Multiple Comparison Procedures To A Control

For AN(C)OVA Models

Statsomat.com Contributors*

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Contents

*Denise Welsch, Markus Neuhäuser, Viktoria Daum, Linda Müller, Damian Nink, Simone Schüttler, Daniela Wüller

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

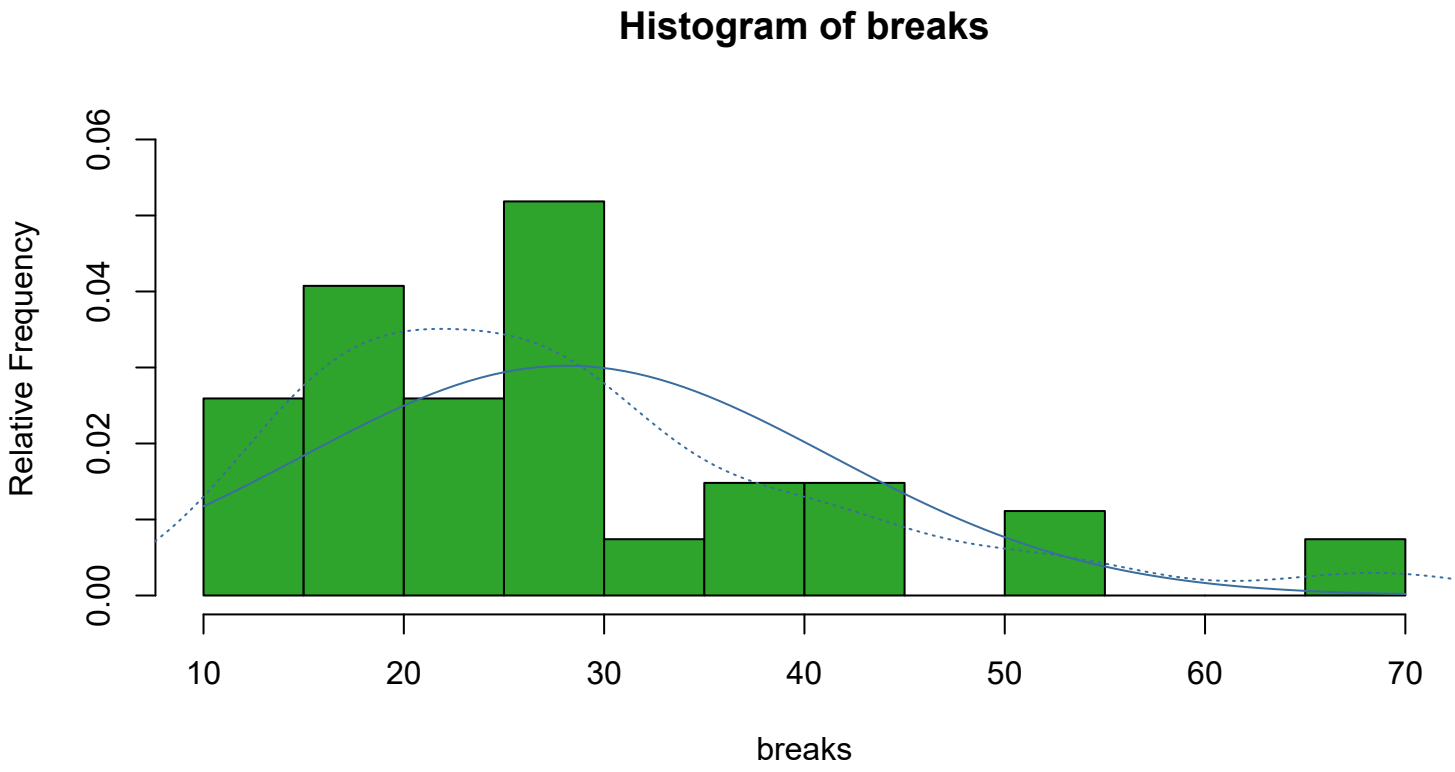
Variables considered categorical
wool
tension

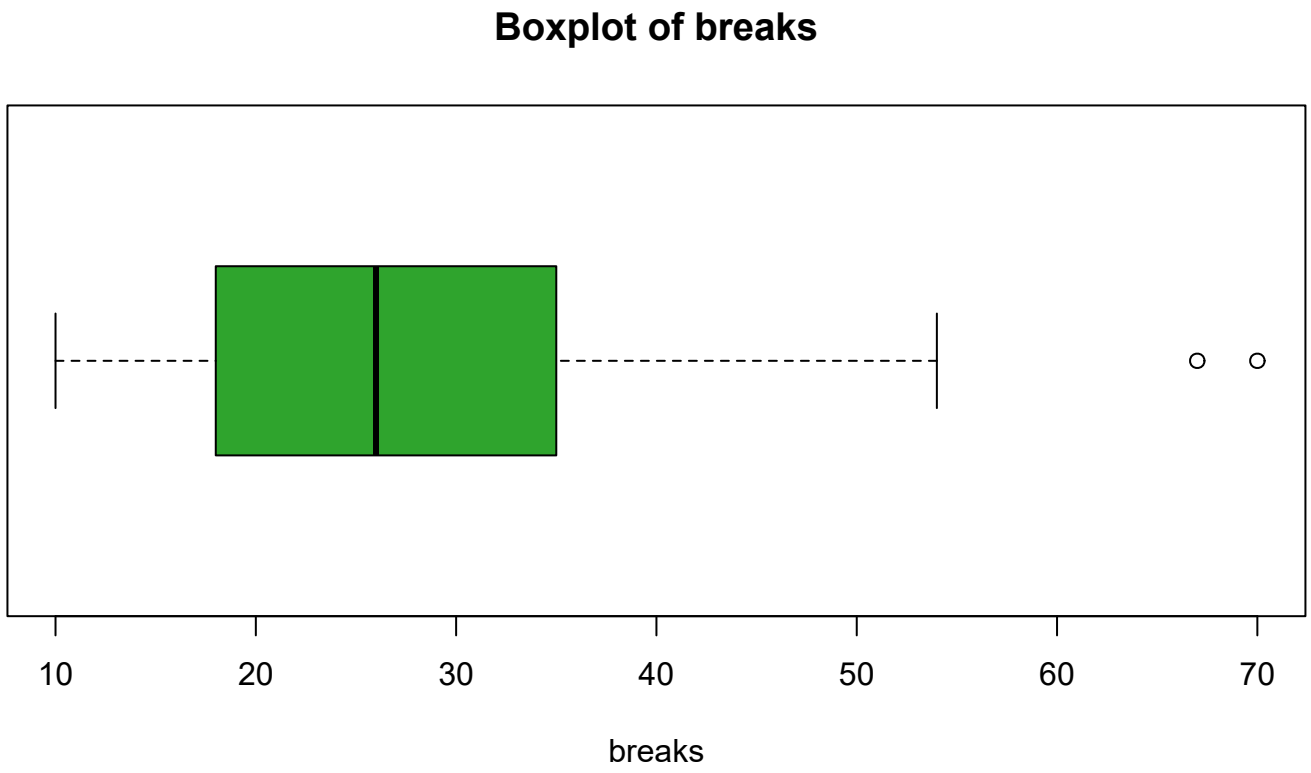
Model Information

You defined the following linear model: breaks~wool
You are interested in the factor: wool
You are interested in pairwise comparisons to the control factor level: A

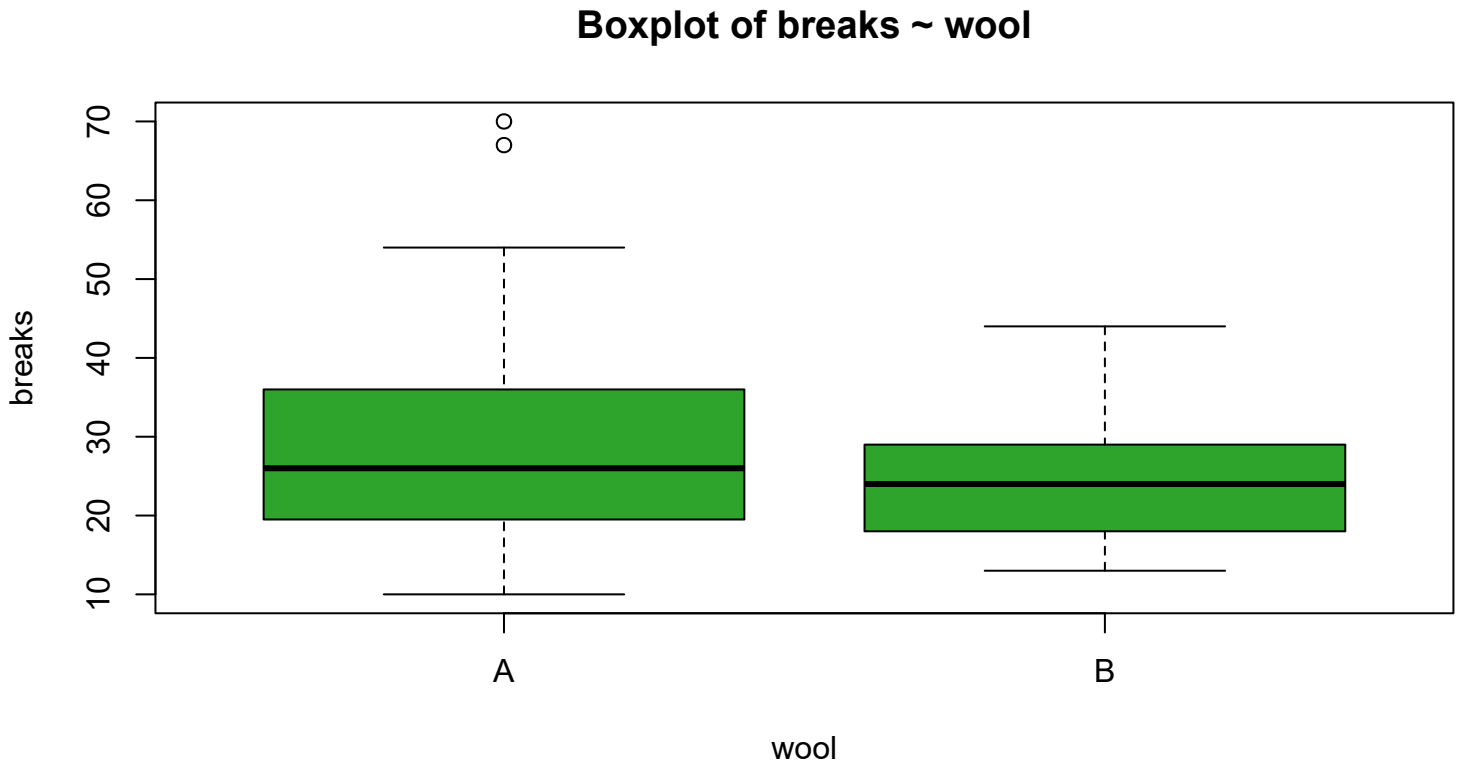
Descriptive Plots

Dependent Variable




Boxplot of breaks
10
20
30
40
50
60
70
breaks

Dependent Against Categorical Factors



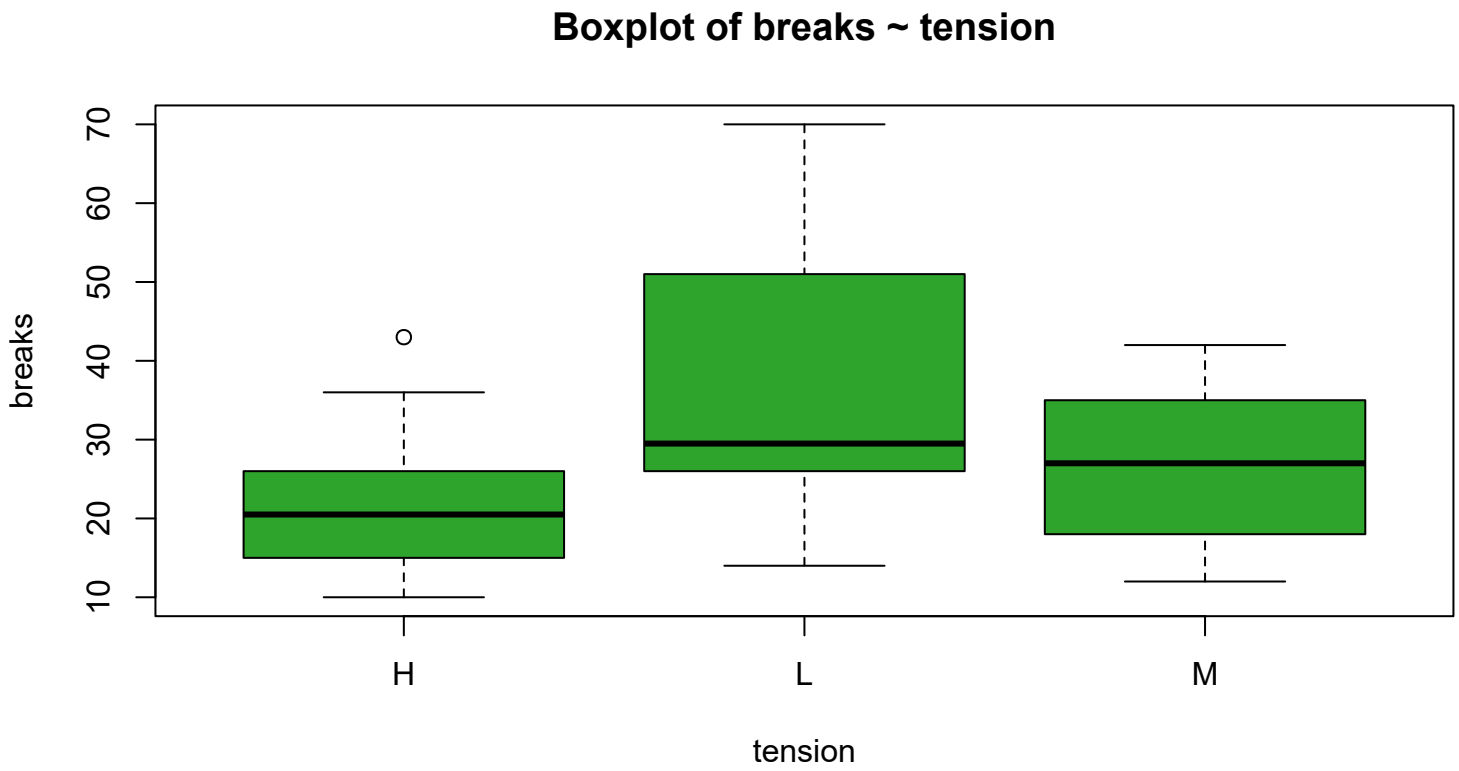

Boxplot of breaks ~ tension
breaks
10
20
30
40
50
60
70
H
L
M
tension

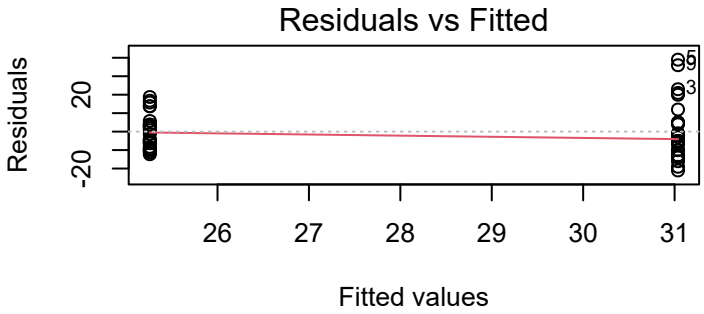
Table 4: Parameter Estimates

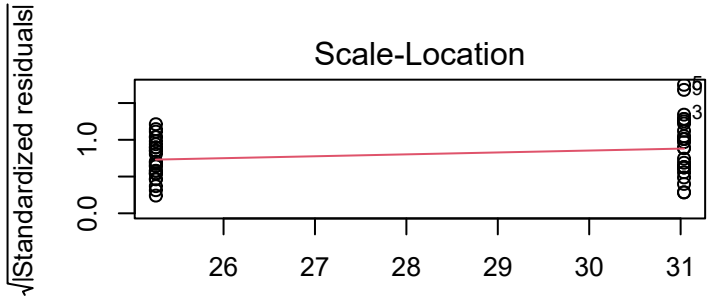
Variable	Value	Std.Error	t.value	pvalue	sign. level[1]	Significance at 5 percent error
(Intercept)	28.15	1.77	15.92	<0.001	***	Intercept Significant.
wool1	2.89	1.77	1.63	0.108		Not Significant. No difference between the effect of wool1 and its reference.

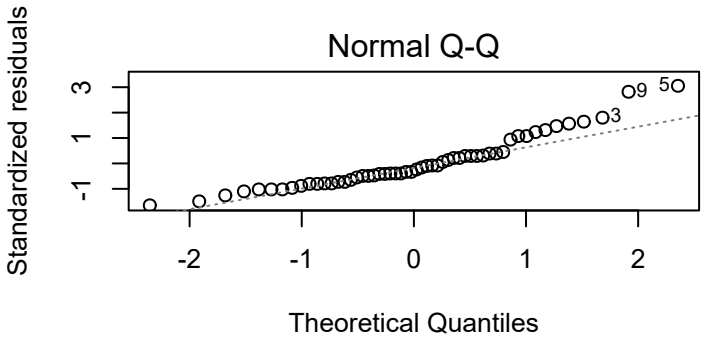
[1] '***': sign. to 0.1% error. '**': sign. to 1% error. '*': sign. to 5% error. ' . ': sign. to 10% error. ' ': not sign. ' - ': no statement.

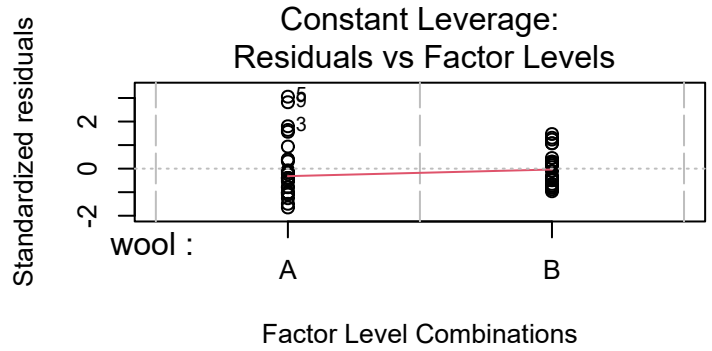
```
Anova Table (Type III tests)

Response: breaks
            Sum Sq Df  F value Pr(>F)
(Intercept)  42785  1 253.3355 <2e-16 ***
wool           451  1   2.6684 0.1084
Residuals     8782 52
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```


Residuals vs Fitted
Residuals
-20
20
26
27
28
29
30
31
Fitted values
5
9
3


Scale-Location
√|Standardized residuals|
0.0
1.0
26
27
28
29
30
31
Fitted values
5
9
3


Normal Q-Q
Standardized residuals
-1
1
3
-2
-1
0
1
2
Theoretical Quantiles
9
5
3


Constant Leverage:
Residuals vs Factor Levels
Standardized residuals
-2
0
2
wool :
A
B
Factor Level Combinations
5
9
3

Multiple Comparisons of Means to a Control

Theoretical background: Testing multiple hypotheses simultaneously and each at the same pre-specified significance level, increases the probability of false positive effects. The probability to commit at least one false positive decision increases with the number of hypotheses. A solution to overcome this problem is given by multiple comparisons procedures. Here, we do not control the per-hypothesis Type I error but the probability of committing at least one Type I error over all hypotheses. Using p-values adjusted for multiplicity, individual hypotheses can be finally compared with the pre-specified significance level.

Dunnet

Test whether the factor level A of the factor wool is different from the other levels. The Null Hypothesis is for example B - A =0.

Multiple Comparison: Dunnet Contrasts

Null Hypothesis	Value	Std.Error	T.value	adjusted P.value	Sign. level[1]	Significance at 5 percent Type I error
B - A = 0	-5.78	3.54	-1.63	0.11		Not Significant. Level A of factor wool is not different than B[2]

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

[2] H1 does not hold significantly.

[3] H1 holds significantly.

Simultaneous Confidence Intervals which includes the true value of the difference between the reference level A and the other levels of wool

Simoultaneous Confidence Intervals: Dunnet Contrasts

Null Hypothesis	Value	Lower bound	Upper bound	Interpretation
B - A = 0	-5.78	-12.88	1.32	The interval (-12.88, 1.32) traps the true difference B-A with probability 95 percent.[2]

[1] Remark: Zero is not in the conidence interval.

[2] Remark: Zero is in the confidence interval.

References

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