**LAB Day 2b: Multigroup models and Measurement Invariance**

Today’s lab meeting consists of two exercises:

Exercise 1 addresses multigroup regression and, Exercise 2, measurement invariance.

Practical information:

* All the data and other files for these exercises can be found at the LLL platform.

Make sure to unzip the files. The folder containing these files will be your working directory.

* Solutions to the exercises can be found in the Solutions folder.

We provided R scripts for doing each of the exercises with lavaan.

***Exercise 1: Multigroup Regression***

In this exercise, we extend the regression analysis of Day 1 to a multi-group analysis (and thus use **popular\_regr.txt** again and remember that -99 and -999 denote missings). In the multigroup analysis, you want to predict levels of socially desirable answering patterns of adolescents (*sw*) by overt (*overt*) and covert antisocial behaviour (*covert*), for males and females (*gender*).

a)

Create lavaan code for a multigroup comparison between males and females to answer the question whether there are differences in the regression coefficients between sw and overt.

* Bear in mind that gender is a grouping variable consisting of two levels. By making it a factor, one can easily assign labels (e.g., ‘males’ and ‘females’) to it.
* To run a multigroup analysis (for gender), the lavaan function needs the argument: group = "gender".
* To also obtain the confidence intervals use: ci = TRUE.
* In this case, we will not use FIML, as we also started with in the regression analysis of Day 1.

You will now get results for males and females separately.

*Are there differences between males and females?*

*What do the confidence intervals indicate?*

b)

Compute a significance test (Wald test) to test whether the regression coefficients for males and females are the same or not.

For a lavaan object (with label names!), one can do this with lavTestWald(fit, constraints = ‘<insert equality restriction>’).

Now, there is only one equation for both groups, so one needs to assign two labels (say, b1\_m and b1\_f) to the ‘single’ parameter, by using: c(b1\_m,b1\_f)\*

*What do you conclude about the equality of regression parameters (b1\_m&b1\_f and b2\_m&b2\_f)?*

***Exercise 2: Measurement Invariance***

In this exercise you will repeat the measurement invariance analyses of the lecture about Prolonged Grief Disorder. Use **PGDdata2.txt**; and note that missing data is denoted by -999. The data set consists of the grouping variable Kin2 (with two levels: partner and else) and 5 items taken from the Inventory of Complicated Grief (see the pdf of Boelen et al. (2010) in your zip-folder):

1. Yearning; 2. Part of self died; 3. Difficulty accepting the loss; 4. Avoiding reminders of deceased; 5. Bitterness about the loss

a)

Run a 1-factor CFA on the data set ignoring the multigroup structure, using the default parameterization in the cfa() function.

*How many subjects are there?*

*How about the fit of the model?*

*Which item has the weakest contribution to the latent factor (in terms of standardized factor loading and explained variance)?*

b)

Run a 1-factor CFA on the data set with multigroup using: group = "Kin".

*How many subjects are there per group?*

c)

Test for configural, metric (weak) and scalar (strong) invariance.

Configural: model used in b.

Weak: In the cfa function, one should add group.equal = "loadings".

Strong: In the cfa function, one should add group.equal = c("intercepts", "loadings").

One can compare these model with: lavTestLRT().

*What is the model fit in the configural, metric (weak) and scalar (strong) invariant model?*

*Which model do you prefer?*

d)

Add constraints such that also the residual variances are constrained to be the same for both groups. In the cfa function in the group.equal argument, one should add "residuals".

Check for AIC and BIC differences and use the Chi-square difference test, by using the anova() function.

*Did the model get significantly worse?*