LabRM 2 - Group 14

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1 Questions, First part

We started by evaluating the Present Value of a single investment grade (IG) in a years' time using the Creditmetrics approach. First, we determined the zero-coupon rates for both 1y and 1.5y using the interp1 function. Next, we used the rating transition matrix and forward discounts in order to compute the forward value of the bond under each simulated rating.

IG	HY	Default
100.51	98.42	40.00

Table 1: 1y fwd price for a given risky bond

Lastly, in order to compute the Present Value in a years' time, we calculated the mean of these forward values by weighting them according to the probabilities of being in each state after one year. Our result is 99.76.

Then, we proceeded by evaluating the one-year and 99.9% VaR. We computed the barriers to default and downgrade, along with the associated losses for each state. To further assess risk, we employed MonteCarlo simulation to generate standardized Asset Value Returns (AVRs), using the formula $v_i = \rho_i \cdot y + \sqrt{1-\rho_i^2} \cdot \epsilon_i$. We then tracked the occurrence of various scenarios (such as default or downgrade) and used these frequencies to evaluate the 1y and 99.9% Value at Risk. We considered defaults only and then both defaults and migrations assuming correlation $\rho = 0$ (independent issuers).

	Default Only	Default & Migration
VaR	1.49	1.25

Table 2: VaR with correlation $\rho = 0$

2 Questions, Second part

As in previous section, we computed the VaR by taking into account the case defaults and migration, considering 200 issuers, but under three different correlation values and obtained:

AVR correlation	VaR Default & Migration
$\sqrt{0.12}$	4.09
$\sqrt{0.24}$	7.40
$\sqrt{0.213}$	6.68

Table 3: VaR D&M, 200 issuers

We can observe that as the correlation increases, the VaR also tends to increase.

3 Questions, Third part

This time we considered only 20 issuers instead of 200, in order to assess concentration risk. As before we computed:

AVR correlation	VaR Default & Migration
$\sqrt{0.12}$	6.97
$\sqrt{0.24}$	9.79
$\sqrt{0.213}$	9.58

Table 4: VaR D&M, 20 issuers

As a portfolio becomes more concentrated, the associated Value at Risk (VaR) tends to increase.

4 Discussion

Inclusion of migration risk at very high confidence level (e.g., 99.9%) has no material impact on VaR measurement if the portfolio is well diversified. False: Migration risk refers to the possibility that an issuer's credit rating changes (upgrades or downgrades) over time. When calculating Value at Risk (VaR), considering migration risk is crucial, especially at high confidence levels, since high-confidence VaR accounts for extreme scenarios, and migration risk can lead to unexpected losses. Even in a well-diversified portfolio, migration risk can significantly impact VaR.

Portfolio VaR is very sensitive to asset correlations. True: Portfolio VaR depends heavily on asset correlations. Correlations determine how assets move together during market stress. High correlations amplify portfolio risk because losses tend to occur simultaneously. Low correlations enhance diversification benefits, reducing overall portfolio risk.

Inclusion of migration risk causes an increase in VaR under any correlation assumptions. False: The impact of migration risk on VaR depends on correlation assumptions: Negative Correlation: If migration risk leads to downgrades during market downturns, it may reduce VaR (as bonds become less correlated with equities). Positive Correlation: If migration risk coincides with market stress, it can increase VaR (as bonds and equities move together). Neutral Correlation: In some cases, migration risk may have minimal impact on VaR.

A Credit Portfolio Model is not sensitive to concentration risk if it is based on a single systematic factor. False: Even if it is based on a single systematic factor, a Credit Portfolio Model would still be sensitive to concentration risk. This is because concentration risk arises from large exposures to specific issuers.