

Final Test – 2023-2024

Credit Risk

École Nationale des Ponts et Chaussées
Master II

Loïc BRIN • Benoît ROGER

Exercise 1: Trading CDS.

The purpose of this exercise is to study the bonds and CDS of ABC LTD. We suppose the risk free rate is of 3%.

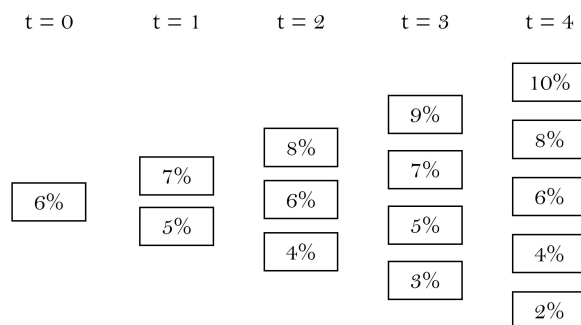
1. Suppose an ABC LTD bond, which matures in a year, trades with a credit spread of 88 bps, and that the market assumes a recovery rate of 60% for this bond in case of default, what is your best estimate of a CDS spread on this bond?
2. What is the risky duration of this CDS?
3. A 2-year bond of the same firm trades with a spread of 73 bps, and a 3-year bond with one of 53 bps.
 - a. What is the probability of default of the firm in two years, knowing it has not defaulted on the first year?
 - b. What is the probability of default of the firm in three years, knowing it has not defaulted over the first two years?
 - c. Can you comment the credit spread term structure? Would you say such a term structure is classical or atypical?
4. In case of a default, a CDS triggers an auction that aims at identifying the bond of the counterpart that is the 'cheapest to deliver', no matter its maturity or the maturity of the CDS. Based on this assessment, the CDS buyer either receives cash (cash settlement) or bonds (physical settlement) to compensate for the losses.

ABC LTD defaults. Its one-year bond now trades at 55% of the nominal value, its two-year bond at 58% and its three-year bond at 62%. John Limkick had invested ten million dollars in the two-year bond. Anticipating a likely default, he bought three month ago a three-year CDS for the same notional.

- a. How much will John Limick earn thanks to its CDS?
- b. Would John Limick rather opt for a physical or a cash settlement? Why?

Exercise 2: Funding Valuation Adjustment.

We consider a discrete dynamic of interest rates. The date of computation is $t = 0$, and we suppose that the future states of the world are the ones of a binomial tree on four periods, i.e., $t = 0, t = 1, t = 2, t = 3$ and $t = 4$. We suppose that there is no discounting and that the probabilities of reaching the next branches on each knot are both equal to 50%.



The purpose of the exercise is to understand and compute the Funding Valuation Adjustment: that is an adjustment in the pricing of a deal that takes into account that collateral might not be posted by a counterparty and that, in comparison to the same deal with a counterparty that would post collateral reusable by the bank (e.g. to post collateral for another bank), the deal is less profitable, as, other things being equal, the bank needs less funding in the latter case.

1. Fill the tree above with the cash-flows of a swap exchanging a fixed interest rate for a variable one; you pay the fixed rate at 6% and you receive the variable one on a notional of 100 MEUR.

2. Deduce the market value of the swap at each date.

3. Suppose that BMP, a bank, sells this exact same swap to two different counterparties: the American Bank of Development (ABD) and Banque du Commerce Français (BCF). ABD is not requested to post collateral but BCF is. As a reminder, when collateral is posted, the counterparty can use this collateral to fund another activity or to post collateral for another deal.

a. For BMP, which deal is more profitable between the two? Why?

b. We consider we are in $t = 0$. For each date $t > 0$, compute the expectation of the positive part of the market value of the swap. We will call this curve $EE(t)$.

c. For each knot, how much is saved by BMP because of collateralization with BCF compared to the deal with AMD?

d. The FVA being the expected cumulative discounted funding opportunity costs of not having collateral: what is the FVA of the deal with ABD?

Exercise 3: Quiz.

Select the correct answer(s).

1. A convertible bond is a bond that can be converted into a share if the convertible bond holder requests it. Suppose there is a bespoke CDS on a convertible bond. Would you say that:

1. The spread of such a bespoke CDS is higher than the one of a regular CDS on a bond;
2. The spread of such a bespoke CDS is smaller than one of a regular CDS on a bond;
3. The spread of such a bespoke CDS is the same than the one of a regular CDS on a bond;
4. It depends.

2. When one wants to model the Loss Given Default of counterparties, he or she would rather look for a distribution that is:

1. inverted U-shaped;
2. U-shaped;
3. leptokurtic;
4. none of the above.

3. When analyzing credit ratings and the observed historical defaults, it can be shown that the relationship between the rating and the probability of default is:
1. linear;
 2. exponential;
 3. logarithmic;
 4. polynomial.
4. In credit RWA models, the correlation factor tends to:
1. benefit to large corporates;
 2. be detrimental to SME;
 3. benefit to SME and retail customers;
 4. be very different from the correlation as observed in the economy.
5. Credit RWA tends to represent:
1. half of the RWA of a bank;
 2. more than 70%;
 3. less than half of the RWA of a bank;
 4. between 50% and 70% of the RWA of a bank.
6. An analyst of a technological firm considers that there is one-in-five chance that this firm defaults in the next five years, with no recovery should the default happen as its assets are mostly intangible. What is the most likely spread of a CDS on this firm?
1. 20%;
 2. 4%;
 3. 5%;
 4. There are not enough information to have a first estimate.
7. On average, would you say that:
1. the historical probability of default is higher than the risk neutral probability of default;
 2. the historical probability of default is smaller than the risk neutral probability of default;
 3. the historical probability of default should be the same as the risk neutral probability of default;
 4. the historical probability of default is the same as the risk neutral probability of default.
8. I have just bought a CDS on Italian debt to Banca Milanese: would you say that?
1. I am exposed to WWR;
 2. I am exposed to RWR;
 3. I am exposed to both WWM and RWR;
 4. We cannot tell.
9. A swap has just been settled between PJ and BM, respectively a large american bank and an Asian conglomerate, what can we say about the CVA?
1. it should be negative;
 2. it should be positive;
 3. it should be equal to zero;
 4. we lack information to conclude.
10. A bank has assets of 1000 GEUR, a leverage ratio of 5%, and a net income of 22 GEUR. Would you say that this bank is profitable?
1. yes, as its net income is positive;
 2. yes, as its net income is very likely larger than its cost of equity;
 3. yes, as its return on asset is larger than its leverage ratio;
 4. we cannot tell.