Portfolio Optimization with Python3

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1 Important Concepts

1.1 Return, Expected Return, and Excess return

Return refers to the money made or lost on an investment over a period of time. It can be expressed in terms of percentage change or money profit/loss. A positive return represents a profit whereas a negative one represents a loss. This code optimizes the portfolio with regards to the *nominal return*, which is the net profit or loss before any adjustments for taxes, fees, dividends, inflation, or any other influence on the amount [**?**].

A *holding period return* is an investment's return over the time it is owned by a particular investor. Holding period return may be expressed nominally or as a percentage. When expressed as a percentage, the term often used is *rate of return (RoR)* [**?**].

The *expected return* is the anticipated profit or loss based on known historical rates of return [**?**]

$$\langle R \rangle = \sum_i R_i P_i \tag{1}$$

Where R_i is the return of the i-th component of the series and P_i its corresponding probability. Equation 1 is not used in the code because we don't know the probabilities. Instead, we approximate the expected return with the mean value of the probabilities look into the notes of prof. Nobach regarding the approximation of the mean value.

The expected return is usually based on historical data and is therefore not guaranteed into the future; however, it does often set reasonable expectations. Therefore, the expected return figure can be thought of as a long-term weighted average of historical returns.

An *annualized total return* is the geometric average amount of money earned by an investment each year over a given time period. The annualized return formula is calculated as a geometric average to show what an investor would earn over a period of time if the annual return was compounded [**?**].

The *excess return* is

https://pythonforfinance.net/2017/01/21/investment-portfolio-optimisation-with-python
http://www.stat.ucla.edu/~nchristo/statistics_c183_c283/sharpe__mutual_fund_performance.pdf