ETC3430 / ETC5343 Financial Mathematics under Uncertainty

2022 S1 Assignment 2

Instructions

1. It is an individual assignment. Collaboration / collusion / plagiarism between students is strictly prohibited.

2. You can type up your answers in Word or PDF, and / or write up and scan your answers. The maximum length allowed is 5 pages. You should use R to perform simulations and computations, and you must also submit your R code separately.

3. This assignment contains two questions. You must complete all the questions.

4. You should submit your work via Moodle by Friday, 27th May 2022, 4:30pm. No extension will be granted. (Refer to the Moodle site for details.)

5. This assignment contributes 10% to the total mark of this unit. The assessment is based on the accuracy of computations, reasonableness of analysis, and quality of presentation.

Question 1 [5 mark]

Each student is allocated a specific mortality data set. Fit the LC model and the CBD model to the data. Project and simulate future death / mortality rates until year 2060 and so (cohort) life expectancy at age 60 in the first year of projection. Analyse and compare the life expectancy results under the two models. You have to develop your own R code and should not use any mortality modelling package.

[For ETC5343 students (only), compute and analyse (cohort) life expectancy at age 0 as well under the LC model. In this case, the death rates are projected until, say, year 2120.]

Question 2 [5 marks]

Using the same data set as in Question 1, choose (evenly spread) three specific years of data within the period up to year 2000 for fitting, one year of data for validation, and then one year of data for testing. For instance, if the data range given covers years 1980-2018, the fitting set can include years 1980, 1990, and 2000, the validation set can include year 2010, and the testing set can include year 2018. Apply the one-layer FNN to the three years of data (central death rates) in the fitting set (1980, 1990, 2000), with age and year as the two main features, and project the values for the validation set (2010). Find the optimal number of hidden nodes and number of epochs based on the validation set.

Then apply the calibrated one-layer FNN model to project the values for the testing set (2018). Analyse the forecast performance of the calibrated model.

You have to develop your own R code and should not use any neural network package.