Supplementary materials for the paper

Van de Schoot, R., Lugtig, P., & Hox. J. (2012). A checklist for testing measurement invariance. *European Journal of Developmental Psychology.*

The analysis of measurement invariance of latent constructs is important in research across groups, or across time. By establishing whether factor loadings, intercepts and residual variances are equivalent in a factor model that measures a latent concept, we can assure that comparisons that are made on the latent variable are valid across groups or time. Establishing measurement invariance involves running a set of increasingly constrained Structural Equation Models, and testing whether differences between these models are significant. In Van de Schoot, Lugtig and Hox (2012) a step-by-step guide is provided in analyzing Measurement Invariance. Below we provide MPLUS syntax to perform the analyses discussed in the paper of Van de Schoot et al. The statistical model is shown in Figure 1.

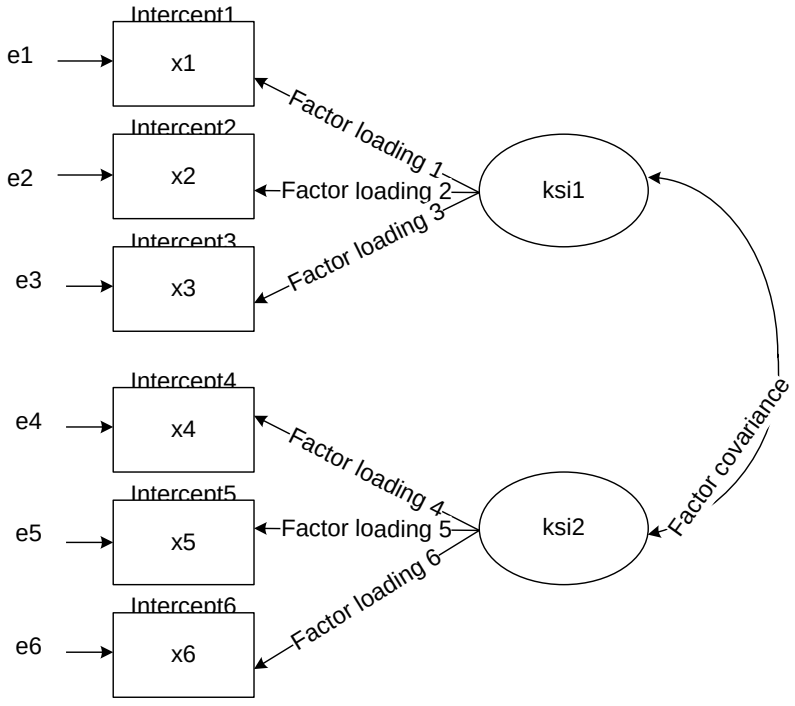

Figure 1. CFA with six items

Appendix A. Syntax for the parameterization of the factor model in Figure 2A and 2B

The parameterization of Figure 2A can be obtained in Mplus using the following syntax:

```
MODEL:

ksi BY X1* X2 X3;      !where the * indicate to release the
                       constraint on the first factor loading

ksi@1;                 !the factor variance is fixed to equal 1

[ksi@0];               !the factor mean is fixed to equal 0
```

If this syntax is used, the factor loadings and intercepts can be compared across groups.

The parametrization of Figure 2B can be obtained in Mplus using the following syntax:

```
MODEL:

ksi BY X1 X2 X3;
```

If this syntax is used, the first factor loading is fixed to 1 and its intercept to 0. Consequently, the factor mean and its variance is estimated and can be compared across groups. Note, however, in case of a multiple group model by default the latent mean for the first group is constrained to 0.

Appendix B. Mplus syntax needed when testing for measurement invariance

0. Configural invariance: use the syntax of appendix A and run the model separately for each group using:

```
VARIABLE: USEOBS ARE (GROUP EQ 1); ! model for group 1 alone
MODEL:
ksi1 BY X1* X2 X3; ksi1@1; [ksi1@0];
ksi2 BY X4* X5 X6; ksi2@1; [ksi2@0];
```

1. Metric invariance:

```
VARIABLE: GROUPING IS group (1 = gr1 2 = gr2); !multigroup
MODEL:
ksi1 BY X1* X2 X3; ksi1@1; [ksi1@0];
ksi2 BY X4* X5 X6; ksi2@1; [ksi2@0];
Model gr1:
[X1-X6];              !allow the intercepts to differ
Model gr2:
[X1-X6];              !allow the intercepts to differ
```

2. Intercept only invariance:

```
VARIABLE: GROUPING IS group (1 = gr1 2 = gr2);
MODEL:
```

```
ksi1 BY X1* X2 X3; ksi1@1; [ksi1@0];

ksi2 BY X4* X5 X6; ksi2@1; [ksi2@0];

Model gr1:

ksi1 BY X1* X2 X3;    !allow the factor loadings to differ

ksi2 BY X4* X5 X6;

Model gr2:

ksi1 BY X1* X2 X3; !allow the factor loadings to differ

ksi2 BY X4* X5 X6;
```

3. Scalar invariance:

```
VARIABLE: GROUPING IS group (1 = gr1 2 = gr2);

MODEL:

ksi1 BY X1* X2 X3; ksi1@1; [ksi1@0];

ksi2 BY X4* X5 X6; ksi2@1; [ksi2@0];
```

4. Full uniqueness invariance:

```
VARIABLE: GROUPING IS group (1 = gr1 2 = gr2);

MODEL:

ksi1 BY X1* X2 X3; ksi1@1; [ksi1@0];

ksi2 BY X4* X5 X6; ksi2@1; [ksi2@0];

X1-X6 (1-6);    !where the (1-6) forces the errors to be equal
```

5. Comparing means and correlations (using the default constraints of Mplus):

```
VARIABLE: GROUPING IS group (1 = gr1 2 = gr2);

MODEL:

ksi1 BY X1 X2 X3;

ksi2 BY X4 X5 X6;

OUTPUT: TECH4;        !request for the correlations between the
                      latent factors
```

Mplus will automatically constrain the first factor mean to zero. The mean of the second group will be estimated and its significance indicates whether the second group mean differs from zero and hence whether it differs from the mean of group 1.

To test whether correlations are different between groups, one could use the `MODEL TEST` option in `Mplus`:

```
MODEL:

ksi1 BY X1 X2 X3;

ksi2 BY X4 X5 X6;

MODEL gr1: ksi1  WITH ksi2 (a);

MODEL gr2: ksi1  WITH ksi2 (b);

MODEL TEST: a=b;
```

This syntax will provide a Wald test between the correlations of each group. Note that these tests result in substantive conclusions.