

Longitudinal Invariance Example in Mplus (N = 151; 6 variables over 3 occasions)

These data measuring a latent trait of social functioning were collected at a Psychiatric Rehabilitation center, in which time 1 was admittance, and times 2 and 3 were collected at six-month intervals. There were 6 subscales that were completed by the hospital staff for each patient, including positively-oriented measures of Social Competence, Social Interest, and Personal Neatness, and negatively-oriented measures of Psychoticism, Motor Retardation, and Irritability. The negatively-oriented subscales were reflect (*-1) prior to analysis. Initial models examined the fit of one-factor versus two-factor models given the two valences of the subscales, but the fit of the two-factor model was not a significant improvement, and thus a one-factor model was used here.

Mplus Code to Read in Data:

```

TITLE:      Longitudinal Invariance
DATA:      FILE IS CAF.dat;                ! Don't need path if in same folder
              FORMAT IS free;                ! Default
              TYPE IS INDIVIDUAL;           ! Default

VARIABLE:  NAMES ARE REID                ! Every variable in data set
              VAR1T1 VAR1T2 VAR1T3
              VAR2T1 VAR2T2 VAR2T3
              VAR3T1 VAR3T2 VAR3T3
              VAR4T1 VAR4T2 VAR4T3
              VAR5T1 VAR5T2 VAR5T3
              VAR6T1 VAR6T2 VAR6T3;
              USEVARIABLES ARE              ! Every variable in MODEL
              VAR1T1 VAR1T2 VAR1T3
              VAR2T1 VAR2T2 VAR2T3
              VAR3T1 VAR3T2 VAR3T3
              VAR4T1 VAR4T2 VAR4T3
              VAR5T1 VAR5T2 VAR5T3
              VAR6T1 VAR6T2 VAR6T3;
              MISSING ARE ALL (9999);       ! Make sure to specify all missing values

ANALYSIS:  TYPE IS GENERAL;               ! Default
              ESTIMATOR IS ML;              ! Default if TYPE=GENERAL and all continuous items

OUTPUT:    SAMPSTAT                       ! Sample descriptives to verify data
              MODINDICES (6)                ! Voodoo to improve model (list if  $\chi^2 > 6$  for  $p < .01$ )
              STDYX                          ! Requests fully standardized solution
              RESIDUAL;                       ! Requests standardized and normalized residuals

MODEL:    (model syntax goes here, to be changed for each model)

```

Model 1. Configural Longitudinal Invariance Model (Everything separate across groups)

MODEL:	
! Model 1: Configural Longitudinal Invariance	Chi-Square Test of Model Fit
! Factor Loadings - second set to 1 for identification	
FACTOR1 BY VAR1T1*	Value
VAR2T1@1	Degrees of Freedom
VAR3T1*	P-Value
VAR4T1*	
VAR5T1*	
VAR6T1*;	Chi-Square Test of Model Fit for the Baseline Model
FACTOR2 BY VAR1T2*	Value
VAR2T2@1	Degrees of Freedom
VAR3T2*	P-Value
VAR4T2*	
VAR5T2*	
VAR6T2*;	CFI/TLI
FACTOR3 BY VAR1T3*	CFI
VAR2T3@1	TLI
VAR3T3*	
VAR4T3*	
VAR5T3*	
VAR6T3*;	Loglikelihood
! Intercepts - second set to 0 for identification	H0 Value
[VAR1T1* VAR1T2* VAR1T3*];	H1 Value
[VAR2T1@0 VAR2T2@0 VAR2T3@0];	
[VAR3T1* VAR3T2* VAR3T3*];	Information Criteria
[VAR4T1* VAR4T2* VAR4T3*];	Number of Free Parameters
[VAR5T1* VAR5T2* VAR5T3*];	Akaike (AIC)
[VAR6T1* VAR6T2* VAR6T3*];	Bayesian (BIC)
! Residual variances - all free now	Sample-Size Adjusted BIC
VAR1T1* VAR1T2* VAR1T3*;	(n* = (n + 2) / 24)
VAR2T1* VAR2T2* VAR2T3*;	RMSEA (Root Mean Square Error Of Approximation)
VAR3T1* VAR3T2* VAR3T3*;	Estimate
VAR4T1* VAR4T2* VAR4T3*;	90 Percent C.I.
VAR5T1* VAR5T2* VAR5T3*;	Probability RMSEA <= .05
VAR6T1* VAR6T2* VAR6T3*;	
! Factor variances and covariances (all free now)	SRMR (Standardized Root Mean Square Residual)
FACTOR1* FACTOR2* FACTOR3*;	Value
FACTOR1 WITH FACTOR2*;	
FACTOR1 WITH FACTOR3*;	
FACTOR2 WITH FACTOR3*;	
! Factor means (all free now)	
[FACTOR1* FACTOR2* FACTOR3*];	
! Residual covariances for same indicator across time	
VAR1T1 WITH VAR1T2* VAR1T3*;	
VAR2T1 WITH VAR2T2* VAR2T3*;	
VAR3T1 WITH VAR3T2* VAR3T3*;	
VAR4T1 WITH VAR4T2* VAR4T3*;	
VAR5T1 WITH VAR5T2* VAR5T3*;	
VAR6T1 WITH VAR6T2* VAR6T3*;	

Although the fit is not great, attempts to improve it logically were unsuccessful, so we proceed from here as the configural model...

UNSTANDARDIZED MODEL RESULTS - NOTE ALL PARAMETERS (EXCEPT MARKER LOADINGS AND MARKER INTERCEPTS) DIFFER ACROSS TIME

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value		Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
FACTOR LOADINGS PER OCCASION					Means - FACTOR MEANS ARE APPROXIMATELY MEANS OF VAR2 OVER TIME				
FACTOR1 BY					FACTOR1	8.672	0.297	29.163	0.000
VAR1T1	1.682	0.222	7.577	0.000	FACTOR2	9.981	0.267	37.414	0.000
VAR2T1	1.000	0.000	999.000	999.000	FACTOR3	10.442	0.279	37.399	0.000
VAR3T1	1.086	0.153	7.096	0.000	Intercepts - ARE EXPECTED OUTCOME WHEN FACTOR IS AT 0				
VAR4T1	1.031	0.169	6.108	0.000	VAR1T1	1.488	1.986	0.749	0.454
VAR5T1	0.486	0.078	6.265	0.000	VAR1T2	3.432	1.434	2.392	0.017
VAR6T1	0.753	0.108	6.941	0.000	VAR1T3	4.175	1.586	2.633	0.008
FACTOR2 BY					VAR2T1	0.000	0.000	999.000	999.000
VAR1T2	1.382	0.141	9.831	0.000	VAR2T2	0.000	0.000	999.000	999.000
VAR2T2	1.000	0.000	999.000	999.000	VAR2T3	0.000	0.000	999.000	999.000
VAR3T2	1.029	0.110	9.318	0.000	VAR3T1	2.551	1.372	1.859	0.063
VAR4T2	1.013	0.132	7.693	0.000	VAR3T2	2.193	1.131	1.939	0.053
VAR5T2	0.567	0.083	6.793	0.000	VAR3T3	3.706	1.226	3.022	0.003
VAR6T2	0.730	0.079	9.233	0.000	VAR4T1	-11.979	1.514	-7.913	0.000
FACTOR3 BY					VAR4T2	-13.317	1.350	-9.865	0.000
VAR1T3	1.301	0.151	8.591	0.000	VAR4T3	-11.673	1.515	-7.707	0.000
VAR2T3	1.000	0.000	999.000	999.000	VAR5T1	-5.499	0.697	-7.885	0.000
VAR3T3	0.893	0.117	7.656	0.000	VAR5T2	-7.325	0.861	-8.507	0.000
VAR4T3	0.856	0.144	5.937	0.000	VAR5T3	-6.683	0.905	-7.383	0.000
VAR5T3	0.521	0.086	6.075	0.000	VAR6T1	-9.398	0.972	-9.665	0.000
VAR6T3	0.777	0.091	8.549	0.000	VAR6T2	-9.696	0.809	-11.989	0.000
Variances - ARE VAR2 ITEM VARIANCE DUE TO FACTOR					VAR6T3	-10.187	0.955	-10.666	0.000
FACTOR1	3.667	1.040	3.525	0.000	Residual Variances - VARIANCE PER ITEM THAT IS NOT THE FACTOR				
FACTOR2	4.292	0.963	4.455	0.000	VAR1T1	0.241	0.345	0.699	0.485
FACTOR3	3.845	0.974	3.947	0.000	VAR1T2	0.511	0.248	2.059	0.039
FACTOR1 WITH - FACTOR COVARIANCES					VAR1T3	0.523	0.238	2.196	0.028
FACTOR2	3.118	0.735	4.244	0.000	VAR2T1	8.672	1.073	8.084	0.000
FACTOR3	2.656	0.642	4.135	0.000	VAR2T2	5.913	0.743	7.954	0.000
FACTOR2 WITH					VAR2T3	5.142	0.766	6.710	0.000
FACTOR3	2.726	0.624	4.369	0.000	VAR3T1	2.413	0.367	6.583	0.000
*** Residual covariances among same item across time ***					VAR3T2	2.202	0.309	7.120	0.000
VAR1T1 WITH					VAR3T3	2.381	0.366	6.510	0.000
VAR1T2	-0.214	0.205	-1.042	0.298	VAR4T1	7.199	0.893	8.065	0.000
VAR1T3	-0.004	0.206	-0.019	0.984	VAR4T2	6.765	0.841	8.048	0.000
VAR1T2 WITH					VAR4T3	6.456	0.895	7.215	0.000
VAR1T3	0.113	0.171	0.656	0.512	VAR5T1	1.824	0.218	8.369	0.000
.....					VAR5T2	4.676	0.559	8.364	0.000
					VAR5T3	2.944	0.373	7.902	0.000
					VAR6T1	1.694	0.221	7.646	0.000
					VAR6T2	1.103	0.146	7.575	0.000
					VAR6T3	0.751	0.129	5.830	0.000

Model 2a. Metric Invariance Model (ALL loadings held equal across time – identified model using Factor1 Variance = 1)

<pre> MODEL: ! Model 2a: Metric Invariance - factor loadings constrained FACTOR1 BY VAR1T1* (L1) VAR2T1* (L2) VAR3T1* (L3) VAR4T1* (L4) VAR5T1* (L5) VAR6T1* (L6); FACTOR2 BY VAR1T2* (L1) VAR2T2* (L2) VAR3T2* (L3) VAR4T2* (L4) VAR5T2* (L5) VAR6T2* (L6); FACTOR3 BY VAR1T3* (L1) VAR2T3* (L2) VAR3T3* (L3) VAR4T3* (L4) VAR5T3* (L5) VAR6T3* (L6); ! Intercepts - second set to 0 for identification [VAR1T1* VAR1T2* VAR1T3*]; [VAR2T1@0 VAR2T2@0 VAR2T3@0]; [VAR3T1* VAR3T2* VAR3T3*]; [VAR4T1* VAR4T2* VAR4T3*]; [VAR5T1* VAR5T2* VAR5T3*]; [VAR6T1* VAR6T2* VAR6T3*]; ! Residual variances - all free now VAR1T1* VAR1T2* VAR1T3*; VAR2T1* VAR2T2* VAR2T3*; VAR3T1* VAR3T2* VAR3T3*; VAR4T1* VAR4T2* VAR4T3*; VAR5T1* VAR5T2* VAR5T3*; VAR6T1* VAR6T2* VAR6T3*; ! Factor variances (first fixed=1 for identification) FACTOR1@1 FACTOR2* FACTOR3*; ! Factor covariances (still all free) FACTOR1 WITH FACTOR2*; FACTOR1 WITH FACTOR3*; FACTOR2 WITH FACTOR3*; ! Factor means (all free now) [FACTOR1* FACTOR2* FACTOR3*]; ! Residual covariances for same indicator across time VAR1T1 WITH VAR1T2* VAR1T3*; VAR1T2 WITH VAR1T3*; VAR2T1 WITH VAR2T2* VAR2T3*; VAR2T2 WITH VAR2T3*; VAR3T1 WITH VAR3T2* VAR3T3*; VAR3T2 WITH VAR3T3*; VAR4T1 WITH VAR4T2* VAR4T3*; VAR4T2 WITH VAR4T3*; VAR5T1 WITH VAR5T2* VAR5T3*; VAR5T2 WITH VAR5T3*; VAR6T1 WITH VAR6T2* VAR6T3*; VAR6T2 WITH VAR6T3*; </pre>	<pre> Chi-Square Test of Model Fit Value 316.712 Degrees of Freedom 124 P-Value 0.0000 CFI/TLI CFI 0.905 TLI 0.883 Information Criteria Number of Free Parameters 65 Akaike (AIC) 9014.803 Bayesian (BIC) 9210.926 Sample-Size Adjusted BIC 9005.208 (n* = (n + 2) / 24) RMSEA (Root Mean Square Error Of Approximation) Estimate 0.101 90 Percent C.I. 0.088 0.115 Probability RMSEA <= .05 0.000 SRMR (Standardized Root Mean Square Residual) Value 0.094 Did model fit get significantly worse relative to the configural model (1)? MODEL MODIFICATION INDICES BY Statements M.I. E.P.C. Std E.P.C. StdYX E.P.C. BY Statements FACTOR1 BY VAR1T1 10.912 0.182 0.182 0.058 FACTOR1 BY VAR5T1 6.374 -0.054 -0.054 -0.033 FACTOR3 BY VAR6T3 7.994 0.201 0.175 0.105 Modification indices suggest that freeing the loading for Var1 at Time 1 would help, and that matches our observations, so let's try that. </pre>
--	--

1 UNSTANDARDIZED MODEL RESULTS - NOW ALL FACTOR LOADINGS ARE HELD EQUAL (VARIANCE OF FACTOR1=1 FOR IDENTIFICATION)

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value		Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
FACTOR1 BY					Means - OF FACTOR - HAVE CHANGED SCALE, BUT RELATIVE STILL HOLDS				
VAR1T1	3.004	0.203	14.794	0.000	FACTOR1	4.092	0.439	9.329	0.000
VAR2T1	2.117	0.214	9.915	0.000	FACTOR2	4.716	0.492	9.581	0.000
VAR3T1	2.139	0.168	12.722	0.000	FACTOR3	4.927	0.512	9.623	0.000
VAR4T1	2.018	0.209	9.652	0.000					
VAR5T1	0.981	0.106	9.241	0.000	Intercepts - SCALED SO SHOULD BE EQUAL ACROSS TIME				
VAR6T1	1.611	0.125	12.843	0.000	VAR1T1	3.794	1.073	3.537	0.000
FACTOR2 BY					VAR1T2	3.063	1.200	2.551	0.011
VAR1T2	3.004	0.203	14.794	0.000	VAR1T3	2.966	1.250	2.373	0.018
VAR2T2	2.117	0.214	9.915	0.000	VAR2T1	0.000	0.000	999.000	999.000
VAR3T2	2.139	0.168	12.722	0.000	VAR2T2	0.000	0.000	999.000	999.000
VAR4T2	2.018	0.209	9.652	0.000	VAR2T3	0.000	0.000	999.000	999.000
VAR5T2	0.981	0.106	9.241	0.000	VAR3T1	3.214	0.813	3.954	0.000
VAR6T2	1.611	0.125	12.843	0.000	VAR3T2	2.385	0.910	2.621	0.009
FACTOR3 BY					VAR3T3	2.503	0.949	2.636	0.008
VAR1T3	3.004	0.203	14.794	0.000	VAR4T1	-11.298	0.992	-11.383	0.000
VAR2T3	2.117	0.214	9.915	0.000	VAR4T2	-12.722	1.118	-11.382	0.000
VAR3T3	2.139	0.168	12.722	0.000	VAR4T3	-12.664	1.164	-10.878	0.000
VAR4T3	2.018	0.209	9.652	0.000	VAR5T1	-5.306	0.511	-10.383	0.000
VAR5T3	0.981	0.106	9.241	0.000	VAR5T2	-6.290	0.593	-10.606	0.000
VAR6T3	1.611	0.125	12.843	0.000	VAR5T3	-6.079	0.608	-9.995	0.000
FACTOR1 WITH					VAR6T1	-9.469	0.612	-15.469	0.000
FACTOR2	0.769	0.059	12.937	0.000	VAR6T2	-10.010	0.682	-14.670	0.000
FACTOR3	0.626	0.069	9.117	0.000	VAR6T3	-10.024	0.710	-14.124	0.000
FACTOR2 WITH					Residual Variances - ITEM VARIANCE THAT IS NOT THE FACTOR				
FACTOR3	0.573	0.084	6.848	0.000	VAR1T1	0.729	0.316	2.307	0.021
Variances OF FACTORS					VAR1T2	0.455	0.242	1.879	0.060
FACTOR1	1.000	0.000	999.000	999.000	VAR1T3	0.452	0.237	1.908	0.056
FACTOR2	0.956	0.120	7.982	0.000	VAR2T1	8.485	1.063	7.984	0.000
FACTOR3	0.761	0.113	6.709	0.000	VAR2T2	5.963	0.747	7.980	0.000
*** Residual covariances among same item across time ***					VAR2T3	5.187	0.767	6.760	0.000
VAR1T1 WITH					VAR3T1	2.190	0.327	6.708	0.000
VAR1T2	-0.208	0.204	-1.018	0.309	VAR3T2	2.235	0.310	7.200	0.000
VAR1T3	0.035	0.211	0.168	0.867	VAR3T3	2.361	0.366	6.444	0.000
VAR1T2 WITH					VAR4T1	7.281	0.912	7.980	0.000
VAR1T3	0.096	0.182	0.529	0.597	VAR4T2	6.745	0.827	8.152	0.000
.....					VAR4T3	6.522	0.897	7.273	0.000
					VAR5T1	1.819	0.220	8.258	0.000
					VAR5T2	4.694	0.559	8.396	0.000
					VAR5T3	2.958	0.374	7.918	0.000
					VAR6T1	1.635	0.223	7.341	0.000
					VAR6T2	1.082	0.144	7.531	0.000
					VAR6T3	0.796	0.129	6.171	0.000

Model 2b. Metric Invariance Model with loading for Var1 at Time 1 free

MODEL:	
! Model 2b: Metric Invariance without VAR1T1	
FACTOR1 BY VAR1T1*	
VAR2T1* (L2)	
VAR3T1* (L3)	
VAR4T1* (L4)	
VAR5T1* (L5)	
VAR6T1* (L6);	
FACTOR2 BY VAR1T2* (L1)	
VAR2T2* (L2)	
VAR3T2* (L3)	
VAR4T2* (L4)	
VAR5T2* (L5)	
VAR6T2* (L6);	
FACTOR3 BY VAR1T3* (L1)	
VAR2T3* (L2)	
VAR3T3* (L3)	
VAR4T3* (L4)	
VAR5T3* (L5)	
VAR6T3* (L6);	
! Intercepts - second set to 0 for identification	
[VAR1T1* VAR1T2* VAR1T3*];	
[VAR2T1@0 VAR2T2@0 VAR2T3@0];	
[VAR3T1* VAR3T2* VAR3T3*];	
[VAR4T1* VAR4T2* VAR4T3*];	
[VAR5T1* VAR5T2* VAR5T3*];	
[VAR6T1* VAR6T2* VAR6T3*];	
! Residual variances - all free now	
VAR1T1* VAR1T2* VAR1T3*;	
VAR2T1* VAR2T2* VAR2T3*;	
VAR3T1* VAR3T2* VAR3T3*;	
VAR4T1* VAR4T2* VAR4T3*;	
VAR5T1* VAR5T2* VAR5T3*;	
VAR6T1* VAR6T2* VAR6T3*;	
! Factor variances (first fixed=1 for identification)	
FACTOR1@1 FACTOR2* FACTOR3*;	
! Factor covariances (still all free)	
FACTOR1 WITH FACTOR2*;	
FACTOR1 WITH FACTOR3*;	
FACTOR2 WITH FACTOR3*;	
! Factor means (all free now)	
[FACTOR1* FACTOR2* FACTOR3*];	
! Residual covariances for same indicator across time	
VAR1T1 WITH VAR1T2* VAR1T3* ; VAR1T2 WITH VAR1T3* ;	
VAR2T1 WITH VAR2T2* VAR2T3* ; VAR2T2 WITH VAR2T3* ;	
VAR3T1 WITH VAR3T2* VAR3T3* ; VAR3T2 WITH VAR3T3* ;	
VAR4T1 WITH VAR4T2* VAR4T3* ; VAR4T2 WITH VAR4T3* ;	
VAR5T1 WITH VAR5T2* VAR5T3* ; VAR5T2 WITH VAR5T3* ;	
VAR6T1 WITH VAR6T2* VAR6T3* ; VAR6T2 WITH VAR6T3* ;	
Chi-Square Test of Model Fit	
Value	303.247
Degrees of Freedom	123
P-Value	0.0000
CFI/TLI	
CFI	0.912
TLI	0.890
Information Criteria	
Number of Free Parameters	66
Akaike (AIC)	9003.337
Bayesian (BIC)	9202.478
Sample-Size Adjusted BIC	8993.595
(n* = (n + 2) / 24)	
RMSEA (Root Mean Square Error Of Approximation)	
Estimate	0.099
90 Percent C.I.	0.085 0.113
Probability RMSEA <= .05	0.000
SRMR (Standardized Root Mean Square Residual)	
Value	0.091
How does this fit compare to the fully metric invariant model (2a)?	
How does this fit compare to the configural model (1)?	
No invariance-related modification indices were found, so we'll call it good!	

2b UNSTANDARDIZED MODEL RESULTS - ALL FACTOR LOADINGS ARE HELD EQUAL EXCEPT VAR1T1

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value		Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
FACTOR1 BY					Means - OF FACTOR - RELATIVE STILL HOLDS				
VAR1T1	3.233	0.208	15.530	0.000	FACTOR1	4.446	0.492	9.044	0.000
VAR2T1	1.950	0.204	9.558	0.000	FACTOR2	5.118	0.553	9.256	0.000
VAR3T1	1.967	0.168	11.744	0.000	FACTOR3	5.350	0.576	9.293	0.000
VAR4T1	1.899	0.199	9.541	0.000					
VAR5T1	0.968	0.102	9.458	0.000	Intercepts - SCALED SO SHOULD BE EQUAL ACROSS TIME				
VAR6T1	1.476	0.123	12.004	0.000	VAR1T1	1.705	1.366	1.248	0.212
FACTOR2 BY					VAR1T2	3.697	1.155	3.200	0.001
VAR1T2	2.644	0.201	13.163	0.000	VAR1T3	3.612	1.202	3.005	0.003
VAR2T2	1.950	0.204	9.558	0.000	VAR2T1	0.000	0.000	999.000	999.000
VAR3T2	1.967	0.168	11.744	0.000	VAR2T2	0.000	0.000	999.000	999.000
VAR4T2	1.899	0.199	9.541	0.000	VAR2T3	0.000	0.000	999.000	999.000
VAR5T2	0.968	0.102	9.458	0.000	VAR3T1	3.231	0.815	3.963	0.000
VAR6T2	1.476	0.123	12.004	0.000	VAR3T2	2.401	0.910	2.640	0.008
FACTOR3 BY					VAR3T3	2.517	0.949	2.652	0.008
VAR1T3	2.644	0.201	13.163	0.000	VAR4T1	-11.479	0.998	-11.501	0.000
VAR2T3	1.950	0.204	9.558	0.000	VAR4T2	-12.929	1.123	-11.512	0.000
VAR3T3	1.967	0.168	11.744	0.000	VAR4T3	-12.881	1.170	-11.007	0.000
VAR4T3	1.899	0.199	9.541	0.000	VAR5T1	-5.592	0.535	-10.443	0.000
VAR5T3	0.968	0.102	9.458	0.000	VAR5T2	-6.616	0.619	-10.686	0.000
VAR6T3	1.476	0.123	12.004	0.000	VAR5T3	-6.425	0.636	-10.094	0.000
FACTOR1 WITH					VAR6T1	-9.434	0.607	-15.552	0.000
FACTOR2	0.847	0.068	12.472	0.000	VAR6T2	-9.967	0.675	-14.774	0.000
FACTOR3	0.682	0.077	8.841	0.000	VAR6T3	-9.983	0.702	-14.228	0.000
FACTOR2 WITH					Residual Variances - ITEM VARIANCE THAT IS NOT THE FACTOR				
FACTOR3	0.699	0.110	6.354	0.000	VAR1T1	0.170	0.334	0.509	0.611
Variances					VAR1T2	0.548	0.243	2.257	0.024
FACTOR1	1.000	0.000	999.000	999.000	VAR1T3	0.509	0.228	2.230	0.026
FACTOR2	1.162	0.159	7.292	0.000	VAR2T1	8.702	1.075	8.097	0.000
FACTOR3	0.941	0.152	6.172	0.000	VAR2T2	5.895	0.739	7.976	0.000
*** Residual covariances among same item across time ***					VAR2T3	5.177	0.764	6.776	0.000
VAR1T1 WITH					VAR3T1	2.502	0.364	6.874	0.000
VAR1T2	-0.225	0.202	-1.111	0.266	VAR3T2	2.178	0.303	7.180	0.000
VAR1T3	-0.012	0.205	-0.057	0.955	VAR3T3	2.309	0.358	6.455	0.000
VAR1T2 WITH					VAR4T1	7.172	0.882	8.131	0.000
VAR1T3	0.132	0.176	0.749	0.454	VAR4T2	6.759	0.834	8.106	0.000
.....					VAR4T3	6.613	0.918	7.205	0.000
					VAR5T1	1.829	0.218	8.376	0.000
					VAR5T2	4.678	0.557	8.393	0.000
					VAR5T3	2.944	0.372	7.919	0.000
					VAR6T1	1.707	0.223	7.656	0.000
					VAR6T2	1.090	0.146	7.465	0.000
					VAR6T3	0.784	0.128	6.146	0.000

Model 3a. Scalar Invariance Model (all intercepts held equal across over time except VAR1T1); identified by Factor1 mean=0

MODEL: !Model 3a: Scalar Invariance-intercepts (no VAR1T1)

```

FACTOR1 BY VAR1T1*
           VAR2T1* (L2)
           VAR3T1* (L3)
           VAR4T1* (L4)
           VAR5T1* (L5)
           VAR6T1* (L6);
FACTOR2 BY VAR1T2* (L1)
           VAR2T2* (L2)
           VAR3T2* (L3)
           VAR4T2* (L4)
           VAR5T2* (L5)
           VAR6T2* (L6);
FACTOR3 BY VAR1T3* (L1)
           VAR2T3* (L2)
           VAR3T3* (L3)
           VAR4T3* (L4)
           VAR5T3* (L5)
           VAR6T3* (L6);
! All intercepts now constrained except VAR1T1
[VAR1T1*];
      [VAR1T2* VAR1T3* ] (I1);
[VAR2T1* VAR2T2* VAR2T3* ] (I2);
[VAR3T1* VAR3T2* VAR3T3* ] (I3);
[VAR4T1* VAR4T2* VAR4T3* ] (I4);
[VAR5T1* VAR5T2* VAR5T3* ] (I5);
[VAR6T1* VAR6T2* VAR6T3* ] (I6);
! Residual variances - all free now
VAR1T1* VAR1T2* VAR1T3*;
VAR2T1* VAR2T2* VAR2T3*;
VAR3T1* VAR3T2* VAR3T3*;
VAR4T1* VAR4T2* VAR4T3*;
VAR5T1* VAR5T2* VAR5T3*;
VAR6T1* VAR6T2* VAR6T3*;
! Factor variances (first fixed=1 for identification)
FACTOR1@1 FACTOR2* FACTOR3*;
! Factor covariances (still all free)
FACTOR1 WITH FACTOR2*;
FACTOR1 WITH FACTOR3*;
FACTOR2 WITH FACTOR3*;
! Factor means (first=0 for identification)
[FACTOR1@0 FACTOR2* FACTOR3*];
! Residual covariances for same indicator across time
VAR1T1 WITH VAR1T2* VAR1T3*; VAR1T2 WITH VAR1T3*;
VAR2T1 WITH VAR2T2* VAR2T3*; VAR2T2 WITH VAR2T3*;
VAR3T1 WITH VAR3T2* VAR3T3*; VAR3T2 WITH VAR3T3*;
VAR4T1 WITH VAR4T2* VAR4T3*; VAR4T2 WITH VAR4T3*;
VAR5T1 WITH VAR5T2* VAR5T3*; VAR5T2 WITH VAR5T3*;
VAR6T1 WITH VAR6T2* VAR6T3*; VAR6T2 WITH VAR6T3*;
    
```

Chi-Square Test of Model Fit			
Value	355.594		
Degrees of Freedom	132		
P-Value	0.0000		
CFI/TLI			
CFI	0.890		
TLI	0.873		
Information Criteria			
Number of Free Parameters	57		
Akaike (AIC)	9037.685		
Bayesian (BIC)	9209.670		
Sample-Size Adjusted BIC	9029.271		
(n* = (n + 2) / 24)			
RMSEA (Root Mean Square Error Of Approximation)			
Estimate	0.106		
90 Percent C.I.	0.093	0.119	
Probability RMSEA <= .05	0.000		
SRMR (Standardized Root Mean Square Residual)			
Value	0.093		

Did model fit get significantly worse relative to the partially metric invariant model (2b)?

MODEL MODIFICATION INDICES					
Means/Intercepts/Thresholds					
		M.I.	E.P.C.	Std E.P.C.	StdYX E.P.C.
[VAR2T1]		15.324	-0.696	-0.696	-0.189
[VAR4T1]		10.797	0.366	0.366	0.113
[VAR5T1]		21.688	-0.027	-0.027	-0.017
[VAR5T2]		14.732	-0.596	-0.596	-0.241

Modification indices suggest that freeing these intercepts would help, so let's try VAR5T1 first (biggest χ^2 change suggested).

3a UNSTANDARDIZED MODEL RESULTS - NOW FACTOR LOADINGS AND INTERCEPTS ARE HELD EQUAL (EXCEPT VAR1T1)

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value		Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
FACTOR1 BY									
VAR1T1	3.223	0.210	15.368	0.000	Means - NOW FACTOR MEAN DIFFERENCES				
VAR2T1	2.072	0.210	9.850	0.000	(SCALE HAS CHANGED SO THAT ZERO IS MEAN AT TIME 1)				
VAR3T1	2.023	0.169	11.983	0.000	FACTOR1	0.000	0.000	999.000	999.000
VAR4T1	1.794	0.194	9.244	0.000	FACTOR2	0.228	0.073	3.131	0.002
VAR5T1	0.907	0.103	8.834	0.000	FACTOR3	0.452	0.089	5.052	0.000
VAR6T1	1.516	0.125	12.154	0.000					
FACTOR2 BY					Intercepts				
VAR1T2	2.662	0.203	13.102	0.000	VAR1T1	16.089	0.273	58.973	0.000
VAR2T2	2.072	0.210	9.850	0.000	VAR1T2	16.589	0.252	65.753	0.000
VAR3T2	2.023	0.169	11.983	0.000	VAR1T3	16.589	0.252	65.753	0.000
VAR4T2	1.794	0.194	9.244	0.000	VAR2T1	9.368	0.258	36.248	0.000
VAR5T2	0.907	0.103	8.834	0.000	VAR2T2	9.368	0.258	36.248	0.000
VAR6T2	1.516	0.125	12.154	0.000	VAR2T3	9.368	0.258	36.248	0.000
FACTOR3 BY					VAR3T1	12.026	0.205	58.581	0.000
VAR1T3	2.662	0.203	13.102	0.000	VAR3T2	12.026	0.205	58.581	0.000
VAR2T3	2.072	0.210	9.850	0.000	VAR3T3	12.026	0.205	58.581	0.000
VAR3T3	2.023	0.169	11.983	0.000	VAR4T1	-3.388	0.252	-13.456	0.000
VAR4T3	1.794	0.194	9.244	0.000	VAR4T2	-3.388	0.252	-13.456	0.000
VAR5T3	0.907	0.103	8.834	0.000	VAR4T3	-3.388	0.252	-13.456	0.000
VAR6T3	1.516	0.125	12.154	0.000	VAR5T1	-1.189	0.135	-8.784	0.000
FACTOR1 WITH					VAR5T2	-1.189	0.135	-8.784	0.000
FACTOR2	0.837	0.067	12.435	0.000	VAR5T3	-1.189	0.135	-8.784	0.000
FACTOR3	0.678	0.076	8.883	0.000	VAR6T1	-2.775	0.156	-17.774	0.000
FACTOR2 WITH					VAR6T2	-2.775	0.156	-17.774	0.000
FACTOR3	0.689	0.108	6.365	0.000	VAR6T3	-2.775	0.156	-17.774	0.000
Variances					Residual Variances				
FACTOR1	1.000	0.000	999.000	999.000	VAR1T1	0.247	0.348	0.711	0.477
FACTOR2	1.133	0.156	7.270	0.000	VAR1T2	0.603	0.244	2.475	0.013
FACTOR3	0.923	0.150	6.170	0.000	VAR1T3	0.560	0.229	2.440	0.015
*** Residual covariances among same item across time still there but not shown ***					VAR2T1	9.256	1.185	7.813	0.000
					VAR2T2	5.874	0.743	7.911	0.000
					VAR2T3	5.060	0.747	6.775	0.000
					VAR3T1	2.443	0.367	6.659	0.000
					VAR3T2	2.145	0.301	7.125	0.000
					VAR3T3	2.284	0.355	6.429	0.000
					VAR4T1	7.291	0.912	7.996	0.000
					VAR4T2	6.715	0.827	8.122	0.000
					VAR4T3	6.512	0.900	7.238	0.000
					VAR5T1	1.846	0.222	8.315	0.000
					VAR5T2	5.196	0.638	8.139	0.000
					VAR5T3	3.193	0.412	7.748	0.000
					VAR6T1	1.692	0.226	7.488	0.000
					VAR6T2	1.073	0.146	7.366	0.000
					VAR6T3	0.757	0.126	6.022	0.000

Model 3b. Scalar Invariance Model (all intercepts held equal across over time except VAR1T1 and VAR5T1)

MODEL: !Model 3b: Scalar Invariance (no VAR1T1 or VAR5T1)

(rest of code before is same)

! All intercepts now constrained except VAR1T1 and VAR5T1

```
[VAR1T1*];
  [VAR1T2* VAR1T3* ] (I1);
[VAR2T1* VAR2T2* VAR2T3* ] (I2);
[VAR3T1* VAR3T2* VAR3T3* ] (I3);
[VAR4T1* VAR4T2* VAR4T3* ] (I4);
[VAR5T1*];
  [VAR5T2* VAR5T3* ] (I5);
[VAR6T1* VAR6T2* VAR6T3* ] (I6);
```

! Factor means (first=0 for identification)

```
[FACTOR1@0 FACTOR2* FACTOR3*];
```

(rest of code after is same)

Chi-Square Test of Model Fit

```
Value          331.911
Degrees of Freedom 131
P-Value        0.0000
```

CFI/TLI

```
CFI          0.901
TLI          0.885
```

Information Criteria

```
Number of Free Parameters 58
Akaike (AIC)              9016.001
Bayesian (BIC)            9191.004
Sample-Size Adjusted BIC  9007.440
(n* = (n + 2) / 24)
```

RMSEA (Root Mean Square Error Of Approximation)

```
Estimate          0.101
90 Percent C.I.   0.087  0.114
Probability RMSEA <= .05 0.000
```

SRMR (Standardized Root Mean Square Residual)

```
Value          0.086
```

How does this fit compare to the fully scalar invariant model (3a)?

How does this fit compare to the partially metric invariant model (2b)?

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
Means - OF FACTORS (0=MEAN AT TIME 1)				
FACTOR1	0.000	0.000	999.000	999.000
FACTOR2	0.285	0.075	3.802	0.000
FACTOR3	0.514	0.093	5.555	0.000

Intercepts

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
VAR1T1	16.090	0.273	58.974	0.000
VAR1T2	16.444	0.251	65.421	0.000
VAR1T3	16.444	0.251	65.421	0.000
VAR2T1	9.271	0.257	36.038	0.000
VAR2T2	9.271	0.257	36.038	0.000
VAR2T3	9.271	0.257	36.038	0.000
VAR3T1	11.957	0.203	58.999	0.000
VAR3T2	11.957	0.203	58.999	0.000
VAR3T3	11.957	0.203	58.999	0.000
VAR4T1	-3.447	0.251	-13.717	0.000
VAR4T2	-3.447	0.251	-13.717	0.000
VAR4T3	-3.447	0.251	-13.717	0.000
VAR5T1	-1.216	0.132	-9.229	0.000
VAR5T2	-1.794	0.179	-10.002	0.000
VAR5T3	-1.794	0.179	-10.002	0.000
VAR6T1	-2.847	0.154	-18.432	0.000
VAR6T2	-2.847	0.154	-18.432	0.000
VAR6T3	-2.847	0.154	-18.432	0.000

MODEL MODIFICATION INDICES

Means/Intercepts/Thresholds

	M.I.	E.P.C.	Std E.P.C.	StdYX E.P.C.
[VAR2T1]	12.033	-0.599	-0.599	-0.164
[VAR4T1]	14.398	0.425	0.425	0.132
[VAR4T2]	6.677	-0.306	-0.306	-0.096

Modification indices still suggest that freeing these intercepts would help, so let's try VAR4T1 next (biggest χ^2 change suggested).

Model 3c. Scalar Invariance Model (all intercepts held equal across over time except VAR1T1, VAR5T1, and VAR4T1)

MODEL: ! Model 3c: Scalar (no VAR1T1, VAR5T1, or VAR4T1)

(rest of code before is same)

! All intercepts now constrained except VAR1T1, VAR5T1, VAR4T1

```
[VAR1T1*];
  [VAR1T2* VAR1T3* ] (I1);
[VAR2T1* VAR2T2* VAR2T3* ] (I2);
[VAR3T1* VAR3T2* VAR3T3* ] (I3);
[VAR4T1*];
  [VAR4T2* VAR4T3* ] (I4);
[VAR5T1*];
  [VAR5T2* VAR5T3* ] (I5);
[VAR6T1* VAR6T2* VAR6T3* ] (I6);
```

! Factor means (first=0 for identification)

```
[FACTOR1@0 FACTOR2* FACTOR3*];
```

(rest of code after is same)

Chi-Square Test of Model Fit

Value	316.337
Degrees of Freedom	130
P-Value	0.0000

CFI/TLI

CFI	0.909
TLI	0.892

Information Criteria

Number of Free Parameters	59
Akaike (AIC)	9002.427
Bayesian (BIC)	9180.447
Sample-Size Adjusted BIC	8993.718
(n* = (n + 2) / 24)	

RMSEA (Root Mean Square Error Of Approximation)

Estimate	0.097	
90 Percent C.I.	0.084	0.111
Probability RMSEA <= .05	0.000	

SRMR (Standardized Root Mean Square Residual)

Value	0.092
-------	-------

How does this fit compare to the partially scalar invariant model (3b)?

How does this fit compare to the partially metric invariant model (2b)?

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
Means - OF FACTORS (0=MEAN AT TIME 1)				
FACTOR1	0.000	0.000	999.000	999.000
FACTOR2	0.346	0.078	4.425	0.000
FACTOR3	0.573	0.096	5.969	0.000

Intercepts

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
VAR1T1	16.090	0.273	58.984	0.000
VAR1T2	16.286	0.256	63.738	0.000
VAR1T3	16.286	0.256	63.738	0.000
VAR2T1	9.171	0.258	35.595	0.000
VAR2T2	9.171	0.258	35.595	0.000
VAR2T3	9.171	0.258	35.595	0.000
VAR3T1	11.885	0.202	58.933	0.000
VAR3T2	11.885	0.202	58.933	0.000
VAR3T3	11.885	0.202	58.933	0.000
VAR4T1	-3.023	0.274	-11.045	0.000
VAR4T2	-3.845	0.278	-13.832	0.000
VAR4T3	-3.845	0.278	-13.832	0.000
VAR5T1	-1.214	0.132	-9.211	0.000
VAR5T2	-1.854	0.181	-10.220	0.000
VAR5T3	-1.854	0.181	-10.220	0.000
VAR6T1	-2.919	0.154	-18.941	0.000
VAR6T2	-2.919	0.154	-18.941	0.000
VAR6T3	-2.919	0.154	-18.941	0.000

MODEL MODIFICATION INDICES

Means/Intercepts/Thresholds

	M.I.	E.P.C.	Std E.P.C.	StdYX E.P.C.
[VAR2T1]	8.891	-0.497	-0.497	-0.137

Modification indices still suggest that freeing this intercept would help, so let's try VAR2T1 next (last χ^2 change over 6).

Model 3d. Scalar Invariance Model (all intercepts held equal across over time except VAR1T1, VAR5T1, VAR4T1, VAR2T1)

```

MODEL: ! Model 3d: Scalar
      ! (no VAR1T1, VAR5T1, VAR4T1, VAR2T1)

(rest of code before and after is same)

! All intercepts now constrained except
! VAR1T1, VAR5T1, VAR4T1, VAR2T1
  [VAR1T1*];
      [VAR1T2* VAR1T3* ] (I1);
  [VAR2T1*];
      [VAR2T2* VAR2T3* ] (I2);
  [VAR3T1* VAR3T2* VAR3T3* ] (I3);
  [VAR4T1*];
      [VAR4T2* VAR4T3* ] (I4);
  [VAR5T1*];
      [VAR5T2* VAR5T3* ] (I5);
  [VAR6T1* VAR6T2* VAR6T3* ] (I6);

! Factor means (first=0 for identification)
  [FACTOR1@0 FACTOR2* FACTOR3*];

Chi-Square Test of Model Fit
  Value                307.239
  Degrees of Freedom    129
  P-Value               0.0000

CFI/TLI
  CFI                  0.913
  TLI                  0.896

Information Criteria
  Number of Free Parameters    60
  Akaike (AIC)                8995.330
  Bayesian (BIC)              9176.366
  Sample-Size Adjusted BIC    8986.473
    (n* = (n + 2) / 24)

RMSEA (Root Mean Square Error Of Approximation)
  Estimate                0.096
  90 Percent C.I.        0.082  0.109
  Probability RMSEA <= .05  0.000

SRMR (Standardized Root Mean Square Residual)
  Value                  0.091
    
```

How does this fit compare to the partially scalar invariant model (3c)?

How does this fit compare to the partially metric invariant model (2b)?

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
Means - OF FACTORS (0=MEAN AT TIME 1)				
FACTOR1	0.000	0.000	999.000	999.000
FACTOR2	0.293	0.078	3.738	0.000
FACTOR3	0.521	0.095	5.479	0.000
Intercepts				
VAR1T1	16.090	0.273	58.988	0.000
VAR1T2	16.425	0.257	63.862	0.000
VAR1T3	16.425	0.257	63.862	0.000
VAR2T1	8.674	0.295	29.376	0.000
VAR2T2	9.413	0.258	36.418	0.000
VAR2T3	9.413	0.258	36.418	0.000
VAR3T1	11.950	0.204	58.683	0.000
VAR3T2	11.950	0.204	58.683	0.000
VAR3T3	11.950	0.204	58.683	0.000
VAR4T1	-3.024	0.274	-11.047	0.000
VAR4T2	-3.744	0.277	-13.512	0.000
VAR4T3	-3.744	0.277	-13.512	0.000
VAR5T1	-1.215	0.132	-9.219	0.000
VAR5T2	-1.802	0.181	-9.970	0.000
VAR5T3	-1.802	0.181	-9.970	0.000
VAR6T1	-2.854	0.156	-18.306	0.000
VAR6T2	-2.854	0.156	-18.306	0.000
VAR6T3	-2.854	0.156	-18.306	0.000

For whatever reason, even after controlling for factor level, the responses to these items at time 1 are lower than what is predicted.

No invariance-related modification indices were found, so we'll call it good!

Model 4a. Residual Variance Invariance Model (error variances held equal for all except non-invariant items)

MODEL: ! Model 4a: Residual Variances ! (except for non-invariant items)		Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
(rest of code before and after is same)					
! All residual variances constrained ! except for non-invariant items					
VAR1T1*; VAR1T2* VAR1T3* (E1); VAR2T1*; VAR2T2* VAR2T3* (E2); VAR3T1* VAR3T2* VAR3T3* (E3); VAR4T1*; VAR4T2* VAR4T3* (E4); VAR5T1*; VAR5T2* VAR5T3* (E5); VAR6T1* VAR6T2* VAR6T3* (E6);					
Chi-Square Test of Model Fit					
Value	341.094				
Degrees of Freedom	137				
P-Value	0.0000				
CFI/TLI					
CFI	0.900				
TLI	0.888				
Information Criteria					
Number of Free Parameters	52				
Akaike (AIC)	9013.185				
Bayesian (BIC)	9170.083				
Sample-Size Adjusted BIC	9005.509				
(n* = (n + 2) / 24)					
RMSEA (Root Mean Square Error Of Approximation)					
Estimate	0.099				
90 Percent C.I.	0.086	0.113			
Probability RMSEA <= .05	0.000				
SRMR (Standardized Root Mean Square Residual)					
Value	0.095				
How does this fit compare to the partially scalar invariant model (3d)?					
PREVIOUS MODEL (3D) Residual Variances					
VAR1T1	0.186	0.331	0.560	0.575	
VAR1T2	0.577	0.242	2.379	0.017	
VAR1T3	0.521	0.227	2.297	0.022	
VAR2T1	8.692	1.074	8.096	0.000	
VAR2T2	5.868	0.736	7.973	0.000	
VAR2T3	5.162	0.758	6.806	0.000	
VAR3T1	2.490	0.362	6.882	0.000	
VAR3T2	2.169	0.303	7.158	0.000	
VAR3T3	2.300	0.356	6.453	0.000	
VAR4T1	7.174	0.883	8.124	0.000	
VAR4T2	6.758	0.835	8.095	0.000	
VAR4T3	6.616	0.919	7.197	0.000	
VAR5T1	1.836	0.220	8.340	0.000	
VAR5T2	4.696	0.562	8.352	0.000	
VAR5T3	2.930	0.370	7.925	0.000	
VAR6T1	1.704	0.223	7.657	0.000	
VAR6T2	1.089	0.146	7.441	0.000	
VAR6T3	0.780	0.127	6.150	0.000	
CURRENT MODEL (4A) Residual Variances					
VAR1T1	0.520	0.314	1.658	0.097	
VAR1T2	0.604	0.215	2.806	0.005	
VAR1T3	0.604	0.215	2.806	0.005	
VAR2T1	8.389	1.034	8.111	0.000	
VAR2T2	5.536	0.567	9.771	0.000	
VAR2T3	5.536	0.567	9.771	0.000	
VAR3T1	2.238	0.234	9.553	0.000	
VAR3T2	2.238	0.234	9.553	0.000	
VAR3T3	2.238	0.234	9.553	0.000	
VAR4T1	7.204	0.890	8.096	0.000	
VAR4T2	6.608	0.731	9.042	0.000	
VAR4T3	6.608	0.731	9.042	0.000	
VAR5T1	1.657	0.189	8.777	0.000	
VAR5T2	3.868	0.410	9.430	0.000	
VAR5T3	3.868	0.410	9.430	0.000	
VAR6T1	1.218	0.124	9.817	0.000	
VAR6T2	1.218	0.124	9.817	0.000	
VAR6T3	1.218	0.124	9.817	0.000	
MODEL MODIFICATION INDICES					
Variances/Residual Variances					
	M.I.	E.P.C.	Std E.P.C.	StdYX E.P.C.	
VAR5T2	13.652	0.755	0.755	0.153	
VAR5T3	13.653	-1.125	-1.125	-0.238	
VAR6T1	14.725	0.421	0.421	0.124	
VAR6T3	8.375	-0.393	-0.393	-0.124	

Model 4b. Residual Variance Invariance Model (error variances held equal for all except non-invariant items and Var5T2 from Var5T3)

```

MODEL: ! Model 4b: Residual Variances
      ! (no Var5T2 and Var5T3)

(rest of code before and after is same)

! All residual variances constrained
! except for non-invariant items
VAR1T1*;
      VAR1T2* VAR1T3* (E1);
VAR2T1*;
      VAR2T2* VAR2T3* (E2);
VAR3T1* VAR3T2* VAR3T3* (E3);
VAR4T1*;
      VAR4T2* VAR4T3* (E4);
VAR5T1*;
      VAR5T2*;
      VAR5T3*;
VAR6T1* VAR6T2* VAR6T3* (E6);

Chi-Square Test of Model Fit
Value          326.427
Degrees of Freedom 136
P-Value        0.0000

CFI/TLI
CFI            0.907
TLI            0.895

Information Criteria
Number of Free Parameters 53
Akaike (AIC)              9000.518
Bayesian (BIC)            9160.434
Sample-Size Adjusted BIC  8992.694
(n* = (n + 2) / 24)

RMSEA (Root Mean Square Error Of Approximation)
Estimate          0.096
90 Percent C.I.  0.083  0.110
Probability RMSEA <= .05 0.000

SRMR (Standardized Root Mean Square Residual)
Value            0.093

How does this fit compare to the fully residual invariant model (4a)?

How does this fit compare to the partially scalar invariant model (3d)?
    
```

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
CURRENT MODEL (4b) Residual Variances				
Residual Variances				
VAR1T1	0.515	0.314	1.643	0.100
VAR1T2	0.601	0.215	2.794	0.005
VAR1T3	0.601	0.215	2.794	0.005
VAR2T1	8.396	1.034	8.119	0.000
VAR2T2	5.552	0.566	9.804	0.000
VAR2T3	5.552	0.566	9.804	0.000
VAR3T1	2.235	0.234	9.537	0.000
VAR3T2	2.235	0.234	9.537	0.000
VAR3T3	2.235	0.234	9.537	0.000
VAR4T1	7.189	0.887	8.102	0.000
VAR4T2	6.604	0.730	9.041	0.000
VAR4T3	6.604	0.730	9.041	0.000
VAR5T1	1.840	0.222	8.278	0.000
VAR5T2	4.674	0.561	8.338	0.000
VAR5T3	2.876	0.364	7.901	0.000
VAR6T1	1.222	0.124	9.840	0.000
VAR6T2	1.222	0.124	9.840	0.000
VAR6T3	1.222	0.124	9.840	0.000
MODEL MODIFICATION INDICES				
Variances/Residual Variances				
	M.I.	E.P.C.	Std E.P.C.	StdYX E.P.C.
VAR6T1	14.531	0.419	0.419	0.125
VAR6T3	7.543	-0.373	-0.373	-0.118
After freeing Var6T1 (Model 4c):				
VAR6T1*; VAR6T2* VAR6T3* (E6);				
Chi-Square Test of Model Fit				
Value			311.852	
Degrees of Freedom			135	
P-Value			0.0000	
How does this fit compare to the partially residual invariant model (4b)?				
How does this fit compare to the partially scalar invariant model (3d)?				

UNSTANDARDIZED MODEL RESULTS FOR PARTIAL MEASUREMENT INVARIANCE SOLUTION

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value		Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
FACTOR1 BY					Means - FACTOR MEAN DIFFERENCES (SCALED SO THAT ZERO IS MEAN AT TIME 1)				
VAR1T1	3.214	0.208	15.434	0.000	Means				
VAR2T1	1.945	0.202	9.632	0.000	FACTOR1	0.000	0.000	999.000	999.000
VAR3T1	1.983	0.165	12.042	0.000	FACTOR2	0.295	0.078	3.759	0.000
VAR4T1	1.913	0.197	9.700	0.000	FACTOR3	0.520	0.094	5.511	0.000
VAR5T1	0.987	0.102	9.636	0.000					
VAR6T1	1.470	0.120	12.220	0.000	Intercepts - VAR3 AND VAR6 ARE HOLDING THIS TOGETHER WITH TIME1				
FACTOR2 BY					VAR1T1	16.089	0.273	59.025	0.000
VAR1T2	2.644	0.199	13.283	0.000	VAR1T2	16.418	0.258	63.574	0.000
VAR2T2	1.945	0.202	9.632	0.000	VAR1T3	16.418	0.258	63.574	0.000
VAR3T2	1.983	0.165	12.042	0.000	VAR2T1	8.675	0.295	29.446	0.000
VAR4T2	1.913	0.197	9.700	0.000	VAR2T2	9.416	0.258	36.525	0.000
VAR5T2	0.987	0.102	9.636	0.000	VAR2T3	9.416	0.258	36.525	0.000
VAR6T2	1.470	0.120	12.220	0.000	VAR3T1	11.950	0.203	58.943	0.000
FACTOR3 BY					VAR3T2	11.950	0.203	58.943	0.000
VAR1T3	2.644	0.199	13.283	0.000	VAR3T3	11.950	0.203	58.943	0.000
VAR2T3	1.945	0.202	9.632	0.000	VAR4T1	-3.024	0.274	-11.035	0.000
VAR3T3	1.983	0.165	12.042	0.000	VAR4T2	-3.750	0.277	-13.520	0.000
VAR4T3	1.913	0.197	9.700	0.000	VAR4T3	-3.750	0.277	-13.520	0.000
VAR5T3	0.987	0.102	9.636	0.000	VAR5T1	-1.213	0.132	-9.215	0.000
VAR6T3	1.470	0.120	12.220	0.000	VAR5T2	-1.803	0.181	-9.980	0.000
FACTOR1 WITH					VAR5T3	-1.803	0.181	-9.980	0.000
FACTOR2	0.843	0.068	12.417	0.000	VAR6T1	-2.851	0.155	-18.363	0.000
FACTOR3	0.683	0.077	8.869	0.000	VAR6T2	-2.851	0.155	-18.363	0.000
FACTOR2 WITH					VAR6T3	-2.851	0.155	-18.363	0.000
FACTOR3	0.692	0.109	6.376	0.000	Residual Variances				
Variances					VAR1T1	0.284	0.312	0.912	0.362
FACTOR1	1.000	0.000	999.000	999.000	VAR1T2	0.539	0.191	2.826	0.005
FACTOR2	1.159	0.158	7.327	0.000	VAR1T3	0.539	0.191	2.826	0.005
FACTOR3	0.934	0.150	6.235	0.000	VAR2T1	8.562	1.049	8.163	0.000
*** Residual covariances among same item across time still there but not shown ***					VAR2T2	5.592	0.566	9.886	0.000
					VAR2T3	5.592	0.566	9.886	0.000
					VAR3T1	2.312	0.233	9.915	0.000
					VAR3T2	2.312	0.233	9.915	0.000
					VAR3T3	2.312	0.233	9.915	0.000
					VAR4T1	7.139	0.874	8.172	0.000
					VAR4T2	6.686	0.736	9.080	0.000
					VAR4T3	6.686	0.736	9.080	0.000
					VAR5T1	1.829	0.220	8.332	0.000
					VAR5T2	4.705	0.563	8.356	0.000
					VAR5T3	2.908	0.367	7.929	0.000
					VAR6T1	1.664	0.217	7.687	0.000
					VAR6T2	0.957	0.110	8.681	0.000
					VAR6T3	0.957	0.110	8.681	0.000

STRUCTURAL INVARIANCE TESTS

Model 5. Factor Variance Invariance Model

Model 6. Factor Mean Invariance Model

<p>MODEL: ! Model 5: Factor Variance Invariance</p> <p>(rest of code before and after is same)</p> <p>! Model 5: Factor Variance Invariance (all fixed to 1 now) FACTOR1@1 FACTOR2@1 FACTOR3@1;</p> <p>Chi-Square Test of Model Fit</p> <table border="0"> <tr><td>Value</td><td>314.385</td></tr> <tr><td>Degrees of Freedom</td><td>137</td></tr> <tr><td>P-Value</td><td>0.0000</td></tr> </table> <p>CFI/TLI</p> <table border="0"> <tr><td>CFI</td><td>0.913</td></tr> <tr><td>TLI</td><td>0.903</td></tr> </table> <p>Information Criteria</p> <table border="0"> <tr><td>Number of Free Parameters</td><td>52</td></tr> <tr><td>Akaike (AIC)</td><td>8986.475</td></tr> <tr><td>Bayesian (BIC)</td><td>9143.374</td></tr> <tr><td>Sample-Size Adjusted BIC</td><td>8978.799</td></tr> <tr><td colspan="2">(n* = (n + 2) / 24)</td></tr> </table> <p>RMSEA (Root Mean Square Error Of Approximation)</p> <table border="0"> <tr><td>Estimate</td><td>0.093</td></tr> <tr><td>90 Percent C.I.</td><td>0.079 0.106</td></tr> <tr><td>Probability RMSEA <= .05</td><td>0.000</td></tr> </table> <p>SRMR (Standardized Root Mean Square Residual)</p> <table border="0"> <tr><td>Value</td><td>0.100</td></tr> </table> <p>How does this fit compare to the partially residual invariant model (4c)?</p> <p>FACTOR MEANS FROM MODEL 5 (REPRESENT MEAN DIFFERENCES):</p> <table border="0"> <tr><td>FACTOR1</td><td>0.000</td><td>0.000</td><td>999.000</td><td>999.000</td></tr> <tr><td>FACTOR2</td><td>0.291</td><td>0.076</td><td>3.851</td><td>0.000</td></tr> <tr><td>FACTOR3</td><td>0.517</td><td>0.091</td><td>5.685</td><td>0.000</td></tr> </table>	Value	314.385	Degrees of Freedom	137	P-Value	0.0000	CFI	0.913	TLI	0.903	Number of Free Parameters	52	Akaike (AIC)	8986.475	Bayesian (BIC)	9143.374	Sample-Size Adjusted BIC	8978.799	(n* = (n + 2) / 24)		Estimate	0.093	90 Percent C.I.	0.079 0.106	Probability RMSEA <= .05	0.000	Value	0.100	FACTOR1	0.000	0.000	999.000	999.000	FACTOR2	0.291	0.076	3.851	0.000	FACTOR3	0.517	0.091	5.685	0.000	<p>MODEL: ! Model 6: Factor Mean Invariance ! Testing Diff between Time2 and Time3</p> <p>(rest of code before and after is same)</p> <p>! Model 6: Factor Mean Invariance (time2 and time3 held equal) [FACTOR1@0]; [FACTOR2* FACTOR3*] (Fmean);</p> <p>Chi-Square Test of Model Fit</p> <table border="0"> <tr><td>Value</td><td>321.682</td></tr> <tr><td>Degrees of Freedom</td><td>138</td></tr> <tr><td>P-Value</td><td>0.0000</td></tr> </table> <p>CFI/TLI</p> <table border="0"> <tr><td>CFI</td><td>0.910</td></tr> <tr><td>TLI</td><td>0.900</td></tr> </table> <p>Information Criteria</p> <table border="0"> <tr><td>Number of Free Parameters</td><td>51</td></tr> <tr><td>Akaike (AIC)</td><td>8991.773</td></tr> <tr><td>Bayesian (BIC)</td><td>9145.654</td></tr> <tr><td>Sample-Size Adjusted BIC</td><td>8984.244</td></tr> <tr><td colspan="2">(n* = (n + 2) / 24)</td></tr> </table> <p>RMSEA (Root Mean Square Error Of Approximation)</p> <table border="0"> <tr><td>Estimate</td><td>0.094</td></tr> <tr><td>90 Percent C.I.</td><td>0.081 0.107</td></tr> <tr><td>Probability RMSEA <= .05</td><td>0.000</td></tr> </table> <p>SRMR (Standardized Root Mean Square Residual)</p> <table border="0"> <tr><td>Value</td><td>0.108</td></tr> </table> <p>How does this fit compare to the factor variance invariant model (5)?</p> <p>FACTOR MEANS FROM MODEL 6 (REPRESENT MEAN DIFFERENCES):</p> <table border="0"> <tr><td>FACTOR1</td><td>0.000</td><td>0.000</td><td>999.000</td><td>999.000</td></tr> <tr><td>FACTOR2</td><td>0.364</td><td>0.073</td><td>5.006</td><td>0.000</td></tr> <tr><td>FACTOR3</td><td>0.364</td><td>0.073</td><td>5.006</td><td>0.000</td></tr> </table>	Value	321.682	Degrees of Freedom	138	P-Value	0.0000	CFI	0.910	TLI	0.900	Number of Free Parameters	51	Akaike (AIC)	8991.773	Bayesian (BIC)	9145.654	Sample-Size Adjusted BIC	8984.244	(n* = (n + 2) / 24)		Estimate	0.094	90 Percent C.I.	0.081 0.107	Probability RMSEA <= .05	0.000	Value	0.108	FACTOR1	0.000	0.000	999.000	999.000	FACTOR2	0.364	0.073	5.006	0.000	FACTOR3	0.364	0.073	5.006	0.000
Value	314.385																																																																																						
Degrees of Freedom	137																																																																																						
P-Value	0.0000																																																																																						
CFI	0.913																																																																																						
TLI	0.903																																																																																						
Number of Free Parameters	52																																																																																						
Akaike (AIC)	8986.475																																																																																						
Bayesian (BIC)	9143.374																																																																																						
Sample-Size Adjusted BIC	8978.799																																																																																						
(n* = (n + 2) / 24)																																																																																							
Estimate	0.093																																																																																						
90 Percent C.I.	0.079 0.106																																																																																						
Probability RMSEA <= .05	0.000																																																																																						
Value	0.100																																																																																						
FACTOR1	0.000	0.000	999.000	999.000																																																																																			
FACTOR2	0.291	0.076	3.851	0.000																																																																																			
FACTOR3	0.517	0.091	5.685	0.000																																																																																			
Value	321.682																																																																																						
Degrees of Freedom	138																																																																																						
P-Value	0.0000																																																																																						
CFI	0.910																																																																																						
TLI	0.900																																																																																						
Number of Free Parameters	51																																																																																						
Akaike (AIC)	8991.773																																																																																						
Bayesian (BIC)	9145.654																																																																																						
Sample-Size Adjusted BIC	8984.244																																																																																						
(n* = (n + 2) / 24)																																																																																							
Estimate	0.094																																																																																						
90 Percent C.I.	0.081 0.107																																																																																						
Probability RMSEA <= .05	0.000																																																																																						
Value	0.108																																																																																						
FACTOR1	0.000	0.000	999.000	999.000																																																																																			
FACTOR2	0.364	0.073	5.006	0.000																																																																																			
FACTOR3	0.364	0.073	5.006	0.000																																																																																			

Summary of Longitudinal Invariance Model Comparisons (from Excel workbook):

Model	Model Chi-Square	Model DF	Abs Value Chi Diff	Abs DF Diff	p Value
<u>MEASUREMENT INVARIANCE COMPARISONS</u>					
1. Configural Model	292.514	114			
2a. Full Metric Invariance (Loadings) vs. Configural	316.712	124	24.198	10	0.0070918
2b. Partial Metric: free Var1T1 Loading vs. 2a Full Metric vs. Configural	303.247	123	13.465 10.733	1 9	0.0002431 0.2944553
3a. Scalar Invariance (Intercepts) no Var1T1 vs. 2b. Partial Metric	355.594	132	52.347	9	0.0000000
3b. Partial Scalar Invariance (no Var1T1 or Var5T1) vs. 3a. Full Scalar vs. 2b. Partial Metric	331.911	131	23.683 28.664	1 8	0.0000011 0.0003631
3c. Partial Scalar Invariance (no Var1T1, Var5T1, Var4T1) vs. 3b. Partial Scalar vs. 2b. Partial Metric	316.337	130	15.574 13.090	1 7	0.0000793 0.0699457
3d. Partial Scalar Invariance (no Var1T1, Var5T1, Var4T1, Var2T1) vs. 3c. Partial Scalar vs. 2b. Partial Metric	307.239	129	9.098 3.992	1 6	0.0025589 0.6777591
4a. Residual Variance Invariance (except previous non-invariant items) vs. 3d. Partial Scalar Invariance	341.094	137	33.855	8	0.0000432
4b. Residual Variance Invariance (except non-invariant items + Var5T2) vs. 4a. Fully Residual Variance vs. 3d. Partial Scalar Invariance	326.427	136	14.667 19.188	1 7	0.0001283 0.0076184
4c. Residual Variance Invariance (except non-invariant items + Var5T2, Var6T1) vs. 4b. Partial Residual Variance vs. 3d. Partial Scalar Invariance	311.852	135	14.575 4.613	1 6	0.0001347 0.5943159
<u>STRUCTURAL INVARIANCE COMPARISONS</u>					
5. Factor Variance Invariance vs. 4c. Partial Residual Invariance	314.385	137	2.533	2	0.2818163
6. Factor Mean Invariance (Time2 vs Time3) vs. 5. Factor Variance Invariance	321.682	138	7.297	1	0.0069070