

Tutorial 5

Risk Modeling and Bank Steering

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An Excel version of the correction is available here: http://defaultrisk.free.fr/tutorials/ENPC_CreditRisk_Lecture5_Tutorial.xlsx.

Exercise 1: Going through the Credit Risk Weighted Assets formula.

We saw in class that the Credit Risk Weighted Assets formula is:

$$RWA = LGD \times \left(\Phi \left(\frac{\Phi^{-1}(PD) + \sqrt{\rho}\Phi^{-1}(0.999)}{\sqrt{1-\rho}} \right) - PD \right) \times MA \times SF \times MCR \times EAD$$

1. What does $LGD \times PD$ represent?
2. We recall that the Vasicek model states that:

$$L | F \sim (1 - R)\Phi \left(\frac{\Phi^{-1}(PD) - \sqrt{\rho}F}{\sqrt{1-\rho}} \right)$$

with R , the recovery rate, ρ the correlation factor, F a normalized centered Gaussian parameter that can be considered as a systemic factor.

How can the following part of the Credit Risk Weighted Assets formula can be interpreted?

$$LGD \times \Phi \left(\frac{\Phi^{-1}(PD) + \sqrt{\rho}\Phi^{-1}(0.999)}{\sqrt{1-\rho}} \right)$$

3. We recall that in the Internal Ratings-Based Approach (IRBA), the bank must estimate PD , EAD and LGD , but not ρ . The correlation parameter ρ is indeed imposed by the regulator but its value depends on the counterparty of the studied contract:

Type	Value for ρ
Large Corporates Institutions	$0.24 - 0.12 \times \frac{1 - e^{-50 \times PD}}{1 - e^{-50}}$
Small and Medium Enterprises with turn over < 5 MEUR	$0.20 - 0.12 \times \frac{1 - e^{-50 \times PD}}{1 - e^{-50}}$
Small and Medium Enterprises	$0.24 - 0.12 \times \frac{1 - e^{-50 \times PD}}{1 - e^{-50}} - 0.04 \times \left(1 - \frac{T-5}{45} \right)$
Residential Mortgages	0.15
Revolving	0.04
Other retail exposure	$0.16 - 0.13 \times \frac{1 - e^{-35 \times PD}}{1 - e^{-35}}$

- a. Let us define $f(\alpha, x) = \frac{1 - \exp(-\alpha x)}{1 - \exp(-\alpha)}$: study how $f(\alpha, x)$ evolves for any given value of (α, x) in Excel.
- b. In each case, show that the correlation is bounded and give the boundaries.

c. For an exact same contract, with different contractor types, in which cases are the Credit Risk Weighted Assets formula advantageous?

4. MA , the maturity adjustment is equal to:

$$MA = \frac{1 + (M - 2.5) \times b}{1 - 1.5 \times b}$$

with $b = (0.11852 - 0.05478 \times \log(PD))^2$ and M the maturity of the studied loan, bond, contract in general.

a. Plot MA for M between 0 and 5 years and $PD = 0.2\%$ and $PD = 4\%$.

b. Plot MA for PD between 0 and 5 % and $M = 3$.

c. According to you, where does b 's formula come from?

5. SF is called the Scaling Factor and is a regulatory coefficient equal to 1.06: what can you say about it?

6. MCR is the Minimal Capital Requirement and is equal to 12.5. According to you, where does this value come from?

Exercise 2: The study of Simple Bank.

The purpose of this exercise is to compute the RWA, the ROE, RAROC, WACC, EVA 1, EVA 2, RARORAC 1, and RARORAC 2 of Simple Bank.

In the balance sheet of the bank, the liabilities are:

- the equity that amounts to 70 kEUR and for which the shareholders expect a 10 % return on their equity;
- the long term debt that represents 300 kEUR, and for which the interest rate is 0.8%;
- the deposits, that amount to 971.5 kEUR and do not bear interests.

In the balance sheet of the bank, the assets are:

Detail	Maturity	Nominal	Credit score	Recovery Rate	Interest Rate
Residential Mortgage to Ms Henry	15	157 000	1	75%	1.70%
Residential Mortgage to Mr Martin	12	245 000	3	67%	6%
Loan to Marinot Inc.	3	100 000	2	10%	1.20%
Loan to Total SA	4	800 000	1	80%	1.10%
Revolving to John BODIT	2	1 500	4	25%	10%
Consumer Loan to Sylvie BATIN	1.5	38 000	5	30%	11%

Last year, Marinot Inc.'s revenues were 19 MEUR.

1. What are the Risk Weighted Assets of Simple Bank? We will assume Simple Bank has no market exposure and an operational RWA equal to 1,9 kEUR.

2. Is Simple Bank compliant with Basel III?

3. The Net Income of Simple Bank is 2.1 kEUR, what is its Return On Equity?

4. What is Simple Bank RAROC?

5. The purpose of this question is to take into account the cost of capital in the measurement of the return of Simple Bank.

a. What is Simple Bank WACC?

b. What is Simple Bank EVA1 and EVA2?

c. What is Simple Bank RARORAC1 and RARORAC2?

The credit scores used by Simple Bank correspond to the following probabilities of default:

Credit Score	PD
1	0.20%
2	0.80%
3	4.00%
4	18.00%
5	100%