

# *SFM01 – VaR – blockmaxima – backtesting*

July 13th, 2016

Project members:

Liang chen 15620151152901

Du yao 15620151152897

Feng xiaowei 15520151152644

Zi xuefei 15620151152919

Data source: *http : //en.boerse – frankfurt.de*

Data range: all the trading days from 2002 – 01 – 01 to 2016 – 06 – 30, daily data.

Data files: *Bayer – close – 0216.txt, Bmw – close – 0216.txt, Siemens – close – 0216.txt.*

Steps of procedure:

1.construct a portfolio:  $V = Bayer + Bmw + Siemens$ .

2.Calculate the  $VaR$  of the portfolio by using Block Maxima Model.

(1)Decompose negative returns  $\{X_t\}_{t=1}^T$  into  $k$  non-overlapping sets.

(2)Define  $\{Z_j\}_{j=1}^k$  where  $Z_j = \max\{X_{(j-1)n+1}, \dots, X_{jn}\}$ .

(3)For  $\{Z_j\}_{j=1}^k$ , fit generalized extreme value distribution  $G_\gamma(\frac{x-\mu}{\sigma})$ .

(4) $VaR$  at  $\alpha$ :  $VaR(\alpha) = \mu + \frac{\sigma}{\gamma}[(-\log(1 - \alpha^n))^{-\gamma} - 1]$ .

T denotes the number of observations.

3.Backtesting with Moving Window Method.

(1)Daily P&L of the portfolio from 2002 – 01 – 01 to 2016 – 06 – 30.

(2)Static windows of size  $h = 250$  scrolling in time  $t$  for  $VaR$  estimation  $\{X_t\}_{t=s-h+1}^s$  for  $s = h, \dots, T$ .

(3)Moving window results: Estimates of the parameters of  $G_\gamma(\frac{x-\mu}{\sigma})$  by MLE, that is,  $\{\hat{\mu}_t\}_{t=h}^T$ ,  $\{\hat{\sigma}_t\}_{t=h}^T$ ,  $\{\hat{\gamma}_t\}_{t=h}^T$ , and  $\{\widehat{VaR}_{1-\alpha}^t\}_{t=h}^T$ .

(4)Take the opposites of  $\{\widehat{VaR}_{1-\alpha}^t\}_{t=h}^T$  and find the outliers.

4.Calculate exceedances ratio

$$\hat{\alpha} = \frac{1}{T-h} \sum_{t=h+1}^T I\{X_t < -\widehat{VaR}_{1-\alpha}^t\}$$

5.Realizations by R and Matlab.

(1)Value-at-Risk estimation at  $\alpha = 0.05$  level for portfolio, with size of moving window  $h = 250$  and size of block  $n = 16$ .

(2)Backtesting result with R:  $\hat{\alpha} = 0.0495$ .

(3)Backtesting result with Matlab:  $\hat{\alpha} = 0.0501$ .

(4)The difference is caused by the different estimation procedure of GEV in the two softwares.

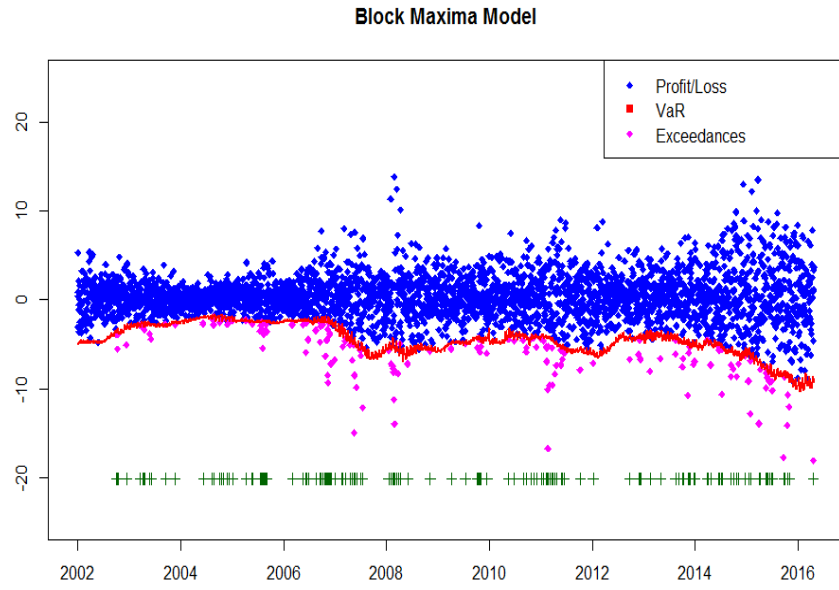


Figure 1:  $VaR - BBM - backtesting - R$

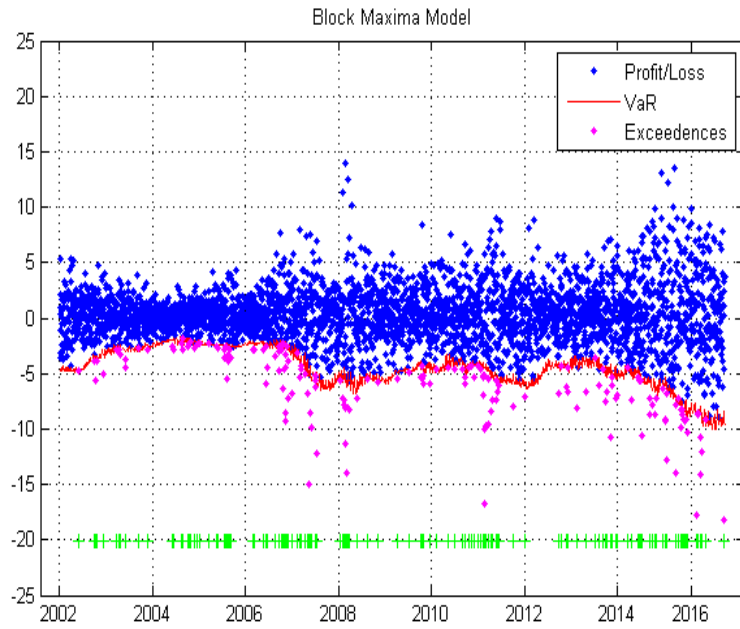


Figure 2:  $VaR - BBM - backtesting - Matlab$