

# ECO-6004B The Economics of Alternative Investments

## Summative Assessment 01

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27<sup>th</sup> April 2020

The return date for this summative assignment is Thursday 30<sup>th</sup> April 2020 by 3pm BST.

Please submit your work via **Blackboard**. Solutions must be in a .pdf file. There is no requirement to submit your Excel spreadsheets.

Answer to ALL the questions.

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## Data

You have also been provided with an Excel file with the title **Summative Assessment 01 – Data**. There are two worksheets, Sheet 1 and Sheet 2. Sheet 1 provides the data. Sheet 1 also provides “some” suggested structure to address Questions 01 and 02, while Sheet 2 provides “some” suggested structure to address Questions 03. There is no requirement to follow the suggested structures. Please always allow for four digits in your calculations.

The following 5–years daily time series are provided (except for one):

- i. Commodity – Price Index (USD)
- ii. Brent Spot – Price (USD)
- iii. Gold price (USD)
- iv. FTSE World REIT – Price Index (USD)
- v. FTSE 250 – Price Index (GBP)
- vi. USDGBP (GBP 1 purchases “some” quantity of USD)
- vii. FTSE 250 – Price Index (USD) (To be computed by you.)
- viii. 10Y T–Bond rate (%) (Note that this time series has annualised figures.)
- ix. S&P 500 – Price Index (USD)
- x. 3M T–Bill rate (%) (Note that this time series has annualised figures.)

## Question 01 (20 marks)

- a) Time series i., ii., iii., iv., vii., viii. will be at the basis of every portfolio you will build. Compute the daily returns time series for each mentioned time series.
- b) Compute the following descriptive statistics: Mean (daily), Standard Deviation (daily), Median (daily), Skewness (daily), Kurtosis (daily), Minimum (daily), Maximum (daily), Range (daily), Number of observations, Mean (annualised), Standard Deviation (annualised). Report them in the solutions file. Comment the findings and briefly discuss the features of the series.
- c) Plot a line graph of the mentioned returns time series. (Hint: Assign a right vertical axis to returns of time series ii.)
- d) Compute the Variance–Covariance Matrix and the Correlation Matrix for the mentioned time series. Report and briefly discuss them.

## Question 02 (40 marks)

- a) Based on previous findings and using daily (and non-annualised) data, compute weights for the Minimum Variance, and two Optimal Risky Portfolios (assuming the risk-free rate to be equal to **daily mean of 3M T-bill rate**,  **$-10 \cdot$  daily mean of 3M T-bill rate** and  **$-1.0000\%$** , respectively). Assume the naive diversification as initial portfolio weights for each of three cases. Report the portfolio weights, Mean return, Variance, Standard Deviation and Sharpe Ratio for each of the three cases. Briefly introduce the theory related to Minimum Variance and Optimal Risky Portfolios, respectively, before briefly commenting your findings.
- b) If short sales are forbidden, do the portfolio weights change for any of the three portfolios? If so, please report the new portfolio weights and explain why they changed.
- c) Using the constant parameters reported in Sheet 1 of the Excel file, compute the weights for additional optimal portfolios, starting from the weights associated to the two Optimal Risky Portfolios you found in Question 02 a). Report the portfolio weights for these additional portfolios and their associated Mean Returns and Standard Deviations.
- d) Briefly explain what the Efficient Frontier is, plot it and comment your graph.

### Question 03 (40 marks)

- a) Consider that returns time series you used to solve Question 02. Using the weights computed in Question 02 a), build the time series of the returns of each of these three portfolios.
- b) Assuming the daily (and non-annualised) 3M T-bill rate to be your risk-free rate time series for Question 03 and returns of time series .ix to be the market portfolio returns time series (note that you need to compute this returns time series), please report the excess returns time series for the three mentioned portfolios and the market portfolio.
- c) Compute the alpha and beta for each of the three portfolios under the assumptions of Question 03 b). Report and briefly comment them.
- d) Focus now only on the Minimum Variance portfolio and its associated alpha and beta. Supposing that you want to eliminate the systematic risk, would you be long or short on the mentioned portfolio? Which hedging strategy would you implement? And how would you implement it? Please briefly motivate your answer and write the formulae associated with it.
- e) Assume that your portfolio's market value is equal to USD 18 millions, you can trade futures according to your answer to Question 03 d) and that each of these futures delivers 500 times the S&P 500 – Price Index, at a price equal to the last observation you have for that time series. How many futures will you trade? Please report the roundation of the figure to the nearest integer.