Package 'factorQR'

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Title Bayesian quantile regression factor models

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Depends R (>= 2.1), lattice

Description Package to fit Bayesian quantile regression models that
assume a factor structure for at least part of the design
matrix.

LazyLoad yes

LazyData yes

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R topics documented:

| bayesQR | *Bayesian quantile regression* |

Description

bayesQR is an MCMC sampler to fit a Bayesian quantile regression model. This does not assume a factor structure.

Arguments

formula	A formula of the form formula = Y ~ X1 + X2, where Y is the response and variables on the right-hand side are covariates.
dataSet	An optional data frame, list, or environment containing the variables in the model.
pQuant	Response quantile to model. Defaults to pQuant=0.5.
nSamp	Number of MCMC iterations, with a default of 5000.
burn	Iterations of burn-in, with a default of 0.
thin	Number of iterations to skip between stored values, with a default of 0.
C0	Prior shape for τ, which is the inverse scale of the response. Defaults to 1.
D0	Prior scale for τ.
B0	Prior precision (i.e., inverse variance) for β regression parameters. Default is a diagonal matrix with non-zero values of 0.01. May be left at NULL, or changed to a non-negative scalar, a vector with length equal to the number of covariates, or a symmetric, positive semi-definite matrix with dimension equal to the number of covariates.
betaZero	Starting value for β.
verbose	If TRUE, prints progress updates in Gibbs sampler.

Value

Returns an item of the class bayesQR composed of the following components:

param	Matrix of sampled parameter values.
call	The matched call.
betLen	The number of β components.
nObs	The number of observations.
burn	The number of Gibbs iterations before samples were stored.
thin	The number of Gibbs iterations between stored values.
nSamp	The total number of Gibbs iterations.

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checkFcn	*Check function*

Description

checkFcn is the check function, or tilted absolute value function.

Arguments

x	A vector of points at which we evaluate the function.
p	The quantile of interest.

Value

Returns a vector with the same length as x. The check loss is defined to be -1*(x < 0)*x*(1-p) + (x>0)*p*x.

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factorQR	*A Bayesian factor model for quantile regression*

Description

factorQR is an MCMC sampler to fit a Bayesian factor model for quantile regression.

Arguments

factorForm	A formula of the form factorForm = Y ~ X1 + X2, where Y is the response and variables on the right-hand side are manifest variables related to the latent factors on which we are regressing Y. The right-hand side variables will be centered automatically, though they are not scaled.
nonFactorForm	An optional formula of the form nonFactorForm = ~ X3 + X4. These covariates are used to model Y, but they do not relate to any of the latent factors.
dataSet	An optional data frame, list, or environment containing the variables in the model.
pQuant	Response quantile to model. Defaults to pQuant=0.5.
whichFactor	Vector of indicators to show factor grouping. E.g., if whichFactor=c(1,1,1,2,2,2), it would mean the first three variables in the right-hand side of factorForm group and the last three group together in two factors. If whichFactor = NULL, a single latent factor will be assumed.
nSamp	Number of MCMC iterations, with a default of 5000.

burn	Iterations of burn-in, with a default of `0`.
thin	Number of iterations to skip between stored values in the chain, with a default of `0`.
cTau0	Prior shape for τ, which is the inverse scale of the response. Defaults to 1.
dTau0	Prior scale for τ.
cPsi0	Prior shape for Ψ, the inverse scale of the manifest variables related to the factors. Defaults to 1.
dPsi0	Prior rate for Ψ. Defaults to 1.
sig0	Hyperparameter for scale of free Λ_{-s} variables, which is rows of the factor loading matrix that do not correspond to the response. Defaults to 1.
mu0	Prior mean for Λ_{-s} components. Defaults to 1.
R0	Prior scale of Φ^{-1}. If not specified, defaults to the identity matrix.
nu0	Prior degrees of freedom for inverse Wishart associated with Φ. Must be an integer greater than or equal to the dimension of Φ, but defaults to one greater than that dimension.
B0s	Prior precision (i.e., inverse variance) for Λ_s. Default is a diagonal matrix with non-zero values of `0.01`. May be left at NULL, or changed to a non-negative scalar, a vector with length equal to the number of latent factors, or a symmetric, positive definite matrix with dimension equal to the number of latent factors.
B0Beta	Prior precision for regression coefficients related to `nonFactorForm`. Default is a diagonal matrix with non-zero values of `0.01`. May be left at NULL, or changed to a non-negative scalar, a vector with length equal to the number of covariates not related to the latent factors, or a symmetric, positive definite matrix with that dimension.
betaZero	Starting value for β.
PhiZero	Initial value of Φ.
invPsiZero	initial value of Ψ^{-1}.
LambdaZero	Initial value of Λ_{-s}. Must be a scalar or vector with length equal to the number of manifest variables in the right-hand side of `factorForm`. Will be expanded to its matrix form internally, and elements that should be fixed at 1 will be adjusted if necessary, with warning.
LambdaSZero	Initial value of last row of Λ, i.e. the part that models the left-hand side of `factorForm`. If specified, must either be a scalar or vector with length equal to the number of latent factors being modeled. Defaults to `0.1`
OmegaZero	Initial value for latent Ω.
verbose	If TRUE, prints progress updates in Gibbs sampler.
storeOmega	If TRUE, stores the sampled Ω values.
latentInteract	If TRUE, interacts the first two latent factors. More latent/latent interactions are not currently supported.
interactX	If supplied, a matrix of variables with which to interact the latent factors. Repeated columns are allowed.
whichFactorInteract	
	A vector that indicates which factors to interact with the columns of `interactX`. For example, `whichFactorInteract = c(1,1)` would indicate that the two columns of `interactX` are to be interacted with the first latent factor.

Value

Returns an item of the class `factorQR` composed of the following components:

param	Matrix of sampled parameter values.
call	The matched call.
nReg	The number of regression parameters.
betLen	The number of β components.
nObs	The number of observations.
burn	The number of Gibbs iterations before samples were stored.
thin	The number of Gibbs iterations between stored values.
nSamp	The total number of Gibbs iterations.
nFact	The number of modeled latent factors.
nFactorX	The number of manifest variables related to the factors.
omega	Sampled Ω values, if `storeOmega` is `TRUE`.
nFactInt	Number of factor/manifest variable interactions.

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makeData	*Function to make synthetic data for the factorQR function*

Description

`makeData` simulates data from a factor quantile regression model.

Arguments

N	The sample size.
whichFactor	A vector that indicates which factor each manifest variable relates to. E.g., `whichFactor = c(1,1,1,2,2)` would indicate a two-factor model, with the first three manifest variables relating to the first factor and the second two to the second factor.
pQuant	The quantile of interest. Defaults to `0.5`.
lambda	The vector of the non-zero elements of the factor loading matrix, with length equal to that of `whichFactor`. Do not include the factor loadings related to the response variable. Defaults to `1`.
LambdaS	The vector of factor loadings related to the response. Must have length equal to the number of distinct values in `whichFactor`. Defaults to `0`.
Phi	Matrix of latent factor covariances. Must be symmetric and positive-definite and have dimension equal to the number of latent factors. Defaults to the identity matrix.
lapScale	Scale of the asymmetric Laplace error distribution. Defaults to `1`.
Psi	Vector of error variances for the manifest explanatory variables.

Value

Returns a matrix whose first column is the response `Y` and whose remaining columns are the explanatory manifest variables with the underlying factor grouping implied by `whichFactor`.

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