# MFE 409: Financial Risk Management
# Problem set 6

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Due 5/25 before midnight

You should work with your assigned group but should write up your answer individually. Give the name of your group memebers in your writeup and post it on CCLE before Monday May 25 at midnight.

## 1 Risk management and regulation after the 2008 Financial Crisis

Each study group is assigned to a bank as follows and reponsible for summarizing their risk management policies. Your group number can be found in the attached list.

| Group | Bank |
|---|---|
| 1 | Goldman Sachs |
| 2 | UBS |
| 3 | JP Morgan Chase |
| 4 | Citigroup |
| 5 | Barclays Capital |
| 6 | Morgan Stanley |
| 7 | Deutsche Bank |
| 8 | Bank of America |
| 9 | BNP Paribas |
| 10 | Credit Suisse |

Download their 2009 and most recent annual reports (10-K for US firms and 20-F or 6-K for foreign firms) from SEC's website (https://www.sec.gov/edgar/searchedgar/companysearch.htm Write a short essay describing the approach of the bank is following for risk management. In particular, describe how it computes the various risk measures to respect the Basel regulations.

## 2 Bootstrapping a CDS curve

1. Recover the hazard rate curve from slide 15 of the notes.

2. Use this hazard rate curve to price a 6-year bond on the same company which pays 3% coupon every 6 month and has face value \$100.

## 3 Historical vs bond-implied hazard rates

Explain the patterns you see in the table on slide 16 of the notes.

## 4 *Optional:* Dynamic credit model

Consider 8 categories: AAA, AA, BBB, BB, B, CCC and default. We are interested in constructing a stochastic dynamic model of rating and default in continuous time. For this we will use the information in slide 7 of the notes.

1. Let us call $P(t)$ the $8 \times 8$ matrix of transition probability after time $t$. This means that $P_{ij}(t)$ is the probability of being in category $j$ at date $t$ if the firm is in category $i$ at date 0.

   (a) What is $P(0)$?

   (b) What is $P(1)$?

2. Just like we defined the hazard rate has the instantaneous probability of default, we can consider instantaneous transition probability $\lambda_{ij}$ such that $\lambda_{ij} dt$ is the probability of going from rating $i$ to rating $j$ during an interval $dt$ if $i \neq j$. When $i = j$, we define $\lambda_{ii}$ as the opposite of the intensity of leaving state $i$: $\lambda_{ii} = -\sum_{j \neq i} \lambda_{ij}$. We can put all these in a matrix $\Lambda$. Express $\Lambda$ as a function of $P$ and its first derivative.

3. Assuming that $\Lambda$ is constant over time, derive an expression relating $P(1)$ and $\Lambda$.

4. Compute $\Lambda$ for the values of slide 7.

5. Use this matrix $\Lambda$ to compute the probabilities of default at horizon 1, 2, 3, 4, 5, 7, and 10 years given each initial rating.

6. Compare your results to slide 6 of the notes. What can explain the similarities and differences?

7. Use this model to price a 6-year bond on a BBB company which pays 3% coupon every 6 month and has face value \$100. Assume that the risk-free interest rate is 0% and recovery is 60%

8. Compute the 3, 5, and 10-year CDS spreads for the same company.