



Multivariate multinomial probit regressions

PRELIS distinguishes between y - and x - variables. The x -variables can be fixed or random variables. If they are random, their joint distribution is unspecified and assumed not to contain any parameters of interest. These x -variables can be dummy-coded categorical variables or measured variables on an interval scale assumed not to contain measurement error. As before, the y -variables can be continuous, censored, or ordinal variables. Most of the analysis that is done by PRELIS is concerned with the conditional distribution of y for given x , but PRELIS will also estimate the unconditional joint covariance matrix of y and x and its asymptotic covariance matrix. These can be used with WLS in LISREL in an analysis with fixed- x .

PRELIS assumes by default that all variables are y -variables. To specify x -variables, include a command

FI *varlist*

in the input file, where *varlist* is a list of the x -variables. All variables not listed in *varlist* are assumed to be y -variables. All y -variables are assumed to be ordinal, unless they are declared continuous or censored.

For each ordinal y -variable, PRELIS will estimate the univariate probit regression of y^* on the x -variables, where y^* is the variable underlying y . For each pair of ordinal variables, PRELIS will also estimate conditional polychoric correlation for given x . Jöreskog & Aish (1986) give further details and several applications of structural equation modeling with ordinal and fixed variables.

There are three different ways of handling the thresholds in the probit regressions:

- The thresholds may be estimated jointly with the regression coefficients in the probit regressions. This is the default alternative.
- The thresholds may be estimated from the marginal distributions of the ordinal variables. The regression coefficients in the probit regressions are then estimated for fixed thresholds. To specify this alternative, include a command

MT *varlist*
in the input file.

- The regression coefficients in the probit regressions may be estimated for fixed thresholds specified by the user. To specify this alternative, include a command

FT = filename varlist

in the input file.

In the second and third alternative, *varlist* may be ALL to specify that this should be done for all ordinal variables. Note that, if *varlist* contains only a subset of the ordinal variables, one can have mixtures of any two or all three alternatives.

The following input file (**EX11.PRL** in the **PRELIS examples\Descriptives** folder) reads data on two ordinal variables and two fixed variables and estimates the probit regressions of each ordinal variable on the *x*-variables and the conditional polychoric correlation between the two ordinal variables. The joint covariance matrix of the four variables and the corresponding asymptotic covariance matrix is also estimated.

```
EXAMPLE 11: TEST OF FIXED-X
DA NI=4
RA=EX11.RAW
FI 3 4
OU MA=CM CM =DATA.COV AC=DATA.ACC PA
```

The output file gives the following results:

Univariate Probit Regression for VAR 1
Standard Parameterization

Thresholds: -0.780 0.323 1.046

```
VAR 1 = 0.0 + 0.919*VAR 3 + 1.757*VAR 4 + Error, R2 = 0.968
Standerr      (0.0939)      (0.157)
Z-values      9.788          11.171
P-values      0.000          0.000
```

Thresholds: -0.381 0.448 1.385

```
VAR 2 = 0.0 + 0.480*VAR 3 + 0.0959*VAR 4 + Error, R2 = 0.564
Standerr      (0.0355)      (0.0255)
Z-values      13.512         3.766
P-values      0.000          0.000
```

Conditional Covariance Matrix

	VAR 1	VAR 2
VAR 1	1.000	
VAR 2	0.630 (0.074) 8.481	1.000

Covariance Matrix

	VAR 1	VAR 2	VAR 3	VAR 4
VAR 1	31.217			
VAR 2	5.685	2.296		
VAR 3	7.918	2.371	4.508	
VAR 4	13.057	1.637	2.148	6.308

Total Variance = 44.329 Generalized Variance = 14.361

Largest Eigenvalue = 39.784 Smallest Eigenvalue = 0.128

Condition Number = 17.648

Means

	VAR 1	VAR 2	VAR 3	VAR 4
	0.653	0.151	0.269	0.231

Standard Deviations

	VAR 1	VAR 2	VAR 3	VAR 4
	5.587	1.515	2.123	2.512

Asymptotic Covariance Matrix of Variances and Covariances

	S(1,1)	S(2,1)	S(2,2)	S(3,1)	S(3,2)	S(3,3)
S(1,1)	7.10837					
S(2,1)	1.28299	0.31347				
S(2,2)	0.30934	0.09366	0.03192			
S(3,1)	1.85225	0.39763	0.10342	0.66170		
S(3,2)	0.39962	0.09963	0.03486	0.15053	0.04589	
S(3,3)	0.65966	0.15304	0.04131	0.25067	0.06654	0.11602
S(4,1)	2.93472	0.46839	0.12354	0.67338	0.14274	0.24451
S(4,2)	0.46879	0.11629	0.01672	0.14586	0.02779	0.04056
S(4,3)	0.67356	0.14599	0.02150	0.24093	0.04457	0.07025
S(4,4)	1.24122	0.20142	0.02749	0.27189	0.05491	0.08065

Asymptotic Covariance Matrix of Variances and Covariances

	S(4,1)	S(4,2)	S(4,3)	S(4,4)
S(4,1)	1.24204			
S(4,2)	0.20023	0.04101		
S(4,3)	0.27107	0.04989	0.08747	
S(4,4)	0.60003	0.05284	0.07494	0.20476

Each univariate probit regression is given in equation form with standard errors in parentheses below the regression coefficients and t -values are also given for the conditional polychoric correlations. Standard errors (without t -values are given for the threshold estimates.