

Chapter 3 - Linear Regression

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04/03/2022

Applied Exercise 3.11

Upload packages

```
library(lmreg)
```

Generate the sample model

```
set.seed(1)
x=rnorm(100)
y=2*x+rnorm (100)
```

(a) Perform a simple linear regression of y onto x , without an intercept. Report the coefficient estimate $\hat{\beta}$, the standard error of this coefficient estimate, and the t-statistic and p-value associated with the null hypothesis $H_0 : \beta = 0$. Comment on these results

```
lm1<-lm(y~x-1)
summary(lm1)
```

```
##
## Call:
## lm(formula = y ~ x - 1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.9154 -0.6472 -0.1771  0.5056  2.3109
##
## Coefficients:
##      Estimate Std. Error t value Pr(>|t|)
## x      1.9939      0.1065   18.73  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.9586 on 99 degrees of freedom
## Multiple R-squared:  0.7798, Adjusted R-squared:  0.7776
## F-statistic: 350.7 on 1 and 99 DF,  p-value: < 2.2e-16
```

The estimated model is expressed as follows

$$\hat{y} = 1.993x$$

The standard error, t-statistic and p-value are 0.106, 18.73 and 2e-16, respectively.

In this problem we will investigate the t-statistic for the null hypothesis $H_0 : \beta = 0$ in simple linear regression without an intercept. To begin, we generate a predictor x and a response y as follows.

```
set.seed(1)
x=rnorm(100)
y=2*x+rnorm (100)
```

(b) Now perform a simple linear regression of x onto y without an intercept, and report the coefficient estimate, its standard error, and the corresponding t-statistic and p-values associated with the null hypothesis $H_0 : \beta = 0$.

```
lm2<-lm(x~y-1)

summary(lm2)
```

```
##
## Call:
## lm(formula = x ~ y - 1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.8699 -0.2368  0.1030  0.2858  0.8938
##
## Coefficients:
##      Estimate Std. Error t value Pr(>|t|)
## y   0.39111    0.02089   18.73  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4246 on 99 degrees of freedom
## Multiple R-squared:  0.7798, Adjusted R-squared:  0.7776
## F-statistic: 350.7 on 1 and 99 DF,  p-value: < 2.2e-16
```

The estimated model is expressed as follows

$$\hat{x} = 0.39y$$

The standard error, t-statistic and p-value are 0.02, 18.73 and 2e-16, respectively.

(c) What is the relationship between the results obtained in (a) and (b)?

The principal difference between these models, is the magnitude of slope in curve. In the item (a), the slope is 2, as in item (b) is 0.4, aproximately.