bayes: xtreg — Bayesian random-effects linear model

Description

Bayesian random-effects linear regression of y on x1 and x2 with random intercepts by id (after xtsetting on panel variable id), using default normal priors for regression coefficients and default inverse-gamma priors for the error variance and for the variance of random intercepts

Quick start

Bayesian random-effects linear regression of y on x1 and x2 with random intercepts by id (after xtsetting on panel variable id), using default normal priors for regression coefficients and default inverse-gamma priors for the error variance and for the variance of random intercepts

bayes: xtreg y x1 x2

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

bayes, normalprior(10): xtreg 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): xtreg 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)): xtreg y x1 x2

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

bayes, saving(simdata) rseed(123): xtreg 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): xtreg 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

Use Gibbs sampling for all parameters, including random effects

bayes, gibbs: xtreg y x1 x2

Also see Quick start in [BAYES] bayes and Quick start in [XT] xtreg.

Menu

Statistics > Longitudinal/panel data > Bayesian regression > Linear regression
### Syntax

```plaintext
bayes [ , bayesopts ] : xtreg depvar [ indepvars ] [ if ] [ in ] [ , options ]
```

### options Description

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>noconstant</td>
<td>suppress constant term</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reporting display_options</th>
<th>control spacing, line width, and base and empty cells</th>
</tr>
</thead>
<tbody>
<tr>
<td>level(#)</td>
<td>set credible level; default is level(95)</td>
</tr>
</tbody>
</table>

A panel variable must be specified; see [XT] `xtset`. 
`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. 
bayes: xtreg, level() is equivalent to bayes, clevel(): xtreg. 
For a detailed description of options, see Options in [XT] `xtreg`. 

### bayesopts Description

<table>
<thead>
<tr>
<th>Priors</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>*gibbs</td>
<td>specify Gibbs sampling; available only with normal priors for regression coefficients and an inverse-gamma prior for variance</td>
</tr>
<tr>
<td>*normalprior(#)</td>
<td>specify standard deviation of default normal priors for regression coefficients; default is normalprior(100)</td>
</tr>
<tr>
<td>*igammaprior(# #)</td>
<td>specify shape and scale of default inverse-gamma prior for variance components; default is igammaprior(0.01 0.01)</td>
</tr>
</tbody>
</table>

| prior(priorspec) | prior for model parameters; this option may be repeated |
| dryrun | show model summary without estimation |

<table>
<thead>
<tr>
<th>Simulation</th>
<th>Description</th>
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<tr>
<td>nchains(#)</td>
<td>number of chains; default is to simulate one chain</td>
</tr>
<tr>
<td>mcmcsize(#)</td>
<td>MCMC sample size; default is mcmcsize(10000)</td>
</tr>
<tr>
<td>burnin(#)</td>
<td>burn-in period; default is burnin(2500)</td>
</tr>
<tr>
<td>thinning(#)</td>
<td>thinning interval; default is thinning(1)</td>
</tr>
<tr>
<td>rseed(#)</td>
<td>random-number seed</td>
</tr>
<tr>
<td>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>block( paramref[, blockopts ] )</td>
<td>specify a block of model parameters; this option may be repeated display block summary</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Initialization</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>initial(initspec)</td>
<td>specify initial values for model parameters with a single chain</td>
</tr>
<tr>
<td>init#(initspec)</td>
<td>specify initial values for #th chain; requires nchains()</td>
</tr>
<tr>
<td>initall(initspec)</td>
<td>specify initial values for all chains; requires nchains()</td>
</tr>
<tr>
<td>nomleinitial</td>
<td>suppress the use of maximum likelihood estimates as starting values</td>
</tr>
<tr>
<td>initrandom</td>
<td>specify random initial values</td>
</tr>
<tr>
<td>initsummary</td>
<td>display initial values used for simulation</td>
</tr>
<tr>
<td>*noisily</td>
<td>display output from the estimation command during initialization</td>
</tr>
</tbody>
</table>
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
remargl  compute log marginal-likelihood; suppressed by default
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
[nodots]  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
showeffects[(reref)]  specify that all or a subset of random-effects parameters be 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}, error variance {sigma2}, random effects {U[panelvar]} or simply {U}, and random-effects variance {var_U}. 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 [XT] xtreg.
For a simple example of the `bayes` prefix, see *Introductory example* in `[BAYES] bayes`. Also see *Panel-data models* in `[BAYES] bayes`.

**Stored results**

See *Stored results* in `[BAYES] bayes`. In addition, `bayes: xtreg` also stores the following results:

Macros
- `e(ivar)` variable denoting groups
- `e(redistrib)` distribution of random effects

**Methods and formulas**

See *Methods and formulas* in `[BAYES] bayesmh`.

**Also see**

- `[BAYES] bayes` — Bayesian regression models using the bayes prefix
- `[XT] xtreg` — Fixed-, between-, and random-effects and population-averaged linear models
- `[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`