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Master in Mathematical Finance

Interest Rate and Credit Risk Models

Exam – 6 September 2017

Time: 2h

1. Please present the main theoretical issues behind the assessment of financial market participants' expectations from option prices, as well as the main estimation methodologies of risk-neutral density functions from option prices. (4/20)

2. Please consider the following information on the Euro area yield curve for the 4th September 2017:

Interest rates (%)

Maturities	Euribor	Germany
Overnight	-0,415	
1 week	-0,413	
1month	-0,428	
3 months	-0,38	
6 months	-0,298	
1 year	-0,198	
2 years		-0,729
3 years		-0.564
5 years		-0,341
10 years		0,37

2.1.   Considering the main explanatory theories of the term structure of interest rates, characterize the expectations on the future behavior of short-term rates of the Euro (1,5/20)

2.2.   Compute the price of a futures contract for the 3-month Euribor, with expiry date in December 2017. (1,5/20)

2.3.   Considering that the 5 and 10 year maturities of the Government debt are represented by bonds paying annual coupons, with a redemption value of 1000 Euros and coupon rates of 3% and 4%, 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. (1,5/20)

2.4. Assuming that the 3-year bond has a redemption value of 1000 Euros and an annual coupon rate of 1%, compute the 3-year spot rate using a bootstrapping methodology and identify the main conceptual differences to the yield to maturity (1,5/20).

3. Please describe multi-factor affine models for the term structure of interest rates, presenting the equations for the yield curve, the short-term rate, the volatility curve and the term premium and identifying the main differences between stochastic and constant volatility models (4/20)

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

Maturity (years)	Prob.Default
1	0,62%
2	1,31%
3	3,05&

4.1. Compute the premium of a credit default swap with the following features: (2/20)

Maturity = 3 years

Notional = € 1.000.000

Payment in case of default = 75% of the notional

4.2. Please explain how would you assess the credit risk of ABC from its share prices, presenting the theoretical framework and the information required. (2,5/20)

4.3. How could you model the PD of the company using reduced form models? (1,5/20)

5. Please discuss in which extent an asset is riskier when its pay-off is negatively correlated to the stochastic discount factor (1,5)