Package 'mgarchBEKK'

December 6, 2022

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/

RoxygenNote 7.2.1

NeedsCompilation yes

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Repository CRAN

Date/Publication 2022-12-06 07:50:02 UTC

R topics documented:

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

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

estimation	The return value of the mvBEKK.est function

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$eps)

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

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

## End(Not run)
```

mGJR *Bivariate GJR Estimation*

Description

Provides bivariate GJR (`mGJR(p,q,g)`) estimation procedure.

Usage

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

Arguments

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

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

```
## 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

series.count	The number of series to be simulated.
T	The length of series to be simulated.
order	BEKK(p, q) order. An integer vector of length 2 giving the orders of the model to fit. order[2] refers to the ARCH order and order[1] to the GARCH order.
params	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

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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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