Title

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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

```
bayes [, bayesopts] : mestreg fe_equation
    [|| re_equation] [|| re_equation ...], distribution(distname) [options]
```

where the syntax of *fe_equation* is

```
[indepvars] [if] [in] [weight] [, fe_options]
```

and the syntax of *re_equation* is one of the following:

for random coefficients and intercepts

```
levelvar: [varlist] [, re_options]
```

for random effects among the values of a factor variable

```
levelvar: R.varname
```

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.

fe_options	Description
Model	
`noconstant`	suppress constant term from the fixed-effects equation
`offset(`*varname*`)`	include *varname* in model with coefficient constrained to 1

re_options	Description
Model	
`covariance(`*vartype*`)`	variance–covariance structure of the random effects; only structures `independent`, `identity`, and `unstructured` supported
`noconstant`	suppress constant term from the random-effects equation

options	Description
Model	
* `distribution(`*distname*`)`	specify survival distribution
`time`	use accelerated failure-time metric
Reporting	
`nohr`	do not report hazard ratios
`tratio`	report time ratios
`noshow`	do not show st setting information
`notable`	suppress coefficient table
`noheader`	suppress output header
`nogroup`	suppress table summarizing groups
display_options	control spacing, line width, and base and empty cells
`level(#)`	set credible level; default is `level(95)`

*distribution(*distname*) is required.
You must stset your data before using bayes: mestreg; see [ST] stset.
indepvars 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.

bayesopts	Description
Priors	
*normalprior(#)	specify standard deviation of default normal priors for regression coefficients and log-ancillary parameters; default is normalprior(100)
*igammaprior(# #)	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()
initall(*initspec*)	specify initial values for all chains; requires nchains()
nomleinitial	suppress the use of maximum likelihood estimates as starting values
initrandom	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

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
*tratio	report time ratios; requires option time with mestreg
eform[(*string*)]	report exponentiated coefficients and, optionally, label as *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
nomesummary	suppress multilevel-structure 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 dots
dots(#[, every(#)])	display dots as simulation is performed
[no]show(*paramref*)	specify model parameters to be excluded from or included in the output
showreffects[(*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 *rename*s 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

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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 [ME] **mestreg**.

For a simple example of the bayes prefix, see *Introductory example* in [BAYES] **bayes**. For multilevel examples, see *Multilevel models* in [BAYES] **bayes**.

Ancillary model parameters

In addition to regression coefficients {_t:*varlist*}, 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 1. Ancillary model parameters defined by bayes: mestreg

Distribution	Ancillary parameters	Transformed model parameters
Exponential	None	None
Weibull	p	{ln_p}
Lognormal	σ	{lnsigma}
Loglogistic	γ	{lngamma}
Gamma	s	{lnscale}

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

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

[ME] **mestreg** — Multilevel mixed-effects parametric survival models

[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**