Package ‘egarch’

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Type Package

Title EGARCH simulation and fitting

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Description functions for simulating and fitting EGARCH models

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R topics documented:

egarch *Fitting EGARCH models to Time Series*

Description

This function fits an Exponential Generalized Autoregressive Conditional Heteroscedastic Model (EGARCH(p, q)-Model) with normal or ged distributed innovations to a given univariate time series.

Usage

```
egarch(x, order, include.shape = FALSE, include.mu = FALSE, control
    = list())
```

Arguments

`x` a time series.

`order` integer vector with the p and q component of EGARCH(p, q). See Details for more information.

`include.shape` logical flag. If `include.shape = TRUE` the shape parameter is assumed to be 2, otherwise it will be estimated during the optimization.

`include.mu` logical flag. If `include.mu = TRUE` the mean parameter will be estimated, otherwise it is assumed to be 0.

`control` list of control parameters, the same as declared in `optim`.

Details

There are different definitions of the EGARCH model. The conditional variance process of the form

$$\log(\sigma_t^2) = \beta_0+\beta_1\log(\sigma_{t-1}^2)+...+\beta_p\log(\sigma_{t-p}^2)+\eta_1 Z_{t-1}+\gamma_1(|Z_{t-1}|-E(|Z_{t-1}|))+...+\eta_q Z_{t-q} +\gamma_q(|Z_{t-q}|-E(|Z_{t-q}|))$$

is used here. To calculate the maximum likelihood estimates `egarch` uses the simplex algorithm of Nelder and Mead. For more details see Nelder and Mead (1965). The `optimi` function used here is a slightly modified version of R Core Teams `optim` function.

Value

Returns a list of class "egarch" with the following elements:

`beta` estimated beta coefficients of the fitted EGARCH model.

`eta` estimated eta coefficients of the fitted EGARCH model.

`gamma` estimated gamma coefficients of the fitted EGARCH model.

`nu` estimated shape parameter of the fitted EGARCH model. This parameter is only estimated when `include.shape = TRUE`.

`mu` estimated mean of the fitted EGARCH model. This parameter is only estimated when when `include.mu = TRUE`.

`ics` values of the AIC-, BIC- and HQ-criterion for the fitted EGARCH model.

...

Author(s)

Kerstin Konnerth,
R Core Team, the main parts of `optimi`.

References

Nelder J.A., Mead R. (1965): A simplex algorithm for function minimization. *Computer Journal* 7, 308 - 313.

Nelson D.B. (1991): Conditional Heteroskedasticity in Asset Returns: A New Approach. *Econometrica* 59, 347 - 370.

Nocedal J., Wright S.J. (1999): *Numerical Optimization*. Springer.

Straumann D. (2005): *Estimation in Conditionally Heteroscedastic Time Series Models*. Springer.

Wuertz D., Chalabi Y., Luksan L.: Parameter Estimation of ARMA models with GARCH/APARCH errors. *Journal of Statistical Software*.

Examples

```
# Simulating and fitting of an EGARCH(1,1) model with no mean and normal
# distributed innovations
x <- egarchSim(mu = 0, beta = c(0.01, 0.8), eta = -0.5, gamma = 0.4,
    nu = 2, n = 2000)
fit <- egarch(x = x, order = c(1, 1))

# Simulating and fitting of an EGARCH(2,2) model with no mean and ged
# distributed innovations
x <- egarchSim(mu = 0, beta = c(0.01, 0.2, 0.5), eta = c(-0.3, -0.2),
    gamma = c(0.3, 0.4), nu = 1.5, n = 2000)
fit <- egarch(x = x, order = c(2, 2), include.shape = TRUE)

# Simulating and fitting of an EGARCH(2,1) model with mean = 0.2 and
# normal distributed innovations
x <- egarchSim(mu = 0.2, beta = c(0.01, 0.3, 0.6), eta = -0.4,
    gamma = 0.6, nu = 2, n = 5000)
fit <- egarch(x = x, order = c(2, 1), include.mu = TRUE)
```

`egarchSim` *Simulation of a univariate EGARCH model*

Description

This function simulates a univariate EGARCH(p, q) model with normal or ged distributed innovations.

Usage

```
egarchSim(mu, beta, eta, gamma, nu, n, start.n)
```

Arguments

`mu`	the mean value, by default 0.
`beta`	the vector of beta coefficients. See Details for more information.
`eta`	the value or vector of eta coefficients. See Details for more information.
`gamma`	the value or vector of gamma coefficients. See Details for more information.
`nu`	the shape value, by default 2.
`n`	integer value, length of output series.
`start.n`	integer value, length of "burn-in" period. The default value is 2000.

Details

There are different definitions of the EGARCH model. The conditional variance process of the form

$$\log(\sigma_t^2) = \beta_0 + \beta_1 \log(\sigma_{t-1}^2) + ... + \beta_p \log(\sigma_{t-p}^2) + \eta_1 Z_{t-1} + \gamma_1(|Z_{t-1}| - E(|Z_{t-1}|)) + ... + \eta_q Z_{t-q}$$
$$+ \gamma_q(|Z_{t-q}| - E(|Z_{t-q}|))$$

ist used here. The model is checked for stationarity.

Value

`egarchSim` returns a time-series object of class "ts".

Author(s)

Kerstin Konnerth,
Diethelm Wuertz for the 'rged' R-port.

References

Nelson D.B. (1991): Conditional Heteroskedasticity in Asset Returns: A New Approach. *Econometrica* 59, 347 - 370.
Straumann D. (2005): *Estimation in Conditionally Heteroscedastic Time Series Models*. Springer.

Examples

```
# simulation of EGARCH(1,1) process with normal distributed innovations
# and zero mean
  x <- egarchSim(beta = c(0.01, 0.7), eta = -0.3, gamma = 0.7, n = 1000)

# simulation of EGARCH(3,2) process with ged distributed innovations
# and mean = 0.2
  x <- egarchSim(mu = 0.2, beta = c(0.01, 0.2, 0.3, 0.3), eta = c(-0.2,
      -0.3), gamma = c(0.3, 0.4), nu = 1.5, n = 1500)
```

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