**bayes: regress — Bayesian linear regression**

**Description**

`bayes: regress` fits a Bayesian linear regression to a continuous outcome; see `[BAYES] bayes` and `[R] regress` for details.

**Quick start**

Bayesian linear regression of $y$ on $x_1$ and $x_2$, using default normal priors for regression coefficients and default inverse-gamma prior for the variance

```
bayes: regress y x1 x2
```

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

```
bayes, normalprior(10): regress y x1 x2
```

Use a shape of 1 and a scale of 2 instead of values of 0.01 for the default inverse-gamma prior

```
bayes, igammaprior(1 2): regress y x1 x2
```

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

```
bayes, prior({y: x1 x2}, uniform(-10,10)) ///
   prior({y:_cons}, normal(0,10)): regress y x1 x2
```

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

```
bayes, saving(simdata) rseed(123): regress y x1 x2
```

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): regress y x1 x2
```

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
```

Also see *Quick start* in `[BAYES] bayes* and *Quick start* in `[R] regress*.
Syntax

bayes [, bayesopts] : \texttt{regress depvar [indepvars] [if] [in] [weight] [ , options]}

<table>
<thead>
<tr>
<th>options</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model</strong></td>
<td></td>
</tr>
<tr>
<td>\texttt{noconstant}</td>
<td>suppress constant term</td>
</tr>
<tr>
<td><strong>Reporting</strong></td>
<td></td>
</tr>
<tr>
<td>\texttt{eform(string)}</td>
<td>report exponentiated coefficients and label as \texttt{string}</td>
</tr>
<tr>
<td>\texttt{display_options}</td>
<td>control spacing, line width, and base and empty cells</td>
</tr>
<tr>
<td>\texttt{level(#)}</td>
<td>set credible level; default is \texttt{level(95)}</td>
</tr>
</tbody>
</table>

\texttt{indepvars} may contain factor variables; see [U] \texttt{11.4.3 Factor variables.}
\texttt{depvar} and \texttt{indepvars} may contain time-series operators; see [U] \texttt{11.4.4 Time-series varlists.}
\texttt{fweight}s are allowed; see [U] \texttt{11.1.6 weight.}
bayes: \texttt{regress}, \texttt{level()} is equivalent to bayes, \texttt{clevel(): regress.}
For a detailed description of \texttt{options}, see \texttt{Options} in [R] \texttt{regress.}

\texttt{bayesopts} Description

<table>
<thead>
<tr>
<th>Priors</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>\texttt{gibbs}</em></td>
<td>specify Gibbs sampling; available only with normal priors for regression coefficients and an inverse-gamma prior for variance</td>
</tr>
<tr>
<td><em>\texttt{normalprior(#)}</em></td>
<td>specify standard deviation of default normal priors for regression coefficients; default is \texttt{normalprior(100)}</td>
</tr>
<tr>
<td><em>\texttt{igammaprior(# #)}</em></td>
<td>specify shape and scale of default inverse-gamma prior for variance; default is \texttt{igammaprior(0.01 0.01)}</td>
</tr>
<tr>
<td>\texttt{prior(priorspec)}</td>
<td>prior for model parameters; this option may be repeated</td>
</tr>
<tr>
<td>\texttt{dryrun}</td>
<td>show model summary without estimation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Simulation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>\texttt{nchains(#)}</td>
<td>number of chains; default is to simulate one chain</td>
</tr>
<tr>
<td>\texttt{mcmcs(size(#))}</td>
<td>MCMC sample size; default is \texttt{mcmcsize(10000)}</td>
</tr>
<tr>
<td>\texttt{burnin(#)}</td>
<td>burn-in period; default is \texttt{burnin(2500)}</td>
</tr>
<tr>
<td>\texttt{thinning(#)}</td>
<td>thinning interval; default is \texttt{thinning(1)}</td>
</tr>
<tr>
<td>\texttt{rseed(#)</td>
<td>random-number seed</td>
</tr>
<tr>
<td>\texttt{exclude(paramref)}</td>
<td>specify model parameters to be excluded from the simulation results</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Blocking</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>\texttt{blocksize(#)}</em></td>
<td>maximum block size; default is \texttt{blocksize(50)}</td>
</tr>
<tr>
<td>\texttt{block(paramref[, blockopts])}</td>
<td>specify a block of model parameters; this option may be repeated</td>
</tr>
<tr>
<td>\texttt{blocksummary}</td>
<td>display block summary</td>
</tr>
<tr>
<td><em>\texttt{noblocking</em></td>
<td>do not block parameters by default</td>
</tr>
</tbody>
</table>
Initialization

\[ \text{initial} \left( \text{initspec} \right) \]  
specify initial values for model parameters with a single chain

\[ \text{init#} \left( \text{initspec} \right) \]  
specify initial values for \#th chain; requires \text{nchains}()

\[ \text{initall} \left( \text{initspec} \right) \]  
specify initial values for all chains; requires \text{nchains}()

\[ \text{nomleinit} \]  
suppress the use of maximum likelihood estimates as starting values

\[ \text{initrandom} \]  
specify random initial values

\[ \text{initsummary} \]  
display initial values used for simulation

\[ \text{*noisily} \]  
display output from the estimation command during initialization

Adaptation

\[ \text{adaptation} \left( \text{adaptopts} \right) \]  
control the adaptive MCMC procedure

\[ \text{scale}(#) \]  
initial multiplier for scale factor; default is \text{scale}(2.38)

\[ \text{covariance}(\text{cov}) \]  
initial proposal covariance; default is the identity matrix

Reporting

\[ \text{clevel}(#) \]  
set credible interval level; default is \text{clevel}(95)

\[ \text{hpd} \]  
display HPD credible intervals instead of the default equal-tailed credible intervals

\[ \text{eform}[\left( \text{string} \right)] \]  
report exponentiated coefficients and, optionally, label as \text{string}

\[ \text{batch}(#) \]  
specify length of block for batch-means calculations; 
default is \text{batch}(0)

\[ \text{saving}(\text{filename}[\text{, replace}]) \]  
save simulation results to \text{filename}.dta

\[ \text{nomodelsummary} \]  
suppress model summary

\[ \text{chainsdetail} \]  
display detailed simulation summary for each chain

\[ \text{[no]} \text{dots} \]  
suppress dots or display dots every 100 iterations and iteration numbers every 1,000 iterations; default is \text{nodots}

\[ \text{dots}(#, \text{every}(#)) \]  
display dots as simulation is performed

\[ \text{[no]} \text{show}(\text{paramref}) \]  
specify model parameters to be excluded from or included in the output

\[ \text{notable} \]  
suppress estimation table

\[ \text{noheader} \]  
suppress output header

\[ \text{title}(\text{string}) \]  
display \text{string} as title above the table of parameter estimates

\[ \text{display_options} \]  
control spacing, line width, and base and empty cells

Advanced

\[ \text{search}(\text{search_options}) \]  
control the search for feasible initial values

\[ \text{corrlag}(#) \]  
specify maximum autocorrelation lag; default varies

\[ \text{corrtol}(#) \]  
specify autocorrelation tolerance; default is \text{corrtol}(0.01)

\[ \text{Starred options are specific to the bayes prefix; other options are common between bayes and bayesmh.} \]

\[ \text{Options prior() and block() may be repeated.} \]

\[ \text{priorspec and paramref are defined in [BAYES] bayesmh.} \]

\[ \text{paramref may contain factor variables; see [U] 11.4.3 Factor variables.} \]

\[ \text{See [U] 20 Estimation and postestimation commands for more capabilities of estimation commands.} \]

\[ \text{Model parameters are regression coefficients \{depvar:indepvars\} and variance \{sigma2\}. Use the dryrun option to see the definitions of model parameters prior to estimation.} \]

\[ \text{For a detailed description of bayesopts, see Options in [BAYES] bayes.} \]
Remarks and examples

For a general introduction to Bayesian analysis, see [BAYES] Intro. For a general introduction to Bayesian estimation using adaptive Metropolis–Hastings and Gibbs algorithms, see [BAYES] bayesmh. For remarks and examples specific to the bayes prefix, see [BAYES] bayes. For details about the estimation command, see [R] regress.

For a simple example of the bayes prefix, see Introductory example in [BAYES] bayes. Also see Linear regression: A case of informative default priors in [BAYES] bayes.

Video examples

Bayesian linear regression using the bayes prefix
Bayesian linear regression using the bayes prefix: How to specify custom priors
Bayesian linear regression using the bayes prefix: Checking convergence of the MCMC chain
Bayesian linear regression using the bayes prefix: How to customize the MCMC chain

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
[R] regress — Linear regression
[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