Master in Monetary and Financial Economics

Banking and Insurance

Exam – 29 January 2024

Time: 2h15m

1. Considering the following information about the performance of the Z-score model in a sample of 10 loans (0 corresponds to regular loans and 1 to defaults):

Loan Performance	Z-Score
0	21
0	19
0	14
1	10
0	8
0	6
0	5
0	4
1	2
1	1

1.1. Compute the Kolmogorov-Smirnov indicator and conclude about the model adequacy. (2,5/20)
- See spreadsheet

1.2. Characterize the magnitude of the type I and type II errors, the shape of the CAP and the ROC curves and the level of the accuracy ratio expected if the model exhibits a sound predictive power. (2,5/20)

- Type I and II errors must be of small magnitude with the CAP and ROC curves far from the main diagonal, with the AR closer to 1 than to 0,5

2. Considering the following information about the performance of a given loan portfolio:

Maturity (Years from today)	h_i	n_i
1	0	100
2	1	90
3	1	80
4	0	80
5	1	79

2.1. Compute the cumulative observed and Kaplan-Meier probabilities of default (being h_i the number of defaults during each year i and n_i the number of existing loans after defaults and redemptions at the end of each year). (2,0/20)
- See spreadsheet

2.2. Explain the main differences you may have found between both probabilities of default mentioned in the previous question. (1,5/20)

- There are differences since the 1st default occurs after the withdrawal of loans from the sample not due to default.

2.3. Compute the minimum spread to be charged in a 5-year loan to a company whose credit risk is measured by the adequate Kaplan-Meier probability of default previously obtained and assuming adequate assumptions for the parameters mentioned. (1,5/20)

- See spreadsheet

3. Consider the following 100 daily returns for the S&P 500 Index by increasing order (from the left to the right and from the top to the bottom), being the average return equal to -0,01%:

1st-20th	21st-40th	41st-60th	61st-80th	81st-100th
-2,51%	-1,10%	-0,46%	0,27%	1,04%
-2,24%	-1,09%	-0,40%	0,31%	1,08%
-2,23%	-1,05%	-0,35%	0,32%	1,21%
-2,19%	-0,99%	-0,30%	0,41%	1,26%
-2,12%	-0,98%	-0,25%	0,44%	1,27%
-1,98%	-0,90%	-0,22%	0,47%	1,29%
-1,84%	-0,85%	-0,18%	0,48%	1,40%
-1,80%	-0,83%	-0,14%	0,51%	1,46%
-1,55%	-0,78%	-0,12%	0,56%	1,48%
-1,52%	-0,78%	-0,08%	0,61%	1,54%
-1,50%	-0,74%	-0,07%	0,63%	1,67%
-1,44%	-0,71%	-0,05%	0,70%	1,76%
-1,40%	-0,67%	0,04%	0,77%	1,88%
-1,36%	-0,67%	0,05%	0,81%	2,06%
-1,25%	-0,65%	0,06%	0,86%	2,23%
-1,24%	-0,57%	0,16%	0,86%	2,29%
-1,22%	-0,54%	0,17%	0,92%	2,35%
-1,13%	-0,50%	0,19%	0,98%	2,36%
-1,11%	-0,49%	0,20%	0,99%	2,52%
-1,10%	-0,47%	0,24%	1,02%	3,13%

3.1. Using an empirical approach, compute the daily and annual relative and absolute VaR for a confidence level of 99% and a portfolio of 10 million €, interpreting the results obtained. (2,5/20)

- see spreadsheet

3.2. Describe alternative measures of Market Risk and explain how is the VaR related to the corresponding capital requirements. (2,5/20)

- ES - expected loss over an N-day period conditional on the loss being worse than the VaR, having replaced VaR as the market risk measure set by the BCBS for capital requirements, due to the improved ability to capture tail risks.

- stress tests

- Basel Committee set capital requirements for market risk based on VaR in 1996, as a conservative multiple (k) of the 10-day 99% VaR, being k a factor chosen on a bank-by-bank basis by regulators, with a minimum of 3, for additional risks not model by the usual VaR estimations – model risk – depending on the results of backtests.

4. Please consider the following information about static marginal gaps of Bank ABC (figures in Million €):

	<1week	1week-1month	1-3 months	3-6 months	6-12 months
Liquidity	100	-50	-200	300	400
Interest Rate	50	200	100	300	250

4.1. Characterize and assess the magnitude of these risks, identifying measures to tackle these risks. (2,5/20)

- Liquidity Risk: the risk of losing the ability to have enough cash to keep operating smoothly, while the bank is solvent. Sometimes, it is also referred to as rollover risk. The bank faces a negative cumulative gap from 1-3m onwards => there is a liquidity shortfall since those maturities, that the bank can overcome by redefining its funding plan, e.g. by decreasing the volume of credit, increasing bonds issues, deposits from customers or funding from the ECB.

- Interest Rate Risk – positive gaps mean that the bank is exposed to the risk of interest rate decreases. This risk can be mitigated by increasing fixed-rate assets or floating rate liabilities.

4.2. Characterize the main alternative indicators to assess liquidity risk and identify the relevance of the main roles performed by banks behind this risk. (2,5/20)

- regulatory ratios and elligible collaterals to obtain liquidity from the ECB. Banks face liquidity risk as they transform short-term liabilities (mostly deposits) into long-term assets (e.g. residential mortgage loans).