Parsimony Indices

Models with good fit come about in two ways (Mulaik et al., 1989)

1) A hypothesis correctly constraints parameters of the model
2) Models estimates many parameters

Many of the available fit assessments favored complex over simple model.

Overfitting → Cannot generalize easily

Parsimony ratio = degree of freedom from estimated model / degree of freedom from null model

Parsimony indices seek to compensate for the artifactual increase in fit resulting from estimating more parameters.

Parsimony indices are the product of parsimony ratio and goodness-of-fit index.

$$\text{PNFI} = \frac{df}{df_0}\text{NFI} = \frac{df}{\frac{k(k-1)}{2}}\frac{\chi_0^2 - \chi^2}{\chi_0^2}$$

$$\text{PGFI} = \frac{df}{df_0}\text{GFI} = \frac{df}{\frac{k(k+1)}{2}}\left(1 - \frac{\text{tr}(\widehat{\boldsymbol{\Sigma}}^{-1}\mathbf{S} - \mathbf{I})^2}{\text{tr}(\widehat{\boldsymbol{\Sigma}}^{-1}\mathbf{S})^2}\right)$$

where

PNFI	=	Parsimonious normed-fit index
PGFI	=	Parsimonious goodness-of-fit index
df	=	degrees of freedom of the estimated model
df_0	=	degrees of freedom of the null model
NFI	=	Normed-fit index
GFI	=	Goodness-of-fit Index
k	=	number of observed variables
χ_0^2	=	Chi-square statistic of the null model
χ^2	=	Chi-square statistic of the estimated model
$\widehat{\boldsymbol{\Sigma}}$	=	Reproduced variance-covariance matrix from estimated parameters
$\mathbf{S}$	=	Obtained variance-covariance matrix
$\mathbf{I}$	=	Identity matrix

Other parsimonious statistics based on parsimony ratio are PCFI, PNFI2 (based on IFI)

Author Note

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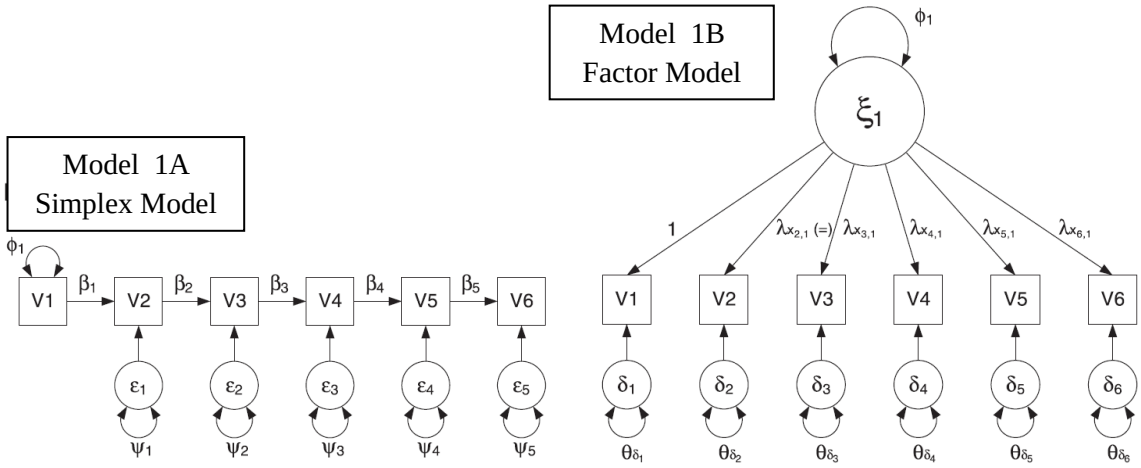
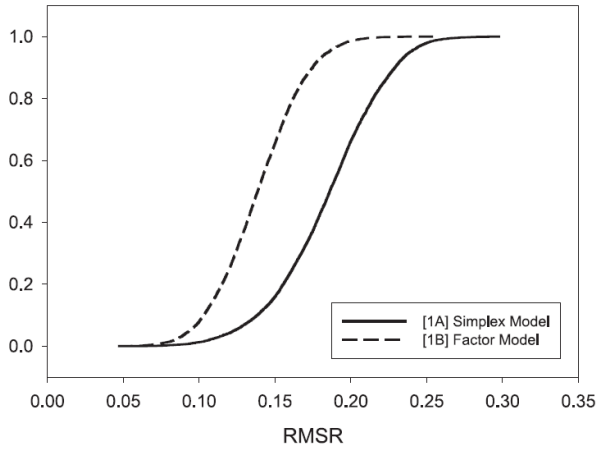
Correspondence to Sunthud Pornprasertmanit Email: psunthud@ku.edu

Model	Parsimonious Ratio	PNFI	PCFI
Default	.867	.788	.854
Saturated	.000	.000	.000
Independence	1.000	.000	.000

From Garson (2009)

Not only the number of free parameters specifies model parsimony, other characteristics account for model parsimony, such as equation form (Preacher, 2006).





Cumulative frequency distributions of RMSR for a simplex model and factor model (both *df* = 11) to the same 10,000 random correlation matrices. From Preacher (2006)

Reference

Garson, G. D. (2009). Structural equation modeling. Retrieved from http://faculty.chass.ncsu.edu/garson/PA765/structur.htm

Mulaik, S. A., James, L. R., Van Alstine., J. Bennett, N., Lind, S., & Stilwell, C. D. (1989). Evaluation of goodness-of-fit indices for structural equation models. Psychological Bulletin, 105, 430-455.

Preacher, K. J. (2006). Quantifying parsimony in structural equation modeling. Multivariate Behavioral Research, 41, 227-259.