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## Postestimation commands

The following postestimation commands are available after `ziologit`:

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

\*`forecast`, `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, and standard errors.

## Menu for predict

Statistics > Postestimation

## Syntax for predict

```
predict [type] { stub* | newvar | newvarlist } [if] [in] [, statistic
    outcome(outcome) nooffset]
```

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

<i>statistic</i>	Description
------------------	-------------

Main

<code>pmargin</code>	marginal probabilities of levels, $\Pr(y_j = h)$ ; the default
<code>pjoint1</code>	joint probabilities of levels and susceptibility, $\Pr(y_j = h, s_j = 1)$
<code>pcond1</code>	probabilities of levels conditional on susceptibility, $\Pr(y_j = h   s_j = 1)$
<code>ps</code>	probability of susceptibility, $\Pr(s_j = 1)$
<code>pns</code>	probability of nonsusceptibility, $\Pr(s_j = 0)$
<code>xb</code>	linear prediction
<code>xbinfl</code>	linear prediction for inflation equation
<code>stdp</code>	standard error of the linear prediction
<code>stdpinfl</code>	standard error of the linear prediction for inflation equation

If you do not specify `outcome()`, `pmargin`, `pjoint1`, and `pcond1` (with one new variable specified) assume `outcome(#1)`.

You specify one or  $k$  new variables with `pmargin`, `pjoint1`, and `pcond1`, where  $k$  is the number of outcomes.

You specify one new variable with `ps`, `pns`, `xb`, `xbinfl`, `stdp`, and `stdpinfl`.

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

## Options for predict

Main

`pmargin`, the default, calculates the predicted marginal probabilities of outcome levels,  $\Pr(y_j = h)$ .

`pjoint1` calculates the predicted joint probabilities of outcome levels and susceptibility,  $\Pr(y_j = h, s_j = 1)$ .

`pcond1` calculates the predicted probabilities of outcome levels conditional on susceptibility,  $\Pr(y_j = h | s_j = 1)$ .

With `pmargin`, `pjoint1`, and `pcond1`, you can compute predicted probabilities for one or for all outcome levels. When you specify one new variable, `predict` computes probabilities for the first outcome level. You can specify the `outcome(#i)` option to obtain probabilities for the  $i$ th level. When you specify multiple new variables or a stub, `predict` computes probabilities for all outcome levels. The behavior of `predict` with one new variable is equivalent to specifying `outcome(#1)`.

`ps` and `pns` calculate the predicted marginal probability of susceptibility [ $\Pr(s_j = 1)$ ] and of nonsusceptibility [ $\Pr(s_j = 0)$ ], respectively.

In econometrics literature, probabilities of susceptibility and nonsusceptibility are known as probabilities of participation and nonparticipation. Similarly to `predict` after `zioprobit`, you can use options `ppar` and `pnpair` to compute these probabilities. Options `ppar` and `pnpair` produce identical results to the respective options `ps` and `pns` but label new variables as `Pr(participation)` and `Pr(nonparticipation)` instead of `Pr(susceptible)` and `Pr(nonsusceptible)`.

`xb` calculates the linear prediction for the ordered logit equation, which is  $\mathbf{x}_j\boldsymbol{\beta}$  if `offset()` was not specified with `zilogit` and is  $\mathbf{x}_j\boldsymbol{\beta} + \text{offset}_j^\beta$  if `offset()` was specified.

`xbinfl` calculates the linear prediction for the inflation equation, which is  $\mathbf{z}_j\boldsymbol{\gamma}$  if `offset()` was not specified in `inflate()` and is  $\mathbf{z}_j\boldsymbol{\gamma} + \text{offset}_j^\gamma$  if `offset()` was specified in `inflate()`.

`stdp` calculates the standard error of the linear prediction for the ordered logit equation.

`stdpinfl` calculates the standard error of the linear prediction for the inflation equation.

`outcome(outcome)` specifies the outcome for which predicted probabilities are to be calculated. `outcome()` should contain either one value of the dependent variable or one of `#1`, `#2`,  $\dots$ , with `#1` meaning the first category of the dependent variable, `#2` meaning the second category, etc. `outcome()` is allowed only with `pmargin`, `pjoint1`, and `pcond1`.

`nooffset` is relevant only if you specified `offset(varname)` with `zilogit` or within the `inflate()` option. It modifies the calculations made by `predict` so that they ignore the offset variable; that is, the linear prediction for the main regression equation is treated as  $\mathbf{x}_j\boldsymbol{\beta}$  rather than as  $\mathbf{x}_j\boldsymbol{\beta} + \text{offset}_j^\beta$  and the linear prediction for the inflation equation is treated as  $\mathbf{z}_j\boldsymbol{\gamma}$  rather than as  $\mathbf{z}_j\boldsymbol{\gamma} + \text{offset}_j^\gamma$ .

`scores` calculates equation-level score variables.

The first new variable will contain  $\partial \ln L / \partial (\mathbf{x}_j\boldsymbol{\beta})$ . In the absence of independent variables in the main equation, this variable is not stored.

The second new variable will contain  $\partial \ln L / \partial (\mathbf{z}_j\boldsymbol{\gamma})$ .

When the dependent variable takes  $k$  different values, the third new variable through new variable  $k + 1$  will contain  $\partial \ln L / \partial (\kappa_h)$  for  $h = 0, 1, \dots, k - 2$ .

## 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]
```

<i>statistic</i>	Description
default	marginal probabilities for each outcome
<u>p</u> margin	marginal probabilities of levels, $\Pr(y_j = h)$ ; the default
<u>p</u> joint1	joint probabilities of levels and susceptibility, $\Pr(y_j = h, s_j = 1)$
<u>p</u> cond1	probabilities of levels conditional on susceptibility, $\Pr(y_j = h   s_j = 1)$
<u>p</u> s	probability of susceptibility, $\Pr(s_j = 1)$
<u>p</u> ns	probability of nonsusceptibility, $\Pr(s_j = 0)$
<u>x</u> b	linear prediction
<u>x</u> binfl	linear prediction for inflation equation
<u>s</u> tdp	not allowed with <code>margins</code>
<u>s</u> tdpinfl	not allowed with <code>margins</code>

`pmargin`, `pjoint1`, and `pcond1` default to the first outcome.

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

For the full syntax, see [R] [margins](#).

## Remarks and examples

[stata.com](http://stata.com)

The ZIOL model allows all the predictions and marginal effects available with the standard `ologit` model (see [\[R\] ologit postestimation](#)), along with additional predictions and marginal effects related to the inflation equation for susceptibility. The probabilities of susceptibility and nonsusceptibility can be calculated using options `ps` and `pns`, respectively. If you prefer an alternative terminology of probabilities of participation and nonparticipation, you can instead use options `ppar` and `pnpar`, which will produce identical numerical results but label variables as `Pr(participation)` and `Pr(nonparticipation)` instead of `Pr(susceptible)` and `Pr(nonsusceptible)`.

### ► Example 1: Average marginal effect of gender on probability of nonsusceptibility

In [example 1](#) of [\[R\] ziologit](#), we fit a model for levels of cigarette consumption.

```
. use https://www.stata-press.com/data/r18/tobacco
(Fictional tobacco consumption data)
. ziologit tobacco education income age i.female,
> inflate(education income age i.female i.parent i.religion)
(output omitted)
```

This model parallels the zero-inflated ordered probit (ZIOP) model that was fit in [example 1](#) of [\[R\] zioprobit](#).

To continue the comparison between the ZIOL and ZIOP models, we re-create [example 1](#) from [\[R\] zioprobit postestimation](#) by using `margins` to estimate the average marginal effect of gender on the probability of nonsusceptibility (being an excess zero) for individuals with a college degree (17 years of education) and a smoking parent.

```
. margins, predict(pns) dydx(female) at(education = 17 parent = 1)
Average marginal effects                Number of obs = 15,000
Model VCE: OIM
Expression: Pr(nonsusceptible), predict(pns)
dy/dx wrt: 1.female
At: education = 17
    parent   = 1
```

	Delta-method				
	dy/dx	std. err.	z	P> z	[95% conf. interval]
female					
Female	.085421	.010096	8.46	0.000	.0656333 .1052087

Note: dy/dx for factor levels is the discrete change from the base level.

Despite the differences between the ZIOL and ZIOP models, the conclusion is the same: women with a college degree and a smoking parent are expected to have an approximately 8.5% higher chance of being genuine nonsmokers (excess zeros) than comparable men.



### ► Example 2: Predicted probabilities of conditional zeros

Next, we consider the effect of income on the probability of zero tobacco consumption, conditional on susceptibility. These would-be smokers are known as conditional zeros. In [example 1](#) of [\[R\] ziologit](#), we saw that increasing income raises a smoker's odds of increased tobacco consumption dramatically, so we expect to see a larger fraction of conditional zeros at the lower end of the income scale.

We examine conditional probabilities of zero consumption for incomes ranging from \$10,000 to \$60,000, and we use the `noatlegend` option to suppress the default legend because we know the values 1 to 6 correspond to income in tens of thousands of dollars.

```
. margins, predict(pcond1 outcome(0)) at(income = (1/6)) noatlegend
Predictive margins                                Number of obs = 15,000
Model VCE: OIM
Expression: Pr(tobacco=0|susceptible=1), predict(pcond1 outcome(0))
```

_at	Delta-method		z	P> z	[95% conf. interval]	
	Margin	std. err.				
1	.5923634	.0027586	214.73	0.000	.5869566	.5977702
2	.5393818	.0025948	207.87	0.000	.534296	.5444676
3	.4854668	.0024651	196.94	0.000	.4806354	.4902982
4	.4306299	.0023953	179.78	0.000	.4259352	.4353245
5	.3741538	.0024547	152.42	0.000	.3693427	.3789649
6	.3152985	.0026294	119.91	0.000	.3101449	.320452

The influence of income is dramatic: susceptible individuals (potential smokers) who earn \$10,000 a year are almost twice as likely to refrain from smoking as potential smokers who earn \$60,000 per year (59% versus 32%).

◀

## Methods and formulas

See *Methods and formulas* in [R] **ziologit** for the model definition and notation. Specifically, see (1) for the formula for the probability of susceptibility,  $\Pr(s_j = 1|\mathbf{z}_j)$ ; see (2) for the formula for the probabilities of outcome levels conditional on susceptibility,  $\Pr(y_j = h|s_j = 1, \mathbf{x}_j)$ ; and see (4) for the formula for the marginal probabilities of outcome levels,  $\Pr(y_j = h|\mathbf{z}_j, \mathbf{x}_j)$ .

The joint probability of susceptibility and outcome  $y_j = h$  can be expressed as

$$\Pr(y_j = h, s_j = 1|\mathbf{z}_j, \mathbf{x}_j) = \Pr(s_j = 1|\mathbf{z}_j) \Pr(y_j = h|s_j = 1, \mathbf{x}_j)$$

for  $h = 0, 1, \dots, H$ .

## Reference

Kelley, M. E., and S. J. Anderson. 2008. Zero inflation in ordinal data: Incorporating susceptibility to response through the use of a mixture model. *Statistics in Medicine* 27: 3674–3688. <https://doi.org/10.1002/sim.3267>.

## Also see

[R] **ziologit** — Zero-inflated ordered logit regression

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

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