Exam: Finansiell Risk, MVE 220/MSA400
Friday, August 24, 2018, 14:00-18:00
Jour: Ivar Simonsson, ankn 5325

Allowed material: List of Formulas, Chalmers allowed calculator.

Problems 1-4: Multiple choice, only hand in table with answers
Only one correct answer. Correct answer gives 5 points, no answer ("don't know") gives 0 points and wrong answer gives -1 point (more than one answer automatically gives -1 point).

Uppgift	a	b	c	d	e	f (Don't know)	Points
1	☐	☐	☐	☐	☐	☐	
2	☐	☐	☐	☐	☐	☐	
3	☐	☐	☐	☐	☐	☐	
4	☐	☐	☐	☐	☐	☐	

Problems 5-10: Hand in full solutions

1 Consider the following statements:

1 Solvency 2 includes two distinct capital requirements.

2 To compute the Solvency 2 capital requirements, an insurance company can use either a standard model developed by the legislators or develop their own full or partial model.

3 Almost no insurance companies have chosen to develop their own Solvency 2 model.

4 The narrative qualitative reporting requirements in Solvency 2 are that the insurance company must provide two reports, a solvency financial conditions report (SFCR), and a regulatory supervisory report (RSR).

Which of the following is true?

(a) ☐ Statement 1 is wrong, the others are correct

(b) ☐ Statement 2 is wrong, the others are correct

(c) ☐ Statement 3 is wrong, the others are correct

(d) ☐ Statement 4 is wrong, the others are correct

(e) ☐ None of the above

(f) ☐ Don't know.

2 Consider the following statements:

1 No other company warned Volkswagen that the defeat devices were illegal.

2 As a result of Dieselgate the Volkswagen stock lost 90% of its value.

3 On the 10th of January 2017, despite the scandal, Volkswagen was still the biggest car manufacturer in the world with more then 10.3 million cars sold world wide.

4 Several persons have been jailed in the USA because of the manipulations using defeat devices.

Which of the following is true?

(a) ☐ All the statements are correct

(b) ☐ 1 and 2 are wrong; the others are correct

(c) ☐ 3 and 4 are wrong, the others are correct

(d) ☐ 2 is wrong: the others are correct

(e) ☐ None of the above

(f) ☐ Don't know.

3 Consider the following statements:

1 Only owners of the E-mini contracts were affected by the Flash Crash.

2 High frequency trading played a major role in the Flash Crash.

3 *Spoofing trading* is an algorithm which put lots of buy and sell orders on different prize levels to lure other programs and traders to a certain prize level and then withdraws the orders before they are executed.

4 There is a clear and generally accepted explanation for why the Flash Crash happened.

Which of the following is true?

(a) ☐ 1, 2 are correct; the others are wrong

(b) ☐ 2 and 3 are correct; the others are wrong

(c) ☐ 3 and 4 are correct; the others are wrong

(d) ☐ 1 and 3 are correct; the others are wrong

(e) ☐ None of the above

(f) ☐ Don't know

4 Consider the following statements:

1 The goal for Basel III was that regulation, supervision and risk management within the banking sector would be improved in order to make financial bubbles and crises less common.

2 In Basel III stable funding is for example the bank's capital, preferred stocks or liabilities that has a maturity that is one year or longer, etc.

3 Banks have an inclination to be cyclical in the way that their growth is very big when the economy as a whole is growing. Basel III tries to encourage banks to do this.

4 The new stronger requirements in Basel III may lead to a higher entrance threshold for new actors into the business and lead to reduced competition in an already oligopolistic industry.

Which of the following is true?

(a) ☐ Statement 1 is correct; the others are wrong

(b) ☐ Statements 1, 2 are correct; the others are wrong

(c) ☐ Statements 1, and 4 are correct; the others are wrong

(d) ☐ Statements 2 and 4 are correct; the others are wrong

(e) ☐ None of the above

(f) ☐ Don't know.

data. This leads to the maximum likelihood estimate

$$(\hat{\mu}, \hat{\sigma}, \hat{\xi}) = (-1.64, 0.27, -0.084),$$

with a maximized value of the log-likelihood equal to -14.3. The corresponding estimated variance-covariance matrix is

$$V = \begin{bmatrix} 0.00141 & 0.000214 & -0.000795 \\ 0.000214 & 0.000652 & -0.000441 \\ -0.000795 & -0.0000441 & 0.00489 \end{bmatrix}.$$

5 Above are shown the maximum likelihood estimates and the estimates of the covariance matrix from the block maxima method applied to a data set. Compute a 95% confidence interval for the location parameter μ. (6p)

6 Suppose daily losses (= -returns) are independent and identically distributed and that the excesses of the level 0.03 follow a GP distribution. Further assume that in four years of data 5% of the observed losses had been larger than 0.03 and that the estimated scale and shape parameters of the GP distribution were $\hat{\sigma} = 0.014$ and $\hat{\gamma} = 0.61$.

a) Find an estimate of the probability that a daily loss is larger than 0.05 (4p)

b) Find an estimate of the 99% quantile of the distribution of daily losses. (4p)

7 Explain how the Block Maxima and Peaks over Threshold methods can be used for modelling of extremes of a dependent stationary sequence. In particular discuss what are the main differences compared to the application of these methods to an independent sequence? (6p)

8 Consider a static credit portfolio with $m = 1000$ obligors which we model as mixed binomial model inspired by the Merton framework. The individual one-year default probability is $\bar{p}$, the individual loss is $\ell = 60\%$ and the default correlation is $\rho = 19\%$. Each loan have notional 1 million SEK. We also know that the probability that within one year, the total portfolio credit loss will be less than 23 million SEK is 56.5%. Use the LPA-approximation formula to compute the probability that within one year, the total portfolio credit loss will be

more than 40 million SEK but less than 90 million SE (6p)

9 Consider a static credit portfolio with $m = 25$ obligors. We model this portfolio as a mixed binomial model and let Z be the random variable representing the background variable affecting all obligors in the portfolio where $X_i = 1$ if obligor i defaults within one year and $X_i = 0$ otherwise. Furthermore, we let $p(Z) = \mathbb{P}[X_i = 1 \,|\, Z]$. In this model Z has two states $\{1, 2\}$ where $\mathbb{P}[Z = j]$ and $p(j)$ for $j = 1, 2$ are given by Table 1. Compute the exact probability of having no defaults in this portfolio within one year.

state j	$j = 1$	$j = 2$
$\mathbb{P}[Z = j]$	0.9	0.1
$p(j)$	0.03	0.10

Table 1: The values $\mathbb{P}[Z = j]$ and $p(j)$ for $j = 1$ and $j = 2$.

(6p)

10 A credit portfolio manager working at the mortgage hedge fund "Gekko Loan Management" wants to compare the 1-year $\mathrm{VaR}_\alpha(L)$ for two different static credit portfolio models: the mixed binomial logit-normal model versus the mixed binomial model inspired by the Merton framework. The portfolio manager (called Gordon) has estimated the one-year parameters $\bar{p}$ and ρ in the Merton framework to $\bar{p} = 3.5\%$ and $\rho = 14\%$ which gives him a certain $\mathrm{VaR}_\alpha(L)$-value in the Merton setup when $\alpha = 95\%$. Gordon now wants to compute the corresponding $\mathrm{VaR}_\alpha(L)$ in a mixed binomial logit-normal model under similar conditions as in the Merton framework and he decides to calibrate the logit-model against the mixed binomial Merton model so that

$$F_M(x_i) = F_{\text{logN}}(x_i) \quad \text{for } i = 1, 2 \text{ where } x_1 = 0.1 \text{ and } x_2 = 0.9$$

where $F_M(x)$ and $F_{\text{logN}}(x)$ are the LPA-distributions for the fractional number of defaults in the credit portfolio, for a mixed binomial Merton model and for the mixed binomial logit-normal model. The credit portfolio has 1000 obligors, each loan has notional 1 million US-dollars and the individual loss is $\ell = 60\%$. If Gordon uses the LPA-approach

with $\alpha = 95\%$, what will the 1-year $\mathrm{VaR}_{95\%}(L)$ be in the mixed binomial logit-normal model when calibrated to the corresponding Merton framework as above? (8p)