Postestimation commands

The following standard postestimation commands are available after `clogit`:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>contrast</td>
<td>contrasts and ANOVA-style joint tests of estimates</td>
</tr>
<tr>
<td>estat ic</td>
<td>Akaike’s and Schwarz’s Bayesian information criteria (AIC and BIC)</td>
</tr>
<tr>
<td>estat summarize</td>
<td>summary statistics for the estimation sample</td>
</tr>
<tr>
<td>estat vce</td>
<td>variance–covariance matrix of the estimators (VCE)</td>
</tr>
<tr>
<td>estat (svy)</td>
<td>postestimation statistics for survey data</td>
</tr>
<tr>
<td>estimates</td>
<td>cataloging estimation results</td>
</tr>
<tr>
<td>etable</td>
<td>table of estimation results</td>
</tr>
<tr>
<td>*hausman</td>
<td>Hausman’s specification test</td>
</tr>
<tr>
<td>lincom</td>
<td>point estimates, standard errors, testing, and inference for linear combinations of coefficients</td>
</tr>
<tr>
<td>linktest</td>
<td>link test for model specification</td>
</tr>
<tr>
<td>*lrtest</td>
<td>likelihood-ratio test</td>
</tr>
<tr>
<td>margins</td>
<td>marginal means, predictive margins, marginal effects, and average marginal effects</td>
</tr>
<tr>
<td>marginsplot</td>
<td>graph the results from margins (profile plots, interaction plots, etc.)</td>
</tr>
<tr>
<td>nlcom</td>
<td>point estimates, standard errors, testing, and inference for nonlinear combinations of coefficients</td>
</tr>
<tr>
<td>predict</td>
<td>probabilities, influence statistics, residuals, etc.</td>
</tr>
<tr>
<td>predictnl</td>
<td>point estimates, standard errors, testing, and inference for generalized predictions</td>
</tr>
<tr>
<td>pwcompare</td>
<td>pairwise comparisons of estimates</td>
</tr>
<tr>
<td>suest</td>
<td>seemingly unrelated estimation</td>
</tr>
<tr>
<td>test</td>
<td>Wald tests of simple and composite linear hypotheses</td>
</tr>
<tr>
<td>testnl</td>
<td>Wald tests of nonlinear hypotheses</td>
</tr>
</tbody>
</table>

*Hausman and lrtest are not appropriate with svy estimation results.
predict

Description for predict

predict creates a new variable containing predictions such as probabilities, linear predictions, standard errors, influence statistics, lack-of-fit statistics, Hosmer and Lemeshow leverages, Pearson residuals, and the equation-level score.

Menu for predict

Statistics > Postestimation

Syntax for predict

 predict [ type ] newvar [ if ] [ in ] [ , statistic nooffset ]

<table>
<thead>
<tr>
<th>statistic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>pc1</td>
<td>probability of a positive outcome; the default</td>
</tr>
<tr>
<td>pu0</td>
<td>probability of a positive outcome, assuming fixed effect is zero</td>
</tr>
<tr>
<td>xb</td>
<td>linear prediction</td>
</tr>
<tr>
<td>stdp</td>
<td>standard error of the linear prediction</td>
</tr>
<tr>
<td>*dbeta</td>
<td>Delta-β influence statistic</td>
</tr>
<tr>
<td>*dx2</td>
<td>Delta-χ² lack-of-fit statistic</td>
</tr>
<tr>
<td>*gdbeta</td>
<td>Delta-β influence statistic for each group</td>
</tr>
<tr>
<td>*gdx2</td>
<td>Delta-χ² lack-of-fit statistic for each group</td>
</tr>
<tr>
<td>*hat</td>
<td>Hosmer and Lemeshow leverage</td>
</tr>
<tr>
<td>*residuals</td>
<td>Pearson residuals</td>
</tr>
<tr>
<td>rstandard</td>
<td>standardized Pearson residuals</td>
</tr>
</tbody>
</table>
| score     | first derivative of the log likelihood with respect to \( x_j \beta \)

Unstarred statistics are available both in and out of sample; type predict ... if e(sample) ... if wanted only for the estimation sample. Starred statistics are calculated only for the estimation sample, even when if e(sample) is not specified.

Starred statistics are available for multiple controls per case-matching design only. They are not available if vce(robust), vce(cluster clustvar), or pweights were specified with clogit.

dbeta, dx2, gdbeta, gdx2, hat, and rstandard are not available if constraints() was specified with clogit.

Options for predict

 pc1, the default, calculates the probability of a positive outcome conditional on one positive outcome within group.
 pu0 calculates the probability of a positive outcome, assuming that the fixed effect is zero.
 xb calculates the linear prediction.
 stdp calculates the standard error of the linear prediction.
\texttt{dbeta} calculates the Delta-\(\beta\) influence statistic, a standardized measure of the difference in the coefficient vector that is due to deletion of the observation.

\texttt{dx2} calculates the Delta-\(\chi^2\) influence statistic, reflecting the decrease in the Pearson \(\chi^2\) that is due to deletion of the observation.

\texttt{gdbeta} calculates the approximation to the Pregibon stratum-specific Delta-\(\beta\) influence statistic, a standardized measure of the difference in the coefficient vector that is due to deletion of the entire stratum.

\texttt{gdx2} calculates the approximation to the Pregibon stratum-specific Delta-\(\chi^2\) influence statistic, reflecting the decrease in the Pearson \(\chi^2\) that is due to deletion of the entire stratum.

\texttt{hat} calculates the Hosmer and Lemeshow leverage or the diagonal element of the hat matrix.

\texttt{residuals} calculates the Pearson residuals.

\texttt{rstandard} calculates the standardized Pearson residuals.

\texttt{score} calculates the equation-level score, \(\partial \ln L / \partial (x_{it}\beta)\).

\texttt{nooffset} is relevant only if you specified \texttt{offset(varname)} for \texttt{clogit}. It modifies the calculations made by \texttt{predict} so that they ignore the offset variable; the linear prediction is treated as \(x_j b\) rather than as \(x_j b + \text{offset}_j\). This option cannot be specified with \texttt{dbeta}, \texttt{dx2}, \texttt{gdbeta}, \texttt{gdx2}, \texttt{hat}, and \texttt{rstandard}.
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 ]

Description

pu: probability of a positive outcome, assuming fixed effect is zero; the default
xb: linear prediction
not allowed with margins
stdp: not allowed with margins
eta: not allowed with margins
dx: not allowed with margins
geta: not allowed with margins
gdx: not allowed with margins
hat: not allowed with margins
residual: not allowed with margins
not allowed with margins
sc: not allowed with margins

Statistics not allowed with margins are functions of stochastic quantities other than e(b).
For the full syntax, see [R] margins.

Remarks and examples

predict may be used after clogit to obtain predicted values of the index $x_{it}\beta$. Predicted probabilities for conditional logistic regression must be interpreted carefully. Probabilities are estimated for each group as a whole, not for individual observations. Furthermore, the probabilities are conditional on the number of positive outcomes in the group (that is, the number of cases and the number of controls), or it is assumed that the fixed effect is zero. predict may also be used to obtain influence and lack-of-fit statistics for an individual observation and for the whole group, to compute Pearson, standardized Pearson residuals, and leverage values.

predict may be used for both within-sample and out-of-sample predictions.
Suppose that we have 1:k_{2i} matched data and that we have previously fit the following model:

```
use https://www.stata-press.com/data/r17/clogitid
clogit y x1 x2, group(id)
```

To obtain the predicted values of the index, we could type `predict idx, xb` to create a new variable called `idx`. From `idx`, we could then calculate the predicted probabilities. Easier, however, would be to type

```
predict phat
```

`phat` would then contain the predicted probabilities.

As noted previously, the predicted probabilities are really predicted probabilities for the group as a whole (that is, they are the predicted probability of observing \(y_{it} = 1\) and \(y_{it'} = 0\) for all \(t' \neq t\)). Thus, if we want to obtain the predicted probabilities for the estimation sample, it is important that, when we make the calculation, predictions be restricted to the same sample on which we estimated the data. We cannot predict the probabilities and then just keep the relevant ones because the entire sample determines each probability. Thus, assuming that we are not attempting to make out-of-sample predictions, we type

```
predict phat2 if e(sample)
```

Methods and formulas

Recall that \(i = 1, \ldots, n\) denote the groups and \(t = 1, \ldots, T_i\) denote the observations for the \(i\)th group.

`predict` produces probabilities of a positive outcome within group conditional on there being one positive outcome (pc1),

\[
Pr\left(y_{it} = 1 \bigg| \sum_{t=1}^{T_i} y_{it} = 1\right) = \frac{\exp(x_{it}\beta)}{\sum_{t=1}^{T_i} \exp(x_{it}\beta)}
\]

or `predict` calculates the unconditional \(pu0\):

\[
Pr(y_{it} = 1) = \frac{\exp(x_{it}\beta)}{1 + \exp(x_{it}\beta)}
\]

Let \(N = \sum_{j=1}^{n} T_j\) denote the total number of observations, \(p\) denote the number of covariates, and \(\hat{\theta}_{it}\) denote the conditional predicted probabilities of a positive outcome (pc1).

For the multiple control per case \((1: k_{2i})\) matching, Hosmer, Lemeshow, and Sturdivant (2013, 248–251) propose the following diagnostics:

The Pearson residual is

\[
r_{it} = \frac{(y_{it} - \hat{\theta}_{it})}{\sqrt{\hat{\theta}_{it}}}
\]
The leverage (hat) value is defined as
\[
h_{it} = \hat{\theta}_{it} \tilde{x}_{it}^T (\tilde{X}^T U \tilde{X})^{-1} \tilde{x}_{it}
\]
where \( \tilde{x}_{it} = x_{it} - \sum_{j=1}^{T_i} x_{ij} \hat{\theta}_{ij} \) is the \( 1 \times p \) row vector of centered by a weighted stratum-specific mean covariate values, \( U_N = \text{diag}\{\hat{\theta}_{it}\} \), and the rows of \( \tilde{X}_{N \times p} \) are composed of \( \tilde{x}_{it} \) values.

The standardized Pearson residual is
\[
r_{sit} = \frac{r_{it}}{\sqrt{1 - h_{it}}}
\]

The lack-of-fit and influence diagnostics for an individual observation are (respectively) computed as
\[
\Delta \chi^2_{it} = r_{sit}^2
\]
and
\[
\Delta \hat{\beta}_{it} = \Delta \chi^2_{it} \frac{h_{it}}{1 - h_{it}}
\]
The lack-of-fit and influence diagnostics for the groups are the group-specific totals of the respective individual diagnostics shown above.

Reference

Also see
[R] clogit — Conditional (fixed-effects) logistic regression
[U] 20 Estimation and postestimation commands