MASTER OF FINANCIAL ENGINEERING
UCLA Anderson School
Credit Risk
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Problem Set 4
Due: 24 Oct 2019, 3pm

Problem 10 (Credit Default Swaps)

We assume that the intensity follows a CIR process with parameters

$$\kappa = 0.05,\ \theta = 0.03,\ \sigma = 0.1,\ \lambda_0 = 0.02.$$

(a) Implement an algorithm to calculate the present values of the fee and the protection leg. Consider both cases: discrete and continuous fee payments. Disregard accrued fees in the discrete case.

(b) Use the algorithm from (a) to compute the fair spreads of CDS contracts with maturities $T = 1, \ldots, 10$ and quarterly fee payments. Assume that the default-free interest rate is $r = 0.01$ and that the recovery rate is $R = 0.5$.

(c) Repeat the analysis in (b) for a default-free interest rate of $r = 0.05$. What do you realize?

(d) Compare your results of part (b) to a situation where fee payments are made continuously.

Problem 11 (CDS Calibration)

CDS spreads for the XYZ company are given below. Fee payments are made quarterly. The default-free interest rate is assumed to be $r = 0.05$ and the recovery rate is assumed to be $R = 0.4$.

Maturity	CDS spread in bps
1	13.9
2	16.4
3	20.5
4	24
5	30.5
6	36
7	40.2
8	44.1

(a) Implement an algorithm to calculate the fair spread of a CDS contract if the intensity λ follows an inhomogeneous Poisson process with stepwise-constant intensity, i.e.,

$$\lambda(t) = \sum_{i=0}^{7} \lambda_i^{step} \cdot \mathbf{1}_{[i,i+1]}(t).$$

(b) Calibrate the above model to the eight observed CDS spreads and plot the intensity process.

(c) Now, use a CIR model for the intensity λ to fit the above CDS data. To calibrate such a model, one usually minimizes the pricing errors. Implement a function that gives you the average quadratic pricing error for some given observed spreads when using a parameter set $[\kappa, \theta, \sigma, \lambda_0]$. Minimize this pricing error function via an optimization algorithm (in MATLAB that would be fsolve or fminsearch ...) and provide the optimal parameters.