Risk Management in Financial Institutions

Instructions

This is a group assignment of groups of 2-4 students as formed on beforehand (self-chosen or random). The random groups will be announced at latest in the first days of April on Toledo.

- The assignment consists of 2 questions for which data is provided in the Excel file that can be downloaded via Toledo – Assignments (Data 2023). This Excel file contains 2 sheets: DATA Q1 to solve Question 1, and DATA Q2 to solve Question 2.
- Note that the data are uncleaned and contain data from non-trading days. Look up the non-trading days for the Swiss Stock Exchange / Euronext Brussels on the internet to **remove the non-trading days** as these will distort the analysis (as they will give by definition a zero return). Other zero returns that appear, can be kept.
- Write a report to explain the solutions you obtain: clearly present and interprete the results. This also has to include explanatory notes on the steps that you have executed (e.g. showing intermediate results or snapshots) and on the underlying assumptions that are made. **Ensure to answer all questions.** Use Excel to solve both questions (but do not use the percentile functions). Assume that a trading year has 250 trading days and for interest allocation assume 360 days a year. Do not round any intermediate steps; only round the solution at 4 decimal places. Follow all instructions carefully!
- This assignment counts for 20% of the total examination score. It has to be handed in by 28 May 2023 (before midnight), by submitting the **explanatory report** in **pdf format** via the Toledo assignment page. The Excel calculations themselves are not to be provided along. (Excel files that are provided nonetheless, will not be looked at).
- In case of inclarities or questions, these can be posed on the discussion forum, where they will be answered. Content-wise questions related to the assignment will not be answered via e-mail to ensure that all groups dispose of the same information.

Good luck!
Tim Wouters

Question 1

As a fund manager you are invested in stocks of Credit Swiss (Swiss Stock Exchange). See sheet DATA Q1 for its historical total index values (in CHF). Clean the data for the non-trading days at the Swiss Stock Exchange.

1. First assume, that you look the data of 2022 only. At the end of the year 2022, you want to calculate a 1-day absolute 95% VaR (in return terms) for your portfolio of the Credit Suisse stock under different sets of assumptions for returns:

   (i) Assume the Credit Suisse returns are normally distributed, with a mean and variance as derived from the historical sample.

   (ii) Use the basic historical simulation approach for returns.

   (iii) Improve upon the basic historical simulation approach by assuming an exponential weighting scheme to weigh returns with $\lambda = 0.95$, where more recent observations receive a higher weight.

   (iv) Improve upon the basic historical simulation approach by accounting for the time-variation in the volatility of returns (start from an initial volatility of 40% p.a with a decay parameter $\lambda = 0.95$ in an EWMA context).

   In the analysis:

   - discuss the different solutions you obtain;
   - elaborate on the reasons for the different results that you find under the alternative sets of assumptions;

2. Assume that on the end of the last day of which you have data (21 March 2023), you want to repeat the analysis using (at that moment) data of the last year, i.e. from 22 March 2022 until 21 March 2023.

   - Calculate the VaR results again with the 4 different methods.
   - Compare these VaR results with the results from the 2022 data series and explain the differences.
   - For the four different methods, would you believe more the result based on the 2022 data series or the one based on the 22 March 2022 - 21 March 2023 data series? Substantiate your choice.

3. For the results obtained with the normal distribution assumption on both data series, calculate the number of VaR breaches in the corresponding dataset and assess whether this is acceptable. Compare the results between both data series and explain the difference.

Question 2

As a fund manager you invest €10,000,000 spread over 10 different Euronext Brussels stocks on 21 March 2023, with following (euro-based) weights:

Company	Weight
AB Inbev (ABI)	17%
Ageas (AGS)	8%
AHold Delhaize (AD)	20%
D'ieteren (DIE)	8%
KBC Group (KBC)	10%
Proximus (PROX)	9%
Sofina (SOF)	4%
Solvay (SOLB)	7%
UCB (UCB)	5%
Umicore (UMI)	12%

See sheet DATA Q2 for a history of total return indices of these 10 stocks, the risk-free rate p.a. (for each day), and the total return index of their primary risk factor the MSCI Belgium index. Do not forget to clean the data for the non-trading days at Euronext Brussels.

(i) Use the delta-normal approach to calculate a 95% 10-day relative VaR (in value terms) using the market model. Ignore idiosyncratic risk. Interpret your results. Explain why mapping is used and what its advantages/disadvantages are. *(To estimate the 'delta' of the stocks one can use the* `SLOPE` *function or regression analysis.)*

(ii) In addition to the above portfolio VaR, also compute the individual delta-normal VaRs, i.e. when investing the €10,000,000 in a single stock. Also calculate the normal VaRs for these cases. Which of these stock investments yields the highest/lowest delta normal VaR and why is this the case? For these latter two stocks with the highest/lowest delta normal VaR, compare their delta normal VaR with their normal VaRs. Can you see also reasons for the behaviour in the time period observed?

(iii) Suppose that your company has a risk appetite that allows for a VaR of €1,000,000. Provide comments to your management committee (starting from the delta normal VaR) on the riskiness of the diversified portfolio and whether you can (qualitatively) propose actions in line with the risk appetite.

(iv) Suppose that the weights of the investments are changing to the weights below (with same total investment amount of €10,000,000). How does the delta normal VaR change and would you prefer – taking into account all relevant factors – this changed portfolio over the initial one or not, again assuming the same risk appetite? Comment on your reasoning.

Company	Weight
AB Inbev (ABI)	20%
Ageas (AGS)	0%
AHold Delhaize (AD)	0%
D'ieteren (DIE)	0%
KBC Group (KBC)	20%
Proximus (PROX)	20%
Sofina (SOF)	0%
Solvay (SOLB)	20%
UCB (UCB)	0%
Umicore (UMI)	20%