# Title



**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* ]

| *options* | Description |
|---|---|
| Model | |
| `noconstant` | suppress constant term |
| Reporting | |
| *display_options* | control spacing, line width, and base and empty cells |
| `level(#)` | set credible level; default is `level(95)` |

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 |
|---|---|
| Priors | |
| * `gibbs` | specify Gibbs sampling; available only with normal priors for regression coefficients and an inverse-gamma prior for variance |
| * `normalprior(#)` | specify standard deviation of default normal priors for regression coefficients; default is `normalprior(100)` |
| * `igammaprior(# #)` | specify shape and scale of default inverse-gamma prior for variance components; default is `igammaprior(0.01 0.01)` |
| `prior(`*priorspec*`)` | prior for model parameters; this option may be repeated |
| `dryrun` | show model summary without estimation |
| 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 | |
| `block(`*paramref* [ , *blockopts* ]`)` | specify a block of model parameters; this option may be repeated |
| `blocksummary` | display block summary |
| 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 |
| 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 |
| showreffects[(*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

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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**



For suggested citations, see the FAQ on citing Stata documentation.