

## FAQ: How to use latent factors as EFA indicators such as in second order ESEM.

Here is an outline of a 3-stage estimation procedure, which will allow you to use latent variables in combination with other latent or observed variables to conduct a second order EFA.

This approach is similar to EwC approach (ESEM-within-CFA) described in

H. W. Marsh, A.J.S. Morin, P. D. Parker, and G. Kaur (2014) Exploratory Structural Equation Modeling: An Integration of the Best Features of Exploratory and Confirmatory Factor Analysis. *Annu. Rev. Clin. Psychol.* 2014. 10:85-110.

[http://www.vanderbilt.edu/psychological\\_sciences/graduate/programs/quantitative-methods/quantitative-content/marsh\\_morin\\_parker\\_kaur\\_2014.pdf](http://www.vanderbilt.edu/psychological_sciences/graduate/programs/quantitative-methods/quantitative-content/marsh_morin_parker_kaur_2014.pdf)

**Stage 1.** Estimate the full correlation matrix of all the variables in the future EFA model with a sample run like this (here the goal is to estimate the full correlation matrix for the latent variables F1, ..., F9.)

Model:

F1 by A1-A5\*1;

F2 by B1-B6\*1;

F3 by C1-C8\*1;

F4 by D1-D3\*1;

F5 by E1-E4\*1;

F6 by M1-M4\*1;

F7 by G1-G5\*1;

F8 by K1-K6\*1;

F9 by L1-L4\*1;

F1-F9@1;

savdata: tech4=correl.dat;

**Stage 2.** Remove/delete the factor means from the correl.dat file (the first nine entries in the above example). Then run an EFA on that correlation matrix. In this example we run a second order 3 factor EFA.

DATA: File IS correl.dat;

TYPE IS correlation; nobs=589; !(this is the number of observations from Stage 1)

VARIABLE: Names are f1-f9;

ANALYSIS: TYPE = efa 3 3;

**Stage 3.** Determine all large (>0.3) and significant loadings from the Stage 2 EFA and insert those in the Stage 1 input. For example if the stage 2 result looks like this

GEOMIN ROTATED LOADINGS (\* significant at 5% level)

	1	2	3
F1	0.927*	0.009	-0.196*
F2	0.964*	-0.089	0.000
F3	0.507*	0.326*	0.033
F4	0.435*	0.004	0.341*
F5	0.346*	0.625*	-0.009*
F6	-0.002	1.251*	-0.300*
F7	0.164*	0.743*	0.045
F8	0.040	0.300*	0.636*
F9	-0.015*	0.210	0.812*

Then use the following model in Stage 3 and as your final model

Model:

F1 by A1-A5;

F2 by B1-B6;

F3 by C1-C8;

F4 by D1-D3;

F5 by E1-E4;

F6 by M1-M4;

F7 by G1-G5;

F8 by K1-K6;

F9 by L1-L4;

FF1 by F1-F4; !(those are determined in stage 2 – the significant/large loadings)

FF2 by F3 F5-F7; !(those are determined in stage 2 – the significant/large loadings)

FF3 by F4 F8 F9; !(those are determined in stage 2 – the significant/large loadings)