QBUS6830
Financial Time Series and Forecasting
Semester 1, 2022

Group Assignment Part I

Group Assignment Part I will contribute 15% towards your final grade and is to be completed in groups of 3 students. The due date is Wednesday 27th April, by 11:59pm via online submission in Canvas.

Obtaining Data and Excel Questions

For this assignment you will need to download the Python Jupyter notebook file "assignment_data_prep_QBUS6830.ipynb". The file can be found in Canvas by clicking on 'Assignments' on the left-hand menu and then clicking on 'Group Assignment Part I'. Once you have downloaded the file, enter your group number in the 6th input line, i.e. change the number '10' in the code "group_num = 10" to the group number of your registered group on Canvas. Then, run all the commands in the same Jupyter notebook file to retrieve and save your group's data set, which will be saved into the file "my_group_data.csv"

Submission Requirements

The assignment submission consists of 3 parts; a Jupyter notebook file with numerical and written answers and all Python code used, plus group Meeting Minutes and a Peer Assessment form.

In the Jupyter notebook file, you should provide your answers to all questions below, by including Python output and written answers (you can type in any input cell by using the "markdown" option in Jupyter). Only one student should submit this file, per group.

A template for the group Meeting Minutes will be placed on Canvas and should have entries for at least 3 group meetings. Only one student should submit per group.

Finally, the Peer Assessment Form, requires each group member to assess the contributions of their fellow group members and will be used to adjust marks in the case where student contribution differs significantly across group members. Each member of the group must submit their own Peer Assessment form.

Submission links will become available in Canvas shortly before the due date.

Question 1 (22 marks) – Principle Components and Factor Analyses

Data on the adjusted closing asset prices of 8 assets are in the file you created "my_group_data.csv". Please ensure your group number is entered correctly into "assignment_data_prep_QBUS6830.ipynb", so you are using the correct data for your group. Form the percentage log-returns for your 8 assets.

Principle Components analysis

Conduct a Principle Components analysis on the covariance matrix, Σ, of the 8 percentage log-return series.

(10marks) Written Report submission questions

a) (3 marks) Present the summarized results of your analysis in a table. What percentage of the total variance is captured by each component?
b) (2 marks) How many components would you choose? Justify your answer.
c) (1 mark) What is the cumulative percentage of the total variance captured by the first *m* components, where *m* is the number you chose in part (b).
d) (4 marks) Describe the first *m* principle components found, where *m* is the number you chose in part (b). Do they have a relevant or useful interpretation?

Factor Analysis

Perform a statistical factor analysis on the 8 percentage log-return series using *m* factors; separately for *m* = 1, 2, 3, 4.

(12 marks)

e) (4 marks) For the 3-factor model, present the results of your analysis in a table and describe the factors found. Do they have a relevant or useful interpretation? Justify your answer.

f) (3 marks) Conduct the hypothesis test that the 3 factor model is appropriate for your data.

g) (4 marks) How many factors would you choose to include in your factor model? Justify your answer.

h) (1 mark) For the 2 factor model, what percent of variance is captured by the model?

i) (1 mark) For the 3 factor model, what is the Adjusted R-squared for asset 4?

j) (1 mark) For the 1 factor model, what is the specificity for asset 2?

Question 2 (18 marks) – Time series models and forecasting

Data on the adjusted closing asset prices of 8 assets are in the file you created "my_group_data.csv". For this study only use four assets: assets 1, 2, 3 and 4.

You are required to use various forecasting methods and use the forecasts to create portfolios in a dynamic portfolio optimization problem. The 5 methods are:

1. Naïve
2. 15 day average
3. ARMA(1,1) model
4. Regression of each asset using asset 1, lag 1 as regressor.
5. The combined average of all forecasts.

You should first estimate models/methods 3 and 4 for your three assets' (assets 2, 3 and 4) percentage log returns, using the first T=2000 observations as the in-sample data. You are then required to generate moving origin, horizon 1 forecasts for each observation in your forecast sample, using the 5 methods/models listed above. Use a moving data window of size T=2000 for your in-sample period and update your model estimates daily.

Next, you should generate dynamic portfolio weights, using the forecasts obtained so far, for your 3 assets (assets 2, 3 and 4). Dynamic portfolios must be created for each combination of forecast model and portfolio strategy (i.e. 5×3 = 15 in total). The portfolio weights must be updated daily, according to the following strategies:

1. Equal weights
2. Weight proportional to the forecast return for each asset
3. Weight inversely proportional to the forecast error standard deviation for each asset, taken over the last 10 forecast days. (the weights can be equal for the first 10 forecast days)

Once the task is completed you are required answer the questions below.

(18 marks)

(a) (2 marks) Discuss the model estimates obtained for model 4 for asset 2.

(b) (5 marks) Present the forecast accuracy measures RMSE and MAD, as well as the MZ regression results (parameters F, p-value, R-squared), for all forecasting methods/models in a table, for asset 2. Discuss the performance of the different forecasting_approaches.

(c) (8 marks) Present the returns and standard deviations obtained for all forecasting model and portfolio strategy combinations. Discuss the performance of the various combinations of models and strategies.

(d) (1 mark) Which combination of forecast model and portfolio strategy gives the highest mean return?

(e) (1 mark) Which combination of forecast model and portfolio strategy gives the lowest standard deviation?

(f) (1 mark) Which combination of forecast model and portfolio strategy gives the highest ratio of mean return to standard deviation?

Some notes regarding group peer assessment

1. Your group will be required to document, using minute form, at least 3 group meetings. Documentation should be in terms of attendance, discussion points, actions decided, tasks allocated and/or completed by each member, etc. An example form for this will be distributed OR you may use your own.

2. Peer assessment items are **required** to be handed in as part of the online submission process. *If you do not complete and hand these in, then you will lose marks **individually**.*

3. At the end of the assignment, everyone will rate BOTH themselves and their other group members in terms of participation and effort on the assignment. For each individual group member, the total group mark will either be adjusted (i) downwards; or (ii) upwards; or (iii) remain the same, depending on my academic judgement of the peer assessment items provided by each individual in each group and reflecting each individual's overall contribution to, and effort in, completing the assignment tasks.

3. Based on peer assessment and *after having put in a reasonable effort on the group project,* the maximum amount a student can lose from their group mark is 10% of the total mark. However, an exception to this is if a student has TRULY DONE NOTHING (or close enough to; i.e. not put even close to a reasonable effort), in which case I will award a mark of 0.

4. If a group is concerned that one or more of their members is not contributing sufficiently to the assignment please inform the course coordinator and provide any evidence (meeting minutes or otherwise) to support your claim. If the concern appears valid a warning will be sent to the student(s) and an immediate penalty of 10% will be imposed. Should the situation miraculously improve the penalty may be removed later. Should the situation not improve, a mark of 0 is possible as discussed above.