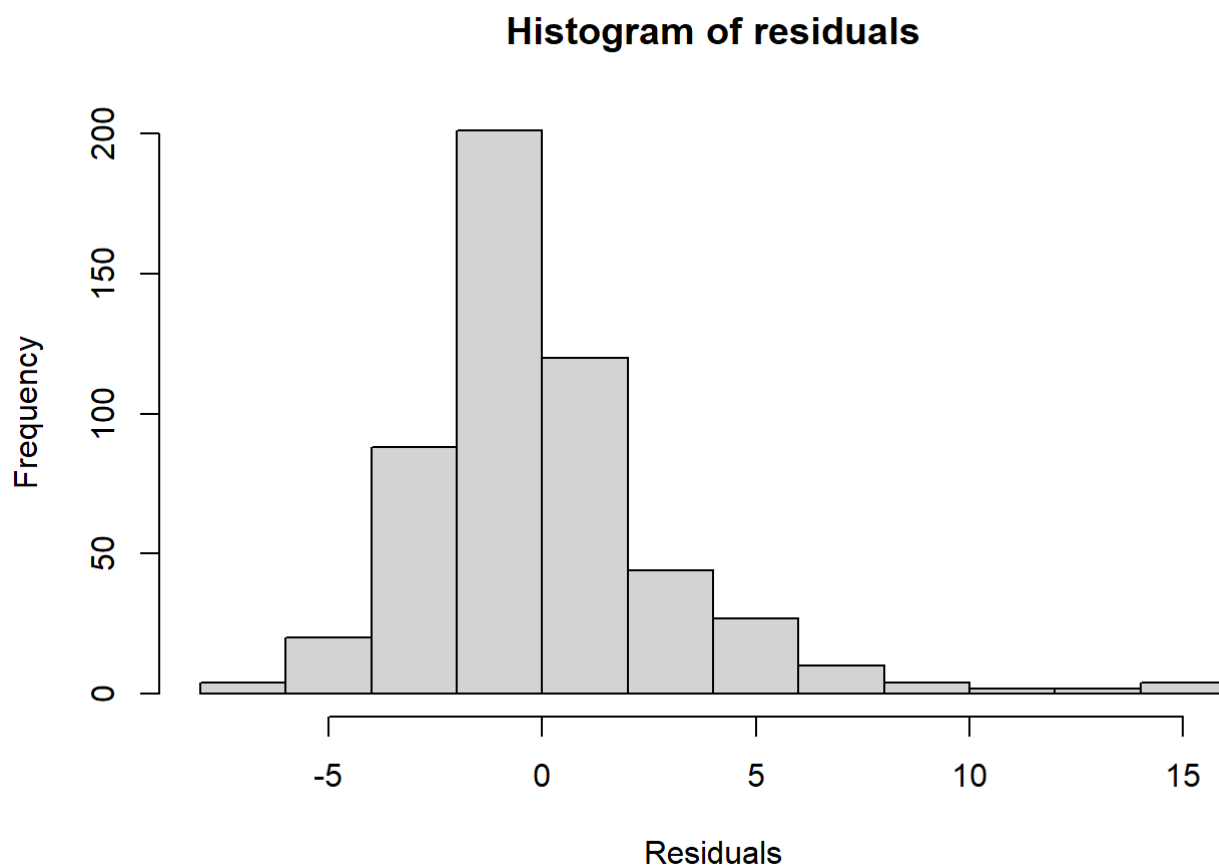
```
lm1<-lm(wage~educ+exper+tenure)

summary(lm1)
```

```
##
## Call:
## lm(formula = wage ~ educ + exper + tenure)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -7.6068 -1.7747 -0.6279  1.1969 14.6536
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -2.87273     0.72896  -3.941 9.22e-05 ***
## educ          0.59897     0.05128  11.679 < 2e-16 ***
## exper         0.02234     0.01206   1.853  0.0645 .
## tenure        0.16927     0.02164   7.820 2.93e-14 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.084 on 522 degrees of freedom
## Multiple R-squared:  0.3064, Adjusted R-squared:  0.3024
## F-statistic: 76.87 on 3 and 522 DF,  p-value: < 2.2e-16
```

Histogram

```
hist(lm1$residuals,  
     main="Histogram of residuals",  
     xlab="Residuals")
```



Normality of residuals test

```
Box.test(lm1$residuals, type="Ljung-Box") #lm1
```

```
##  
## Box-Ljung test  
##  
## data:  lm1$residuals  
## X-squared = 5.6728, df = 1, p-value = 0.01723
```

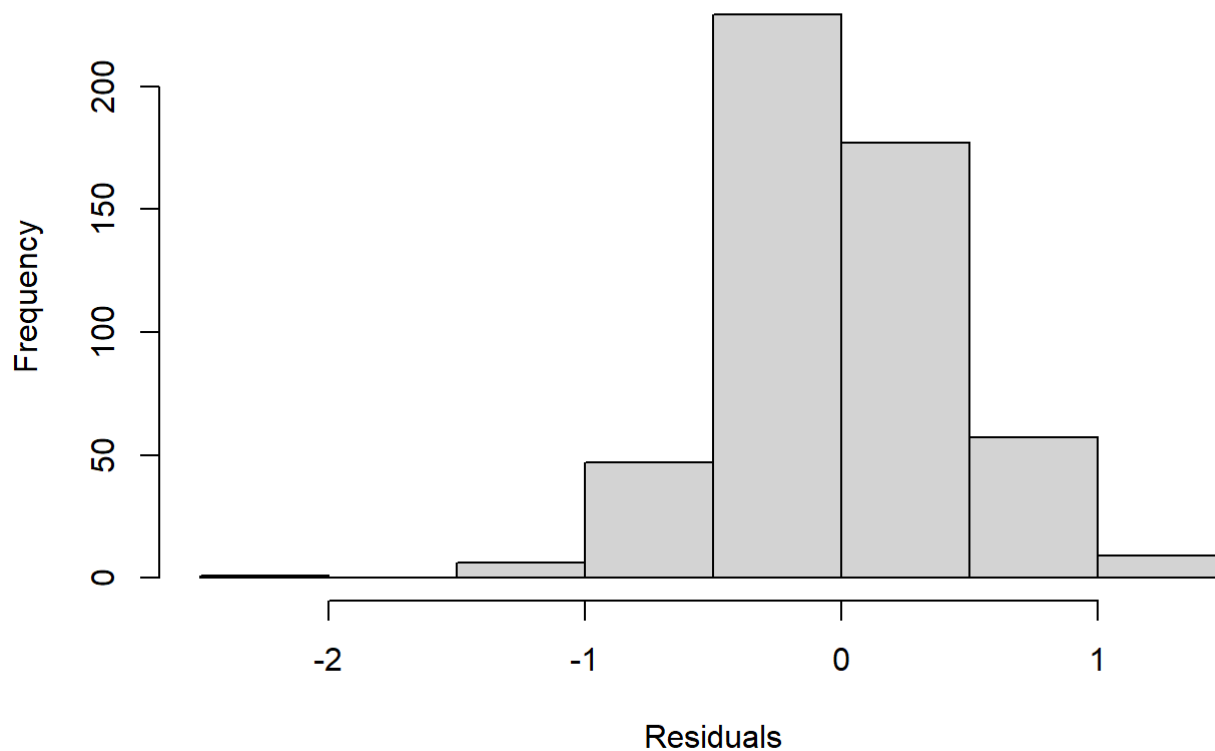
(ii) Repeat part (i), but with $\log(\text{wage})$ as the dependent variable.

```
lm2<-lm(lwage~educ+exper+tenure)  
  
summary(lm2)
```

```
##
## Call:
## lm(formula = lwage ~ educ + exper + tenure)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.05802 -0.29645 -0.03265  0.28788  1.42809
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.284360   0.104190   2.729  0.00656 **
## educ         0.092029   0.007330  12.555 < 2e-16 ***
## exper        0.004121   0.001723   2.391  0.01714 *
## tenure       0.022067   0.003094   7.133 3.29e-12 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4409 on 522 degrees of freedom
## Multiple R-squared:  0.316, Adjusted R-squared:  0.3121
## F-statistic: 80.39 on 3 and 522 DF, p-value: < 2.2e-16
```

```
hist(lm2$residuals,
     main="Histogram of residuals",
     xlab="Residuals")
```

Histogram of residuals



```
Box.test(lm2$residuals, type="Ljung-Box") #lm2
```

```
##  
## Box-Ljung test  
##  
## data: lm2$residuals  
## X-squared = 6.9406, df = 1, p-value = 0.008426
```

(iii) Would you say that Assumption MLR.6 is closer to being satisfied for the level-level model or the log-level model?

The first case is more close of a normal distribution of residuals.