Package ‘mfGARCH’

December 4, 2019

Title Mixed-Frequency GARCH Models

Version 0.1.9

Description Estimating GARCH-MIDAS (MIxed-DAta-Sampling) models (Engle, Ghysels, Sohn, 2013, <doi:10.1162/REST_a_00300>) and related statistical inference, accompanying the paper “Two are better than one: volatility forecasting using multiplicative component GARCH models” by Conrad and Kleen (2018, <doi:10.2139/ssrn.2752354>). The GARCH-MIDAS model decomposes the conditional variance of (daily) stock returns into a short- and long-term component, where the latter may depend on an exogenous covariate sampled at a lower frequency.

Depends R (>= 3.3.0)

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Encoding UTF-8

LazyData true

RoxygenNote 6.1.1

Imports Rcpp, graphics, stats, numDeriv, zoo, maxLik

LinkingTo Rcpp

URL https://github.com/onnokleen/mfGARCH/

BugReports https://github.com/onnokleen/mfGARCH/issues

Suggests testthat, dplyr, ggplot2, covr, rmarkdown

NeedsCompilation yes

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Repository CRAN

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df_financial

Description

A dataset containing the S&P 500 stock returns and the NFCI

Usage

df_financial

Format

A data frame with 11,306 rows and 5 variables:

date  date
return daily S&P 500 log returns times 100
rv    5-minute realized variances
week  a dummy for each year/week combination
nfcI  National Financial Conditions Index

Source

https://github.com/onnokleen/mfGARCH/
https://de.finance.yahoo.com/
https://fred.stlouisfed.org/series/NFCI
https://realized.oxford-man.ox.ac.uk
**df_mfgarch**

---

**df_mfgarch**  
*Mixed-frequency data set.*

---

**Description**

A dataset containing the S&P 500 stock returns, realized variances and macroeconomic variables

**Usage**

df_mfgarch

**Format**

A data frame with 11,938 rows and 11 variables:

- **date** date
- **return** daily S&P 500 log returns times 100
- **open_close** open-close returns
- **rv** 5-minute realized variances
- **vix** Cboe VIX
- **year_week** a dummy for each year/week combination
- **dhousing** changes in housing starts
- **dindpro** changes in industrial production
- **nai** NAI
- **nfci** National Financial Conditions Index
- **year_month** a dummy for each year/month combination

**Source**

https://github.com/onnokleen/mfGARCH/
https://de.finance.yahoo.com/
https://fred.stlouisfed.org
https://realized.oxford-man.ox.ac.uk
This function estimates a multiplicative mixed-frequency GARCH model. For the sake of numerical stability, it is best to multiply log returns by 100.

**Description**

This function estimates a multiplicative mixed-frequency GARCH model. For the sake of numerical stability, it is best to multiply log returns by 100.

**Usage**

```r
fit_mfgarch(data, y, x = NULL, K = NULL, low.freq = "date",
            var.ratio.freq = NULL, gamma = TRUE, weighting = "beta.restricted",
            x.two = NULL, K.two = NULL, low.freq.two = NULL,
            weighting.two = NULL, multi.start = FALSE, control = list(par.start = NULL))
```

**Arguments**

- **data**: data frame containing a column named date of type 'Date'.
- **y**: name of high frequency dependent variable in df.
- **x**: covariate employed in mfGARCH.
- **K**: an integer specifying lag length K in the long-term component.
- **low.freq**: a string of the low frequency variable in the df.
- **var.ratio.freq**: specify a frequency column on which the variance ratio should be calculated.
- **gamma**: if TRUE, an asymmetric GJR-GARCH is used as the short-term component. If FALSE, a simple GARCH(1,1) is employed.
- **weighting**: specifies the weighting scheme employed in the long-term component. Options are "beta.restricted" (default) or "beta.unrestricted"
- **x.two**: optional second covariate
- **K.two**: lag lgenth of optional second covariate
- **low.freq.two**: low frequency of optional second covariate
- **weighting.two**: specifies the weighting scheme employed in the optional second long-term component. Currently, the only option is "beta.restricted"
- **multi.start**: if TRUE, optimization is carried out with multiple starting values
- **control**: a list
Value

A list of class mfGARCH with letters and numbers.

- par - vector of estimated parameters
- rob.std.err - sandwich/HAC-type standard errors
- broom.mgarch - a broom-like data.frame with entries 1) estimate: column of estimated parameters 2) rob.std.err - sandwich/HAC-type standard errors 3) p.value - p-values derived from sandwich/HAC-type standard errors 4) opg.std.err - Bollerslev-Wooldrige/OPG standard errors for GARCH processes 5) opg.p.value - corresponding alternative p-values
- tau - fitted long-term component
- g - fitted short-term component
- df.fitted - data frame with fitted values and residuals
- K - chosen lag-length in the long-term component
- weighting.scheme - chosen weighting scheme
- llh - log-likelihood value at estimated parameter vector
- bic - corresponding BIC value
- y - dependent variable y
- optim - output of the optimization routine
- K.two - lag-length of x.two if two covariates are employed
- weighting.scheme.two - chosen weighting scheme of x.two (if K.two != NULL)
- tau.forecast - one-step ahead forecast of the long-term component
- variance.ratio - calculated variance ratio
- est.weighting - estimated weighting scheme
- est.weighting.two - estimated weighting scheme of x.two (if K.two != NULL)

Examples

```r
## Not run:
fit_mfgarch(data = df_financial, y = "return", x = "nfci", low.freq = "week", K = 52)
fit_mfgarch(data = df_mfgarch, y = "return", x = "nfci", low.freq = "year_week", K = 52,
x.two = "dindpro", K.two = 12, low.freq.two = "year_month", weighting.two = "beta.restricted")

## End(Not run)
```
plot_weighting_scheme  
This function plots the weighting scheme of an estimated GARCH-MIDAS model

Description
This function plots the weighting scheme of an estimated GARCH-MIDAS model

Usage
plot_weighting_scheme(x)

Arguments
x  
mfGARCH object obtained by fit_mfgarch

simulate_mfgarch  
This function simulates a GARCH-MIDAS model. Innovations can follow a standard normal or student-t distribution.

Description
This function simulates a GARCH-MIDAS model. Innovations can follow a standard normal or student-t distribution.

Usage
simulate_mfgarch(n.days, mu, alpha, beta, gamma, m, theta, w1 = 1, w2, K, psi, sigma.psi, low.freq = 1, n.intraday = 288, student.t = NULL, corr = 0)

Arguments
n.days  
number of days
mu  
mu
alpha  
alpha
beta  
beta
gamma  
gamma
m  
m
theta  
theta
w1  
w1
w2  
w2
K  
K
This function simulates a GARCH-MIDAS model where the short-term GARCH component is replaced by its diffusion limit, see Andersen (1998)

**Description**

This function simulates a GARCH-MIDAS model where the short-term GARCH component is replaced by its diffusion limit, see Andersen (1998)

**Usage**

`simulate_mfgarch_diffusion(n.days, mu, alpha, beta, m, theta, w1 = 1, w2, K, psi, sigma.psi, low.freq = 1, n.intraday = 288)`

**Arguments**

- `n.days`  number of days
- `mu`  mu
- `alpha`  alpha
- `beta`  beta
- `m`  m
- `theta`  theta
- `w1`  w1
- `w2`  w2
- `K`  K
- `psi`  psi
- `sigma.psi`  sigma.psi
- `low.freq`  low.freq
- `n.intraday`  n.intraday

**Examples**

```r
simulate_mfgarch(n.days = 200, mu = 0, alpha = 0.06, beta = 0.92, gamma = 0, m = 0, theta = 0.1, w1 = 1, w2 = 3, K = 12, psi = 0.98, sigma.psi = 0.1, low.freq = 10)
```
simulate_mfgarch_rv_dependent

Simulate a GARCH-MIDAS similar to Wang/Ghysels with lagged RVol as covariate

Usage

simulate_mfgarch_rv_dependent(n.days, mu, alpha, beta, gamma, m, theta,
    w1 = 1, w2, K, n.intraday = 288, low.freq = 1, rvol = FALSE)

Arguments

n.days number of days
mu mu
alpha alpha
beta beta
gamma gamma
m m
theta theta
w1 w1
w2 w2
K K
n.intraday number of maximum intraday returns, default 288
low.freq number of days per low frequency
rvol if TRUE, the square root of the realized variance is used as a covariate

Examples

simulate_mfgarch_rv_dependent(n.days = 2200, mu = 0, alpha = 0.06, beta = 0.92, gamma = 0, m = 0,
    theta = 0.1, w1 = 1, w2 = 3, K = 3, low.freq = 22)
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