Exam: Finansiell Risk, MVE 220/MSA400
Friday, Aug 18, 2017, 14 till 18
Jour: Fanny Berglund, ankn 5325

Allowed material: List of Formulas, Chalmers allowed calculator.

Scoring: Multiple choice questions, only one correct answer. Correct answer gives 2 points, no answer ("don't know") gives 0 points and wrong answer gives -0.5 points (more than one answer automatically gives -0.5 points).

Fill out the first page, and turn in the entire exam. Only what you have written on the first page counts for the grade.

Uppgift	a	b	c	d	e	f (Don't know)	Points
1	☐	☐	☐	☐	☐	☐	
2	☐	☐	☐	☐	☐	☐	
3	☐	☐	☐	☐	☐	☐	
4	☐	☐	☐	☐	☐	☐	
5	☐	☐	☐	☐	☐	☐	
6	☐	☐	☐	☐	☐	☐	
7	☐	☐	☐	☐	☐	☐	
8	☐	☐	☐	☐	☐	☐	
9	☐	☐	☐	☐	☐	☐	
10	☐	☐	☐	☐	☐	☐	
11	☐	☐	☐	☐	☐	☐	
12	☐	☐	☐	☐	☐	☐	
13	☐	☐	☐	☐	☐	☐	
14	☐	☐	☐	☐	☐	☐	
15	☐	☐	☐	☐	☐	☐	

Signature:

Name (print):

1 Consider the following statements:

1 Selling a mortgage backed security (MBS) increases the risk for the seller, usually a bank. This means that the seller/bank has to be more careful in checking the creditworthiness of persons who take out mortgages.

2 CDO is short for Collateralized Debt Obligation.

3 CDO-s and BTO-s are called structured products

4 It is generally believed that the Dodd-Frank Wall Street Reform and Consumer Protection Act (DFA) has made the risk of a new financial crisis very small.

5 A difference between BTO-s and CDO-s is that BTO-s are tailored to the wishes of individual investors.

Which of the following is true?

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

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

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

(d) ☐ Statements 4 and 5 are wrong, the others are correct

(e) ☐ None of the above

(f) ☐ Don't know.

2 Consider the following statements:

1 Carl-Eric Björkegren was a very rich man when he disappeared without a trace in June of 1994.

2 The reason that the finance market started to "crash" in the end of the 1980-ies was that the central bank of Sweden had introduced very many new and harmful rules which the banks had to follow.

3 Carl-Eric Björkegren speculated in, among other things, real estate and arts and antiques.

4 The butler was for a while a suspect in the disappearance of Carl-Eric Björkegren.

5 Carl-Eric Björkegren was the first man ever to be convicted in Sweden of insider trading.

Which of the following is true?

(a) ☐ All the statements are correct

(b) ☐ 2 is correct; 1, 3, 4, 5 are wrong

(c) ☐ 4, 5 are correct; 1, 2, 3 are wrong

(d) ☐1, 3, 5 are correct; 2, 4 are wrong

(e) ☐ None of the above

(f) ☐ Don't know.

3 Consider the following statements:

1 Bitcoin will perhaps change the financial system.

2 A drawback with Bitcoin is that it can be used to whitewash black money.

3 Satoshi Nakamoto is the director of Bitcoin, and has complete control over all transactions in Bitcoin.

4 Bitcoin can guarantee anonymity for both buyer and seller.

5 QR-codes play a part of Bitcoin transactions.

6 It has proved impossible for hackers to get into Bitcoin exchanges.

Which of the following is true?

(a) ☐ 1, 2, are correct; 3,4,5,6 are wrong

(b) ☐ 1, 2, 4, are correct; 3, 5, 6 are wrong

(c) ☐ 1, 2, 4, 5 are correct; 3, 6 are wrong

(d) ☐ 2, 3, 5 are correct; 1, 4, 6 are wrong

(e) ☐ None of the above

(f) ☐ Don't know

4 Consider the following statements:

1 In Markowitz portfolio theory an efficient portfolio has the lowest variance for its expected return and the highest expected return for its variance.

2 A common expression in finance is Homo Economicus. This means a person who is a rational wealth maximizer.

3 Behavioural finance has shown that most persons always act as rational wealth maximizers.

4 Daniel Kahneman received the Nobel Memorial Prize in Economic Sciences 2002, for his contributions to the field of irrationality in economics.

5 "Prospect theory" says that we value losses and gains of the same size differently.

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.

5 Consider the following statements:

1 Muhammad Yunnus was a professor of economics when he started the microloans

2 Yunnus started by lending his own money to poor people, who often were women.

3 One great success story for Yunus and Grameen Bank is their work in helping beggars.

4 CAPM is, after four decades, still one of the main alternatives in the estimation of expected return or cost of equity for individual stocks (commodity derivatives, energy/electricity markets, etc.) and other financial securities.

5 CAPM and APT use macroeconomic background factors to estimate expected returns.

Which of the following is true?

(a) ☐ All statements are correct

(b) ☐ All statements are wrong

(c) ☐ 1 is wrong; the others are correct

(d) ☐ 3 is wrong; the others are correct

(e) ☐ None of the above

(f) ☐ Don't know.

6 Suppose a data set contains 7-day losses (= - returns) during the last 2 years for a portfolio, and that the mean and standard deviation of the losses are -0.002 and 0.03, respectively. If one assumes that losses are normally distributed and that SEK 1.7 million is invested in the portfolio, what is then the 7-day 99% VaR, in SEK, for the portfolio?

(a) ☐ SEK 165,600

(b) ☐ SEK 54,900

(c) ☐ SEK 152,800

(d) ☐ SEK 97,600

(e) ☐ None of the above

(f) ☐ Don't know

7 Suppose that daily portfolio losses are mutually independent and that 7-day maximum losses expressed in % have a GEV distribution function with estimated location parameter $\hat{\mu} = 0.96$, estimated scale parameter $\hat{\sigma} = 1.17$, and estimated shape parameter $\hat{\gamma} = 0.21$, and that the extremal index has been estimated to be $\hat{\theta} = 0.73$. Then an estimate for the 1-day 95% VaR for such a portfolio with an initial value of SEK 1.7 million is

(a) ☐ SEK 33,000

(b) ☐SEK 9.800

(c) ☐ SEK 137,300

(d) ☐ SEK 13,200

(e) ☐ None of the above

(f) ☐ Don't know

8 Consider the following statements:

1 The analysis of the Swedish windstorm insurance losses did not reveal any evidence of a time trend.

2 One can use the inverse of the Fisher information matrix to estimate variances of parameter estimates .

3 Backtesting means that one 1) reverses the order of the losses in a data set; 2) uses the same procedure to estimate VaR from the reversed data set as for the original data set; and 3) compares the original estimates with the reversed ones.

4 If empirical estimates of quantiles exist, then they are always better than model-based ones.

5 If the shape parameter γ of a GP distribution equals zero, then the left endpoint of the distribution is $-\infty$ and the right endpoint is $+\infty$.

Which one of the following is correct?

(a) ☐ Statements 3,4,5 are wrong, the others are right.

(b) ☐ Statements 1, 4,5 are wrong, the others are right.

(c) ☐ Statements 1, 2, 5 are wrong, the others are right.

(d) ☐ Statements 1,2,3 are wrong, the others are right.

(e) ☐ Statement 5 is wrong, the others are right.

(f) ☐ Don't know

9 Suppose that an excesses of a threshold u has a GP distribution with scale parameter σ and shape parameter γ, where it for simplicity is assumed that $\gamma > 0$. Assume that $v > 0$. Then the conditional distribution of excesses of the level $u + v$ is also a GP distribution.

What are the parameters of this distribution?

(a) ☐ The shape parameter is $1 + \frac{\gamma}{\sigma} v$ and the scale parameter is γ.

(b) ☐ The shape parameter is $1 + \frac{\gamma}{\sigma} v$ and the scale parameter is γ/σ.

(c) ☐ The shape parameter is $\sigma + \gamma v$ and the scale parameter is γ.

(d) ☐ The shape parameter is $\sigma + \gamma v$ and the scale parameter is γ/σ.

(e) ☐ None of the above

(f) ☐ Don't know

10 In a peaks over thresholds analysis to compute VaR one assumed that from very long experience it was known that the 95% quantile of the losses was exactly 2.60, with negligible error. Further, one used a GP distribution with shape parameter $\gamma = 0$, so that the distribution function was $H(x) = 1 - e^{-x/\sigma}$, to model the excesses over the threshold 2.60. The estimated parameter was $\hat{\sigma} = 0.90$, and the standard deviation of $\hat{\sigma}$ was estimated to be 0.057.

Let $\widehat{VaR}_{.8}(H)$ be the the estimated 80% VaR of the distribution function H, so that the estimated 0.99 VaR of the losses equals $2.60 + \widehat{VaR}_{.8}(H)$. Then a 95% confidence interval for the 99% VaR of the losses is

(a) ☐ $(3.15, 3.30)$

(b) ☐ $(3.00, 3.50)$

(c) ☐ $(3.30, 3.83)$

(d) ☐ $(2.15, 4.03)$

(e) ☐ None of the above

(f) ☐ Don't know

11 Consider a static credit portfolio with $m = 1000$ obligors which we model as mixed binomial model inspired by the Merton framework (for one year, so $T = 1$) and where each loan have notional 1 million SEK and the individual loss is $\ell = 60\%$.

Recall that in this credit portfolio model each obligor i can be considered as a firm in the sense that the value of obligor i-s assets $V_{t,i}$ at any time point $t \geq 0$ follows the dynamics

$$V_{t,i} = V_{0,i} e^{(\mu_i - \frac{1}{2}\sigma_i^2)t + \sigma_i B_{t,i}}$$

where

$$B_{t,i} = \sqrt{\rho} W_{t,0} + \sqrt{1-\rho} W_{t,i}$$

and $W_{t,0}, W_{t,1}, \ldots, W_{t,m}$ are independent standard Brownian motions. Hence, at each time point t it holds that $W_{t,i} \sim N(0,t)$, i.e. $W_{t,i}$ is normally distributed with zero mean and variance t. Here, $W_{t,0}$ is the economic background factor affecting all obligors.

Let D_i be the debt (to be repaid at time T) for each obligor i and recall from the Merton model that obligor i defaults if the value of its assets at time T is lower than the debt, that is, if $V_{T,i} < D_i$, i.e.

$$V_{0,i} e^{(\mu_i - \frac{1}{2}\sigma_i^2)T + \sigma_i B_{T,i}} < D_i$$

and in our case we know that $T = 1$. Since the portfolio is homogeneous we have that $V_{0,i} = V_0$, $D_i = D$, $\mu_i = \mu$ and $\sigma_i = \sigma$ for all obligors. Let $D = 130$, $V_0 = 180$, $\mu = 0.17$, $\sigma = 0.32$ and $\rho = 0.25$. Compute the one-year ($T = 1$) default probability $\bar{p}$, that is, find $\bar{p} = \mathbb{P}[V_{1,i} \leq D]$.

The probability $\bar{p}$ is

(a) ☐ 4.76%

(b) ☐ 8.25%

(c) ☐ 10.4%

(d) ☐ 13.6%

(e) ☐ None of the above

(f) ☐ Don't know

12 Consider a static credit portfolio with $m = 1000$ obligors which we model as mixed binomial model with a logit-normal mixing distribution (for one year, say) and where each loan have notional 1 million SEK and the individual loss is $\ell = 60\%$. We know that the one-year LPA-VaR formula produces the values $\mathrm{VaR}_{95\%}(L) = 101.4$ million SEK and $\mathrm{VaR}_{99\%}(L) = 285.8$ million SEK. Given this, compute the one-year $\mathrm{VaR}_{\alpha}(L)$ for $\alpha = 99.9\%$ with the LPA-VaR formula.

(a) ☐ 394 million SEK

(b) ☐ 437 million SEK

(c) ☐ 498 million SEK

(d) ☐ 526 million SEK

(e) ☐ None of the above

(f) ☐ Don't know

13 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 $\rho = 17\%$. 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 12 million SEK is 38.5%. Use the LPA-approximation formula to compute the probability that within one year, the total portfolio credit loss will be more than 88 million SEK.

(a) ☐ 2.7%

(b) ☐ 5.3%

(c) ☐ 7.8%

(d) ☐ 9.6%

(e) ☐ None of the above

(f) ☐ Don't know

14 For any mixed binomial model we will below 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. Let $p(Z) = \mathbb{P}[X_i = 1 \mid Z]$. Furthermore, we let $\mathrm{Corr}(X_i, X_j)$ denote the correlation between X_i and X_j for $i \neq j$ and $N_m = \sum_{i=1}^{m} X_i$ where m is the number of obligors in the portfolio.

Consider the following statements:

1 If $i \neq j$, then $\mathbb{P}[X_i = 1, X_j = 1] > \mathrm{Var}(p(Z)) + \mathbb{P}[X_i = 1]^2$.

2 In the mixed binomial model inspired by the Merton framework it holds that $\mathrm{Corr}(X_i, X_j) > 0$ if $\rho > 0$.

3 For fixed a and b (where $0 \leq a < b \leq m$) and fixed $\mathbb{P}[X_i = 1]$ the probability $\mathbb{P}[a \leq N_m \leq b]$ is increasing with increasing $\mathrm{Corr}(X_i, X_j)$ for $i \neq j$.

4 In the mixed beta binomial model with parameters a and b, $\mathrm{Corr}(X_i, X_j)$ decreases if a increases and b is fixed.

Which of the following is true?

(a) ☐ 1, 2, 4 are correct; 3 is wrong

(b) ☐ 3, 4 are correct; 1, 2 are wrong

(c) ☐ 2, 4 are correct; 1, 3 are wrong

(d) ☐ 2 is correct; 1, 3, 4 are wrong

(e) ☐ None of the above

(f) ☐ Don't know.

15 For any mixed binomial model we will below 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 $p(Z) = \mathbb{P}[X_i = 1 \mid Z]$ and $F(x) = \mathbb{P}[p(Z) \leq x]$ and m is the number of obligors in the portfolio.

Consider the following statements:

1 For a logit-normal mixing distribution with parameters μ and σ it must hold that $\mu > 0$ and $\sigma > 0$.

2 Let $U_1, U_2, \ldots, U_m$ be a i.i.d sequence where each U_i is uniformly distributed on $[0, 1]$ and independent of Z. For each $i = 1, 2, \ldots, m$ define Y_i as

$$Y_i = \begin{cases} 1 & \text{if } U_i \geq p(Z) \\ 0 & \text{otherwise, i.e. if } U_i < p(Z) \end{cases}$$

Then it holds that $\mathbb{P}[Y_i = 1 \mid Z] = p(Z)$ for each $i = 1, 2, \ldots, m$

3 In the mixed beta binomial model with parameters a and b, $\mathbb{P}[X_i = 1]$ increases if a increases and b is fixed.

4 If Z and $p(Z)$ are continuous random variables and if m is large then it holds that

$$\frac{\mathrm{ES}_\alpha(L)}{\mathrm{VaR}_\alpha(L)} \leq \frac{1}{F^{-1}(\alpha)} \quad \text{for all } \alpha \in (0, 1).$$

Which of the following is true?

(a) ☐ 1, 2, 4 are correct; 3 is wrong

(b) ☐ 1, 2, 3 are correct; 4 is wrong

(c) ☐ 2, 3 are correct; 1, 4 are wrong

(d) ☐ 3, 4 are correct; 1, 2 are wrong

(e) ☐ None of the above

(f) ☐ Don't know.