

Multigroup SEM Example¹

All Parameters Free Across Groups

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title: Multigroup structural model example--All parameters free ;

data: file=C:\Jason\mplus\semclass\stack1.dat; format=11f1.0;
      listwise=on;

variable: names = widow panas1 panas2 panas3 panas4 panas5
           panas6 panas7 panas8 panas9 panas10 ;
           grouping is widow (0=notwidow,1=widow);

           missing = blank;

analysis: type=general; iterations = 200;
           model=nomeanstructure; information=expected;

model: posaff by panas1* panas2@1 panas3-panas5;
       negaff by panas6-panas9* panas10@1;

! Note: by default in Mplus, measurement errors and factor correlations are not
! constrained to be equal across groups;

Model notwidow: posaff by panas1* panas2@1 panas3-panas5;
                negaff by panas6-panas9* panas10@1;

Model widow: posaff by panas1* panas2@1 panas3-panas5;
              negaff by panas6-panas9* panas10@1;

output: stdyx ;

Multigroup structural model example--All parameters free ;
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SUMMARY OF ANALYSIS

Number of groups	2
Number of observations	
Group NOTWIDOW	159
Group WIDOW	40
Number of dependent variables	10
Number of independent variables	0
Number of continuous latent variables	2

Grouping variable WIDOW

TESTS OF MODEL FIT

Chi-Square Test of Model Fit

Value	112.947
Degrees of Freedom	68
P-Value	0.0005

Chi-Square Contributions From Each Group

NOTWIDOW	72.686
WIDOW	40.260

Chi-Square Test of Model Fit for the Baseline Model

Value	1643.772
Degrees of Freedom	90
P-Value	0.0000

CFI/TLI

CFI	0.971
TLI	0.962

RMSEA (Root Mean Square Error Of Approximation)

Estimate	0.082
90 Percent C.I.	0.054 0.108

¹ Note: I only illustrate some of the tests that may be needed (e.g., loadings or all parameters equal vs. all parameters free). For brevity sake, I do not illustrate, comparison of variances, covariances, or mean and intercept comparisons. See the handout "Multigroup SEM" for an overview.

SRMR (Standardized Root Mean Square Residual)
 Value 0.046

MODEL RESULTS

Group	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
NOTWIDOW				
POSAFF BY				
PANAS1	0.861	0.066	13.107	0.000
PANAS2	1.000	0.000	999.000	999.000
PANAS3	0.914	0.067	13.676	0.000
PANAS4	0.988	0.070	14.073	0.000
PANAS5	0.960	0.075	12.789	0.000
NEGAFF BY				
PANAS6	0.981	0.093	10.577	0.000
PANAS7	0.734	0.093	7.936	0.000
PANAS8	0.919	0.093	9.884	0.000
PANAS9	0.467	0.073	6.419	0.000
PANAS10	1.000	0.000	999.000	999.000
NEGAFF WITH				
POSAFF	-0.474	0.085	-5.555	0.000
Variances				
POSAFF	0.748	0.123	6.073	0.000
NEGAFF	0.661	0.135	4.889	0.000
Residual Variances				
PANAS1	0.176	0.024	7.277	0.000
PANAS2	0.405	0.051	7.965	0.000
PANAS3	0.153	0.023	6.775	0.000
PANAS4	0.145	0.023	6.271	0.000
PANAS5	0.250	0.033	7.484	0.000
PANAS6	0.102	0.026	3.868	0.000
PANAS7	0.442	0.053	8.266	0.000
PANAS8	0.227	0.034	6.671	0.000
PANAS9	0.357	0.042	8.598	0.000
PANAS10	0.697	0.086	8.144	0.000
Group WIDOW				
POSAFF BY				
PANAS1	0.872	0.061	14.349	0.000
PANAS2	1.000	0.000	999.000	999.000
PANAS3	0.828	0.072	11.478	0.000
PANAS4	0.842	0.074	11.361	0.000
PANAS5	0.730	0.085	8.636	0.000
NEGAFF BY				
PANAS6	1.625	0.425	3.822	0.000
PANAS7	1.407	0.382	3.682	0.000
PANAS8	1.247	0.350	3.558	0.000
PANAS9	0.599	0.232	2.581	0.010
PANAS10	1.000	0.000	999.000	999.000
NEGAFF WITH				
POSAFF	-0.400	0.184	-2.168	0.030
Variances				
POSAFF	1.568	0.400	3.920	0.000
NEGAFF	0.457	0.254	1.800	0.072
Residual Variances				
PANAS1	0.045	0.023	1.977	0.048
PANAS2	0.230	0.061	3.785	0.000
PANAS3	0.160	0.042	3.798	0.000
PANAS4	0.172	0.045	3.828	0.000
PANAS5	0.315	0.075	4.222	0.000
PANAS6	0.091	0.077	1.176	0.240
PANAS7	0.314	0.091	3.431	0.001
PANAS8	0.388	0.100	3.897	0.000
PANAS9	0.533	0.121	4.396	0.000
PANAS10	1.117	0.256	4.369	0.000

All Parameters Constrained Across Groups

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title: Multigroup structural model example--All Parameters Equal ;

data: file=C:\Jason\mplus\semclass\stack1.dat; format=11f1.0;
      listwise=on;

variable: names = widow panas1 panas2 panas3 panas4 panas5
           panas6 panas7 panas8 panas9 panas10 ;
           grouping is widow (0=notwidow,1=widow);

           missing = blank;

analysis: type=general; iterations = 200;
           model=nomeanstructure; information=expected;

model: posaff by panas1-panas5;
       negaff by panas6-panas10;

! The above statements lead to loadings equal by default
! but other parameters must be set equal using the following statements
! and some authors recommend using highest loading for reference variable;

Model notwidow: posaff by panas1* (1)
                 panas2@1
                 panas3-panas5 (2-4);
                 negaff by panas6-panas9* (5-8)
                 panas10@1;

                 panas1-panas5 (9-13) ! measurement variances equal;
                 panas6-panas10 (14-18);

                 posaff (19);           ! factor variance equal;
                 negaff (20);

                 posaff with negaff (21); ! factor covariance equal;

Model widow: posaff by panas1* (1)
              panas2@1
              panas3-panas5 (2-4);
              negaff by panas6-panas9* (5-8)
              panas10@1;

              panas1-panas5 (9-13) ! measurement variances equal;
              panas6-panas10 (14-18);

              posaff (19);           ! factor variance equal;
              negaff (20);

              posaff with negaff (21); ! factor covariance equal;

output: stdyx ;

```

TESTS OF MODEL FIT

Chi-Square Test of Model Fit

Value	166.403
Degrees of Freedom	89
P-Value	0.0000

Chi-Square Contributions From Each Group

NOTWIDOW	86.052
WIDOW	80.351

MODEL RESULTS

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
Group NOTWIDOW				
POSAFF BY				
PANAS1	0.861	0.049	17.498	0.000

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PANAS2	1.000	0.000	999.000	999.000
PANAS3	0.877	0.050	17.411	0.000
PANAS4	0.930	0.052	17.772	0.000
PANAS5	0.878	0.056	15.605	0.000

NEGAFF BY

PANAS6	1.096	0.101	10.881	0.000
PANAS7	0.867	0.096	9.039	0.000
PANAS8	0.987	0.097	10.220	0.000
PANAS9	0.501	0.073	6.900	0.000
PANAS10	1.000	0.000	999.000	999.000

NEGAFF WITH

POSAFF	-0.468	0.079	-5.927	0.000
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Variances

POSAFF	0.924	0.125	7.387	0.000
NEGAFF	0.612	0.120	5.089	0.000

Residual Variances

PANAS1	0.148	0.020	7.593	0.000
PANAS2	0.358	0.041	8.660	0.000
PANAS3	0.159	0.021	7.662	0.000
PANAS4	0.158	0.021	7.354	0.000
PANAS5	0.269	0.031	8.627	0.000
PANAS6	0.116	0.028	4.208	0.000
PANAS7	0.423	0.047	8.961	0.000
PANAS8	0.253	0.034	7.537	0.000
PANAS9	0.388	0.040	9.624	0.000
PANAS10	0.789	0.085	9.268	0.000

Group WIDOW

POSAFF BY

PANAS1	0.861	0.049	17.498	0.000
PANAS2	1.000	0.000	999.000	999.000
PANAS3	0.877	0.050	17.411	0.000
PANAS4	0.930	0.052	17.772	0.000
PANAS5	0.878	0.056	15.605	0.000

NEGAFF BY

PANAS6	1.096	0.101	10.881	0.000
PANAS7	0.867	0.096	9.039	0.000
PANAS8	0.987	0.097	10.220	0.000
PANAS9	0.501	0.073	6.900	0.000
PANAS10	1.000	0.000	999.000	999.000

NEGAFF WITH

POSAFF	-0.468	0.079	-5.927	0.000
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Variances

POSAFF	0.924	0.125	7.387	0.000
NEGAFF	0.612	0.120	5.089	0.000

Residual Variances

PANAS1	0.148	0.020	7.593	0.000
PANAS2	0.358	0.041	8.660	0.000
PANAS3	0.159	0.021	7.662	0.000
PANAS4	0.158	0.021	7.354	0.000
PANAS5	0.269	0.031	8.627	0.000
PANAS6	0.116	0.028	4.208	0.000
PANAS7	0.423	0.047	8.961	0.000
PANAS8	0.253	0.034	7.537	0.000
PANAS9	0.388	0.040	9.624	0.000
PANAS10	0.789	0.085	9.268	0.000

Loadings Only Constrained Equal Across Groups

INPUT INSTRUCTIONS

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title: Multigroup structural model example--Loadings Only Equal ;

data: file=C:\Jason\mplus\semclass\stack1.dat; format=11f1.0;
      listwise=on;

variable: names = widow panas1 panas2 panas3 panas4 panas5
           panas6 panas7 panas8 panas9 panas10 ;
           grouping is widow (0=notwidow,1=widow);

           missing = blank;

analysis: type=general; iterations = 200;
           model=nomeanstructure; information=expected;

model: posaff by panas1* panas2@1 panas3-panas5;
       negaff by panas6-panas9* panas10@1;

! Note: by default in Mplus, measurement errors and factor correlations are not
! constrained to be equal across groups;

Model notwidow: posaff by panas1* (1)
                 panas2@1
                 panas3-panas5 (2-4);
                 negaff by panas6-panas9* (5-8)
                 panas10@1;

Model widow: posaff by panas1* (1)
              panas2@1
              panas3-panas5 (2-4);
              negaff by panas6-panas9* (5-8)
              panas10@1;

output: stdyx ;
  
```

TESTS OF MODEL FIT

Chi-Square Test of Model Fit

Value	128.908
Degrees of Freedom	76
P-Value	0.0001

Chi-Square Contributions From Each Group

NOTWIDOW	77.761
WIDOW	51.147

CFI/TLI

CFI	0.966
TLI	0.960

RMSEA (Root Mean Square Error Of Approximation)

Estimate	0.084
90 Percent C.I.	0.058 0.108

SRMR (Standardized Root Mean Square Residual)

Value	0.065
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MODEL RESULTS

Group	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
Group NOTWIDOW				
POSAFF BY				
PANAS1	0.875	0.045	19.441	0.000
PANAS2	1.000	0.000	999.000	999.000
PANAS3	0.873	0.048	18.163	0.000
PANAS4	0.926	0.050	18.471	0.000
PANAS5	0.876	0.055	15.947	0.000
NEGAFF BY				
PANAS6	1.070	0.096	11.179	0.000

PANAS7	0.854	0.092	9.273	0.000
PANAS8	0.964	0.093	10.407	0.000
PANAS9	0.486	0.070	6.909	0.000
PANAS10	1.000	0.000	999.000	999.000
NEGAFF WITH				
POSAFF	-0.458	0.080	-5.744	0.000
Variances				
POSAFF	0.809	0.116	6.951	0.000
NEGAFF	0.569	0.114	4.987	0.000
Residual Variances				
PANAS1	0.170	0.024	7.040	0.000
PANAS2	0.394	0.050	7.868	0.000
PANAS3	0.154	0.023	6.837	0.000
PANAS4	0.153	0.023	6.549	0.000
PANAS5	0.261	0.034	7.688	0.000
PANAS6	0.097	0.026	3.715	0.000
PANAS7	0.441	0.054	8.181	0.000
PANAS8	0.232	0.034	6.907	0.000
PANAS9	0.358	0.041	8.632	0.000
PANAS10	0.707	0.085	8.287	0.000
Group WIDOW				
POSAFF BY				
PANAS1	0.875	0.045	19.441	0.000
PANAS2	1.000	0.000	999.000	999.000
PANAS3	0.873	0.048	18.163	0.000
PANAS4	0.926	0.050	18.471	0.000
PANAS5	0.876	0.055	15.947	0.000
NEGAFF BY				
PANAS6	1.070	0.096	11.179	0.000
PANAS7	0.854	0.092	9.273	0.000
PANAS8	0.964	0.093	10.407	0.000
PANAS9	0.486	0.070	6.909	0.000
PANAS10	1.000	0.000	999.000	999.000
NEGAFF WITH				
POSAFF	-0.569	0.221	-2.578	0.010
Variances				
POSAFF	1.450	0.351	4.130	0.000
NEGAFF	0.954	0.277	3.451	0.001
Residual Variances				
PANAS1	0.055	0.023	2.372	0.018
PANAS2	0.232	0.061	3.816	0.000
PANAS3	0.158	0.042	3.736	0.000
PANAS4	0.171	0.046	3.704	0.000
PANAS5	0.327	0.079	4.126	0.000
PANAS6	0.142	0.072	1.983	0.047
PANAS7	0.345	0.091	3.776	0.000
PANAS8	0.360	0.100	3.607	0.000
PANAS9	0.526	0.121	4.337	0.000
PANAS10	1.140	0.271	4.204	0.000

Chi-square comparisons

	Comparison to all-free model			
	χ^2	df	$\Delta\chi^2$	Δdf
All parameters free	112.947	68		
All parameters equal	166.403	89	53.456***	21
Loadings only equal	128.908	76	15.961 ^a	8

^a p < .10, * p < .05, ** p < .01, *** p < .001