

Quantitative Portfolio Management

Assignment #5

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Instructions for each assignment . . . I

- ▶ Assignment #1 should be done individually.
- ▶ The other 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.
 - ▶ **Diversity in groups is strongly encouraged**
(people from different countries, different genders, different finance knowledge, and different coding ability, etc.)

Instructions for each assignment . . . II

- ▶ Each assignment should be emailed as a **Jupyter file**
 - ▶ To Raman.Uppal@edhec.edu
 - ▶ The subject line of the email should be: "QPM: Assignment **n** ," where $n = \{1, 2, \dots, 8\}$.
 - ▶ Assignment **n** is due **before** Lecture **n** , where $n = \{1, 2, \dots, 8\}$.
 - ▶ Assignments submitted **late** will **not** be accepted (grade = 0), so please do not email me assignments after the deadline.

Instructions for each assignment . . . III

- ▶ The Jupyter file should include the following (use Markdown):
 - ▶ Section “0” with information about your submission:
 - ▶ Line 1: QPM: Assignment n
 - ▶ Line 2: Group members: listed alphabetically by last name, where the last name is written in CAPITAL letters
 - ▶ Line 3: Any comments/challenges about the assignment
 - ▶ Section “ k ” where $k = \{1, 2, \dots\}$.
 - ▶ 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.

Initial step to prepare the data for this assignment

- ▶ The data we will be using is the **same** that we used for the previous assignment. For convenience, I have typed again the instructions.
 - ▶ Make sure you have already imported “pandas” and “yfinance.”
 - ▶ Download from Wikipedia (or any other source) a table that lists the companies that comprise the S&P 500. (See “**Helpful links**” provided at the end of the assignment.)
 - ▶ From this table, extract the list of ticker symbols.
 - ▶ Set the start date and end date to be
 - ▶ `start_date = "2000-01-01"`
 - ▶ `end_date = "2022-12-31"`
 - ▶ Build a dataframe that contains the stock prices for the S&P 500 companies. (If there are errors for some company names, it is fine to ignore the company names with errors.)
 - ▶ Drop the columns that have only “NaN” entries.
 - ▶ Drop also the companies with more than 100 missing observations.

Questions for Assignment 5 ... I

- ▶ Select the following 10 companies (these are the first 10 companies with no missing data):
"MMM", "AOS", "ABT", "ADM", "ADBE", "ADP", "AES", "AFL", "A", "AKAM"
- ▶ So, just like for the last assignment, our dataset for this assignment will consist of **monthly returns for these 10 companies**.
- ▶ To reduce the work required for this assignment, please continue to assume that the **risk-free rate of return is zero**.

Questions for Assignment 5 ... II

- Q5.1** Choose the estimation window to be $T^{\text{est}} = 60$ months of monthly returns. Call this the estimation sample. Use the estimation sample to compute the following two portfolio strategies:
- a. mean-variance portfolio **with nonnegativity constraints** on the weights (when a risk-free rate is available, and set this rate to 0); we will refer to this portfolio as “MVP-C.”
 - b. global minimum variance (GMV) portfolio with **nonnegativity constraints**; we will refer to this portfolio as “GMV-C”.
- For each of the two portfolios, rescale the weights in the risky assets so that they sum to 1; that is, you are “fully invested” in just the risky assets.

Questions for Assignment 5 ... III

- ▶ So, compared to the previous assignment, the only change is that
 - ▶ we have replaced the unconstrained strategies
 - ▶ by strategies that have **nonnegativity constraints** on the weights, which rule out short selling.
- ▶ The remaining instructions are the same as for last week.

Q5.2 Now use a **rolling window** of $T^{\text{est}} = 60$ months to **estimate the portfolio weights** for the two strategies listed above for each of the $T - T^{\text{est}}$ months. That is, repeat the calculations of the previous question for all the dates *after* the first 60 months.

Q5.3 Use the time-series of portfolios weights for each of the two portfolio strategies, to **compute the out-of-sample portfolio returns**. That is, for each of the two portfolio strategies that you estimate at each date t , compute its out-of-sample return in month $t + 1$.

Q5.4 Now, **compute the Sharpe ratio** of the out-of-sample returns for the two portfolio strategies. Which strategy has the higher Sharpe ratio?

Helpful hints

- ▶ **Helpful links** for information on downloading S&P 500 ticker symbols.
 - ▶ from [Danny Groves](#)
 - ▶ from [GitHub](#)
- ▶ Finally, please save the data you have downloaded and created for these ten companies because we will be using it again.

End of questions