Why does the margins command not work with a nested factor in anova in Stata?

Authored by

stats writer

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The "margins" command in Stata is used to calculate marginal effects of variables in a model. However, it does not work with nested factors in ANOVA. This is because the "margins" command is designed to work with linear regression models, which assume that all variables are continuous. In ANOVA, nested factors are categorical variables with multiple levels, which cannot be processed by the "margins" command. Therefore, using the "margins" command with nested factors in ANOVA will result in an error.

Why doesn't the margins command work with a nested factor in anova? Stata FAQ

A client sent in a question concerning a problem he had with the margins command. It involved a repeated measures anova that used a nested factor as an error term in the model. The problem occurred when he tried to use margins on the between-subjects factor and on the between-within interaction term.

Here is an example dataset and anova model that illustrates the same problem.

```
use https://stats.idre.ucla.edu/stat/data/repeated_anova2, clear

anova dv trt / sid|trt time trt#time

Number of obs = 270 R-squared = 0.7581
```

Root MSE = 3.32007 Adj R-squared = 0.6973

Source | Partial SS df MS F Prob > F

----------+--

Model | 7426.31359 54 137.524326 12.48 0.0000

|

trt | 1054.39272 1 1054.39272 8.81 0.0049

sid|trt | 5147.56292 43 119.710766

----------+--

time | 1108.93641 5 221.787283 20.12 0.0000

trt#time | 21.3536895 5 4.27073789 0.39 0.8571

|

Residual | 2369.91186 215 11.0228459

----------+--

Total | 9796.22545 269 36.417195

margins time

Predictive margins Number of obs = 270

Expression : Linear prediction, predict()

| Delta-method

| Margin Std. Err. z P>|z|

----------+----------

time |

1 | 14.34467 .4949264 28.98 0.000 13.37463 15.3147

2 | 12.60844 .4949264 25.48 0.000 11.63841 13.57848

3 | 10.89067 .4949264 22.00 0.000 9.920629 11.8607

4 | 10.13 .4949264 20.47 0.000 9.159962 11.10004

5 | 8.855778 .4949264 17.89 0.000 7.88574 9.825816

6 | 8.217111 .4949264 16.60 0.000 7.247073 9.187149

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margins trt

Predictive margins Number of obs = 270

Expression : Linear prediction, predict()

| Delta-method

| Margin Std. Err. z P>|z|

----------+----------

trt |

0 | (not estimable)

1 | (not estimable)

----

margins trt#time

Predictive margins Number of obs = 270

Expression : Linear prediction, predict()

--

| Delta-method

| Margin Std. Err. z P>|z|

-------------+--

trt#time |

0 1 | (not estimable)

0 2 | (not estimable)

0 3 | (not estimable)

0 4 | (not estimable)

0 5 | (not estimable)

0 6 | (not estimable)

1 1 | (not estimable)

1 2 | (not estimable)

1 3 | (not estimable)

1 4 | (not estimable)

1 5 | (not estimable)

1 6 | (not estimable)

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As you can see, both margins trt and margins trt#time show up as not estimable.
The problem is caused by the fact that sid and trt not crossed but nested, that is,
sid is nested within trt. This is easily seen as subjects 1 through 26 are found in
treatment level 0 while subjects 27 through 58 in treatment level 1.
The result of the nesting is that the design matrix for sid|trt has numerous empty cells.

Fortunately, there's an easy fix for this situation and that is to use the asbalanced and
emptycells(reweighted) options. Here is how the results look when these options are
used.

margins trt, asbalanced emptycells(reweight)

Adjusted predictions Number of obs = 270

Expression : Linear prediction, predict()
at : trt (asbalanced)
sid (asbalanced)
time (asbalanced)

| Delta-method
| Margin Std. Err. z P>|z|
---+---
trt |
0 | 13.37725 .3287356 40.69 0.000 12.73294 14.02156
1 | 9.30131 .2561487 36.31 0.000 8.799267 9.803352
---

margins trt#time, asbalanced emptycells(reweight)

Adjusted predictions Number of obs = 270

Expression : Linear prediction, predict()
at : trt (asbalanced)
sid (asbalanced)
time (asbalanced)

| Delta-method
| Margin Std. Err. z P>|z|
---+---
trt#time |
0 1 | 16.58824 .8052346 20.60 0.000 15.01 18.16647
0 2 | 14.97294 .8052346 18.59 0.000 13.39471 16.55117
0 3 | 14.12882 .8052346 17.55 0.000 12.55059 15.70705

0 4 | 12.27471 .8052346 15.24 0.000 10.69648 13.85294
0 5 | 11.40294 .8052346 14.16 0.000 9.82471 12.98117
0 6 | 10.89588 .8052346 13.53 0.000 9.317652 12.47411
1 1 | 12.9825 .6274337 20.69 0.000 11.75275 14.21225
1 2 | 11.17286 .6274337 17.81 0.000 9.94311 12.4026
1 3 | 8.924643 .6274337 14.22 0.000 7.694895 10.15439
1 4 | 8.827857 .6274337 14.07 0.000 7.59811 10.0576
1 5 | 7.309286 .6274337 11.65 0.000 6.079538 8.539033
1 6 | 6.590714 .6274337 10.50 0.000 5.360967 7.820462

By the way, this problem does not occur if you use xtmixed instead of anova
as shown below.

xtmixed dv trt##time || s:, var

Performing EM optimization:

Performing gradient-based optimization:
Iteration 0: log restricted-likelihood = -745.45836
Iteration 1: log restricted-likelihood = -745.45836

Computing standard errors:

Mixed-effects REML regression Number of obs = 270
Group variable: sid Number of groups = 45

Obs per group: min = 6
avg = 6.0
max = 6

Wald chi2(11) = 119.88
Log restricted-likelihood = -745.45836 Prob > chi2 = 0.0000

--
dv | Coef. Std. Err. z P>|z|
-------------+--
1.trt | -3.605735 1.659698 -2.17 0.030 -6.858683 -.3527872
|
time |
2 | -1.615294 1.138774 -1.42 0.156 -3.847249 .616661
3 | -2.459412 1.138774 -2.16 0.031 -4.691367 -.2274567
4 | -4.313529 1.138774 -3.79 0.000 -6.545485 -2.081574
5 | -5.185294 1.138774 -4.55 0.000 -7.417249 -2.953339
6 | -5.692353 1.138774 -5.00 0.000 -7.924308 -3.460398
|
trt#time |
1 2 | -.1943487 1.443659 -0.13 0.893 -3.023868 2.635171

1 3 | -1.598445 1.443659 -1.11 0.268 -4.427965 1.231074
1 4 | .1588865 1.443659 0.11 0.912 -2.670633 2.988406
1 5 | -.4879202 1.443659 -0.34 0.735 -3.31744 2.341599
1 6 | -.6994328 1.443659 -0.48 0.628 -3.528952 2.130087
|
_cons | 16.58824 1.309187 12.67 0.000 14.02228 19.1542

Random-effects Parameters | Estimate Std. Err.
---+---
sid: Identity |
var(_cons) | 18.11467 4.306567 11.36754 28.86652
---+---
var(Residual) | 11.02284 1.063137 9.124236 13.31652

LR test vs. linear regression: chibar2(01) = 148.23 Prob >= chibar2 = 0.0000

margins trt

Predictive margins Number of obs = 270

Expression : Linear prediction, fixed portion, predict()

| Delta-method

| Margin Std. Err. z P>|z|

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trt |

0 | 13.37725 1.083345 12.35 0.000 11.25394 15.50057

1 | 9.30131 .8441355 11.02 0.000 7.646834 10.95578

---

margins trt#time

Adjusted predictions Number of obs = 270

Expression : Linear prediction, fixed portion, predict()

| Delta-method

| Margin Std. Err. z P>|z|

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trt#time |

0 1 | 16.58824 1.309187 12.67 0.000 14.02228 19.1542

0 2 | 14.97294 1.309187 11.44 0.000 12.40698 17.5389

0 3 | 14.12882 1.309187 10.79 0.000 11.56286 16.69478

0 4 | 12.27471 1.309187 9.38 0.000 9.708746 14.84067

0 5 | 11.40294 1.309187 8.71 0.000 8.836981 13.9689

0 6 | 10.89588 1.309187 8.32 0.000 8.329922 13.46184

1 1 | 12.9825 1.020111 12.73 0.000 10.98312 14.98188

1 2 | 11.17286 1.020111 10.95 0.000 9.173477 13.17224

1 3 | 8.924643 1.020111 8.75 0.000 6.925263 10.92402
1 4 | 8.827857 1.020111 8.65 0.000 6.828477 10.82724
1 5 | 7.309286 1.020111 7.17 0.000 5.309906 9.308666
1 6 | 6.590714 1.020111 6.46 0.000 4.591334 8.590094
