Package ‘gogarch’

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Description


Usage

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

See Also

VDW

Examples

data(BVDW)
str(BVDW)

---

BVDWAIR

Stock prices transportation sector, oil and kerosene prices

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

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.
- **AmericanAir** Stock prices of American Airlines.
- **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://www.econstats.com

References

Examples

```r
data(BVDWAIR)
str(BVDWAIR)
```

---

**BVDWSTOXX**  
*Sector indices of the EURO STOXX 600*

---

**Description**


**Usage**

```r
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](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
```r
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
```r
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:

\[
\hat{\Gamma}_k(s) = \frac{1}{n} \sum_{t=k+1}^{n} S_t S_{t-k}
\]

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

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
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("Goestmm", ...), 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.
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".
cecov Returns the conditional co-variances as object with class attribute "mts" "ts".
cecor 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 coefficient of the component GARCH models.
Goestnls-class

converged  Returns the convergence codes of the component GARCH models.
formel  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

nls: 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.
Dsq: 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.
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 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**

Specification and estimation of GO-GARCH models

**Description**

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

**Usage**

```r
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 to optim if estby = "nls" is employed or to nlminb if the GO-GARCH model is estimated by maximum likelihood, i.e., estby = "ml". It is not employed if the methods of moments estimator is chosen.

If the argument initial is left NULL, the starting values are computed according `seq(3.0, 0.1, length.out = 1)`, whereby 1 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 \(m \times (m - 1)/2\) for estimation by Maximum-Likelihood and \(m \times (m + 1)/2\) 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.

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, 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

### gogml

```r
solve(gogml@Z)
```

```r
## End(Not run)
```

---

**GoGARCH-class**

**Class "GoGARCH": Estimated GO-GARCH Models**

---

### 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": 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`.
- **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 "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".
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.
plot Plots 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 \(X\).
- \(Dsq\): 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")

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

Usage
  gollh(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:

  \[ L_{\theta,\alpha,\beta} = -\frac{1}{2} \sum_{i=1}^{T} m \log(2\pi) + \log |Z\theta Z_\theta^\prime| + \log |H_t| + y_t^\prime H_t^{-1} y_t \]

  whereby \( Z = P \Delta^{\frac{1}{2}} U_0 \), \( y_t = Z^{-1} x_t \) and \( H_t \) is the conditional variance matrix of the independent components.

Value
  negll  Scalar, the negative value of the log-Likelihood function.
**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:

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

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
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 $X = Y Z$.

Methods
- `show` show-method for objects of class Gosum.

Author(s)
Bernhard Pfaff

See Also
GoGARCH, Goestml

gotheta

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

Usage
`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 GoGARCH 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 \( \text{UprodR} \). The linear map \( Z \) is computed next as \( Z = PD^{1/2}U' \). The unobserved components \( Y \) are calculated as \( Y = XZ^{-1} \). These are then utilized in the estimation of the univariate GARCH models according to \( \text{object@garchf} \). 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)
```
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**

$Rd2(\text{theta})$

**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**

$Rd2(\pi/3)$

---

Umatch  

*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**

$\text{Umatch(from, to)}$
unvech

Arguments
from Matrix: orthogonal
to Matrix: orthogonal

Value
mat Matched matrix.

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

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)

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 * (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
validGoinitObject

Examples

\[
\begin{align*}
\theta & \leftarrow c(\pi/3, \pi/5, \pi/7) \\
U & \leftarrow UprodR(\theta) \\
U
\end{align*}
\]

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

\[
\begin{align*}
data(VDW) \\
go & \leftarrow goinit(VDW) \\
validObject(go)
\end{align*}
\]
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**


**See Also**

- `BVDW`

**Examples**

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