GRA 65131 Financial Risk Management

Exam component weight: 20% of GRA 65131

Term: Spring 2025
To be answered: In groups of 1-5
Answer paper size: 10 pages, excl. attachments, appendices, and figures/tables.
Number and type of attachments allowed: 1 .zip file.

Formal requirements: *No additional requirements.*

Financial Risk Management Spring 2025: Assignment 2

The assignment is to be handed in individually via WiseFlow. **There are four parts you need to hand in:**

1) The group work for this assignment, questions 1 to 7. Please list your group members IDs.

2) The individual work for this assignment, question 8. This should be appendix 1 to the main PDF submission, so part of the same file.

3) The group report you submitted for Assignment 1. This should be appendix 2 to the main PDF submission, so also part of the same file.

4) Any backup material for Assignment 1 (so what you previously submitted as backup) and backup material for Assignment 2. These should be submitted as a .zip file attachment.

The assignment is **due by Friday, May 2 by 1200 CET on WiseFlow**. You do not need submit the complete set of any provided data or your simulations, snippets of the data and simulations are sufficient. You need to submit enough such that a person with reasonable experience and knowledge could replicate your analyses. If submitting code, please submit it in its original form and not as a separate pdf (e.g., do not submit a PDF of python/R code, instead submit the python/R code in its native format).

There is no single correct answer and, so, I cannot judge the correctness of your analysis from only your results. I need to see all steps of your analysis with explanations and arguments as to why you performed your analysis the way you did. You will be assessed based on your discussion, intuition, and the accuracy and execution of your calculations. Using more complex methods can be beneficial but should not be done at the cost of poor execution. A wrong model is wrong 100% of the time, no matter how complex.

I hope you will find the assignment interesting and instructive, and the team work experience beneficial!

Motivation:

After hearing about the excellent work your team did on past engagements, you have been approached by the risk-management team at a medium sized US-based bank that has recently purchased a series of new automobile subprime loans. Given concerns regarding tariffs, interest rates, and automobile prices, they would like an outside opinion on their current risk management practices regarding the credit and liquidity risk of this loan profile. In light of recent market events; they would like a rapid analysis of their new loan portfolio.

The bank recently entered into this portfolio of loans in order to broaden their base of business. However, given recent losses by competitors coupled with increased pressure from potentially losing depositors if they are deemed too risky, the senior management is highly interested in understanding if a large degree of credit failures in their loans will expose them to significant risks.

Using the attached information, they would like you to report on various aspects of their potential exposures and risk-management. Their main concern is that a failure of the loan portfolio could present significant risks to their own balance sheet and cause them potentially high losses. However, they would like to understand the interactions between their loan performance, liquidity trading and funding risks, and potential risk management options. They would also like you to provide an overview of some of the issues that they face as well as recommendations/guidelines, which they can then use in a report to their board of directors.

Assumptions

1. **The bank has their own methodology for forecasting interest rate scenarios. They have provided you with 10 000 simulations for each month over the next five years (the maturity of each of the loans). Therefore, you can use these in the valuations of the loans. The forecast is done using the Cox-Ingersoll-Ross model, and calculated to match the remaining maturity for the loans in question. In addition, the bank has provided the underlying factor shocks used to generate each of the simulations.**
2. **If needed you can assume the current risk-free rate is 4.28% for 1-month and 4.4006% for 5-years.**
3. **You can ignore any relationship between the loan portfolio and the rest of the bank's assets and liabilities. Thus, your analysis should focus on this loan portfolio. The bank has provided you the characteristics of the loans including their principal, maturity, yield, fixed monthly payments (includes amortization), expected monthly default probabilities, and expected annualized default probabilities. You can assume there are no pre- or early payments.**
4. **You can assume a recovery rate of 40% on the loans.**

Support Materials:

As noted the bank has provided their forecasts of simulated interest rates as well as the factor underlying those forecasts, information on the loan portfolio, as well as information on CDS spreads for a potential derivatives dealer, and the historical proportional bid-ask spreads on a proxy portfolio estimated from ABS.

A member of the bank's team has agreed to provide a set of information sessions for your team to ask questions. These will be arranged separately.

Questions

1. **Calculate the exposure the bank has on the loan portfolio given the interest rate forecast simulations. For each month for each forecast simulation, you should calculate the value of the loan portfolio. Since these are fixed payments, you can utilize the standard annuity formula based on the provided interest rate simulation for each loan and then sum across the loan portfolio to get the total exposure. (7.5%)**

2. **Simulate a series of potential defaults for each of the interest rate forecasts. For the purposes of this analysis, you can assume the correlation between the interest rate factor and the underlying loan defaults are 0.39. You are welcome to make any additional assumptions you need, but should note these in your analysis. (10%)**
    a. **Using your simulated defaults, calculate the total accumulated number of defaults for each month for each simulation. (Hint this should be a 60 x 10 000 matrix).**
    b. **Using the simulated defaults, calculate the total accumulated credit losses on the loans. The credit loss is the exposure on the loan x (1-Recovery Rate).**
    c. **For each month calculate the 99% VaR, expected loss, and total value of the loan portfolio (assuming no defaults). Discuss these results.**
    d. **Describe whether the bank has right-way or wrong-way risk in the context of its loan portfolio.**

3. **Now assume an investment bank (derivative dealer) approaches you with the following derivative: (10%)**
    a. **The cost of the derivative is calculated to be that the bank will buy the loan portfolio at its default free value if the cumulative losses exceed 15% of the portfolios value in the given month. For simplicity you can assume the discount rate for the payoff is the current 5-year risk-free rate. Calculate the expected cost of the derivative.**
    b. **The benefit of the derivative is that the bank buys the loan portfolio at 95% of its default free value. Thus, the total loss for the bank will be just the 5% haircut the derivative seller takes as its spread. For simplicity you can assume the discount rate for the payoff is the current 5-year risk-free rate. Calculate the value of this benefit for the bank.**

4. **Now the bank is also concerned about counterparty risk on the derivative. Using the provided CDS information for the investment bank, calculate a CVA for the benefit, you can assume the recovery rate for the investment bank is 60%. (5%)**
    a. **Explain a CVA and why it might be a useful calculation for the bank to take into account.**
    b. **Taking into account the CVA what is the total cost of the bank entering into the derivative (i.e., the Cost – benefit + CVA)?**

5. **The bank has to meet minimal capital requirements depending on the potential losses of its credit portfolio. Assume that if the accumulated losses on the loan portfolio exceed 15%, that the bank must raise additional capital for all losses greater than 15%. The cost of additional capital is 8% (i.e., the cost would be the loss > 15% of value x 1.08). (7.5%)**
    a. **What is the expected and 99% worst case additional cost of this funding liquidity for the bank for each month? You should use your calculations and simulations from above.**
    b. **Given this analysis, discuss whether the bank should purchase the derivative offered?**

6. **The bank would also like to understand the liquidity of the portfolio. Specifically, the bank would like to know the cost of liquidating its portfolio for each month. You have been provided a historical series of bid-ask proportional spreads for an automobile loan ABS that you can use as a proxy for the transaction cost of selling the loan portfolio. (5%)**
    a. **What is the expected cost to unwind/liquidate the loan portfolio? You can assume the bank would liquidate the remaining value of the loan portfolio in a given month (so risk-free value - accumulated losses from defaults).**
    b. **What would the cost be in a stressed environment (e.g., at the 99th percentile of spreads)?**
    c. **If you wanted to model a correlation between the loan portfolio value and the bid-ask spread how would you do it? Why might this be something that would be a concern? You do not have to model this, just discuss.**
    d. **Discuss briefly whether ABS spreads are an appropriate proxy for liquidation costs of a portfolio of individual automobile loans and why.**

7. **Provide some overall recommendations to the bank's risk management team. (2.5%)**
    a. **Given your estimates, is the bank facing substantial credit risks, should they hedge them, what type of liquidity risks is it facing?**
    b. **What other types of risks should they consider when evaluating their risk management practices, especially in light of recent swings in the market?**
    c. **How could they avoid counter party risks? What about liquidity risks?**

8. **Individual Question: Comment and reflect on your own experiences with these assignments (approximately 1 page). Your discussion should include: (2.5%)**
    a. **What you have contributed to your group, this can include things such as writing, coding, discussion, etc. Be specific about your contributions. In addition, if you individually felt that group members did not participate adequately, then this is your opportunity to say so (this will be kept confidential).**
    b. **What you have learned over the course of the two assignments. Be specific about the specific topics and/or provide examples.**
    c. **If you feel your understanding of applications of risk management have grown and why or why not?**