SFM01-VaR-blockmaxima-backtesting

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Data

- 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: $V = Bayer + Bmw + Siemens$

Steps of procedure

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

- Decompose negative returns $\{X_t\}_{t=1}^{T}$ into k non-overlapping sets.
- Define $\{Z_j\}_{j=1}^{k}$ where $Z_j = max\{X_{(j-1)n+1}, ..., X_{jn}\}$.
- For $\{Z_j\}_{j=1}^{k}$, fit generalized extreme value distribution $G_\gamma(\frac{x-\mu}{\sigma})$.
- VaR at α: $VaR(\alpha) = \mu + \frac{\sigma}{\gamma}[(-log(1-\alpha^n))^{-\gamma} - 1]$.
- T denotes the number of observations.

Steps of procedure

3.Backtesting with Moving Window Method.

- Daily P&L of the portfolio from $2002-01-01$ to $2016-06-30$.
- Static windows of size $h = 250$ scrolling in time t for VaR estimation $\{X_t\}_{t=s-h+1}^{s}$ for $s = h, ..., T$.
- 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 $\{\widehat{VaR}_{1-\alpha}^{t}\}_{t=h}^{T}$.
- Take the opposites of $\{\widehat{VaR}_{1-\alpha}^{t}\}_{t=h}^{T}$ and find the outliers.

Steps of procedure

4.Calculate exceedances ratio

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

Steps of procedure

5.Realizations by R and Matlab.

- Value-at-Risk estimation at $\alpha = 0.05$ level for portfolio, with size of moving window $h = 250$ and size of block $n = 16$.
- Backtesting result with R: $\hat{\alpha} = 0.0495$.
- Backtesting result with Matlab: $\hat{\alpha} = 0.0501$.
- The difference is caused by the different estimation procedure of GEV in the two softwares.

Steps of procedure

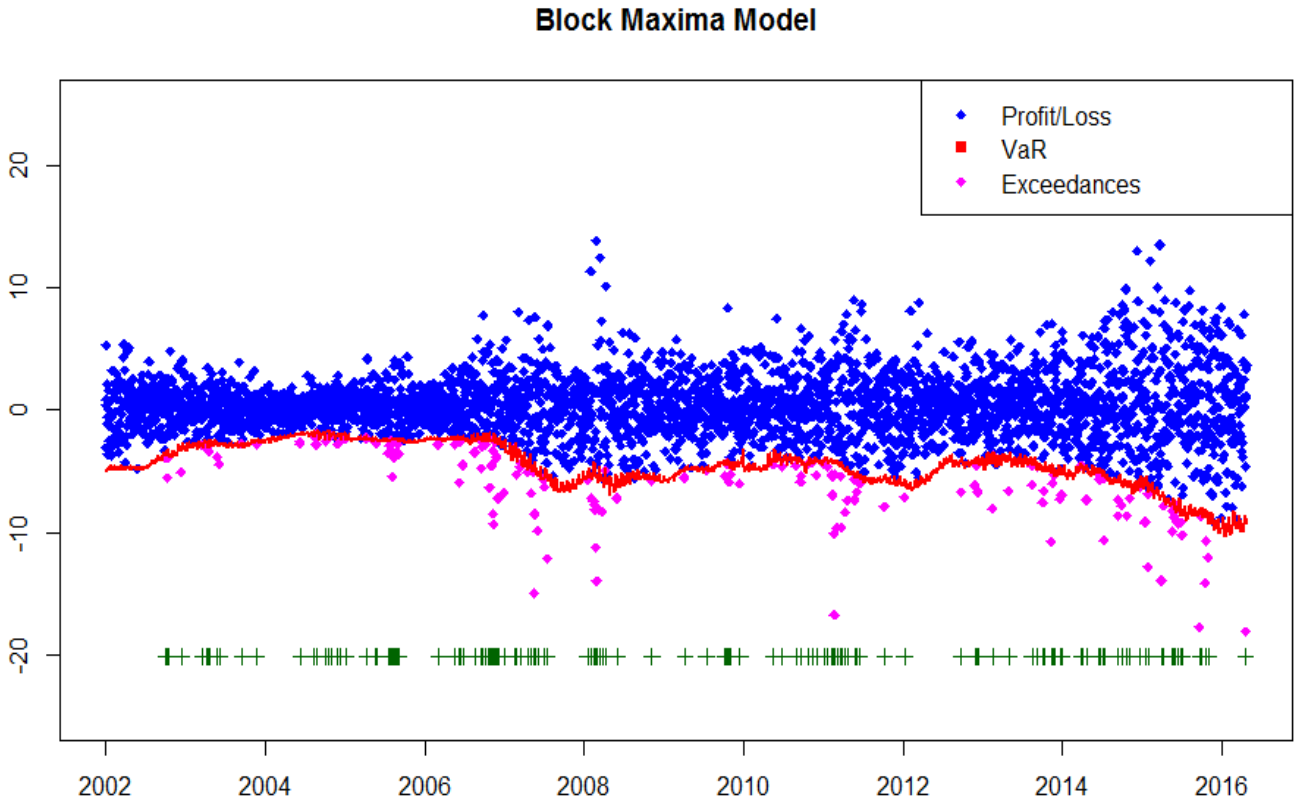

Figure: $VaR - BBM - backtesting - R$

Steps of procedure

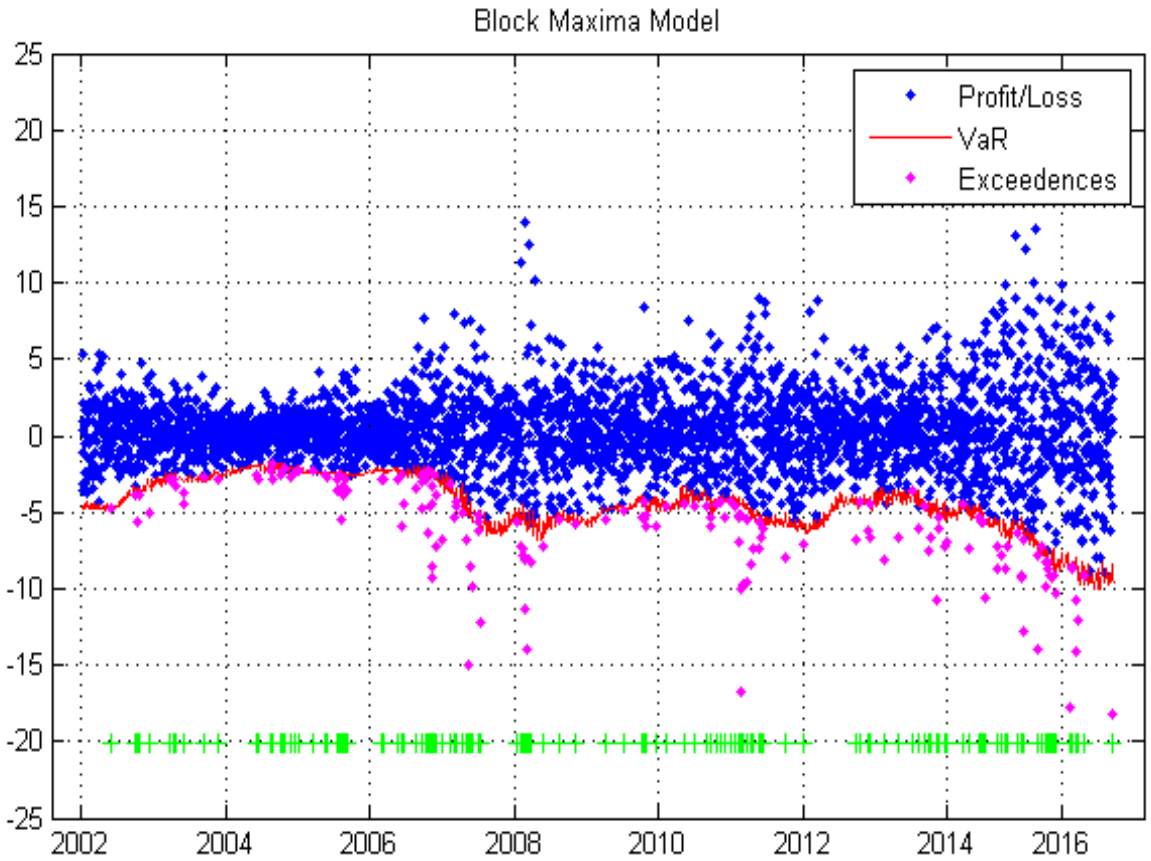

Figure: $VaR - BBM - backtesting - Matlab$