**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 `x1` and `x2` with random intercepts by `id` (after `xtset`ing 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

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

<table>
<thead>
<tr>
<th>options</th>
<th>Description</th>
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<tbody>
<tr>
<td>noconstant</td>
<td>suppress constant term</td>
</tr>
<tr>
<td>display_options</td>
<td>control spacing, line width, and base and empty cells</td>
</tr>
<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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<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>
<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>

<table>
<thead>
<tr>
<th>Simulation</th>
<th>Description</th>
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<tbody>
<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>
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<table>
<thead>
<tr>
<th>Initialization</th>
<th>Description</th>
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<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>initiitsummary</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>
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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
[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
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 \texttt{bayes} prefix, see \textit{Introductory example} in [BAYES] \texttt{bayes}. Also see \textit{Panel-data models} in [BAYES] \texttt{bayes}.

\section*{Stored results}

See \textit{Stored results} in [BAYES] \texttt{bayes}. In addition, \texttt{bayes: xtreg} also stores the following results:

\begin{itemize}
\item \texttt{e(ivar)} \hspace{1cm} variable denoting groups
\item \texttt{e(redistrib)} \hspace{1cm} distribution of random effects
\end{itemize}

\section*{Methods and formulas}

See \textit{Methods and formulas} in [BAYES] \texttt{bayesmh}.

\section*{Also see}

[BAYES] \texttt{bayes} — Bayesian regression models using the bayes prefix

[XT] \texttt{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