LiMo WiSe 16/17 Sh4 Ex5

Christoph Stiehm

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5a) How many observations did we use?

n = 76 (Calculate with DF = 73 or by utilizing Adjusted R-squared from output $R^2(adj) = 1 - \frac{n-1}{n-k-1}(1-R^2)$)

5b) Fill in the missing values.

t-value for x calculated as absolute value of ratio of estimate and standard error, here 0.45842/0.12677

p-Values

```
pt(0.74669 / 0.24922, 73, lower = F) * 2
```

```
## [1] 0.003733763
```

```
pt(abs(-0.45842/ 0.12677), 73, lower = F) * 2
```

```
## [1] 0.0005471155
```

```
pt(0.02796/0.01255, 73, lower = F) * 2
```

```
## [1] 0.02896945
```

Coefficients

Covariate	t value	p Value
(Intercept)	2.996	0.003733
x	3.616	0.000547
x^2	2.227	0.02900

F-statistic

Variant 1

$F = \frac{R^2 * (n-k-1)}{(1-R^2)*k} \Rightarrow F = \frac{0.3383*(76-2-1)}{(1-0.3383)*2} \Leftrightarrow F = 18.66095$

Control (p-Value given in output)

```
pf(18.66095, 2, 73, lower.tail = F)
```

```
## [1] 2.84532e-07
```

Variant 2

Calculate SS_{Error}, RSE taken from Output $RSE = \sqrt{\frac{SS_{Error}}{n-k-1}} \Rightarrow 0.9343 = \sqrt{\frac{SS_{Error}}{73}} \Leftrightarrow SS_{Error} = 63.7229$

Calculate SS_{Total}
$SS_{Total} = \frac{SS_{Error}}{1-R^2} \Rightarrow SS_{Total} = \frac{63.7229}{1-0.3383} \Leftrightarrow SS_{Total} = 96.3018$

Calculate $SS_{Regression}$
$SS_{Regression} = SS_{Total} - SS_{Error} \Rightarrow SS_{Regression} = 32.5789$

Calculate $MS_{Regression}$ and MS_{Error}
$MS_{Regression} = \frac{SS_{Regression}}{k} \Rightarrow MS_{Regression} = 16.28945$
$MS_{Error} = \frac{SS_{Error}}{n-k-1} \Rightarrow MS_{Error} = 0.8729164$

Calculate F statistic $F = \frac{MS_{Regression}}{MS_{Error}} \Rightarrow F = 18.66095$

Conforms with value from Variant 1 therefore fits the p-Value as well.

5c) Test the overall regression hypothesis (significance level 1%).

p-Value in Output, 2.841e-07 < 0.01, we reject $H_0 : \boldsymbol{\beta}_1 = 0$, at least one of β_1 or β_2 ist not zero.

5d) Can we reject (at 5% significance level) the hypothesis that the regression function goes through the origin?

Yes. p-Value for Intercept 0.003733 < 0.05, Intercept is not zero.

Control via CI
$\beta_0 \pm t_{0.975,n-k-1} SE_{\beta_0}$
Upper
$\Rightarrow 0.74669 + 1.992997 * 0.24922 = 1.243385$
Lower
$\Rightarrow 0.74669 - 1.992997 * 0.24922 = 0.2499953$