Credit Risk
Module 6, 2022-23

Lecturer: Carsten Sprenger
csprenger@nes.ru

TA: Gennady Ivanov
givanov@nes.ru

Course description

This course gives an introduction to commonly used models of credit risk. Credit risk is the risk of loss when a debtor fails to honor a financial obligation. We study models of default risk of a single counterparty, which we then extend to the case of portfolios of bond or loans. The major complication with portfolios is default dependence. A widely used tool to deal with it, Copula distributions, is introduced. We briefly present the current regulation of credit risk in the Basel III Accord. Finally, we introduce devices to mitigate credit risk, in particular credit derivatives, and learn how to price these instruments.

I have designed the course to strike a balance between a practical approach to the most popular credit risk models and their theoretical underpinnings. I will present class examples for particular problems that will use R as a programming tool. Your weekly homework consists in the completion of the tasks that we start working on in class. Even though you are free to use other languages (Python, Matlab, Mathematica etc.), I would strongly encourage you to use this opportunity to learn R since it adapts well to the data-driven tasks, econometrics, modeling and simulations.

The course will also include one case study where you need to put together various parts of knowledge that you obtained. A set of review questions that I will give you towards the end of the course will help you to prepare for the exam.

The course gives you a good preparation for the credit risk parts of the Financial Risk Manager® and Professional Risk Manager™ Examinations provided by the professional risk manager associations GARP and PRMIA, respectively. Both certificates are valuable assets on your CV if you aim at a career in the banking sector.

Course requirements, grading, and attendance policies

Requisites: Risk Management, Derivatives.
Attendance: Not mandatory, but highly recommended. Even though I provide you with lecture slides, there are many examples and in depth-explanations that I will only give in class.
Grading: Your final grade will be composed of the following parts:
- Homework assignments involving programming (20%)
- Case study (15%)
- Final exam (65%)

You need to get a passing grade (≥35%) both for the whole course and in the final exam.

Course contents

(The indicated chapter numbers refer to the readings given in the next section.)
1. The elements of Credit Risk [H 19.2, 19.3, DS 1, 2.4-2.5]
- Introduction, outline and literature
- Definition, market vs. credit Risk
- The elements of credit risk: Default, exposure, and loss given default (or recovery)

- The loss distribution
- Expected loss, VaR, unexpected loss, and expected shortfall.

2. Credit exposure [H 20]
- Pre-settlement and settlement risk
- Measures of exposure, exposure profiles
- Credit value adjustment (CVA)
- Wrong-way and right-way risk

3. Models of Single Counterparty Default Risk [H 19.1, 19.6-19.8, 21.1, 21.4, DS 3-4]
- Scoring, logit and probit
- Credit ratings
- Rating-based models: CreditMetrics
- Default rates implied from bond prices
- Default rates implied from equity prices: Asset-based (structural) models (Merton and KMV models)
- Intensity-based (reduced-form) models

4. Modelling Default and Recovery: Portfolio Models [H 21.2-21.4, 11.4, 11.5, DS 10]
- Asset return models, correlated Defaults and CreditMetrics for portfolios
- Introduction to Copula distributions
- Vasicek model of correlated defaults

5. Economic capital and regulatory capital [H 15, 16, 26, SA 3, 13, DS 2.5]
- Economic capital
- Short history and current provisions of the Basel Accord
- Calculation of capital charges and main regulations of Basel II and Basel III

6. Credit risk management [H 19.4-19.5, 6.2, DS 8]
- Exposure mitigation: Netting, collateral, limits, guarantees
- Credit derivatives
    o Single-name credit default swap (CDS): mechanics and pricing
    o Basket CDS
    o Collateralized debt obligations
- Harvard case no. 9-203-033 (First American Bank: Credit Default Swaps by Chacko and Strick, 2002)

Course material

Required textbooks and materials
- Lecture slides will be provided to students in electronic form.
- Hull, John C. (2015), Risk Management and Financial Institutions (4th edition), Pearson (or 5th edition, 2018), (short: H)

Additional materials
- Bolder, David J. (2018), Credit-Risk Modelling – Theoretical Foundations, Diagnostic Tools, Practical Examples, and Numerical Recipes in Python, Springer.
- Duffie, Darrell and Kenneth J. Singleton (2003): Credit Risk, Princeton UP (short: DS).
- Jorion, Philippe (2011): Financial Risk Manager Handbook, Wiley.
- Löffler, Gunter, and Peter N. Posch (2012), Credit Risk Modeling using Excel and VBA, Wiley, 2nd edition.
- Witzany, Jiri (2017), Credit Risk Management – Pricing, Measurement, and Modeling, Springer.

Academic integrity policy

Cheating, plagiarism, and any other violations of academic ethics at NES are not tolerated.