bayes: streg — Bayesian parametric survival models

Description

bayes: streg fits a Bayesian parametric survival model to a survival-time outcome; see [BAYES] **bayes** and [ST] **streg** for details.

Quick start

Bayesian Weibull survival model of stset survival-time outcome on x1 and x2, using default normal priors for regression coefficients and log-ancillary parameters

```
bayes: streg x1 x2, distribution(weibull)
```

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

```
bayes, normalprior(10): streg x1 x2, 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)): streg x1 x2, distribution(weibull)
```

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

```
bayes, saving(simdata) rseed(123): ///
streg x1 x2, distribution(weibull)
```

Specify 20,000 Markov chain Monte Carlo (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): ///
streg x1 x2, distribution(weibull)
```

In the above, request that the 90% highest posterior density (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: streg x1 x2, distribution(weibull) time
```

Display time ratios on replay

```
bayes, tratio
```

Also see *Quick start* in [BAYES] **bayes** and *Quick start* in [ST] **streg**.

Menu

Statistics > Survival analysis > Regression models > Bayesian parametric survival models

Syntax

> bayes [, *bayesopts*] : streg [*varlist*] [*if*] [*in*] [, *options*]

options	Description
Model	
<u>noconst</u>ant	suppress constant term
<u>dist</u>ribution(<u>exp</u>onential)	exponential survival distribution
<u>dist</u>ribution(<u>gom</u>pertz)	Gompertz survival distribution
<u>dist</u>ribution(<u>loglog</u>istic)	loglogistic survival distribution
<u>dist</u>ribution(<u>llog</u>istic)	synonym for distribution(loglogistic)
<u>dist</u>ribution(<u>wei</u>bull)	Weibull survival distribution
<u>dist</u>ribution(<u>logn</u>ormal)	lognormal survival distribution
<u>dist</u>ribution(<u>lnorm</u>al)	synonym for distribution(lognormal)
<u>dist</u>ribution(<u>gg</u>amma)	generalized gamma survival distribution
<u>fr</u>ailty(gamma)	gamma frailty distribution
<u>fr</u>ailty(<u>invg</u>aussian)	inverse-Gaussian distribution
time	use accelerated failure-time metric
Model 2	
<u>str</u>ata(*varname*)	strata ID variable
<u>off</u>set(*varname*)	include *varname* in model with coefficient constrained to 1
<u>shar</u>ed(*varname*)	shared frailty ID variable
<u>anc</u>illary(*varlist*)	use *varlist* to model the first ancillary parameter
anc2(*varlist*)	use *varlist* to model the second ancillary parameter
Reporting	
nohr	do not report hazard ratios
tratio	report time ratios
<u>nosh</u>ow	do not show st setting information
display_options	control spacing, line width, and base and empty cells
level(#)	set credible level; default is level(95)

You must stset your data before using bayes: streg; see [ST] **stset**.

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

bayes: streg, level() is equivalent to bayes, clevel(): streg.

For a detailed description of *options*, see *Options* in [ST] **streg**.

bayesopts	Description
Priors	
* <u>normalprior</u>(#)	specify standard deviation of default normal priors for regression coefficients and log-ancillary parameters; default is normalprior(100)
prior(*priorspec*)	prior for model parameters; this option may be repeated
dryrun	show model summary without estimation

Simulation

<u>nch</u>ains(#)	number of chains; default is to simulate one chain
<u>mcmcs</u>ize(#)	MCMC sample size; default is mcmcsize(10000)
<u>burn</u>in(#)	burn-in period; default is burnin(2500)
<u>thin</u>ning(#)	thinning interval; default is thinning(1)
rseed(#)	random-number seed
<u>excl</u>ude(*paramref*)	specify model parameters to be excluded from the simulation results

Blocking

* <u>blocks</u>ize(#)	maximum block size; default is blocksize(50)
block(*paramref* [, *blockopts*])	specify a block of model parameters; this option may be repeated
<u>blocksu</u>mmary	display block summary
* <u>noblock</u>ing	do not block parameters by default

Initialization

<u>init</u>ial(*initspec*)	specify initial values for model parameters with a single chain
init#(*initspec*)	specify initial values for #th chain; requires nchains()
<u>initall</u>(*initspec*)	specify initial values for all chains; requires nchains()
<u>nomle</u>initial	suppress the use of maximum likelihood estimates as starting values
<u>initr</u>andom	specify random initial values
<u>inits</u>ummary	display initial values used for simulation
* <u>nois</u>ily	display output from the estimation command during initialization

Adaptation

<u>adapt</u>ation(*adaptopts*)	control the adaptive MCMC procedure
<u>sc</u>ale(#)	initial multiplier for scale factor; default is scale(2.38)
<u>cov</u>ariance(*cov*)	initial proposal covariance; default is the identity matrix

Reporting

<u>cl</u>evel(#)	set credible interval level; default is clevel(95)
hpd	display HPD credible intervals instead of the default equal-tailed credible intervals
* <u>nohr</u>	do not report hazard ratios
* <u>tratio</u>	report time ratios; requires option time with streg
<u>ef</u>orm[(*string*)]	report exponentiated coefficients and, optionally, label as *string*
batch(#)	specify length of block for batch-means calculations; default is batch(0)
<u>sav</u>ing(*filename*[, replace])	save simulation results to *filename*.dta
<u>nomods</u>ummary	suppress model summary
<u>chainsd</u>etail	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
<u>notable</u>	suppress estimation table
<u>nohead</u>er	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

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**.

collect is allowed; see [U] **11.1.10 Prefix commands**.

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

Model parameters are regression coefficients {*depvar*:*indepvars*} and ancillary parameters as described in *Ancillary model parameters*. 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**.

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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 [ST] **streg**.

For a simple example of the bayes prefix, see *Introductory example* in [BAYES] **bayes**. Also see *Parametric survival model* in [BAYES] **bayes**.

Ancillary model parameters

In addition to regression coefficients {_t:*varlist*}, bayes: streg 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: streg

Distribution	Ancillary parameters	Transformed model parameters
Exponential	None	None
Weibull	p	{ln_p}
Gompertz	γ	{gamma}
Lognormal	σ	{lnsigma}
Loglogistic	γ	{lngamma}
Generalized gamma	σ, κ	{lnsigma}, {kappa}

For frailty models, when option frailty() or option shared() is specified with streg, bayes: streg also defines the log-frailty parameter {lntheta}.

If option `ancillary(varlist)` is specified, regression coefficients {ln_p:*varlist*}, {gamma:*varlist*}, and so on are defined for all ancillary parameters except κ. If option `anc2(varlist)` is specified, then regression coefficients {kappa:*varlist*} are defined for κ.

If option `strata(varname)` is specified, additional stratum-specific coefficients of the form {*eqname*:#.*varname*} are defined for the main regression and ancillary parameters. For example, if drug contains three strata, then specifying option `strata(drug)` will result in additional main regression coefficients {_t:2.drug} and {_t:3.drug} and—say, for Weibull regression—in additional parameters {ln_p:2.drug} and {ln_p:3.drug}. In the model summary with default priors, you may see these parameters labeled as {_t:i.drug} and {ln_p:i.drug}, for short.

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[+]

[ST] **streg** — Parametric survival models

[BAYES] **Bayesian postestimation** — Postestimation tools after Bayesian estimation

[BAYES] **Bayesian estimation** — Bayesian estimation commands

[BAYES] **Bayesian commands** — Introduction to commands for Bayesian analysis

[BAYES] **Intro** — Introduction to Bayesian analysis

[BAYES] **Glossary**

For suggested citations, see the FAQ on citing Stata documentation.