Empirical Means of Statistics T_μ, T_σ, and T_{ml}

As noted in the article "Fit Indices for Mean Structures with Growth Curve Models" by Ke-Hai Yuan, Zhiyong Zhang and Lifang Deng, the following Table A contains the empirical means of statistics T_μ, T_σ, and T_{ml} for a misspecified linear growth curve model. The population conditions C1 to C4 are specified in Table 1 of the article. When the mean structure is misspecified in C1 and C2, the mean of T_μ increases with N for both normally and nonnormally distributed data. In contrast, the mean of T_σ in C1 and C2 is little affected by N since the covariance structure is correctly specified in the two conditions. However, like the results in Table 3, the mean of T_σ is strongly affected by nonnormally distributed data.

Table A. Empirical means of statistics T_μ, T_σ, and T_{ml} for a misspecified linear growth curve model ($df_\mu = 4$, $df_\sigma = 17$, $df_{ml} = 21$), with conditions being described in Table 1: (C1) misspecified mean structure with population RMSEA corresponding to T_μ equal to .05; (C2) misspecified mean structure with population RMSEA corresponding to T_μ equal to .10; (C3) misspecified covariance structure with population RMSEA corresponding to T_σ equal to .05; (C4) misspecified covariance structure with population RMSEA corresponding to T_σ equal to .10.

		normally distributed data				nonnormally distributed data			
		N				N			
	statistic	100	300	500	800	100	300	500	800
C1	T_μ	4.855	6.962	8.836	11.992	5.034	7.109	9.123	12.282
	T_σ	17.536	17.266	17.303	17.392	41.476	42.998	43.660	43.983
	T_{ml}	22.343	24.205	26.122	29.369	46.460	50.083	52.764	56.250
C2	T_μ	7.748	15.957	23.626	35.949	8.119	16.171	24.229	36.608
	T_σ	17.596	17.367	17.439	17.587	41.543	43.104	43.803	44.186
	T_{ml}	25.267	33.270	41.018	53.491	49.580	59.220	67.983	80.749
C3	T_μ	3.907	3.915	4.007	4.006	3.947	4.054	3.990	3.976
	T_σ	21.546	29.800	38.374	51.024	45.347	55.624	64.915	77.531
	T_{ml}	25.415	33.702	42.373	55.025	49.254	59.664	68.897	81.502
C4	T_μ	3.901	3.912	4.012	4.005	3.959	4.066	3.991	3.985
	T_σ	33.926	67.718	101.829	152.516	57.566	93.633	128.534	178.927
	T_{ml}	37.789	71.617	105.833	156.516	61.486	97.686	132.517	182.907

When the covariance structure is misspecified in C3 and C4, where the mean structure is correctly specified, the mean of T_μ is rather close to its nominal degrees of freedom for all the Ns with both normally and nonnormally distributed data. The mean of T_σ in C3 and C4 monotonically increases with N for both normally and nonnormally distributed data, but the condition of distribution has a clear effect on the value of the means.

In each of the four conditions, the mean of T_{ml} increases with N, and the values of the means with nonnormally distributed data are much greater than those with normally distributed data. This is because T_{ml} approximately equal the sum of T_{μ} and T_{σ}.

Results of Four Models with the Closeness Data in Preacher et al. (2008)

As noted in the article "Fit Indices for Mean Structures with Growth Curve Models" by Ke-Hai Yuan, Zhiyong Zhang and Lifang Deng, the following Table B contains test statistics and fit indices for four models, with data from Table 2.2 of Preacher, Wichman, MacCallum, and Briggs (2008). In the table, H denotes models with homogeneous error variances and V denotes models with independently-varying error variances; C&M denotes covariance and mean structures being jointly evaluated with statistic T_{ml}, C denotes the covariance structure being evaluated alone with statistic T_{σ}, and M denotes the mean structure being evaluated alone with statistic T_{μ}.

Table B. Growth curve model with covariate: Test statistics and fit indices with jointly evaluating the fit in covariances and means (C&M) as well as separately evaluating the fit in covariances (C) and means (M) [$N = 851$ and $p = 6$, data are from Preacher et al. (2008)]. (a) Linear growth model with homogeneous error variances (H), (b) Linear growth model with independently-varying error variances (V), (c) Quadratic growth model with homogeneous error variances (H), (d) Quadratic growth model with independently-varying error variances (V).

	T (df)	p-value	T_b (df_b)	CFI	NFI/R^2	NNFI	RMSEA
Linear (H)							
C&M	81.653 (17)		2272.40 (23)	.971	.964	.961	.067
C	76.586 (14)		2107.80 (19)	.970	.964	.959	.072
M	5.073 (3)	.167	287.88 (4)	.993	.982	.990	.028
Linear (V)							
C&M	58.457 (13)		2148.195 (19)	.979	.973	.969	.064
C	53.862 (10)		1971.162 (15)	.978	.973	.966	.072
M	4.601 (3)	.203	284.666 (4)	.994	.984	.992	.025
Quadratic (H)							
C&M	53.631 (12)		2272.011 (23)	.981	.976	.965	.064
C	51.520 (10)		2104.700 (19)	.980	.976	.962	.070
M	2.114 (2)	.348	284.934 (4)	1.000	.993	.999	.008
Quadratic (V)							
C&M	26.958 (8)	.0007	2148.195 (19)	.991	.987	.979	.053
C	24.669 (6)	.0004	1971.162 (15)	.990	.987	.976	.061
M	2.291 (2)	.318	282.640 (4)	.999	.992	.998	.013

Note: All the omitted p-values are below 10^{-6}.

Across the four models, all the incremental fit indices for jointly evaluating mean and covariance structure models are above .95. However, all the corresponding RMSEAs are also above .05. When separately evaluating the mean and covariance structure models, all the RMSEA_{μ}s are below .03 (close fit), and the one under the quadratic model with equal error variances is below .01 (excellent fit). The results suggest that, covariance structures are not as well fitted as the mean structures across the four models.