Deadline for delivery: 23rd November, end of day

Provide a report containing the answer to the following questions (with the graphs and tables you think are relevant), accompanied by the data you downloaded and the Python code that generates the data included in the tables and the plots of the report. In the code, please mark where you are computing/estimating/collecting the data for a specific table or which graph you are generating.

The evaluation will consider completeness, correctness, and clarity of report AND code.

1. Download using LSEG Data & Analytics the price/level time series for a set of a minimum of 10 and a maximum of 20 assets following the information reported in the table at the end of this document; data must be daily and must cover at least 10 years (end date must be the 31st of October 2025). Explain the criteria you used in choosing the assets (if any – do not use sample size as a criteria).
2. On the assets you chose, compute the logarithmic returns and perform a descriptive analysis on the full sample, highlighting if you do have evidence of serial dependence, asymmetry in distribution, and deviations from normality, volatility clustering, and occurrence of extreme events. Comment also on the correlation across your asset returns. Determine if the mean, variance, correlation, kurtosis and skewness are constant over time, ideally using graphical tools.
3. Excluding the last year of data (1/11/2024-31/10/2025), fit a univariate GARCH model of your choice using a Normal density on each series and comment on the statistical significance of the estimated parameters. Then, in each day, compute the average of the returns of the assets (you are computing the daily returns of an equally weighted portfolio – call il EWP), and re-estimate a univariate GARCH, still with Normal density. Plot the conditional variance for at least one asset and of the portfolio. Comment on the plots.
4. Recover the one-step-ahead (static) forecasts for the last year of the sample for each of the assets and for the EWP. Using the variance predictions, compute the Value-at-Risk under Normality (VaR Case 1) for the last year. Then, using the in-sample standardized residuals (call them Z), determine if they are distributed as a Normal or if they distributed more closely to a different density of your choice. What happens to the Value-at-Risk when you replace the Normality assumption with that different distribution in the GARCH model? (call the new Value-at-Risk as VaR Case 2)
5. Focus now on the standardized residuals Z for the in-sample period. Fit a GEV assuming independence (no extremal index) and determine the quality of the fit to your data (again for the assets and the EWP). Compute then the Value-at-Risk of Z, with and without the introduction of the extremal index.
6. Replicate the Value-at-Risk evaluation on the standardized residuals using the GPD.
7. Recover the Value-at-Risk for the asset returns combining the EVT-based quantiles (estimated in-sample – no need to re-estimate GEV and GPD when new information arrives) with GARCH forecasts in the various cases (GEV under independence – VaR Case 3 --- GEV with extremal index – VaR Case 4 --- GPD under independence – VaR Case 5).

8. Using graphical tools and descriptive statistics of your choice, contrast the various VaR sequences you have obtained for at least one asset and for EWP, focusing on the number of cases in which the asset returns are below the predicted VaR.
9. BONUS QUESTION: in at least one of the VaR 5 cases considered and for at least one asset, compute the Expected Shortfall and plot it together with the returns and the Value-at-Risk.

Table 1: groups and markets – download only equities belonging to the large cap segment of the market and representing primary quotes (you have a selection tool to restrict search to primary quotes within LSEG D&A)

Group ID	Members	Markets
1	ANDRETTO CORTESE PERARO SILVEGNI	South Korea
2	AGUILERA AQUINO CAPONE DAL POZZOLO MEINARDO	UK
3	CASASANTA DANESE CILIBIU CASOTTO	South Africa
4	BALI BUZOI FRACCA LAI	Germany
5	COTTINI PICCOLO BABISKI ARRUDA PACIARONI	Australia
6	GHIOTTI OMAN MAJI MONTINA	Brazil
7	GRAVILI ROVERSI MASIERO	France
8	TARENGHI DYUSSENBAYEVA ATMADJA	Hong Kong