The University of Chicago Financial Math 36702

Portfolio Credit Risk: Modeling and Estimation

Spring 2023

Syllabus

**Description**

The global credit crisis of 2008 taught that credit loss can destroy financial institutions that had previously seemed secure. Students in Portfolio Credit Risk learn the models used to analyze this risk, to limit positions in credit-sensitive instruments, to allocate costs to align with risk, and to determine required minimum bank capital. Beyond these applications, portfolio credit risk provides tools and insights that can be used in situations when available data is sparse.

**Prerequisites**

Required: Linear Algebra

Probability and Statistics

FINM 36700: Portfolio Theory and Risk Management I

Recommended:\* Regression Analysis

Markets and Investments

Programming in Python

\*Financial Math students cover the recommended prerequisites in the September Academic Review.

**Staff**

Instructor: Jon Frye [jonfrye@uchicago.edu](mailto:jonfrye@uchicago.edu)

TA: Lisheng Su [Lisheng@uchicago.edu](mailto:Lisheng@uchicago.edu)

Grader: Davide Negri [davidenegri@uchicago.edu](mailto:davidenegri@uchicago.edu)

**Lectures**

Five Thursdays, 23 March 2023 through 20 April 2023, 6:00-9:00pm Chicago Time,

Kent Chemistry Laboratory, 1020 E 58th St, Chicago, IL 60637; north side of the Main Quad.

**Help**

Office hours: 3PM-5PM before class on Stevanovich third floor by appointment

**Course Materials** are maintained on Canvas: **https://canvas.uchicago.edu/courses/48373**.

**Announcements**: Announcements handle errors in lectures, clarifications about homework questions and other matters. Students are responsible to take the actions called for in Announcements.

**Modules**: There is one Module for each week. A Module contains the lecture slides, optional readings, and other items. The lecture slides are the principal reference for this course.

**Assignments:** Each week, a homework assignment becomes available on Canvas after the class session ends. That assignment is due on Canvas at 6pm before class starts the following week. Late submissions are graded like others, but the score is penalized 50% the first 24 hours and 100% afterwards. Submit early to be safe.

Students must complete their own homework submissions. It is of course OK for students to discuss questions with each other, but if there is copying of answers or parts of answers, this would become a matter for Department and Division discipline.

The purpose of the homeworks is to prepare a student to do well on the final exam. No student has performed well on the exam who had a poor record of homework performance.

**On-line sessions:** Teaching Assistant Lisheng Su conducts five optional on-line sessions on Sundays beginning at 6PM Chicago Time. The principal topics of the on-line sessions are

* questions and guidance on course content
* approaches to solving the current homework
* in-depth review and discussion of previous homework

If there are topics you would like Lisheng to address, please Email him in advance if possible. A recording of each session is posted to Canvas afterwards.

**Final exam**

The final exam takes place from 6:00 to about 7:30 on Thursday April 27 in Kent 107. You must pass the final exam to pass the course.

* You must bring your University of Chicago photo ID to the exam.
* You cannot use books or written notes of any kind.
* You cannot use any electronic gear.
  + This includes everything: No laptops, tablets, cell phones, or calculators
* Any violations will be treated as serious.

**Grades**

Subject to (mostly favorable) discretion, 84% of the final grade stems from the final exam and 16% stems from homework. Meredith Muir handles requests for Pass/Fail grading.

**Course Topics**

The tangled world of debt, default, and loss

Stylizing default and loss given default

The need to connect the defaults of firms

Correlations of variables and correlations of events

The Central Limit Theorem and the Gauss copula

Other distributions and other copulas

Distributions of functions of random variables

The simplest non-trivial Gauss copula: The single risk factor model

The conditionally expected default rate and its distribution

The distribution of defaults in a finite uniform portfolio

“Basel” global standards for minimum bank capital

Multiple risk factors and portfolio diversification

Multistate models and transition matrices

Review of maximum likelihood estimation and hypothesis testing

How standard techniques mislead credit loss modelers

Credit loss modeling weak spots

Parameter value estimation weak spots

Vended estimates of PD

Vended estimates of correlations

The loss given default (LGD) rate

Expected LGD and conditionally expected LGD

The existence of an LGD function of the default rate

The simplest known LGD function

Testing the simple LGD function

Use of the LGD function in Federal Reserve stress tests

Beyond data and models: the analysis of forecasts

The effect of significance testing on forecast quality

The effect of model specification search on forecast quality

The effect of serial dependence on forecast quality

The effect of overfitting on forecast quality

Applications of the course tools beyond portfolio credit loss

**Biography**

Jon Frye is known both as speaker and as the author of articles on market risk and credit risk modeling. Before his career at the Federal Reserve Bank of Chicago, he developed risk management systems at large Chicago banks. Dr. Frye holds a Ph.D. in Economics from Northwestern University.