Title

**bayes: poisson — Bayesian Poisson regression**

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**Description**

bayes: poisson fits a Bayesian Poisson regression to a nonnegative count outcome; see [BAYES] bayes and [R] poisson for details.

**Quick start**

Bayesian Poisson regression of y on x1 and x2, using default normal priors for regression coefficients

```
bayes: poisson y x1 x2
```

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

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

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

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

Display incidence-rate ratios on replay

```
bayes, irr
```

Also see _Quick start_ in [BAYES] bayes and _Quick start_ in [R] poisson.

**Menu**

Statistics > Count outcomes > Bayesian regression > Poisson regression
Syntax

\[ \text{bayes} [\ , \ \text{bayesopts}] : \text{poisson} \ \text{depvar} \ [\ \text{indepvars} \ [\ [\ \text{if}\ ]\ [\ \text{in}\ ]\ [\ \text{weight}\ ]\ [\ ,\ \text{options}\ ]]] \]

<table>
<thead>
<tr>
<th>options</th>
<th>Description</th>
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<tr>
<td>Model</td>
<td></td>
</tr>
<tr>
<td>noconstant</td>
<td>suppress constant term</td>
</tr>
<tr>
<td>exposure(\text{varname}_e)</td>
<td>include ln(\text{varname}_e) in model with coefficient constrained to 1</td>
</tr>
<tr>
<td>offset(\text{varname}_o)</td>
<td>include \text{varname}_o in model with coefficient constrained to 1</td>
</tr>
<tr>
<td>Reporting</td>
<td></td>
</tr>
<tr>
<td>\text{ir}</td>
<td>report incidence-rate ratios</td>
</tr>
<tr>
<td>display_options</td>
<td>control spacing, line width, and base and empty cells</td>
</tr>
<tr>
<td>\text{level(#)}</td>
<td>set credible level; default is level(95)</td>
</tr>
</tbody>
</table>

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

bayesopts Description

<table>
<thead>
<tr>
<th>Priors</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>*normalprior(#)</td>
<td>specify standard deviation of default normal priors for regression coefficients; default is normalprior(100)</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>
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</table>

Simulation

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

Blocking

*blocksize(#) maximum block size; default is blocksize(50)
block(paramref[ , blockopts]) specify a block of model parameters; this option may be repeated
display block summary
*noblocking do not block parameters by default
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()
nomleinitial       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 andparamref 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}. 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] poisson.

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] poisson — Poisson 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