Package 'bsreg'

October 12, 2022

Type Package

Title Bayesian Spatial Regression Models

Version 0.0.2

Date 2022-02-25

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Description Fit Bayesian models with a focus on the spatial econometric models.

Depends R (>= 3.5.0)

Imports R6, Matrix, stats, graphics, utils, grDevices

Suggests stochvol, coda

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Encoding UTF-8

LazyData true

RoxygenNote 7.1.2

NeedsCompilation no

Repository CRAN

Date/Publication 2022-02-25 14:40:02 UTC

R topics documented:

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bsreg-package *Bayesian Spatial Regression Models*

Description

Fit Bayesian models with a focus on the spatial econometric models.

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bm *Fit a Bayesian model*

Description

Fit a Bayesian model

Usage

```
bm(x, ...)

## S3 method for class 'formula'
bm(
  x,
  data = NULL,
  n_save = 1000L,
  n_burn = 500L,
  options = set_options(),
  mh = set_mh(),
  verbose = TRUE,
  W,
  X_SLX,
  type = c("lm", "slx", "sar", "sem", "sdm", "sdem", "sv"),
  ...
)

## S3 method for class 'bm'
bm(x, n_save = 1000L, n_burn = 0L, verbose = TRUE, ...)

blm(...)

bslx(...)

bsar(...)

bsem(...)
```

`bsdm(...)`

`bsdem(...)`

`bsv(...)`

Arguments

`x`	Formula or `bm` object to sample with.
`...`	Not used.
`data`	A `data.frame` containing the variables in the model.
`n_save, n_burn`	Integer scalar. Number of draws for the burn-in period and to store for inference.
`options`	Settings for the prior setup. See `set_options`.
`mh`	Settings to tune the Metropolis-Hastings step. See `set_mh`.
`verbose`	Logical scalar. Whether to print status updates.
`W`	Numeric matrix (or function to construct one) with the spatial connectivities.
`X_SLX`	Numeric matrix with explanatory variables that should be lagged spatially.
`type`	Character scalar used to specify the desired model.

Value

Returns a list with draws from the specified Bayesian model and an object to obtain further samples.

Examples

```
N <- 100L
beta <- 1:5
X <- matrix(rnorm(N * 5), N, 5)
y <- X %*% beta + rnorm(N)

bm(y ~ X, n_burn = 100, n_draw = 100)


# Reproduce the linear model in Kuschnig (2022)
blm(log(sales) ~ log(price / cpi) + log(ndi / cpi) +
  factor(name) + factor(year), data = cigarettes)
```

`cigarettes` *Cigarette demand*

Description

Panel dataset on cigarette demand in 46 US states from 1963 until 1992, see Baltagi and Levin (1992) and Baltagi and Li (2004). Extended with longitude and latitude from the `us_states` dataset.

Usage

```
cigarettes
```

Format

A `data.frame` object.

References

Baltagi, B. H. and Levin, D. (1992). Cigarette taxation: raising revenues and reducing consumption, *Structural Change and Economic Dynamics*, **3(2)**, 321-335. doi: 10.1016/0954349X(92)90010-4. Baltagi, B. H. and Li, D. (2004). Prediction in the panel data model with spatial correlation. *Advances in Spatial Econometrics*, 283-295. Springer, Berlin. doi: 10.1007/9783662056172_13.

`coda` *Methods for* **coda** *Markov chain Monte Carlo objects*

Description

Methods to convert parameter and/or coefficient draws to **coda**'s `mcmc` format for further processing.

Usage

```
as.mcmc.bm(x, ...)
```

Arguments

`x`	A `bm` object, obtained from `bm`.
`...`	Other parameters for `as.mcmc`.

Value

Returns a **coda** `mcmc` object.

sample *Obtain draws from a Bayesian model sampler*

Description

Obtain draws from a Bayesian model sampler

Usage

```
sample(x, n_save = 1000L, n_burn = 0L, mh = set_mh(), verbose = TRUE)
```

Arguments

x	Bayesian model
n_save, n_burn	Integer scalar with number of draws to save / burn.
mh	Settings to tune the Metropolis-Hastings step. See set_mh.
verbose	Logical scalar. Whether to print status updates.

Value

Returns a numeric matrix with stored draws. The Bayesian model is modified in place.

set_mh *Settings to tune a Metropolis-Hastings step*

Description

Settings to tune a Metropolis-Hastings step

Usage

```
set_mh(adjust_burn = 0.8, acc_target = c(0.2, 0.45), acc_change = 0.01)
```

Arguments

adjust_burn	Numeric scalar with the percentage of burn-in that should be used to tune the MH step.
acc_target	Numeric vector with the lower and upper bound of the target acceptance rate for the MH step.
acc_change	Numeric scalar with the percentage adjustment to the proposal scale for tuning.

Value

Returns a list with settings to tune the Metropolis-Hastings step of a Bayesian model.

Examples

```
set_mh(0.5, c(0.1, 0.5), .05)
```

`set_NG` *Set up a Normal-Gamma prior*

Description

Set up a Normal-Gamma prior

Usage

```
set_NG(
  mu = 0,
  precision = 1e-08,
  shape = 0.01,
  rate = 0.01,
  beta = NULL,
  sigma = NULL
)

set_SNG(
  lambda_a = 0.01,
  lambda_b = 0.01,
  theta_scale = 0,
  theta_a = 1,
  lambda = 1,
  tau = 10,
  theta = 0.1
)

set_HS(lambda = 1, tau = 1, zeta = 1, nu = 1)
```

Arguments

`mu`	Numeric scalar or vector with the prior mean of 'beta'.
`precision`	Numeric scalar or matrix with the prior precision of 'beta'. Not used for shrinkage priors.
`shape, rate`	Numeric scalars with the prior shape and rate of 'sigma'.
`lambda_a, lambda_b`	Numeric scalars with the prior shape and rate of 'lambda'.
`theta_scale`	Numeric scalar with the proposal scale of 'theta'. Defaults to zero for a fixed value.
`theta_a`	Numeric scalar with the prior rate of 'theta'.
`lambda, tau, theta, zeta, nu, beta, sigma`	Numerics with starting values for the respective parameter.

Value

Returns a list with priors and settings.

`set_options` *Set up Bayesian model priors and settings*

Description

Set up Bayesian model priors and settings

Usage

```
set_options(
  type = c("Independent", "Conjugate", "Shrinkage", "Horseshoe"),
  NG = set_NG(),
  SNG = set_SNG(),
  HS = set_HS(),
  SAR = set_SAR(),
  SLX = set_SLX(),
  SEM = set_SEM(),
  SV = set_SV(),
  ...
)
```

Arguments

`type`	Character scalar with the prior type for the nested linear model.
`NG`	Settings for the Normal-Gamma prior (independent or conjugate). See `set_NG`.
`SNG`	Settings for the Normal-Gamma shrinkage prior (Polson and Scott, 2010). See `set_NG`.
`HS`	Settings for the Horseshoe shrinkage prior (Makalic and Schmidt, 2015). See `set_NG`.
`SAR`	Settings for the spatial autoregressive setup. See `set_SAR`.
`SLX`	Settings for the spatially lagged explanatory setup. See `set_SAR`. Note that settings for the spatial term 'theta' are provided to *NG* instead.
`SEM`	Settings for the spatial error setup. See `set_SAR`.
`SV`	Settings for the stochastic volatility setup. See `set_SV`.
`...`	Used to provide custom prior elements.

Value

Returns a list with priors and settings for a Bayesian model.

Examples

```
set_options("Shrinkage", SNG = set_SNG(lambda_a = 1, lambda_b = 1))
```

set_SAR *Set up a spatial prior*

Description

Set up a spatial prior

Usage

```
set_SAR(
  lambda_a = 1.01,
  lambda_b = 1.01,
  lambda = 0,
  lambda_scale = 0.1,
  lambda_min = -1,
  lambda_max = 1 - 1e-12,
  delta_a = 1.01,
  delta_b = 1.01,
  delta = 1,
  delta_scale = 0,
  delta_min = 1e-12,
  delta_max = Inf
)

set_SLX(
  lambda_a = 1.01,
  lambda_b = 1.01,
  lambda = 0,
  lambda_scale = 0.1,
  lambda_min = -1,
  lambda_max = 1 - 1e-12,
  delta_a = 1.01,
  delta_b = 1.01,
  delta = 1,
  delta_scale = 0,
  delta_min = 1e-12,
  delta_max = Inf
)

set_SEM(
  lambda_a = 1.01,
  lambda_b = 1.01,
  lambda = 0,
  lambda_scale = 0.1,
  lambda_min = -1,
  lambda_max = 1 - 1e-12,
  delta_a = 1.01,
```

```
  delta_b = 1.01,
  delta = 1,
  delta_scale = 0,
  delta_min = 1e-12,
  delta_max = Inf
)
```

Arguments

`lambda_a, lambda_b`	Numeric scalars with the prior shapes of the connectivity strength 'lambda'.
`lambda, delta`	Numerics with starting values for the respective parameter.
`lambda_scale`	Numeric scalar with the proposal scale of 'lambda'.
`lambda_min, lambda_max`	Numeric scalars with upper and lower bounds for 'lambda'.
`delta_a, delta_b`	Numeric scalars with the prior shapes of the connectivity parameter 'delta'.
`delta_scale`	Numeric scalar with the proposal scale of 'delta'. Defaults to zero for a fixed value.
`delta_min, delta_max`	Numeric scalars with upper and lower bounds for 'delta'.

Value

Returns a list with priors and settings.

`set_SV` *Set up a volatility prior*

Description

Set up a volatility prior

Usage

```
set_SV(
  priors,
  mu = 0,
  phi = 0.5,
  sigma = 1,
  nu = Inf,
  rho = 0,
  beta = 0,
  latent0 = 0
)
```

Arguments

priors	Prior settings from specify_priors.
mu, phi, sigma, nu, rho, beta, latent0	Numerics with starting values for the respective parameter.

Value

Returns a list with priors and settings.

---

tune *Burn-in and tune a Bayesian model sampler*

Description

Burn-in and tune a Bayesian model sampler

Usage

```
tune(x, n_burn = 1000L, mh = set_mh(), verbose = TRUE)

burn(x, n_burn = 1000L, verbose = TRUE)
```

Arguments

x	Bayesian model
n_burn	Integer scalar with number of draws to save / burn.
mh	Settings to tune the Metropolis-Hastings step. See set_mh.
verbose	Logical scalar. Whether to print status updates.

Value

Modifies the Bayesian model in place and returns it invisibly.

us_states *United States Historical States*

Description

Polygons of US state boundaries for the period 1960–2000. Subset from Siczewicz (2011). Licensed under CC BY-NC-SA 2.5 by the Atlas of Historical County Boundaries.

Usage

```
us_states
```

Format

A `data.frame` object.

Source

https://publications.newberry.org/ahcbp/

References

Siczewicz, P. (2011) U.S. Historical States and Territories (Generalized 0.01 deg). Dataset. Atlas of Historical County Boundaries, edited by Long, J. H. . Chicago: The Newberry Library, 2011. Available online from https://publications.newberry.org/ahcbp/.

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