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 x1 and x2, 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.

Menu

Statistics > Linear models and related > Bayesian regression > Linear regression
bayes: regress — Bayesian linear regression

Syntax

`bayes [, bayesopts] : regress depvar [ indepvars ] [ if ] [ in ] [ weight ] [ , options ]`

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

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

bayesopts

<table>
<thead>
<tr>
<th>Options</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priors</td>
<td></td>
</tr>
<tr>
<td><code>*gibbs</code></td>
<td>specify Gibbs sampling; available only with normal priors for</td>
</tr>
<tr>
<td></td>
<td>regression coefficients and an inverse-gamma prior for variance</td>
</tr>
<tr>
<td><code>*normalprior(#)</code></td>
<td>specify standard deviation of default normal priors for regression</td>
</tr>
<tr>
<td></td>
<td>coefficients; default is <code>normalprior(100)</code></td>
</tr>
<tr>
<td><code>*igammaprior(# #)</code></td>
<td>specify shape and scale of default inverse-gamma prior for variance; default is <code>igammaprior(0.01 0.01)</code></td>
</tr>
<tr>
<td>prior(priorspec)</td>
<td>prior for model parameters; this option may be repeated</td>
</tr>
<tr>
<td>dryrun</td>
<td>show model summary without estimation</td>
</tr>
<tr>
<td>Simulation</td>
<td></td>
</tr>
<tr>
<td><code>nchains(#)</code></td>
<td>number of chains; default is to simulate one chain</td>
</tr>
<tr>
<td><code>mcmcsize(#)</code></td>
<td>MCMC sample size; default is <code>mcmcsize(10000)</code></td>
</tr>
<tr>
<td><code>burnin(#)</code></td>
<td>burn-in period; default is <code>burnin(2500)</code></td>
</tr>
<tr>
<td><code>thinning(#)</code></td>
<td>thinning interval; default is <code>thinning(1)</code></td>
</tr>
<tr>
<td><code>rseed(#)</code></td>
<td>random-number seed</td>
</tr>
<tr>
<td><code>exclude(paramref)</code></td>
<td>specify model parameters to be excluded from the simulation results</td>
</tr>
<tr>
<td>Blocking</td>
<td></td>
</tr>
<tr>
<td><code>*blocksize(#)</code></td>
<td>maximum block size; default is <code>blocksize(50)</code></td>
</tr>
<tr>
<td><code>block(paramref[, blockopts])</code></td>
<td>specify a block of model parameters; this option may be repeated</td>
</tr>
<tr>
<td><code>blocksummary</code></td>
<td>display block summary</td>
</tr>
<tr>
<td><code>*noblocking</code></td>
<td>do not block parameters by default</td>
</tr>
</tbody>
</table>
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()
-nomleinit 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
-eform[(string)] report exponentiated coefficients and, optionally, label as string
-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
-chainsdetail display detailed simulation summary for each chain
-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
-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_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\} and variance \{sigma2\}. 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 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