Quantitative Portfolio Management

Assignment #3
(based on Lecture 5)

Raman Uppal
EDHEC Business School

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Instructions for each assignment

- Assignments are to be done in groups of 4 or 5 students.
  - This means that groups of 1, 2, 3, 6, etc. are not allowed and will be assigned a grade of 0.
  - Diversity in groups is strongly encouraged
    (people from different countries, different genders, different finance knowledge, and different coding abilities, etc.)
- Each assignment should be emailed as a Jupyter file
  - To Raman.Uppal@edhec.edu
  - The subject line of the email should be: "QPM-2025-2026: Assignment n," where $n = \{1, 2, 3, 4\}$.

Instructions for each assignment

- The Jupyter file should include the following (use Markdown):
  - Section "0" with information about your submission:
    - Line 1: Submission date
    - Line 2: QPM-2025-2026: Assignment *n*
    - Line 3: Group members: listed alphabetically by last name, where the last name is written in CAPITAL letters
    - Line 4: Explain along which dimensions your group is diverse
    - Line 5: Any other comments about the assignment (e.g., if you think your Python code is particularly beautiful, you can mention this)
    - The same instructions apply to each assignment, so you can re-use the same Section 0 for all four assignments.
  - Section "*k*" where $k = \{1, 2, \ldots\}$.
    - First type Question *k* of Assignment *n*.
    - Then, below the question, provide your answer.
    - Your code should include any packages that need to be imported.

Questions for Assignment 3

Note that this assignment has only one question. To make it easy to get to the final answer, the question has been divided into seven small parts. The first two parts ask you to compute the Markowitz and capitalization-weighted portfolios. The next four parts ask you to compute, in small steps, the Black-Litterman portfolio weights. The seventh part asks you to compare the weights from these three portfolios.

- In this question, we determine the optimal portfolio weights for an investor who is considering investing in an asset universe that consists of only six stocks: AAPL, MSFT, AMZN, NVDA, TESLA, and META.
- Please download prices for these six stocks and compute their monthly excess returns starting January 2015 and ending December 2022, assuming that the risk-free rate is 0.
- Use the "Index Weighting" reported in this article from Investopedia to determine the market weights for these assets (you may also be able to get the market capitalizations from Yahoo Finance).

Questions for Assignment 3

Q1.1 Based on the sample data on returns, first compute the Markowitz mean-variance portfolio weights. Are these weights reasonable? Explain why.

Q1.2 Based on the data on index weighting (or market capitalization) you have downloaded, write down the "market" weights of a portfolio that invests in only AAPL, MSFT, AMZN, NVDA, TESLA, and META.

Finally, we will compute the Black-Litterman portfolio weights. We will do this in several small steps.

Q1.3 Step 1: Using the market-capitalization weights you have downloaded, calculate the CAPM-implied expected returns.

Questions for Assignment 3

Q1.4 Step 2: Specify the pick matrix P and the view vector q that captures the following views for each of the assets:

- AAPL: its absolute excess return is expected to be 10% per year.
- MSFT: its absolute excess return is expected to be 5% per year.
- AMZN: no views
- NVDA will outperform TSLA by 2% per year.
- TSLA will underperform META by 1% per year.

Finally, explain your choice for the matrix Ω, which captures the uncertainty about these views. (There are different ways to specify this matrix, so feel free to choose anything reasonable.)

Q1.5 Step 3: Use these views to compute the conditional expected excess returns (μ_{BL}) and covariance matrix of excess returns (Σ_{BL}).

Questions for Assignment 3

Q1.6 Step 4: Now, use μ_{BL} and Σ_{BL} to compute the Black-Litterman mean-variance weights.

Q1.7 Finally, compare the three sets of portfolio weights you have computed:

- Markowitz mean-variance portfolio weights;
- Capitalization-weighted (market) portfolio weights;
- Black-Litterman mean-variance portfolio weights.

Which weights seem the most reasonable? Why?

End of questions