

Further Introduction to LISREL

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Agenda

- Identification of latent variable variances
- Unstandardized solution, standardized solution, completely standardized solution.
- Fit statistics
- Residuals and model modification

Fit statistics

- The basic aim of an Lisrel model is to specify a set of linear equations that will reproduce the correlation matrix.
- The success of this is measured by the fit statistics. A model fits if the misfit (distance between implied and empirical correlation matrix) is not significant.
- The lisrel output contains an enormous load of fit statistics, in fact everything that has ever been proposed in the literature.

Test-statistic: Chi-2

- The most often test-statistic is the Chi-2, that follows the chi-2 distribution that we also use when testing the association in a cross-tabulation of counts.
- The same statistic can be applied to the difference between modeled and empirical correlation matrix.
- Most important value: $ndf=1$, $chi2=3.84$, $P=.05$.

Problems with significance testing

- Problems with significance testing are:
 - Significance is an all-or-nothing decision, model fit is typically matter of degree.
 - The quality of the test is critically dependent upon the assumption on multivariate normality.
 - Significance is in the case of a non-fitting model dependent upon sampe size.
- Most alternative measures describe the size of the misfit, in stead of testing it against a H0.
- Size of misfit should not be dependent upon sampe size.

RMSEA

- RMSEA is a function of the average residuals. RMSEA should be around .05 or lower (in a correlation matrix).
- At the same time, the size of the RMSEA can be tested against $H_0=.05$.
- I find this a useful thing to look at. However, evaluation of a model is much more a theoretical argument than a statistical one.
- I also find the chi2 distance between models as a useful thing to look at.

Model modification

- If a model does not fit, it can be modified by estimating (=freeing) extra parameters.
- The most useful suggestions about additional parameters one gets by looking at the residuals.
- Modification indices can also be useful to peek on.
- However, the real important thing is to evaluate the model theoretically. Never modify a model mechanically, try to give an explanation why the patterns are as they are.

KM / CM

- Despite warnings against it, I find it most useful to analyze a correlation matrix. This will generally lead you to a standardized set of equations, similar to standardized regressions.
- Only if you have read in a CM, you can do $MA=CM$. The resulting equations are like understandardized regressions, however without intercept.
- Some fit statistics are not sensitive to the choice, others are. Residuals appear both unstandardised and standardized.

Identifying latent variable variances

- The variance (unit of measurement) of the latent variables is a problematic part in LISREL.
- SPSS factor analysis assumes a completely standardized solution with Z-standardized latent variables.
- This also happens in LISREL by freeing all LY and TE. However this does not always work.
- Alternative: specify one fixed LY=1 (but estimate the corresponding TE). This will equalize the unit of measurement of the latent variable to that of the observed variable.