bayes: mestreg — Bayesian multilevel parametric survival models

Description

bayes: mestreg fits a Bayesian multilevel parametric survival model to a survival-time outcome; see [BAYES] bayes and [ME] mestreg for details.

Quick start

Bayesian two-level Weibull survival model of stset survival-time outcome on x1 and x2 with random intercepts by id, using default normal priors for regression coefficients and log-ancillary parameters and default inverse-gamma prior for the variance of random intercepts

bayes: mestreg x1 x2 || id:, distribution(weibull)

Use a standard deviation of 10 instead of 100 for the default normal priors

bayes, normalprior(10): mestreg x1 x2 || id:, distribution(weibull)

Use uniform priors for the slopes and a normal prior for the intercept

bayes, prior({-_t: x1 x2}, uniform(-10,10)) ///
   prior({-_t:_cons}, normal(0,10)): ///
   mestreg x1 x2 || id:, distribution(weibull)

Save simulation results to simdata.dta, and use a random-number seed for reproducibility

bayes, saving(simdata) rseed(123): ///
   mestreg x1 x2 || id:, distribution(weibull)

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

bayes, mcmcsize(20000) burnin(5000) dots(500): ///
   mestreg x1 x2 || id:, distribution(weibull)

In the above, request that the 90% HPD credible interval be displayed instead of the default 95% equal-tailed credible interval

bayes, clevel(90) hpd

Use accelerated failure-time metric instead of proportional-hazards parameterization, and display time ratios instead of coefficients

bayes, tratio: mestreg x1 x2 || id:, distribution(weibull) time

Display time ratios on replay

bayes, tratio

Also see Quick start in [BAYES] bayes and Quick start in [ME] mestreg.

Menu

Statistics > Multilevel mixed-effects models > Bayesian regression > Parametric survival regression
Syntax

\[
\text{bayes} \ [\text{, bayesopts}] : \text{mestreg} \ \text{fe\_equation}
\]

\[
\[\mid \mid \text{re\_equation} \ [\mid \mid \text{re\_equation} \ldots], \text{distribution(distname)} \ [\text{options}]
\]

where the syntax of \text{fe\_equation} is

\[
[\text{indepvars} \ [\text{if} \ [\text{in} \ [\text{weight} \ [\text{, fe\_options}]]]]]
\]

and the syntax of \text{re\_equation} is one of the following:

for random coefficients and intercepts

\[
\text{levelvar} : [\text{varlist} \ [\text{, re\_options}]]
\]

for random effects among the values of a factor variable

\[
\text{levelvar} : \text{R.\_varname}
\]

\text{levelvar} either is a variable identifying the group structure for the random effects at that level or is \_all, representing one group comprising all observations.

\text{fe\_options} \quad \text{Description}

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>noconstant</td>
<td>suppress constant term from the fixed-effects equation</td>
</tr>
<tr>
<td>offset(varname)</td>
<td>include varname in model with coefficient constrained to 1</td>
</tr>
</tbody>
</table>

\text{re\_options} \quad \text{Description}

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>covariance(vartype)</td>
<td>variance–covariance structure of the random effects; only structures independent, identity, and unstructured supported</td>
</tr>
<tr>
<td>noconstant</td>
<td>suppress constant term from the random-effects equation</td>
</tr>
</tbody>
</table>

\text{options} \quad \text{Description}

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>*distribution(distname)</td>
<td>specify survival distribution</td>
</tr>
<tr>
<td>time</td>
<td>use accelerated failure-time metric</td>
</tr>
<tr>
<td>Reporting</td>
<td></td>
</tr>
<tr>
<td>nohr</td>
<td>do not report hazard ratios</td>
</tr>
<tr>
<td>tratio</td>
<td>report time ratios</td>
</tr>
<tr>
<td>noshow</td>
<td>do not show st setting information</td>
</tr>
<tr>
<td>notable</td>
<td>suppress coefficient table</td>
</tr>
<tr>
<td>noheader</td>
<td>suppress output header</td>
</tr>
<tr>
<td>nogroup</td>
<td>suppress table summarizing groups</td>
</tr>
<tr>
<td>display_options</td>
<td>control spacing, line width, and base and empty cells</td>
</tr>
<tr>
<td>level(#)</td>
<td>set credible level; default is level(95)</td>
</tr>
</tbody>
</table>
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distribution(distname) is required.
You must stset your data before using bayes: mestreg; see [ST] stset.

indeps may contain factor variables; see [U] 11.4.3 Factor variables.
fweights are allowed; see [U] 11.1.6 weight.
bayes: mestreg, level() is equivalent to bayes, clevel(): mestreg.
For a detailed description of options, see Options in [ME] mestreg.

bayesopty                Description

Priors
*n公章n prior(#)       specify standard deviation of default normal priors for regression
coefficients and log-ancillary parameters;
default is normalprior(100)

*igampprior(# #)       specify shape and scale of default inverse-gamma prior for
          variance components; default is igammaprior(0.01 0.01)

*iwishartprior(# [...]) specify degrees of freedom and, optionally, scale matrix of default
          inverse-Wishart prior for unstructured random-effects covariance
          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
restubs(restub1 restub2 ...) specify stubs for random-effects parameters for all levels

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()
nomleinitial         suppress the use of maximum likelihood estimates as starting values
initall(initspec)      specify initial values for all chains; requires nchains()
inirandom            specify random initial 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
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Reporting

clevel(#) set credible interval level; default is clevel(95)
hpd display HPD credible intervals instead of the default equal-tailed credible intervals

* nohr do not report hazard ratios
* ratio report time ratios; requires option time with mestreg
eform[\(\text{string}\)] report exponentiated coefficients and, optionally, label as \text{string}
remargl compute log marginal-likelihood
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
nomessummary suppress multilevel-structure summary
chainedetail display detailed simulation summary for each chain
[no] dots display dots or display dots every 100 iterations and iteration numbers every 1,000 iterations; default is dots
dots[#[, every(#)]] display dots as simulation is performed
[no] show(paramref) specify model parameters to be excluded from or included in the output
showeffects[\(\text{reref}\)] specify that all or a subset of random-effects parameters be included in the output
melabel display estimation table using the same row labels as mestreg
nogroup suppress table summarizing groups
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\}, ancillary parameters as described in Ancillary model parameters, random effects \{rename\}, and either variance components \{rename:sigma2\} or, if option covariance(unstructured) is specified, matrix parameter \{restub:Sigma,matrix\}; see Likelihood model in [BAYES] bayes for how renames and restub are defined. 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
sta.com

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
Ancillary model parameters

In addition to regression coefficients \{t: varlist\}, \texttt{bayes: mestreg} defines ancillary parameters that depend on the chosen survival model; see table 1 below. Positive ancillary parameters are transformed to be defined on the whole real line. All ancillary parameters are assigned default normal priors with zero mean and variance of 10,000.

<table>
<thead>
<tr>
<th>Distribution</th>
<th>Ancillary parameters</th>
<th>Transformed model parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exponential</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Weibull</td>
<td>( p )</td>
<td>{ln_p}</td>
</tr>
<tr>
<td>Lognormal</td>
<td>( \sigma )</td>
<td>{ln_sigma}</td>
</tr>
<tr>
<td>Loglogistic</td>
<td>( \gamma )</td>
<td>{ln_gamma}</td>
</tr>
<tr>
<td>Gamma</td>
<td>( s )</td>
<td>{ln_scale}</td>
</tr>
</tbody>
</table>

Use the \texttt{dryrun} option with the \texttt{bayes} prefix to see the definitions of model parameters prior to estimation.

Stored results

See \textit{Stored results} in \texttt{[BAYES bayes]}.

Methods and formulas

See \textit{Methods and formulas} in \texttt{[BAYES bayesmh]}.

Also see

- \texttt{[BAYES bayes]} — Bayesian regression models using the bayes prefix
- \texttt{[ME mestreg]} — Multilevel mixed-effects parametric survival models
- \texttt{[BAYES Bayesian postestimation]} — Postestimation tools for bayesmh and the bayes prefix
- \texttt{[BAYES Bayesian estimation]} — Bayesian estimation commands
- \texttt{[BAYES Bayesian commands]} — Introduction to commands for Bayesian analysis
- \texttt{[BAYES Intro]} — Introduction to Bayesian analysis
- \texttt{[BAYES Glossary]}