**bayes: nbreg — Bayesian negative binomial regression**

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**Description**

`bayes: nbreg` fits a Bayesian negative binomial regression to a nonnegative count outcome; see [BAYES] `bayes` and [R] `nbreg` for details.

**Quick start**

Bayesian negative binomial regression of `y` on `x1` and `x2`, using default normal priors for regression coefficients and log-overdispersion parameter

```
bayes: nbreg y x1 x2
```

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

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

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

```
bayes, saving(simdata) rseed(123): nbreg 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): nbreg 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
```

Display incidence-rate ratios instead of coefficients

```
bayes: nbreg y x1 x2, irr
```

Display incidence-rate ratios on replay

```
bayes, irr
```

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

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**Menu**

Statistics > Count outcomes > Bayesian regression > Negative binomial regression
## Syntax

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

### options

<table>
<thead>
<tr>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Model</strong></td>
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<tr>
<td>noconstant           suppress constant term</td>
</tr>
<tr>
<td>dispersion(mean)     parameterization of dispersion; the default</td>
</tr>
<tr>
<td>dispersion(constant) constant dispersion for all observations</td>
</tr>
<tr>
<td>exposure(varname_e)  include ln(varname_e) in model with coefficient constrained to 1</td>
</tr>
<tr>
<td>offset(varname_o)    include varname_o in model with coefficient constrained to 1</td>
</tr>
<tr>
<td><strong>Reporting</strong></td>
</tr>
<tr>
<td>irr                  report incidence-rate ratios</td>
</tr>
<tr>
<td>display_options      control spacing, line width, and base and empty cells</td>
</tr>
<tr>
<td>level(#)             set credible level; default is level(95)</td>
</tr>
</tbody>
</table>

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

*depvar*, *indepvars*, *varname_e*, and *varname_o* may contain time-series operators; see [U 11.4.4 Time-series varlists.]

fweights are allowed; see [U 11.1.6 weight.]

`bayes: nbreg, level()` is equivalent to `bayes, clevel(): nbreg`.

For a detailed description of options, see `Options for nbreg` in [R nbreg].

### bayesopts

<table>
<thead>
<tr>
<th>Description</th>
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<tr>
<td><strong>Priors</strong></td>
</tr>
<tr>
<td>*normalprior(#)      specify standard deviation of default normal priors for regression coefficients and log-overdispersion parameter; default is normalprior(100)</td>
</tr>
<tr>
<td>prior(priorspec)     prior for model parameters; this option may be repeated</td>
</tr>
<tr>
<td>dryrun               show model summary without estimation</td>
</tr>
<tr>
<td><strong>Simulation</strong></td>
</tr>
<tr>
<td>nchains(#)           number of chains; default is to simulate one chain</td>
</tr>
<tr>
<td>mcmcsize(#)          MCMC sample size; default is mcmcsize(10000)</td>
</tr>
<tr>
<td>burnin(#)            burn-in period; default is burnin(2500)</td>
</tr>
<tr>
<td>thinning(#)          thinning interval; default is thinning(1)</td>
</tr>
<tr>
<td>rseed(#)             random-number seed</td>
</tr>
<tr>
<td>exclude(paramref)    specify model parameters to be excluded from the simulation results</td>
</tr>
<tr>
<td><strong>Blocking</strong></td>
</tr>
<tr>
<td>*blocksize(#)        maximum block size; default is blocksize(50)</td>
</tr>
<tr>
<td>block([paramref [, blockopts]]) specify a block of model parameters; this option may be repeated</td>
</tr>
<tr>
<td>blocksummary         display block summary</td>
</tr>
<tr>
<td>*noblocking          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
- `*irr` report incidence-rate ratios
- `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.

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

Model parameters are regression coefficients `{depvar:indepvars}` and log-overdispersion parameter `{lnalpha}` with mean dispersion or `{lndelta}` with constant dispersion. 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 [R] nbreg.

For a simple example of the bayes prefix, see Introductory example in [BAYES] bayes.

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] nbreg — Negative binomial 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