**Portfolio optimisation exercise**.

Using your preferred software (ideally R or Python), you are required to develop a small-scale portfolio optimization tool. The tool should allow the user to interact through a web application (e.g., use Shiny for R or Python). The goal is to decide the weight to be assigned to a broad stock index at time *t* using the standard mean-variance formula:

where is the forecast of excess return of the index at time *t* for time *t*+1; is the forecast of the variance of the index at time *t* for time *t*+1; is the coefficient of risk aversion for the investor and is chosen by the user. You can either use the S&P500 data provided or collect the data for an index of your choice.

For the stock index, 10 years of monthly returns data should be available. You should split the data into an in-sample period, which you will use to estimate , and , and an out-of-sample period, over which you will evaluate the performance of the portfolio. More specifically, you need to:

1. Select the size of the in-sample period;
2. Decide the best method to forecast , and and implement it;
3. Compute the optimal weight for each month in the out-of-sample period assuming that the investor holds the position for a month and rebalancing occurs at the end of every month;
4. Use the metrics that you deem appropriate to evaluate the performance of the portfolio over the out-of-sample period (transaction costs can be ignored).

The web-based application should allow the user to select . Using this , it should calculate the optimal allocation over the out-of-sample period and report the average weight assigned to the stock index and the values of the performance measures of choice.

Optional: instead of choosing the size of the in-sample and out-of-sample period, you could let the user set it.   
  
Note that there is no uniquely correct way to answer this task.   
  
You should email your code, together with a document of no more than two pages that describes clearly and concisely the methods that you have used under point (b), the justification for your approach and any assumptions that you have made to [richard.harris@bristol.ac.uk](mailto:richard.harris@bristol.ac.uk), [manuela.pedio@bristol.ac.uk](mailto:manuela.pedio@bristol.ac.uk), and dimos.andronoudis@fathom-consulting.com by Monday 4 March 2024, 5.00PM (London time).