bayes: tobit — Bayesian tobit regression

Description
bayes: tobit fits a Bayesian tobit regression to a censored continuous outcome; see [BAYES] bayes and [R] tobit for details.

Quick start
Bayesian tobit regression of \( y \) on \( x_1 \) and \( x_2 \), using a lower censoring limit of 17 and using default normal priors for regression coefficients and default inverse-gamma prior for the variance
\[
\text{bayes: tobit } y \ x_1 \ x_2, \ ll(17)
\]
Use a standard deviation of 10 instead of 100 for the default normal priors
\[
\text{bayes, normalprior(10): tobit } y \ x_1 \ x_2, \ ll(17)
\]
Use a shape of 1 and a scale of 2 instead of values of 0.01 for the default inverse-gamma prior
\[
\text{bayes, igammaprior(1 2): tobit } y \ x_1 \ x_2, \ ll(17)
\]
Use uniform priors for the slopes and a normal prior for the intercept
\[
\text{bayes, prior({y: }x_1 \ x_2), uniform(-10,10))} \\
\text{prior({y: _cons}, normal(0,10)): tobit } y \ x_1 \ x_2, \ ll(17)
\]
Save simulation results to simdata.dta, and use a random-number seed for reproducibility
\[
\text{bayes, saving(simdata) rseed(123): tobit } y \ x_1 \ x_2, \ ll(17)
\]
Specify 20,000 MCMC samples, set length of the burn-in period to 5,000, and request that a dot be displayed every 500 simulations
\[
\text{bayes, mcmcsize(20000) burnin(5000) dots(500): tobit } y \ x_1 \ x_2, \ ll(17)
\]
In the above, request that the 90% HPD credible interval be displayed instead of the default 95% equal-tailed credible interval
\[
\text{bayes, clevel(90) hpd}
\]
Also see Quick start in [BAYES] bayes and Quick start in [R] tobit.

Menu
Statistics > Linear models and related > Bayesian regression > Tobit regression
## Syntax

```
bayes [, bayesopts] : tobit depvar [ indepvars ] [ if ] [ in ] [ weight ] [ , options ]
```

### options

<table>
<thead>
<tr>
<th>Description</th>
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<tbody>
<tr>
<td><code>noconstant</code> suppress constant term</td>
</tr>
<tr>
<td>`ll(varname</td>
</tr>
<tr>
<td>`ul(varname</td>
</tr>
<tr>
<td><code>offset(varname)</code> include <code>varname</code> in model with coefficient constrained to 1</td>
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</tbody>
</table>

### Reporting

- `display_options` control spacing, line width, and base and empty cells
- `level(#)` set credible level; default is `level(95)`

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

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

`fweights` are allowed; see [U] 11.1.6 weight.

`bayes: tobit, level()` is equivalent to `bayes, clevel(): tobit`.

For a detailed description of `options`, see Options in [R] tobit.

### bayesopts

#### Priors

- `normalprior(#)` specify standard deviation of default normal priors for regression coefficients; default is `normalprior(100)`
- `igammaprior(# #)` specify shape and scale of default inverse-gamma prior for variance; default is `igammaprior(0.01 0.01)`
- `prior(priorspec)` prior for model parameters; this option may be repeated
- `dryrun` show model summary without estimation

#### Simulation

- `nchains(#)` number of chains; default is to simulate one chain
- `mcmcsize(#)` MCMC sample size; default is `mcmcsize(10000)`
- `burnin(#)` burn-in period; default is `burnin(2500)`
- `thinning(#)` thinning interval; default is `thinning(1)`
- `rseed(#)` random-number seed
- `exclude(paramref)` specify model parameters to be excluded from the simulation results

#### Blocking

- `blocksize(#)` maximum block size; default is `blocksize(50)`
- `block(paramref[ , blockopts ])` specify a block of model parameters; this option may be repeated
- `blocksummary` display block summary
- `noblocking` do not block parameters by default
Initialization

`initial( initspec )` specify initial values for model parameters with a single chain
`init#( initspec )` specify initial values for #th chain; requires `nchains()`
`initall( initspec )` specify initial values for all chains; requires `nchains()`
`nomleinit` suppress the use of maximum likelihood estimates as starting values
`initsummary` display initial values used for simulation
`*noisily` display output from the estimation command during initialization

Adaptation

`adaptation( adaptopts )` control the adaptive MCMC procedure
`scale(#)` initial multiplier for scale factor; default is `scale(2.38)`
`covariance(cov)` initial proposal covariance; default is the identity matrix

Reporting

`clevel(#)` set credible interval level; default is `clevel(95)`
`hpd` display HPD credible intervals instead of the default equal-tailed credible intervals
`eform[ (string) ]` report exponentiated coefficients and, optionally, label as `string`
`batch(#)` specify length of block for batch-means calculations; default is `batch(0)`
`saving( filename[, replace] )` save simulation results to `filename.dta`
`nomodelsummary` suppress model summary
`chainsdetail` display detailed simulation summary for each chain
`[ no ] dots` suppress dots or display dots every 100 iterations and iteration numbers every 1,000 iterations; default is `nodots`
`dots(#[, every(#) ])` display dots as simulation is performed
`[ no ] show(paramref)` specify model parameters to be excluded from or included in the output
`notable` suppress estimation table
`noheader` suppress output header
`title(string)` display `string` as title above the table of parameter estimates
`display_options` control spacing, line width, and base and empty cells

Advanced

`search( search_options )` control the search for feasible initial values
`corrlag(#)` specify maximum autocorrelation lag; default varies
`corrtol(#)` specify autocorrelation tolerance; default is `corrtol(0.01)`

∗Starred options are specific to the `bayes` prefix; other options are common between `bayes` and `bayesmh`.

Options `prior()` and `block()` may be repeated.

`priorspec` and `paramref` are defined in [BAYES] `bayesmh`.

`paramref` may contain factor variables; see [U] 11.4.3 Factor variables.

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

Model parameters are regression coefficients `{depvar:indepvars}` and variance `{sigma2}`. Use the `dryrun` option to see the definitions of model parameters prior to estimation.

For a detailed description of `bayesopts`, see Options in [BAYES] `bayes`.
Remarks and examples

For a general introduction to Bayesian analysis, see [BAYES] Intro. For a general introduction to Bayesian estimation using an adaptive Metropolis–Hastings algorithm, see [BAYES] bayesmh. For remarks and examples specific to the bayes prefix, see [BAYES] bayes. For details about the estimation command, see [R] tobit.

For a simple example of the bayes prefix, see Introductory example in [BAYES] bayes.

Stored results

See Stored results in [BAYES] bayes.

Methods and formulas

See Methods and formulas in [BAYES] bayesmh.

Also see

[BAYES] bayes — Bayesian regression models using the bayes prefix
[R] tobit — Tobit regression
[BAYES] Bayesian postestimation — Postestimation tools for bayesmh and the bayes prefix
[BAYES] Bayesian estimation — Bayesian estimation commands
[BAYES] Bayesian commands — Introduction to commands for Bayesian analysis
[BAYES] Intro — Introduction to Bayesian analysis
[BAYES] Glossary