How can I do tests of simple main effects in Stata?

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July 1, 2024

RECOMMENDED CITATION

stats writer (2024). *How can I do tests of simple main effects in Stata?*. PSYCHOLOGICAL SCALES. Retrieved from https://scales.arabpsychology.com/?p=164363

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Stata is a statistical software commonly used for data analysis and research. One important aspect of this software is the ability to conduct tests of simple main effects. This involves examining the effect of a single independent variable on a dependent variable, while holding all other independent variables constant. To do this in Stata, the researcher must first use the "xtset" command to specify the panel structure of the data. Then, the "xtreg" command can be used to fit a linear regression model. Finally, the "margins" command can be used to estimate and test the simple main effects. This process allows for a thorough analysis of the relationship between variables and provides valuable insights for research and decision-making.

How can I do tests of simple main effects in Stata? | Stata FAQ

Stata does not have a built-in command to do tests of simple main effects, however
ATS has developed a program that will perform them. You can you can the sme
command by typing search sme (see
How can I use the search command to search for programs and get additional
help? for more information about using search).

Now, let's read in an example dataset,
crf24, adapted from Kirk (1968, 1st Edition).

use https://stats.idre.ucla.edu/stat/stata/faq/crf24, clear

These data are from a 2×4 factorial design. The variable y is the dependent variable.

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The variable a is an independent variable with two levels while b is an independent variable with four levels. Let's look at a table of cell means and standard deviations.

table a b, contents(n y mean y sd y)

----------+-----------------------------------
| b
a | 1 2 3 4
----------+-----------------------------------
1 | 4 4 4 4
| 3.75 4 7 8
| 1.5 .8164966 .8164966 .8164966
|
2 | 4 4 4 4
| 1.75 3 5.5 10
| .5 .8164966 .5773503 .8164966
----------+-----------------------------------

Now let's run the ANOVA.

anova y a b a*b

Number of obs = 32 R-squared = 0.9214

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```
Root MSE = .877971 Adj R-squared = 0.8985

Source | Partial SS df MS F Prob > F
-----------+----------------------------------------------------
Model | 217.00 7 31.00 40.22 0.0000
|
a | 3.125 1 3.125 4.05 0.0554
b | 194.50 3 64.8333333 84.11 0.0000
a*b | 19.375 3 6.45833333 8.38 0.0006
|
Residual | 18.50 24 .770833333
-----------+----------------------------------------------------
Total | 235.50 31 7.59677419
```

We see that in addition to a significant main effect for b there is a
significant a*b interaction effect. Before we do any of the tests of simple main effects,
let's graph the cell means to get an idea of what the interaction looks like. The following sequence
of commands will produce a graph of the cell means.

```
predict yhat
sort a b
```

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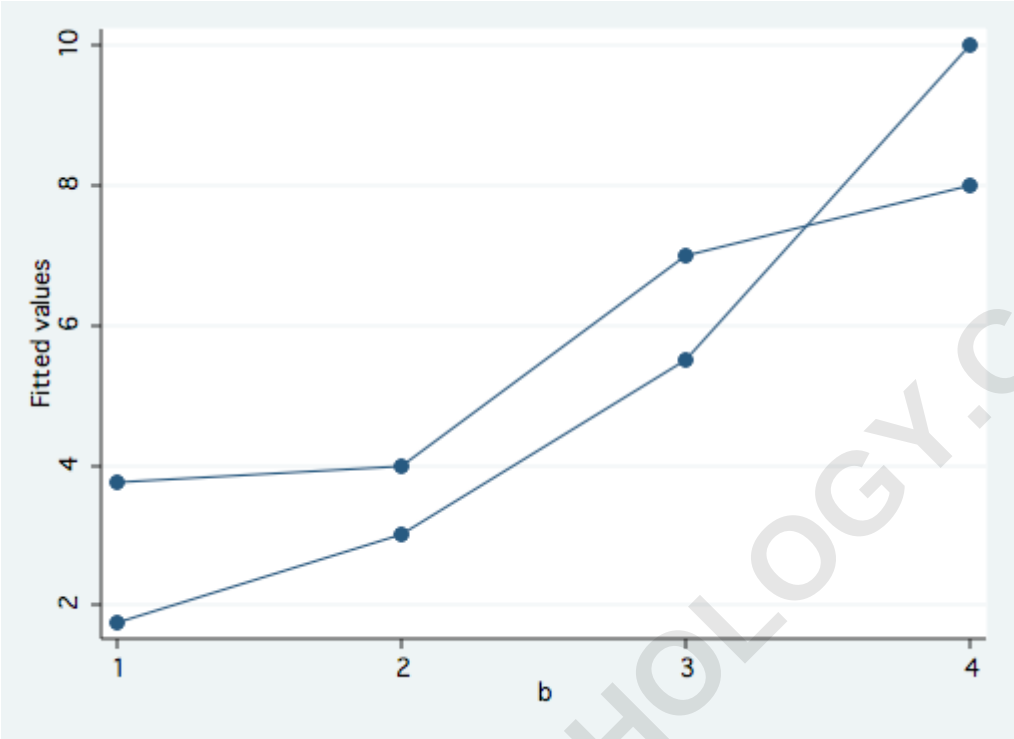
graph twoway scatter yhat b, connect(L)



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The interaction is clearly shown where the two lines cross over between levels
b3 and b4.
We will now do a test of simple main effects looking at differences in a at each level of
b.
In the sme command the first variable listed is the one being tested at each level of the second variable listed.

sme a b

Test of a at b(1): F(1/24) = 10.378378
Test of a at b(2): F(1/24) = 2.5945946
Test of a at b(3): F(1/24) = 5.8378378
Test of a at b(4): F(1/24) = 10.378378

Critical value of F for alpha = .05 using ...

Dunn's procedure = 5.7165623
per family error rate = 7.291317
simultaneous test procedure = 12.090564

If we were to use the per family error rate then the differences in a at
b1
and b4 would be statistically significant. And from the graph of the interaction we know that
the differences are in opposite directions. Using the very conservative simultaneous test procedure
none of the differences in a would be considered statistically significant. Using the criteria
for Dunn's procedure may result in finding too many significant effects.

Note:Statisticians do not universally approve of the use

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**of tests of simple
main effects. In particular, there are concerns over the conceptual error
rate. Tests of simple main effects are one tool that can be useful in
interpreting interactions. Caution should be exercised in interpreting
the results produced by sme. In general, the results of tests of simple
main effects should be considered suggestive and not definitive.**

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