Title

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cmroprobit postestimation — Postestimation tools for cmroprobit

Postestimation commands

The following postestimation commands are of special interest after `cmroprobit`:

Command	Description
`estat covariance`	covariance matrix of the utility errors for the alternatives
`estat correlation`	correlation matrix of the utility errors for the alternatives
`estat facweights`	covariance factor weights matrix

The following standard postestimation commands are also available:

Command	Description
`contrast`	contrasts and ANOVA-style joint tests of estimates
`estat ic`	Akaike's and Schwarz's Bayesian information criteria (AIC and BIC)
`estat summarize`	summary statistics for the estimation sample
`estat vce`	variance–covariance matrix of the estimators (VCE)
`estimates`	cataloging estimation results
`etable`	table of estimation results
`hausman`	Hausman's specification test
`lincom`	point estimates, standard errors, testing, and inference for linear combinations of coefficients
`lrtest`	likelihood-ratio test
`margins`	adjusted predictions, predictive margins, and marginal effects
`marginsplot`	graph the results from margins (profile plots, interaction plots, etc.)
`nlcom`	point estimates, standard errors, testing, and inference for nonlinear combinations of coefficients
`predict`	probabilities, etc.
`predictnl`	point estimates, standard errors, testing, and inference for generalized predictions
`pwcompare`	pairwise comparisons of estimates
`test`	Wald tests of simple and composite linear hypotheses
`testnl`	Wald tests of nonlinear hypotheses

predict

Description for predict

`predict` creates a new variable containing predictions such as probabilities, linear predictions, and standard errors.

Menu for predict

Statistics > Postestimation

Syntax for predict

`predict` [*type*] *newvar* [*if*] [*in*] [, *statistic*]

`predict` [*type*] *stub*`*` [*if*] [*in*], `scores`

statistic	Description
Main	
`pr`	probability of each ranking, by case; the default
`pr1`	probability alternative is preferred
`xb`	linear prediction
`stdp`	standard error of the linear prediction

These statistics are available both in and out of sample; type `predict ... if e(sample) ...` if wanted only for the estimation sample.

`predict` omits missing values casewise if `cmroprobit` used casewise deletion (the default); if `cmroprobit` used alternativewise deletion (option `altwise`), `predict` uses alternativewise deletion.

Options for predict

Main

`pr`, the default, calculates the probability of each ranking. For each case, one probability is computed for the ranks in `e(depvar)`.

`pr1` calculates the probability that each alternative is preferred.

`xb` calculates the linear prediction $\mathbf{x}_{ij}\boldsymbol{\beta} + \mathbf{z}_i\boldsymbol{\alpha}_j$ for alternative j and case i.

`stdp` calculates the standard error of the linear prediction.

`scores` calculates the scores for each coefficient in `e(b)`. This option requires a new variable list of length equal to the number of columns in `e(b)`. Otherwise, use the *stub*`*` syntax to have `predict` generate enumerated variables with prefix *stub*.

margins

Description for margins

`margins` estimates margins of response for probabilities and linear predictions.

Menu for margins

Statistics > Postestimation

Syntax for margins

`margins` [*marginlist*] [`,` *options*]

`margins` [*marginlist*] `,` `predict(`*statistic* ...`)` [`predict(`*statistic* ...`)` ...] [*options*]

statistic	Description
`pr`	not allowed with `margins`
`pr1`	probability alternative is preferred; the default
`xb`	linear prediction
`stdp`	not allowed with `margins`
`scores`	not allowed with `margins`

Statistics not allowed with `margins` are functions of stochastic quantities other than `e(b)`.

For more details, see [CM] **margins**.

estat

Description for estat

`estat covariance` computes the estimated variance–covariance matrix of the utility (latent-variable) errors for the alternatives. The estimates are displayed, and the variance–covariance matrix is stored in `r(cov)`.

`estat correlation` computes the estimated correlation matrix of the utility (latent-variable) errors for the alternatives. The estimates are displayed, and the correlation matrix is stored in `r(cor)`.

`estat facweights` displays the covariance factor weights matrix and stores it in `r(C)`.

Menu for estat

Statistics > Postestimation

Syntax for estat

Covariance matrix of the utility errors for the alternatives

```
estat covariance [ , format(%fmt) border(bspec) left(#) ]
```

Correlation matrix of the utility errors for the alternatives

```
estat correlation [ , format(%fmt) border(bspec) left(#) ]
```

Covariance factor weights matrix

```
estat facweights [ , format(%fmt) border(bspec) left(#) ]
```

`collect` is allowed with all `estat` commands; see **[U] 11.1.10 Prefix commands**.

Options for estat covariance, estat correlation, and estat facweights

`format(%fmt)` sets the matrix display format. The default for `estat covariance` and `estat facweights` is `format(%9.0g)`; the default for `estat correlation` is `format(%9.4f)`.

`border(bspec)` sets the matrix display border style. The default is `border(all)`. See [P] **matlist**.

`left(#)` sets the matrix display left indent. The default is `left(2)`. See [P] **matlist**.

Remarks and examples

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After fitting a rank-ordered probit choice model, you can use `predict` to obtain the probabilities of the observed rankings of the alternatives or the probabilities of each alternative being preferred.

When evaluating the multivariate normal probabilities via Monte Carlo, `predict` uses the same method to generate the random sequence of numbers as the previous call to `cmroprobit`. For example, if you specified `intmethod(halton)` when fitting the model, `predict` also uses Halton sequences.

In example 1 of [CM] **cmroprobit**, we fit a model of job characteristic preferences. This is a study of Wisconsin high school graduates who were asked to rate their relative preference of four job characteristics: esteem, variety, autonomy, and security. The alternatives are ranked such that 1 is the preferred alternative and 4 is the least preferred.

The case-specific covariates are gender, `female`, an indicator variable for females, and `score`, a score on a general mental ability test measured in standard deviations. From the variables `high` and `low`, we create an alternative-specific variable, `currentjob`, that indicates whether the respondent's current job is high, low, or neither in esteem, variety, autonomy, or security.

We load the data and `cmset` them. For speed of running this example, we keep only untied rankings. Then, we fit our `cmroprobit` model.

```
. use https://www.stata-press.com/data/r17/wlsrank
(1992 Wisconsin Longitudinal Study data on job values)

. cmset id jobchar

     Case ID variable: id
Alternatives variable: jobchar

. keep if noties
(11,244 observations deleted)

. generate currentjob = 1 if low==1
(1,304 missing values generated)

. replace currentjob = 2 if low==0 & high==0
(805 real changes made)

. replace currentjob = 3 if high==1
(499 real changes made)

. label define current 1 "Low" 2 "Neither" 3 "High"

. label values currentjob current

. cmroprobit rank i.currentjob, casevars(i.female score) reverse
note: variable 2.currentjob has 69 cases that are not alternative-specific;
      there is no within-case variability.
note: variable 3.currentjob has 107 cases that are not alternative-specific;
      there is no within-case variability.

Iteration 0:   log simulated-likelihood = -1102.9667
Iteration 1:   log simulated-likelihood = -1089.1146  (backed up)
Iteration 2:   log simulated-likelihood = -1085.7877  (backed up)
Iteration 3:   log simulated-likelihood = -1083.0085  (backed up)
Iteration 4:   log simulated-likelihood = -1082.5081  (backed up)
Iteration 5:   log simulated-likelihood = -1082.1977  (backed up)
Iteration 6:   log simulated-likelihood = -1082.1208  (backed up)
Iteration 7:   log simulated-likelihood = -1082.0995
Iteration 8:   log simulated-likelihood = -1082.0442
Iteration 9:   log simulated-likelihood = -1081.8316  (backed up)
Iteration 10:  log simulated-likelihood = -1081.6816
Iteration 11:  log simulated-likelihood = -1081.5777
Iteration 12:  log simulated-likelihood = -1081.5137
Iteration 13:  log simulated-likelihood = -1081.1495
Iteration 14:  log simulated-likelihood = -1081.0503
Iteration 15:  log simulated-likelihood = -1080.7247
```

```
Iteration 16:  log simulated-likelihood = -1080.1485
Iteration 17:  log simulated-likelihood = -1080.0215
Iteration 18:  log simulated-likelihood = -1080.0179
Iteration 19:  log simulated-likelihood = -1079.9916
Iteration 20:  log simulated-likelihood = -1079.9733
Iteration 21:  log simulated-likelihood = -1079.9733

Rank-ordered probit choice model              Number of obs      =      1,660
Case ID variable: id                          Number of cases    =        415

Alternatives variable: jobchar                Alts per case: min =          4
                                                             avg =        4.0
                                                             max =          4

Integration sequence:      Hammersley
Integration points:               642         Wald chi2(8)       =      33.92
Log simulated-likelihood = -1079.9733         Prob > chi2        =     0.0000
```

rank	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
jobchar						
currentjob						
Neither	.0694818	.1092531	0.64	0.525	-.1446503	.2836138
High	.4435911	.121678	3.65	0.000	.2051066	.6820757
Esteem	(base alternative)					
Variety						
female						
Female	.1354259	.1843808	0.73	0.463	-.2259537	.4968055
score	.14071	.0977659	1.44	0.150	-.0509077	.3323278
_cons	1.734496	.1449852	11.96	0.000	1.45033	2.018661
Autonomy						
female						
Female	.2562822	.1645938	1.56	0.119	-.0663158	.5788801
score	.189963	.0873586	2.17	0.030	.0187433	.3611827
_cons	.7007559	.1203087	5.82	0.000	.4649553	.9365566
Security						
female						
Female	.2326342	.2055864	1.13	0.258	-.1703079	.6355762
score	-.1779831	.1101985	-1.62	0.106	-.3939682	.0380021
_cons	1.34348	.1598787	8.40	0.000	1.030123	1.656836
/lnl2_2	.1813086	.0756934	2.40	0.017	.0329522	.329665
/lnl3_3	.4843953	.0793885	6.10	0.000	.3287967	.639994
/l2_1	.6060303	.1158474	5.23	0.000	.3789735	.8330871
/l3_1	.4491585	.1435157	3.13	0.002	.167873	.7304441
/l3_2	.2305503	.121713	1.89	0.058	-.0080029	.4691034

```
(jobchar=Esteem is the alternative normalizing location)
(jobchar=Variety is the alternative normalizing scale)
```

We obtain the probabilities of the observed alternative rankings using `predict` with the `pr` option. The probabilities of each alternative being preferred is given by the `pr1` option.

```
. predict prob, pr
. predict prob1, pr1
. list id jobchar rank prob prob1 in 1/12, sepby(id)
```

	id	jobchar	rank	prob	prob1
1.	13	Esteem	4	.0424396	.0159974
2.	13	Variety	2	.0424396	.6024934
3.	13	Autonomy	1	.0424396	.1029332
4.	13	Security	3	.0424396	.278576
5.	19	Esteem	3	.0942127	.0140184
6.	19	Variety	2	.0942127	.4026075
7.	19	Autonomy	4	.0942127	.1232482
8.	19	Security	1	.0942127	.4601093
9.	22	Esteem	4	.1416861	.0255156
10.	22	Variety	1	.1416861	.455048
11.	22	Autonomy	2	.1416861	.2565435
12.	22	Security	3	.1416861	.2629159

The `prob` variable is constant for each case because it contains the probability of the observed ranking in the `rank` variable. The `prob1` variable contains the estimated probability of each alternative being preferred. The sum of the values in `prob1` will be approximately 1 for each case. They do not add up to exactly 1 because of approximations due to the GHK algorithm.

For examples of the specialized `estat` subcommands `covariance` and `correlation`, see [CM] **Intro 6** and [CM] **cmroprobit**.

Also see

[CM] **cmroprobit** — Rank-ordered probit choice model

[CM] **cmmprobit** — Multinomial probit choice model

[CM] **cmmprobit postestimation** — Postestimation tools for cmmprobit

[CM] **margins** — Adjusted predictions, predictive margins, and marginal effects

[U] **20 Estimation and postestimation commands**