Master in Mathematical Finance

Interest Rate and Credit Risk Models

Exam – 5 February 2021

Time: 2:00h

1. Considering a loan portfolio with 10 contracts, each with a value equal to 5 Million €, compute:

1.1. Its Credit-VaR, under the Gaussian Copula hypothesis and taking into account the following data: **(4,0)**

Portfolio amount = 50 M€

1y Probability of Default (PD) = 10%

Correlation coefficient (ρ) = 0.2

Recovery Rate (RR) = 40%

- see excel file

1.2. The minimum number of contracts to get into default, in order to reach a credit loss corresponding to the Credit-VaR computed in the previous question, and the probability of getting that number of contacts into default, assuming that all these are independent. **(4,0)**

- see excel file

1.3. How do you compare the results obtained in the two previous questions? **(2,0)**

- correlation increases Credit-VaR

2. Assuming that you have a financial asset whose price follows a stochastic process corresponding to a Geometric Brownian Motion, with a drift equal to 0,1 and a volatility of 25% (both per annum):

2.1. Compute an estimate for this asset price one week from today, being the current price equal to 120 and the random component equal to zero. **(2,5)**

- see excel

2.2. Characterize the distribution of the growth rate of the asset price, also computing the expected value and the variance of this growth rate for a period of one week. **(2,5)**

- see excel

2.3. Present the stochastic process of the forward rate on this asset price. **(3,0)**

- see excel

2.4. What would happen to the stochastic process if shorter periods of time were considered in the previous questions? **(2,0)**

- Slide 110

- When Dt -> 0, the path becomes much more irregular, as the size of the movement in the variable in time Dt is proportional to the sqrt(delta(t)). When Dt is small, the sqrt(delta(t)) is much larger than Delta(t) => the changes in z will be much larger than Dt, as $\Delta z = \epsilon\sqrt{\Delta t}$