Package 'pqrfe'

October 13, 2022

Type Package

Title Penalized Quantile Regression with Fixed Effects

Version 1.0

Date 2022-08-23

Description

Quantile regression with fixed effects is a general model for longitudinal data. Here we proposed to solve it by several methods. The estimation methods include three loss functions as: check, asymetric least square and asymetric Huber functions; and three structures as: simple regression, fixed effects and fixed effects with penalized intercepts by LASSO.

License GPL (>= 2)

Imports Rcpp (>= 1.0.5), MASS (>= 7.3-49)

LinkingTo Rcpp, RcppArmadillo

RoxygenNote 7.2.1

NeedsCompilation yes

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R topics documented:

`pqrfe-package` *Penalized Quantile Regression with Fixed Effects*

Description

Quantile regression with fixed effects is a general model for longitudinal data. Here we proposed to solve it by several methods. The estimation methods include three loss functions as: check, asymetric least square and asymetric Huber functions; and three structures as: simple regression, fixed effects and fixed effects with penalized intercepts by LASSO.

Details

The DESCRIPTION file:

Package:	pqrfe
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Version:	1.0
Date:	2022-08-23
Authors@R:	person(family = "Danilevicz", given = "Ian Meneghel", email = "iandanilevicz@gmail.com", role = c("aut",
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Author:	Ian Meneghel Danilevicz [aut, cre] (0000-0003-4541-0524)
Maintainer:	Ian Meneghel Danilevicz <iandanilevicz@gmail.com>

Index of help topics:

psi_mq	Psi M-quantile
q_cov	Covariance
rho_koenker	Rho Koenker
rho_mq	Rho M-quantile
sgf	Identify significance

This section should provide a more detailed overview of how to use the package, including the most important functions.

Author(s)

NA

Maintainer: NA

References

This optional section can contain literature or other references for background information.

See Also

Optional links to other man pages

Examples

```
## Optional simple examples of the most important functions
## Use \dontrun{} around code to be shown but not executed
```

---

check_lambda *check lambda*

Description

check lambda

Usage

```
check_lambda(lambda, infb, supb)
```

Arguments

lambda	Numeric, value of lambda.
infb	Numeric, lower bound of lambda.
supb	Numeric, upper bound of lambda.

Value

lambda Numeric, valid value of lambda.

choice_p *choice model*

Description

choice model

Usage

```
choice_p(effect)
```

Arguments

effect	Factor, simple, fixed or lasso.

Value

penalty Numeric, 1, 2 and 3.

clean_data *Clean missings*

Description

Clean missings

Usage

```
clean_data(y, x, id)
```

Arguments

y	Numeric vector, outcome.
x	Numeric matrix, covariates
id	Numeric vector, identifies the unit to which the observation belongs.

Value

list with the same objects y, x, id, but without missings.

Examples

```
n = 10
m = 4
d = 3
N = n*m
L = N*d
x = matrix(rnorm(L), ncol=d, nrow=N)
subj = rep(1:n, each=m)
alpha = rnorm(n)
beta = rnorm(d)
eps = rnorm(N)
y = x %*% beta  + matrix(rep(alpha, each=m) + eps)
y = as.vector(y)
x[1,3] = NA
clean_data(y=y, x=x, id=subj)
```

---

d_psi_als *D Psi ALS*

Description

Derivative of Psi asymetric least square

Usage

```
d_psi_als(x, tau)
```

Arguments

x	generic vector
tau	percentile

---

d_psi_mq *D Psi M-quantile*

Description

Derivative of psi M-quantile

Usage

```
d_psi_mq(x, tau, c)
```

Arguments

x	generic vector
tau	percentile
c	tuning

`f_den` *Kernel density*

Description

Kernel density

Usage

```
f_den(x)
```

Arguments

x	Numeric vector.

Value

y vector, kernel density estimation.

Examples

```
x = rnorm(10)
f_den(x)
```

`f_tab` *Tabular function*

Description

Tabular function

Usage

```
f_tab(N, n, d, theta, sig2, kind)
```

Arguments

N	sample size.
n	length of alpha.
d	length of beta.
theta	Numeric vector.
sig2	Numeric vector.
kind	Numeric, 1 means alpha, 2 means beta

---

loss_er *Loss expectile regression*

Description

Loss expectile regression

Usage

```
loss_er(beta, x, y, tau, N, d)
```

Arguments

beta	initial values
x	design matrix
y	vector output
tau	percentile
N	sample size
d	columns of x

---

loss_erfe *Loss expectile regression with fixed effects*

Description

Loss expectile regression with fixed effects

Usage

```
loss_erfe(theta, x, y, z, tau, n, d, mm)
```

Arguments

theta	initial values
x	design matrix
y	vector output
z	incident matrix
tau	percentile
n	N sample size
d	columns of x
mm	n columns of z

---

loss_erlasso *Loss lasso expectile regression with fixed effects*

Description

Loss lasso expectile regression with fixed effects

Usage

```
loss_erlasso(theta, x, y, z, tau, n, d, mm, lambda)
```

Arguments

theta	initial values
x	design matrix
y	vector output
z	incident matrix
tau	percentile
n	N sample size
d	columns of x
mm	n columns of z
lambda	constriction parameter

loss_mqr *Loss M-quantile regression*

Description

Loss M-quantile regression

Usage

```
loss_mqr(beta, x, y, tau, N, d, c)
```

Arguments

beta	initial values
x	design matrix
y	vector output
tau	percentile
N	sample size
d	columns of x
c	tuning

loss_mqrfe *Loss M-quantile regression with fixed effects*

Description

Loss M-quantile regression with fixed effects

Usage

```
loss_mqrfe(theta, x, y, z, tau, n, d, mm, c)
```

Arguments

theta	initial values
x	design matrix
y	vector output
z	incident matrix
tau	percentile
n	N sample size
d	columns of x
mm	n columns of z
c	tuning

loss_mqrlasso *Loss lasso M-quantile regression with fixed effects*

Description

Loss lasso M-quantile regression with fixed effects

Usage

```
loss_mqrlasso(theta, x, y, z, tau, n, d, mm, c, lambda)
```

Arguments

theta	initial values
x	design matrix
y	vector output
z	incident matrix
tau	percentile
n	N sample size
d	columns of x
mm	n columns of z
c	tuning
lambda	constriction parameter

loss_qr *Loss quantile regression*

Description

Loss quantile regression

Usage

```
loss_qr(beta, x, y, tau, N, d)
```

Arguments

beta	initial values
x	design matrix
y	vector output
tau	percentile
N	sample size
d	columns of x

loss_qrfe *Loss quantile regression with fixed effects*

Description

Loss quantile regression with fixed effects

Usage

```
loss_qrfe(theta, x, y, z, tau, n, d, mm)
```

Arguments

theta	initial values
x	design matrix
y	vector output
z	incident matrix
tau	percentile
n	N sample size
d	columns of x
mm	n columns of z

loss_qrlasso *Loss lasso quantile regression with fixed effects*

Description

Loss lasso quantile regression with fixed effects

Usage

```
loss_qrlasso(theta, x, y, z, tau, n, d, mm, lambda)
```

Arguments

theta	initial values
x	design matrix
y	vector output
z	incident matrix
tau	percentile
n	N sample size
d	columns of x
mm	n columns of z
lambda	constriction parameter

mpqr *multiple penalized quantile regression*

Description

Estimate QR for several taus

Usage

```
mpqr(x, y, subj, tau = 1:9/10, effect = "simple", c = 0)
```

Arguments

x	Numeric matrix, covariates
y	Numeric vector, outcome.
subj	Numeric vector, identifies the unit to which the observation belongs.
tau	Numeric vector, identifies the percentiles.
effect	Factor, "simple" simple regression, "fixed" regression with fixed effects, "lasso" penalized regression with fixed effects.
c	Numeric, 0 is quantile, Inf is expectile, any number between zero and infinite is M-quantile.

Value

Beta Numeric array, with three dimmensions: 1) tau, 2) coef., lower bound, upper bound, 3) exploratory variables.

Examples

```
n = 10
m = 5
d = 4
N = n*m
L = N*d
x = matrix(rnorm(L), ncol=d, nrow=N)
subj = rep(1:n, each=m)
alpha = rnorm(n)
beta = rnorm(d)
eps = rnorm(N)
y = as.vector(x %*% beta + rep(alpha, each=m) + eps)

Beta = mpqr(x,y,subj,tau=1:9/10, effect="fixed", c = 1.2)
Beta
```

optim_er *optim expectile regression*

Description

This function solves a expectile regression

Usage

```
optim_er(beta, x, y, tau, N, d)
```

Arguments

beta	Numeric vector, initials values beta.
x	Numeric matrix, covariates.
y	Numeric vector, output.
tau	Numeric scalar, the percentile.
N	Numeric integer, sample size.
d	Numeric integer, X number of columns.

Value

parametric vector and residuals.

optim_erfe *optim expectile regression with fixed effects*

Description

This function solves a expectile regression with fixed effects

Usage

```
optim_erfe(beta, alpha, x, y, z, tau, N, d, n)
```

Arguments

beta	Numeric vector, initials values beta.
alpha	Numeric vector, initials values alpha.
x	Numeric matrix, covariates.
y	Numeric vector, output.
z	Numeric matrix, incidence matrix.
tau	Numeric scalar, the percentile.
N	Numeric integer, sample size.
d	Numeric integer, X number of columns.
n	Numeric integer, length of alpha.

Value

parametric vector and residuals.

`optim_erlasso` *optim expectile regression with fixed effects and LASSO*

Description

This function solves a expectile regression with fixed effects and LASSO

Usage

```
optim_erlasso(beta, alpha, x, y, z, tau, N, d, n)
```

Arguments

`beta`	Numeric vector, initials values beta.
`alpha`	Numeric vector, initials values alpha.
`x`	Numeric matrix, covariates.
`y`	Numeric vector, output.
`z`	Numeric matrix, incidence matrix.
`tau`	Numeric scalar, the percentile.
`N`	Numeric integer, sample size.
`d`	Numeric integer, X number of columns.
`n`	Numeric integer, length of alpha.

Value

parametric vector and residuals.

`optim_mqr` *optim M-quantile regression*

Description

This function solves a M-quantile regression

Usage

```
optim_mqr(beta, x, y, tau, N, d, c)
```

Arguments

beta	Numeric vector, initials values beta.
x	Numeric matrix, covariates.
y	Numeric vector, output.
tau	Numeric scalar, the percentile.
N	Numeric integer, sample size.
d	Numeric integer, X number of columns.
c	Numeric, positive real value.

Value

parametric vector and residuals.

---

optim_mqrfe *optim quantile regression with fixed effects*

Description

This function solves a quantile regression with fixed effects

Usage

```
optim_mqrfe(beta, alpha, x, y, z, tau, N, d, n, c)
```

Arguments

beta	Numeric vector, initials values beta.
alpha	Numeric vector, initials values alpha.
x	Numeric matrix, covariates.
y	Numeric vector, output.
z	Numeric matrix, incidence matrix.
tau	Numeric scalar, the percentile.
N	Numeric integer, sample size.
d	Numeric integer, X number of columns.
n	Numeric integer, length of alpha.
c	Numeric, positive real value.

Value

parametric vector and residuals.

`optim_mqrlasso` *optim M-quantile regression with fixed effects and LASSO*

Description

This function solves a M-quantile regression with fixed effects and LASSO

Usage

```
optim_mqrlasso(beta, alpha, x, y, z, tau, N, d, n, c)
```

Arguments

`beta`	Numeric vector, initials values beta.
`alpha`	Numeric vector, initials values alpha.
`x`	Numeric matrix, covariates.
`y`	Numeric vector, output.
`z`	Numeric matrix, incidence matrix.
`tau`	Numeric scalar, the percentile.
`N`	Numeric integer, sample size.
`d`	Numeric integer, X number of columns.
`n`	Numeric integer, length of alpha.
`c`	Numeric, positive real value.

Value

parametric vector and residuals.

`optim_qr` *optim quantile regression*

Description

This function solves a quantile regression

Usage

```
optim_qr(beta, x, y, tau, N, d)
```

Arguments

beta	Numeric vector, initials values.
x	Numeric matrix, covariates.
y	Numeric vector, output.
tau	Numeric scalar, the percentile.
N	Numeric integer, sample size.
d	Numeric integer, X number of columns.

Value

parametric vector and residuals.

---

optim_qrfe *optim quantile regression with fixed effects*

Description

This function solves a quantile regression with fixed effects

Usage

```
optim_qrfe(beta, alpha, x, y, z, tau, N, d, n)
```

Arguments

beta	Numeric vector, initials values beta.
alpha	Numeric vector, initials values alpha.
x	Numeric matrix, covariates.
y	Numeric vector, output.
z	Numeric matrix, incidence matrix.
tau	Numeric scalar, the percentile.
N	Numeric integer, sample size.
d	Numeric integer, X number of columns.
n	Numeric integer, length of alpha.

Value

parametric vector and residuals.

optim_qrlasso *optim quantile regression with fixed effects and LASSO*

Description

This function solves a quantile regression with fixed effects and LASSO

Usage

```
optim_qrlasso(beta, alpha, x, y, z, tau, N, d, n)
```

Arguments

beta	Numeric vector, initials values beta.
alpha	Numeric vector, initials values alpha.
x	Numeric matrix, covariates.
y	Numeric vector, output.
z	Numeric matrix, incidence matrix.
tau	Numeric scalar, the percentile.
N	Numeric integer, sample size.
d	Numeric integer, X number of columns.
n	Numeric integer, length of alpha.

Value

parametric vector and residuals.

plot_taus *plot multiple penalized quantile regression*

Description

plot QR for several taus

Usage

```
plot_taus(
  Beta,
  tau = 1:9/10,
  D,
  col = 2,
  lwd = 1,
  lty = 2,
```

```
  pch = 1,
  cex.axis = 1,
  cex.lab = 1,
  main = ""
)
```

Arguments

Beta	Numeric array, with three dimmensions: 1) tau, 2) coef., lower bound, upper bound, 3) exploratory variables.
tau	Numeric vector, identifies the percentiles.
D	covariate's number.
col	color.
lwd	line width.
lty	line type.
pch	point character.
cex.axis	cex axis length.
cex.lab	cex axis length.
main	title.

Examples

```
n = 10
m = 5
d = 4
N = n*m
L = N*d
x = matrix(rnorm(L), ncol=d, nrow=N)
subj = rep(1:n, each=m)
alpha = rnorm(n)
beta = rnorm(d)
eps = rnorm(N)
y = as.vector(x %*% beta + rep(alpha, each=m) + eps)

Beta = mpqr(x,y,subj,tau=1:9/10, effect="lasso", c = Inf)
plot_taus(Beta,tau=1:9/10,D=1)
```

---

pqr *Penalized quantile regression with fixed effects*

Description

Estimate parameters and tuning parameter.

Usage

```
pqr(x, y, subj, tau = 0.5, effect = "simple", c = 1)
```

Arguments

x	Numeric matrix, covariates
y	Numeric vector, outcome.
subj	Numeric vector, identifies the unit to which the observation belongs.
tau	Numeric scalar between zero and one, identifies the percentile.
effect	Factor, "simple" simple regression, "fixed" regression with fixed effects, "lasso" penalized regression with fixed effects.
c	Numeric, 0 is quantile, Inf is expectile, any number between zero and infinite is M-quantile.

Value

alpha Numeric vector, intercepts' coefficients.

beta Numeric vector, exploratory variables' coefficients.

lambda Numeric, estimated lambda.

res Numeric vector, percentile residuals.

tau Numeric scalar, the percentile.

penalty Numeric scalar, indicate the chosen effect.

c Numeric scalar, indicate the chosen c.

sig2_alpha Numeric vector, intercepts' standard errors.

sig2_beta Numeric vector, exploratory variables' standard errors.

Tab_alpha Data.frame, intercepts' summary.

Tab_beta Data.frame, exploratory variables' summary.

Mat_alpha Numeric matrix, intercepts' summary.

Mat_beta Numeric matrix, exploratory variables' summary.

References

Danilevicz, I.M., Bondon, P., Reisen, V.A. (2022), "Alternative methods to quantile regression for panel data". Journal, vol number pages.

Koenker, R. (2004), "Quantile regression for longitudinal data", J. Multivar. Anal., 91(1): 74-89.

Examples

```
n = 10
m = 5
d = 4
N = n*m
x = matrix(rnorm(d*N), ncol=d, nrow=N)
subj = rep(1:n, each=m)
```

```
alpha = rnorm(n)
beta = rnorm(d)
eps = rnorm(N)
y = as.vector(x %*% beta + rep(alpha, each=m) + eps)
m1 = pqr(x=x, y=y, subj=subj, tau=0.75, effect="lasso", c = 0)
m1$Tab_beta
```

`print.PQR` *Print an PQR*

Description

Define the visible part of the object class PQR

Usage

```
## S3 method for class 'PQR'
print(x, ...)
```

Arguments

`x`	An object of class "PQR"
`...`	further arguments passed to or from other methods.

`psi_als` *Psi ALS*

Description

Psi asymetric least square

Usage

```
psi_als(x, tau)
```

Arguments

`x`	generic vector
`tau`	percentile

psi_mq *Psi M-quantile*

Description

Psi M-quantile

Usage

```
psi_mq(x, tau, c)
```

Arguments

x	generic vector
tau	percentile
c	tuning

q_cov *Covariance*

Description

Estimate Covariance matrix

Usage

```
q_cov(n, N, d, Z, X, tau, res, penalty, c)
```

Arguments

n	length of alpha.
N	sample size.
d	length of beta.
Z	Numeric matrix, incident matrix.
X	Numeric matrix, covariates.
tau	Numeric, identifies the percentile.
res	Numeric vector, residuals.
penalty	Numeric, 1 quantile regression, 2 quantile regression with fixed effects, 3 Lasso quantile regression with fixed effects
c	Numeric, tuning

rho_koenker *Rho Koenker*

Description

Rho Koenker

Usage

```
rho_koenker(x, tau)
```

Arguments

x	generic vector
tau	percentile

rho_mq *Rho M-quantile*

Description

Rho M-quantile

Usage

```
rho_mq(x, tau, c)
```

Arguments

x	generic vector
tau	percentile
c	tuning

sgf *Identify significance*

Description

Identify significance

Usage

```
sgf(x)
```

Arguments

x	Numeric vector.

Value

y vector Factor, symbol flag of significant p-values.

Examples

```
n = 10
pvalue = rgamma(10,1,10)
sgf(pvalue)
```

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