



## Compare model fit using deviance statistics

HLM also provides, as an option, a multi-parameter test for the variance-covariance components. This likelihood-ratio test compares the deviance statistic of a restricted model with a more general alternative.

The deviance is a measure of lack of fit between model and data, but not directly interpretable. Comparison of the deviances of two nested models is typically used to evaluate whether the one model contributes significantly to the explanation of variation in the outcome compared to the second model.

The test is based on the difference between the deviance statistics (defined as the  $-2\ln(\text{likelihood})$  function value at convergence) of the two models, which has a chi-square distribution with degrees of freedom equal to the difference in the number of parameters estimated in the models being compared. The option is available for all HLM modules.

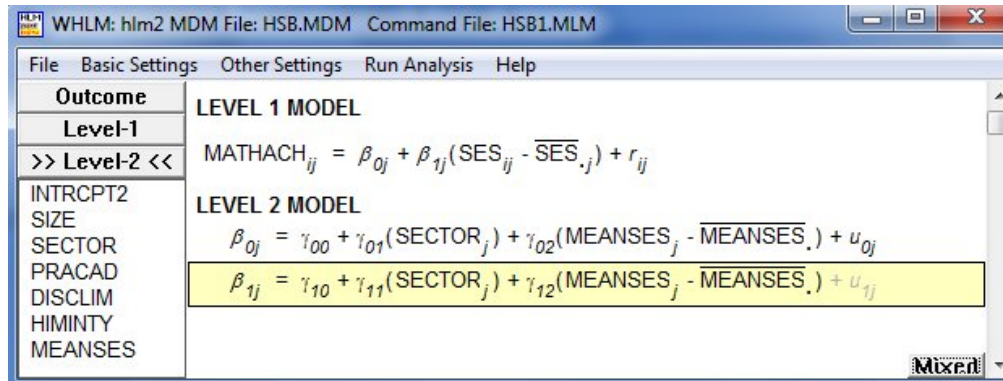
There are two cases when this option may not be available:

- When HGLM models are estimated under PQL, no deviance statistic is produced. It is only available for models where one of the other estimation methods is used.
- Multiple imputation/plausible value runs contain deviance statistics for individual runs, but not for the \*.avg file. This is because the \*.avg file contains calculated, not estimated, values.

It should also be noted that the default method of estimation in HLM2 is restricted maximum likelihood. Deviances obtained under REML can be used only if the two models compared have the *same* fixed parts and *differ only* in their random parts. If this is not the case, the deviance obtained using Full ML should be used instead.

The user must input the value of the deviance statistic and related degrees of freedom for the alternative specification. Below we compare the variance-covariance components of two Intercept-and-Slope-as-outcome models. One treats  $\beta_1$  as random and the other does not.

The first model



produced a deviance statistic and estimated number of parameters as shown below. This information is printed at the end of the standard HLM output file.

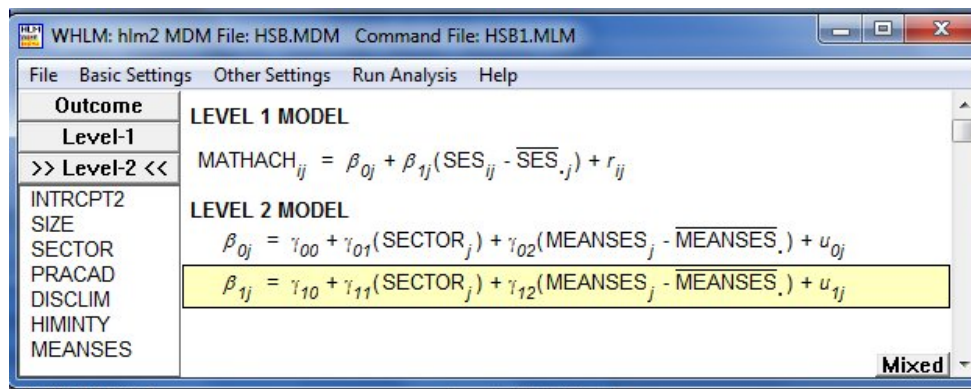
#### Statistics for the current model

Deviance = 46495.596020

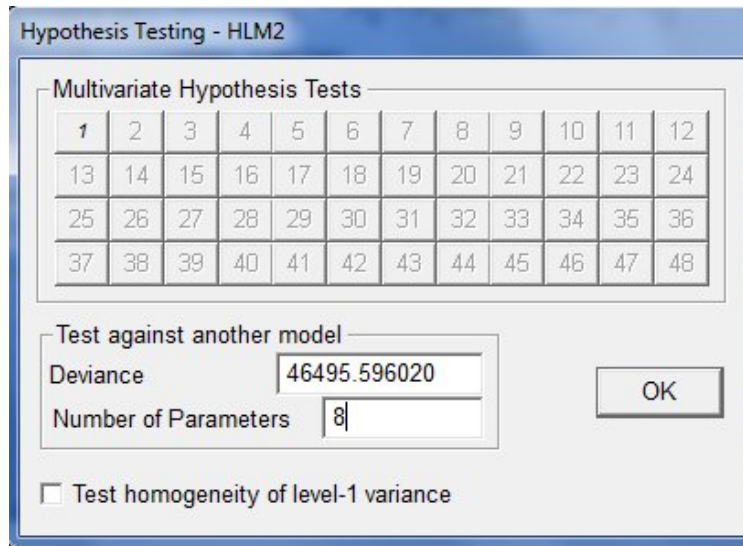
Number of estimated parameters = 8

In order to evaluate the contribution of the addition of a random slope to the model considered above, the random intercept term  $u_1$  is enabled by selecting the second level-2 equation and clicking on  $u_1$ . Note that, in this comparison, the fixed part of both models is the same - only the number of elements in the level-2  $\tau$ -matrix differs.

Before running the second model



select the **Hypothesis Settings** option from the **Other Settings** menu to open the **Hypothesis Testing - HLM2** dialog box. Enter the deviance and number of parameters from the first model in the **Test against another** model group box. Click **OK** to return to the main window and click the **Run Analysis** option on the main menu bar to perform the analysis.



In the final section of the output for the second model, the following information is then given:

**Statistics for the current model**

Deviance = 46494.592685

Number of estimated parameters = 10

**Model comparison test**

$\chi^2$  statistic = 1.00333

Degrees of freedom = 2

p-value = >.500

The first section provides the deviance and associated number of estimated parameters for the second model, while the second section compares the deviances of the two models. It appears that the addition of the random slope's contribution to the explanation of variation in the outcome was negligible.