

Master in Mathematical Finance

Interest Rate and Credit Risk Models

Exam – 10 January 2018

Time: 2h

1. Please consider the following information on the Euro area yield curve for the 5th January 2018 (figures in %):

Maturities	Euro Money Market	German Government Debt
Overnight	-0,413	
1 week	-0,410	
1month	-0,423	
3 months	-0,385	
6 months	-0,320	
1 year	-0,223	
2 years		-0,605
3 years		-0,484
5 years		-0,203
10 years		0,438

- 1.1. Compute the price of a futures contract for the 3-month Euribor, with expiry date in April 2018. (2,0/20)
- 1.2. Considering that the 5 and 10 year maturities of the Government debt are represented by bonds paying annual coupons, with a redemption value of 100 Euros and coupon rates of 2% and 3%, respectively, compute the number of 10-year bonds to use in a duration hedging strategy of a portfolio comprised by 100 bonds representative of the 5-year maturity. (2,5/20)
- 1.3. Assuming that most shifts in this yield curve are parallel or just involve changes in the slope and the volatility of interest rates is constant, present an adequate affine model to characterize the curve, by specifying the main equations (e.g. the spot, the one-period forward, the volatility and the term premium curves). (3,0/20)
- 1.4. Considering the model presented in the previous question, please show how can one conclude that a financial asset is riskier when its pay-off is negatively correlated to the stochastic discount factor. (2,5/20)

2. Please consider the marginal probabilities of default for the company EFG (in addition to the interest rate information on the Government Debt provided in question 1):

Maturity (years)	Prob.Default
1	0,53%
2	1,05%

- 2.1. Compute the premium of a credit default swap with the following features: (2,5/20)

Maturity = 2 years

Notional = € 10.000.000

Payment in case of default = 80% of the notional

- 2.2. Please explain how would you assess the credit risk of EFG by using a structural model, presenting the theoretical framework and the information required. (2,5/20)

- 2.3. Assuming that the price of a bond issued by EFG one year ahead will be 105 or 103, respectively if the rating is A or B at that time and the recovery rate is 40%, please compute the 1-year Credit VaR of a portfolio comprised by 1000 bonds issued by this company, for an adequate percentile. (3,0/20)

- 2.4. What would be the main consequences of adding a second bond to this portfolio in what concerns to the calculation of the Credit VaR. (2,0/20)