PP plot against Generalized Extreme Value Distribution

July 18th, 2016

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1 Introduction

PP plot of tail values of daily log-returns of portfolio against Generalized Extreme Value Distribution with a global parameter γ estimated with the block maxima method.

2 Data source

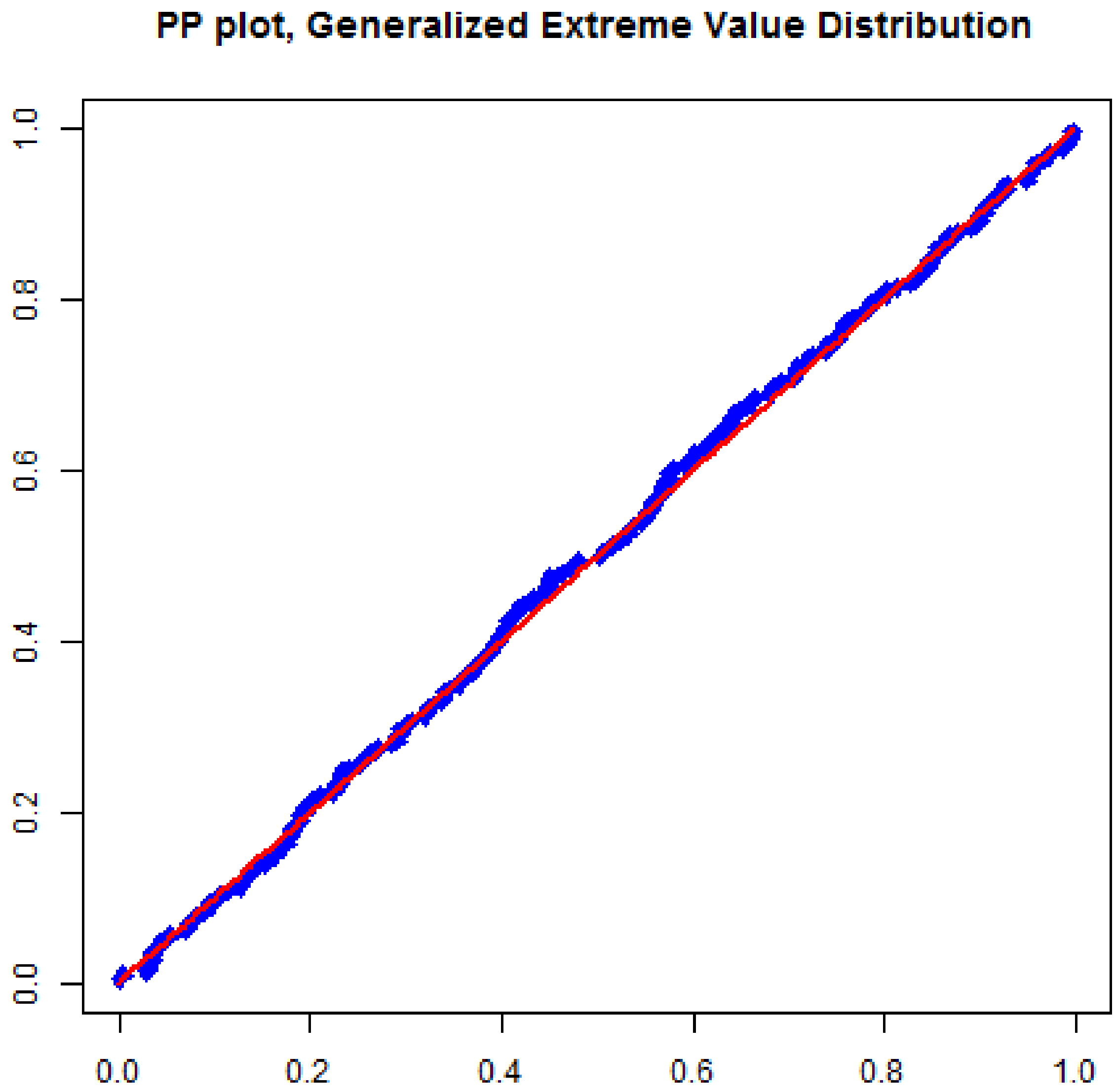
1. Data websites:
   - http://finance.yahoo.com/quote/BAYN.DE/history
   - http://finance.yahoo.com/quote/BMW.DE/history
   - http://finance.yahoo.com/quote/SIE.DE/history
2. Data range: all the trading days from $2000-01-01$ to $2016-07-11$, daily data.
3. Data files: *close.csv*

3 Procedure

1. Construct a portfolio: $p = Bayer + Bmw + Siemens$.
2. Calculate the parameters of the portfolio by using Block Maxima Model.
   (a) Decompose negative returns $\{X_t\}_{t=1}^{T}$ into k non-overlapping sets.
   (b) Define $\{Z_j\}_{j=1}^{k}$ where $Z_j = max\{X_{(j-1)n+1}, ..., X_{jn}\}$.
   (c) For $\{Z_j\}_{j=1}^{k}$, fit generalized extreme value distribution $G_\gamma(\frac{x-\mu}{\sigma})$.
   (d) Get the shape parameter γ, the location parameter μ and the scale parameter σ. T denotes the number of observations.
3. Plot the PP plot.
   (a) Use static windows of size w = 214 scrolling in time t for VaR estimation $\{X_t\}_{t=s-w+1}^{s}$ for $s = w, \cdots, T$.
   (b) Plot the PP plot for static windows of size w.

4 Plots

The PP plot against the Generalized Extreme Value Distribution is shown in the following figure



5 R Code

```
# clear variables and close windows
rm(list = ls(all = TRUE))
graphics.off()
# install and load packages
libraries = c("fExtremes")
lapply(libraries, function(x) if (!(x %in% installed.packages())) {install.
    packages(x)})
```

```
lapply(libraries, library, quietly = TRUE, character.only = TRUE)
# load data
dat <- read.table(file="close.csv",header = TRUE,stringsAsFactors = FALSE,sep= ",")
# Portfolio
p = dat$Bayer.Close.Price + dat$BMW.Close.Price + dat$Siemens.Close.Price
l = length(p)  # length of portfolio
loss  = log(p[1:(l - 1)]/p[2:l])  # negative log-returns
# Determine the Block Maxima data
T = length(loss)
n = 20
k = T/n
z = matrix(, , )
for (j in 1:k) {
        d = loss[((j - 1) * n + 1):(j * n)]
        z[j] = max(d)
}
w = sort(z)
# Fit the Generalized Extreme Value Distribution
GEV = gevFit(w, type = "mle")
# shape parameter
gama = attr(GEV, "fit")$par.ests[1]
gama
# location parameter
mu = attr(GEV, "fit")$par.ests[2]
# scale parameter
sigma = attr(GEV, "fit")$par.ests[3]
t = (1:k)/(k + 1)
y = pgev(w, xi = gama, mu = mu, beta = sigma)
# Plot the PP plot
dev.new()
png("SFMTailGEV.png")
plot(y, t, col = "blue", pch = 23, bg = "blue", xlab = c(""), ylab = c(""))
lines(y, y, type = "l", col = "red", lwd = 2)
title("PP plot, Generalized Extreme Value Distribution")
```