

Package ‘mgarchBEKK’

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Title Simulating, Estimating and Diagnosing MGARCH (BEKK and mGJR)
Processes

Version 0.0.5

Description Procedures to simulate, estimate and diagnose MGARCH
processes of BEKK and multivariate GJR (bivariate asymmetric GARCH
model) specification.

Depends R (>= 3.2.3), tseries, mvtnorm

Suggests testthat, devtools, roxygen2

License GPL-3

Encoding UTF-8

URL <https://github.com/vst/mgarchBEKK/>

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BEKK

*Estimate MGARCH-BEKK processes***Description**

Provides the MGARCH-BEKK estimation procedure.

Usage

```
BEKK(
  eps,
  order = c(1, 1),
  params = NULL,
  fixed = NULL,
  method = "BFGS",
  verbose = F
)
```

Arguments

<code>eps</code>	Data frame holding time series.
<code>order</code>	BEKK(p, q) order. An integer vector of length 2 giving the orders of the model to be fitted. <code>order[2]</code> refers to the ARCH order and <code>order[1]</code> to the GARCH order.
<code>params</code>	Initial parameters for the <code>optim</code> function.
<code>fixed</code>	Vector of parameters to be fixed.
<code>method</code>	The method that will be used by the <code>optim</code> function.
<code>verbose</code>	Indicates if we need verbose output during the estimation.

Details

BEKK estimates a BEKK(p,q) model, where p stands for the GARCH order, and q stands for the ARCH order.

Value

Estimation results packaged as BEKK class instance.

eps a data frame containing all time series

length length of the series

order order of the BEKK model fitted

estimation.time time to complete the estimation process

total.time time to complete the whole routine within the `mvBEKK.est` process

estimation estimation object returned from the optimization process, using `optim`

aic the AIC value of the fitted model
est.params list of estimated parameter matrices
asy.se.coef list of asymptotic theory estimates of standard errors of estimated parameters
cor list of estimated conditional correlation series
sd list of estimated conditional standard deviation series
H.estimated list of estimated series of covariance matrices
eigenvalues estimated eigenvalues for sum of Kronecker products
uncond.cov.matrix estimated unconditional covariance matrix
residuals list of estimated series of residuals

References

Bauwens L., S. Laurent, J.V.K. Rombouts, Multivariate GARCH models: A survey, April, 2003
Bollerslev T., Modelling the coherence in short-run nominal exchange rate: A multivariate generalized ARCH approach, Review of Economics and Statistics, 498–505, 72, 1990
Engle R.F., K.F. Kroner, Multivariate simultaneous generalized ARCH, Econometric Theory, 122–150, 1995
Engle R.F., Dynamic conditional correlation: A new simple class of multivariate GARCH models, Journal of Business and Economic Statistics, 339–350, 20, 2002
Tse Y.K., A.K.C. Tsui, A multivariate generalized autoregressive conditional heteroscedasticity model with time-varying correlations, Journal of Business and Economic Statistics, 351–362, 20, 2002

Examples

```
## Simulate series:
simulated <- simulateBEKK(2, 1000, c(1,1))

## Prepare the matrix:
simulated <- do.call(cbind, simulated$eps)

## Estimate with default arguments:
estimated <- BEKK(simulated)

## Not run:
## Show diagnostics:
diagnoseBEKK(estimated)

## End(Not run)
```

`diagnoseBEKK`*Diagnose BEKK process estimation*

Description

Provides diagnostics for a BEKK process estimation.

Usage

```
diagnoseBEKK(estimation)
```

Arguments

<code>estimation</code>	The return value of the <code>mvBEKK.est</code> function
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Details

This procedure provides console output and browsable plots for a given BEKK process estimation. Therefore, it is meant to be interactive as the user needs to proceed by pressing `c` on the keyboard to see each plot one-by-one.

Value

Nothing special

Examples

```
## Simulate series:
simulated = simulateBEKK(2, 1000, c(1,1))

## Prepare the matrix:
simulated = do.call(cbind, simulated$seps)

## Estimate with default arguments:
estimated = BEKK(simulated)

## Not run:
## Show diagnostics:
diagnoseBEKK(estimated)

## End(Not run)
```

Description

Provides bivariate GJR ($\text{mGJR}(p, q, g)$) estimation procedure.

Usage

```
mGJR(
  eps1,
  eps2,
  order = c(1, 1, 1),
  params = NULL,
  fixed = NULL,
  method = "BFGS"
)
```

Arguments

<code>eps1</code>	First time series.
<code>eps2</code>	Second time series.
<code>order</code>	$\text{mGJR}(p, q, g)$ order a three element integer vector giving the order of the model to be fitted. <code>order[2]</code> refers to the ARCH order and <code>order[1]</code> to the GARCH order and <code>order[3]</code> to the GJR order.
<code>params</code>	Initial parameters for the <code>optim</code> function.
<code>fixed</code>	A two dimensional vector that contains the user specified fixed parameter values.
<code>method</code>	The method that will be used by the <code>optim</code> function. See <code>?optim</code> for available options.

Value

Estimation results packaged as `mGJR` class instance. The values are defined as:

eps1 first time series
eps2 second time series
length length of each series
order order of the `mGJR` model fitted
estimation.time time to complete the estimation process
total.time time to complete the whole routine within the `mGJR.est` process
estimation estimation object returned from the optimization process, using `optim`
aic the AIC value of the fitted model
est.params estimated parameter matrices

asy.se.coef asymptotic theory estimates of standard errors of estimated parameters
cor estimated conditional correlation series
sd1 first estimated conditional standard deviation series
sd2 second estimated conditional standard deviation series
H.estimated estimated series of covariance matrices
eigenvalues estimated eigenvalues for sum of Kronecker products
uncond.cov.matrix estimated unconditional covariance matrix
resid1 first estimated series of residuals
resid2 second estimated series of residuals

References

Bauwens L., S. Laurent, J.V.K. Rombouts, Multivariate GARCH models: A survey, April, 2003
 Bollerslev T., Modelling the coherence in short-run nominal exchange rate: A multivariate generalized ARCH approach, Review of Economics and Statistics, 498–505, 72, 1990
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Examples

```
## Not run:
sim = BEKK.sim(1000)
est = mGJR(sim$eps1, sim$eps2)

## End(Not run)
```

simulateBEKK

Simulate BEKK processes

Description

Provides a procedure to simulate BEKK processes.

Usage

```
simulateBEKK(series.count, T, order = c(1, 1), params = NULL)
```

Arguments

<code>series.count</code>	The number of series to be simulated.
<code>T</code>	The length of series to be simulated.
<code>order</code>	BEKK(p, q) order. An integer vector of length 2 giving the orders of the model to fit. <code>order[2]</code> refers to the ARCH order and <code>order[1]</code> to the GARCH order.
<code>params</code>	A vector containing a sequence of parameter matrices' values.

Details

simulateBEKK simulates an N dimensional BEKK(p, q) model for the given length, order list, and initial parameter list where N is also specified by the user.

Value

Simulated series and auxiliary information packaged as a simulateBEKK class instance. Values are:

length length of the series simulated
order order of the BEKK model
params a vector of the selected parameters
true.params list of parameters in matrix form
eigenvalues computed eigenvalues for sum of Kronecker products
uncond.cov.matrix unconditional covariance matrix of the process
white.noise white noise series used for simulating the process
eps a list of simulated series
cor list of series of conditional correlations
sd list of series of conditional standard deviations

References

Bauwens L., S. Laurent, J.V.K. Rombouts, Multivariate GARCH models: A survey, April, 2003
 Bollerslev T., Modelling the coherence in short-run nominal exchange rate: A multivariate generalized ARCH approach, Review of Economics and Statistics, 498–505, 72, 1990
 Engle R.F., K.F. Kroner, Multivariate simultaneous generalized ARCH, Econometric Theory, 122–150, 1995
 Engle R.F., Dynamic conditional correlation: A new simple class of multivariate GARCH models, Journal of Business and Economic Statistics, 339–350, 20, 2002
 Tse Y.K., A.K.C. Tsui, A multivariate generalized autoregressive conditional heteroscedasticity model with time-varying correlations, Journal of Business and Economic Statistics, 351–362, 20, 2002

Examples

```
## Simulate series:
simulated = simulateBEKK(2, 1000, c(1,1))
```

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