# Multiple Comparison Procedures To A Control

For AN(C)OVA Models

Statsomat.com Contributors*

10 Juni 2021

## Contents



*Denise Welsch, Markus Neuhäuser, Studentin1, Studentin2, Studentin3, Studentin4, Studentin5

# Basic Information

Automatic statistics for the file:

| File |
|---|
| warpbreaks.csv |

Your selection for the encoding: UTF-8
Your selection for the decimal character: .
Observations (rows with at least one non-missing value): 54
Variables (columns with at least one non-missing value): 3
Variables considered continuous: 1

| Variables considered continuous |
|---|
| breaks |

Variables considered categorical: 2

| Variables considered categorical |
|---|
| wool |
| tension |

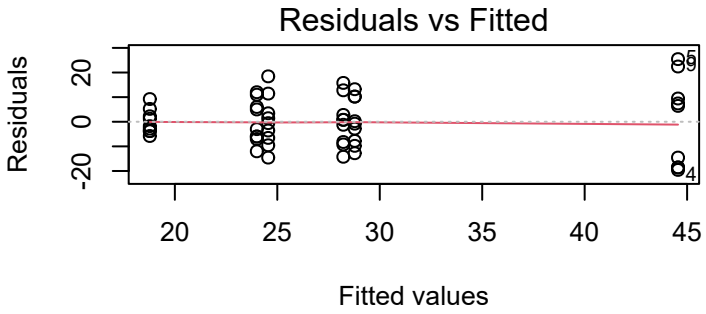
Table 4: Parameter Estimates

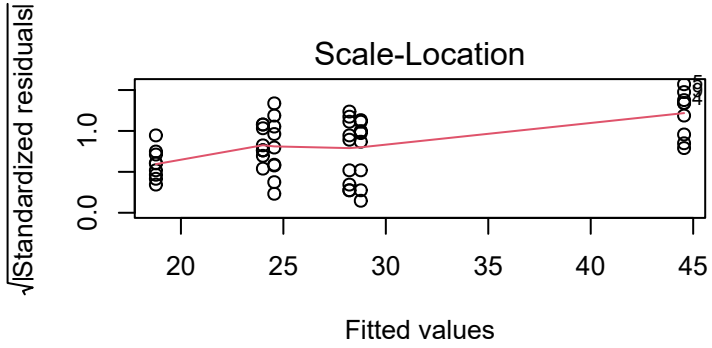
| Variable | Value | Std.Error | t.value | pvalue | sign. level[1] | Significance at 5 percent error |
|---|---|---|---|---|---|---|
| (Intercept) | 28.15 | 1.49 | 18.91 | <0.001 | *** | Intercept Significant. |
| wool1 | 2.89 | 1.49 | 1.94 | 0.058 | . | Not Significant. No difference between the effect of wool1 and its reference. |
| tension1 | 8.24 | 2.11 | 3.91 | <0.001 | *** | Significant. A Difference between the effect of tension1 and its reference. |
| tension2 | -6.48 | 2.11 | -3.08 | 0.003 | ** | Significant. A Difference between the effect of tension2 and its reference. |
| wool1:tension1 | 5.28 | 2.11 | 2.51 | 0.016 | * | Interaction Significant. Effect wool1 vs. reference depends on tension1. |
| wool1:tension2 | 0.00 | 2.11 | 0.00 | 1 | | Interaction not Significant. Effect wool1 vs. reference don't depends on tension2. |

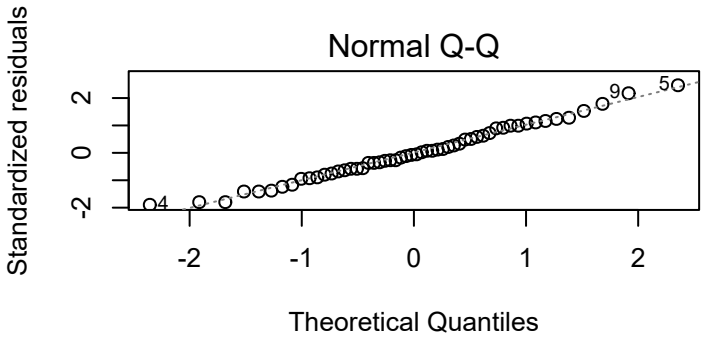
[1] '***': sign. to 0.1% error. '**': sign. to 1% error. '*': sign. to 5% error. ' . ': sign. to 10% error. ' ': not sign. ' - ': no statement.

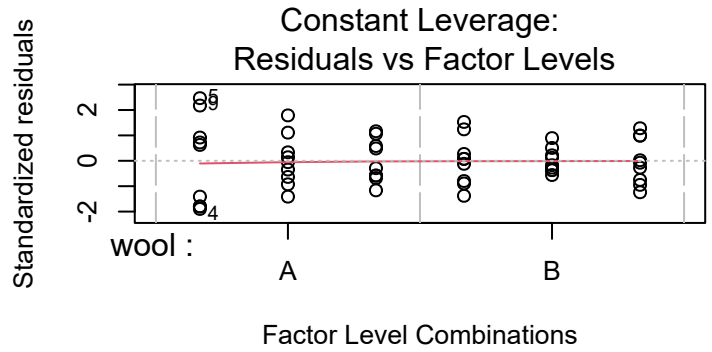
```
Anova Table (Type III tests)

Response: breaks
             Sum Sq Df  F value    Pr(>F)
(Intercept)   42785  1 357.4672 < 2.2e-16 ***
wool            451  1   3.7653 0.0582130 .
tension        2034  2   8.4980 0.0006926 ***
wool:tension   1003  2   4.1891 0.0210442 *
Residuals      5745 48
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```




```
     Simultaneous Tests for General Linear Hypotheses

Multiple Comparisons of Means: Dunnett Contrasts


Fit: lm(formula = modelfunction, data = df_factorized)

Linear Hypotheses:
           Estimate Std. Error t value  Pr(<t)
H - L >= 0  -14.722      3.647  -4.037 0.00019 ***
M - L >= 0  -10.000      3.647  -2.742 0.00809 **
```

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
(Adjusted p values reported -- single-step method)


     Simultaneous Confidence Intervals

Multiple Comparisons of Means: Dunnett Contrasts


Fit: lm(formula = modelfunction, data = df_factorized)

Quantile = 1.9613
95% family-wise confidence level


Linear Hypotheses:
           Estimate lwr      upr
H - L >= 0 -14.7222     -Inf  -7.5698
M - L >= 0 -10.0000     -Inf  -2.8475


     Simultaneous Tests for General Linear Hypotheses

Multiple Comparisons of Means: Dunnett Contrasts


Fit: lm(formula = modelfunction, data = df_factorized)

Linear Hypotheses:
           Estimate Std. Error t value  Pr(<t)
H - L >= 0  -14.722      3.647  -4.037 0.00019 ***
M - L >= 0  -10.000      3.647  -2.742 0.00428 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
(Adjusted p values reported -- free method)


     Simultaneous Tests for General Linear Hypotheses

Multiple Comparisons of Means: Dunnett Contrasts


Fit: lm(formula = modelfunction, data = df_factorized)
```

```
Linear Hypotheses:
           Estimate Std. Error t value   Pr(<t)
H - L >= 0  -14.722      3.699  -3.980 0.000213 ***
M - L >= 0  -10.000      3.812  -2.623 0.009922 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
(Adjusted p values reported -- single-step method)


     Simultaneous Confidence Intervals

Multiple Comparisons of Means: Dunnett Contrasts


Fit: lm(formula = modelfunction, data = df_factorized)

Quantile = 1.9069
95% family-wise confidence level


Linear Hypotheses:
           Estimate lwr      upr
H - L >= 0 -14.7222     -Inf  -7.6683
M - L >= 0 -10.0000     -Inf  -2.7300


     Simultaneous Tests for General Linear Hypotheses

Multiple Comparisons of Means: Dunnett Contrasts


Fit: lm(formula = modelfunction, data = df_factorized)

Linear Hypotheses:
           Estimate Std. Error t value   Pr(<t)
H - L >= 0  -14.722      3.699  -3.980 0.000213 ***
M - L >= 0  -10.000      3.812  -2.623 0.005824 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
(Adjusted p values reported -- free method)
```

# References


Fox, John, and Sanford Weisberg. 2019. *An R Companion to Applied Regression*. Third. Thousand Oaks CA: Sage. https://socialsciences.mcmaster.ca/jfox/Books/Companion/.

Gross, Juergen, and Uwe Ligges. 2015. *Nortest: Tests for Normality*. https://CRAN.R-project.org/package=nortest.

Madsen, Jacob H. 2018. *DDoutlier: Distance & Density-Based Outlier Detection*. https://CRAN.R-project.org/package=DDoutlier.

R Core Team. 2019. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing. https://www.R-project.org/.

Zeileis, Achim, and Torsten Hothorn. 2002. "Diagnostic Checking in Regression Relationships." *R News* 2 (3): 7–10. https://CRAN.R-project.org/doc/Rnews/.