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Mplus Annotated Output

This document provides annotated Mplus output for the communication example in Chapter 12. I use output for the WLSMV estimator because it is more complete than that for maximum likelihood and doing so allows me to highlight fit indices that otherwise are not available. The concepts directly generalize to the maximum likelihood based output, with minor exceptions. For interpretation of Mplus output more generally, see the Output tab on my webpage. The annotations I added appear in **red:**

Mplus first repeats the input syntax.

```
INPUT INSTRUCTIONS

  TITLE: Probit ;
  DATA: FILE IS c:\mplus\communication.dat ;
  DEFINE:
  CENTER CQ1 BS1 PA1 PK1 PE1 (GRANDMEAN) ;
  VARIABLE:
      NAMES ARE ID COM3 PA2 PK2 PE2 CQ1
      PA1 PK1 PE1 TREAT BS1 ;
      USEVARIABLES ARE COM3 PA2 PK2 PE2 CQ1
      PA1 PK1 PE1 TREAT BS1 ;
      CATEGORICAL ARE COM3 ;
      MISSING ARE ALL (-9999) ;
  ANALYSIS:
    ESTIMATOR = WLSMV ;
  MODEL:
  PA2 ON BS1 CQ1 TREAT PA1  (b1 b2 p1 b3) ;
  PK2 ON BS1 CQ1 TREAT PK1  (b4 b5 p2 b6) ;
  PE2 ON BS1 CQ1 TREAT PE1  (b7 b8 p3 b9) ;
  COM3 ON PA2 PK2 PE2 TREAT BS1 CQ1 (p4 p5 p6 p7 b10 b11) ;
  [COM3$1] (thresh) ;
  [PA2] (a1) ;
  [PK2] (a2) ;
  [PE2] (a3) ;
  MODEL INDIRECT:
     COM3 IND TREAT ;
   OUTPUT: SAMP STANDARDIZED(STDY) RESIDUAL MOD(ALL 4)
    CINTERVAL TECH4 ;
```

Mplus indicates there were no syntax errors.

INPUT READING TERMINATED NORMALLY

Mplus repeats the title line at the top of new pages. I delete them after this one in the interest of saving space

Probit ;

SUMMARY OF ANALYSIS

Mplus will do single group or multiple group analyses. Below it tells us that it is doing a single group analysis with N = 1500.

Number of groups	1
Number of observations	1500

Mplus indicates below the number of endogenous (dependent) variables in the model, the number of exogenous (independent) variables in the model, and the number of latent continuous variables.

Number of dependent variables	4
Number of independent variables	6
Number of continuous latent variables	0

Mplus identifies the names of variables that are in each of the above categories.

Observed dependent variables

  Continuous
   PA2 PK2 PE2

  Binary and ordered categorical (ordinal)
   COM3

Observed independent variables
   CQ1 PA1 PK1 PE1 TREAT BS1

Variables with special functions

Mplus tells you any centering that was done.

  Centering (GRANDMEAN)
   CQ1 BS1 PA1 PK1 PE1

Mplus tells you the estimator it used and then provides some technical information.

Estimator	WLSMV
Maximum number of iterations	1000
Convergence criterion	0.500D-04
Maximum number of steepest descent iterations	20
Maximum number of iterations for H1	2000
Convergence criterion for H1	0.100D-03
Parameterization	DELTA
Link	PROBIT

Mplus tells you the input data file it used and the format it was in.

```
Input data file(s)
  c:\mplus\communication.dat ;

Input data format  FREE
```

SUMMARY OF DATA

Mplus tells you the number of different missing data patterns. In this case, there was only one and it represented no missing data because every case had complete data. See the Output tab on my web page to for how to interpret more complex missing data output.

Number of missing data patterns 1

COVARIANCE COVERAGE OF DATA

Minimum covariance coverage value 0.100

Mplus tells you below the proportion of complete cases for each variance and covariance of the input data. See the Output tab of my web page for details. In the present case, there was no missing data because the proportion of the data present in each cell of the covariance matrix was 1.000.

PROPORTION OF DATA PRESENT

Covariance Coverage

	COM3	PA2	PK2	PE2
COM3	1.000			
PA2	1.000	1.000		
PK2	1.000	1.000	1.000	
PE2	1.000	1.000	1.000	1.000

Mplus tells you the proportion of cases that were in the two categories for the binary outcome variable

UNIVARIATE PROPORTIONS AND COUNTS FOR CATEGORICAL VARIABLES

COM3

Category 1	0.532	798.000
Category 2	0.468	702.000

SAMPLE STATISTICS

Mplus provides below selected descriptive statistics for the model input data. It is good to examine it to make sure it all makes sense so you can be confident the data were read in properly. For the bivariate slopes, the endogenous variables in the rows are regressed onto the exogenous variables in the columns. The slopes for COM3 are probit coefficients

MEANS/INTERCEPTS/THRESHOLDS

COM3$1	PA2	PK2	PE2
0.329	0.063	0.017	-0.062

SLOPES

	CQ1	PA1	PK1	PE1	TREAT
COM3	0.218	0.023	0.240	-0.103	0.496
PA2	0.092	0.360	-0.015	-0.012	0.822
PK2	-0.019	0.006	0.360	0.020	0.842
PE2	-0.122	0.073	-0.016	0.345	0.007

SLOPES

	BS1
COM3	0.293
PA2	0.097
PK2	-0.013
PE2	-0.085

CORRELATION MATRIX (WITH VARIANCES ON THE DIAGONAL)

	COM3	PA2	PK2	PE2
COM3				
PA2	0.121	0.145		
PK2	0.098	0.016	0.153	
PE2	-0.141	0.019	0.012	0.149

Mplus provides more detailed descriptive statistics below. Each variable listed on the left has two rows of information. The labels at the top of the table described the contents of the first row of information (Mean, Skewness, Minimum, % with Minimum Score, 20th percentile, 40th percentile, Median) followed by a / and then the labels for the content of the second row of information for that variable (Sample Size, Variance, Kurtosis, Maximum, % with Maximum Score, 60th percentile, 80th percentile). I use a smaller font here to make everything fit in this table; Mplus uses its standard font.

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
PA2	0.469	0.040	-1.230	0.07%	-0.060	0.300	0.450
1500.000	0.335	-0.476	2.230	0.07%	0.650	0.980	
PK2	0.433	0.042	-1.270	0.07%	-0.110	0.250	0.410
1500.000	0.347	-0.541	2.200	0.07%	0.600	0.970	
PE2	-0.059	-0.008	-1.380	0.07%	-0.410	-0.160	-0.050
1500.000	0.171	-0.127	1.360	0.07%	0.040	0.300	
CQ1	0.000	0.015	-1.072	0.07%	-0.322	-0.102	-0.002
1500.000	0.148	0.016	1.478	0.07%	0.098	0.328	
PA1	0.000	0.034	-1.350	0.07%	-0.330	-0.100	0.000
1500.000	0.149	0.016	1.350	0.07%	0.090	0.320	
PK1	0.000	0.007	-1.339	0.07%	-0.329	-0.099	0.001
1500.000	0.151	0.093	1.441	0.07%	0.091	0.321	
PE1	0.000	0.009	-1.202	0.13%	-0.332	-0.102	-0.002
1500.000	0.152	-0.165	1.108	0.07%	0.098	0.338	
TREAT	0.494	0.024	0.000	50.60%	0.000	0.000	0.000
1500.000	0.250	-1.999	1.000	49.40%	1.000	1.000	
BS1	0.000	-0.099	-0.525	47.53%	-0.525	-0.525	0.475
1500.000	0.249	-1.990	0.475	52.47%	0.475	0.475	

MODEL FIT INFORMATION

Number of Free Parameters 25

Mplus below provides global fit indices for the model, but I do not cover all of them in my book. Some will look familiar to you and others will not.

Chi-Square Test of Model Fit

Value	13.223*
Degrees of Freedom	12
P-Value	0.3530

* The chi-square value for MLM, MLMV, MLR, ULSMV, WLSM and WLSMV cannot be used for chi-square difference testing in the regular way. MLM, MLR and WLSM chi-square difference testing is described on the Mplus website. MLMV, WLSMV, and ULSMV difference testing is done using the DIFFTEST option.

RMSEA (Root Mean Square Error Of Approximation)

Estimate	0.008	
90 Percent C.I.	0.000	0.028
Probability RMSEA <= .05	1.000	

CFI/TLI

CFI	1.000
TLI	0.999

Chi-Square Test of Model Fit for the Baseline Model

Value	4038.687
Degrees of Freedom	30
P-Value	0.0000

SRMR (Standardized Root Mean Square Residual)

Value	0.013

Optimum Function Value for Weighted Least-Squares Estimator

Value	0.43922126D-02

MODEL RESULTS

Below are the unstandardized coefficients and parameter estimates for the model and their associated estimated standard errors (S.E.), critical ratios (Est./S.E.), and p values.

For the three continuous mediators listed first, the coefficients are interpreted per linear regression. Of key interest is the coefficient for the dummy variable TREAT, which is a covariate adjusted mean difference subtracting the control group adjusted mean from the treatment group adjusted mean.

		Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
PA2	ON				
BS1		0.097	0.020	4.923	0.000
CQ1		0.092	0.026	3.511	0.000
TREAT		0.822	0.020	41.593	0.000
PA1		0.358	0.028	12.645	0.000

PK2 ON				
BS1	-0.013	0.020	-0.617	0.537
CQ1	-0.019	0.027	-0.703	0.482
TREAT	0.842	0.020	41.360	0.000
PK1	0.363	0.028	12.925	0.000
PE2 ON				
BS1	-0.085	0.020	-4.250	0.000
CQ1	-0.122	0.026	-4.652	0.000
TREAT	0.007	0.020	0.368	0.713
PE1	0.344	0.027	12.993	0.000

Because COM3 is a binary outcome, the below coefficients are probit coefficients. For continuous predictors, for every one unit that the predictor increases, the predicted probit changes by a value indicated by the coefficient. Stated another way, a one-unit increase in the predictor leads to a change in the z-score corresponding to the probability of the outcome equal to the value of the coefficient. For dummy variables (e.g., TREAT), the coefficient is the covariate adjusted predicted probit for the group scored 1 minus the corresponding probit for the reference group.

COM3 ON				
PA2	0.291	0.080	3.628	0.000
PK2	0.295	0.079	3.722	0.000
PE2	-0.360	0.079	-4.558	0.000
TREAT	0.011	0.113	0.094	0.925
BS1	0.238	0.066	3.596	0.000
CQ1	0.153	0.088	1.747	0.081

Below are the model estimated intercepts for the continuous endogenous variables in the model, with their estimated standard errors, critical ratios, and p values.

Intercepts				
PA2	0.063	0.014	4.556	0.000
PK2	0.017	0.014	1.175	0.240
PE2	-0.062	0.014	-4.443	0.000

Below is the threshold value for binary outcome. If you multiply it by minus one, you obtain the intercept for the probit equation predicting it.

Thresholds				
COM3$1	0.375	0.047	8.038	0.000

Below are the model estimated residual variances for the disturbance terms for endogenous continuous variables in the model. They are unstandardized. You also are given their estimated standard errors, critical ratios, and p values. See my webpage on the OUTPUT tab for how to interpret them.

Residual Variances				
PA2	0.146	0.005	27.747	0.000
PK2	0.153	0.006	27.296	0.000
PE2	0.149	0.006	26.644	0.000

QUALITY OF NUMERICAL RESULTS

Condition Number for the Information Matrix 0.145E-02
(ratio of smallest to largest eigenvalue)

STANDARDIZED MODEL RESULTS

Below are the partially standardized counterparts of the above parameters. Because I used the STDY option for standardization, only the endogenous variables (PA2, PK2, PE2, and the latent y* underlying COM3) are standardized, the exogenous variables are not. Mplus reports critical ratios and p values for them. If one endogenous variable predicts another endogenous variable, then the coefficient is a fully standardized coefficient because both variables have been standardized.

STANDARDIZED MODEL RESULTS

STDY Standardization

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
PA2 ON				
BS1	0.168	0.034	4.920	0.000
CQ1	0.158	0.045	3.522	0.000
TREAT	1.420	0.026	54.719	0.000
PA1	0.617	0.047	13.170	0.000
PK2 ON				
BS1	-0.021	0.034	-0.617	0.537
CQ1	-0.033	0.047	-0.703	0.482
TREAT	1.430	0.026	56.067	0.000
PK1	0.617	0.046	13.410	0.000
PE2 ON				
BS1	-0.206	0.048	-4.263	0.000
CQ1	-0.296	0.063	-4.715	0.000
TREAT	0.018	0.049	0.368	0.713
PE1	0.834	0.059	14.196	0.000

COM3 ON				
PA2	0.161	0.044	3.624	0.000
PK2	0.166	0.045	3.720	0.000
PE2	-0.142	0.031	-4.550	0.000
TREAT	0.010	0.108	0.094	0.925
BS1	0.227	0.062	3.652	0.000
CQ1	0.146	0.083	1.754	0.079
Intercepts				
PA2	0.109	0.025	4.369	0.000
PK2	0.029	0.025	1.163	0.245
PE2	-0.151	0.034	-4.425	0.000
Thresholds				
COM3$1	0.358	0.043	8.384	0.000
Residual Variances				
PA2	0.434	0.017	25.464	0.000
PK2	0.440	0.017	25.534	0.000
PE2	0.872	0.017	51.772	0.000

R-SQUARE

Below are the model estimated squared (multiple) correlations for endogenous variables in the model, with their estimated standard errors, critical ratios, and p values. The squared R for the binary outcome is for the latent propensity y* underlying it.

Observed Variable	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value	Residual Variance
COM3	0.129	0.021	6.210	0.000	0.955
PA2	0.566	0.017	33.231	0.000	
PK2	0.560	0.017	32.432	0.000	
PE2	0.128	0.017	7.605	0.000	

Below are the unstandardized coefficients for analyses of indirect effects that derive from the MODEL INDIRECT command in your syntax. For each effect, you are provided the estimate of the overall coefficient, its estimated standard error, its critical ratio, and its p value. In all cases, the coefficient predicts the unstandardized latent propensity y* underlying COM3, so they are interpreted as traditional coefficients in linear regression. However, because the metric of y* is arbitrary, they are difficult to interpret in a substantively meaningful way.

TOTAL, TOTAL INDIRECT, SPECIFIC INDIRECT, AND DIRECT EFFECTS

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
Effects from TREAT to COM3				
Total	0.496	0.066	7.506	0.000
Total indirect	0.485	0.093	5.217	0.000
Specific indirect 1				
COM3				
PA2				
TREAT	0.239	0.066	3.616	0.000
Specific indirect 2				
COM3				
PK2				
TREAT	0.249	0.067	3.708	0.000
Specific indirect 3				
COM3				
PE2				
TREAT	-0.003	0.007	-0.367	0.714
Direct				
COM3				
TREAT	0.011	0.113	0.094	0.925

Below are the partially standardized counterparts of the above parameters. The latent propensity y* underlying COM3 has been standardized but the TREAT variable has not been standardized. As a result, the coefficients can be interpreted as mean differences in the standardized y* (analogous to a Cohen's d) through the particular mediational chain denoted. See my book for further explanation.

STDY Standardization

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
Effects from TREAT to COM3				
Total	0.474	0.060	7.953	0.000
Total indirect	0.464	0.089	5.232	0.000

Specific indirect 1				
COM3				
PA2				
TREAT	0.229	0.063	3.619	0.000
Specific indirect 2				
COM3				
PK2				
TREAT	0.237	0.064	3.714	0.000
Specific indirect 3				
COM3				
PE2				
TREAT	-0.003	0.007	-0.366	0.714
Direct				
COM3				
TREAT	0.010	0.108	0.094	0.925

Below are the confidence intervals for the unstandardized model results. The coefficient estimate is repeated in the middle column called "Estimate" and the 95% confidence intervals are under Lower 2.5% and Upper 2.5%. I use a smaller font here so everything fits on a single line.

CONFIDENCE INTERVALS OF MODEL RESULTS

	Lower .5%	Lower 2.5%	Lower 5%	Estimate	Upper 5%	Upper 2.5%	Upper .5%
PA2 ON							
BS1	0.046	0.059	0.065	0.097	0.130	0.136	0.148
CQ1	0.024	0.041	0.049	0.092	0.135	0.143	0.159
TREAT	0.771	0.783	0.790	0.822	0.855	0.861	0.873
PA1	0.285	0.302	0.311	0.358	0.404	0.413	0.430
PK2 ON							
BS1	-0.065	-0.052	-0.046	-0.013	0.021	0.027	0.040
CQ1	-0.090	-0.073	-0.064	-0.019	0.026	0.034	0.051
TREAT	0.789	0.802	0.808	0.842	0.875	0.882	0.894
PK1	0.291	0.308	0.317	0.363	0.410	0.419	0.436
PE2 ON							
BS1	-0.137	-0.124	-0.118	-0.085	-0.052	-0.046	-0.034
CQ1	-0.190	-0.174	-0.166	-0.122	-0.079	-0.071	-0.055
TREAT	-0.044	-0.032	-0.026	0.007	0.040	0.047	0.059
PE1	0.276	0.292	0.301	0.344	0.388	0.396	0.413
COM3 ON							
PA2	0.084	0.134	0.159	0.291	0.423	0.449	0.498
PK2	0.091	0.140	0.165	0.295	0.426	0.451	0.500
PE2	-0.563	-0.514	-0.489	-0.360	-0.230	-0.205	-0.156
TREAT	-0.281	-0.211	-0.176	0.011	0.197	0.232	0.302
BS1	0.068	0.108	0.129	0.238	0.347	0.368	0.409
CQ1	-0.073	-0.019	0.009	0.153	0.297	0.325	0.379

Intercepts							
PA2	0.027	0.036	0.040	0.063	0.086	0.090	0.099
PK2	-0.020	-0.011	-0.007	0.017	0.040	0.045	0.054
PE2	-0.098	-0.090	-0.085	-0.062	-0.039	-0.035	-0.026
Thresholds							
COM3$1	0.255	0.284	0.298	0.375	0.452	0.466	0.495
Residual Variances							
PA2	0.132	0.135	0.137	0.146	0.154	0.156	0.159
PK2	0.138	0.142	0.143	0.153	0.162	0.164	0.167
PE2	0.134	0.138	0.139	0.149	0.158	0.160	0.163

CONFIDENCE INTERVALS OF STANDARDIZED MODEL RESULTS

Below are the confidence intervals for the partially standardized model results.

STDY Standardization

	Lower .5%	Lower 2.5%	Lower 5%	Estimate	Upper 5%	Upper 2.5%	Upper .5%
PA2 ON							
BS1	0.080	0.101	0.112	0.168	0.224	0.235	0.256
CQ1	0.043	0.070	0.084	0.158	0.232	0.247	0.274
TREAT	1.353	1.369	1.377	1.420	1.462	1.470	1.486
PA1	0.497	0.525	0.540	0.617	0.694	0.709	0.738
PK2 ON							
BS1	-0.110	-0.089	-0.078	-0.021	0.035	0.046	0.068
CQ1	-0.152	-0.124	-0.109	-0.033	0.044	0.058	0.087
TREAT	1.364	1.380	1.388	1.430	1.472	1.480	1.496
PK1	0.499	0.527	0.542	0.617	0.693	0.708	0.736
PE2 ON							
BS1	-0.331	-0.301	-0.286	-0.206	-0.127	-0.111	-0.082
CQ1	-0.458	-0.420	-0.400	-0.296	-0.193	-0.173	-0.134
TREAT	-0.107	-0.077	-0.062	0.018	0.098	0.113	0.143
PE1	0.683	0.719	0.737	0.834	0.931	0.949	0.985
COM3 ON							
PA2	0.047	0.074	0.088	0.161	0.234	0.248	0.276
PK2	0.051	0.079	0.093	0.166	0.239	0.253	0.281
PE2	-0.222	-0.203	-0.193	-0.142	-0.091	-0.081	-0.062
TREAT	-0.268	-0.202	-0.168	0.010	0.188	0.222	0.288
BS1	0.067	0.105	0.125	0.227	0.330	0.349	0.388
CQ1	-0.068	-0.017	0.009	0.146	0.283	0.310	0.361
Intercepts							
PA2	0.045	0.060	0.068	0.109	0.150	0.158	0.174
PK2	-0.035	-0.020	-0.012	0.029	0.069	0.077	0.092
PE2	-0.239	-0.218	-0.207	-0.151	-0.095	-0.084	-0.063
Thresholds							
COM3$1	0.248	0.274	0.288	0.358	0.428	0.442	0.468
Residual Variances							
PA2	0.390	0.400	0.406	0.434	0.462	0.467	0.478
PK2	0.396	0.407	0.412	0.440	0.469	0.474	0.485
PE2	0.829	0.839	0.844	0.872	0.900	0.905	0.915

CONFIDENCE INTERVALS OF TOTAL, TOTAL INDIRECT, SPECIFIC INDIRECT, AND DIRECT EFFECTS

Below are the confidence intervals for the unstandardized total and indirect effects

	Lower .5%	Lower 2.5%	Lower 5%	Estimate	Upper 5%	Upper 2.5%	Upper .5%
Effects from TREAT to COM3							
Total	0.326	0.366	0.387	0.496	0.605	0.625	0.666
Total indirect	0.246	0.303	0.332	0.485	0.638	0.668	0.725
Specific indirect 1							
COM3							
PA2							
TREAT	0.069	0.110	0.131	0.239	0.348	0.369	0.410
Specific indirect 2							
COM3							
PK2							
TREAT	0.076	0.117	0.138	0.249	0.359	0.380	0.421
Specific indirect 3							
COM3							
PE2							
TREAT	-0.021	-0.017	-0.015	-0.003	0.009	0.012	0.016
Direct							
COM3							
TREAT	-0.281	-0.211	-0.176	0.011	0.197	0.232	0.302

CONFIDENCE INTERVALS OF STANDARDIZED TOTAL, TOTAL INDIRECT, SPECIFIC INDIRECT, AND DIRECT EFFECTS

Below are the confidence intervals for the partially standardized total and indirect effects.

STDY Standardization

	Lower .5%	Lower 2.5%	Lower 5%	Estimate	Upper 5%	Upper 2.5%	Upper .5%
Effects from TREAT to COM3							
Total	0.320	0.357	0.376	0.474	0.572	0.590	0.627
Total indirect	0.235	0.290	0.318	0.464	0.609	0.637	0.692
Specific indirect 1							
COM3							
PA2							
TREAT	0.066	0.105	0.125	0.229	0.333	0.353	0.391
Specific indirect 2							
COM3							
PK2							
TREAT	0.073	0.112	0.132	0.237	0.342	0.363	0.402

Specific indirect 3							
COM3							
PE2							
TREAT	-0.020	-0.016	-0.014	-0.003	0.009	0.011	0.015
Direct							
COM3							
TREAT	-0.268	-0.202	-0.168	0.010	0.188	0.222	0.288

RESIDUAL OUTPUT

ESTIMATED MODEL AND RESIDUALS (OBSERVED - ESTIMATED)

Below are the model's predicted means and thresholds.

Model Estimated Means/Intercepts/Thresholds

COM3$1	PA2	PK2	PE2
0.329	0.063	0.017	-0.062

Below are the observed means/thresholds for the measured variables minus their predicted model means. The residuals should be near zero.

Residuals for Means/Intercepts/Thresholds

COM3$1	PA2	PK2	PE2
0.000	0.000	0.000	0.000

Below are the model estimated bivariate slopes for the model with respect to the endogenous variables regressed onto the exogenous variables. The endogenous variable in the row is regressed onto the exogenous variable in the column.

Model Estimated Slopes

	CQ1	PA1	PK1	PE1	TREAT
COM3	0.218	0.104	0.107	-0.124	0.496
PA2	0.092	0.358	0.000	0.000	0.822
PK2	-0.019	0.000	0.363	0.000	0.842
PE2	-0.122	0.000	0.000	0.344	0.007

Model Estimated Slopes

	BS1
COM3	0.293
PA2	0.097
PK2	-0.013
PE2	-0.085

Below are the residuals for the observed minus predicted slopes. The closer they are to zero, the better.

Residuals for Slopes

	CQ1	PA1	PK1	PE1	TREAT
COM3	0.000	-0.081	0.132	0.020	0.000
PA2	0.000	0.002	-0.015	-0.012	0.000
PK2	0.000	0.006	-0.004	0.020	0.000
PE2	0.000	0.073	-0.016	0.001	0.000

Residuals for Slopes

	BS1
COM3	0.000
PA2	0.000
PK2	0.000
PE2	0.000

Below are the model estimated covariances and correlations between the continuous variables in the model (the entry for COM3 refers to the latent propensity underlying it, y*)

Model Estimated Covariances/Correlations/Residual Correlations

	COM3	PA2	PK2	PE2
COM3				
PA2	0.042	0.146		
PK2	0.045	0.000	0.153	
PE2	-0.053	0.000	0.000	0.149

Model Estimated Correlations/Residual Correlations

	COM3	PA2	PK2	PE2
COM3				
PA2	0.111	1.000		
PK2	0.115	0.000	1.000	
PE2	-0.139	0.000	0.000	1.000

Below are the residuals for the above matrices, reflecting the difference between the observed and estimated values. They should be near zero.

Residuals for Covariances/Correlations/Residual Correlations

	COM3	PA2	PK2	PE2
COM3				
PA2	0.004	0.000		
PK2	-0.007	0.002	0.000	
PE2	-0.001	0.003	0.002	0.000

Residuals for Correlations/Residual Correlations

	COM3	PA2	PK2	PE2
COM3				
PA2	0.010	0.000		
PK2	-0.017	0.016	0.000	
PE2	-0.003	0.019	0.012	0.000

Below are the observed and model estimated proportion of cases in the two categories of COM3. The residuals should be near zero.

UNIVARIATE PROPORTIONS FOR CATEGORICAL VARIABLES

Variable	Observed	Estimated	Residual (Obs.-Est.)	Stand. Residual
COM3				
Category 1	0.532	0.532	0.000	0.001
Category 2	0.468	0.468	0.000	-0.001

The next sections report the same model estimates and residual statistics as above but now for all the parameters in the full model. The interpretations are the same and the COM3 variable refers to the y* latent propensity.

ESTIMATED MODEL AND RESIDUALS (OBSERVED - ESTIMATED) FOR THE JOINT MODEL

Model Estimated Means/Thresholds for the Joint Model (Dependent and Independent Variables)

COM3$1	PA2	PK2	PE2	CQ1
0.084	0.343	0.399	0.066	0.000

Model Estimated Means/Thresholds for the Joint Model (Dependent and Independent Variables)

PA1	PK1	PE1	TREAT	BS1
0.000	0.000	0.000	0.494	0.000

Residuals for Means/Thresholds for the Joint Model (Dependent and Independent Variables)

COM3$1	PA2	PK2	PE2	CQ1
0.000	0.000	0.000	0.000	0.000

Residuals for Means/Thresholds for the Joint Model (Dependent and Independent Variables)

PA1	PK1	PE1	TREAT	BS1
0.000	0.000	0.000	0.000	0.000

Model Estimated Covariances/Correlations for the Joint Model (Dependent and Independent Variables)

	COM3	PA2	PK2	PE2	CQ1
COM3	1.096				
PA2	0.161	0.335			
PK2	0.154	0.176	0.347		
PE2	-0.069	-0.003	0.002	0.170	
CQ1	0.031	0.012	-0.006	-0.018	0.149
PA1	0.021	0.051	0.014	-0.001	-0.001
PK1	0.018	0.012	0.050	0.001	-0.003
PE1	-0.019	-0.003	-0.002	0.052	0.000
TREAT	0.124	0.204	0.208	0.001	-0.002
BS1	0.075	0.028	-0.001	-0.020	0.001

Model Estimated Covariances/Correlations for the Joint Model (Dependent and Independent Variables)

	PA1	PK1	PE1	TREAT	BS1
PA1	0.149				
PK1	0.047	0.151			
PE1	-0.002	0.001	0.152		
TREAT	-0.004	-0.006	-0.003	0.250	
BS1	0.006	0.002	0.004	0.002	0.250

Residuals for Covariances/Correlations for the Joint Model (Dependent and Independent Variables)

	COM3	PA2	PK2	PE2	CQ1
COM3	0.003				
PA2	0.001	0.000			
PK2	-0.002	0.002	0.000		
PE2	0.001	0.006	0.003	0.001	
CQ1	0.000	0.000	0.000	0.000	0.000
PA1	-0.006	0.000	0.001	0.010	0.000
PK1	0.016	-0.002	0.000	0.001	0.000
PE1	0.003	-0.002	0.003	0.000	0.000
TREAT	-0.001	0.000	0.000	0.000	0.000
BS1	0.000	0.000	0.000	0.000	0.000

Residuals for Covariances/Correlations for the Joint Model (Dependent and Independent Variables)

	PA1	PK1	PE1	TREAT	BS1
PA1	0.000				
PK1	0.000	0.000			
PE1	0.000	0.000	0.000		
TREAT	0.000	0.000	0.000	0.000	
BS1	0.000	0.000	0.000	0.000	0.000

Model Estimated Correlations for the Joint Model (Dependent and Independent Variables)

	COM3	PA2	PK2	PE2	CQ1
COM3	1.000				
PA2	0.266	1.000			
PK2	0.250	0.516	1.000		
PE2	-0.160	-0.014	0.006	1.000	
CQ1	0.077	0.052	-0.026	-0.116	1.000
PA1	0.051	0.227	0.062	-0.008	-0.005
PK1	0.044	0.053	0.219	0.004	-0.020
PE1	-0.047	-0.014	-0.010	0.323	-0.003
TREAT	0.236	0.705	0.708	0.004	-0.012
BS1	0.143	0.098	-0.003	-0.096	0.005

	PA1	PK1	PE1	TREAT	BS1
PA1	1.000				
PK1	0.315	1.000			
PE1	-0.016	0.008	1.000		
TREAT	-0.019	-0.030	-0.016	1.000	
BS1	0.030	0.008	0.023	0.009	1.000

Residuals for Correlations for the Joint Model (Dependent and Independent Variables)

	COM3	PA2	PK2	PE2	CQ1
COM3	0.000				
PA2	0.001	0.000			
PK2	-0.003	0.006	0.000		
PE2	0.002	0.024	0.013	0.000	
CQ1	-0.001	0.000	0.000	0.000	0.000
PA1	-0.014	-0.002	0.003	0.063	0.000
PK1	0.040	-0.010	-0.001	0.006	0.000
PE1	0.009	-0.008	0.013	-0.001	0.000
TREAT	-0.001	0.001	0.000	-0.001	0.000
BS1	-0.001	0.000	0.000	0.002	0.000

Residuals for Correlations for the Joint Model (Dependent and Independent Variables)

	PA1	PK1	PE1	TREAT	BS1
PA1	0.000				
PK1	0.000	0.000			
PE1	0.000	0.000	0.000		
TREAT	0.000	0.000	0.000	0.000	
BS1	0.000	0.000	0.000	0.000	0.000

MODEL MODIFICATION INDICES

Minimum M.I. value for printing the modification index 4.000

Below are the model modification indices. Values greater than 4 suggest the parameter will be statistically significant (p < 0.05) if added to the model. E.P.C. estimates what the unstandardized parameter value will be if the parameter is added and it was previously constrained to be zero, i.e., omitted from the model. StdYX E.P.C. estimates what the standardized parameter value will be if the parameter is added to the model.

		M.I.	E.P.C.	Std E.P.C.	StdYX E.P.C.
ON Statements					
PE2	ON PA1	7.320	0.074	0.074	0.069

TECHNICAL 4 OUTPUT

This section provides model estimates of different parameters, their standard errors, their critical ratios (Est./S.E.) and their p values as part of the TECH4 output. If a value of 999 appears, that means the statistic could not be computed or is not relevant to the model.

ESTIMATES DERIVED FROM THE MODEL

ESTIMATED MEANS FOR THE LATENT VARIABLES

COM3	PA2	PK2	PE2
0.291	0.469	0.433	-0.059

ESTIMATED COVARIANCE MATRIX FOR THE LATENT VARIABLES

	COM3	PA2	PK2	PE2
COM3	1.096			
PA2	0.161	0.335		
PK2	0.154	0.176	0.347	
PE2	-0.069	-0.003	0.002	0.170

ESTIMATED CORRELATION MATRIX FOR THE LATENT VARIABLES

	COM3	PA2	PK2	PE2
COM3	1.000			
PA2	0.266	1.000		
PK2	0.250	0.516	1.000	
PE2	-0.160	-0.014	0.006	1.000

ESTIMATES DERIVED FROM THE MODEL

S.E. FOR ESTIMATED MEANS FOR THE LATENT VARIABLES

COM3	PA2	PK2	PE2
0.034	0.015	0.015	0.011

EST./S.E. FOR ESTIMATED MEANS FOR THE LATENT VARIABLES

COM3	PA2	PK2	PE2
8.466	31.302	28.420	-5.475

TWO-TAILED P-VALUE FOR ESTIMATED MEANS FOR THE LATENT VARIABLES

COM3	PA2	PK2	PE2
0.000	0.000	0.000	0.000

S.E. FOR ESTIMATED COVARIANCE MATRIX FOR THE LATENT VARIABLES

	COM3	PA2	PK2	PE2
COM3	0.020			
PA2	0.020	0.012		
PK2	0.020	0.009	0.013	
PE2	0.014	0.004	0.005	0.006

EST./S.E. FOR ESTIMATED COVARIANCE MATRIX FOR THE LATENT VARIABLES

	COM3	PA2	PK2	PE2
COM3	53.489			
PA2	8.121	27.238		
PK2	7.559	19.592	26.902	
PE2	-4.984	-0.751	0.336	26.468

TWO-TAILED P-VALUE FOR ESTIMATED COVARIANCE MATRIX FOR THE LATENT VARIABLES

	COM3	PA2	PK2	PE2
COM3	0.000			
PA2	0.000	0.000		
PK2	0.000	0.000	0.000	
PE2	0.000	0.453	0.737	0.000

S.E. FOR ESTIMATED CORRELATION MATRIX FOR THE LATENT VARIABLES

	COM3	PA2	PK2	PE2
COM3	0.000			
PA2	0.030	0.000		
PK2	0.031	0.014	0.000	
PE2	0.032	0.019	0.019	0.000

EST./S.E. FOR ESTIMATED CORRELATION MATRIX FOR THE LATENT VARIABLES

	COM3	PA2	PK2	PE2
COM3	999.000			
PA2	8.861	999.000		
PK2	8.142	36.343	999.000	
PE2	-5.081	-0.751	0.336	999.000

TWO-TAILED P-VALUE FOR ESTIMATED CORRELATION MATRIX FOR THE LATENT VARIABLES

	COM3	PA2	PK2	PE2
COM3	0.000			
PA2	0.000	0.000		
PK2	0.000	0.000	0.000	
PE2	0.000	0.453	0.737	0.000