Package 'robustGarch'

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Type Package

Title Robust Garch(1,1) Model

Version 0.4.2

Description A method for modeling robust generalized autoregressive conditional heteroskedasticity (Garch) (1,1) processes, providing robustness toward additive outliers instead of innovation outliers. This work is based on the methodology described by Muler and Yohai (2008) <doi:10.1016/j.jspi.2007.11.003>.

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Encoding UTF-8

URL https://github.com/EchoRLiu/robustGarch

BugReports https://github.com/EchoRLiu/robustGarch/issues

RoxygenNote 7.3.2

Suggests rmarkdown, testthat, PCRA

Imports Rsolnp, nloptr, rugarch, zoo, xts

Depends R (>= 4.3.0)

NeedsCompilation no

Author Echo Liu [aut, cre],
Daniel Xia [aut],
R. Douglas Martin [aut]

Maintainer Echo Liu <yuhong.echo.liu@gmail.com>

Repository CRAN

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Contents

robGarch *Robust GARCH(1,1) Model Estimation*

Description

Computes "BM" robust Garch(1,1) model parameter estimate by using a bounded objective function and a bounded conditional variance recursion. Alternatively, it computes: (1) "M" estimates by using only the bounded objective function, (2) "QML" estimates based on a typically incorrect assumption of normally distributed innovations, (3) "t-MLE" estimates based on an assumption of an innovations t-distributed MLE with unknown location, scale,and degrees of freedom parameters. CHECK IF (3) IS CORRECT.

Usage

```
robGarch(
  data,
  fitMethod = c("BM", "M", "QML", "MLE"),
  robTunePars = c(0.8, 3),
  optChoice = c("Rsolnp", "nloptr", "nlminb"),
  initialPars = c(5e-04, 0.15, 0.75),
  SEmethod = c("numDeriv", "optim", "sandwich"),
  optControl = list(trace = 0)
)
```

Arguments

`data`	an xts object
`fitMethod`	character valued name of fitting method, one of "BM", "M" "QML" or "tMLE", with "BM" the default value.
`robTunePars`	a numeric vector c(cM,cFlt) that controls the extent of fitMethod robustness, with default c(0.8,3.0).
`optChoice`	character valued optChoice name, one of "Rsolnp", "nloptr", "nlminb", with default "Rsolnp".
`initialPars`	numeric user-defined initial parameters c(gamma0, alpha0, beta0) for use by optChoice, with default values c(0.0005, 0.15, 0.75).
`SEmethod`	character valued name of standard error method, one of "numDeriv", "optim", "sandwich", with default "numDeriv".
`optControl`	list of arguments passed to optChoice, with default `list(trace=0)`.

Details

The "BM" fit method delivers the highest robustness by using a half-Huber psi function to bound the normal distribution log-likelihood, and using a Huber psi function to prevent the propagation of influential outliers in the variance recursion. The "M" method is obtained by dropping the BM bounding of the variance recursion, and is therefore less robust toward outliers.

ECHO OR DAN, PLEASE PROVIDE DETAILS FOR optControl. For details of the list of control arguments, please refer to `nloptr::nloptr`, `Rsolnp::solnp`, `nlminb`. The SEmethod default "numDeriv" is based on the Hessian from the optimization.

Value

A list object of class "robustGarch" with components:

`data`	the input xts object
`fitMethod`	the the fitMethod specified
`robtunePars`	the robtunePars specified
`initialPars`	the initialPars specified
`optChoice`	the optChoice specified
`coefEstimates`	computed parameter estimates
`sigma`	conditional standard deviation xts class time series
`SEmethod`	the specidied of calculating standard errors
`observedInfoMat`	observed information matrix
`optDetails`	a list containing the optChoice specified, the control values specified, and the optChoice minimized objective, and convergence status message

References

Muler, N. and Yohai, V. (2008). Robust estimates for GARCH models. Journal of Statistical Planning and Inference, 138, 2918-2940.

Examples

```
if (requireNamespace("PCRA", quietly = TRUE)) {
  ret <- PCRA::retOFG
  ret <- ret$RET
  (robFitBM <- robGarch(ret, fitMethod = "BM"))
  sum(robFitBM$fitted_pars[2:3])
  summary(robFitBM)
}
```

`robustGARCH` *Robust GARCH Package*

Description

Robust GARCH modeling functions.

Author(s)

Maintainer: Echo Liu <yuhong.echo.liu@gmail.com>

Authors:

- Daniel Xia <dxia94@gmail.com>
- R. Douglas Martin <dougPCRA@gmail.com>

See Also

Useful links:

- https://github.com/EchoRLiu/robustGarch
- Report bugs at https://github.com/EchoRLiu/robustGarch/issues

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`robustGARCH-summary` *Summary for robustGARCH class*

Description

Summarizes the results of a robust GARCH(1,1) model fit by extracting key model components.

Usage

```
## S3 method for class 'robustGARCH'
summary(object, digits = 3, ...)

## S3 method for class 'robustGARCH'
print(x, digits = 3, ...)

## S3 method for class 'robustGARCH'
plot(
  x,
  digits = 3,
  estimation_pos = "topleft",
  line_name_pos = "topright",
  par_ = par(no.readonly = TRUE),
  pctReturn_ = TRUE,
  abs_ = TRUE,
  original_ = FALSE,
  main_name = "Conditional Volatility (vs |pctReturns(%)|)",
  ...
)

## S3 method for class 'robustGARCH'
coef(object, ...)

aef(fit, nu = 5)
```

Arguments

object	Same as fit, for summary.robustGARCH
digits	the number of digits for print and plot, default is 3.
...	# to be written
x	Same as fit, for plot.robustGARCH and print.robustGARCH
estimation_pos	string that determines the legend position that specifies gamma, alpha, beta estimations. Choice of "bottomright", "bottom", "bottomleft", "left", "topleft", "top", "topright", "right" and "center". Default is "topleft".
line_name_pos	string that determines the legend position that specifies the names of lines in the plot. Choice of "bottomright", "bottom", "bottomleft", "left", "topleft", "top", "topright", "right" and "center". Default is "topright".
par_	graphical parameters that can be set, which is in the form of par(...). The default is par(no.readonly = TRUE).
pctReturn_	a logical argument. IF TRUE, the plot function will plot the returns in percentage instead of original. Default is TRUE.
abs_	a logical argument, when TRUE, the plot function will plot abs(returns) with conditional standard deviation instead of returns, default to TRUE.
original_	a logical argument. If TRUE, the original return will be plotted. Default is FALSE
main_name	the title of the plot, default is "Conditional SD (vs returns)"
fit	A robustGARCH fit object of class robGarch
nu	degrees of freedom in a Student's t-distribution.

Value

A list of class "summary.robustGARCH" containing:

method	The fitting method used (e.g., "BM", "M", "QML", or "MLE").
coefficients	Named vector of parameter estimates.
loglikelihood	The value of the objective function at convergence.
converged	Logical; indicates whether the optimizer converged successfully.

Examples

```
if (requireNamespace("PCRA", quietly = TRUE)) {
  library(robustGarch)

  ret <- PCRA::retOFG
  ret <- ret$RET

  (robFitBM <- robGarch(ret, fitMethod = "BM"))

  sum(robFitBM$fitted_pars[2:3])
  summary(robFitBM)
  print(robFitBM)
```

```
  plot(robFitBM)
  coef(robFitBM)
} else {
  message("Run install.packages('PCRA') to run this example.")
}
```

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