

Tutorial 1

Introduction, reduced-form models and CDS

École Nationale des Ponts et Chaussées
Département Ingénierie Mathématique et Informatique – Master II

Loïc BRIN • Benoit ROGER

The first two exercises are taken from Options, futures, and other derivatives, Hull C. You can find other exercises of this kind in the book. An Excel version of the correction is available here: http://defaultrisk.free.fr/tutorials/ENPC_CreditRisk_Lecture1_Tutorial.xlsx.

Exercise 1: Implied probability of default and discrete payment of coupons.

Let us suppose that the LIBOR/swap rate curve (risk free rate) is flat equal to 3% (compound rate), and that a 4-year corporate bond provides a coupon of 4% per year payable semiannually and it has a yield of 5% expressed with continuous compounding. Assume that defaults can take place at the end of the year (immediately before a coupon or principal payment) and that the recovery rate is 30%. Estimate the risk-neutral default probability on the assumption that it is the same each year.

Exercise 2: CDS pricing and discrete payment of spreads.

Suppose that the risk-free zero-coupon curve is flat at 7% per annum with continuous compounding and that defaults can occur halfway through each year in a new 5-year credit default swap (CDS). We assume that in case of default, the protection is paid at the end of the year, and that half of the annual spread is paid in case of default during the second semester of the year. Suppose that the recovery rate is 30% and the default probability each year conditional on no earlier default is 3%.

1. Estimate the credit default swap spread.
2. What is the value of the swap per dollar of notional principal to the protection buyer if the credit default swap spread is 150 basis points?
3. What is the credit default swap spread if it is a binary CDS?

Exercise 3: Position on the spread curve.

In this exercise, we assume that all the flows are continuous.

1. Let us consider a seller of protection for 5 years on firm A. In case of default of A, the recovery rate is of 60%. Knowing that the spread is 70 bps, what is the default intensity?
2. What is the sensitivity of the short position price to the spread? Let us take $r = 4\%$.
3. What is, considering constant the default intensity, the seven year spread?
4. The spread curve is expected to steepen. Between a five-year and a seven-year CDS, which one the trader should sell, knowing that he wants to be insensitive to any parallel shifts of the spreads?
5. The five-year spread goes down of 3 bps and the seven-year of 1 bp. What is the P&L of the trader who set up a

strategy for a 15 MEUR nominal for a maturity of five years?

Exercise 4: Forward CDS.

The 3-year CDS spread on a firm is 40 bp and its 7-year CDS spread is 75 bp. Compute the the spread of the contract that buys protection on A during the period starting in 3 years and ending in 7 years. We assume that the recovery rate is 40% and the risk free rate is 4%.