**eoprobit postestimation** — Postestimation tools for eoprobit and xteoprobit



## Postestimation commands

The following postestimation command is of special interest after `eoprobit` and `xteoprobit`:

| Command | Description |
|---|---|
| `estat teffects` | treatment effects and potential-outcome means |

The following standard postestimation commands are also available after `eoprobit` and `xteoprobit`:

| Command | Description |
|---|---|
| `contrast` | contrasts and ANOVA-style joint tests of parameters |
| `estat ic` | Akaike's, consistent Akaike's, corrected Akaike's, and Schwarz's Bayesian information criteria (AIC, CAIC, AICc, and BIC, respectively) |
| `estat summarize` | summary statistics for the estimation sample |
| `estat vce` | variance–covariance matrix of the estimators (VCE) |
| † `estat (svy)` | postestimation statistics for survey data |
| `estimates` | cataloging estimation results |
| `etable` | table of estimation results |
| * `forecast` | dynamic forecasts and simulations |
| * `hausman` | Hausman's specification test |
| `lincom` | point estimates, standard errors, testing, and inference for linear combinations of parameters |
| * `lrtest` | likelihood-ratio test |
| `margins` | marginal means, predictive margins, marginal effects, and average 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 parameters |
| `predict` | means, probabilities, treatment effects, etc. |
| `predictnl` | point estimates, standard errors, testing, and inference for generalized predictions |
| `pwcompare` | pairwise comparisons of parameters |
| † `suest` | seemingly unrelated estimation |
| `test` | Wald tests of simple and composite linear hypotheses |
| `testnl` | Wald tests of nonlinear hypotheses |

*`forecast`, `hausman`, and `lrtest` are not appropriate with `svy` estimation results.

†`suest` and the survey data `estat` commands are not available after `xteoprobit`.

# predict

Predictions after eoprobit and xteoprobit are described in

| | |
|---|---|
| [ERM] **eoprobit predict** | predict after eoprobit and xteoprobit |
| [ERM] **predict treatment** | predict for treatment statistics |
| [ERM] **predict advanced** | predict's advanced features |

[ERM] **eoprobit predict** describes the most commonly used predictions. If you fit a model with treatment effects, predictions specifically related to these models are detailed in [ERM] **predict treatment**. [ERM] **predict advanced** describes less commonly used predictions, such as predictions of outcomes in auxiliary equations.

# margins

## Description for margins

margins estimates statistics based on fitted models. These statistics include marginal means, marginal probabilities, potential-outcome means, average and conditional derivatives, average and conditional effects, and treatment effects.

## Menu for margins

Statistics > Postestimation

## Syntax for margins

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

| *statistic* | Description |
|---|---|
| Main | |
| pr | probability for binary or ordinal $y_j$; the default |
| mean | mean |
| pomean | potential-outcome mean |
| te | treatment effect |
| tet | treatment effect on the treated |
| xb | linear prediction excluding all complications |
| pr(*a*,*b*) | $\Pr(a < y_j < b)$ for continuous $y_j$ |
| e(*a*,*b*) | $E(y_j \mid a < y_j < b)$ for continuous $y_j$ |
| ystar(*a*,*b*) | $E(y_j^*)$, $y_j^* = \max\{a, \min(y_j, b)\}$ for continuous $y_j$ |

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

For the full syntax, see [R] **margins**.

## Remarks and examples

See [ERM] **Intro 7** for an overview of using `margins` and `predict` after `eoprobit` and `xteoprobit`. For examples using `margins`, `predict`, and `estat teffects`, see *Interpreting effects* in [ERM] **Intro 9** and see [ERM] **Example 1a**.

## Methods and formulas

This section contains methods and formulas for the default `asf` prediction. Methods and formulas for other predictions are given in *Methods and formulas* of [ERM] **eoprobit**. We begin with the cross-sectional model, and then we extend our discussion to the random-effect models that we use for panel data.

In the ordered probit model for exogenous covariates $\mathbf{x}_i$ and endogenous regressors $\mathbf{w}_i$, we have

$$y_i = v_h \quad \text{iff} \quad \kappa_{h-1} < \mathbf{x}_i\boldsymbol{\beta} + \mathbf{w}_i\boldsymbol{\beta}_2 + \epsilon_i \leq \kappa_h$$

The values $v_1, \ldots, v_H$ are real numbers such that $v_h < v_m$ for $h < m$. $\kappa_0$ is taken as $-\infty$ and $\kappa_H$ is taken as $+\infty$. The error $\epsilon_i$ is standard normal and correlated with $\mathbf{w}_i$.

Because $\epsilon_i$ is a normally distributed, mean 0, random variable, we can split it into two mean 0, normally distributed, independent parts,

$$\epsilon_i = u_i + \psi_i$$

where $u_i = \boldsymbol{\gamma}\boldsymbol{\epsilon}_{2i}$ is the unobserved heterogeneity that gives rise to the endogeneity and $\psi_i$ is an idiosyncratic error term with variance $\sigma^2_\psi$.

For $h = 0, \ldots, H$, define

$$c_{ih} = \begin{cases} -\infty & h = 0 \\ \kappa_h - \mathbf{x}_i\boldsymbol{\beta} - \mathbf{w}_i\boldsymbol{\beta}_2 - u_i & h = 1, \ldots, H-1 \\ \infty & h = H \end{cases}$$

Conditional on the covariates and the unobserved heterogeneity, we have

$$\begin{aligned} E\{\mathbf{1}(y_i = v_h)|\mathbf{x}_i, \mathbf{w}_i, u_i\} &= \Pr(y_i = v_h|\mathbf{x}_i, \mathbf{w}_i, u_i) \\ &= \Phi_1^*(c_{i(h-1)}, c_{ih}, \sigma^2_\psi) \end{aligned}$$

Predictions and effects are computed based on the expression above. Including $u_i$ controls for endogeneity. Thus, all effects computed using the expression above have a structural interpretation. See Imbens and Newey (2009) and Wooldridge (2010) for a detailed description of structural functions for models with endogeneity.

Our discussion easily extends to models for panel data with random effects. In this case, we have $N$ panels. Panel $i = 1, \ldots, N$ has observations $t = 1, \ldots, N_i$, so we observe $y_{it}$ with random effect $\alpha_i$ and observation-level error $\epsilon_{it}$. These errors are independent of each other. So the combined error $\xi_{it} = \alpha_i + \epsilon_{it}$ is normal with mean 0 and variance $1 + \sigma^2_\alpha$, where $\sigma^2_\alpha$ is the variance of $\alpha_i$. The results discussed earlier can then be applied using the combined error $\xi_{it}$ rather than the cross-sectional error.

All predictions after `xteoprobit` assume the panel-level random effects ($\alpha_i$) are zero. Put another way, predictions condition on the random effects being set to their means.

## References

Imbens, G. W., and W. K. Newey. 2009. Identification and estimation of triangular simultaneous equations models without additivity. *Econometrica* 77: 1481–1512. https://doi.org/10.3982/ECTA7108.

Wooldridge, J. M. 2010. *Econometric Analysis of Cross Section and Panel Data*. 2nd ed. Cambridge, MA: MIT Press.

## Also see

[ERM] **eoprobit** — Extended ordered probit regression

[ERM] **eoprobit predict** — predict after eoprobit and xteoprobit

[ERM] **predict treatment** — predict for treatment statistics

[ERM] **predict advanced** — predict's advanced features

[ERM] **eprobit postestimation** — Postestimation tools for eprobit and xteprobit

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