Package ‘riskSimul’

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Title Risk Quantification for Stock Portfolios under the T-Copula Model
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Author Wolfgang Hormann, Ismail Basoglu
Maintainer Wolfgang Hormann <hormannw@boun.edu.tr>
Description Implements efficient simulation procedures to estimate tail loss probabilities and conditional excess for a stock portfolio. The log-returns are assumed to follow a t-copula model with generalized hyperbolic or t marginals.
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   riskSimul Risk Quantification for Stock Portfolios under the T-Copula Model
Description

This package can estimate the tail loss probabilities and conditional excess for a stock portfolio. The log-returns are assumed to follow a t-copula model with generalized hyperbolic or t marginals. 

\textbf{SISTCopula()} is the name of the function that uses stratified importance sampling (SIS) to estimate a single or several tailloss probabilities and the corresponding conditional excess in a very efficient way.

\textbf{NVTCopula()} estimates the same quantities using naive simulation (without variance reduction).

Details

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Author(s)

Wolfgang Hormann, Ismail Basoglu

References


Examples

R <- matrix(
  c(1, 0.554, 0.632, 0.419, 0.400,  
    0.554, 1, 0.495, 0.540, 0.479,  
    0.632, 0.495, 1, 0.426, 0.445,  
    0.419, 0.540, 0.426, 1, 0.443,  
    0.400, 0.479, 0.445, 0.443, 1), ncol=5)

pmg <- matrix(NA, ncol=5, nrow=5)
colnames(pmg) <- c("lambda", "alpha", "beta", "delta", "mu")

pmg[1,] <- c(-0.602828, 8.52771, -0.533197, 0.014492, -0.000091)

pmg[2,] <- c(-1.331923, 2.72759, -2.573416, 0.019891, 0.001388)

pmg[3,] <- c(-1.602705, 3.26482, 1.456542, 0.035139, -0.001662)

pmg[4,] <- c(-1.131092, 15.13351, -1.722396, 0.014771, 0.001304)

pmg[5,] <- c(-0.955118, 31.14005, 0.896576, 0.015362, -0.000238)
SISTCopula

portfo <- new.portfobj(nu=8.195,R=R,typemg="GH",parmg=pmg,c=rep(1,5),w=rep(0.2,5))

res1<- SISTCopula(n=10^4,npilot=c(10^3,3*10^3),portfobj=portfo,threshold=c(0.97,0.96,0.95,0.94),
stratasize=c(22,22),CEopt=FALSE,beta=0.75,mintype=0)

Description

Using stratified importance sampling (SIS) or naive simulation (NV) the tail-loss probabilities and conditional excess values for several threshold values are estimated for a stock portfolio. The log-returns of the stocks are assumed to follow a t-copula model with generalized hyperbolic or t marginals.

Usage

SISTCopula(n=10^5,npilot=c(10^4,2*10^4),portfobj,threshold=c(0.95,0.9),
stratasize=c(22,22),CEopt=FALSE,beta=0.75,mintype=-1)

NVTCopula(n=10^5, portfobj, threshold=c(0.95,0.9))

new.portfobj(nu,R,typemg="GH",parmg,c=rep(1,dim(R)[1]),w=c/sum(c))

Arguments

n total sample size
npilot size of one or several pilot runs, the sum of them should be smaller than n/2
portfobj object of portfolio parameters
threshold one or several threshold values (they should be ordered)
stratasize a vector of length two holding the number of strata
CEopt TRUE ... minimize the overall error of Conditional Excess estimates, otherwise of tail-loss estimates
beta weight of maximal threshold value used for calculating the intermediate threshold used for selecting the IS density, only used when length(threshold)>1
mintype only used when length(threshold)>1; 0 ... minimize mean square errors, -1 ... minimize relative MSE, -2 ... minimize the maximal error, -3 minimize the maximal relative error; a positive integer j indicates that the variance of the estimate for the j-th threshold is minimized.
nu degrees of freedom of the t-copula
R correlation matrix of the t-copula
typemg type of the marginal distribution, "GH" generalized hyperbolic distribution, "t" t-distribution
**Value**

For the case that the variable `threshold` contains only one value a matrix containing the results for the tail-loss probability in the first row and that of the conditional excess in the second row is returned.

In the case that several threshold values are considered, a list consisting of the result matrices for tail-loss probabilities and for conditional excess and the vector of the threshold values is returned.

**Author(s)**

Ismail Basoglu, Wolfgang Hormann

**Examples**

```r
R <- matrix(
c(1, 0.554, 0.632, 0.419, 0.400,
  0.554, 1, 0.495, 0.540, 0.479,
  0.632, 0.495, 1, 0.426, 0.445,
  0.419, 0.540, 0.426, 1, 0.443,
  0.400, 0.479, 0.445, 0.443, 1),
  ncol=5)

pmg <- matrix(NA, ncol=5, nrow=5)
colnames(pmg) <- c("lambda", "alpha", "beta", "delta", "mu")

pmg[1,] <- c(-0.602828, 8.52771, -0.533197, 0.014492, -0.000091)
pmg[2,] <- c(-1.331923, 2.72759, -2.573416, 0.019891, 0.001388)
pmg[3,] <- c(-1.602705, 3.26482, 1.456542, 0.035139, -0.001662)
pmg[4,] <- c(-1.131092, 15.13351, -1.722396, 0.014771, 0.001304)
pmg[5,] <- c(-0.955118, 31.14005, 0.896576, 0.015362, -0.000238)

portfo <- new.portfobj(nu=8.195, R=R, typemg="GH", parmg=pmg, c=rep(1,5), w=rep(0.2,5))

res1 <- SISTCopula(n=10^4, npilot=c(10^4, 3*10^3), portfobj=portfo, threshold=c(0.97, 0.96, 0.95, 0.94),
  stratasize=c(22, 22), CEopt=FALSE, beta=0.75, mintype=0)

res1

SISTCopula(n=10^4, npilot=c(10^4, 3*10^3), portfobj=portfo, threshold=0.94,
  stratasize=c(22, 22), CEopt=FALSE)

NVTCopula(n=10^4, portfobj=portfo, threshold=c(0.97, 0.96, 0.95, 0.94))

NVTCopula(n=10^4, portfobj=portfo, threshold=0.94)
```

# example with t-marginals

```r
R <- matrix(
  c(1, 0.554, 0.632, 0.419, 0.400,
    0.554, 1, 0.495, 0.540, 0.479,
    0.632, 0.495, 1, 0.426, 0.445,
    0.419, 0.540, 0.426, 1, 0.443,
    0.400, 0.479, 0.445, 0.443, 1),
  ncol=5)
```
SISTCopula

```r
c(1, 0.551, 0.636, 0.421, 0.398,
0.551, 1, 0.496, 0.540, 0.477,
0.636, 0.496, 1, 0.428, 0.447,
0.421, 0.540, 0.428, 1, 0.444,
0.398, 0.477, 0.447, 0.444, 1), ncol=5)

pmg <- matrix(NA, ncol=3, nrow=5)
colnames(pmg) <- c("mu", "sigma", "nu")
pmg[1,] <- c(-0.000258, 0.013769, 1.78)
pmg[2,] <- c(0.000794, 0.012166, 2.64)
pmg[3,] <- c(-0.000837, 0.019616, 3.25)
pmg[4,] <- c(0.001041, 0.009882, 2.67)
pmg[5,] <- c(-0.000104, 0.010812, 3.10)

portfo <- new.portfobj(nu=7.525, R=R, typemg="t", parg=pmg, c=rep(1, 5), w=rep(0.2, 5))

res1 <- SISTCopula(n=10^4, npilot=c(10^3, 3*10^3), portfobj=portfo, threshold=c(0.97, 0.96, 0.95, 0.94),
stratasize=c(22, 22), CEopt=FALSE, beta=0.75, mintype=0)

NVTCopula(n=10^4, portfobj=portfo, threshold=c(0.97, 0.96, 0.95, 0.94))
NVTCopula(n=10^4, portfobj=portfo, threshold=0.94)
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