One-Factor CFA Example

Mplus

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Mplus VERSION 8.9
MUTHEN & MUTHEN

INPUT INSTRUCTIONS


  title:  Self-esteem CFA Example--One Factor;

  data:  file=se1.dat;  format=free;
  !note that this data set contains no missing values;

  variable:  names = rnotworr rnumqal ramfailr ramable rnotprdr rfelpos;
     usevariables = rnotworr rnumqal ramfailr ramable rnotprdr rfelpos;


  analysis:  type=general; estimator=ml;
  !  For now, I am using the above analysis commands to estimate using ML, non-robust,
  !   with no missing data estimation, but this will change later;

  model:
  se by rnotworr rnumqal ramfailr ramable rnotprdr rfelpos;

  !by default, Mplus sets the first loading to 1 for identification;

     !factor variance identification approach;
     !se by rnotworr*1 rnumqal-rfelpos;
        !se@1;
     ! rnotprdr with rnumqal;

      !setting the second indicator as referent:
      !se by rnotworr* rnumqal@1 ramfailr ramable rnotprdr rfelpos;

      !altenative specification of factor variance identification:
      !se by rnotworr* rnumqal ramfailr ramable rnotprdr rfelpos;
      !se@1;

      !the effects coding approach to factor variance identification (Little et al 2008)
   !   se by rnotworr* (ly1)
    !  rnumqal (ly2)
    !  ramfailr (ly3)
    !  ramable (ly4)
    !  rnotprdr (ly5)
    !  rfelpos (ly6);

  !model constraint:
  !    ly1 = 6 - ly2 - ly3 -ly4 - ly5 - ly6;

  output:  stdyx;



INPUT READING TERMINATED NORMALLY



Self-esteem CFA Example--One Factor;

SUMMARY OF ANALYSIS

Number of groups                                                 1
Number of observations                                         118

Number of dependent variables                                    6
Number of independent variables                                  0
Number of continuous latent variables                            1

Observed dependent variables

  Continuous
   RNOTWORR    RNUMQAL     RAMFAILR    RAMABLE     RNOTPRDR    RFELPOS
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Continuous latent variables
   SE


Estimator                                                      ML
Information matrix                                       OBSERVED
Maximum number of iterations                                1000
Convergence criterion                                  0.500D-04
Maximum number of steepest descent iterations                 20

Input data file(s)
  se1.dat

Input data format  FREE
```

UNIVARIATE SAMPLE STATISTICS

UNIVARIATE HIGHER-ORDER MOMENT DESCRIPTIVE STATISTICS

Variable/ Sample Size	Mean/ Variance	Skewness/ Kurtosis	Minimum/ Maximum	% with Min/Max	Percentiles 20%/60%	40%/80%	Median
RNOTWORR	3.653	-0.935	1.000	2.54%	2.000	4.000	4.000
118.000	1.023	-0.029	5.000	13.56%	4.000	4.000	
RNUMQAL	4.093	-1.658	1.000	0.85%	4.000	4.000	4.000
118.000	0.322	8.974	5.000	16.95%	4.000	4.000	
RAMFAILR	4.008	-1.107	2.000	6.78%	4.000	4.000	4.000
118.000	0.517	2.032	5.000	19.49%	4.000	4.000	
RAMABLE	3.475	-0.887	1.000	2.54%	2.000	4.000	4.000
118.000	0.876	-0.184	5.000	5.08%	4.000	4.000	
RNOTPRDR	3.992	-1.352	2.000	7.63%	4.000	4.000	4.000
118.000	0.483	2.928	5.000	16.10%	4.000	4.000	
RFELPOS	3.678	-0.949	2.000	10.17%	3.000	4.000	4.000
118.000	0.540	0.535	5.000	5.93%	4.000	4.000	

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THE MODEL ESTIMATION TERMINATED NORMALLY

MODEL FIT INFORMATION

Number of Free Parameters                       18

Loglikelihood

          H0 Value                       -757.201
          H1 Value                       -747.474

Information Criteria

          Akaike (AIC)                   1550.402
          Bayesian (BIC)                 1600.274
          Sample-Size Adjusted BIC       1543.371
            (n* = (n + 2) / 24)

Chi-Square Test of Model Fit

          Value                             19.454
          Degrees of Freedom                    9
          P-Value                           0.0216

RMSEA (Root Mean Square Error Of Approximation)

          Estimate                           0.099
          90 Percent C.I.                    0.036  0.160
          Probability RMSEA <= .05           0.086

CFI/TLI

          CFI                                0.910
          TLI                                0.850
```

Chi-Square Test of Model Fit for the Baseline Model

Value	131.265
Degrees of Freedom	15
P-Value	0.0000

SRMR (Standardized Root Mean Square Residual)

Value	0.054

MODEL RESULTS

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
SE BY				
RNOTWORR	1.000	0.000	999.000	999.000
RNUMQAL	0.637	0.175	3.633	0.000
RAMFAILR	0.969	0.213	4.541	0.000
RAMABLE	0.265	0.203	1.301	0.193
RNOTPRDR	1.262	0.314	4.019	0.000
RFELPOS	0.478	0.174	2.740	0.006
Intercepts				
RNOTWORR	3.653	0.093	39.222	0.000
RNUMQAL	4.093	0.052	78.379	0.000
RAMFAILR	4.008	0.066	60.566	0.000
RAMABLE	3.475	0.086	40.316	0.000
RNOTPRDR	3.992	0.064	62.390	0.000
RFELPOS	3.678	0.068	54.351	0.000
Variances				
SE	0.231	0.099	2.340	0.019
Residual Variances				
RNOTWORR	0.793	0.115	6.881	0.000
RNUMQAL	0.228	0.033	6.932	0.000
RAMFAILR	0.300	0.058	5.173	0.000
RAMABLE	0.860	0.113	7.645	0.000
RNOTPRDR	0.116	0.061	1.912	0.056
RFELPOS	0.488	0.065	7.468	0.000

QUALITY OF NUMERICAL RESULTS

Condition Number for the Information Matrix (ratio of smallest to largest eigenvalue)	0.237E-02

STANDARDIZED MODEL RESULTS

STDYX Standardization

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
SE BY				
RNOTWORR	0.475	0.089	5.355	0.000
RNUMQAL	0.539	0.077	7.000	0.000
RAMFAILR	0.647	0.083	7.758	0.000
RAMABLE	0.136	0.101	1.342	0.180
RNOTPRDR	0.872	0.073	11.933	0.000
RFELPOS	0.312	0.095	3.298	0.001
Intercepts				
RNOTWORR	3.611	0.252	14.304	0.000
RNUMQAL	7.215	0.479	15.075	0.000
RAMFAILR	5.576	0.374	14.891	0.000
RAMABLE	3.711	0.259	14.355	0.000
RNOTPRDR	5.743	0.385	14.917	0.000
RFELPOS	5.003	0.338	14.783	0.000
Variances				
SE	1.000	0.000	999.000	999.000

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 Residual Variances
    RNOTWORR           0.775      0.084      9.201      0.000
    RNUMQAL            0.709      0.083      8.539      0.000
    RAMFAILR           0.581      0.108      5.373      0.000
    RAMABLE            0.982      0.027     35.702      0.000
    RNOTPRDR           0.240      0.127      1.882      0.060
    RFELPOS            0.903      0.059     15.285      0.000


R-SQUARE

    Observed                                        Two-Tailed
    Variable        Estimate       S.E.  Est./S.E.    P-Value

    RNOTWORR           0.225      0.084      2.678      0.007
    RNUMQAL            0.291      0.083      3.500      0.000
    RAMFAILR           0.419      0.108      3.879      0.000
    RAMABLE            0.018      0.027      0.671      0.502
    RNOTPRDR           0.760      0.127      5.966      0.000
    RFELPOS            0.097      0.059      1.649      0.099
```

lavaan

```
> rm(model)
> remove(d)
>
>
>
>
> ## One-factor CFA example, Newsom's SEM Class, self-esteem
>
> #there is an error in the variable names list and there should be more:
> #rnotworr ' ' rnumqal ' ' ramfailr ' ' ramable ' 'rnotprdr ' '
> #rfelpos ' ' rfelsat ' 'rwishmrr ' ' ruselesr ' ' rspnogdr .
> d <- read.table(file=paste('c:/jason/mplus/semclass/se1.dat',sep="/"))
> names(d) = c("rnotworr","rnumqal","ramfailr","ramable","rnotprdr","rfelpos")
> #Note, there are no missing values, otherwise might need to identify, e.g.,
> ##d[d == -99] <- NA
>
> library(lavaan)
> model = '
+        se =~ rnotworr + rnumqal + ramfailr + ramable + rnotprdr + rfelpos
+ '
> # For now, I use the following analysis commands to estimate using ML, non-robust,
> #   with no missing data estimation
> fit = sem(model, data = d)
> summary(fit,fit.measures=TRUE, rsquare=TRUE, standardized=TRUE)
lavaan 0.6-18 ended normally after 30 iterations

  Estimator                                         ML
  Optimization method                           NLMINB
  Number of model parameters                        12

  Number of observations                           118

Model Test User Model:

  Test statistic                                19.454
  Degrees of freedom                                 9
  P-value (Chi-square)                           0.022

Model Test Baseline Model:

  Test statistic                               131.265
  Degrees of freedom                                15
  P-value                                        0.000

User Model versus Baseline Model:

  Comparative Fit Index (CFI)                    0.910
  Tucker-Lewis Index (TLI)                       0.850

Loglikelihood and Information Criteria:

  Loglikelihood user model (H0)              -757.201
  Loglikelihood unrestricted model (H1)      -747.474

  Akaike (AIC)                               1538.402
  Bayesian (BIC)                             1571.650
  Sample-size adjusted Bayesian (SABIC)      1533.715

Root Mean Square Error of Approximation:
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  RMSEA                                          0.099
  90 Percent confidence interval - lower         0.036
  90 Percent confidence interval - upper         0.160
  P-value H_0: RMSEA <= 0.050                    0.086
  P-value H_0: RMSEA >= 0.080                    0.737

Standardized Root Mean Square Residual:

  SRMR                                           0.061

Parameter Estimates:

  Standard errors                             Standard
  Information                                 Expected
  Information saturated (h1) model          Structured

Latent Variables:
                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
  se =~
    rnotworr          1.000                               0.480    0.475
    rnumqal           0.637    0.159    4.012    0.000    0.306    0.539
    ramfailr          0.969    0.220    4.405    0.000    0.466    0.647
    ramable           0.265    0.202    1.309    0.190    0.127    0.136
    rnotprdr          1.262    0.279    4.521    0.000    0.606    0.872
    rfelpos           0.478    0.174    2.751    0.006    0.229    0.312

Variances:
                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
   .rnotworr          0.793    0.111    7.134    0.000    0.793    0.775
   .rnumqal           0.228    0.033    6.866    0.000    0.228    0.709
   .ramfailr          0.300    0.050    6.029    0.000    0.300    0.581
   .ramable           0.860    0.112    7.650    0.000    0.860    0.982
   .rnotprdr          0.116    0.051    2.268    0.023    0.116    0.240
   .rfelpos           0.488    0.065    7.496    0.000    0.488    0.903
    se                0.231    0.094    2.460    0.014    1.000    1.000

R-Square:
                   Estimate
    rnotworr          0.225
    rnumqal           0.291
    ramfailr          0.419
    ramable           0.018
    rnotprdr          0.760
    rfelpos           0.097
```

Write-up

I will provide a write-up example with the next confirmatory factor analysis example.