MScFE 652 PORTFOLIO MANAGEMENT

Group Work Project # 2

See grading rubric here.

Scenario

What does it mean to "know of" a technique versus "knowing" a technique? Suppose you take a class where the instructor covers the Kelly criterion. You may have attended the lecture, read the notes, and perhaps done a homework problem. Then, you put down on your resume that you "know" Kelly. But this knowledge is more about "knowing of" the technique. Knowing a technique requires an understanding of *when* and *how* to use it. In today's fast-paced, package-filled Python world, knowing how to use something may simply mean finding the right Python package to use. However, little thought may be required if you know that using the Kelly criterion improves investment decisions. Let us use this case study to ensure that we understand when applying a methodology like the Kelly criterion works better than not applying it.

In this case study, you will be members of a portfolio strategy team.

- **Student A** will be the Black-Litterman specialist. Instead of using Markowitz portfolio optimization, implement the Black-Litterman model.
- **Student B** will be the Kelly criterion specialist. Perform back-testing using the Kelly criterion for each security in the portfolio to size the allocation to that security.
- **Student C** will be the Leverage Constraint specialist. Apply different leverage constraints (fractions such as the half-Kelly; multiples of Kelly, etc.)

Each specialist is responsible for performing their own analysis and writing a 1-page description of the features and benefits of their method. Then, students will work together to see if combinations of the methods work even better.

Tasks

Scenario with a group of 3 students:

1. Complete the following:
    a. Select a portfolio with a minimum of 5 securities. (**Note that you should choose stocks for which you can find recent news, headlines, analyst reports, etc**.)
    b. Download daily or weekly returns for a period that allows you to have at least 100 data points (about 6 months daily returns, or 2 years of weekly returns). Assume you cannot short any securities.
    c. Compute the covariance matrix from the observations.
    d. Run a classical Markowitz portfolio optimization. Be sure to print / display / graph the weights of each security in the portfolio optimization results.
2. Specialist A addresses Black-Litterman.
    a. Find recent news, headlines, analyst reports, etc. that can be quantitatively translated into new values of returns and volatilities within the Black-Litterman framework.
    b. Apply the BL portfolio optimization. Compare the original portfolio allocation with the BL results. The comparison should include differences in weights and performance.
    c. Write 1-2 pages of background information. The background information provides equations, explains the terms in the equation, distinguishes inputs and outputs, explains how the parameters are estimated and calibrated, gives any interpretation to what the parameters mean, etc. The background is a technical summary of how the model works using equations, graphs, figures, tables, charts, and other illustrations, along with written explanations and interpretations.
3. Specialist B addresses Kelly criterion.
    a. Perform back-testing using the Kelly criterion for each security in the portfolio to size the allocation to that security.
    b. Perform a series of historical backtests to see how the combined portfolio performs.
    c. Write 1-2 pages of background information. The background information provides equations, explains the terms in the equation, distinguishes inputs and outputs, explains how the parameters are estimated and calibrated, gives any interpretation to what the parameters mean, etc. The

background is a technical summary of how the model works using equations, graphs, figures, tables, charts, and other illustrations, along with written explanations and interpretations.

4. Specialist C addresses leverage constraints applied to the previous portfolio.
    a. Apply a leverage constraint smaller than Kelly (such as half-Kelly).
    b. Apply a leverage constraint larger than Kelly (such as two to five times Kelly).
    c. Write 1-2 pages of background information. The background information provides equations, explains the terms in the equation, distinguishes inputs and outputs, explains how the parameters are estimated and calibrated, gives any interpretation to what the parameters mean, etc. The background is a technical summary of how the model works using equations, graphs, figures, tables, charts, and other illustrations, along with written explanations and interpretations.
5. ALL SPECIALISTS work together to combine methods:
    a. Compare the original portfolio allocation, BL allocation, Kelly allocation, and Leverage Constraint.
    b. Show how different combinations (all 3, BL & Kelly, BL & LC, Kelly & LC, etc.) compare in performance using metrics that you choose.
    c. Choose the single best combination and explain why it is optimal.

Scenario with a group of 2 students:

1. Complete the following:
    a. Select a portfolio with a minimum of 5 securities. (**Note that you should choose stocks for which you can find recent news, headlines, analyst reports, etc**.).
    b. Download daily or weekly returns for a period that allows you to have at least 100 data points (about 6 months daily returns, or 2 years of weekly returns). Assume you cannot short any securities.
    c. Compute the covariance matrix from the observations.
    d. Run a classical Markowitz portfolio optimization. Be sure to print / display / graph the weights of each security in the portfolio optimization results.
2. Students A and B will select one specialty each and complete the related tasks described above.

3. Specialist A and B work together to combine methods:
    a. Compare the original portfolio allocation, with your specialist methods.
    b. Show how different combinations compare in performance using metrics that you choose.
    c. Choose the single best combination and explain why it is optimal

Submission requirements and format

One team member submits on behalf of the entire group the following:

1. **1 PDF document*** (3-6 pages) with written notes of background information.
    a. Use the available Report Template and fill out the required information on the first page
2. 1 **zipped folder** including:
    a. One (1) Jupyter notebook with:
        - Code
        - Graphs
        - Explanation of procedures and choices
        - Results
        - Interpretation
3. 1 **PDF of a 3-page summary report*** that compares all 4 portfolios (3 for groups of 2 students):
    - Original
    - BL
    - Kelly
    - Leveraged

    The comparison should include both quantitative metrics and tabular or graphical visualizations. It should have a column for each of the portfolios.

***Use Google Docs to collaborate**. Start by uploading the Report Template provided in the Course Overview. Once your report is completed, click File → Download → PDF Document (.pdf) to obtain the copy for your submission.*

*** **Use Google Colab or GitHub to collaborate** in completing the executable Python program.*

*The PDF file must be uploaded **separately** from the zipped folder that includes any other types of files. This allows Turnitin to generate a similarity report.*

Rubric

Your instructor will evaluate your group submission for GPW1 using the following rubric:

Quantitative Analysis (open-ended questions) 40 Points	Technical and Non-technical Reports 30 Points	Writing and Formatting 20 Points
The group is able to apply results, formulas, and their knowledge of theory to real-life finance scenarios by doing the following: ● Providing all the necessary information to support their arguments. ● Presenting arguments that reflect group discussion and research. ● Using authoritative references to support a position and provide updated information. ● Concluding with practical takeaways for more insightful financial decision-making.	Technical Reports contain 3 parts: 1) summary of key results; 2) interpretation of results; and 3) the recommended course of action that can reasonably follow from those results and interpretations. **Note**: Technical reports will include the technicalities of models, such as names, methods of estimation, parameter values, etc. and exclude generalities about the work done. It should NOT include the names of Python code that was used.	A submission that looks professional should include: ● The axes, labels, and scales in graphs. ● No significant grammar errors or typos. ● Organized, well-structured, and easy-to-read document. ● Proper citations and bibliography using MLA format.
	Non-technical Reports contain 3 parts: 1) clear explanation of results; 2) the recommended course of action that follows; and 3) the identification of factors that impact each portfolio. **Note**: AVOID all references to model names, algorithms, and unnecessary details. Instead, focus on the investment decision.	