

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](https://doi.org/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

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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 <code>c(cM, cFlt)</code> that controls the extent of <code>fitMethod</code> robustness, with default <code>c(0.8, 3.0)</code> .
optChoice	character valued <code>optChoice</code> name, one of "Rsolnp", "nloptr", "nlminb", with default "Rsolnp".
initialPars	numeric user-defined initial parameters <code>c(gamma0, alpha0, beta0)</code> for use by <code>optChoice</code> , with default values <code>c(0.0005, 0.15, 0.75)</code> .
SEmethod	character valued name of standard error method, one of "numDeriv", "optim", "sandwich", with default "numDeriv".
optControl	list of arguments passed to <code>optChoice</code> , with default <code>list(trace=0)</code> .

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:

<code>data</code>	the input xts object
<code>fitMethod</code>	the the fitMethod specified
<code>robtunePars</code>	the robtunePars specified
<code>initialPars</code>	the initialPars specified
<code>optChoice</code>	the optChoice specified
<code>coefEstimates</code>	computed parameter estimates
<code>sigma</code>	conditional standard deviation xts class time series
<code>SEmethod</code>	the specidied of calculating standard errors
<code>observedInfoMat</code>	observed information matrix
<code>optDetails</code>	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)

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See Also

Useful links:

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

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

<code>object</code>	Same as <code>fit</code> , for <code>summary.robustGARCH</code>
<code>digits</code>	the number of digits for print and plot, default is 3.
<code>...</code>	# to be written
<code>x</code>	Same as <code>fit</code> , for <code>plot.robustGARCH</code> and <code>print.robustGARCH</code>
<code>estimation_pos</code>	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".
<code>line_name_pos</code>	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".
<code>par_</code>	graphical parameters that can be set, which is in the form of <code>par(...)</code> . The default is <code>par(no.readonly = TRUE)</code> .
<code>pctReturn_</code>	a logical argument. IF TRUE, the plot function will plot the returns in percentage instead of original. Default is TRUE.
<code>abs_</code>	a logical argument, when TRUE, the plot function will plot <code>abs(returns)</code> with conditional standard deviation instead of returns, default to TRUE.
<code>original_</code>	a logical argument. If TRUE, the original return will be plotted. Default is FALSE
<code>main_name</code>	the title of the plot, default is "Conditional SD (vs returns)"
<code>fit</code>	A robustGARCH fit object of class <code>robGarch</code>
<code>nu</code>	degrees of freedom in a Student's t-distribution.

Value

A list of class "summary.robustGARCH" containing:

<code>method</code>	The fitting method used (e.g., "BM", "M", "QML", or "MLE").
<code>coefficients</code>	Named vector of parameter estimates.
<code>loglikelihood</code>	The value of the objective function at convergence.
<code>converged</code>	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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