

Python for finance and optimization

Homework I: Portfolio strategies

This first homework is based on the Excel file https://www.oliviergueant.com/uploads/4/3/0/9/4309511/sbf120_as_of_end_2018.xlsx that contains prices and market capitalizations of SBF 120 components (as of end 2018) over the period 2011-Sept 2021 (used in lectures 1 and 2).

We consider a investment universe of 10 stocks corresponding to those having the highest market capitalization as of end 2018.

Propose a notebook that compares, in terms of Sharpe ratio and maximum drawdown, the respective performance of the three following portfolios over the year 2019:

- an equally-weighted portfolio with the above 10 stocks (weights are considered on a daily basis).
- a Markowitz minimum-variance portfolio (with the above 10 stocks), the covariance matrix being computed over 2017-2018 and not updated.
- an ERC portfolio (with the above 10 stocks), the covariance matrix being computed over 2017-2018 and not updated.¹

The last cell of the notebook should plot a graph with the three PnL trajectories (with an initial wealth of 1 million euros). The legend of the plot must contain the name of the strategies and the two above performance metrics for each strategy.

¹If Σ is the covariance matrix of returns and $\sigma : w \mapsto \sqrt{w' \Sigma w}$, ERC weights verify

$$\sum_i w_i = 1 \quad \text{and} \quad \forall i, j, w_i \frac{\partial \sigma}{\partial w_i}(w) = w_i \frac{\partial \sigma}{\partial w_i}(w).$$

You can find a method to build ERC portfolios in the book “Introduction to risk parity and budgeting” by T. Roncalli.