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 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): regress y x1 x2

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

Also see Quick start in [Bayes] bayes and Quick start in [R] regress.

Menu

Statistics > Linear models and related > Bayesian regression > Linear regression
Syntax

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

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* 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.
fweights 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**

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* Priors and Simulation options (nchains, mcmcs, burnin, thinning, rseed) can be specified multiple times.
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
- `[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
- `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(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 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
[BMA] bmaregress — Bayesian model averaging for linear regression