

Package ‘AdaptQMLE’

April 3, 2016

Type Package

Title Adaptive Quasi-Maximum Likelihood Estimation

Version 0.1.0

Date 2016-04-03

Maintainer Xiaorui(Jeremy) Zhu <zhuxiaorui1989@gmail.com>

Depends R (>= 3.0.1), utils, xts

Imports zoo, tseries, its

Description Includes all related function of Adaptive Quasi-Maximum Likelihood Estimation method. It is not only for GARCH model with normal distributed innovation, but also for models with student's t innovation, Pearson's type IV innovation and so on.

License GPL-3

LazyData true

RoxygenNote 5.0.1

R topics documented:

A_tQMLE	2
com.residue	2
Estdf	3
GARCH1_1	3
GARCH_t	4
gen.lin	5
getHighFreqData	5
google.intraday.data	6
LogL_GARCH_Norm	6
LogL_GARCH_PIV	7
LogL_GARCH_t	7
LogL_Linear_Norm	8
MLE	8
tQMLE	9
YITAtQMLE	10
Index	11

A_tQMLE

*Adaptive Quasi Maximum Likelihood Estimation***Description**

This is the function which can be used to estimate parameters of all kinds of models. The critical idea of this methods is to estimate parameters according to data themselves with unspecified assumption of error's distribution.

Usage

```
A_tQMLE(series, order = c(1, 1))
```

Arguments

series	The original time-series that need to be fitted as GARCH model
order	The GARCH model orders. Includes GARCH terms and ARCH terms.

Value

The estimation of parameters.

Examples

```
#test
```

com.residue

com.residue is a function used to calculate the residue of GARCH model so that the futher adaptive procedure can be move forward.

Description

com.residue is a function used to calculate the residue of GARCH model so that the futher adaptive procedure can be move forward.

Usage

```
com.residue(alpha, beta, series)
```

Arguments

alpha	Includes intercept and all parameters of ARCH terms.
beta	Includes all parameters of GARCH terms.
series	Time series.

Value

Return a list contains estimators, residues and conditional sigma square.

Examples

```
# need to be changed.
```

Estdf

*Estimation of degree freedom d_f using tQMLE***Description**

This function is the crux of whole adaptive quasi maximum likelihood estimation. It estimates degree of freedom d_f from the model residues under specified assumption of distribution family of error. So the input is only model residues.

Usage

Estdf(e)

Arguments

e The innovation calculated by estimate parameters

Value

Return value is the estimator of degree of freedom when the $\eta_f = 1$, which means the asymptotic distribution of sample residues.

Examples

```
# need revisions.
```

GARCH1_1

*GARCH(1,1)***Description**

Example to generate GARCH(1,1) with normal innovation.

Usage

GARCH1_1(n, a, b)

Arguments

n series number
a alpha include intercept and alpha1
b beta

Value

A list includes GARCH(1,1) series, error series and conditional variances series.

Examples

```
# Need revisions.
```

GARCH_t

*GARCH.t***Description**

Function to generate GARCH time series with t-students distribution innovations

Usage

```
GARCH_t(alpha, beta, n = 100, rnd = c("rt", "rnorm"), df.t, ntrans = 100)
```

Arguments

alpha	The vector include the intercept and the parameters of autoregression part, which is ARCH terms (q).
beta	The vector include the parameters of conditional variance, which is GARCH terms with order p.
n	The lenght of time series
rnd	The distribution of error(innovation) of GARCH model. Right now we only consider student's t and normal distributions. Generalized Gaussian and Pearson Type III distributions will be included.
df.t	The df of student's t distribution. df.t>2 continuous parameter
ntrans	burn-in size, i.e. number of initial simulated data to be discarded

Details

This function is used to generate GARCH time series with t-students distribution innovations. This kind of innovations will better perform the heavy-tailed characteristics of financial data.

Value

A list includes time-series "x" and conditional sigma square "sig.sq".

Author(s)

Xiaorui(Jeremy) Zhu

Examples

```
# Test for GARCH(1,1) with t innovation #
xx <- GARCH_t(alpha = c(0.1, 0.4), beta = 0.4, n = 2000, rnd = "rt", df.t = 4)
y <- xx$x
plot(y, type = "l")
```

gen.lin	<i>Single linear model $y = a + b \cdot x$.</i>
---------	--

Description

Generating function for single linear model $y = a + b \cdot x$.

Usage

```
gen.lin(intercept, slope, noise.variance, x, dis.error = c("rt", "rnorm"),
        dft)
```

Arguments

intercept	The intercept of single linear model.
slope	The parameter b, which is the slope of $y = a + b \cdot x$.
noise.variance	The variance of error series.
x	The depedent variable.
dis.error	Distribution of error, student's t or normal.
dft	The degree of freedom if error was specified as student's t.

Value

A data frame contains x, y and error series.

getHighFreqData	<i>getHighFreqData</i>
-----------------	------------------------

Description

This function is used to download high frequent data of stock. The source is Google.

Usage

```
getHighFreqData(instrument, start, end, provider, savename)
```

Arguments

instrument	The quote symbol of the stock. This quote should correspond with Yahoo list. Symbols can be found here: http://www.marketwatch.com/tools/industry/stocklist.asp?bcind_ind=95 .
start	The start date of your period with the format "YYYY-MM-DD". Default start date is "1991-01-02".
end	The end date of your period with the format "YYYY-MM-DD". The default end date is the day before the today in your system.
provider	The source of data, contains options: "google", "yahoo", "onada".
savename	The saving name the file including downloaded data. The default folder is the current working directory of the R process.

Value

The time series data will be returned.

Examples

```
# need revisions
```

```
google.intraday.data
```

google.intraday.data is used to download Google minutely trading date of stocks.

Description

This is a function used get Google minutely trading data of stocks.

Usage

```
google.intraday.data(symbol, freq, period)
```

Arguments

symbol	The stock symbol. This quote should correspond with Yahoo list. Symbols can be found here: http://www.marketwatch.com/tools/industry/stocklist.asp?bcind_ind=9537&bcind_pe
freq	The interval of time. The unit of it is second. The minimal interval is 60 seconds. Like "60s". Please input numeric.
period	The time period. The unit is day, "d". Please input numeric.

Value

Return data include data untill now.

Examples

```
# Need examples.
```

```
LogL_GARCH_Norm
```

Log-likelihood function fo GARCH(p,q)

Description

The Log-likelihood function of GARCH(p,q) model.

Usage

```
LogL_GARCH_Norm(series, p, q)
```

Arguments

series	The time series that need to be fitted.
p	The order of GARCH terms σ^2
q	The order of ARCH terms ϵ^2

Value

Log likelihood function

LogL_GARCH_PIV	<i>log-likelihood function of GARCH(p,q) with Pearson's Type IV (PIV) distribution</i>
----------------	--

Description

The Log-likelihood function of GARCH model with Pearson's Type IV (PIV) distributed error

Usage

LogL_GARCH_PIV(series, p, q, df)

Arguments

series	The time series that need to be fitted.
p	The order of GARCH terms σ^2
q	The order of ARCH terms ϵ^2
df	The specified degree of freedom of student's t innovation.

Value

Log-Likelihood function of GARCH with t error

LogL_GARCH_t	<i>LogL_GARCH_t</i>
--------------	---------------------

Description

The Log likelihood function of GARCH model. Here is the GARCH(p,q) with student's t error

Usage

LogL_GARCH_t(series, p, q, df)

Arguments

series	The time series that need to be fitted
p	The order of GARCH terms σ^2
q	The order of ARCH terms ϵ^2
df	The specified degree of freedom of student's t innovation.

Value

Log likelihood funtion.

LogL_Linear_Norm	<i>Log-likelihood function of single linear model.</i>
------------------	--

Description

The Log-likelihood function of linear model. Here is the $y=a + b*x$. Need to be changed.

Usage

```
LogL_Linear_Norm(X, y)
```

Arguments

X	The independent variable x without intercept.
y	The dependent variable y.

Value

Log-likelihood function

MLE	<i>Simple Maximum Likelihood Estimation based on normal residual assumption.</i>
-----	--

Description

Simple Maximum Likelihood Estimation based on normal residual assumption.

Usage

```
MLE(y, X, LogLFunc = c("LogL_GARCH_Norm", "LogL_Linear_Norm"), order = c(1, 1))
```

Arguments

y	The dependent variable or time series.
X	The single independent variable for single linear regression. It could be missing if use this function to estimate GARCH(p,q) model.
LogLFunc	The log-likelihood function of models.
order	The order of GARCH model.

Value

is the estimated parameters of GARCH(p,q)

Examples

```
# Test for GARCH(1,1) with t innovation #
library(tseries)
xx <- GARCH_t(alpha = c(0.1, 0.4), beta = 0.4, n = 2000, rnd = "rt", df.t = 4)
y <- xx$x
plot(y, type = "l")
# Estimate parameters using "garch" function in the "tseries" package
x.arch <- garch(y, order = c(1,1))
est1 <- MLE(y = y, LogLFunc = LogL_GARCH_Norm, order = c(1,1))
est1

# Example for single linear regression model.
# Simulate from the model \eqn{Y=\beta_0+\beta_1*x+N(0,\sigma^2)}
# Inputs: intercept; slope; variance; vector of x; return sample or estimated
# Fix x values for all runs of the simulation; draw from an exponential
n <- 2000 # So we don't have magic #s floating around
beta.0 <- 5; beta.1 <- -2; sigma.sq <- 1; fixed.x <- rexp(n=n)
data <- gen.lin(intercept=beta.0, slope = beta.1, noise.variance=sigma.sq, x=fixed.x, dis.error = "rt", dft=3)
par(mfrow=c(1,1))
hist(fixed.x, freq = FALSE, breaks = 50, xlab = expression(x[i]), main = "")
hist(data$y, freq = FALSE, breaks = 50, xlab = expression(y[i]), main = "")
plot(data$x, data$y)
test <- lm(data$y~data$x)
test
y <- as.matrix(data$y); X <- as.matrix(data$x)
myMLE <- MLE(y, X, LogLFunc = "LogL_Linear_Norm")
myMLE
# Very good example for single linear regression by suing "MLE" function.
```

tQMLE

Quasi-maximum likelihood estimation with student's t innovation

Description

tQMLE is a function that can be used to estimate parameters of GARCH(p,q) with student's t innovation by specified log-likelihood estimation as "LogL_GARCH_t" and "dfest"(degree of freedom). It also includes QMLE other

Usage

```
tQMLE(series, LogLFunc = c("LogL_GARCH_Norm", "LogL_GARCH_t"), order = c(1,
1), dfest)
```

Arguments

series	The original time series, which need to be fitted as GARCH(1,1)
LogLFunc	is the log likelihood function of GARCH(p,q) with student's t innovation. The model is setted as $\sigma_{t t-1}^2 = \omega + \sum_{i=1}^q \alpha_i u_{t-i}^2 + \sum_{j=1}^p \beta_j \sigma_{t-j}^2$. This input can be changed according to assumption. Default setting is normal distributed innovation.
order	p: order for GARCH terms, q: order for ARCH terms.
dfest	is specified degree of freedom of innovation.

Value

A list.

Examples

```
# If the prespecified degree of freedom of student's t innovation is 4, then the tQML estimator will be:
xx <- GARCH_t(alpha = c(0.1, 0.2, 0.3), beta = 0.3, n = 1000, rnd = "rt", df.t = 4)
y <- xx$x
plot(y, type = "l")
# Two bad estimation methods
library(tseries)
x.arch <- garch(y, order = c(2,1)) # Fit GARCH(2,1)
est1 <- MLE(y = y, LogLFunc = LogL_GARCH_Norm, order = c(2,1))
est1
# Better estimation methods with specified innovation.
est2 <- tQMLE(series = y, LogLFunc = LogL_GARCH_t, dfest = 4)
est2
```

YITAtQMLE

Estimation of scale parameter η_f using tQMLE

Description

This function is used to estimate scale parameter η_f from the model residues under specified assumption of distribution of error. So the input includes degree of freedom and model residues.

Usage

```
YITAtQMLE(e, dfest)
```

Arguments

e	The innovation caculated by estimate parameters
dfest	The parameter of Quais likelihood. Continuous parameter dfest>2 so that finite variance

Value

The estimator of eta

Examples

```
# need revisions
```

Index

A_tQMLE, [2](#)

com.residue, [2](#)

Estdf, [3](#)

GARCH1_1, [3](#)

GARCH_t, [4](#)

gen.lin, [5](#)

getHighFreqData, [5](#)

google.intraday.data, [6](#)

LogL_GARCH_Norm, [6](#)

LogL_GARCH_PIV, [7](#)

LogL_GARCH_t, [7](#)

LogL_Linear_Norm, [8](#)

MLE, [8](#)

tQMLE, [9](#)

YITAtQMLE, [10](#)