F78AB - Actuarial and Financial Mathematics B (2023/24)

COURSEWORK DESCRIPTION

Coursework to be submitted on or before:

For all students, 15:30, Local Time, Wednesday, 27 March 2024.

Total marks: 20 (worth 20% of the final mark for F78AB)

The coursework must be done individually. Please read the instructions carefully before beginning the coursework.

Instructions

What to submit Your online submission will consist of one file:

- Your Excel spreadsheet (with **all non-integers and non-currency amounts formatted to 6 decimal places**. For currency amounts, format to 2 decimal places). Your spreadsheet should be understandable to another person. Any writing should be done within the Excel spreadsheet. Use sufficient column width and label columns so that another person can follow your spreadsheet calculations, logic and writing.

- You must also complete the Standard Declaration of Student Authorship quiz on Canvas.

How to submit You submit your file by uploading it to the Canvas course website. A link will appear in the *Assessment* folder.

Marks The assignment has 20 marks available and is worth up to 20% of the final mark for F78AB. Marks and feedback are expected to be available 3 weeks after the due date.

Late submission If your assignment is submitted after the deadline, you will get a penalty of 30% for submissions up to 5 working days late. Submissions received more than 5 working days after the deadline will receive a mark of 0.

Please also see: https://www.hw.ac.uk/uk/students/doc/plagiarismguide.pdf

What to include in your spreadsheet Please include at the top left of each worksheet your student ID number, e.g. H00123456.

Best practice for spreadsheets To maximise your marks, you must follow best practice:

- Your calculations should be broken down in small steps. This is best practice as it makes your calculations easier to check and follow.

- As far as reasonably possible, you should assign a name to each constant in Excel. This is best practice as it makes your spreadsheet easier to modify if the constants change.

Coursework description

The aim of this coursework is that you construct the cash flows from an Index-Linked Bond and you start evaluating a bond by means of simulation.

Assumptions

All taxes, fees and transaction costs are ignored.

Questions

1. (*Construction of an Index-Linked Bond*) You are working as an analyst for a financial institution that wants to issue an Index Linked Bond. This bond will be issued on 22 July 2024 and will be redeemed at par on 22 July 2045. There are two coupon payments on 22 January and 22 July of every year. The first coupon will be paid on 22 January 2025. The last published RPI is 378 in January 2024. It is assumed that the inflation rate will be $q = 5\%$ per annum. The time lag for the indexation of this bond is 3 months. The institution has told you that the money yield on this bond is set to $i = 3\%$ per annum. Write an Excell worksheet to do the following:

   (a) Find the value at issuance of this bond assuming that each coupon payment is, before inflation-indexing, £2.0625 pounds per £100 nominal. [4 marks]

   (b) Find the value of each coupon payment if the value at issuance of this bond is fixed at £200 per £100 nominal. [4 marks]

2. (*Stochastic evaluation of the Index-Linked Bond*) Consider now the $4\frac{1}{8}\%$ Index-Linked Treasury Gilt 2030 issued on 12 June 1992, which is presented in Example 3.24 in Section 3.4 of the lecture notes. Suppose today is 22 January 2013 and the annual increase of inflation rate is $q = 5\%$ per annum for the future.
   In reality, yearly inflation rate q is not constant and deterministic. Hence, we assume that the yearly inflation rate is a random variable Q. Assume that $1 + Q \sim logN(\mu, \sigma^2)$, where $\mu = 0.0485$ and $\sigma = 0.0237$.

   (a) Write a Excel worksheet to sample 20 values $\{q_1, q_2, ..., q_{20}\}$ for Q. For this sake, use the Inverse Transform Sampling Method (*norm.s.inv* command, similar to Computer Lab 3). [3 marks]

   (b) For each of these values $\{q_1, q_2, ..., q_{20}\}$, compute the value today of the $4\frac{1}{8}\%$ Index-Linked Treasury Gilt 2030. Compute then the mean and the standard deviation of the money values based on the sampled 20 values. [3 marks]

   (c) Explain briefly (in one sentence) in a new worksheet why the mean is not the same as that calculated with $q = 5\%$. [2 marks]

   There are 4 marks available for the presentation of your spreadsheet and good spreadsheet practice. This means that

1. keep formulas readable, e.g. splitting long formulas into multiple smaller calculations, and do not use fixed numbers in formulas, use separate input cells for fixed values and name these in order to use them in formulas, [1 mark]

2. label columns/rows using clear and consistent names, [1 mark]

3. clear presentation of the results. [2 mark]

[Total: 20 marks]

IMPORTANT: *Please position your main findings/comments near the top left of the worksheet and make sure that it is clearly labelled and highlighted in colour.*