Package ‘gogarch’

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### BVDW

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### Description


### Usage

```r
data(BVDW)
```

### Format

A data frame with 2610 observations on the following 3 variables.

- **Date**  Date in the format YYYYMMDD.
- **DJIA**  Level of the DIJA.
- **NASDAQ**  Level of the NASDAQ.

### Details

This data set has been utilized in the source below and was kindly provided by Roy van der Weide.

### Source

Boswijk, H. Peter and van der Weide, Roy (2006), Wake me up before you GO-GARCH, *Tinbergen Institute Discussion Paper, TI 2006-079/4*, University of Amsterdam and Tinbergen Institute.

### References

**Description**

This data frame contains the stock prices from American Airlines, South-West Airlines, Boeing and FedEx. In addition the spot prices for crude oil and kerosene are included. This data set was used in the article by Boswijk and van der Weide (2009). The data range is from July, 19 1993 until August, 12 2008.

**Usage**

```r
data(BVDWAIR)
```

**Format**

A data frame with 3791 observations on the following 7 variables.

- `date`: POSIXt: The dates of observations.
- `crudeoil`: Crude oil price.
- `kerosene`: Kerosene price.
- `southwest`: Stock prices of South-West Airlines.
- `boeing`: Stock prices of Boeing.
- `fedex`: Stock prices of Boeing.

**Details**

The stock price data was downloaded from Yahoo Finance and the price series for crude oil and kerosene were obtained from the U.S. Energy Information Administration (EIA).

**Source**

- [http://finance.yahoo.com](http://finance.yahoo.com) and [http://www.econstats.com](http://www.econstats.com)

**References**

Examples

data(BVDWAIR)
str(BVDWAIR)

---

BVDWSTOXX

Sector indices of the EURO STOXX 600

Description


Usage

data(BVDWSTOXX)

Format

A data frame with 5652 observations on the following 16 variables.

Date POSIXt: The dates of observations.
AutoParts Sector index Automobiles & Parts
Banks Sector index Banks
BasicRes Sector index Basic Resources
Chemicals Sector index Chemicals
ConstrMat Sector index Construction and Materials
FoodBeverage Sector index Food & Beverages
FinService Sector index Financial Services
HealthCare Sector index Health Care
IndustrialGoods Sector index Industrial Goods & Services
Insurance Sector index Insurance
Media Sector index Media
OilGas Sector index Oil & Gas
Technology Sector index Technology
Telecom Sector index Telecommunications
Utilities Sector index Utilities

Source

http://www.stoxx.com
References

Boswijk, H. Peter and van der Weide, Roy (2009), Method of Moments Estimation of GO-GARCH Models, Working Paper, University of Amsterdam, Tinbergen Institute and World Bank.

Examples

data(BVDWSTOXX)
str(BVDWSTOXX)

cora

Autocorrelations of a Matrix Process

Description

This function computes the autocorrelation matrix for a given lag. For instance, it is used for estimating GO-GARCH models whence the method of moments is utilized.

Usage

cora(SSI, lag = 1, standardize = TRUE)

Arguments

SSI

Array with dimension dim = c(m, m, n)

lag

Integer, the lag for which the autocorrelation is computed.

standardize

Logical, if TRUE (the default), the autocorrelation matrix is computed, otherwise the autocovariance matrix.

Details

This function computes the autocorrelation matrix according to:

$$\hat{\Gamma}_k(s) = \frac{1}{n} \sum_{t=k+1}^{n} S_tS_{t-k}$$

$$\hat{\Phi}_k(s) = \hat{\Gamma}_0(s)^{-1/2}\hat{\Gamma}_k(s)\hat{\Gamma}_0(s)^{-1/2}$$

It is computationally assured that $\hat{\Phi}_k(s)$ is symmetric by setting it equal to: $\hat{\Phi}_k(s) = \frac{1}{2}(\hat{\Phi}_k(s) + \hat{\Phi}_k(s)')$. The standardization matrix $\hat{\Gamma}_0(s)^{-1/2}$ is derived from the singular value decomposition of the co-variance matrix at lag zero.

Value

cora
Matrix with dimension dim = c(m, m).
Author(s)
Bernhard Pfaff

References
Boswijk, H. Peter and van der Weide, Roy (2009), Method of Moments Estimation of GO-GARCH Models, Working Paper, University of Amsterdam, Tinbergen Institute and World Bank.

See Also
gogarch

goest-methods Methods for Function goest

Description
These are methods for estimating GO-GARCH models. Currently only a method for estimating GO-GARCH models by Maximum-Likelihood is implemented.

Details
The declared estimation methods are called from function gogarch.

Methods
goest signature(object = "Goestica")
goest signature(object = "Goestmm")
goest signature(object = "Goestml")
goest signature(object = "Goestnls")

Author(s)
Bernhard Pfaff

See Also
garchFit,Goestica,Goestml,Goestnls,Goestmm,gogarch
Goestica-class

Class "Goestica": GO-GARCH models estimated by fast ICA

Description
This class contains the GoGARCH class and has the mixing matrix \( A \) as additional slot.

Objects from the Class
Objects can be created by calls of the form `new("Goestica", ...), or with the function gogarch whereby method = "ica" has been set.

Slots

- ica: Object of class "list": List object returned by fastICA.
- Z: Object of class "matrix": Transformation matrix.
- U: Object of class "matrix": Orthogonal matrix.
- Y: Object of class "matrix": Extracted component matrix.
- H: Object of class "list": List of conditional variance/covariance matrices.
- models: Object of class "list": List of univariate GARCH model fits.
- estby: Object of class "character": Estimation method.
- X: Object of class "matrix": The data matrix.
- V: Object of class "matrix": Covariance matrix of \( X \).
- P: Object of class "matrix": Left singular values of Var/Cov matrix of \( X \).
- Dsqr: Object of class "matrix": Square roots of eigenvalues on diagonal, else zero.
- garchf: Object of class "formula": Garch formula used for uncorrelated component GARCH models.
- name: Object of class "character": The name of the original data object.

Extends
Class "GoGARCH", directly. Class "Goinit", by class "GoGARCH", distance 2.

Methods

- cvar Returns the conditional variances as object with class attribute "mts" "ts".
- ccov Returns the conditional co-variances as object with class attribute "mts" "ts".
- ccor Returns the conditional correlations as object with class attribute "mts" "ts".
- coef Returns the coefficients of the component GARCH models.
- converged Returns the convergence codes of the component GARCH models.
- formula Returns the formula for the component GARCH models.
- goest Fast ICA estimation of Go-GARCH models.
plot  Plotting of the conditional correlations.

predict Returns the conditional covariances and mean forecasts and the forecasts of the component GARCH models, object is of class Gopredict.

residuals Returns the residuals of the Go-GARCH model as object with class attribute "mts" "ts".

resid Returns the residuals of the Go-GARCH model as object with class attribute "mts" "ts".

show show-method for objects of class Goestmm.

summary summary-method for objects of class Goestml, object is of class Gosum.

update Updates an object of class Goestml.

Author(s)
Bernhard Pfaff

References

See Also
  GoGARCH, Goinit, Gosum, Gopredict, goest-methods and gogarch

---

Goestml-class

Class "Goestml": GO-GARCH models estimated by Maximum-Likelihood

Description
This class contains the GoGARCH class and has the outcome of n1minb as an additional slot.

Objects from the Class
Objects can be created by calls of the form new("Goestml", ...), or with the function gogarch whereby method = "ml" has been set.

Slots
opt: Object of class "list": List returned by n1minb.
Z: Object of class "matrix": Transformation matrix.
U: Object of class "matrix": Orthogonal matrix.
Y: Object of class "matrix": Extracted component matrix.
H: Object of class "list": List of conditional variance/covariance matrices.
models: Object of class "list": List of univariate GARCH model fits.
estby: Object of class "character": Estimation method.
Goestml-class

X: Object of class "matrix": The data matrix.
V: Object of class "matrix": Covariance matrix of X.
P: Object of class "matrix": Left singular values of Var/Cov matrix of X.
Dsqr: Object of class "matrix": Square roots of eigenvalues on diagonal, else zero.
garchf: Object of class "formula": Garch formula used for uncorrelated component GARCH models.
name: Object of class "character": The name of the original data object.

Extends

Class "GoGARCH", directly. Class "Goinit", by class "GoGARCH", distance 2.

Methods

angles Returns the Eulerian angles.
cvar Returns the conditional variances as object with class attribute "mts" "ts".
ccov Returns the conditional co-variances as object with class attribute "mts" "ts".
ccor Returns the conditional correlations as object with class attribute "mts" "ts".
coef Returns the coefficients of the component GARCH models.
converged Returns the convergence codes of the component GARCH models.
formula Returns the formula for the component GARCH models.
goest ML-Estimation of Go-GARCH models.
logLik Returns the value of the log-Likelihood function.
plot Plotting of the conditional correlations.
predict Returns the conditional covariances and mean forecasts and the forecasts of the component GARCH models, object is of class Gopredict.
residuals Returns the residuals of the Go-GARCH model as object with class attribute "mts" "ts".
resid Returns the residuals of the Go-GARCH model as object with class attribute "mts" "ts".
show show-method for objects of class Goestml.
summary summary-method for objects of class Goestml, object is of class Gosum.
update Updates an object of class Goestml.

Author(s)

Bernhard Pfaff

See Also

GoGARCH, Goinit, Gosum, Gopredict, goest-methods
Goestmm-class

Class "Goestmm": Go-GARCH models estimated by Methods of Moments

Description
This class contains the GoGARCH class and has the weights vector and the matched orthogonal matrices $U$ as additional slots.

Objects from the Class
Objects can be created by calls of the form `new("Goestmm", ...)`, or with the function `gogarch` whereby method = "mm" has been set.

Slots
- **weights**: Object of class "numeric": Weights for aggregating the matched orthogonal matrices $U$.
- **umatched**: Object of class "list": List of matched orthogonal matrices $U$.
- **Z**: Object of class "matrix": Transformation matrix.
- **U**: Object of class "matrix": Orthogonal matrix.
- **Y**: Object of class "matrix": Extracted component matrix.
- **H**: Object of class "list": List of conditional variance/covariance matrices.
- **models**: Object of class "list": List of univariate GARCH model fits.
- **estby**: Object of class "character": Estimation method.
- **X**: Object of class "matrix": The data matrix.
- **V**: Object of class "matrix": Covariance matrix of $X$.
- **P**: Object of class "matrix": Left singular values of Var/Cov matrix of $X$.
- **dsqr**: Object of class "matrix": Square roots of eigenvalues on diagonal, else zero.
- **garchf**: Object of class "formula": Garch formula used for uncorrelated component GARCH models.
- **name**: Object of class "character": The name of the original data object.

Extends
Class "GoGARCH", directly. Class "Goinit", by class "GoGARCH", distance 2.

Methods
- **cvar** Returns the conditional variances as object with class attribute "mts" "ts".
- **ccov** Returns the conditional co-variances as object with class attribute "mts" "ts".
- **ccor** Returns the conditional correlations as object with class attribute "mts" "ts".
- **coef** Returns the coefficients of the component GARCH models.
converged  Returns the convergence codes of the component GARCH models.
formula  Returns the formula for the component GARCH models.
goest  Methods of moments estimation of Go-GARCH models.
plot  Plotting of the conditional correlations.
predict  Returns the conditional covariances and mean forecasts and the forecasts of the component GARCH models, object is of class gopredict.
residuals  Returns the residuals of the Go-GARCH model as object with class attribute "mts" "ts".
resid  Returns the residuals of the Go-GARCH model as object with class attribute "mts" "ts".
show  show-method for objects of class Goestmm.
summary  summary-method for objects of class Goestml, object is of class Gosum.
update  Updates an object of class Goestml.

Author(s)
Bernhard Pfaff

References
Boswijk, H. Peter and van der Weide, Roy (2009), Method of Moments Estimation of GO-GARCH Models, Working Paper, University of Amsterdam, Tinbergen Institute and World Bank.

See Also
GoGARCH, Goinit, Gosum, Gopredict, goest-methods, gogarch, Umatch

Goestnls-class  

Class "Goestnls": GO-GARCH models estimated by Non-linear Least-Squares

Description
This class contains the GoGARCH class and has the outcome of optim as an additional slot.

Objects from the Class
Objects can be created by calls of the form new("Goestnls", ...), or with the function gogarch whereby method = "nls" has been set.
Goestnls-class

Slots

rls: Object of class "list": List returned by optim.
Z: Object of class "matrix": Transformation matrix.
U: Object of class "matrix": Orthogonal matrix.
Y: Object of class "matrix": Extracted component matrix.
H: Object of class "list": List of conditional variance/covariance matrices.
models: Object of class "list": List of univariate GARCH model fits.
estby: Object of class "character": Estimation method.
X: Object of class "matrix": The data matrix.
V: Object of class "matrix": Covariance matrix of X.
P: Object of class "matrix": Left singular values of Var/Cov matrix of X.
Dsqr: Object of class "matrix": Square roots of eigenvalues on diagonal, else zero.
garchf: Object of class "formula": Garch formula used for uncorrelated component GARCH models.
name: Object of class "character": The name of the original data object.

Extends

Class "GoGARCH", directly. Class "Goinit", by class "GoGARCH", distance 2.

Methods

cvar Returns the conditional variances as object with class attribute "mts" "ts".
ccov Returns the conditional co-variances as object with class attribute "mts" "ts".
ccor Returns the conditional correlations as object with class attribute "mts" "ts".
coef Returns the coefficients of the component GARCH models.
converged Returns the convergence codes of the component GARCH models.
formula Returns the formula for the component GARCH models.
goest NLS-Estimation of Go-GARCH models.
predict Returns the conditional covariances and mean forecasts and the forecasts of the component GARCH models, object is of class gopredict.
residuals Returns the residuals of the Go-GARCH model as object with class attribute "mts" "ts".
resid Returns the residuals of the Go-GARCH model as object with class attribute "mts" "ts".
show show-method for objects of class Goestnls.
summary summary-method for objects of class GoGARCH, object is of class Gosum.
update Updates an object of class GoGARCH.

Author(s)

Bernhard Pfaff
gogarch

See Also

GoGARCH, Goinit, Gosum, Gopredict, goest-methods, gogarch

gogarch

Specification and estimation of GO-GARCH models

Description

This function steers the specification and estimation of GO-GARCH models.

Usage

gogarch(data, formula, scale = FALSE, estby = c("ica", "mm", "ml", "nls"),
lag.max = 1, initial = NULL, garchlist = list(init.rec = "mci", delta
= 2, skew = 1, shape = 4, cond.dist = "norm", include.mean = FALSE,
include.delta = NULL, include.skew = NULL, include.shape = NULL,
leverage = NULL, trace = FALSE, algorithm = "nlminb", hessian =
"ropt", control = list(), title = NULL, description = NULL), ...)

Arguments

data
  Matrix: the original data set.

formula
  Formula: valid formula for univariate GARCH models.

scale
  Logical, if TRUE the data is scaled. The default is scale = FALSE.

estby
  Character: by fast ICA estby = "ica" (the default), by Estbys of Moments
  estby = "mm" or by Maximum-Likelihood estby = "ml" or by non-linear
  Least-Squares estby = "nls".

initial
  Numeric: starting values for optimization (used if estby = "ml" or estby = "nls"
  has been chosen (see Details).

lag.max
  Integer: The number of used lags for computing the matched orthogonal matrices
  \( U \) (used if estby = "mm" has been chosen).

garchlist
  List: Elements are passed to garchfit.

... Ellipsis argument: is passed to the goest method (see details).

Details

The ellipsis argument is passed to the function fastICA if estby = "ica" has been set, or


If the argument initial is left NULL, the starting values are computed according seq(3.0, 0.1, length.out = 1),

whereby \( l \) is the length of initial for estby = "ml" and are set to rep(0.1, d, whereby for

method = "nls". This length must be equal to \( m \ast (m - 1)/2 \) for estimation by Maximum-

Likelihood and \( m \ast (m + 1)/2 \) for estimation by non-linear least-Squares, whereby \( m \) is the number
of columns of data.
Value

Dependent on the chosen estimation method either an object of class Goestica or, Goestmm or Goestml or Goestnls is returned. All of these classes extend the GoGARCH class.

Author(s)

Bernhard Pfaff

References


Boswijk, H. Peter and van der Weide, Roy (2006), Wake me up before you GO-GARCH, *Tinbergen Institute Discussion Paper, TI 2006-079/4*, University of Amsterdam and Tinbergen Institute.


See Also

*GoGARCH, Goestica, Goestmm, Goestnls, Goestml, goest-methods*

Examples

```r
## Not run:
library(vars)
## Boswijk / van der Weide (2009)
data(BVDWSTOXX)
BVDWSTOXX <- zoo(x = BVDWSTOXX[, -1], order.by = BVDWSTOXX[, 1])
BVDWSTOXX <- window(BVDWSTOXX, end = as.POSIXct("2007-12-31"))
BVDWSTOXX <- diff(log(BVDWSTOXX))
sectors <- BVDWSTOXX[, c("AutoParts", "Banks", "OilGas")]
sectors <- apply(sectors, 2, scale, scale = FALSE)
gogmm <- gogarch(sectors, formula = ~garch(1, 1), estby = "mm", lag.max = 100)
gogmm
## Boswijk / van der Weide (2006)
data(BVDW)
BVDW <- zoo(x = BVDW[, -1], order.by = BVDW[, 1])
BVDW <- diff(log(BVDW)) * 100
gognls <- gogarch(BVDW, formula = ~garch(1, 1), scale = TRUE, estby = "nls")
gognls
## van der Weide (2002)
data(VDW)
var1 <- VAR(scale(VDW), p = 1, type = "const")
resid <- residuals(var1)
gogml <- gogarch(resid, ~garch(1, 1), scale = TRUE, estby = "ml", control = list(iter.max = 1000))
gogml
```


GoGARCH-class

### Description

This class defines the slots for estimated GO-GARCH models. It contains the class Goinit.

### Objects from the Class

Objects can be created by calls of the form `new("GoGARCH", ...)`.

### Slots

- **Z**: Object of class "matrix": Transformation matrix.
- **U**: Object of class "Orthonormal matrix.
- **V**: Object of class "matrix": Orthonormal matrix.
- **Y**: Object of class "matrix": Extracted component matrix.
- **H**: Object of class "list": List of conditional variance/covariance matrices.
- **models**: Object of class "list": List of univariate GARCH model fits.
- **estby**: Object of class "character": Estimation method.
- **CALL**: Object of class "call": Result of `match.call` in generating function.
- **X**: Object of class "matrix": The data matrix.
- **V**: Object of class "matrix": Covariance matrix of \( X \).
- **P**: Object of class "matrix": Left singular values of Var/Cov matrix of \( X \).
- **Dsqrt**: Object of class "matrix": Square roots of eigenvalues on diagonal, else zero.
- **garchf**: Object of class "formula": Garch formula used for uncorrelated component GARCH models.
- **name**: Object of class "character": The name of the original data object.

### Extends

Class "Goinit", directly.
Methods

cvar Returns the conditional variances as object with class attribute "mts" "ts".
ccov Returns the conditional co-variances as object with class attribute "mts" "ts".
ccor Returns the conditional correlations as object with class attribute "mts" "ts".
ccoef Returns the coefficients of the component GARCH models.
converged Returns the convergence codes of the component GARCH models.
formula Returns the formula for the component GARCH models.
plot Plotting of the conditional correlations.
predict Returns the conditional covariances and mean forecasts and the forecasts of the component GARCH models, object is of class gopredict.
residuals Returns the residuals of the GO-GARCH model.
show show-method for objects of class GoGARCH.
summary summary-method for objects of class GoGARCH, object is of class Gosum.
update Updates an object of class GoGARCH.

Author(s)

Bernhard Pfaff

See Also

Goinit, Gosum, Gopredict

---

goinit Constructor function for objects of class "Goinit"

Description

This function can be utilized to create objects of class Goinit. These objects are the starting point for estimating GO-GARCH models.

Usage

goinit(X, garchf = ~garch(1, 1), scale = FALSE)

Arguments

X Matrix: the data matrix.
garchf Formula: A formula object that will be used in the GARCH models of the uncorrelated components.
scale Logical, if TRUE the data X will be scaled, the default value is FALSE for no scaling of the data.
Details
This function computes the variance/covariance matrix of \( X \). Next the singular value decomposition is applied and the projection matrix as well as the diagonal matrix with the square roots of the eigen values are computed.

Value
An object of class Goinit.

Author(s)
Bernhard Pfaff

See Also
Goinit

Examples
```r
## Not run:
library(vars)
data(VDW)
var1 <- VAR(VDW, p = 1, type = "const")
resid <- resid(var1)
goinit(resid, scale = TRUE)

## End(Not run)
```

---

Goinit-class

Class "Goinit": Initialisation of GO-GARCH models

Description
This class defines the required slots for estimating GO-GARCH models.

Objects from the Class
Objects can be created by calls of the form `new("Goinit", ...)`, or more conveniently by `goinit()`.

Slots

\( X \): Object of class "matrix": The data matrix.

\( V \): Object of class "matrix": Covariance matrix of \( X \).

\( P \): Object of class "matrix": Left singular values of Var/Cov matrix of \( X \).

\( Dsqr \): Object of class "matrix": Square roots of eigenvalues on diagonal, else zero.

\( garchf \): Object of class "formula": Garch formula used for uncorrelated component GARCH models.

\( name \): Object of class "character": The name of the original data object.
Methods

show  Prints the slots, whereby for $x$ only the head is displayed.

Author(s)

Bernhard Pfaff

See Also

garchFit, goinit

Examples

showClass("Goinit")

golh  

Description

This function returns the negative of the log-Likelihood function for GO-GARCH models.

Usage

golh(params, object, garchlist)

Arguments

params  Vector of initial values for $\theta$.
object  An object of class Goinit or an extension thereof.
garchlist  List, elements are passed to garchFit.

Details

The log-Likelihood function of GO-GARCH models is given as:

$$L_{\theta,\alpha,\beta} = -\frac{1}{2} \sum_{t=1}^{T} \log(2\pi) + \log |Z_{\theta}Z_{\theta}'| + \log |H_t| + y'H_t^{-1}y_t$$

whereby $Z = P\Delta^1U_0$, $y_t = Z^{-1}x_t$ and $H_t$ is the conditional variance matrix of the independent components.

Value

negll  Scalar, the negative value of the log-Likelihood function.
Author(s)
Bernhard Pfaff

References

See Also
garchFit

gonls  
Non-linear least-squares estimation of matrix B

Description
This is the target function for estimating the matrix $B$ by non-linear least-squares. It is used in the estimation method `goest` if `method = "nls"` is chosen.

Usage
gonls(params, SSI)

Arguments
params  
The initial values of the $vech(B)$.

SSI  
A list with two elements, each a list itself, containing $S_t = s_t s_t' - I_m$ and $S_{t-1} = s_{t-1} s_{t-1}' - I_m$, respectively.

Details
Boswijk and van der Weiden (2006) proposed the following criterion function:

$$S(A) = \frac{1}{n} \sum_{t=1}^{n} \text{tr}((s_t s_t' - I_m - B(s_{t-1} s_{t-1}' - I_m)B)^2) = S^*(B)$$

for retrieving the matrix $U$. This matrix is the eigen vector matrix of $B$. The linear map $Z = P\Delta^{1/2}U$ and its inverse can then be computed for calculating the component matrix $Y = XZ^{-1}$.

Value
$f$  
numeric: The value of the target function.

Author(s)
Bernhard Pfaff
References

Boswijk, H. Peter and van der Weide, Roy (2006), Wake me up before you GO-GARCH, Tinbergen Institute Discussion Paper, TI 2006-079/4, University of Amsterdam and Tinbergen Institute.

See Also

gogarch

Gopredict-class  Class "Gopredict": Prediction of GO-GARCH Models

Description

This class defines the slots for forecasts from a GO-GARCH model.

Objects from the Class

Objects can be created by calls of the form new("Gopredict", ...), or with the method predict of formal class objects GoGARCH and Goestml.

Slots

hf: Object of class "list": The forecasted conditional covariances.

xf: Object of class "matrix": The transformed forecasts of the component GARCH mean models.

cGARCHF: Object of class "list": The original forecasts of the component GARCH models.

Methods

ccor Returns the forecasted conditional correlations.

ccov Returns the forecasted conditional co-variances.

cvar Returns the forecasted conditional variances.

show show-method for objects of class Gopredict.

Note

In case more than 10 forecasts steps are computed, the show-method displays only the head of the returned objects. Furthermore, the show-method displays the forecasted conditional variances only. The forecasted conditional co-variances and/or the forecasted conditional correlations can be retrieved with the methods ccov or ccor, respectively.

Author(s)

Bernhard Pfaff

See Also

GoGARCH, Goestml
Class "Gosum": Summary object of GO-GARCH model

Description

The formal summary class of GoGARCH objects or objects that extend this class.

Objects from the Class

Objects can be created by calls of the form `new("Gosum", ...)` or are set by the summary-method.

Slots

- `name`: character: the name of the original data object.
- `model`: formula: The GARCH model formula for the component GARCH models.
- `garchc`: list: The elements are matcoef matrices generated by `garchfit` for the components.
- `zinv`: matrix: The inverse of the linear map $X = YZ$.

Methods

- `show`: show-method for objects of class `gosum`.

Author(s)

Bernhard Pfaff

See Also

GoGARCH, Goestml

gotheta

Creates an object of class GoGARCH based on Euler angles

Description

This function returns an object of class GoGARCH based on an input vector of Euler angles.

Usage

```r
gotheta(theta, object, garchlist = list(init.rec = "mci", delta = 2, skew = 1, shape = 4, cond.dist = "norm", include.mean = FALSE, include.delta = NULL, include.skew = NULL, include.shape = NULL, leverage = NULL, trace = FALSE, algorithm = "nlminb", hessian = "ropt", control = list(), title = NULL, description = NULL))
```
Arguments

theta | Vector of Euler angles.
object | An object of formal class GoInit or an extension thereof.
garchlist | List with optional elements passed to garchFit.

Details

In a first step the orthogonal matrix $U$ is computed as the product of rotation matrices given the vector theta of Euler angles with the function uprodR. The linear map $Z$ is computed next as $Z = PDU'$. The unobserved components $Y$ are calculated as $Y = XZ^{-1}$. These are then utilized in the estimation of the univariate GARCH models according to object@garchf. The conditional variance/covariance matrices are calculated according to $V_t = ZH_tZ'$ whereby $H_t$ signifies a matrix with the conditional variances of the univariate GARCH models on its diagonal.

Value

Returns an object of class GoGARCH.

Author(s)

Bernhard Pfaff

References


See Also

GoInit, GoGARCH, Goestml, garchFit

Examples

```r
## Not run:
library(vars)
data(VDW)
var1 <- VAR(VDW, p = 1, type = "const")
resid <- resid(var1)
gin <- goinit(resid, scale = TRUE)
gotheta(0.5, gin)
## End(Not run)
```
Orthom-class

Class "Orthom": Orthogonal matrices

Description

This class defines an orthogonal matrix, which is characterized by \( \det(M) = 1 \) and \( MM' = I \).

Objects from the Class

Objects can be created by calls of the form `new("Orthom", ...)`. In addition the function `UprodR` returns an object of formal class `Orthom`.

Slots

- \( m \): Object of class "matrix".

Methods

- \( M \): Returns the slot \( m \) of class `Orthom`.
- `print`: print-method for objects of class `Orthom`.
- `show`: show-method for objects of class `Orthom`.
- \( t \): Transpose of object@\( m \).

Note

Objects are validated by `validOrthomObject()`. This function is utilised by `validObject()`.

Author(s)

Bernhard Pfaff

See Also

`UprodR`, `validOrthomObject`

Examples

`showClass("Orthom")`
Rd2

*Rotation matrix, 2-dimensional*

**Description**

Given an angle $\theta$ whereby $\theta \in [0, \pi/2)$ the function Rd2 returns a 2-dimensional rotation matrix of Euler angles.

**Usage**

Rd2(theta)

**Arguments**

theta Numeric, angle in the interval $[0, \pi/2)$.

**Value**

R A 2-dimensional rotation matrix.

**Author(s)**

Bernhard Pfaff

**See Also**

UprodR

**Examples**

Rd2(pi/3)

---

Umatic

*Matching of Orthogonal Matrices for Cayley transforms*

**Description**

This function matches an orthogonal matrix to the importance of the columns of the matrix to which it should be matched.

**Usage**

Umatic(from, to)
unvech

**Arguments**

from Matrix: orthogonal
to Matrix: orthogonal

**Value**

mat Matched matrix.

**Author(s)**

Bernhard Pfaff

**References**


**See Also**

gogarch

---

unvech

*Returns a symmetric matrix from a vector*

**Description**

This function returns the symmetric matrix $X$ from a vector that resulted from $v = \text{vech}(X)$.

**Usage**

unvech(v)

**Arguments**

v Vector, numeric.

**Details**

The vector $v$ must have length equal to $m \times (m + 1)/2$, whereby $m$ is a dimension of the symmetric matrix $X_{m \times m}$.

**Value**

$X$ Matrix, symmetric of order $m \times m$. 
Author(s)
Bernhard Pfaff

See Also
vec

Examples

v <- c(1, 2, 3, 4, 5, 6)
unvech(v)

UprodR

Creation of an orthogonal matrix

Description
This function returns an orthogonal matrix which results of the matrix products of rotation matrices.

Usage
UprodR(theta)

Arguments
theta Vector, of angles of the rotation matrices.

Details
The length of theta must be equal to \( m \times (m - 1)/2 \), where \( m \) is the dimension of the orthogonal matrix. The elements of theta must lie in the interval \([0, \pi/2)\).

Value
result Object of class Orthom.

Author(s)
Bernhard Pfaff

References

See Also
Rd2, Orthom
Examples

theta <- c(pi/3, pi/5, pi/7)
U <- UprodR(theta)
U

validGoinitObject <- Validation function for objects of class Goinit

Description

This function validates objects of class Goinit.

Usage

validGoinitObject(object)

Arguments

object Object of class Goinit.

Details

This function is utilized by validObject(). It is tested whether object@V, object@P, object@DsqR are square matrices; object@V coincides with the singular value decomposition.

Value

TRUE Logical, TRUE if the object passes the validation, otherwise an informative error message is returned.

Author(s)

Bernhard Pfaff

See Also

Goinit, goinit

Examples

data(VDW)
go <- goinit(VDW)
validObject(go)
validOrthomObject  Validation function for objects of class Orthom

Description

This function validates objects of class Orthom.

Usage

validOrthomObject(object)

Arguments

object Object of class Orthom.

Details

This function is utilized by validObject(). It is tested whether object@M is a square matrix, has det(M) = 1 and MM' = I.

Value

TRUE Logical, TRUE if the object passes the validation, otherwise an informative error message is returned.

Author(s)

Bernhard Pfaff

See Also

Orthom

Examples

theta <- c(pi/3, pi/5, pi/7)
U <- UprodR(theta)
validObject(U)
**Description**

The daily (log) returns of the Dow Jones Industrial Average and the NASDAQ composite, respectively. The daily observations start at the first of January, 1990, and end in October 2001.

**Usage**

```r
data(VDW)
```

**Format**

A data frame with 3082 observations on the following 2 variables.

- **DJIA**  Log-return of Dow Jones Industrial Average.
- **NASDAQ**  Log-return of NASDAQ.

**Details**

This data set has been utilized in the source below and can be downloaded from the web-site of the *Journal of Applied Econometrics* (see link below).

**Source**


**References**

[http://www.nasdaq.com](http://www.nasdaq.com)
[http://www.djindexes.com](http://www.djindexes.com)

**See Also**

- `BVDW`

**Examples**

```r
data(VDW)
str(VDW)
```
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