bayes: xtreg — Bayesian random-effects linear model

Description

bayes: xtreg fits a Bayesian panel-data random-effects linear regression to a continuous outcome; see [BAYES] bayes and [XT] xtreg for details.

Quick start

Bayesian random-effects linear regression of $y$ on $x_1$ and $x_2$ with random intercepts by id (after xtseting 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

\[ \text{bayes} \left[ , \text{bayesopts} \right] : \text{xtreg} \ \text{depvar} \ [ \text{indepvars} \] \ [ \text{if} \ \text{in} \ [ , \text{options} \] \]

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<td>\textit{display_options}</td>
<td>control spacing, line width, and base and empty cells</td>
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<tr>
<td>\textit{level(#)}</td>
<td>set credible level; default is \textit{level}(95)</td>
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A panel variable must be specified; see \[XT\] \textit{xtset}.
\textit{indepvars} may contain factor variables; see \[U\] \textit{11.4.3 Factor variables}.
\textit{depvar} and \textit{indepvars} may contain time-series operators; see \[U\] \textit{11.4.4 Time-series varlists}.
bayes: \textit{xtreg}, \textit{level()} is equivalent to bayes, clevel(): \textit{xtreg}.
For a detailed description of options, see \textit{Options} in \[XT\] \textit{xtreg}.

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<tr>
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<td>*\textit{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>*\textit{normalprior(#)}</td>
<td>specify standard deviation of default normal priors for regression coefficients; default is \textit{normalprior}(100)</td>
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<tr>
<td>*\textit{igamma_prior(# #)}</td>
<td>specify shape and scale of default inverse-gamma prior for variance components; default is \textit{igamma_prior}(0.01 0.01)</td>
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<tr>
<td>\textit{prior(priorspec)}</td>
<td>prior for model parameters; this option may be repeated</td>
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<tr>
<td>\textit{dryrun}</td>
<td>show model summary without estimation</td>
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<tr>
<td>Simulation</td>
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<td>\textit{nchains(#)}</td>
<td>number of chains; default is to simulate one chain</td>
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<tr>
<td>\textit{mcmcsize(#)}</td>
<td>MCMC sample size; default is \textit{mcmcsize}(10000)</td>
</tr>
<tr>
<td>\textit{burnin(#)}</td>
<td>burn-in period; default is \textit{burnin}(2500)</td>
</tr>
<tr>
<td>\textit{thinning(#)}</td>
<td>thinning interval; default is \textit{thinning}(1)</td>
</tr>
<tr>
<td>\textit{rseed(#)}</td>
<td>random-number seed</td>
</tr>
<tr>
<td>\textit{exclude(paramref)}</td>
<td>specify model parameters to be excluded from the simulation results</td>
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<tr>
<td>Blocking</td>
<td></td>
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<tr>
<td>\textit{block(paramref[, \textit{blockopts}] ]}</td>
<td>specify a block of model parameters; this option may be repeated</td>
</tr>
<tr>
<td>\textit{blocksummary}</td>
<td>display block summary</td>
</tr>
<tr>
<td>Initialization</td>
<td></td>
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<tr>
<td>\textit{initial(initspec)}</td>
<td>specify initial values for model parameters with a single chain</td>
</tr>
<tr>
<td>\textit{init#(initspec)}</td>
<td>specify initial values for \textit{#}th chain; requires \textit{nchains()}</td>
</tr>
<tr>
<td>\textit{init\textit{#all}(initspec)}</td>
<td>specify initial values for all chains; requires \textit{nchains()}</td>
</tr>
<tr>
<td>\textit{nomle_initial}</td>
<td>suppress the use of maximum likelihood estimates as starting values</td>
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<tr>
<td>\textit{init_random}</td>
<td>specify random initial values</td>
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<tr>
<td>\textit{init_summary}</td>
<td>display initial values used for simulation</td>
</tr>
<tr>
<td>*\textit{noisy_sily}</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] display 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 priors() 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