

**bayes: mestreg** — Bayesian multilevel parametric survival models

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## 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, mcmcs(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.

<i>fe_options</i>	Description
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Model

<code><u>noconstant</u></code>	suppress constant term from the <a href="#">fixed-effects</a> equation
<code><u>offset</u>(<i>varname</i>)</code>	include <i>varname</i> in model with coefficient constrained to 1

<i>re_options</i>	Description
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Model

<code><u>covariance</u>(<i>vartype</i>)</code>	variance–covariance structure of the <a href="#">random effects</a> ; only structures <code>independent</code> , <code>identity</code> , and <code>unstructured</code> supported
<code><u>noconstant</u></code>	suppress constant term from the random-effects equation

<i>options</i>	Description
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Model

* <code><u>distribution</u>(<i>distname</i>)</code>	specify survival distribution
<code><u>time</u></code>	use accelerated failure-time metric
<code><u>collinear</u></code>	keep collinear variables

Reporting

<code><u>nohr</u></code>	do not report hazard ratios
<code><u>tratio</u></code>	report time ratios
<code><u>noshow</u></code>	do not show st setting information
<code><u>notable</u></code>	suppress coefficient table
<code><u>noheader</u></code>	suppress output header
<code><u>nogroup</u></code>	suppress table summarizing groups
<code><u>display_options</u></code>	control spacing, line width, and base and empty cells
<code><u>level</u>(#)</code>	set credible level; default is <code>level(95)</code>

\*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`.

<i>bayesopts</i>	Description
<b>Priors</b>	
* <code>normalprior(#)</code>	specify standard deviation of default normal priors for regression coefficients and log-ancillary parameters; default is <code>normalprior(100)</code>
* <code>igammaprior(# #)</code>	specify shape and scale of default inverse-gamma prior for variance components; default is <code>igammaprior(0.01 0.01)</code>
* <code>iwishartprior(# [...])</code>	specify degrees of freedom and, optionally, scale matrix of default inverse-Wishart prior for unstructured random-effects covariance
<code>prior(priorspec)</code>	prior for model parameters; this option may be repeated
<code>dryrun</code>	show model summary without estimation
<b>Simulation</b>	
<code>mcmcsize(#)</code>	MCMC sample size; default is <code>mcmcsize(10000)</code>
<code>burnin(#)</code>	burn-in period; default is <code>burnin(2500)</code>
<code>thinning(#)</code>	thinning interval; default is <code>thinning(1)</code>
<code>rseed(#)</code>	random-number seed
<code>exclude(paramref)</code>	specify model parameters to be excluded from the simulation results
<code>restubs(restub1 restub2 ...)</code>	specify stubs for random-effects parameters for all levels
<b>Blocking</b>	
* <code>blocksize(#)</code>	maximum block size; default is <code>blocksize(50)</code>
<code>block(paramref[, blockopts])</code>	specify a block of model parameters; this option may be repeated
<code>blocksummary</code>	display block summary
* <code>noblocking</code>	do not block parameters by default
<b>Initialization</b>	
<code>initial(initspec)</code>	initial values for model parameters
<code>nomleinitial</code>	suppress the use of maximum likelihood estimates as starting values
<code>initransom</code>	specify random initial values
<code>initsummary</code>	display initial values used for simulation
* <code>noisily</code>	display output from the estimation command during initialization
<b>Adaptation</b>	
<code>adaptation(adaptopts)</code>	control the adaptive MCMC procedure
<code>scale(#)</code>	initial multiplier for scale factor; default is <code>scale(2.38)</code>
<code>covariance(cov)</code>	initial proposal covariance; default is the identity matrix

## Reporting

<code>clevel(#)</code>	set credible interval level; default is <code>clevel(95)</code>
<code>hpd</code>	display HPD credible intervals instead of the default equal-tailed credible intervals
* <code>nohr</code>	do not report hazard ratios
* <code>tratio</code>	report time ratios; requires option <code>time</code> with <code>mestreg</code>
<code>eform[ (string) ]</code>	report exponentiated coefficients and, optionally, label as <i>string</i>
<code>remargl</code>	compute log marginal likelihood
<code>batch(#)</code>	specify length of block for batch-means calculations; default is <code>batch(0)</code>
<code>saving(filename[ , replace ])</code>	save simulation results to <i>filename.dta</i>
<code>nomodelsummary</code>	suppress model summary
<code>nomesummary</code>	suppress multilevel-structure summary
<code>[no]dots</code>	suppress dots or display dots every 100 iterations and iteration numbers every 1,000 iterations; default is <code>dots</code>
<code>dots(#[ , every(#) ])</code>	display dots as simulation is performed
<code>[no]show(paramref)</code>	specify model parameters to be excluded from or included in the output
<code>showreflects[ (ref) ]</code>	specify that all or a subset of random-effects parameters be included in the output
<code>melabel</code>	display estimation table using the same row labels as <code>mestreg</code>
<code>nogroup</code>	suppress table summarizing groups
<code>notable</code>	suppress estimation table
<code>noheader</code>	suppress output header
<code>title(string)</code>	display <i>string</i> as title above the table of parameter estimates
<code>display_options</code>	control spacing, line width, and base and empty cells

## Advanced

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

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

Options `prior()` and `block()` can 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

[stata.com](http://stata.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 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	$p$	<code>{ln_p}</code>
Lognormal	$\sigma$	<code>{lnsigma}</code>
Loglogistic	$\gamma$	<code>{lngamma}</code>
Gamma	$s$	<code>{lnscale}</code>

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] `bayesmh`.

## 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`