



Instructions

In this first project for Introduction to Financial Engineering, your team acts as bond analysts.

In the next pages, the precise analysis to be done is outlined step by step. BUT the ordering of questions is to illustrate the order of which the questions is naturally addressed when doing the various calculations and analysis. You should write one coherent, self-contained report where you provide the theory, the results from your analysis and the conclusions summarized and/or presented in graphs and tables.

ANY REPORT REFERRING TO QUESTION "THIS AND THAT" WILL NOT BE APPROVED – it must take the form of a coherent, self-contained report referring to itself and relevant literature.

Along with the report, you must submit a file/folder with code that documents the calculations. The code must be executable in one click from the desktop of any computer with the correct software included. This means that any sub-functions used must be distributed as well and that data needs to be downloaded from the Internet or entered manually as the first thing in your code.

The total number of pages is 2 including this front page.

Bond portfolio

A client would like to invest in Danish Government bonds. He asks you to invest DKK 100.000 in a portfolio of bonds and wants you to assess the risk of holding this portfolio.

- The portfolio calculations should be done using NASDAQ prices from a September-day on or after September 17¹. Make sure that prices are documented in an appendix to the report, if they are not loaded automatically (as there is little data in this project, I would not recommend you to spend time on figuring out how to fetch data from the website).
- Convert prices from clean to dirty or vice versa depending on your data and the calculations to be done.
- The term structure of interest rates should be done with a Nelson-Siegel term structure model fitted to all relevant government bond prices.
- Derive an expression for the duration of a portfolio of bonds and argue why you must use the interest rates coming from the fitted term-structure model instead of rates obtained by calculating each bond's yield to maturity.
- Find a portfolio of three bonds with positive portfolio weights, such that the duration of the portfolio is X , where $X = 5 + 0.5 \times \text{the digit sum of your student numbers}$.
- Using these weights, calculate the convexity of the portfolio as well as the value increase/decrease, if the interest rate curve shifts up by 1% (100bp).

¹For some bonds, there might be no recent trades and thereby prices for the day where you wish to do the analysis. In that case, you can for instance use the latest price.