Online Technical Supplements for:

Chapter 27. Exploratory Structural Equation Modeling

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Table of Contents

Data set #1 (ESEM Population Model): CFA Solution

```
!!! Mplus ignores annotations following !

TITLE:
CFA Data 1; ! It is possible to give a title to each analytic input.
DATA:
! this section is used to indicate the name of the data file
! As long as the data file is in the same folder as the input file, then nothing else is needed.
! If the data set is in another folder, then the complete path should be provided
FILE IS data1.dat;

VARIABLE:
! The NAMES function lists the variables included in the data set, in order of appearance
NAMES = X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4 GROUP;
! The NAMES function lists the variables included in the data set, in order of appearance
USEVARIABLES = X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4;
! USEVARIABLES indicates the variables included in the analytic model
! When there is a unique identifier for each participant, IDVARIABLE is used to identify it (ID)
!!! IDVARIABLE = ID;
! When there are missing data, this function is used to identify the missing data code
!!! MISSING ARE *;
!!! MISSING ARE ALL (-999);
! When participants are nested under higher levels units (e.g., classroom, workgroup)
! this function is used to identify the unique identifier of the higher-level units.
!!! CLUSTER = class;

ANALYSIS:
ESTIMATOR = MLR; ! To select MLR estimation
! If one wants to control for nesting, in addition to CLUSTER = classroom, one should add:
!!! TYPE = COMPLEX;

MODEL:
! To define 3 factors, defined by their a priori indicators.
! The * is required to request the free estimation of the loading of the first indicator.
! For identification purposes the factor variance is then fixed to 1 (@1).
F1 BY X1* X2 X3 X4;
F2 BY Y1* Y2 Y3 Y4;
F3 BY Z1* Z2 Z3 Z4;
F1@1;
F2@1;
F3@1;

OUTPUT: ! To request specific output section, we recommend the following:
SAMPSTAT STANDARDIZED MODINDICES CINTERVAL RESIDUAL SVALUES TECH1 TECH3
TECH4;
```

Data set #1 (ESEM Population Model): Bifactor CFA Solution

```
! We only report the MODEL section. Other sections are identical to the previous model.

MODEL:
! The three S-factors are defined as the factors in the CFA model.
SF1 BY X1* X2 X3 X4;
SF2 BY Y1* Y2 Y3 Y4;
SF3 BY Z1* Z2 Z3 Z4;
! The G-factor is defined from all indicators
GF BY X1* X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4;
! All factor variances are fixed to 1 for identification purposes.
SF1@1;
SF2@1;
SF3@1;
GF@1;
! Correlations are fixed to be exactly 0 according to bifactor specifications.
GF WITH SF1@0 SF2@0 SF3@0;
SF1 WITH SF2@0 SF3@0;
SF2 WITH SF3@0;
```

Data set #1 (ESEM Population Model): ESEM Solution

```
! We only report the ANALYIS and MODEL sections.
! Other sections are identical to the previous models.

ANALYSIS:
ESTIMATOR = MLR;
! To request target rotation
ROTATION = target;

MODEL:
F1 BY X1* X2 X3 X4
Y1~0 Y2~0 Y3~0 Y4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F2 BY Y1* Y2 Y3 Y4
X1~0 X2~0 X3~0 X4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F3 BY Z1* Z2 Z3 Z4
X1~0 X2~0 X3~0 X4~0 Y1~0 Y2~0 Y3~0 Y4~0 (*1);

!!! OR
ANALYSIS:
ESTIMATOR = MLR;
! To request Geomin rotation
ROTATION = geomin (.5);
MODEL:
F1-F3 BY X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4 (*1);
```

Data set #1 (ESEM Population Model): Bifactor-ESEM Solution

```
! We only report the ANALYIS and MODEL sections.
! Other sections are identical to the previous models.

ANALYSIS:
ESTIMATOR = MLR;
! To request target rotation for bifactor models
ROTATION = target (orthogonal);

MODEL:
SF1 BY X1* X2 X3 X4
Y1~0 Y2~0 Y3~0 Y4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
SF2 BY Y1* Y2 Y3 Y4
X1~0 X2~0 X3~0 X4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
SF3 BY Z1* Z2 Z3 Z4
X1~0 X2~0 X3~0 X4~0 Y1~0 Y2~0 Y3~0 Y4~0 (*1);
GF BY X1 X2 X3 X4 Y1 Y2 Y3 Y4
Z1 Z2 Z3 Z4 (*1);

!!! OR
ANALYSIS:
ESTIMATOR = MLR;
! To request a bifactor Geomin rotation
ROTATION = bi-geomin (orthogonal .5);
MODEL:
GF SF1-SF3 BY X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4 (*1);

! The following was added to force the model to converge on a solution in which all residuals
! were higher than 0.
Z2 (res1);
MODEL CONSTRAINT:
res1 > 0;
```

Data set #2 (Bifactor-ESEM Population Model): CFA Solution (Time 1 only)

```
TITLE: CFA Time 1 Data 2;

DATA: FILE IS data2.dat;

VARIABLE:
NAMES =  x1_t1 x2_t1 x3_t1 x4_t1 y1_t1 y2_t1 y3_t1 y4_t1 z1_t1 z2_t1 z3_t1 z4_t1
x1_t2 x2_t2 x3_t2 x4_t2 y1_t2 y2_t2 y3_t2 y4_t2 z1_t2 z2_t2 z3_t2 z4_t2;
! To use only Time 1 variables.
USEVARIABLES =  x1_t1 x2_t1 x3_t1 x4_t1 y1_t1 y2_t1 y3_t1 y4_t1 z1_t1 z2_t1 z3_t1 z4_t1;

ANALYSIS:
ESTIMATOR = MLR;

MODEL:
F1_t1 BY X1_t1* X2_t1 X3_t1 X4_t1;
F2_t1 BY Y1_t1* Y2_t1 Y3_t1 Y4_t1;
F3_t1 BY Z1_t1* Z2_t1 Z3_t1 Z4_t1;
F1_t1@1;
F2_t1@1;
F3_t1@1;

OUTPUT:
SAMPSTAT STANDARDIZED MODINDICES CINTERVAL RESIDUAL SVALUES TECH1 TECH3
TECH4;
```

Data set #2 (Bifactor-ESEM Population Model): Bifactor CFA Solution (Time 1 only)

```
! We only report the MODEL section. Other sections are identical to the previous model.

MODEL:
SF1_t1 BY X1_t1* X2_t1 X3_t1 X4_t1;
SF2_t1 BY Y1_t1* Y2_t1 Y3_t1 Y4_t1;
SF3_t1 BY Z1_t1* Z2_t1 Z3_t1 Z4_t1;
GF_t1 BY X1_t1* X2_t1 X3_t1 X4_t1 Y1_t1 Y2_t1 Y3_t1 Y4_t1
Z1_t1 Z2_t1 Z3_t1 Z4_t1;
SF1_t1@1;
SF2_t1@1;
SF3_t1@1;
GF_t1@1;
GF_t1 WITH SF1_t1@0 SF2_t1@0 SF3_t1@0;
SF1_t1 WITH SF2_t1@0 SF3_t1@0;
SF2_t1 WITH SF3_t1@0;
```

Data set #2 (Bifactor-ESEM Population Model): ESEM Solution (Time 1 only)

! We only report the ANALYIS and MODEL sections.
! Other sections are identical to the previous models.

```
ANALYSIS:
ESTIMATOR = MLR;
ROTATION = target;

MODEL:
F1_t1 BY X1_t1* X2_t1 X3_t1 X4_t1
Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1);
F2_t1 BY Y1_t1* Y2_t1 Y3_t1 Y4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1);
F3_t1 BY Z1_t1* Z2_t1 Z3_t1 Z4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 (*1);
```

Data set #2 (Bifactor-ESEM Population Model): Bifactor-ESEM Solution (Time 1 only)

! We only report the ANALYIS and MODEL sections.
! Other sections are identical to the previous models.

```
ANALYSIS:
ESTIMATOR = MLR;
ROTATION = target (orthogonal);

MODEL:
SF1_t1 BY X1_t1* X2_t1 X3_t1 X4_t1
Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1);
SF2_t1 BY Y1_t1* Y2_t1 Y3_t1 Y4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1);
SF3_t1 BY Z1_t1* Z2_t1 Z3_t1 Z4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 (*1);
GF BY X1_t1 X2_t1 X3_t1 X4_t1 Y1_t1 Y2_t1 Y3_t1 Y4_t1
Z1_t1 Z2_t1 Z3_t1 Z4_t1 (*1);
```

Data set #1 (ESEM Population Model):

ESEM Multi-Group Invariance (MLR) - Configural

```
TITLE: CFA Data 1: Configural Invariance;
DATA:
FILE IS data1.dat;
VARIABLE:
NAMES = X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4 GROUP;
USEVARIABLES = X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4;
! The GROUPING command is used to identify the variable used to define the groups (Group)
! In parentheses, each value of the grouping variables are given a label (here G1 and G2).
GROUPING = GROUP (1 = G1 2 = G2);
ANALYSIS:
ESTIMATOR = MLR;
ROTATION = target;
! In a multigroup model, the MODEL section is used to define the parameters that apply to all groups.
! With ESEM (or bifactor-ESEM), the scale of the factors is automatically set by allowing all of the
! loadings and cross-loadings to be freely identified and the factor variances to be fixed to 1.
! For consistency, we strongly recommend setting the scale of the meanstructure in the same manner, by
! freely estimating all intercept and fixing the factors means to be 0, leading to a complete standardized
! factors approach.
MODEL:
! Factor loadings
F1 BY X1* X2 X3 X4
Y1~0 Y2~0 Y3~0 Y4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F2 BY Y1* Y2 Y3 Y4
X1~0 X2~0 X3~0 X4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F3 BY Z1* Z2 Z3 Z4
X1~0 X2~0 X3~0 X4~0 Y1~0 Y2~0 Y3~0 Y4~0 (*1);
! Factor variances
F1@1; F2@1; F3@1;
! Factor means
[F1@0]; [F2@0]; [F3@0];
! Item intercepts
[X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4];
! Item uniquenesses
X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4;
! The specific MODEL G2 section is then used to define how the parameters differ, or not, across groups.
! Generally, one specific section fewer than the total number of groups in needed.
! in the configural model, all parameters are free (so that the previous syntax is repeated here).
MODEL G2:
F1 BY X1* X2 X3 X4
Y1~0 Y2~0 Y3~0 Y4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F2 BY Y1* Y2 Y3 Y4
X1~0 X2~0 X3~0 X4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F3 BY Z1* Z2 Z3 Z4
X1~0 X2~0 X3~0 X4~0 Y1~0 Y2~0 Y3~0 Y4~0 (*1);
F1@1; F2@1; F3@1;
[F1@0]; [F2@0]; [F3@0];
[X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4];
X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4;
```

Data set #1 (ESEM Population Model):

ESEM Multi-Group Invariance (MLR) - Weak

```
! We only report the MODEL section.
! Other sections are identical to the previous models.

MODEL:
F1 BY X1* X2 X3 X4
Y1~0 Y2~0 Y3~0 Y4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F2 BY Y1* Y2 Y3 Y4
X1~0 X2~0 X3~0 X4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F3 BY Z1* Z2 Z3 Z4
X1~0 X2~0 X3~0 X4~0 Y1~0 Y2~0 Y3~0 Y4~0 (*1);
F1@1; F2@1; F3@1;
[F1@0]; [F2@0]; [F3@0];
[X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4];
X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4;

MODEL G2:
! By default, factor loadings are set up to the equal across groups in Mplus.
! So, for tests of weak invariance, the group-specific mention of factor loadings can simply be taken out.
! By constraining the loadings to equality across groups, it is now possible to freely estimate the
! factor variance in all but the first group.
F1*;
F2*;
F3*;

[F1@0]; [F2@0]; [F3@0];
[X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4];
X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4;
```

Data set #1 (ESEM Population Model):

ESEM Multi-Group Invariance (MLR) - Strong

```
! We only report the MODEL section.
! Other sections are identical to the previous models.

MODEL:
F1 BY X1* X2 X3 X4
Y1~0 Y2~0 Y3~0 Y4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F2 BY Y1* Y2 Y3 Y4
X1~0 X2~0 X3~0 X4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F3 BY Z1* Z2 Z3 Z4
X1~0 X2~0 X3~0 X4~0 Y1~0 Y2~0 Y3~0 Y4~0 (*1);
F1@1; F2@1; F3@1;
[F1@0]; [F2@0]; [F3@0];
! Intercepts can be constrained to equality across groups by using identical labels (in parentheses)
! in all groups. We recommend using alphanumeric labels where the letter is linked to the type of
! parameter being estimated (e.g., i for intercept). Labels need to be uniquely associated with a
! single parameter.
[X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4] (i1-i12);

X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4;

MODEL G2:
! Once intercepts are invariant, the factor means can not be freely estimated in in all but the first group.
F1*; F2*; F3*;
[F1*];
[F2*];
[F3*];

[X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4] (i1-i12);

X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4;
```

Data set #1 (ESEM Population Model):

ESEM Multi-Group Invariance (MLR) - Partial Strong

! We only report the MODEL section.
! Other sections are identical to the previous models.

```
MODEL:
F1 BY X1* X2 X3 X4
Y1~0 Y2~0 Y3~0 Y4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F2 BY Y1* Y2 Y3 Y4
X1~0 X2~0 X3~0 X4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F3 BY Z1* Z2 Z3 Z4
X1~0 X2~0 X3~0 X4~0 Y1~0 Y2~0 Y3~0 Y4~0 (*1);
F1@1; F2@1; F3@1;
[F1@0]; [F2@0]; [F3@0];
[X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4] (i1-i12);
X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4;

MODEL G2:
F1*; F2*; F3*;
[F1*]; [F2*]; [F3*];

! To request the free estimation of the non-invariant intercept, simply remove the label.
[X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1] (i1-i9);
[Z2*];
[Z3 Z4] (i11-i12);

X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4;
```

Data set #1 (ESEM Population Model):

ESEM Multi-Group Invariance (MLR) - Strict

```
! We only report the MODEL section.
! Other sections are identical to the previous models.

MODEL:
F1 BY X1* X2 X3 X4
Y1~0 Y2~0 Y3~0 Y4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F2 BY Y1* Y2 Y3 Y4
X1~0 X2~0 X3~0 X4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F3 BY Z1* Z2 Z3 Z4
X1~0 X2~0 X3~0 X4~0 Y1~0 Y2~0 Y3~0 Y4~0 (*1);
F1@1; F2@1; F3@1;
[F1@0]; [F2@0]; [F3@0];
[X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4] (i1-i12);

! Use labels to set the uniquenesses to be equal across groups
X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4 (u1-u12);

MODEL G2:
F1*; F2*; F3*;
[F1*]; [F2*]; [F3*];
[X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1] (i1-i9);
[Z2*];
[Z3 Z4] (i11-i12);

X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4 (u1-u12);
```

Data set #1 (ESEM Population Model):

ESEM Multi-Group Invariance (MLR) – Latent Variances and Covariances

```
! We only report the MODEL section.
! Other sections are identical to the previous models.

MODEL:
F1 BY X1* X2 X3 X4
Y1~0 Y2~0 Y3~0 Y4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F2 BY Y1* Y2 Y3 Y4
X1~0 X2~0 X3~0 X4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F3 BY Z1* Z2 Z3 Z4
X1~0 X2~0 X3~0 X4~0 Y1~0 Y2~0 Y3~0 Y4~0 (*1);
! Factor variances need to be fixed back to 1 in all groups.
! In doing so, factor covariances also need to be specified and set to equality across groups.
F1@1; F2@1; F3@1;
F1 WITH F2 F3 (c1-c2);
F2 WITH F3 (c3);

[F1@0]; [F2@0]; [F3@0];
[X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4] (i1-i12);
X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4 (u1-u12);

MODEL G2:
F1@1; F2@1; F3@1;
F1 WITH F2 F3 (c1-c2);
F2 WITH F3 (c3);

[F1*]; [F2*]; [F3*];
[X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1] (i1-i9);
[Z2*];
[Z3 Z4] (i11-i12);
X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4 (u1-u12);
```

Data set #1 (ESEM Population Model):

ESEM Multi-Group Invariance (MLR) – Latent Means

```
! We only report the MODEL section.
! Other sections are identical to the previous models.

MODEL:
F1 BY X1* X2 X3 X4
Y1~0 Y2~0 Y3~0 Y4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F2 BY Y1* Y2 Y3 Y4
X1~0 X2~0 X3~0 X4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F3 BY Z1* Z2 Z3 Z4
X1~0 X2~0 X3~0 X4~0 Y1~0 Y2~0 Y3~0 Y4~0 (*1);
! Factor means need to be fixed back to 0 in all groups.
F1@1; F2@1; F3@1;
F1 WITH F2 F3 (c1-c2);
F2 WITH F3 (c3);

[F1@0]; [F2@0]; [F3@0];

[X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4] (i1-i12);
X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4 (u1-u12);

MODEL G2:
F1@1; F2@1; F3@1;
F1 WITH F2 F3 (c1-c2);
F2 WITH F3 (c3);

[F1@0]; [F2@0]; [F3@0];

[X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1] (i1-i9);
[Z2*];
[Z3 Z4] (i11-i12);
X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4 (u1-u12);
```

ESEM Multi-Group Invariance (WLSMV) - Configural

```
TITLE: CFA Data X: Configural Invariance WLSMV;
DATA:
FILE IS dataX.dat;
VARIABLE:
NAMES = X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4 GROUP;
USEVARIABLES = X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4;
! To indicate that the variables are ordinal, use the following
CATEGORICAL = X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4;
GROUPING = GROUP (1 = G1 2 = G2);

! Request WLSMV, and parameterization theta (to be able to estimate the uniquenesses)
ANALYSIS:
ESTIMATOR = WLSMV;
PARAM = THETA;
ROTATION = target;
! Specifications related to the factor loadings, variances, and covariances are identical to MLR.
! With ordinal indicators, rather than estimating one intercept per item, one has to work with thresholds.
! There is one fewer thresholds than the number of response categories (3 thresholds for 4 categories).
! Thresholds are specified as "[X1$1]; [X1$2]; [X1$3];" for item 1 with three categories.
! To achieve identification, one threshold must be fixed to equality across groups from the start, and a
! second thresholds for one referent indicator per factor (including the G-factor when appropriate) also
! must be fixed to equality across groups from the start. Doing so makes it possible to freely estimate the
! factor means in all but the first group.
! In addition, with WLSMV, item uniquenesses have to be fixed to 1 in at least one group.
MODEL:
! Factor loadings
F1 BY X1* X2 X3 X4
Y1~0 Y2~0 Y3~0 Y4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F2 BY Y1* Y2 Y3 Y4
X1~0 X2~0 X3~0 X4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F3 BY Z1* Z2 Z3 Z4
X1~0 X2~0 X3~0 X4~0 Y1~0 Y2~0 Y3~0 Y4~0 (*1);
! Factor variances
F1@1; F2@1; F3@1;
! Factor means
[F1@0]; [F2@0]; [F3@0];
! Response thresholds
[X1$1] (t1); ! first threshold of all items set to be equal)
[X1$2] (t2); ! second threshold of one referent indicator per factor set to be equal)
[X1$3];
[X2$1] (t4);
[X2$2];
[X2$3];
[X3$1] (t7);
[X3$2];
[X3$3];
[X4$1] (t10);
[X4$2];
[X4$3];
```

```
[Y1$1] (t13);
[Y1$2] (t14); ! referent indicator
[Y1$3];
[Y2$1] (t16);
[Y2$2];
[Y2$3];
[Y3$1] (t19);
[Y3$2];
[Y3$3];
[Y4$1] (t22);
[Y4$2];
[Y4$3];
[Z1$1] (t25);
[Z1$2] (t26); ! referent indicator
[Z1$3];
[Z2$1] (t28);
[Z2$2];
[Z2$3];
[Z3$1] (t31);
[Z3$2];
[Z3$3];
[Z4$1] (t34);
[Z4$2];
[Z4$3];
! Item uniquenesses fixed to one in the first group
X1@1; X2@1; X3@1; X4@1; Y1@1; Y2@1; Y3@1; Y4@1; Z1@1; Z2@1; Z3@1; Z4@1;

MODEL G2:
F1 BY X1* X2 X3 X4
Y1~0 Y2~0 Y3~0 Y4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F2 BY Y1* Y2 Y3 Y4
X1~0 X2~0 X3~0 X4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F3 BY Z1* Z2 Z3 Z4
X1~0 X2~0 X3~0 X4~0 Y1~0 Y2~0 Y3~0 Y4~0 (*1);
F1@1; F2@1; F3@1;
! free factor means in subsequent groups
[F1*]; [F2*]; [F3*];
[X1$1] (t1);
[X1$2] (t2);
[X1$3];
[X2$1] (t4);
[X2$2];
[X2$3];
[X3$1] (t7);
[X3$2];
[X3$3];
[X4$1] (t10);
[X4$2];
[X4$3];
[Y1$1] (t13);
[Y1$2] (t14);
```

```
[Y1$3];
[Y2$1] (t16);
[Y2$2];
[Y2$3];
[Y3$1] (t19);
[Y3$2];
[Y3$3];
[Y4$1] (t22);
[Y4$2];
[Y4$3];
[Z1$1] (t25);
[Z1$2] (t26);
[Z1$3];
[Z2$1] (t28);
[Z2$2];
[Z2$3];
[Z3$1] (t31);
[Z3$2];
[Z3$3];
[Z4$1] (t34);
[Z4$2];
[Z4$3];
X1* X2* X3* X4* Y1* Y2* Y3* Y4* Z1* Z2* Z3* Z4*;
```

ESEM Multi-Group Invariance (WLSMV) - Weak

! We only report the MODEL section.
! Other sections are identical to the previous models.

```
MODEL:
F1 BY X1* X2 X3 X4
Y1~0 Y2~0 Y3~0 Y4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F2 BY Y1* Y2 Y3 Y4
X1~0 X2~0 X3~0 X4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F3 BY Z1* Z2 Z3 Z4
X1~0 X2~0 X3~0 X4~0 Y1~0 Y2~0 Y3~0 Y4~0 (*1);
F1@1; F2@1; F3@1;
[F1@0]; [F2@0]; [F3@0];
[X1$1] (t1);
[X1$2] (t2);
[X1$3];
[X2$1] (t4);
[X2$2];
[X2$3];
[X3$1] (t7);
[X3$2];
[X3$3];
[X4$1] (t10);
[X4$2];
[X4$3];
[Y1$1] (t13);
[Y1$2] (t14);
[Y1$3];
[Y2$1] (t16);
[Y2$2];
[Y2$3];
[Y3$1] (t19);
[Y3$2];
[Y3$3];
[Y4$1] (t22);
[Y4$2];
[Y4$3];
[Z1$1] (t25);
[Z1$2] (t26);
[Z1$3];
[Z2$1] (t28);
[Z2$2];
[Z2$3];
[Z3$1] (t31);
[Z3$2];
[Z3$3];
[Z4$1] (t34);
[Z4$2];
[Z4$3];
X1@1; X2@1; X3@1; X4@1; Y1@1; Y2@1; Y3@1; Y4@1; Z1@1; Z2@1; Z3@1; Z4@1;
```

```
MODEL G2:
!! Factor loadings are invariant by default (simply remove, and free up the factor variances)
F1*;
F2*;
F3*;
[F1*]; [F2*]; [F3*];
[X1$1] (t1);
[X1$2] (t2);
[X1$3];
[X2$1] (t4);
[X2$2];
[X2$3];
[X3$1] (t7);
[X3$2];
[X3$3];
[X4$1] (t10);
[X4$2];
[X4$3];
[Y1$1] (t13);
[Y1$2] (t14);
[Y1$3];
[Y2$1] (t16);
[Y2$2];
[Y2$3];
[Y3$1] (t19);
[Y3$2];
[Y3$3];
[Y4$1] (t22);
[Y4$2];
[Y4$3];
[Z1$1] (t25);
[Z1$2] (t26);
[Z1$3];
[Z2$1] (t28);
[Z2$2];
[Z2$3];
[Z3$1] (t31);
[Z3$2];
[Z3$3];
[Z4$1] (t34);
[Z4$2];
[Z4$3];
X1* X2* X3* X4* Y1* Y2* Y3* Y4* Z1* Z2* Z3* Z4*;
```

ESEM Multi-Group Invariance (WLSMV) - Strong

```
! We only report the MODEL section.
! Other sections are identical to the previous models.

MODEL:
F1 BY X1* X2 X3 X4
Y1~0 Y2~0 Y3~0 Y4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F2 BY Y1* Y2 Y3 Y4
X1~0 X2~0 X3~0 X4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F3 BY Z1* Z2 Z3 Z4
X1~0 X2~0 X3~0 X4~0 Y1~0 Y2~0 Y3~0 Y4~0 (*1);
F1@1; F2@1; F3@1;
[F1@0]; [F2@0]; [F3@0];
! Set all thresholds to equality
[X1$1] (t1);
[X1$2] (t2);
[X1$3] (t3);
[X2$1] (t4);
[X2$2] (t5);
[X2$3] (t6);
[X3$1] (t7);
[X3$2] (t8);
[X3$3] (t9);
[X4$1] (t10);
[X4$2] (t11);
[X4$3] (t12);
[Y1$1] (t13);
[Y1$2] (t14);
[Y1$3] (t15);
[Y2$1] (t16);
[Y2$2] (t17);
[Y2$3] (t18);
[Y3$1] (t19);
[Y3$2] (t20);
[Y3$3] (t21);
[Y4$1] (t22);
[Y4$2] (t23);
[Y4$3] (t24);
[Z1$1] (t25);
[Z1$2] (t26);
[Z1$3] (t27);
[Z2$1] (t28);
[Z2$2] (t29);
[Z2$3] (t30);
[Z3$1] (t31);
[Z3$2] (t32);
[Z3$3] (t33);
[Z4$1] (t34);
[Z4$2] (t35);
[Z4$3] (t36);
X1@1; X2@1; X3@1; X4@1; Y1@1; Y2@1; Y3@1; Y4@1; Z1@1; Z2@1; Z3@1; Z4@1;
```

```
MODEL G2:
F1*;
F2*;
F3*;
[F1*]; [F2*]; [F3*];
[X1$1] (t1);
[X1$2] (t2);
[X1$3] (t3);
[X2$1] (t4);
[X2$2] (t5);
[X2$3] (t6);
[X3$1] (t7);
[X3$2] (t8);
[X3$3] (t9);
[X4$1] (t10);
[X4$2] (t11);
[X4$3] (t12);
[Y1$1] (t13);
[Y1$2] (t14);
[Y1$3] (t15);
[Y2$1] (t16);
[Y2$2] (t17);
[Y2$3] (t18);
[Y3$1] (t19);
[Y3$2] (t20);
[Y3$3] (t21);
[Y4$1] (t22);
[Y4$2] (t23);
[Y4$3] (t24);
[Z1$1] (t25);
[Z1$2] (t26);
[Z1$3] (t27);
[Z2$1] (t28);
[Z2$2] (t29);
[Z2$3] (t30);
[Z3$1] (t31);
[Z3$2] (t32);
[Z3$3] (t33);
[Z4$1] (t34);
[Z4$2] (t35);
[Z4$3] (t36);
X1* X2* X3* X4* Y1* Y2* Y3* Y4* Z1* Z2* Z3* Z4*;
```

ESEM Multi-Group Invariance (WLSMV) - Strict

! We only report the MODEL section.
! Other sections are identical to the previous models.

```
MODEL:
F1 BY X1* X2 X3 X4
Y1~0 Y2~0 Y3~0 Y4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F2 BY Y1* Y2 Y3 Y4
X1~0 X2~0 X3~0 X4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F3 BY Z1* Z2 Z3 Z4
X1~0 X2~0 X3~0 X4~0 Y1~0 Y2~0 Y3~0 Y4~0 (*1);
F1@1; F2@1; F3@1;
[F1@0]; [F2@0]; [F3@0];
[X1$1] (t1);
[X1$2] (t2);
[X1$3] (t3);
[X2$1] (t4);
[X2$2] (t5);
[X2$3] (t6);
[X3$1] (t7);
[X3$2] (t8);
[X3$3] (t9);
[X4$1] (t10);
[X4$2] (t11);
[X4$3] (t12);
[Y1$1] (t13);
[Y1$2] (t14);
[Y1$3] (t15);
[Y2$1] (t16);
[Y2$2] (t17);
[Y2$3] (t18);
[Y3$1] (t19);
[Y3$2] (t20);
[Y3$3] (t21);
[Y4$1] (t22);
[Y4$2] (t23);
[Y4$3] (t24);
[Z1$1] (t25);
[Z1$2] (t26);
[Z1$3] (t27);
[Z2$1] (t28);
[Z2$2] (t29);
[Z2$3] (t30);
[Z3$1] (t31);
[Z3$2] (t32);
[Z3$3] (t33);
[Z4$1] (t34);
[Z4$2] (t35);
[Z4$3] (t36);
X1@1; X2@1; X3@1; X4@1; Y1@1; Y2@1; Y3@1; Y4@1; Z1@1; Z2@1; Z3@1; Z4@1;
```

```
MODEL G2:
F1*;
F2*;
F3*;
[F1*]; [F2*]; [F3*];
[X1$1] (t1);
[X1$2] (t2);
[X1$3] (t3);
[X2$1] (t4);
[X2$2] (t5);
[X2$3] (t6);
[X3$1] (t7);
[X3$2] (t8);
[X3$3] (t9);
[X4$1] (t10);
[X4$2] (t11);
[X4$3] (t12);
[Y1$1] (t13);
[Y1$2] (t14);
[Y1$3] (t15);
[Y2$1] (t16);
[Y2$2] (t17);
[Y2$3] (t18);
[Y3$1] (t19);
[Y3$2] (t20);
[Y3$3] (t21);
[Y4$1] (t22);
[Y4$2] (t23);
[Y4$3] (t24);
[Z1$1] (t25);
[Z1$2] (t26);
[Z1$3] (t27);
[Z2$1] (t28);
[Z2$2] (t29);
[Z2$3] (t30);
[Z3$1] (t31);
[Z3$2] (t32);
[Z3$3] (t33);
[Z4$1] (t34);
[Z4$2] (t35);
[Z4$3] (t36);
! Fix uniquenesses to 1 in all groups
X1@1; X2@1; X3@1; X4@1; Y1@1; Y2@1; Y3@1; Y4@1; Z1@1; Z2@1; Z3@1; Z4@1;
```

ESEM Multi-Group Invariance (WLSMV) – Latent Variances and Covariances

```
! We only report the MODEL section.
! Other sections are identical to the previous models.

MODEL:
F1 BY X1* X2 X3 X4
Y1~0 Y2~0 Y3~0 Y4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F2 BY Y1* Y2 Y3 Y4
X1~0 X2~0 X3~0 X4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F3 BY Z1* Z2 Z3 Z4
X1~0 X2~0 X3~0 X4~0 Y1~0 Y2~0 Y3~0 Y4~0 (*1);
! Factor variances need to be fixed back to 1 in all groups.
! In doing so, factor covariances also need to be specified and set to equality across groups.
F1@1; F2@1; F3@1;
F1 WITH F2 F3 (c1-c2);
F2 WITH F3 (c3);

[F1@0]; [F2@0]; [F3@0];
[X1$1] (t1);
[X1$2] (t2);
[X1$3] (t3);
[X2$1] (t4);
[X2$2] (t5);
[X2$3] (t6);
[X3$1] (t7);
[X3$2] (t8);
[X3$3] (t9);
[X4$1] (t10);
[X4$2] (t11);
[X4$3] (t12);
[Y1$1] (t13);
[Y1$2] (t14);
[Y1$3] (t15);
[Y2$1] (t16);
[Y2$2] (t17);
[Y2$3] (t18);
[Y3$1] (t19);
[Y3$2] (t20);
[Y3$3] (t21);
[Y4$1] (t22);
[Y4$2] (t23);
[Y4$3] (t24);
[Z1$1] (t25);
[Z1$2] (t26);
[Z1$3] (t27);
[Z2$1] (t28);
[Z2$2] (t29);
[Z2$3] (t30);
[Z3$1] (t31);
[Z3$2] (t32);
[Z3$3] (t33);
```

```
[Z4$1] (t34);
[Z4$2] (t35);
[Z4$3] (t36);
X1@1; X2@1; X3@1; X4@1; Y1@1; Y2@1; Y3@1; Y4@1; Z1@1; Z2@1; Z3@1; Z4@1;

MODEL G2:
F1@1; F2@1; F3@1;
F1 WITH F2 F3 (c1-c2);
F2 WITH F3 (c3);

[F1*]; [F2*]; [F3*];
[X1$1] (t1);
[X1$2] (t2);
[X1$3] (t3);
[X2$1] (t4);
[X2$2] (t5);
[X2$3] (t6);
[X3$1] (t7);
[X3$2] (t8);
[X3$3] (t9);
[X4$1] (t10);
[X4$2] (t11);
[X4$3] (t12);
[Y1$1] (t13);
[Y1$2] (t14);
[Y1$3] (t15);
[Y2$1] (t16);
[Y2$2] (t17);
[Y2$3] (t18);
[Y3$1] (t19);
[Y3$2] (t20);
[Y3$3] (t21);
[Y4$1] (t22);
[Y4$2] (t23);
[Y4$3] (t24);
[Z1$1] (t25);
[Z1$2] (t26);
[Z1$3] (t27);
[Z2$1] (t28);
[Z2$2] (t29);
[Z2$3] (t30);
[Z3$1] (t31);
[Z3$2] (t32);
[Z3$3] (t33);
[Z4$1] (t34);
[Z4$2] (t35);
[Z4$3] (t36);
X1@1; X2@1; X3@1; X4@1; Y1@1; Y2@1; Y3@1; Y4@1; Z1@1; Z2@1; Z3@1; Z4@1;
```

ESEM Multi-Group Invariance (WLSMV) – Latent Means

! We only report the MODEL section.
! Other sections are identical to the previous models.

```
MODEL:
F1 BY X1* X2 X3 X4
Y1~0 Y2~0 Y3~0 Y4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F2 BY Y1* Y2 Y3 Y4
X1~0 X2~0 X3~0 X4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F3 BY Z1* Z2 Z3 Z4
X1~0 X2~0 X3~0 X4~0 Y1~0 Y2~0 Y3~0 Y4~0 (*1);
F1@1; F2@1; F3@1;
F1 WITH F2 F3 (c1-c2);
F2 WITH F3 (c3);
[F1@0]; [F2@0]; [F3@0];
[X1$1] (t1);
[X1$2] (t2);
[X1$3] (t3);
[X2$1] (t4);
[X2$2] (t5);
[X2$3] (t6);
[X3$1] (t7);
[X3$2] (t8);
[X3$3] (t9);
[X4$1] (t10);
[X4$2] (t11);
[X4$3] (t12);
[Y1$1] (t13);
[Y1$2] (t14);
[Y1$3] (t15);
[Y2$1] (t16);
[Y2$2] (t17);
[Y2$3] (t18);
[Y3$1] (t19);
[Y3$2] (t20);
[Y3$3] (t21);
[Y4$1] (t22);
[Y4$2] (t23);
[Y4$3] (t24);
[Z1$1] (t25);
[Z1$2] (t26);
[Z1$3] (t27);
[Z2$1] (t28);
[Z2$2] (t29);
[Z2$3] (t30);
[Z3$1] (t31);
[Z3$2] (t32);
[Z3$3] (t33);
[Z4$1] (t34);
[Z4$2] (t35);
[Z4$3] (t36);
```

```
X1@1; X2@1; X3@1; X4@1; Y1@1; Y2@1; Y3@1; Y4@1; Z1@1; Z2@1; Z3@1; Z4@1;

MODEL G2:
F1@1; F2@1; F3@1;
F1 WITH F2 F3 (c1-c2);
F2 WITH F3 (c3);
! Fix factor means to 0 in all groups.
[F1@0]; [F2@0]; [F3@0];
[X1$1] (t1);
[X1$2] (t2);
[X1$3] (t3);
[X2$1] (t4);
[X2$2] (t5);
[X2$3] (t6);
[X3$1] (t7);
[X3$2] (t8);
[X3$3] (t9);
[X4$1] (t10);
[X4$2] (t11);
[X4$3] (t12);
[Y1$1] (t13);
[Y1$2] (t14);
[Y1$3] (t15);
[Y2$1] (t16);
[Y2$2] (t17);
[Y2$3] (t18);
[Y3$1] (t19);
[Y3$2] (t20);
[Y3$3] (t21);
[Y4$1] (t22);
[Y4$2] (t23);
[Y4$3] (t24);
[Z1$1] (t25);
[Z1$2] (t26);
[Z1$3] (t27);
[Z2$1] (t28);
[Z2$2] (t29);
[Z2$3] (t30);
[Z3$1] (t31);
[Z3$2] (t32);
[Z3$3] (t33);
[Z4$1] (t34);
[Z4$2] (t35);
[Z4$3] (t36);
X1@1; X2@1; X3@1; X4@1; Y1@1; Y2@1; Y3@1; Y4@1; Z1@1; Z2@1; Z3@1; Z4@1;
```

Data set #2 (Bifactor-ESEM Population Model):

Bifactor-ESEM Longitudinal Invariance (MLR) - Configural

```
TITLE: CFA Data 2: Longitudinal Configural Invariance;
DATA: FILE IS data2.dat;
VARIABLE:
NAMES = x1_t1 x2_t1 x3_t1 x4_t1 y1_t1 y2_t1 y3_t1 y4_t1 z1_t1 z2_t1 z3_t1 z4_t1
x1_t2 x2_t2 x3_t2 x4_t2 y1_t2 y2_t2 y3_t2 y4_t2 z1_t2 z2_t2 z3_t2 z4_t2;
USEVARIABLES = x1_t1 x2_t1 x3_t1 x4_t1 y1_t1 y2_t1 y3_t1 y4_t1 z1_t1 z2_t1 z3_t1 z4_t1
x1_t2 x2_t2 x3_t2 x4_t2 y1_t2 y2_t2 y3_t2 y4_t2 z1_t2 z2_t2 z3_t2 z4_t2;
ANALYSIS:
ESTIMATOR = MLR;
ROTATION = target (orthogonal);

MODEL:
! Time 1: Loadings Free
! In a longitudinal model, the factors defined at the different time points need to have different labels
! such as SF1_T1 and SF1_T2. These different factors are defined as forming different sets (*1, and *2).
SF1_t1 BY X1_t1* X2_t1 X3_t1 X4_t1
Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1);
SF2_t1 BY Y1_t1* Y2_t1 Y3_t1 Y4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1);
SF3_t1 BY Z1_t1* Z2_t1 Z3_t1 Z4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 (*1);
GF_t1 BY X1_t1 X2_t1 X3_t1 X4_t1 Y1_t1 Y2_t1 Y3_t1 Y4_t1
Z1_t1 Z2_t1 Z3_t1 Z4_t1 (*1);
! Time 1: Variance Fixed to 1
SF1_t1@1;
SF2_t1@1;
SF3_t1@1;
GF_t1@1;
! Time 1: Means Fixed to 0
[SF1_t1@0];
[SF2_t1@0];
[SF3_t1@0];
[GF_t1@0];
! Time 1: Intercepts Free
[x1_t1 x2_t1 x3_t1 x4_t1];
[y1_t1 y2_t1 y3_t1 y4_t1];
[z1_t1 z2_t1 z3_t1 z4_t1];
! Time 1: Uniquenesses Free
x1_t1 x2_t1 x3_t1 x4_t1;
y1_t1 y2_t1 y3_t1 y4_t1;
z1_t1 z2_t1 z3_t1 z4_t1;
```

```
! Time 2: Loadings Free
SF1_t2 BY X1_t2* X2_t2 X3_t2 X4_t2
Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2);
SF2_t2 BY Y1_t2* Y2_t2 Y3_t2 Y4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2);
SF3_t2 BY Z1_t2* Z2_t2 Z3_t2 Z4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 (*2);
GF_t2 BY X1_t2 X2_t2 X3_t2 X4_t2 Y1_t2 Y2_t2 Y3_t2 Y4_t2
Z1_t2 Z2_t2 Z3_t2 Z4_t2 (*2);
! Time 2: Variance Fixed to 1
SF1_t2@1;
SF2_t2@1;
SF3_t2@1;
GF_t2@1;
! Time 2: Means Fixed to 0
[SF1_t2@0];
[SF2_t2@0];
[SF3_t2@0];
[GF_t2@0];
! Time 2: Intercepts Free
[x1_t2 x2_t2 x3_t2 x4_t2];
[y1_t2 y2_t2 y3_t2 y4_t2];
[z1_t2 z2_t2 z3_t2 z4_t2];
! Time 2: Uniquenesses Free
x1_t2 x2_t2 x3_t2 x4_t2;
y1_t2 y2_t2 y3_t2 y4_t2;
z1_t2 z2_t2 z3_t2 z4_t2;

! Longitudinal correlated uniquenesses
x1_t1 x2_t1 x3_t1 x4_t1 PWITH x1_t2 x2_t2 x3_t2 x4_t2;
y1_t1 y2_t1 y3_t1 y4_t1 PWITH y1_t2 y2_t2 y3_t2 y4_t2;
z1_t1 z2_t1 z3_t1 z4_t1 PWITH z1_t2 z2_t2 z3_t2 z4_t2;
```

Data set #2 (Bifactor-ESEM Population Model):

Bifactor-ESEM Longitudinal Invariance (MLR) - Weak

```
! We only report the MODEL section.
! Other sections are identical to the previous models.

MODEL:
! Time 1: Loadings Invariant
! To indicate that two sets of factors (*1 at Time 1 and *2 at Time 2) are invariant, one simply adds the
! same label in the parenthesis at the end to all factors forming both sets: (* 1 1) and (*2 1).
! The factor variances can then be freed at Time 2 and after.
SF1_t1 BY X1_t1* X2_t1 X3_t1 X4_t1
Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1 1);
SF2_t1 BY Y1_t1* Y2_t1 Y3_t1 Y4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1 1);
SF3_t1 BY Z1_t1* Z2_t1 Z3_t1 Z4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 (*1 1);
GF_t1 BY X1_t1 X2_t1 X3_t1 X4_t1 Y1_t1 Y2_t1 Y3_t1 Y4_t1
Z1_t1 Z2_t1 Z3_t1 Z4_t1 (*1 1);
! Time 1: Variance Fixed to 1
SF1_t1@1;
SF2_t1@1;
SF3_t1@1;
GF_t1@1;
! Time 1: Means Fixed to 0
[SF1_t1@0];
[SF2_t1@0];
[SF3_t1@0];
[GF_t1@0];
! Time 1: Intercepts Free
[x1_t1 x2_t1 x3_t1 x4_t1];
[y1_t1 y2_t1 y3_t1 y4_t1];
[z1_t1 z2_t1 z3_t1 z4_t1];
! Time 1: Uniquenesses Free
x1_t1 x2_t1 x3_t1 x4_t1;
y1_t1 y2_t1 y3_t1 y4_t1;
z1_t1 z2_t1 z3_t1 z4_t1;
! Time 2: Loadings Invariant
SF1_t2 BY X1_t2* X2_t2 X3_t2 X4_t2
Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2 1);
SF2_t2 BY Y1_t2* Y2_t2 Y3_t2 Y4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2 1);
SF3_t2 BY Z1_t2* Z2_t2 Z3_t2 Z4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 (*2 1);
GF_t2 BY X1_t2 X2_t2 X3_t2 X4_t2 Y1_t2 Y2_t2 Y3_t2 Y4_t2
Z1_t2 Z2_t2 Z3_t2 Z4_t2 (*2 1);
! Time 2: Variance Free
SF1_t2*;
SF2_t2*;
SF3_t2*;
GF_t2*;
```

```
! Time 2: Means Fixed to 0
[SF1_t2@0];
[SF2_t2@0];
[SF3_t2@0];
[GF_t2@0];
! Time 2: Intercepts Free
[x1_t2 x2_t2 x3_t2 x4_t2];
[y1_t2 y2_t2 y3_t2 y4_t2];
[z1_t2 z2_t2 z3_t2 z4_t2];
! Time 2: Uniquenesses Free
x1_t2 x2_t2 x3_t2 x4_t2;
y1_t2 y2_t2 y3_t2 y4_t2;
z1_t2 z2_t2 z3_t2 z4_t2;

! Longitudinal correlated uniquenesses
x1_t1 x2_t1 x3_t1 x4_t1 PWITH x1_t2 x2_t2 x3_t2 x4_t2;
y1_t1 y2_t1 y3_t1 y4_t1 PWITH y1_t2 y2_t2 y3_t2 y4_t2;
z1_t1 z2_t1 z3_t1 z4_t1 PWITH z1_t2 z2_t2 z3_t2 z4_t2;
```

Data set #2 (Bifactor-ESEM Population Model):

Bifactor-ESEM Longitudinal Invariance (MLR) - Strong

```
! We only report the ANALYSIS and MODEL section.
! Other sections are identical to the previous models.

ANALYSIS:
ESTIMATOR = MLR;
ROTATION = target (orthogonal);
! To help this model converge on a proper solution, it was necessary to increase the iterations and to
! decrease the convergence. As the data was simulated without missing data, we did not need to increase
! the H1ITERATIONS and to decrease the H1CONVERGENCE. With missing data, matching
! specifications should be used for those two.
ITERATIONS = 100000;
CONVERGENCE = .005;
! H1ITERATIONS = 100000;
! H1CONVERGENCE = .005;
MODEL:
! Time 1: Loadings Invariant
SF1_t1 BY X1_t1* X2_t1 X3_t1 X4_t1
Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1 1);
SF2_t1 BY Y1_t1* Y2_t1 Y3_t1 Y4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1 1);
SF3_t1 BY Z1_t1* Z2_t1 Z3_t1 Z4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 (*1 1);
GF_t1 BY X1_t1 X2_t1 X3_t1 X4_t1 Y1_t1 Y2_t1 Y3_t1 Y4_t1
Z1_t1 Z2_t1 Z3_t1 Z4_t1 (*1 1);
! Time 1: Variance Fixed to 1
SF1_t1@1;
SF2_t1@1;
SF3_t1@1;
GF_t1@1;
! Time 1: Means Fixed to 0
[SF1_t1@0];
[SF2_t1@0];
[SF3_t1@0];
[GF_t1@0];
! Time 1: Intercepts Invariant
[x1_t1 x2_t1 x3_t1 x4_t1] (i1-i4);
[y1_t1 y2_t1 y3_t1 y4_t1] (i5-i8);
[z1_t1 z2_t1 z3_t1 z4_t1] (i9-i12);
! Time 1: Uniquenesses Free
x1_t1 x2_t1 x3_t1 x4_t1;
y1_t1 y2_t1 y3_t1 y4_t1;
z1_t1 z2_t1 z3_t1 z4_t1;
```

```
! Time 2: Loadings Invariant
SF1_t2 BY X1_t2* X2_t2 X3_t2 X4_t2
Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2 1);
SF2_t2 BY Y1_t2* Y2_t2 Y3_t2 Y4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2 1);
SF3_t2 BY Z1_t2* Z2_t2 Z3_t2 Z4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 (*2 1);
GF_t2 BY X1_t2 X2_t2 X3_t2 X4_t2 Y1_t2 Y2_t2 Y3_t2 Y4_t2
Z1_t2 Z2_t2 Z3_t2 Z4_t2 (*2 1);
! Time 2: Variance Free
SF1_t2*;
SF2_t2*;
SF3_t2*;
GF_t2*;
! Time 2: Means Free
[SF1_t2*];
[SF2_t2*];
[SF3_t2*];
[GF_t2*];
! Time 2: Intercepts Invariant
[x1_t2 x2_t2 x3_t2 x4_t2] (i1-i4);
[y1_t2 y2_t2 y3_t2 y4_t2] (i5-i8);
[z1_t2 z2_t2 z3_t2 z4_t2] (i9-i12);
! Time 2: Uniquenesses Free
x1_t2 x2_t2 x3_t2 x4_t2;
y1_t2 y2_t2 y3_t2 y4_t2;
z1_t2 z2_t2 z3_t2 z4_t2;

! Longitudinal correlated uniquenesses
x1_t1 x2_t1 x3_t1 x4_t1 PWITH x1_t2 x2_t2 x3_t2 x4_t2;
y1_t1 y2_t1 y3_t1 y4_t1 PWITH y1_t2 y2_t2 y3_t2 y4_t2;
z1_t1 z2_t1 z3_t1 z4_t1 PWITH z1_t2 z2_t2 z3_t2 z4_t2;
```

Data set #2 (Bifactor-ESEM Population Model):

Bifactor-ESEM Longitudinal Invariance (MLR) – Partial Strong

```
! We only report the MODEL section.
! Other sections are identical to the previous models.

MODEL:
! Time 1: Loadings Invariant
SF1_t1 BY X1_t1* X2_t1 X3_t1 X4_t1
Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1 1);
SF2_t1 BY Y1_t1* Y2_t1 Y3_t1 Y4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1 1);
SF3_t1 BY Z1_t1* Z2_t1 Z3_t1 Z4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 (*1 1);
GF_t1 BY X1_t1 X2_t1 X3_t1 X4_t1 Y1_t1 Y2_t1 Y3_t1 Y4_t1
Z1_t1 Z2_t1 Z3_t1 Z4_t1 (*1 1);
! Time 1: Variance Fixed to 1
SF1_t1@1;
SF2_t1@1;
SF3_t1@1;
GF_t1@1;
! Time 1: Means Fixed to 0
[SF1_t1@0];
[SF2_t1@0];
[SF3_t1@0];
[GF_t1@0];
! Time 1: Intercepts Partial Invariance
[x1_t1 x2_t1 x3_t1 x4_t1] (i1-i4);
[y1_t1 y2_t1 y3_t1 y4_t1] (i5-i8);
[z1_t1] (i9);
[z2_t1*];
[z3_t1 z4_t1] (i11-i12);
! Time 1: Uniquenesses Free
x1_t1 x2_t1 x3_t1 x4_t1;
y1_t1 y2_t1 y3_t1 y4_t1;
z1_t1 z2_t1 z3_t1 z4_t1;

! Time 2: Loadings Invariant
SF1_t2 BY X1_t2* X2_t2 X3_t2 X4_t2
Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2 1);
SF2_t2 BY Y1_t2* Y2_t2 Y3_t2 Y4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2 1);
SF3_t2 BY Z1_t2* Z2_t2 Z3_t2 Z4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 (*2 1);
GF_t2 BY X1_t2 X2_t2 X3_t2 X4_t2 Y1_t2 Y2_t2 Y3_t2 Y4_t2
Z1_t2 Z2_t2 Z3_t2 Z4_t2 (*2 1);
! Time 2: Variance Free
SF1_t2*;
SF2_t2*;
SF3_t2*;
GF_t2*;
```

```
! Time 2: Means Free
[SF1_t2*];
[SF2_t2*];
[SF3_t2*];
[GF_t2*];
! Time 2: Intercepts Partial Invariance
[x1_t2 x2_t2 x3_t2 x4_t2] (i1-i4);
[y1_t2 y2_t2 y3_t2 y4_t2] (i5-i8);
[z1_t2] (i9);
[z2_t2*];
[z3_t2 z4_t2] (i11-i12);
! Time 2: Uniquenesses Free
x1_t2 x2_t2 x3_t2 x4_t2;
y1_t2 y2_t2 y3_t2 y4_t2;
z1_t2 z2_t2 z3_t2 z4_t2;

! Longitudinal correlated uniquenesses
x1_t1 x2_t1 x3_t1 x4_t1 PWITH x1_t2 x2_t2 x3_t2 x4_t2;
y1_t1 y2_t1 y3_t1 y4_t1 PWITH y1_t2 y2_t2 y3_t2 y4_t2;
z1_t1 z2_t1 z3_t1 z4_t1 PWITH z1_t2 z2_t2 z3_t2 z4_t2;
```

Data set #2 (Bifactor-ESEM Population Model):

Bifactor-ESEM Longitudinal Invariance (MLR) – Strict

```
! We only report the MODEL section.
! Other sections are identical to the previous models.

MODEL:
! Time 1: Loadings Invariant
SF1_t1 BY X1_t1* X2_t1 X3_t1 X4_t1
Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1 1);
SF2_t1 BY Y1_t1* Y2_t1 Y3_t1 Y4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1 1);
SF3_t1 BY Z1_t1* Z2_t1 Z3_t1 Z4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 (*1 1);
GF_t1 BY X1_t1 X2_t1 X3_t1 X4_t1 Y1_t1 Y2_t1 Y3_t1 Y4_t1
Z1_t1 Z2_t1 Z3_t1 Z4_t1 (*1 1);
! Time 1: Variance Fixed to 1
SF1_t1@1;
SF2_t1@1;
SF3_t1@1;
GF_t1@1;
! Time 1: Means Fixed to 0
[SF1_t1@0];
[SF2_t1@0];
[SF3_t1@0];
[GF_t1@0];
! Time 1: Intercepts Partial Invariance
[x1_t1 x2_t1 x3_t1 x4_t1] (i1-i4);
[y1_t1 y2_t1 y3_t1 y4_t1] (i5-i8);
[z1_t1] (i9);
[z2_t1*];
[z3_t1 z4_t1] (i11-i12);
! Time 1: Uniquenesses Invariant
x1_t1 x2_t1 x3_t1 x4_t1 (u1-u4);
y1_t1 y2_t1 y3_t1 y4_t1 (u5-u8);
z1_t1 z2_t1 z3_t1 z4_t1 (u9-u12);

! Time 2: Loadings Invariant
SF1_t2 BY X1_t2* X2_t2 X3_t2 X4_t2
Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2 1);
SF2_t2 BY Y1_t2* Y2_t2 Y3_t2 Y4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2 1);
SF3_t2 BY Z1_t2* Z2_t2 Z3_t2 Z4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 (*2 1);
GF_t2 BY X1_t2 X2_t2 X3_t2 X4_t2 Y1_t2 Y2_t2 Y3_t2 Y4_t2
Z1_t2 Z2_t2 Z3_t2 Z4_t2 (*2 1);
! Time 2: Variance Free
SF1_t2*;
SF2_t2*;
SF3_t2*;
GF_t2*;
```

```
! Time 2: Means Free
[SF1_t2*];
[SF2_t2*];
[SF3_t2*];
[GF_t2*];
! Time 2: Intercepts Partial Invariance
[x1_t2 x2_t2 x3_t2 x4_t2] (i1-i4);
[y1_t2 y2_t2 y3_t2 y4_t2] (i5-i8);
[z1_t2] (i9);
[z2_t2*];
[z3_t2 z4_t2] (i11-i12);
! Time 2: Uniquenesses Invariant
x1_t2 x2_t2 x3_t2 x4_t2 (u1-u4);
y1_t2 y2_t2 y3_t2 y4_t2 (u5-u8);
z1_t2 z2_t2 z3_t2 z4_t2 (u9-u12);

! Longitudinal correlated uniquenesses
x1_t1 x2_t1 x3_t1 x4_t1 PWITH x1_t2 x2_t2 x3_t2 x4_t2;
y1_t1 y2_t1 y3_t1 y4_t1 PWITH y1_t2 y2_t2 y3_t2 y4_t2;
z1_t1 z2_t1 z3_t1 z4_t1 PWITH z1_t2 z2_t2 z3_t2 z4_t2;
```

Data set #2 (Bifactor-ESEM Population Model):

Bifactor-ESEM Longitudinal Invariance (MLR) – Latent Variances and Covariances

```
! We only report the MODEL section.
! Other sections are identical to the previous models.

MODEL:
! Time 1: Loadings Invariant
SF1_t1 BY X1_t1* X2_t1 X3_t1 X4_t1
Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1 1);
SF2_t1 BY Y1_t1* Y2_t1 Y3_t1 Y4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1 1);
SF3_t1 BY Z1_t1* Z2_t1 Z3_t1 Z4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 (*1 1);
GF_t1 BY X1_t1 X2_t1 X3_t1 X4_t1 Y1_t1 Y2_t1 Y3_t1 Y4_t1
Z1_t1 Z2_t1 Z3_t1 Z4_t1 (*1 1);
! Time 1: Variance Fixed to 1
SF1_t1@1;
SF2_t1@1;
SF3_t1@1;
GF_t1@1;
! Time 1 Covariances Invariant
GF_t1 WITH SF1_t1 SF2_t1 SF3_t1 (c1-c3);
SF1_t1 WITH SF2_t1 SF3_t1 (c4-c5);
SF2_t1 WITH SF3_t1 (c6);
! Time 1: Means Fixed to 0
[SF1_t1@0];
[SF2_t1@0];
[SF3_t1@0];
[GF_t1@0];
! Time 1: Intercepts Partial Invariance
[x1_t1 x2_t1 x3_t1 x4_t1] (i1-i4);
[y1_t1 y2_t1 y3_t1 y4_t1] (i5-i8);
[z1_t1] (i9);
[z2_t1*];
[z3_t1 z4_t1] (i11-i12);
! Time 1: Uniquenesses Invariant
x1_t1 x2_t1 x3_t1 x4_t1 (u1-u4);
y1_t1 y2_t1 y3_t1 y4_t1 (u5-u8);
z1_t1 z2_t1 z3_t1 z4_t1 (u9-u12);

! Time 2: Loadings Invariant
SF1_t2 BY X1_t2* X2_t2 X3_t2 X4_t2
Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2 1);
SF2_t2 BY Y1_t2* Y2_t2 Y3_t2 Y4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2 1);
SF3_t2 BY Z1_t2* Z2_t2 Z3_t2 Z4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 (*2 1);
GF_t2 BY X1_t2 X2_t2 X3_t2 X4_t2 Y1_t2 Y2_t2 Y3_t2 Y4_t2
Z1_t2 Z2_t2 Z3_t2 Z4_t2 (*2 1);
```

```
! Time 2: Variance Fixed to 1 Invariant
SF1_t2@1;
SF2_t2@1;
SF3_t2@1;
GF_t2@1;
! Time 2 Covariances Invariant
GF_t2 WITH SF1_t2 SF2_t2 SF3_t2 (c1-c3);
SF1_t2 WITH SF2_t2 SF3_t2 (c4-c5);
SF2_t2 WITH SF3_t2 (c6);
! Time 2: Means Free
[SF1_t2*];
[SF2_t2*];
[SF3_t2*];
[GF_t2*];
! Time 2: Intercepts Partial Invariance
[x1_t2 x2_t2 x3_t2 x4_t2] (i1-i4);
[y1_t2 y2_t2 y3_t2 y4_t2] (i5-i8);
[z1_t2] (i9);
[z2_t2*];
[z3_t2 z4_t2] (i11-i12);
! Time 2: Uniquenesses Invariant
x1_t2 x2_t2 x3_t2 x4_t2 (u1-u4);
y1_t2 y2_t2 y3_t2 y4_t2 (u5-u8);
z1_t2 z2_t2 z3_t2 z4_t2 (u9-u12);

! Longitudinal correlated uniquenesses
x1_t1 x2_t1 x3_t1 x4_t1 PWITH x1_t2 x2_t2 x3_t2 x4_t2;
y1_t1 y2_t1 y3_t1 y4_t1 PWITH y1_t2 y2_t2 y3_t2 y4_t2;
z1_t1 z2_t1 z3_t1 z4_t1 PWITH z1_t2 z2_t2 z3_t2 z4_t2;
```

Data set #2 (ESEM Population Model):

Bifactor-ESEM Longitudinal Invariance (MLR) – Latent Means

```
! We only report the MODEL section.
! Other sections are identical to the previous models.

MODEL:
! Time 1: Loadings Invariant
SF1_t1 BY X1_t1* X2_t1 X3_t1 X4_t1
Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1 1);
SF2_t1 BY Y1_t1* Y2_t1 Y3_t1 Y4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1 1);
SF3_t1 BY Z1_t1* Z2_t1 Z3_t1 Z4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 (*1 1);
GF_t1 BY X1_t1 X2_t1 X3_t1 X4_t1 Y1_t1 Y2_t1 Y3_t1 Y4_t1
Z1_t1 Z2_t1 Z3_t1 Z4_t1 (*1 1);
! Time 1: Variance Fixed to 1
SF1_t1@1;
SF2_t1@1;
SF3_t1@1;
GF_t1@1;
! Time 1 Covariances Invariant
GF_t1 WITH SF1_t1 SF2_t1 SF3_t1 (c1-c3);
SF1_t1 WITH SF2_t1 SF3_t1 (c4-c5);
SF2_t1 WITH SF3_t1 (c6);
! Time 1: Means Fixed to 0
[SF1_t1@0];
[SF2_t1@0];
[SF3_t1@0];
[GF_t1@0];
! Time 1: Intercepts Partial Invariance
[x1_t1 x2_t1 x3_t1 x4_t1] (i1-i4);
[y1_t1 y2_t1 y3_t1 y4_t1] (i5-i8);
[z1_t1] (i9);
[z2_t1*];
[z3_t1 z4_t1] (i11-i12);
! Time 1: Uniquenesses Invariant
x1_t1 x2_t1 x3_t1 x4_t1 (u1-u4);
y1_t1 y2_t1 y3_t1 y4_t1 (u5-u8);
z1_t1 z2_t1 z3_t1 z4_t1 (u9-u12);

! Time 2: Loadings Invariant
SF1_t2 BY X1_t2* X2_t2 X3_t2 X4_t2
Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2 1);
SF2_t2 BY Y1_t2* Y2_t2 Y3_t2 Y4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2 1);
SF3_t2 BY Z1_t2* Z2_t2 Z3_t2 Z4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 (*2 1);
GF_t2 BY X1_t2 X2_t2 X3_t2 X4_t2 Y1_t2 Y2_t2 Y3_t2 Y4_t2
Z1_t2 Z2_t2 Z3_t2 Z4_t2 (*2 1);
```

```
! Time 2: Variance Fixed to 1 Invariant
SF1_t2@1;
SF2_t2@1;
SF3_t2@1;
GF_t2@1;
! Time 2 Covariances Invariant
GF_t2 WITH SF1_t2 SF2_t2 SF3_t2 (c1-c3);
SF1_t2 WITH SF2_t2 SF3_t2 (c4-c5);
SF2_t2 WITH SF3_t2 (c6);
! Time 2: Means Fixed to 0 Invariant
[SF1_t2@0];
[SF2_t2@0];
[SF3_t2@0];
[GF_t2@0];
! Time 2: Intercepts Partial Invariance
[x1_t2 x2_t2 x3_t2 x4_t2] (i1-i4);
[y1_t2 y2_t2 y3_t2 y4_t2] (i5-i8);
[z1_t2] (i9);
[z2_t2*];
[z3_t2 z4_t2] (i11-i12);
! Time 2: Uniquenesses Invariant
x1_t2 x2_t2 x3_t2 x4_t2 (u1-u4);
y1_t2 y2_t2 y3_t2 y4_t2 (u5-u8);
z1_t2 z2_t2 z3_t2 z4_t2 (u9-u12);

! Longitudinal correlated uniquenesses
x1_t1 x2_t1 x3_t1 x4_t1 PWITH x1_t2 x2_t2 x3_t2 x4_t2;
y1_t1 y2_t1 y3_t1 y4_t1 PWITH y1_t2 y2_t2 y3_t2 y4_t2;
z1_t1 z2_t1 z3_t1 z4_t1 PWITH z1_t2 z2_t2 z3_t2 z4_t2;
```

Bifactor-ESEM Longitudinal Invariance (WLSMV) - Configural

```
TITLE: CFA DataX: Longitudinal Configural Invariance WLSMV;
DATA: FILE IS dataX.dat;
VARIABLE:
NAMES = x1_t1 x2_t1 x3_t1 x4_t1 y1_t1 y2_t1 y3_t1 y4_t1 z1_t1 z2_t1 z3_t1 z4_t1
x1_t2 x2_t2 x3_t2 x4_t2 y1_t2 y2_t2 y3_t2 y4_t2 z1_t2 z2_t2 z3_t2 z4_t2;
USEVARIABLES = x1_t1 x2_t1 x3_t1 x4_t1 y1_t1 y2_t1 y3_t1 y4_t1 z1_t1 z2_t1 z3_t1 z4_t1
x1_t2 x2_t2 x3_t2 x4_t2 y1_t2 y2_t2 y3_t2 y4_t2 z1_t2 z2_t2 z3_t2 z4_t2;
CATEGORICAL = x1_t1 x2_t1 x3_t1 x4_t1 y1_t1 y2_t1 y3_t1 y4_t1 z1_t1 z2_t1 z3_t1 z4_t1
x1_t2 x2_t2 x3_t2 x4_t2 y1_t2 y2_t2 y3_t2 y4_t2 z1_t2 z2_t2 z3_t2 z4_t2;
ANALYSIS:
ESTIMATOR = WLSMV;
PARAM = THETA;
ROTATION = target (orthogonal);

MODEL:
! Time 1: Loadings Free
SF1_t1 BY X1_t1* X2_t1 X3_t1 X4_t1
Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1);
SF2_t1 BY Y1_t1* Y2_t1 Y3_t1 Y4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1);
SF3_t1 BY Z1_t1* Z2_t1 Z3_t1 Z4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 (*1);
GF_t1 BY X1_t1 X2_t1 X3_t1 X4_t1 Y1_t1 Y2_t1 Y3_t1 Y4_t1
Z1_t1 Z2_t1 Z3_t1 Z4_t1 (*1);
! Time 1: Variance Fixed to 1
SF1_t1@1;
SF2_t1@1;
SF3_t1@1;
GF_t1@1;
! Time 1: Means Fixed to 0
[SF1_t1@0];
[SF2_t1@0];
[SF3_t1@0];
[GF_t1@0];
! Time 1: Thresholds (WLSMV specification, free)
[X1_t1$1] (t1); ! first threshold of all items set to be equal)
[X1_t1$2] (t2); ! second threshold of one referent indicator per factor set to be equal)
[X1_t1$3];
[X2_t1$1] (t4);
[X2_t1$2] (t5); ! A referent indicator has to be picked for the G-factor also.
[X2_t1$3];
[X3_t1$1] (t7);
[X3_t1$2];
[X3_t1$3];
[X4_t1$1] (t10);
[X4_t1$2];
[X4_t1$3];
[Y1_t1$1] (t13);
[Y1_t1$2] (t14); ! referent indicator
```

```
[Y1_t1$3];
[Y2_t1$1] (t16);
[Y2_t1$2];
[Y2_t1$3];
[Y3_t1$1] (t19);
[Y3_t1$2];
[Y3_t1$3];
[Y4_t1$1] (t22);
[Y4_t1$2];
[Y4_t1$3];
[Z1_t1$1] (t25);
[Z1_t1$2] (t26); ! referent indicator
[Z1_t1$3];
[Z2_t1$1] (t28);
[Z2_t1$2];
[Z2_t1$3];
[Z3_t1$1] (t31);
[Z3_t1$2];
[Z3_t1$3];
[Z4_t1$1] (t34);
[Z4_t1$2];
[Z4_t1$3];
! Time 1: Uniquenesses Fixed to 1
x1_t1@1 x2_t1@1 x3_t1@1 x4_t1@1;
y1_t1@1 y2_t1@1 y3_t1@1 y4_t1@1;
z1_t1@1 z2_t1@1 z3_t1@1 z4_t1@1;

! Time 2: Loadings Free
SF1_t2 BY X1_t2* X2_t2 X3_t2 X4_t2
Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2);
SF2_t2 BY Y1_t2* Y2_t2 Y3_t2 Y4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2);
SF3_t2 BY Z1_t2* Z2_t2 Z3_t2 Z4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 (*2);
GF_t2 BY X1_t2 X2_t2 X3_t2 X4_t2 Y1_t2 Y2_t2 Y3_t2 Y4_t2
Z1_t2 Z2_t2 Z3_t2 Z4_t2 (*2);
! Time 2: Variance Fixed to 1
SF1_t2@1;
SF2_t2@1;
SF3_t2@1;
GF_t2@1;
! Time 2: Means Free
[SF1_t2*];
[SF2_t2*];
[SF3_t2*];
[GF_t2*];
Thresholds (WLSMV specification, free)
[X1_t2$1] (t1);
[X1_t2$2] (t2);
[X1_t2$3];
[X2_t2$1] (t4);
```

```
[X2_t2$2] (t5);
[X2_t2$3];
[X3_t2$1] (t7);
[X3_t2$2];
[X3_t2$3];
[X4_t2$1] (t10);
[X4_t2$2];
[X4_t2$3];
[Y1_t2$1] (t13);
[Y1_t2$2] (t14);
[Y1_t2$3];
[Y2_t2$1] (t16);
[Y2_t2$2];
[Y2_t2$3];
[Y3_t2$1] (t19);
[Y3_t2$2];
[Y3_t2$3];
[Y4_t2$1] (t22);
[Y4_t2$2];
[Y4_t2$3];
[Z1_t2$1] (t25);
[Z1_t2$2] (t26);
[Z1_t2$3];
[Z2_t2$1] (t28);
[Z2_t2$2];
[Z2_t2$3];
[Z3_t2$1] (t31);
[Z3_t2$2];
[Z3_t2$3];
[Z4_t2$1] (t34);
[Z4_t2$2];
[Z4_t2$3];
! Time 2: Uniquenesses Free
x1_t2* x2_t2* x3_t2* x4_t2*;
y1_t2* y2_t2* y3_t2* y4_t2*;
z1_t2* z2_t2* z3_t2* z4_t2*;

! Longitudinal correlated uniquenesses
x1_t1 x2_t1 x3_t1 x4_t1 PWITH x1_t2 x2_t2 x3_t2 x4_t2;
y1_t1 y2_t1 y3_t1 y4_t1 PWITH y1_t2 y2_t2 y3_t2 y4_t2;
z1_t1 z2_t1 z3_t1 z4_t1 PWITH z1_t2 z2_t2 z3_t2 z4_t2;
```

Bifactor-ESEM Longitudinal Invariance (WLSMV) - Weak

```
! We only report the MODEL section.
! Other sections are identical to the previous models.

MODEL:
! Time 1: Loadings Invariant
SF1_t1 BY X1_t1* X2_t1 X3_t1 X4_t1
Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1 1);
SF2_t1 BY Y1_t1* Y2_t1 Y3_t1 Y4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1 1);
SF3_t1 BY Z1_t1* Z2_t1 Z3_t1 Z4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 (*1 1);
GF_t1 BY X1_t1 X2_t1 X3_t1 X4_t1 Y1_t1 Y2_t1 Y3_t1 Y4_t1
Z1_t1 Z2_t1 Z3_t1 Z4_t1 (*1 1);
! Time 1: Variance Fixed to 1
SF1_t1@1;
SF2_t1@1;
SF3_t1@1;
GF_t1@1;
! Time 1: Means Fixed to 0
[SF1_t1@0];
[SF2_t1@0];
[SF3_t1@0];
[GF_t1@0];
! Time 1: Thresholds (WLSMV specification, free)
[X1_t1$1] (t1);
[X1_t1$2] (t2);
[X1_t1$3];
[X2_t1$1] (t4);
[X2_t1$2] (t5);
[X2_t1$3];
[X3_t1$1] (t7);
[X3_t1$2];
[X3_t1$3];
[X4_t1$1] (t10);
[X4_t1$2];
[X4_t1$3];
[Y1_t1$1] (t13);
[Y1_t1$2] (t14);
[Y1_t1$3];
[Y2_t1$1] (t16);
[Y2_t1$2];
[Y2_t1$3];
[Y3_t1$1] (t19);
[Y3_t1$2];
[Y3_t1$3];
[Y4_t1$1] (t22);
[Y4_t1$2];
[Y4_t1$3];
[Z1_t1$1] (t25);
[Z1_t1$2] (t26);
```

```
[Z1_t1$3];
[Z2_t1$1] (t28);
[Z2_t1$2];
[Z2_t1$3];
[Z3_t1$1] (t31);
[Z3_t1$2];
[Z3_t1$3];
[Z4_t1$1] (t34);
[Z4_t1$2];
[Z4_t1$3];
! Time 1: Uniquenesses Fixed to 1
x1_t1@1 x2_t1@1 x3_t1@1 x4_t1@1;
y1_t1@1 y2_t1@1 y3_t1@1 y4_t1@1;
z1_t1@1 z2_t1@1 z3_t1@1 z4_t1@1;

! Time 2: Loadings Invariant
SF1_t2 BY X1_t2* X2_t2 X3_t2 X4_t2
Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2 1);
SF2_t2 BY Y1_t2* Y2_t2 Y3_t2 Y4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2 1);
SF3_t2 BY Z1_t2* Z2_t2 Z3_t2 Z4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 (*2 1);
GF_t2 BY X1_t2 X2_t2 X3_t2 X4_t2 Y1_t2 Y2_t2 Y3_t2 Y4_t2
Z1_t2 Z2_t2 Z3_t2 Z4_t2 (*2);
! Time 2: Variance Free
SF1_t2*;
SF2_t2*;
SF3_t2*;
GF_t2*;
! Time 2: Means Free
[SF1_t2*];
[SF2_t2*];
[SF3_t2*];
[GF_t2*];
Thresholds (WLSMV specification, free)
[X1_t2$1] (t1);
[X1_t2$2] (t2);
[X1_t2$3];
[X2_t2$1] (t4);
[X2_t2$2] (t5);
[X2_t2$3];
[X3_t2$1] (t7);
[X3_t2$2];
[X3_t2$3];
[X4_t2$1] (t10);
[X4_t2$2];
[X4_t2$3];
[Y1_t2$1] (t13);
[Y1_t2$2] (t14);
[Y1_t2$3];
[Y2_t2$1] (t16);
```

```
[Y2_t2$2];
[Y2_t2$3];
[Y3_t2$1] (t19);
[Y3_t2$2];
[Y3_t2$3];
[Y4_t2$1] (t22);
[Y4_t2$2];
[Y4_t2$3];
[Z1_t2$1] (t25);
[Z1_t2$2] (t26);
[Z1_t2$3];
[Z2_t2$1] (t28);
[Z2_t2$2];
[Z2_t2$3];
[Z3_t2$1] (t31);
[Z3_t2$2];
[Z3_t2$3];
[Z4_t2$1] (t34);
[Z4_t2$2];
[Z4_t2$3];
! Time 2: Uniquenesses Free
x1_t2* x2_t2* x3_t2* x4_t2*;
y1_t2* y2_t2* y3_t2* y4_t2*;
z1_t2* z2_t2* z3_t2* z4_t2*;

! Longitudinal correlated uniquenesses
x1_t1 x2_t1 x3_t1 x4_t1 PWITH x1_t2 x2_t2 x3_t2 x4_t2;
y1_t1 y2_t1 y3_t1 y4_t1 PWITH y1_t2 y2_t2 y3_t2 y4_t2;
z1_t1 z2_t1 z3_t1 z4_t1 PWITH z1_t2 z2_t2 z3_t2 z4_t2;
```

Bifactor-ESEM Longitudinal Invariance (WLSMV) - Strong

```
! We only report the MODEL section.
! Other sections are identical to the previous models.

MODEL:
! Time 1: Loadings Invariant
SF1_t1 BY X1_t1* X2_t1 X3_t1 X4_t1
Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1 1);
SF2_t1 BY Y1_t1* Y2_t1 Y3_t1 Y4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1 1);
SF3_t1 BY Z1_t1* Z2_t1 Z3_t1 Z4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 (*1 1);
GF_t1 BY X1_t1 X2_t1 X3_t1 X4_t1 Y1_t1 Y2_t1 Y3_t1 Y4_t1
Z1_t1 Z2_t1 Z3_t1 Z4_t1 (*1 1);
! Time 1: Variance Fixed to 1
SF1_t1@1;
SF2_t1@1;
SF3_t1@1;
GF_t1@1;
! Time 1: Means Fixed to 0
[SF1_t1@0];
[SF2_t1@0];
[SF3_t1@0];
[GF_t1@0];
! Time 1: Thresholds (WLSMV specification, invariant)
[X1_t1$1] (t1);
[X1_t1$2] (t2);
[X1_t1$3] (t3);
[X2_t1$1] (t4);
[X2_t1$2] (t5);
[X2_t1$3] (t6);
[X3_t1$1] (t7);
[X3_t1$2] (t8);
[X3_t1$3] (t9);
[X4_t1$1] (t10);
[X4_t1$2] (t11);
[X4_t1$3] (t12);
[Y1_t1$1] (t13);
[Y1_t1$2] (t14);
[Y1_t1$3] (t15);
[Y2_t1$1] (t16);
[Y2_t1$2] (t17);
[Y2_t1$3] (t18);
[Y3_t1$1] (t19);
[Y3_t1$2] (t20);
[Y3_t1$3] (t21);
[Y4_t1$1] (t22);
[Y4_t1$2] (t23);
[Y4_t1$3] (t24);
[Z1_t1$1] (t25);
[Z1_t1$2] (t26);
```

```
[Z1_t1$3] (t27);
[Z2_t1$1] (t28);
[Z2_t1$2] (t29);
[Z2_t1$3] (t30);
[Z3_t1$1] (t31);
[Z3_t1$2] (t32);
[Z3_t1$3] (t33);
[Z4_t1$1] (t34);
[Z4_t1$2] (t35);
[Z4_t1$3] (t36);
! Time 1: Uniquenesses Fixed to 1
x1_t1@1 x2_t1@1 x3_t1@1 x4_t1@1;
y1_t1@1 y2_t1@1 y3_t1@1 y4_t1@1;
z1_t1@1 z2_t1@1 z3_t1@1 z4_t1@1;

! Time 2: Loadings Invariant
SF1_t2 BY X1_t2* X2_t2 X3_t2 X4_t2
Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2 1);
SF2_t2 BY Y1_t2* Y2_t2 Y3_t2 Y4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2 1);
SF3_t2 BY Z1_t2* Z2_t2 Z3_t2 Z4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 (*2 1);
GF_t2 BY X1_t2 X2_t2 X3_t2 X4_t2 Y1_t2 Y2_t2 Y3_t2 Y4_t2
Z1_t2 Z2_t2 Z3_t2 Z4_t2 (*2);
! Time 2: Variance Free
SF1_t2*;
SF2_t2*;
SF3_t2*;
GF_t2*;
! Time 2: Means Free
[SF1_t2*];
[SF2_t2*];
[SF3_t2*];
[GF_t2*];
Thresholds (WLSMV specification, invariant)
[X1_t2$1] (t1);
[X1_t2$2] (t2);
[X1_t2$3] (t3);
[X2_t2$1] (t4);
[X2_t2$2] (t5);
[X2_t2$3] (t6);
[X3_t2$1] (t7);
[X3_t2$2] (t8);
[X3_t2$3] (t9);
[X4_t2$1] (t10);
[X4_t2$2] (t11);
[X4_t2$3] (t12);
[Y1_t2$1] (t13);
[Y1_t2$2] (t14);
[Y1_t2$3] (t15);
[Y2_t2$1] (t16);
```

```
[Y2_t2$2] (t17);
[Y2_t2$3] (t18);
[Y3_t2$1] (t19);
[Y3_t2$2] (t20);
[Y3_t2$3] (t21);
[Y4_t2$1] (t22);
[Y4_t2$2] (t23);
[Y4_t2$3] (t24);
[Z1_t2$1] (t25);
[Z1_t2$2] (t26);
[Z1_t2$3] (t27);
[Z2_t2$1] (t28);
[Z2_t2$2] (t29);
[Z2_t2$3] (t30);
[Z3_t2$1] (t31);
[Z3_t2$2] (t32);
[Z3_t2$3] (t33);
[Z4_t2$1] (t34);
[Z4_t2$2] (t35);
[Z4_t2$3] (t36);
! Time 2: Uniquenesses Free
x1_t2* x2_t2* x3_t2* x4_t2*;
y1_t2* y2_t2* y3_t2* y4_t2*;
z1_t2* z2_t2* z3_t2* z4_t2*;

! Longitudinal correlated uniquenesses
x1_t1 x2_t1 x3_t1 x4_t1 PWITH x1_t2 x2_t2 x3_t2 x4_t2;
y1_t1 y2_t1 y3_t1 y4_t1 PWITH y1_t2 y2_t2 y3_t2 y4_t2;
z1_t1 z2_t1 z3_t1 z4_t1 PWITH z1_t2 z2_t2 z3_t2 z4_t2;
```

Bifactor-ESEM Longitudinal Invariance (WLSMV) - Strict

```
! We only report the MODEL section.
! Other sections are identical to the previous models.

MODEL:
! Time 1: Loadings Invariant
SF1_t1 BY X1_t1* X2_t1 X3_t1 X4_t1
Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1 1);
SF2_t1 BY Y1_t1* Y2_t1 Y3_t1 Y4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1 1);
SF3_t1 BY Z1_t1* Z2_t1 Z3_t1 Z4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 (*1 1);
GF_t1 BY X1_t1 X2_t1 X3_t1 X4_t1 Y1_t1 Y2_t1 Y3_t1 Y4_t1
Z1_t1 Z2_t1 Z3_t1 Z4_t1 (*1 1);
! Time 1: Variance Fixed to 1
SF1_t1@1;
SF2_t1@1;
SF3_t1@1;
GF_t1@1;
! Time 1: Means Fixed to 0
[SF1_t1@0];
[SF2_t1@0];
[SF3_t1@0];
[GF_t1@0];
! Time 1: Thresholds (WLSMV specification, invariant)
[X1_t1$1] (t1);
[X1_t1$2] (t2);
[X1_t1$3] (t3);
[X2_t1$1] (t4);
[X2_t1$2] (t5);
[X2_t1$3] (t6);
[X3_t1$1] (t7);
[X3_t1$2] (t8);
[X3_t1$3] (t9);
[X4_t1$1] (t10);
[X4_t1$2] (t11);
[X4_t1$3] (t12);
[Y1_t1$1] (t13);
[Y1_t1$2] (t14);
[Y1_t1$3] (t15);
[Y2_t1$1] (t16);
[Y2_t1$2] (t17);
[Y2_t1$3] (t18);
[Y3_t1$1] (t19);
[Y3_t1$2] (t20);
[Y3_t1$3] (t21);
[Y4_t1$1] (t22);
[Y4_t1$2] (t23);
[Y4_t1$3] (t24);
[Z1_t1$1] (t25);
[Z1_t1$2] (t26);
```

```
[Z1_t1$3] (t27);
[Z2_t1$1] (t28);
[Z2_t1$2] (t29);
[Z2_t1$3] (t30);
[Z3_t1$1] (t31);
[Z3_t1$2] (t32);
[Z3_t1$3] (t33);
[Z4_t1$1] (t34);
[Z4_t1$2] (t35);
[Z4_t1$3] (t36);
! Time 1: Uniquenesses Fixed to 1
x1_t1@1 x2_t1@1 x3_t1@1 x4_t1@1;
y1_t1@1 y2_t1@1 y3_t1@1 y4_t1@1;
z1_t1@1 z2_t1@1 z3_t1@1 z4_t1@1;

! Time 2: Loadings Invariant
SF1_t2 BY X1_t2* X2_t2 X3_t2 X4_t2
Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2 1);
SF2_t2 BY Y1_t2* Y2_t2 Y3_t2 Y4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2 1);
SF3_t2 BY Z1_t2* Z2_t2 Z3_t2 Z4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 (*2 1);
GF_t2 BY X1_t2 X2_t2 X3_t2 X4_t2 Y1_t2 Y2_t2 Y3_t2 Y4_t2
Z1_t2 Z2_t2 Z3_t2 Z4_t2 (*2);
! Time 2: Variance Free
SF1_t2*;
SF2_t2*;
SF3_t2*;
GF_t2*;
! Time 2: Means Free
[SF1_t2*];
[SF2_t2*];
[SF3_t2*];
[GF_t2*];
Thresholds (WLSMV specification, invariant)
[X1_t2$1] (t1);
[X1_t2$2] (t2);
[X1_t2$3] (t3);
[X2_t2$1] (t4);
[X2_t2$2] (t5);
[X2_t2$3] (t6);
[X3_t2$1] (t7);
[X3_t2$2] (t8);
[X3_t2$3] (t9);
[X4_t2$1] (t10);
[X4_t2$2] (t11);
[X4_t2$3] (t12);
[Y1_t2$1] (t13);
[Y1_t2$2] (t14);
[Y1_t2$3] (t15);
[Y2_t2$1] (t16);
```

```
[Y2_t2$2] (t17);
[Y2_t2$3] (t18);
[Y3_t2$1] (t19);
[Y3_t2$2] (t20);
[Y3_t2$3] (t21);
[Y4_t2$1] (t22);
[Y4_t2$2] (t23);
[Y4_t2$3] (t24);
[Z1_t2$1] (t25);
[Z1_t2$2] (t26);
[Z1_t2$3] (t27);
[Z2_t2$1] (t28);
[Z2_t2$2] (t29);
[Z2_t2$3] (t30);
[Z3_t2$1] (t31);
[Z3_t2$2] (t32);
[Z3_t2$3] (t33);
[Z4_t2$1] (t34);
[Z4_t2$2] (t35);
[Z4_t2$3] (t36);
! Time 2: Uniquenesses Fixed to 1
x1_t2@1 x2_t2@1 x3_t2@1 x4_t2@1;
y1_t2@1 y2_t2@1 y3_t2@1 y4_t2@1;
z1_t2@1 z2_t2@1 z3_t2@1 z4_t2@1;

! Longitudinal correlated uniquenesses
x1_t1 x2_t1 x3_t1 x4_t1 PWITH x1_t2 x2_t2 x3_t2 x4_t2;
y1_t1 y2_t1 y3_t1 y4_t1 PWITH y1_t2 y2_t2 y3_t2 y4_t2;
z1_t1 z2_t1 z3_t1 z4_t1 PWITH z1_t2 z2_t2 z3_t2 z4_t2;
```

Bifactor-ESEM Longitudinal Invariance (WLSMV) – Latent Variances and Covariances

```
! We only report the MODEL section.
! Other sections are identical to the previous models.

MODEL:
! Time 1: Loadings Invariant
SF1_t1 BY X1_t1* X2_t1 X3_t1 X4_t1
Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1 1);
SF2_t1 BY Y1_t1* Y2_t1 Y3_t1 Y4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1 1);
SF3_t1 BY Z1_t1* Z2_t1 Z3_t1 Z4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 (*1 1);
GF_t1 BY X1_t1 X2_t1 X3_t1 X4_t1 Y1_t1 Y2_t1 Y3_t1 Y4_t1
Z1_t1 Z2_t1 Z3_t1 Z4_t1 (*1 1);
! Time 1: Variance Fixed to 1
SF1_t1@1;
SF2_t1@1;
SF3_t1@1;
GF_t1@1;
! Time 1 Covariances Invariant
GF_t1 WITH SF1_t1 SF2_t1 SF3_t1 (c1-c3);
SF1_t1 WITH SF2_t1 SF3_t1 (c4-c5);
SF2_t1 WITH SF3_t1 (c6);
! Time 1: Means Fixed to 0
[SF1_t1@0];
[SF2_t1@0];
[SF3_t1@0];
[GF_t1@0];
! Time 1: Thresholds (WLSMV specification, invariant)
[X1_t1$1] (t1);
[X1_t1$2] (t2);
[X1_t1$3] (t3);
[X2_t1$1] (t4);
[X2_t1$2] (t5);
[X2_t1$3] (t6);
[X3_t1$1] (t7);
[X3_t1$2] (t8);
[X3_t1$3] (t9);
[X4_t1$1] (t10);
[X4_t1$2] (t11);
[X4_t1$3] (t12);
[Y1_t1$1] (t13);
[Y1_t1$2] (t14);
[Y1_t1$3] (t15);
[Y2_t1$1] (t16);
[Y2_t1$2] (t17);
[Y2_t1$3] (t18);
[Y3_t1$1] (t19);
[Y3_t1$2] (t20);
[Y3_t1$3] (t21);
[Y4_t1$1] (t22);
```

```
[Y4_t1$2] (t23);
[Y4_t1$3] (t24);
[Z1_t1$1] (t25);
[Z1_t1$2] (t26);
[Z1_t1$3] (t27);
[Z2_t1$1] (t28);
[Z2_t1$2] (t29);
[Z2_t1$3] (t30);
[Z3_t1$1] (t31);
[Z3_t1$2] (t32);
[Z3_t1$3] (t33);
[Z4_t1$1] (t34);
[Z4_t1$2] (t35);
[Z4_t1$3] (t36);
! Time 1: Uniquenesses Fixed to 1
x1_t1@1 x2_t1@1 x3_t1@1 x4_t1@1;
y1_t1@1 y2_t1@1 y3_t1@1 y4_t1@1;
z1_t1@1 z2_t1@1 z3_t1@1 z4_t1@1;

! Time 2: Loadings Invariant
SF1_t2 BY X1_t2* X2_t2 X3_t2 X4_t2
Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2 1);
SF2_t2 BY Y1_t2* Y2_t2 Y3_t2 Y4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2 1);
SF3_t2 BY Z1_t2* Z2_t2 Z3_t2 Z4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 (*2 1);
GF_t2 BY X1_t2 X2_t2 X3_t2 X4_t2 Y1_t2 Y2_t2 Y3_t2 Y4_t2
Z1_t2 Z2_t2 Z3_t2 Z4_t2 (*2);
! Time 2: Variance Fixed to 1 (Invariant)
SF1_t2@1;
SF2_t2@1;
SF3_t2@1;
GF_t2@1;
! Time 2 Covariances Invariant
GF_t2 WITH SF1_t2 SF2_t2 SF3_t2 (c1-c3);
SF1_t2 WITH SF2_t2 SF3_t2 (c4-c5);
SF2_t2 WITH SF3_t2 (c6);
! Time 2: Means Free
[SF1_t2*];
[SF2_t2*];
[SF3_t2*];
[GF_t2*];
Thresholds (WLSMV specification, invariant)
[X1_t2$1] (t1);
[X1_t2$2] (t2);
[X1_t2$3] (t3);
[X2_t2$1] (t4);
[X2_t2$2] (t5);
[X2_t2$3] (t6);
[X3_t2$1] (t7);
[X3_t2$2] (t8);
```

```
[X3_t2$3] (t9);
[X4_t2$1] (t10);
[X4_t2$2] (t11);
[X4_t2$3] (t12);
[Y1_t2$1] (t13);
[Y1_t2$2] (t14);
[Y1_t2$3] (t15);
[Y2_t2$1] (t16);
[Y2_t2$2] (t17);
[Y2_t2$3] (t18);
[Y3_t2$1] (t19);
[Y3_t2$2] (t20);
[Y3_t2$3] (t21);
[Y4_t2$1] (t22);
[Y4_t2$2] (t23);
[Y4_t2$3] (t24);
[Z1_t2$1] (t25);
[Z1_t2$2] (t26);
[Z1_t2$3] (t27);
[Z2_t2$1] (t28);
[Z2_t2$2] (t29);
[Z2_t2$3] (t30);
[Z3_t2$1] (t31);
[Z3_t2$2] (t32);
[Z3_t2$3] (t33);
[Z4_t2$1] (t34);
[Z4_t2$2] (t35);
[Z4_t2$3] (t36);
! Time 2: Uniquenesses Fixed to 1
x1_t2@1 x2_t2@1 x3_t2@1 x4_t2@1;
y1_t2@1 y2_t2@1 y3_t2@1 y4_t2@1;
z1_t2@1 z2_t2@1 z3_t2@1 z4_t2@1;

! Longitudinal correlated uniquenesses
x1_t1 x2_t1 x3_t1 x4_t1 PWITH x1_t2 x2_t2 x3_t2 x4_t2;
y1_t1 y2_t1 y3_t1 y4_t1 PWITH y1_t2 y2_t2 y3_t2 y4_t2;
z1_t1 z2_t1 z3_t1 z4_t1 PWITH z1_t2 z2_t2 z3_t2 z4_t2;
```

Bifactor-ESEM Longitudinal Invariance (WLSMV) – Latent Means

```
! We only report the MODEL section.
! Other sections are identical to the previous models.

MODEL:
! Time 1: Loadings Invariant
SF1_t1 BY X1_t1* X2_t1 X3_t1 X4_t1
Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1 1);
SF2_t1 BY Y1_t1* Y2_t1 Y3_t1 Y4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Z1_t1~0 Z2_t1~0 Z3_t1~0 Z4_t1~0 (*1 1);
SF3_t1 BY Z1_t1* Z2_t1 Z3_t1 Z4_t1
X1_t1~0 X2_t1~0 X3_t1~0 X4_t1~0 Y1_t1~0 Y2_t1~0 Y3_t1~0 Y4_t1~0 (*1 1);
GF_t1 BY X1_t1 X2_t1 X3_t1 X4_t1 Y1_t1 Y2_t1 Y3_t1 Y4_t1
Z1_t1 Z2_t1 Z3_t1 Z4_t1 (*1 1);
! Time 1: Variance Fixed to 1
SF1_t1@1;
SF2_t1@1;
SF3_t1@1;
GF_t1@1;
! Time 1 Covariances Invariant
GF_t1 WITH SF1_t1 SF2_t1 SF3_t1 (c1-c3);
SF1_t1 WITH SF2_t1 SF3_t1 (c4-c5);
SF2_t1 WITH SF3_t1 (c6);
! Time 1: Means Fixed to 0
[SF1_t1@0];
[SF2_t1@0];
[SF3_t1@0];
[GF_t1@0];
! Time 1: Thresholds (WLSMV specification, invariant)
[X1_t1$1] (t1);
[X1_t1$2] (t2);
[X1_t1$3] (t3);
[X2_t1$1] (t4);
[X2_t1$2] (t5);
[X2_t1$3] (t6);
[X3_t1$1] (t7);
[X3_t1$2] (t8);
[X3_t1$3] (t9);
[X4_t1$1] (t10);
[X4_t1$2] (t11);
[X4_t1$3] (t12);
[Y1_t1$1] (t13);
[Y1_t1$2] (t14);
[Y1_t1$3] (t15);
[Y2_t1$1] (t16);
[Y2_t1$2] (t17);
[Y2_t1$3] (t18);
[Y3_t1$1] (t19);
[Y3_t1$2] (t20);
[Y3_t1$3] (t21);
[Y4_t1$1] (t22);
```

```
[Y4_t1$2] (t23);
[Y4_t1$3] (t24);
[Z1_t1$1] (t25);
[Z1_t1$2] (t26);
[Z1_t1$3] (t27);
[Z2_t1$1] (t28);
[Z2_t1$2] (t29);
[Z2_t1$3] (t30);
[Z3_t1$1] (t31);
[Z3_t1$2] (t32);
[Z3_t1$3] (t33);
[Z4_t1$1] (t34);
[Z4_t1$2] (t35);
[Z4_t1$3] (t36);
! Time 1: Uniquenesses Fixed to 1
x1_t1@1 x2_t1@1 x3_t1@1 x4_t1@1;
y1_t1@1 y2_t1@1 y3_t1@1 y4_t1@1;
z1_t1@1 z2_t1@1 z3_t1@1 z4_t1@1;

! Time 2: Loadings Invariant
SF1_t2 BY X1_t2* X2_t2 X3_t2 X4_t2
Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2 1);
SF2_t2 BY Y1_t2* Y2_t2 Y3_t2 Y4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Z1_t2~0 Z2_t2~0 Z3_t2~0 Z4_t2~0 (*2 1);
SF3_t2 BY Z1_t2* Z2_t2 Z3_t2 Z4_t2
X1_t2~0 X2_t2~0 X3_t2~0 X4_t2~0 Y1_t2~0 Y2_t2~0 Y3_t2~0 Y4_t2~0 (*2 1);
GF_t2 BY X1_t2 X2_t2 X3_t2 X4_t2 Y1_t2 Y2_t2 Y3_t2 Y4_t2
Z1_t2 Z2_t2 Z3_t2 Z4_t2 (*2);
! Time 2: Variance Fixed to 1 (Invariant)
SF1_t2@1;
SF2_t2@1;
SF3_t2@1;
GF_t2@1;
! Time 2 Covariances Invariant
GF_t2 WITH SF1_t2 SF2_t2 SF3_t2 (c1-c3);
SF1_t2 WITH SF2_t2 SF3_t2 (c4-c5);
SF2_t2 WITH SF3_t2 (c6);
! Time 2: Means Fixed to 0 Invariant
[SF1_t2@0];
[SF2_t2@0];
[SF3_t2@0];
[GF_t2@0];
Thresholds (WLSMV specification, invariant)
[X1_t2$1] (t1);
[X1_t2$2] (t2);
[X1_t2$3] (t3);
[X2_t2$1] (t4);
[X2_t2$2] (t5);
[X2_t2$3] (t6);
[X3_t2$1] (t7);
[X3_t2$2] (t8);
```

```
[X3_t2$3] (t9);
[X4_t2$1] (t10);
[X4_t2$2] (t11);
[X4_t2$3] (t12);
[Y1_t2$1] (t13);
[Y1_t2$2] (t14);
[Y1_t2$3] (t15);
[Y2_t2$1] (t16);
[Y2_t2$2] (t17);
[Y2_t2$3] (t18);
[Y3_t2$1] (t19);
[Y3_t2$2] (t20);
[Y3_t2$3] (t21);
[Y4_t2$1] (t22);
[Y4_t2$2] (t23);
[Y4_t2$3] (t24);
[Z1_t2$1] (t25);
[Z1_t2$2] (t26);
[Z1_t2$3] (t27);
[Z2_t2$1] (t28);
[Z2_t2$2] (t29);
[Z2_t2$3] (t30);
[Z3_t2$1] (t31);
[Z3_t2$2] (t32);
[Z3_t2$3] (t33);
[Z4_t2$1] (t34);
[Z4_t2$2] (t35);
[Z4_t2$3] (t36);
! Time 2: Uniquenesses Fixed to 1
x1_t2@1 x2_t2@1 x3_t2@1 x4_t2@1;
y1_t2@1 y2_t2@1 y3_t2@1 y4_t2@1;
z1_t2@1 z2_t2@1 z3_t2@1 z4_t2@1;

! Longitudinal correlated uniquenesses
x1_t1 x2_t1 x3_t1 x4_t1 PWITH x1_t2 x2_t2 x3_t2 x4_t2;
y1_t1 y2_t1 y3_t1 y4_t1 PWITH y1_t2 y2_t2 y3_t2 y4_t2;
z1_t1 z2_t1 z3_t1 z4_t1 PWITH z1_t2 z2_t2 z3_t2 z4_t2;
```

Data set #1 (ESEM Population Model):

Tests of Differential Item Functioning - Null Effects Model

```
TITLE: MIMIC tests of DIF, Null model
DATA: File is data1.dat;
VARIABLE:
NAMES = X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4 GROUP;
! The predictors need to be added to the USERVARIABLES list
USEVARIABLES = X1 X2 X3 X4 Y1 Y2 Y3 Y4 Z1 Z2 Z3 Z4 GROUP;
ANALYSIS:
ESTIMATOR = MLR;
ROTATION = target;
MODEL:
! The factors are defined as before
F1 BY X1* X2 X3 X4
Y1~0 Y2~0 Y3~0 Y4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F2 BY Y1* Y2 Y3 Y4
X1~0 X2~0 X3~0 X4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F3 BY Z1* Z2 Z3 Z4
X1~0 X2~0 X3~0 X4~0 Y1~0 Y2~0 Y3~0 Y4~0 (*1);
! The factors and items are regressed on the predictors, with all predictions fixed to 0 (@0).
F1-F3 ON GROUP@0;
X1-X4 ON GROUP@0;
Y1-Y4 ON GROUP@0;
Z1-Z4 ON GROUP@0;
```

Data set #1 (ESEM Population Model):

Tests of Differential Item Functioning - Saturated Model

```
! We only report the MODEL section.
! Other sections are identical to the previous models.

MODEL:
F1 BY X1* X2 X3 X4
Y1~0 Y2~0 Y3~0 Y4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F2 BY Y1* Y2 Y3 Y4
X1~0 X2~0 X3~0 X4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F3 BY Z1* Z2 Z3 Z4
X1~0 X2~0 X3~0 X4~0 Y1~0 Y2~0 Y3~0 Y4~0 (*1);
! The factors and items are regressed on the predictors.
! The effects of the predictors on the factors remain fixed to 0 (@0).
! The effects of the predictors on the items are freely estimated.
F1-F3 ON GROUP@0;
X1-X4 ON GROUP*;
Y1-Y4 ON GROUP*;
Z1-Z4 ON GROUP*;
```

Data set #1 (ESEM Population Model):

Tests of Differential Item Functioning - Invariant Model

```
! We only report the MODEL section.
! Other sections are identical to the previous models.

MODEL:
F1 BY X1* X2 X3 X4
Y1~0 Y2~0 Y3~0 Y4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F2 BY Y1* Y2 Y3 Y4
X1~0 X2~0 X3~0 X4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F3 BY Z1* Z2 Z3 Z4
X1~0 X2~0 X3~0 X4~0 Y1~0 Y2~0 Y3~0 Y4~0 (*1);
! The factors and items are regressed on the predictors.
! The effects of the predictors on the items remain fixed to 0 (@0).
! The effects of the predictors on the factors are freely estimated.
F1-F3 ON GROUP*;
X1-X4 ON GROUP@0;
Y1-Y4 ON GROUP@0;
Z1-Z4 ON GROUP@0;
```

Data set #1 (ESEM Population Model):

Tests of Differential Item Functioning - Partial Invariance Model

```
! We only report the MODEL section.
! Other sections are identical to the previous models.

MODEL:
F1 BY X1* X2 X3 X4
Y1~0 Y2~0 Y3~0 Y4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F2 BY Y1* Y2 Y3 Y4
X1~0 X2~0 X3~0 X4~0 Z1~0 Z2~0 Z3~0 Z4~0 (*1);
F3 BY Z1* Z2 Z3 Z4
X1~0 X2~0 X3~0 X4~0 Y1~0 Y2~0 Y3~0 Y4~0 (*1);
! Partial Invariance
F1-F3 ON GROUP*;
X1-X4 ON GROUP@0;
Y1-Y4 ON GROUP@0;
Z1 ON GROUP@0;
Z2 ON GROUP*;
Z3-Z4 ON GROUP@0;
```

Data set #1 (ESEM Population Model):

EWC replication of the EFA/ESEM solution

```
! We only report the ANALYSIS and MODEL section.
! Other sections are identical to the previous models.

ANALYSIS:
ESTIMATOR = MLR;
! this is no longer an ESEM solution, to there is no need for a rotation
! ROTATION = target;
MODEL:
    f1 BY x1*0.49292;
    f1 BY x2*0.60563;
    f1 BY x3*0.70723;
    f1 BY x4*0.89702;
    f1 BY y1*0.06962;
    f1 BY y2*-0.18117;
    f1 BY y3*0.11734;
    f1 BY y4@0.01259; ! Y4 = referent indicator for factor 2
    f1 BY z1*0.22328;
    f1 BY z2@-0.04407; ! Z2 = referent indicator for factor 3
    f1 BY z3*-0.08702;
    f1 BY z4*0.02773;
    f2 BY y1*0.57755;
    f2 BY y2*0.67633;
    f2 BY y3*0.75228;
    f2 BY y4*0.87383;
    f2 BY x1*0.22273;
    f2 BY x2*-0.09338;
    f2 BY x3*0.00424;
    f2 BY x4@-0.04284;! X4 = referent indicator for factor 1
    f2 BY z1*-0.00028;
    f2 BY z2@0.02379; ! Z2 = referent indicator for factor 3
    f2 BY z3*-0.10451;
    f2 BY z4*0.16771;
    f3 BY z1*0.48413;
    f3 BY z2*0.62053;
    f3 BY z3*0.68691;
    f3 BY z4*0.82171;
    f3 BY x1*-0.10717;
    f3 BY x2*0.17303;
    f3 BY x3*0.03098;
    f3 BY x4@-0.03360;! X4 = referent indicator for factor 1
    f3 BY y1*-0.04454;
    f3 BY y2*0.15021;
    f3 BY y3*0.09948;
    f3 BY y4@-0.09360;! Y4 = referent indicator for factor 2

    f2 WITH f1*0.24545;
    f3 WITH f1*0.20326;
    f3 WITH f2*0.22463;
```

```
    [ x1*0.00689 ];
    [ x2*0.00171 ];
    [ x3*-0.00108 ];
    [ x4*0.01006 ];
    [ y1*-0.00868 ];
    [ y2*-0.02218 ];
    [ y3*-0.01490 ];
    [ y4*-0.00419 ];
    [ z1*-0.00597 ];
    [ z2*-0.01528 ];
    [ z3*0.00418 ];
    [ z4*-0.01416 ];
    x1*0.68774;
    x2*0.57370;
    x3*0.51388;
    x4*0.18938;
    y1*0.64024;
    y2*0.47130;
    y3*0.36199;
    y4*0.14693;
    z1*0.69878;
    z2*0.90089;
    z3*0.48121;
    z4*0.32527;
! factor variances fixed (@) to 1
    f1@1;
    f2@1;
    f3@1;
```

Data set #2 (Bifactor-ESEM Population Model):

EWC replication of the EFA/ESEM solution (higher-order approach)

```
! We only report the ANALYSIS and MODEL section.
! Other sections are identical to the previous models.

ANALYSIS:
ESTIMATOR = MLR;
! this is no longer an ESEM solution, to there is no need for a rotation
! ROTATION = target;
MODEL:
    f1_t1 BY x1_t1*0.61771;
    f1_t1 BY x2_t1*0.68208;
    f1_t1 BY x3_t1*0.76084;
    f1_t1 BY x4_t1@0.93381; ! X4 = referent indicator for factor 1 (main loading fixed as well)
    f1_t1 BY y1_t1*0.12699;
    f1_t1 BY y2_t1*-0.11466;
    f1_t1 BY y3_t1*0.08664;
    f1_t1 BY y4_t1@0.08388; ! Y4 = referent indicator for factor 2
    f1_t1 BY z1_t1*0.19414;
    f1_t1 BY z2_t1*-0.02991;
    f1_t1 BY z3_t1@-0.03380; ! Z3 = referent indicator for factor 3
    f1_t1 BY z4_t1*0.07084;
    f2_t1 BY y1_t1*0.74537;
    f2_t1 BY y2_t1*0.74838;
    f2_t1 BY y3_t1*0.78135;
    f2_t1 BY y4_t1@0.94995; ! Y4 = referent indicator for factor 2 (main loading fixed as well)
    f2_t1 BY x1_t1*0.39087;
    f2_t1 BY x2_t1*-0.15491;
    f2_t1 BY x3_t1*-0.07163;
    f2_t1 BY x4_t1@-0.03220; ! X4 = referent indicator for factor 1
    f2_t1 BY z1_t1*-0.17238;
    f2_t1 BY z2_t1*0.08446;
    f2_t1 BY z3_t1@-0.02449; ! Z3 = referent indicator for factor 3
    f2_t1 BY z4_t1*0.33115;
    f3_t1 BY z1_t1*0.77790;
    f3_t1 BY z2_t1*0.75949;
    f3_t1 BY z3_t1@0.95000; ! Z3 = referent indicator for factor 3 (main loading fixed as well).
    f3_t1 BY z4_t1*0.68448;
    f3_t1 BY x1_t1*-0.03036;
    f3_t1 BY x2_t1*0.23081;
    f3_t1 BY x3_t1*-0.03261;
    f3_t1 BY x4_t1@-0.01719; ! X4 = referent indicator for factor 1
    f3_t1 BY y1_t1*-0.01703;
    f3_t1 BY y2_t1*0.37838;
    f3_t1 BY y3_t1*-0.02798;
    f3_t1 BY y4_t1@-0.06451; ! Y4 = referent indicator for factor 2

    f2_t1 WITH f1_t1*0.42747;
    f3_t1 WITH f1_t1*0.48023;
    f3_t1 WITH f2_t1*0.42531;
```

```
[ x1_t1*-0.00132 ];
[ x2_t1*0.00686 ];
[ x3_t1*-0.00727 ];
[ x4_t1*0.00760 ];
[ y1_t1*0.01201 ];
[ y2_t1*0.00087 ];
[ y3_t1*0.00223 ];
[ y4_t1*0.01383 ];
[ z1_t1*-0.00626 ];
[ z2_t1*-0.51201 ];
[ z3_t1*-0.00490 ];
[ z4_t1*0.00357 ];

x1_t1*0.29610;
x2_t1*0.44562;
x3_t1*0.47886;
x4_t1*0.16661;
y1_t1*0.38512;
y2_t1*0.17655;
y3_t1*0.35856;
y4_t1*0.09297;
z1_t1*0.29889;
z2_t1*0.38738;
z3_t1*0.14137;
z4_t1*0.15932;
! Factor variances with a start value (*) of 1
f1_t1*1;
f2_t1*1;
f3_t1*1;
```

Data set #2 (Bifactor-ESEM Population Model):

Higher-Order EWC Solution

```
! We only report the ANALYSIS and MODEL section.
! Other sections are identical to the previous models.

ANALYSIS:
ESTIMATOR = MLR;
! this is no longer an ESEM solution, to there is no need for a rotation
! ROTATION = target;
    f1_t1 BY x1_t1*0.61771;
    f1_t1 BY x2_t1*0.68208;
    f1_t1 BY x3_t1*0.76084;
    f1_t1 BY x4_t1@0.93381; ! X4 = referent indicator for factor 1 (main loading fixed as well)
    f1_t1 BY y1_t1*0.12699;
    f1_t1 BY y2_t1*-0.11466;
    f1_t1 BY y3_t1*0.08664;
    f1_t1 BY y4_t1@0.08388; ! Y4 = referent indicator for factor 2
    f1_t1 BY z1_t1*0.19414;
    f1_t1 BY z2_t1*-0.02991;
    f1_t1 BY z3_t1@-0.03380; ! Z3 = referent indicator for factor 3
    f1_t1 BY z4_t1*0.07084;
    f2_t1 BY y1_t1*0.74537;
    f2_t1 BY y2_t1*0.74838;
    f2_t1 BY y3_t1*0.78135;
    f2_t1 BY y4_t1@0.94995; ! Y4 = referent indicator for factor 2 (main loading fixed as well)
    f2_t1 BY x1_t1*0.39087;
    f2_t1 BY x2_t1*-0.15491;
    f2_t1 BY x3_t1*-0.07163;
    f2_t1 BY x4_t1@-0.03220; ! X4 = referent indicator for factor 1
    f2_t1 BY z1_t1*-0.17238;
    f2_t1 BY z2_t1*0.08446;
    f2_t1 BY z3_t1@-0.02449; ! Z3 = referent indicator for factor 3
    f2_t1 BY z4_t1*0.33115;
    f3_t1 BY z1_t1*0.77790;
    f3_t1 BY z2_t1*0.75949;
    f3_t1 BY z3_t1@0.95000; ! Z3 = referent indicator for factor 3 (main loading fixed as well).
    f3_t1 BY z4_t1*0.68448;
    f3_t1 BY x1_t1*-0.03036;
    f3_t1 BY x2_t1*0.23081;
    f3_t1 BY x3_t1*-0.03261;
    f3_t1 BY x4_t1@-0.01719; ! X4 = referent indicator for factor 1
    f3_t1 BY y1_t1*-0.01703;
    f3_t1 BY y2_t1*0.37838;
    f3_t1 BY y3_t1*-0.02798;
    f3_t1 BY y4_t1@-0.06451; ! Y4 = referent indicator for factor 2

! The factors correlations should now be taken out (higher-order models are orthogonal)
!    f2_t1 WITH f1_t1*0.42747;
!    f3_t1 WITH f1_t1*0.48023;
!    f3_t1 WITH f2_t1*0.42531;
```

```
[ x1_t1*-0.00132 ];
[ x2_t1*0.00686 ];
[ x3_t1*-0.00727 ];
[ x4_t1*0.00760 ];
[ y1_t1*0.01201 ];
[ y2_t1*0.00087 ];
[ y3_t1*0.00223 ];
[ y4_t1*0.01383 ];
[ z1_t1*-0.00626 ];
[ z2_t1*-0.51201 ];
[ z3_t1*-0.00490 ];
[ z4_t1*0.00357 ];

x1_t1*0.29610;
x2_t1*0.44562;
x3_t1*0.47886;
x4_t1*0.16661;
y1_t1*0.38512;
y2_t1*0.17655;
y3_t1*0.35856;
y4_t1*0.09297;
z1_t1*0.29889;
z2_t1*0.38738;
z3_t1*0.14137;
z4_t1*0.15932;
! Factor variances with a start value (*) of 1
f1_t1*1;
f2_t1*1;
f3_t1*1;

! To request the Higher-Order Factor
HO BY f1_t1* f2_t1 f3_t1;
HO@1;
```

Data set #2 (Bifactor-ESEM Population Model):

EWC replication of the longitudinal Bifactor-ESEM solution (Latent Variance-Covariance Invariance)

```
! We only report the ANALYSIS and MODEL section.
! Other sections are identical to the previous models.

! For the next example, only the section appearing at the end of this example, in bold, will be used

ANALYSIS:
ESTIMATOR = MLR;
! this is no longer an ESEM solution, to there is no need for a rotation
!ROTATION = target (orthogonal);
MODEL:
! The equality labels (reflecting the invariance of the factor loadings) need to be added by hand
    sf1_t1 BY x1_t1*0.43415 (l1);
    sf1_t1 BY x2_t1*0.55516 (l2);
    sf1_t1 BY x3_t1*0.63023 (l3);
    sf1_t1 BY x4_t1*0.75028 (l4);
    sf1_t1 BY y1_t1*0.03799 (l5);
    sf1_t1 BY y2_t1@-0.18429 (l6); ! Y2 = referent indicator for factor GF
    sf1_t1 BY y3_t1@0.05209 (l7); ! Y3 = referent indicator for factor SF2
    sf1_t1 BY y4_t1*-0.02030 (l8);
    sf1_t1 BY z1_t1*0.24696 (l9);
    sf1_t1 BY z2_t1@-0.00783 (l10); ! Z2 = referent indicator for factor SF3
    sf1_t1 BY z3_t1*-0.02341 (l11);
    sf1_t1 BY z4_t1*0.04563 (l12);

    sf2_t1 BY y1_t1*0.39581 (l13);
    sf2_t1 BY y2_t1@0.24784 (l14); ! Y2 = referent indicator for factor GF
    sf2_t1 BY y3_t1*0.63279 (l15);
    sf2_t1 BY y4_t1*0.47220 (l16);
    sf2_t1 BY x1_t1*0.14772 (l17);
    sf2_t1 BY x2_t1*-0.09603 (l18);
    sf2_t1 BY x3_t1*0.01898 (l19);
    sf2_t1 BY x4_t1@-0.04005 (l20); ! X4 = referent indicator for factor SF1
    sf2_t1 BY z1_t1*-0.00318 (l21);
    sf2_t1 BY z2_t1@-0.02061 (l22); ! Z2 = referent indicator for factor SF3
    sf2_t1 BY z3_t1*-0.17894 (l23);
    sf2_t1 BY z4_t1*0.10018 (l24);

    sf3_t1 BY z1_t1*0.72880 (l25);
    sf3_t1 BY z2_t1*0.54712 (l26);
    sf3_t1 BY z3_t1*0.65799 (l27);
    sf3_t1 BY z4_t1*0.45617 (l28);
    sf3_t1 BY x1_t1*-0.06277 (l29);
    sf3_t1 BY x2_t1*0.23679 (l30);
    sf3_t1 BY x3_t1*0.06900 (l31);
    sf3_t1 BY x4_t1@0.04454 (l32); ! X4 = referent indicator for factor SF1
    sf3_t1 BY y1_t1*-0.08333 (l33);
    sf3_t1 BY y2_t1@0.10286 (l34); ! Y2 = referent indicator for factor GF
```

```
sf3_t1 BY y3_t1@0.00605 (l35); ! Y3 = referent indicator for factor SF2
sf3_t1 BY y4_t1*-0.17359 (l36);

gf_t1 BY x1_t1*0.69453 (l37);
gf_t1 BY x2_t1*0.42182 (l38);
gf_t1 BY x3_t1*0.34164 (l39);
gf_t1 BY x4_t1@0.51945 (l40); ! X4 = referent indicator for factor SF1
gf_t1 BY y1_t1*0.67644 (l41);
gf_t1 BY y2_t1*0.86416 (l42);
gf_t1 BY y3_t1@0.59324 (l43); ! Y3 = referent indicator for factor SF2
gf_t1 BY y4_t1*0.80135 (l44);
gf_t1 BY z1_t1*0.41546 (l45);
gf_t1 BY z2_t1@0.55672 (l46); ! Z2 = referent indicator for factor SF3
gf_t1 BY z3_t1*0.63039 (l47);
gf_t1 BY z4_t1*0.77688 (l48);

sf1_t2 BY x1_t2*0.43415 (l1);
sf1_t2 BY x2_t2*0.55516 (l2);
sf1_t2 BY x3_t2*0.63023 (l3);
sf1_t2 BY x4_t2*0.75028 (l4);
sf1_t2 BY y1_t2*0.03799 (l5);
sf1_t2 BY y2_t2@-0.18429 (l6); ! Y2 = referent indicator for factor GF
sf1_t2 BY y3_t2@0.05209 (l7); ! Y3 = referent indicator for factor SF2
sf1_t2 BY y4_t2*-0.02030 (l8);
sf1_t2 BY z1_t2*0.24696 (l9);
sf1_t2 BY z2_t2@-0.00783 (l10); ! Z2 = referent indicator for factor SF3
sf1_t2 BY z3_t2*-0.02341 (l11);
sf1_t2 BY z4_t2*0.04563 (l12);

sf2_t2 BY y1_t2*0.39581 (l13);
sf2_t2 BY y2_t2@0.24784 (l14); ! Y2 = referent indicator for factor GF
sf2_t2 BY y3_t2*0.63279 (l15);
sf2_t2 BY y4_t2*0.47220 (l16);
sf2_t2 BY x1_t2*0.14772 (l17);
sf2_t2 BY x2_t2*-0.09603 (l18);
sf2_t2 BY x3_t2*0.01898 (l19);
sf2_t2 BY x4_t2@-0.04005 (l20); ! X4 = referent indicator for factor SF1
sf2_t2 BY z1_t2*-0.00318 (l21);
sf2_t2 BY z2_t2@-0.02061 (l22); ! Z2 = referent indicator for factor SF3
sf2_t2 BY z3_t2*-0.17894 (l23);
sf2_t2 BY z4_t2*0.10018 (l24);

sf3_t2 BY z1_t2*0.72880 (l25);
sf3_t2 BY z2_t2*0.54712 (l26);
sf3_t2 BY z3_t2*0.65799 (l27);
sf3_t2 BY z4_t2*0.45617 (l28);
sf3_t2 BY x1_t2*-0.06277 (l29);
sf3_t2 BY x2_t2*0.23679 (l30);
sf3_t2 BY x3_t2*0.06900 (l31);
sf3_t2 BY x4_t2@0.04454 (l32); ! X4 = referent indicator for factor SF1
sf3_t2 BY y1_t2*-0.08333 (l33);
```

```
    sf3_t2 BY y2_t2@0.10286 (l34); ! Y2 = referent indicator for factor GF
    sf3_t2 BY y3_t2@0.00605 (l35); ! Y3 = referent indicator for factor SF2
    sf3_t2 BY y4_t2*-0.17359 (l36);

    gf_t2 BY x1_t2*0.69453 (l37);
    gf_t2 BY x2_t2*0.42182 (l38);
    gf_t2 BY x3_t2*0.34164 (l39);
    gf_t2 BY x4_t2@0.51945 (l40); ! X4 = referent indicator for factor SF1
    gf_t2 BY y1_t2*0.67644 (l41);
    gf_t2 BY y2_t2*0.86416 (l42);
    gf_t2 BY y3_t2@0.59324 (l43); ! Y3 = referent indicator for factor SF2
    gf_t2 BY y4_t2*0.80135 (l44);
    gf_t2 BY z1_t2*0.41546 (l45);
    gf_t2 BY z2_t2@0.55672 (l46); ! Z2 = referent indicator for factor SF3
    gf_t2 BY z3_t2*0.63039 (l47);
    gf_t2 BY z4_t2*0.77688 (l48);

! Partially Invariant Intercepts
    [ x1_t1*0.00523 ] (i1);
    [ x2_t1*0.00192 ] (i2);
    [ x3_t1*-0.00734 ] (i3);
    [ x4_t1*0.00761 ] (i4);
    [ y1_t1*0.00637 ] (i5);
    [ y2_t1*0.00250 ] (i6);
    [ y3_t1*0.00528 ] (i7);
    [ y4_t1*0.01347 ] (i8);
    [ z1_t1*-0.00780 ] (i9);
    [ z2_t1*-0.51201 ];  ! Remember that we had partial strong invariance
    [ z3_t1*-0.00362 ] (i11);
    [ z4_t1*0.00330 ] (i12);
    [ x1_t2*0.00523 ] (i1);
    [ x2_t2*0.00192 ] (i2);
    [ x3_t2*-0.00734 ] (i3);
    [ x4_t2*0.00761 ] (i4);
    [ y1_t2*0.00637 ] (i5);
    [ y2_t2*0.00250 ] (i6);
    [ y3_t2*0.00528 ] (i7);
    [ y4_t2*0.01347 ] (i8);
    [ z1_t2*-0.00780 ] (i9);
    [ z2_t2*0.49617 ]; ! Remember that we had partial strong invariance
    [ z3_t2*-0.00362 ] (i11);
    [ z4_t2*0.00330 ] (i12);

! Invariant Uniquenesses
    x1_t1*0.29476 (u1);
    x2_t1*0.44777 (u2);
    x3_t1*0.48389 (u3);
    x4_t1*0.15655 (u4);
    y1_t1*0.38318 (u5);
    y2_t1*0.15761 (u6);
    y3_t1*0.24748 (u7);
```

```
    y4_t1*0.10903 (u8);
    z1_t1*0.22174 (u9);
    z2_t1*0.38567 (u10);
    z3_t1*0.12885 (u11);
    z4_t1*0.16200 (u12);
    x1_t2*0.29476 (u1);
    x2_t2*0.44777 (u2);
    x3_t2*0.48389 (u3);
    x4_t2*0.15655 (u4);
    y1_t2*0.38318 (u5);
    y2_t2*0.15761 (u6);
    y3_t2*0.24748 (u7);
    y4_t2*0.10903 (u8);
    z1_t2*0.22174 (u9);
    z2_t2*0.38567 (u10);
    z3_t2*0.12885 (u11);
    z4_t2*0.16200 (u12);

! Time-specific orthogonal specifications
    gf_t1 WITH sf1_t1@0;
    gf_t1 WITH sf2_t1@0;
    gf_t1 WITH sf3_t1@0;
    sf1_t1 WITH sf2_t1@0;
    sf1_t1 WITH sf3_t1@0;
    sf2_t1 WITH sf3_t1@0;

    gf_t2 WITH sf1_t2@0;
    gf_t2 WITH sf2_t2@0;
    gf_t2 WITH sf3_t2@0;
    sf1_t2 WITH sf2_t2@0;
    sf1_t2 WITH sf3_t2@0;
    sf2_t2 WITH sf3_t2@0;

! Longitudinal correlated uniquenesses
    x1_t1 WITH x1_t2*0.00283;
    x2_t1 WITH x2_t2*0.05172;
    x3_t1 WITH x3_t2*0.10839;
    x4_t1 WITH x4_t2*0.15416;
    y1_t1 WITH y1_t2*0.05591;
    y2_t1 WITH y2_t2*-0.00092;
    y3_t1 WITH y3_t2*0.15246;
    y4_t1 WITH y4_t2*0.09935;
    z1_t1 WITH z1_t2*0.14764;
    z2_t1 WITH z2_t2*0.10107;
    z3_t1 WITH z3_t2*0.05233;
    z4_t1 WITH z4_t2*-0.00283;

! Longitudinal factor Correlations
    gf_t2 WITH sf1_t1*-0.01063;
    gf_t2 WITH sf2_t1*-0.01146;
    gf_t2 WITH sf3_t1*0.01257;
```

```
    gf_t2 WITH gf_t1*-0.00253;
    sf1_t2 WITH sf1_t1*-0.00671;
    sf1_t2 WITH sf2_t1*-0.00158;
    sf1_t2 WITH sf3_t1*0.00035;
    sf1_t2 WITH gf_t1*-0.00383;
    sf2_t2 WITH sf1_t1*0.01672;
    sf2_t2 WITH sf2_t1*0.01473;
    sf2_t2 WITH sf3_t1*0.00284;
    sf2_t2 WITH gf_t1*-0.00143;
    sf3_t2 WITH sf1_t1*-0.00142;
    sf3_t2 WITH sf2_t1*-0.00562;
    sf3_t2 WITH sf3_t1*-0.02841;
    sf3_t2 WITH gf_t1*-0.00135;

! Invariant Variances
    sf1_t1@1;
    sf2_t1@1;
    sf3_t1@1;
    gf_t1@1;
    sf1_t2@1;
    sf2_t2@1;
    sf3_t2@1;
    gf_t2@1;

! Non-invariant factor means
    [ sf1_t1@0 ];
    [ sf2_t1@0 ];
    [ sf3_t1@0 ];
    [ gf_t1@0 ];

    [ sf1_t2*0.07872 ];
    [ sf2_t2*-0.12475 ];
    [ sf3_t2*0.06134 ];
    [ gf_t2*0.76446 ];
```

Data set #2 (Bifactor-ESEM Population Model):

EWC replication of the longitudinal Bifactor-ESEM solution: Partial Latent Means Invariance

```
! We only report the last section from the previous example to highlight the change.
! Partially invariant factor means
  [ sf1_t1@0 ];
  [ sf2_t1@0 ];
  [ sf3_t1@0 ];
  [ gf_t1@0 ];

  [ sf1_t2@0 ];
  [ sf2_t2@0];
  [ sf3_t2@0];
  [ gf_t2*];
```

Data set #2 (Bifactor-ESEM Population Model):

EWC replication of the longitudinal Bifactor-ESEM solution: Latent Change

! We only report the MODEL section.
! Other sections are identical to the previous models.

! Changes are highlighted in bold

```
MODEL:
    sf1_t1 BY x1_t1*0.43415 (l1);
    sf1_t1 BY x2_t1*0.55516 (l2);
    sf1_t1 BY x3_t1*0.63023 (l3);
    sf1_t1 BY x4_t1*0.75028 (l4);
    sf1_t1 BY y1_t1*0.03799 (l5);
    sf1_t1 BY y2_t1@-0.18429 (l6); ! Y2 = referent indicator for factor GF
    sf1_t1 BY y3_t1@0.05209 (l7); ! Y3 = referent indicator for factor SF2
    sf1_t1 BY y4_t1*-0.02030 (l8);
    sf1_t1 BY z1_t1*0.24696 (l9);
    sf1_t1 BY z2_t1@-0.00783 (l10); ! Z2 = referent indicator for factor SF3
    sf1_t1 BY z3_t1*-0.02341 (l11);
    sf1_t1 BY z4_t1*0.04563 (l12);
    sf2_t1 BY y1_t1*0.39581 (l13);
    sf2_t1 BY y2_t1@0.24784 (l14); ! Y2 = referent indicator for factor GF
    sf2_t1 BY y3_t1*0.63279 (l15);
    sf2_t1 BY y4_t1*0.47220 (l16);
    sf2_t1 BY x1_t1*0.14772 (l17);
    sf2_t1 BY x2_t1*-0.09603 (l18);
    sf2_t1 BY x3_t1*0.01898 (l19);
    sf2_t1 BY x4_t1@-0.04005 (l20); ! X4 = referent indicator for factor SF1
    sf2_t1 BY z1_t1*-0.00318 (l21);
    sf2_t1 BY z2_t1@-0.02061 (l22); ! Z2 = referent indicator for factor SF3
    sf2_t1 BY z3_t1*-0.17894 (l23);
    sf2_t1 BY z4_t1*0.10018 (l24);
    sf3_t1 BY z1_t1*0.72880 (l25);
    sf3_t1 BY z2_t1*0.54712 (l26);
    sf3_t1 BY z3_t1*0.65799 (l27);
    sf3_t1 BY z4_t1*0.45617 (l28);
    sf3_t1 BY x1_t1*-0.06277 (l29);
    sf3_t1 BY x2_t1*0.23679 (l30);
    sf3_t1 BY x3_t1*0.06900 (l31);
    sf3_t1 BY x4_t1@0.04454 (l32); ! X4 = referent indicator for factor SF1
    sf3_t1 BY y1_t1*-0.08333 (l33);
    sf3_t1 BY y2_t1@0.10286 (l34); ! Y2 = referent indicator for factor GF
    sf3_t1 BY y3_t1@0.00605 (l35); ! Y3 = referent indicator for factor SF2
    sf3_t1 BY y4_t1*-0.17359 (l36);
    gf_t1 BY x1_t1*0.69453 (l37);
    gf_t1 BY x2_t1*0.42182 (l38);
    gf_t1 BY x3_t1*0.34164 (l39);
    gf_t1 BY x4_t1@0.51945 (l40); ! X4 = referent indicator for factor SF1
    gf_t1 BY y1_t1*0.67644 (l41);
```

```
! The loading of the referent indicator of the G-factor is fixed to its value on the G-factor (as for
! higher-order models, to be able to freely estimate its variance.
    gf_t1 BY y2_t1@0.86416 (l42); ! Y2 = referent indicator for factor GF
    gf_t1 BY y3_t1@0.59324 (l43); ! Y3 = referent indicator for factor SF2
    gf_t1 BY y4_t1*0.80135 (l44);
    gf_t1 BY z1_t1*0.41546 (l45);
    gf_t1 BY z2_t1@0.55672 (l46); ! Z2 = referent indicator for factor SF3
    gf_t1 BY z3_t1*0.63039 (l47);
    gf_t1 BY z4_t1*0.77688 (l48);

    sf1_t2 BY x1_t2*0.43415 (l1);
    sf1_t2 BY x2_t2*0.55516 (l2);
    sf1_t2 BY x3_t2*0.63023 (l3);
    sf1_t2 BY x4_t2*0.75028 (l4);
    sf1_t2 BY y1_t2*0.03799 (l5);
    sf1_t2 BY y2_t2@-0.18429 (l6); ! Y2 = referent indicator for factor GF
    sf1_t2 BY y3_t2@0.05209 (l7); ! Y3 = referent indicator for factor SF2
    sf1_t2 BY y4_t2*-0.02030 (l8);
    sf1_t2 BY z1_t2*0.24696 (l9);
    sf1_t2 BY z2_t2@-0.00783 (l10); ! Z2 = referent indicator for factor SF3
    sf1_t2 BY z3_t2*-0.02341 (l11);
    sf1_t2 BY z4_t2*0.04563 (l12);

    sf2_t2 BY y1_t2*0.39581 (l13);
    sf2_t2 BY y2_t2@0.24784 (l14); ! Y2 = referent indicator for factor GF
    sf2_t2 BY y3_t2*0.63279 (l15);
    sf2_t2 BY y4_t2*0.47220 (l16);
    sf2_t2 BY x1_t2*0.14772 (l17);
    sf2_t2 BY x2_t2*-0.09603 (l18);
    sf2_t2 BY x3_t2*0.01898 (l19);
    sf2_t2 BY x4_t2@-0.04005 (l20); ! X4 = referent indicator for factor SF1
    sf2_t2 BY z1_t2*-0.00318 (l21);
    sf2_t2 BY z2_t2@-0.02061 (l22); ! Z2 = referent indicator for factor SF3
    sf2_t2 BY z3_t2*-0.17894 (l23);
    sf2_t2 BY z4_t2*0.10018 (l24);

    sf3_t2 BY z1_t2*0.72880 (l25);
    sf3_t2 BY z2_t2*0.54712 (l26);
    sf3_t2 BY z3_t2*0.65799 (l27);
    sf3_t2 BY z4_t2*0.45617 (l28);
    sf3_t2 BY x1_t2*-0.06277 (l29);
    sf3_t2 BY x2_t2*0.23679 (l30);
    sf3_t2 BY x3_t2*0.06900 (l31);
    sf3_t2 BY x4_t2@0.04454 (l32); ! X4 = referent indicator for factor SF1
    sf3_t2 BY y1_t2*-0.08333 (l33);
    sf3_t2 BY y2_t2@0.10286 (l34); ! Y2 = referent indicator for factor GF
    sf3_t2 BY y3_t2@0.00605 (l35); ! Y3 = referent indicator for factor SF2
    sf3_t2 BY y4_t2*-0.17359 (l36);
```

```
    gf_t2 BY x1_t2*0.69453 (l37);
    gf_t2 BY x2_t2*0.42182 (l38);
    gf_t2 BY x3_t2*0.34164 (l39);
    gf_t2 BY x4_t2@0.51945 (l40); ! X4 = referent indicator for factor SF1
    gf_t2 BY y1_t2*0.67644 (l41);
! The loading of the referent indicator of the G-factor is fixed to its value on the G-factor (as for
! higher-order models, to be able to freely estimate its variance.
    gf_t2 BY y2_t2@0.86416 (l42); ! Y2 = referent indicator for factor GF
    gf_t2 BY y3_t2@0.59324 (l43); ! Y3 = referent indicator for factor SF2
    gf_t2 BY y4_t2*0.80135 (l44);
    gf_t2 BY z1_t2*0.41546 (l45);
    gf_t2 BY z2_t2@0.55672 (l46); ! Z2 = referent indicator for factor SF3
    gf_t2 BY z3_t2*0.63039 (l47);
    gf_t2 BY z4_t2*0.77688 (l48);
! Partially Invariant Intercepts
    [ x1_t1*0.00523 ] (i1);
    [ x2_t1*0.00192 ] (i2);
    [ x3_t1*-0.00734 ] (i3);
    [ x4_t1*0.00761 ] (i4);
    [ y1_t1*0.00637 ] (i5);
    [ y2_t1*0.00250 ] (i6);
    [ y3_t1*0.00528 ] (i7);
    [ y4_t1*0.01347 ] (i8);
    [ z1_t1*-0.00780 ] (i9);
    [ z2_t1*-0.51201 ];  ! Remember that we had partial strong invariance
    [ z3_t1*-0.00362 ] (i11);
    [ z4_t1*0.00330 ] (i12);
    [ x1_t2*0.00523 ] (i1);
    [ x2_t2*0.00192 ] (i2);
    [ x3_t2*-0.00734 ] (i3);
    [ x4_t2*0.00761 ] (i4);
    [ y1_t2*0.00637 ] (i5);
    [ y2_t2*0.00250 ] (i6);
    [ y3_t2*0.00528 ] (i7);
    [ y4_t2*0.01347 ] (i8);
    [ z1_t2*-0.00780 ] (i9);
    [ z2_t2*0.49617 ]; ! Remember that we had partial strong invariance
    [ z3_t2*-0.00362 ] (i11);
    [ z4_t2*0.00330 ] (i12);
! Invariant Uniquenesses
    x1_t1*0.29476 (u1);
    x2_t1*0.44777 (u2);
    x3_t1*0.48389 (u3);
    x4_t1*0.15655 (u4);
    y1_t1*0.38318 (u5);
    y2_t1*0.15761 (u6);
    y3_t1*0.24748 (u7);
    y4_t1*0.10903 (u8);
    z1_t1*0.22174 (u9);
    z2_t1*0.38567 (u10);
    z3_t1*0.12885 (u11);
```

```
    z4_t1*0.16200 (u12);
    x1_t2*0.29476 (u1);
    x2_t2*0.44777 (u2);
    x3_t2*0.48389 (u3);
    x4_t2*0.15655 (u4);
    y1_t2*0.38318 (u5);
    y2_t2*0.15761 (u6);
    y3_t2*0.24748 (u7);
    y4_t2*0.10903 (u8);
    z1_t2*0.22174 (u9);
    z2_t2*0.38567 (u10);
    z3_t2*0.12885 (u11);
    z4_t2*0.16200 (u12);
! Time-specific orthogonal specifications
    gf_t1 WITH sf1_t1@0;
    gf_t1 WITH sf2_t1@0;
    gf_t1 WITH sf3_t1@0;
    sf1_t1 WITH sf2_t1@0;
    sf1_t1 WITH sf3_t1@0;
    sf2_t1 WITH sf3_t1@0;
    gf_t2 WITH sf1_t2@0;
    gf_t2 WITH sf2_t2@0;
    gf_t2 WITH sf3_t2@0;
    sf1_t2 WITH sf2_t2@0;
    sf1_t2 WITH sf3_t2@0;
    sf2_t2 WITH sf3_t2@0;
! Longitudinal correlated uniquenesses
    x1_t1 WITH x1_t2*0.00283;
    x2_t1 WITH x2_t2*0.05172;
    x3_t1 WITH x3_t2*0.10839;
    x4_t1 WITH x4_t2*0.15416;
    y1_t1 WITH y1_t2*0.05591;
    y2_t1 WITH y2_t2*-0.00092;
    y3_t1 WITH y3_t2*0.15246;
    y4_t1 WITH y4_t2*0.09935;
    z1_t1 WITH z1_t2*0.14764;
    z2_t1 WITH z2_t2*0.10107;
    z3_t1 WITH z3_t2*0.05233;
    z4_t1 WITH z4_t2*-0.00283;
! Longitudinal factor Correlations
! In this section, the longitudinal correlation between the G-factor at T1 and T2 needs to be removed.
! Because the G-factor at T2 becomes an "empty" variable, it should not be correlated with
! the T1 variables.
    gf_t2 WITH sf1_t1@0;
    gf_t2 WITH sf2_t1@0;
    gf_t2 WITH sf3_t1@0;
!     gf_t2 WITH gf_t1*-0.00253;
    sf1_t2 WITH sf1_t1*-0.00671;
    sf1_t2 WITH sf2_t1*-0.00158;
    sf1_t2 WITH sf3_t1*0.00035;
    sf1_t2 WITH gf_t1*-0.00383;
```

```
    sf2_t2 WITH sf1_t1*0.01672;
    sf2_t2 WITH sf2_t1*0.01473;
    sf2_t2 WITH sf3_t1*0.00284;
    sf2_t2 WITH gf_t1*-0.00143;
    sf3_t2 WITH sf1_t1*-0.00142;
    sf3_t2 WITH sf2_t1*-0.00562;
    sf3_t2 WITH sf3_t1*-0.02841;
    sf3_t2 WITH gf_t1*-0.00135;
! Invariant Variances of the S-factors
    sf1_t1@1;
    sf2_t1@1;
    sf3_t1@1;
    sf1_t2@1;
    sf2_t2@1;
    sf3_t2@1;
! Invariant means of the S-factors
    [ sf1_t1@0 ];
    [ sf2_t1@0 ];
    [ sf3_t1@0 ];
    [ sf1_t2@0 ];
    [ sf2_t2@0];
    [ sf3_t2@0];
! Latent Change Specification
! No modification for the mean and variance at T1
    gf_t1@1;
    [ gf_t1@0 ];
! The change factor is defined by regressing the T2 value on the T1 value and fixing that regression
! @1, and defining a change factor by the T2 value, with a factor loading fixed @1.
! This forces all change occurring over time to be absorbed in the change factor.
gf_t2 ON gf_t1@1;
Change BY gf_t2@1;
! The change factor can be correlated with T1 value.
Change WITH gf_t1;
! The mean and variance at T2 are fixed to 0, allowing us to estimate the mean and variance of the
! change factor. However, because we started from a model in which the variances were invariant (all
! @1), the variance the change factor should also be fixed to 1 (@1), thus creating the same types of
! problems noted by Morin and Asparouhov (2018) for higher order models. To solve this issue, we
! went back to the beginning of the input and constrained the main loading of the referent indicator of
! the G-factor to be fixed to its value on the G-factor itself, thus allowing us to freely estimate the
! variance of the change factor.
gf_t2@0;
[ gf_t2@0];
Change*1;
[Change*];
! Given that the change factor is now different than the G-factor at T2, it can be allowed to correlate
with the T2 S-factors. Alternatively, it can remain orthogonal by adding:
Change WITH SF1_t1@0 SF2_t1@0 SF3_t1@0;
```

Syntax for the Simulated Data Sets Used in the Chapter: Data 1

```
Title: Data generation input #1
montecarlo:
        names =  x1-x4 y1-y4 z1-z4;
        ngroups = 2;
        nobs = 5000 5000;
        nreps = 1;
        save = Data1.dat;
model population:
!Main loadings
F1 BY x1@.50;
F1 BY x2@.60;
F1 BY x3@.70;
F1 BY x4@.90;
F2 BY y1@.60;
F2 BY y2@.70;
F2 BY y3@.80;
F2 BY y4@.90;
F3 BY z1@.50;
F3 BY z2@.60;
F3 BY z3@.70;
F3 BY z4@.80;
!Cross loadings
F1 BY y1@.05;
F1 BY y2@-.20;
F1 BY y3@.10;
F1 BY y4@0;
F1 BY z1@.20;
F1 BY z2@-.05;
F1 BY z3@-.10;
F1 BY z4@0;
F2 BY x1@.20;
F2 BY x2@-.10;
F2 BY x3@0;
F2 BY x4@-.05;
F2 BY z1@0;
F2 BY z2@.05;
F2 BY z3@-.10;
F2 BY z4@.20;
F3 BY x1@-.10;
F3 BY x2@.20;
F3 BY x3@.05;
F3 BY x4@0;
F3 BY y1@-.10;
F3 BY y2@.05;
F3 BY y3@0;
F3 BY y4@-.20;
!Intercepts
[x1@0];
[x2@0];
```

```
[x3@0];
[x4@0];
[y1@0];
[y2@0];
[y3@0];
[y4@0];
[z1@0];
[z2@-.5];
[z3@0];
[z4@0];
!Uniquenesses
x1@.7;
x2@.59;
x3@.5075;
x4@.1875;
y1@.6275;
y2@.4675;
y3@.35;
y4@.15;
z1@.71;
z2@.635;
z3@.49;
z4@.32;
!Latent means
[f1@0];
[f2@0];
[f3@0];
!Latent variances
f1@1;
f2@1;
f3@1;
!Latent covariances
f1 WITH f2@.30;
f1 WITH f3@.20;
f2 WITH f3@.35;
! Non invariant parameters in group 2
model population-g2:
! Item intercept non invariant across group
[z2@.5];
```

Syntax for the Simulated Data Sets Used in the Chapter: Data 2

```
Title: Data generation input #2
montecarlo:
        names =  x1_t1 x2_t1 x3_t1 x4_t1 y1_t1 y2_t1 y3_t1 y4_t1
   z1_t1 z2_t1 z3_t1 z4_t1
   x1_t2 x2_t2 x3_t2 x4_t2 y1_t2 y2_t2 y3_t2 y4_t2
   z1_t2 z2_t2 z3_t2 z4_t2;
        nobs = 10000;
        nreps = 1;
        save = Data2.dat;
model population:
!!! TIME 1
!Main loadings
F1_t1 BY x1_t1@.40;
F1_t1 BY x2_t1@.50;
F1_t1 BY x3_t1@.60;
F1_t1 BY x4_t1@.70;
F2_t1 BY y1_t1@.50;
F2_t1 BY y2_t1@.40;
F2_t1 BY y3_t1@.70;
F2_t1 BY y4_t1@.60;
F3_t1 BY z1_t1@.70;
F3_t1 BY z2_t1@.50;
F3_t1 BY z3_t1@.60;
F3_t1 BY z4_t1@.40;
FG_t1 BY x1_t1@.70;
FG_t1 BY x2_t1@.50;
FG_t1 BY x3_t1@.40;
FG_t1 BY x4_t1@.60;
FG_t1 BY y1_t1@.60;
FG_t1 BY y2_t1@.80;
FG_t1 BY y3_t1@.50;
FG_t1 BY y4_t1@.70;
FG_t1 BY z1_t1@.50;
FG_t1 BY z2_t1@.60;
FG_t1 BY z3_t1@.70;
FG_t1 BY z4_t1@.80;
!Cross loadings
F1_t1 BY y1_t1@.05;
F1_t1 BY y2_t1@-.20;
F1_t1 BY y3_t1@.10;
F1_t1 BY y4_t1@0;
F1_t1 BY z1_t1@.20;
F1_t1 BY z2_t1@-.05;
F1_t1 BY z3_t1@-.10;
F1_t1 BY z4_t1@0;
F2_t1 BY x1_t1@.20;
F2_t1 BY x2_t1@-.10;
F2_t1 BY x3_t1@0;
F2_t1 BY x4_t1@-.05;
F2_t1 BY z1_t1@0;
```

```
F2_t1 BY z2_t1@.05;
F2_t1 BY z3_t1@-.10;
F2_t1 BY z4_t1@.20;
F3_t1 BY x1_t1@-.10;
F3_t1 BY x2_t1@.20;
F3_t1 BY x3_t1@.05;
F3_t1 BY x4_t1@0;
F3_t1 BY y1_t1@-.10;
F3_t1 BY y2_t1@.05;
F3_t1 BY y3_t1@0;
F3_t1 BY y4_t1@-.20;
!Intercepts
[x1_t1@0];
[x2_t1@0];
[x3_t1@0];
[x4_t1@0];
[y1_t1@0];
[y2_t1@0];
[y3_t1@0];
[y4_t1@0];
[z1_t1@0];
[z2_t1@-.5];
[z3_t1@0];
[z4_t1@0];
!Uniquenesses
x1_t1@.3;
x2_t1@.45;
x3_t1@.4775;
x4_t1@.1475;
y1_t1@.3775;
y2_t1@.1575;
y3_t1@.25;
y4_t1@.11;
z1_t1@.22;
z2_t1@.385;
z3_t1@.13;
z4_t1@.16;
!Latent means
[f1_t1@0];
[f2_t1@0];
[f3_t1@0];
[fg_t1@0];
!Latent variances
f1_t1@1;
f2_t1@1;
f3_t1@1;
fg_t1@1;
!Latent covariances
f1_t1 WITH f2_t1@0;
f1_t1 WITH f3_t1@0;
f2_t1 WITH f3_t1@0;
```

```
fg_t1 WITH f1_t1@0;
fg_t1 WITH f2_t1@0;
fg_t1 WITH f3_t1@0;
!!! TIME 2
!Main loadings
F1_t2 BY x1_t2@.40;
F1_t2 BY x2_t2@.50;
F1_t2 BY x3_t2@.60;
F1_t2 BY x4_t2@.70;
F2_t2 BY y1_t2@.50;
F2_t2 BY y2_t2@.40;
F2_t2 BY y3_t2@.70;
F2_t2 BY y4_t2@.60;
F3_t2 BY z1_t2@.70;
F3_t2 BY z2_t2@.50;
F3_t2 BY z3_t2@.60;
F3_t2 BY z4_t2@.40;
FG_t2 BY x1_t2@.70;
FG_t2 BY x2_t2@.50;
FG_t2 BY x3_t2@.40;
FG_t2 BY x4_t2@.60;
FG_t2 BY y1_t2@.60;
FG_t2 BY y2_t2@.80;
FG_t2 BY y3_t2@.50;
FG_t2 BY y4_t2@.70;
FG_t2 BY z1_t2@.50;
FG_t2 BY z2_t2@.60;
FG_t2 BY z3_t2@.70;
FG_t2 BY z4_t2@.80;
!Cross loadings
F1_t2 BY y1_t2@.05;
F1_t2 BY y2_t2@-.20;
F1_t2 BY y3_t2@.10;
F1_t2 BY y4_t2@0;
F1_t2 BY z1_t2@.20;
F1_t2 BY z2_t2@-.05;
F1_t2 BY z3_t2@-.10;
F1_t2 BY z4_t2@0;
F2_t2 BY x1_t2@.20;
F2_t2 BY x2_t2@-.10;
F2_t2 BY x3_t2@0;
F2_t2 BY x4_t2@-.05;
F2_t2 BY z1_t2@0;
F2_t2 BY z2_t2@.05;
F2_t2 BY z3_t2@-.10;
F2_t2 BY z4_t2@.20;
F3_t2 BY x1_t2@-.10;
F3_t2 BY x2_t2@.20;
F3_t2 BY x3_t2@.05;
F3_t2 BY x4_t2@0;
F3_t2 BY y1_t2@-.10;
```

```
F3_t2 BY y2_t2@.05;
F3_t2 BY y3_t2@0;
F3_t2 BY y4_t2@-.20;
!Intercepts
[x1_t2@0];
[x2_t2@0];
[x3_t2@0];
[x4_t2@0];
[y1_t2@0];
[y2_t2@0];
[y3_t2@0];
[y4_t2@0];
[z1_t2@0];
[z2_t2@.5];
[z3_t2@0];
[z4_t2@0];
!Uniquenesses
x1_t2@.3;
x2_t2@.45;
x3_t2@.4775;
x4_t2@.1475;
y1_t2@.3775;
y2_t2@.1575;
y3_t2@.25;
y4_t2@.11;
z1_t2@.22;
z2_t2@.385;
z3_t2@.13;
z4_t2@.16;
!Latent means
[f1_t2@0];
[f2_t2@0];
[f3_t2@0];
[fg_t2@.8];
!Latent variances
f1_t2@1;
f2_t2@1;
f3_t2@1;
fg_t2@1;
!Latent covariances
f1_t2 WITH f2_t2@0;
f1_t2 WITH f3_t2@0;
f2_t2 WITH f3_t2@0;
fg_t2 WITH f1_t2@0;
fg_t2 WITH f2_t2@0;
fg_t2 WITH f3_t2@0;
!!! Longitudinal correlated uniquenesses
 x1_t1 WITH x1_t2@0;
 x2_t1 WITH x2_t2@.050;
 x3_t1 WITH x3_t2@.100;
 x4_t1 WITH x4_t2@.150;
```

```
y1_t1 WITH y1_t2@.050;
y2_t1 WITH y2_t2@0;
y3_t1 WITH y3_t2@.150;
y4_t1 WITH y4_t2@.100;
z1_t1 WITH z1_t2@.150;
z2_t1 WITH z2_t2@.100;
z3_t1 WITH z3_t2@.050;
z4_t1 WITH z4_t2@0;
```