Università Commerciale
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MSc. Finance/CLEFIN
2015/2016 Edition

Advanced Tools for Risk Management and Asset Pricing

June 2016 Exam for Non Attending Students

Time Allowed: 100 minutes

Family Name (Surname)	First Name	Student Number (Matr.)

Please answer all questions by choosing the most appropriate alternative(s) and/or by writing your answers in the spaces provided. You need to carefully justify and show your work in the case of "open" questions. There is only one correct answer(s) for each of the multiple choice questions. Correct answers not selected and questions that have been left blank will receive zero points. Only answers explicitly reported in the appropriate box will be considered. No other answers or indications pointing to potential answers will be taken into consideration. In the case of "open" questions, the maximum number of points is indicated.

Question 1 (1.5 pts). Which of the following statements about compound correlations is FALSE?

☑ (A) Typically, it presents a skew
☐ (B) It may not exist
☐ (C) It is consistent at the level of single tranche
☐ (D) Two tranches on the same pool (same maturity) may yield different values of compound correlation

Question 2 (1.5 pts). Consider a standard CDS's Index (e.g. i-Traxx). Which of the following statements is TRUE?

☑ (A) The copula is parametrized by a matrix of 7750 pairwise correlation values
☐ (B) The copula is parametrized by a matrix of 125 pairwise correlation values
☐ (C) The copula is parametrized in terms of a unique pairwise correlation value
☐ (D) At the level of single tranche, it is market practice to infer a unique base correlation parameter from the tranche price

Question 3 (1.5 pts). Which of the following statements about diffusion processes is FALSE?

☐ (A) The Vasicek and the CIR processes have the same mean
☐ (B) The Vasicek process is distributed as a Gaussian
☐ (C) The CIR process is distributed as a χ^2 distribution
☑ (D) The Vasicek process, given to its mean reverting nature, is a good modeling choice for the stochastic intensity variable

Question 4 (1.5 pts). Which of the following statements about Analytically Tractable First Passage (AT1P) models is FALSE?

☐ (A) Both the barrier and the volatility of the asset are time-dependent
☑ (B) The barrier is modelled as a time-dependent stochastic variable
☐ (C) AT1P models may lead to inconsistent calibration results for short term credit spreads
☐ (D) The number of parameters to calibrate exceeds the number of market quotes

Question 5 (1.5 pts). Which of the following statements about CVA is TRUE?

☐ (A) The close-out amount and the exposure are the same thing
☐ (B) CVA is defined as: $CVA = LGD\ \mathbb{E}_0[\mathbb{I}_{\tau<T}\ (V(\tau))^+]$
☐ (C) CVA is defined as: $CVA = LGD\ \mathbb{E}_0[\mathbb{I}_{\tau<T}\ (V(\tau))\ ]$
☑ (D) None of the above

Question 6 (1.5 pts). The following table shows, at different times (columns 1 to 5), the values of five trades as well as the future exposures to the counterparty, with and without netting.

Trade ID	1	2	3	4	5
1	10	-7	8	-6	-2
2	9	0	4	-2	2
3	7	7	5	10	-8
4	-7	-6	3	-6	-6
5	-5	-5	3	6	-6
Exposures					
No Netting	26	7	23	10	2
Netting	14	-12	23	2	0

Which of the following statement is TRUE?

☐ (A) All exposures are calculated correctly
☐ (B) Exposures with netting at $t = 5$ are correct, but not those without netting
☑ (C) There are two mistakes
☐ (D) There are three mistakes

Question 7 (1.5 pts). Which of the following statements about Basel III is FALSE? (1.5pt)

☑ (A) The CVA capital charge has been introduced to take into account default risk
☐ (B) The Credit risk capital charge is the same as in Basel II
☐ (C) The CCR capital charge has been introduced in Basel II for the first time
☐ (D) Basel III recognizes two types of capital charges for counterparty risk

Question 8 (1.5 pts). Consider the formula:

$$\gamma = \frac{R_{0,b}}{LGD}$$

Which of the following statements is TRUE? (1.5pt)

☐ (A) The market uses this formula to calibrate the term structure of credit spreads
☐ (B) It is possible to derive the formula assuming that the intensity is constant and default and interest rates are independent
☐ (C) The formula requires the knowledge of the interest rate curve
☑ (D) None of the above

Question 9 (1.5 pts). Which of the following statements about the Vasicek Portfolio Loss model is FALSE?

☐ (A) The Economic Capital has been derived under the assumption that all the idiosyncratic risk has been diversified away
☑ (B) The mean of the portfolio loss distribution is a function of ρ
☐ (C) The variance of the portfolio loss distribution is a function of ρ
☐ (D) The Economic Capital is a function of ρ

Question 10 (2 pts). Which of the following statements about Mapping methods for bespoke portfolios is FALSE?

☑ (A) The overlap between the bespoke portfolio and the standard index is irrelevant to the pricing of the bespoke tranches
☐ (B) The correlation used to price the bespoke tranche is taken to be the correlation at the equivalent standard strike
☐ (C) The ATM method is based on the first moment of the portfolio loss
☐ (D) Both the TLP and the PM methods take into account the portfolio dispersion

Question 11 (6 pts).

1. Consider the Gaussian copula approach. Which kinds of inconsistencies/issues affect it? (1 pt)
2. Briefly describe the correlation surface and how it is built, including comments on interpolation. (2 pts)
3. Give the definition of a bespoke portfolio and describe the method used to price the CDO tranches of such portfolio. (3 pts)

Answer. See Lecture 7 "(Advanced) Multi-Name Credit Derivatives":

1. Open issues: (slide 14)
    - Inconsistencies across the capital structure
    - Inconsistencies across maturities
    - Pricing of bespoke tranches

2. Correlation surface (slides 17-18, 22)
    - For a given time horizon T and a given base tranche detachment K (strike), the terminal loss distribution is constructed by imposing a flat pairwise correlation $\rho := \rho(K,T)$ among default indicators in the underlying pool. $\rho(K,T)$ represents the correlation surface and the curve $\rho(K,\bar{T})$ the correlation skew for maturity $\bar{T}$.

    - The points on the correlation surface are obtained by reproducing the market prices of standard tranches. Along the strike dimension, one does not need any interpolation or extrapolation assumptions when calibrating the correlation surface to the market prices of standard tranches. Along the time dimension, interpolation and extrapolation in the time dimension are necessary to produce quarterly loss distributions for the pricing of the standard base tranche legs.

3. Bespoke portfolios (slides 25-31)

    Bespoke portfolios are constructed specifically for structured credit derivatives for which there is no liquid information on implied correlation.

    In order to price bespoke CDO tranches, the base correlation surface of the bespoke portfolio at the strikes (detachment points) of interest must be derived. Such surface is obtained starting from the base correlation surface of standard (liquid) indices, through the so called mapping methods. The procedure goes through the following steps:

    a. The base correlation surface of the standard index is built by calibrating to the liquid tranche market using a bootstrapping algorithm based on the one factor Gaussian copula model
    b. A base tranche with strike (detachment point) $K_{bespoke}$ is selected
    c. Through a given mapping rule the bespoken tranche strike $K_{bespoke}$ is associated an equivalent base tranche strike on the index portfolio K_{index}^{Eq}
    d. The correlation used to price the bespoke tranche is taken to be the correlation at the equivalent standard strike:

$$\rho_B(K_{bespoke}, T) = \rho_I(K_{index}^{Eq}, T)$$

Different mapping methods are identified based on the definition of equivalence between a bespoke and a standard tranche. Equivalence is meant to represent a comparable level of risk for the bespoke and the standard tranche.

Question 12 (2 pts). Considering that the Bonus Cap certificates listed below have been equally priced when issued in the past and that all of them have the FTSE MIB as their underlying asset, which one is likely to be the cheapest today, after issuance?

☐ (A) Bonus Cap with American Barrier at 70%
☑ (B) Bonus Cap with American Barrier at 80%
☐ (C) Bonus Cap with European Barrier at 70%
☐ (D) Bonus Cap with European Barrier at 80%

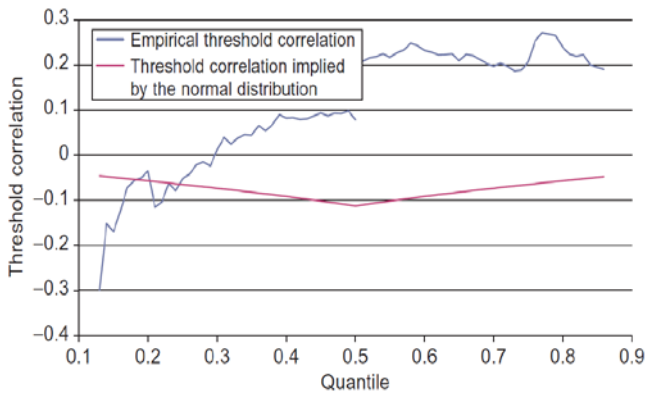
Question 13 (2 pts). You would like to exploit leverage but, because the market is really volatile at present, you are afraid of the negative impact/risks of "compounding effect". Which of the following statements is correct?

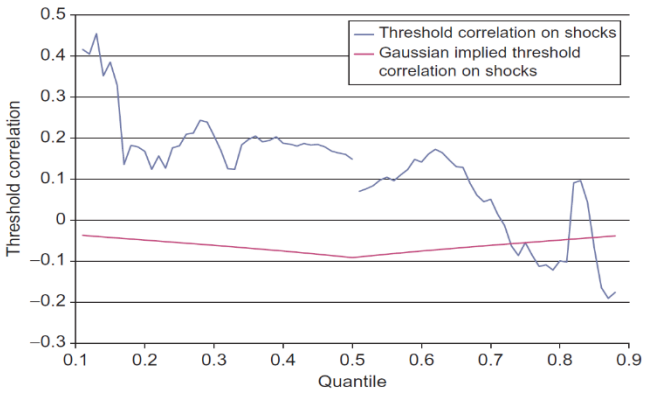
☑ (A) You will buy a Turbo certificate, because it does not imply dynamic leverage and it is not plagued by the "compounding effect"
☐ (B) You will buy a Leverage certificate, because it implies dynamic leverage and it is not plagued by the "compounding effect".
☐ (C) You cannot avoid the "compounding effect"
☐ (D) None of the above

Question 14 (2 pts). Bea has bought an Equity Protection certificate with 100% protection and 50% participation to the positive performance of a basket of stocks. She has paid it 100 Eur. After a while, the correlation among the stocks increases. If all the other conditions remain unchanged, what is likely to happen to the price of the Equity Protection?

☐ (A) The price will decrease. The Equity Protection consists of a ZCB and a long call on the underlying. Therefore, when the correlation increases, the price of the call decreases and so the price of the certificate decreases
☐ (B) The price will decrease. The Equity Protection consists of a ZCB and a short call on the underlying. Therefore, when the correlation increases, the price of the call increases and so the price of the certificate decreases
☑ (C) The price will increase. The Equity Protection consists of a ZCB and a long call on the underlying. Therefore, when the correlation increases, the price of the call increases and so the price of the certificate increases
☐ (D) The price will increase. The Equity Protection consists of a ZCB and a short call on the underlying. Therefore, when the correlation increases, the price of the call decreases and so the price of the certificate increases

Question 15 (1.5 pts). The following plots,





imply that:

☑ (A) Raw data correlations deviate from a bivariate normal because the data show negative excess correlation in the left tail and positive excess correlation in the right tail; the standardized residuals of a GARCH modelling exercise show instead the opposite pattern but fail to be fitted by a bivariate Gaussian model

☐ (B) While the raw data deviate from a bivariate Gaussian model, the standardized residuals of a GARCH modelling exercise do not

☐ (C) Raw data correlations deviate from a bivariate normal because the data show positive excess correlation in the left tail and negative excess correlation in the right tail; the standardized residuals of a GARCH modelling exercise show instead the opposite pattern but fail to be fitted by a bivariate Gaussian model

☐ (D) None of the above

Question 16 (3 pts.)

Bank Tribeax is structuring a one-year equity protection certificate (with protection equal to 90%). The structuring team is looking at all the stocks of the S&P 500 Index to find the most suitable underlying to offer to their client a high participation to the index performance. To make the task easier, Vladimir, one of the smartest and largest structurers in the bank, gives the following suggestion: "we may sort the stocks by the implied dividend and exclude the stocks that pay high dividends". After having described and drawn the payoff of an equity protection certificate (including a detailed decomposition into the different options and securities that compose/replicate it), explain where Vladimir's reasoning is a sensible one and why.

Answer: An equity protection with protection level equal to 90% is a certificate that allows the investor to participate to the performance of the underlying, but guarantees that at least 90% of the capital will be refunded at maturity. In formulas, at maturity the investor will get

$$Eur\ 100\ \times Max\left[90\%;\left(100 + P\% \times \left(\frac{Underlying}{Strike} - 1\right)\right)\right].$$

This is achieved in practice through a combination of a Zero Coupon bond (with value at maturity equal to 90 Eur) and a long call with strike 90% on the underlying. Clearly, if P%, i.e., the participation level, is lower (higher) than 100%, this is equal to buying a lower (higher) proportion of call options. Vladimir would like to exclude the stocks with a high implied dividend but the highest the dividend, the lowest the value of the call option that the investor is buying (the highest the number of call that the investor can afford, and therefore, the highest the participation ratio P% of the certificate). Therefore Vladimir is incorrect and his team should heed his suggestions – that's why his desk mates call him Globulo (a single red globuli cannot feed enough oxygen to his brain).