Christian-Albrechts-Universität zu Kiel **WS 2017/18**
Mathematisches Seminar
Prof. Dr. Jan Kallsen
Dr. Giso Jahncke Sheet 10

Risk Management

Exercises for participants of the programme **Quantitative Finance**

C-Exercise 17

(a) Write a *scilab*-function

```
[VaR, ES] = VaR_ES_var_covar_biv (x_data, c, w, alpha),
```

which computes the estimates $\widehat{VaR}_\alpha$ and $\widehat{ES}_\alpha$ of the variance covariance method for the two-dimensional linearized loss operator

$$l^\Delta(x) = -(c + w^T \cdot x),$$

$c \in \mathbb{R}, w \in \mathbb{R}^2$ and given historical risk factor changes $x\_data = (x_1, \ldots, x_n) \in \mathbb{R}^{n\times 2}$ at level $\alpha \in (0,1)$.

(b) On the page of this course you will find a time series containing daily DAX and S&P 500 data. Consider a portfolio with initial value of 1000 €, that always invests 50% of the current portfolio value in the DAX and 50% in the S&P 500. (We interprete the current index levels as stock prices in €.) Compute for each trading day $m = 254, \ldots, 6279$ the estimates for *value at risk* and *expected shortfall* at level $\alpha = 0.99$. Apply the function from (a) on the last $n = 252$ risk factor changes $(x_m, x_{m-1}, \ldots, x_{m-n+1})$. Plot the estimates. Compute the number of violations, i.e. the days when the actual loss lies above the estimated VaR, and compare it with the theoretical number of violations.

C-Exercise 18

(a) Write a *scilab*-function

```
[VaR, ES] = VaR_ES_historic_biv (x_data, l, alpha),
```

which computes the estimates $\widehat{VaR}_\alpha$ and $\widehat{ES}_\alpha$ of the historical simulation method for given historical risk factor changes $x\_data = (x_1, \ldots, x_n) \in \mathbb{R}^{n\times 2}$, a two-dimensional loss operator $l : \mathbb{R}^2 \to \mathbb{R}$ and level $\alpha \in (0,1)$.

(b) Apply the same steps as in C-Exercise 17 (b) for the bivariate historical simulation and compare the results.

Submit until: Thursday, 25.01.2018, 08:30 (before the lecture)