Title

> **oprobit —** Ordered probit regression

Description

oprobit fits ordered probit models of ordinal variable *depvar* on the independent variables *indepvars*. The actual values taken on by the dependent variable are irrelevant, except that larger values are assumed to correspond to "higher" outcomes.

Quick start

Ordinal probit model of y on x1 and categorical variables a and b

    oprobit y x1 i.a i.b

Model of y on x1 and a one-period lagged value of x1 using tsset data

    oprobit y x1 L.x1

As above, but calculate results for each level of catvar and save statistics to myfile.dta

    statsby, by(catvar) saving(myfile): oprobit y x1 L.x1

Menu

Statistics > Ordinal outcomes > Ordered probit regression

Syntax

> [oprobit](#) *[depvar](#)* [*[indepvars](#)*] [*[if](#)*] [*[in](#)*] [*[weight](#)*] [, *options*]

options	Description
Model	
[off](#)set(*[varname](#)*)	include *varname* in model with coefficient constrained to 1
[const](#)raints(*[constraints](#)*)	apply specified linear constraints
[coll](#)inear	keep collinear variables
SE/Robust	
vce(*[vcetype](#)*)	*vcetype* may be oim, [r](#)obust, [cl](#)uster *clustvar*, [boot](#)strap, or
	[jack](#)knife
Reporting	
[lev](#)el(*#*)	set confidence level; default is level(95)
nocnsreport	do not display constraints
[display_options](#)	control columns and column formats, row spacing, line width, display of omitted variables and base and empty cells, and factor-variable labeling
Maximization	
[maximize_options](#)	control the maximization process; seldom used
coeflegend	display legend instead of statistics

indepvars may contain factor variables; see [U] **11.4.3 Factor variables**.

depvar and *indepvars* may contain time-series operators; see [U] **11.4.4 Time-series varlists**.

bootstrap, by, fp, jackknife, mfp, mi estimate, nestreg, rolling, statsby, stepwise, and svy are allowed; see [U] **11.1.10 Prefix commands**.

vce(bootstrap) and vce(jackknife) are not allowed with the mi estimate prefix; see [MI] **mi estimate**.

Weights are not allowed with the bootstrap prefix; see [R] **bootstrap**.

vce() and weights are not allowed with the svy prefix; see [SVY] **svy**.

fweights, iweights, and pweights are allowed; see [U] **11.1.6 weight**.

coeflegend does not appear in the dialog box.

See [U] **20 Estimation and postestimation commands** for more capabilities of estimation commands.

Options

Model

offset(*varname*), constraints(*constraints*), collinear; see [R] **estimation options**.

SE/Robust

vce(*vcetype*) specifies the type of standard error reported, which includes types that are derived from asymptotic theory (oim), that are robust to some kinds of misspecification (robust), that allow for intragroup correlation (cluster *clustvar*), and that use bootstrap or jackknife methods (bootstrap, jackknife); see [R] *vce_option*.

Reporting

level(*#*); see [R] **estimation options**.

nocnsreport; see [R] **estimation options**.

display_options: noci, nopvalues, noomitted, vsquish, noemptycells, baselevels,
   allbaselevels, nofvlabel, fvwrap(*#*), fvwrapon(*style*), cformat(*%fmt*), pformat(*%fmt*),
   sformat(*%fmt*), and nolstretch; see [R] **estimation options**.

Maximization

maximize_options: difficult, technique(*algorithm_spec*), iterate(*#*), [no]log, trace,
   gradient, showstep, hessian, showtolerance, tolerance(*#*), ltolerance(*#*),
   nrtolerance(*#*), nonrtolerance, and from(*init_specs*); see [R] **maximize**. These options are
   seldom used.

The following option is available with oprobit but is not shown in the dialog box:

coeflegend; see [R] **estimation options**.

Remarks and examples

An ordered probit model is used to estimate relationships between an ordinal dependent variable
and a set of independent variables. An *ordinal* variable is a variable that is categorical and ordered,
for instance, "poor", "good", and "excellent", which might indicate a person's current health status or
the repair record of a car. If there are only two outcomes, see [R] **logistic**, [R] **logit**, and [R] **probit**.
This entry is concerned only with more than two outcomes. If the outcomes cannot be ordered (for
example, residency in the north, east, south, or west), see [R] **mlogit**. This entry is concerned only
with models in which the outcomes can be ordered. See [R] **logistic** for a list of related estimation
commands.

In ordered probit, an underlying score is estimated as a linear function of the independent variables
and a set of cutpoints. The probability of observing outcome i corresponds to the probability that the
estimated linear function, plus random error, is within the range of the cutpoints estimated for the
outcome:

$$\Pr(\text{outcome}_j = i) = \Pr(\kappa_{i-1} < \beta_1 x_{1j} + \beta_2 x_{2j} + \cdots + \beta_k x_{kj} + u_j \leq \kappa_i)$$

u_j is assumed to be normally distributed. In either case, we estimate the coefficients β_1, β_2, ...,
β_k together with the cutpoints κ_1, κ_2, ..., κ_{I-1}, where I is the number of possible outcomes.
κ_0 is taken as $-\infty$, and κ_I is taken as $+\infty$. All of this is a direct generalization of the ordinary
two-outcome probit model.

▷ Example 1

In example 2 of [R] **ologit**, we use a variation of the automobile dataset (see [U] **1.2.2 Example
datasets**) to analyze the 1977 repair records of 66 foreign and domestic cars. We use ordered logit
to explore the relationship of rep77 in terms of foreign (origin of manufacture), length (a proxy
for size), and mpg. Here we fit the same model using ordered probit rather than ordered logit:

```
. use http://www.stata-press.com/data/r14/fullauto
(Automobile Models)

. oprobit rep77 foreign length mpg

Iteration 0:   log likelihood = -89.895098
Iteration 1:   log likelihood = -78.106316
Iteration 2:   log likelihood = -78.020086
Iteration 3:   log likelihood = -78.020025
Iteration 4:   log likelihood = -78.020025
```

Ordered probit regression

				Number of obs	=	66
				LR chi2(3)	=	23.75
				Prob > chi2	=	0.0000
Log likelihood = -78.020025				Pseudo R2	=	0.1321

rep77	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
foreign	1.704861	.4246796	4.01	0.000	.8725037	2.537217
length	.0468675	.012648	3.71	0.000	.022078	.0716571
mpg	.1304559	.0378628	3.45	0.001	.0562463	.2046656
/cut1	10.1589	3.076754			4.128577	16.18923
/cut2	11.21003	3.107527			5.119389	17.30067
/cut3	12.54561	3.155233			6.361467	18.72975
/cut4	13.98059	3.218793			7.671874	20.28931

We find that foreign cars have better repair records, as do larger cars and cars with better mileage ratings.

◁

Stored results

oprobit stores the following in e():

Scalars
e(N)	number of observations
e(N_cd)	number of completely determined observations
e(k_cat)	number of categories
e(k)	number of parameters
e(k_aux)	number of auxiliary parameters
e(k_eq)	number of equations in e(b)
e(k_eq_model)	number of equations in overall model test
e(k_dv)	number of dependent variables
e(df_m)	model degrees of freedom
e(r2_p)	pseudo-R-squared
e(ll)	log likelihood
e(ll_0)	log likelihood, constant-only model
e(N_clust)	number of clusters
e(chi2)	χ^2
e(p)	significance of model test
e(rank)	rank of e(V)
e(ic)	number of iterations
e(rc)	return code
e(converged)	1 if converged, 0 otherwise

Macros
e(cmd)	oprobit
e(cmdline)	command as typed
e(depvar)	name of dependent variable
e(wtype)	weight type
e(wexp)	weight expression
e(title)	title in estimation output
e(clustvar)	name of cluster variable
e(offset)	linear offset variable
e(chi2type)	Wald or LR; type of model χ^2 test
e(vce)	*vcetype* specified in vce()
e(vcetype)	title used to label Std. Err.
e(opt)	type of optimization
e(which)	max or min; whether optimizer is to perform maximization or minimization
e(ml_method)	type of ml method
e(user)	name of likelihood-evaluator program
e(technique)	maximization technique
e(properties)	b V
e(predict)	program used to implement predict
e(marginsdefault)	default predict() specification for margins
e(asbalanced)	factor variables fvset as asbalanced
e(asobserved)	factor variables fvset as asobserved

Matrices
e(b)	coefficient vector
e(Cns)	constraints matrix
e(ilog)	iteration log (up to 20 iterations)
e(gradient)	gradient vector
e(cat)	category values
e(V)	variance–covariance matrix of the estimators
e(V_modelbased)	model-based variance

Functions
e(sample)	marks estimation sample

Methods and formulas

See *Methods and formulas* of [R] **ologit**.

References

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Also see

[R] **oprobit postestimation** — Postestimation tools for oprobit

[R] **heckoprobit** — Ordered probit model with sample selection

[R] **logistic** — Logistic regression, reporting odds ratios

[R] **mlogit** — Multinomial (polytomous) logistic regression

[R] **mprobit** — Multinomial probit regression

[R] **ologit** — Ordered logistic regression

[R] **probit** — Probit regression

[ME] **meoprobit** — Multilevel mixed-effects ordered probit regression

[MI] **estimation** — Estimation commands for use with mi estimate

[SVY] **svy estimation** — Estimation commands for survey data

[XT] **xtoprobit** — Random-effects ordered probit models

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