

Master in Mathematical Finance

Interest Rate and Credit Risk Models

Exam – 30 January 2018

Time: 2h

1. Please consider the following information on the yield curve of U.S.A. for the 26th January 2018 (figures in %):

Maturities	Money Market	Government Debt
Overnight	1.425	
1 week	1.463	
1month	1.553	
3 months	1.745	
6 months	1.970	
1 year	2.320	
2 years		2.060
3 years		2.494
5 years		2.766
10 years		2.868

- 1.1. Considering the several explanatory theories of the term structure of interest rates, what could you conclude about the expectations on the future values of short-term interest rates? (2,5/20)
- 1.2. What are the impacts on the forecast of future values for short-term interest rates of assuming that these interest rates follow a Wiener or a Generalized Wiener process? (2,0/20)
- 1.3. Assuming that the 2-year and the 3-year bonds pay annual coupons on the same day with redemption value of 100 and coupon rates of 3% (for both bonds), being their prices 101.824 and 101,445, respectively, compute the spot rates for the maturities of 1, 2 and 3 years, by using a bootstrapping methodology and identify the main conceptual differences to the yield to maturity (3,0/20).
- 1.4. Describe the main features, including pros and cons, of 3 different static methodologies to estimate this yield curve, identifying the most adequate

methodology and assuming that all bonds previously identified pay coupons on different days (3,0/20).

- 1.5. Characterize the main features of the yield curve to be assessed in order to decide about the most adequate dynamic model to fit the yield curve, presenting this model according to reasonable assumptions (2,0/20).

2. Please consider the following information about a 1-year rating transition matrix, assuming that there are only 3 ratings classifications – investment grade (I), speculative grade (S) and default (D):

	I	S	D
I	0,7	0,25	0,05
S	0,2	0,7	0,1

- 2.1. Compute the 2-year probability of default of the company XYZ with a rating classification of “I”, taking into consideration the potential rating migrations. (2,5/20)

- 2.2. Assuming that XYZ shares are listed in the stock market and their price observe a very significant fall, assess the meaning of that stock price behavior for the probability of default of XYZ, presenting the main features of a model you could use and identifying the information needed to estimate this probability. (3,0)

- 2.3. Describe the information you would need to calculate a credit-Var of a portfolio comprising bonds issued by XYZ and by the Portuguese Treasury (2,0).