Lab Section 07

Please go on the website and download the spreadsheet:

Lab 07 Basic Data

What's in the spreadsheet

In the blue columns you'll find prices of US Treasury securities, from the Wall Street journal of May 9th, 2022. The first column is the maturity date of the bond. The second column is the (annual) coupon rate. The third column is the ask price.

In the green box are guesses for the coefficient a0, a1, a2, a3 for the yield function, as shown in the power point presentation.

Calculate the price including accrued interest

Using the formula discussed during class, calculate the price of each bond, including the accrued interest.

Calculate the price of zero coupon bonds

Given any guess for the coefficients a0, a1, a2, and a3, in the pink cells of the spreadsheet, for every payout date, calculate

- the time difference between the current date and the payout date (in year)
- the discount rate
- the price of a zero coupon bond with face value $1

For each bond calculate the PV of each payout

For each bond, and each payout, calculate the present value of the payout, given any guess for the coefficients a0, a1, a2, and a3. Recall that coupon payments are semi annual.

Calculate bond prices

Given any guess for the coefficients a0, a1, a2, and a3, calculate the theoretical prices of the various bonds in the spreadsheet. Using Excel SOLVER, find the a0, a1, a2, and a3 that minimize the distance between the theoretical prices and the actual prices.

Plot the yield curve

Answer the following questions:

Are most bonds in the data premium bonds or discount bonds? Do bonds with high coupon tend to sell at higher or lower prices? Why?

How accurate is the model of the yield curve? What is the percentage error if you calculate price using the model?

According to the expectations hypothesis, do investors expect interest rate to go up over time? Did their expectations prove correct from over the last year?

According to the expectations hypothesis, as of May 9th, 2022, what is the market expectation about the 1 year short-term interest rate on February 15th, 2025? Is it lower or higher than the YTM on a ZCB paying off on February 15th, 2026? Why?

Suppose you invest in a ZCB paying off on February 15th, 2036, and hold it to maturity, and assume that inflation is 2% per year over this time period. What is your real return?

Suppose you run a corporation and issue a bond on February 15th 2022 with 15 years to maturity, and a coupon rate of 10%. Coupons are paid semi-annualy. If your bond were default free, what would be its price on May 9th, 2022?

Suppose that investors' expect you to default with probability of 3% per year, and expect no recovery in case of default (i.e., if you default, you would not be able to pay them anything). If investors were risk neutral, what would be the price of your bond on May 9th, 2022?

<u>How to calculate default probability:</u>

For the above calculation, it is useful to assume that the probability distribution over the default time is exponential with a parameter of 3%. Practically, this means that you calculate the probability of default as follows:

Probability of default by time t = 1 – exp(- 0.03*t)

Note that this is approximately equal to 3%. Likewise, note that the annualized probability of default over a short horizon is equal to 3%.