Homework 3: Default Probabilities from Credit Spreads and Defaultable Bonds

Credit Risk (MF772) Fall 2021 Instructor: Roza Galeeva

Due date: Sep 30, 2021 8am. Please, note that `late assignments will not be accepted.`

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1. Suppose that the CDS spreads for 1-, 3-, 5-, 7- year instruments are 50, 75, 80, 90 basis points, respectively and the expected recovery rate is 50%. Calculate:

- Unconditional default probability in the interval between 2 and 4 years
- Survival probability up in the first 6 years.

2. A company issued three and five year bonds:

- Each bond has a coupon of 5% per year, paid annually, at the end of the year.
- The yields on the bonds (continuous compounding) are 6% and 6.5%, respectively.
- Risk-free interest rates are 4% with continuous compounding
- The recovery rate is 40%
- Default can take place halfway through each year, so at times $0.5, 1.5, 2.5, 3.5, 4.5$
- The unconditional risk-neutral default probabilities per year are Q_1 for years $1, 2, 3$ and Q_2 for years $4, 5$.

Estimate Q_1 and Q_2, by the procedure we discussed in the class:

- Calculate prices of a corporate bonds and coupons, using the given yields.
- Calculate prices of risk-free bonds with the same coupons, same maturity, using risk-free yields.
- The differences between the corporate and the corresponding risk free bonds will give the total loss on three and five years periods.
- Calculate Q_1 using the same procedure as in the class, placing default times at $0.5, 1.5, 2.5$ years.
- Use Q_1 from the previous step to calculate the loss in the first three years for the 5 year bond, and then get Q_2, placing defaults at $3.5, 4.5$ years. [1]

[1] I would advise to repeat the calculations in the table on slide 9, to make sure you do those correctly