



## Fit Indices commonly reported for CFA and SEM

There are more than a dozen different fit statistics researchers use to assess their confirmatory factor analyses and structural equation models. Here we have assembled a list of the most popular fit statistics used and recommended cut-offs that indicate a good fit.

Measure	Name	Description	Cut-off for good fit
$\chi^2$	Model Chi-Square	Assess overall fit and the discrepancy between the sample and fitted covariance matrices. Sensitive to sample size. $H_0$ : The model fits perfectly.	p-value > 0.05
(A)GFI	(Adjusted) Goodness of Fit	GFI is the proportion of variance accounted for by the estimated population covariance. Analogous to $R^2$ . AGFI favors parsimony.	GFI $\geq$ 0.95 AGFI $\geq$ 0.90
(N)NFI TLI	(Non) Normed-Fit Index  Tucker Lewis index	An NFI of .95, indicates the model of interest improves the fit by 95% relative to the null model. NNFI is preferable for smaller samples. Sometimes the NNFI is called the Tucker Lewis index (TLI)	NFI $\geq$ 0.95 NNFI $\geq$ 0.95
CFI	Comparative Fit Index	A revised form of NFI. Not very sensitive to sample size. Compares the fit of a target model to the fit of an independent, or null, model.	CFI $\geq$ .90
RMSEA	Root Mean Square Error of Approximation	A parsimony-adjusted index. Values closer to 0 represent a good fit.	RMSEA < 0.08
(S)RMR	(Standardized) Root Mean Square Residual	The square-root of the difference between the residuals of the sample covariance matrix and the hypothesized model. If items vary in range (i.e. some items are 1-5, others 1-7) then RMR is hard to interpret, better to use SRMR.	SRMR < 0.08
AVE (CFA only)	Average Value Explained	The average of the $R^2$ s for items within a factor	AVE > .5

Kline suggests that at a minimum the following indices should be reported:

- 1) The model chi-square
- 2) RMSEA
- 3) CFI
- 4) SRMR

How to estimate these fit indices:

- In R, use the FitMeasures function from the lavaan package.
- In SAS's Proc Calis, specify the fitindex option with the particular indices you want.
- In Stata, after executing a CFA or SEM, use the command: estat gof, stats(all)

References:

Principles and Practice of Structural Equation Modeling. Rex B. Kline. 2005.

Structural Equation Modelling: Guidelines for Determining Model Fit. Daire Hooper, et al. 2008.