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

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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

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<td><code>dryrun</code></td>
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Simulation

\texttt{\textbf{nchains}(\#)} \quad \text{number of chains; default is to simulate one chain}
\texttt{\textbf{mcmcs}\texttt{ize}(\#)} \quad \text{MCMC sample size; default is mcmcs\texttt{ize}(10000)}
\texttt{\textbf{burnin}(\#)} \quad \text{burn-in period; default is burnin(2500)}
\texttt{\textbf{thinning}(\#)} \quad \text{thinning interval; default is thinning(1)}
\texttt{\textbf{rseed}(\#)} \quad \text{random-number seed}
\texttt{\textbf{exclude}(paramref)} \quad \text{specify model parameters to be excluded from the simulation results}

Blocking

\texttt{\textbf{blocksize}(\#)} \quad \text{maximum block size; default is blocksize(50)}
\texttt{\textbf{block}(paramref[, blockopts])} \quad \text{specify a block of model parameters; this option may be repeated}
\texttt{\textbf{blocksummary}} \quad \text{display block summary}
\texttt{\textbf{noblocking}} \quad \text{do not block parameters by default}

Initialization

\texttt{\textbf{initial}(initspec)} \quad \text{specify initial values for model parameters with a single chain}
\texttt{\textbf{init\#}(initspec)} \quad \text{specify initial values for \#th chain; requires nchains()}
\texttt{\textbf{inital}(initspec)} \quad \text{specify initial values for all chains; requires nchains()}
\texttt{\textbf{nomleinitial}} \quad \text{suppress the use of maximum likelihood estimates as starting values}
\texttt{\textbf{initrandom}} \quad \text{specify random initial values}
\texttt{\textbf{initsymmary}} \quad \text{display initial values used for simulation}
\texttt{\textbf{noisily}} \quad \text{display output from the estimation command during initialization}

Adaptation

\texttt{\textbf{adaptation}(adaptopts)} \quad \text{control the adaptive MCMC procedure}
\texttt{\textbf{scale}(\#)} \quad \text{initial multiplier for scale factor; default is scale(2.38)}
\texttt{\textbf{covariance}(cov)} \quad \text{initial proposal covariance; default is the identity matrix}

Reporting

\texttt{\textbf{clevel}(\#)} \quad \text{set credible interval level; default is clevel(95)}
\texttt{\textbf{hpd}} \quad \text{display HPD credible intervals instead of the default equal-tailed credible intervals}
\texttt{\textbf{nohr}} \quad \text{do not report hazard ratios}
\texttt{\textbf{tratio}} \quad \text{report time ratios; requires option time with \texttt{streg}}
\texttt{\textbf{eform}(string)} \quad \text{report exponentiated coefficients and, optionally, label as \texttt{string}}
\texttt{\textbf{batch}(\#)} \quad \text{specify length of block for batch-means calculations; default is batch(0)}
\texttt{\textbf{saving}(filename[, replace])} \quad \text{save simulation results to \texttt{filename.dta}}
\texttt{\textbf{nomodelsummary}} \quad \text{suppress model summary}
\texttt{\textbf{chainsdetail}} \quad \text{display detailed simulation summary for each chain}
\texttt{\textbf{nodots}} \quad \text{suppress dots or display dots every 100 iterations and iteration numbers every 1,000 iterations; default is nodots}
\texttt{\textbf{dots}(\#[, every(\#)])} \quad \text{display dots as simulation is performed}
\texttt{\textbf{no]show}(paramref)} \quad \text{specify model parameters to be excluded from or included in the output}
\texttt{\textbf{notable}} \quad \text{suppress estimation table}
\texttt{\textbf{noheader}} \quad \text{suppress output header}
\texttt{\textbf{title}(string)} \quad \text{display \texttt{string} as title above the table of parameter estimates}
\texttt{\textbf{display_options}} \quad \text{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 **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.

### 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>
<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>Gompertz</td>
<td>(\gamma)</td>
<td>{gamma}</td>
</tr>
<tr>
<td>Lognormal</td>
<td>(\sigma)</td>
<td>{lnsigma}</td>
</tr>
<tr>
<td>Loglogistic</td>
<td>(\gamma)</td>
<td>{lngamma}</td>
</tr>
<tr>
<td>Generalized gamma</td>
<td>(\sigma, \kappa)</td>
<td>{lnsigma}, {kappa}</td>
</tr>
</tbody>
</table>

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 \(\kappa\). If option anc2(varlist) is specified, then regression coefficients \{kappa:varlist\} are defined for \(\kappa\).
If option \texttt{strata(varname)} is specified, additional stratum-specific coefficients of the form \{\texttt{eqname:##.varname}\} are defined for the main regression and ancillary parameters. For example, if \texttt{drug} contains three strata, then specifying option \texttt{strata(drug)} will result in additional main regression coefficients \{_t:2.drug\} and \{_t:3.drug\} and—say, for Weibull regression—in additional parameters \{\texttt{ln_p:2.drug}\} and \{\texttt{ln_p:3.drug}\}. In the model summary with default priors, you may see these parameters labeled as \{_t:i.drug\} and \{\texttt{ln_p:i.drug}\}, for short.

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 \cite{Bayes:Stata} \texttt{bayes}.

### Methods and formulas

See \textit{Methods and formulas} in \cite{Bayes:Stata} \texttt{bayesmh}.

### Also see

- \cite{Bayes:Stata} \texttt{bayes} — Bayesian regression models using the \texttt{bayes} prefix
- \cite{ST:streg} \texttt{streg} — Parametric survival models
- \cite{Bayes:Bayesian_postestimation} \texttt{Bayesian postestimation} — Postestimation tools for \texttt{bayesmh} and the \texttt{bayes} prefix
- \cite{Bayes:Bayesian_estimation} \texttt{Bayesian estimation} — Bayesian estimation commands
- \cite{Bayes:Bayesian_commands} \texttt{Bayesian commands} — Introduction to commands for Bayesian analysis
- \cite{Bayes:Intro} \texttt{Intro} — Introduction to Bayesian analysis
- \cite{Bayes:Glossary} \texttt{Glossary}