Fi=hlml14

Comments on Multiparameter Hypothesis Testing

by
Ralph B. Taylor
breck@rbtaylor.net

There are several types of multiparameter hypothesis tests (MPHs) one can do with HLM. This material comes from pp. 50 on in Bryk and Raudenbush.

Fixed effects. You can do several things with this set of MPHs.

1. Test if a set of L-2 predictors adds significant explained variance to an outcome. The null hypothesis you seek to reject is an omnibus null hypothesis that the parameters you are testing equal zero (see Eq. 3.74, p. 53, B&R). If you reject the null hypothesis you know that one or more of your parameters being tested is not equal to zero.

This seems roughly analogous to the F test for R^2 increment you can do in OLS. Strictly speaking, it is an example of the general linear hypothesis also called the general linear model.[1]

But there is some confusion. In OLS the set can be significant, but it is possible -- although it does not happen a whole lot - that no individual members of the set is significant. Can that happen here? Must one of the parameters not=0 if you reject the null hypothesis? My best guess at this point is that is must.

They give an example where they examine if SECTOR (Catholic vs. public) affects both the mean level of achievement (B0j) and the mean slope of achievement on SES (B1j). They want to test both of these hypotheses at once. In other words they are saying: do I need this additional variable (SECTOR) at all in my L-2 models?

Another interesting example they also give is when you have a series of dummy variables reflecting

---

1 SAS explains it this way: your "hypothesis tests are expressed in terms of a linear function of the parameters" (SAS User's Guide: Statistics, V. 5, p. 16). You are testing the null hypothesis:

H0: $L_0B_0 + L_1B_1 + \ldots L_kB_k = 0$

where B are the coefficients you would recover from OLS.

something like regional variation. You want to see if regional variation influences a slope, or an intercept, or both.

This also would apply if you hade several different measures that were conceptually related. For example, in some fear models we are currently working on we have several measures of recent neighborhood change. We could ask: if we add these in as a set, do we get significant changes in explained variation?

2. Contrast between specific categories of an L-2 variable. The example they give is contrasting an intercepts or slopes in two different regions of the country (e.g., the South vs. the Midwest, such as Nisbett does in his survey work on violence and the code of honor).

Random effects

Although it is not yet implemented in the program, you can theoretically test several L-1 parameters for varying effects. I think what this is saying is that you can test the idea that a number of L-1 slopes vary randomly, rather than testing them one by one.

Variance-Covariance Components

We already have discussed this MPH; this is our deviance statistic (Eq. 3.86, p. 56). We have two models, with the same fixed effects, and different random effects, and do a chi square test to see if they are different. Your null hypothesis is that the goodness of fit of the model to the data is equivalent in both models (Eq. 3.84 p. 55).

IMPLEMENTATION

Variance-Covariance Components

This is easiest. In CMD file for run with the random effects of interest, and the same fixed effects, tell it:

hypoth:y
deviance:nnnn

where nnnn = deviance statistic from your model where the random effects in question are removed.

If Chi square is significant then you know are rejecting the null hypothesis that the two models do not differ in goodness of fit.

This is an extremely useful tool for model simplification.

Fixed effects: set = 0

You can do this completely in batch mode, through the command file. The only trick with this is that you have to tell it which specific gammas you want to set to zero (see Manual, p. 51).

Alternatively, you can say
hypoth:y

on the command file, and it will take you into a menu, and you specify the contrasts here, putting a 1 value for the parameters you wish to set to zero. See how they do it in the example on p. 51. The output (Manual, p. 55) looks pretty straightforward. It tells you, in the example used there, that it is highly unlikely that the effects of sector on achievement, and/or the effects of sector on the slope of SES, are = 0. Of course, this test does not tell you which individual parameter is significant, but you have the answer to that elsewhere in your output.