

Math 575: Market and Credit Risk Models and Management

Spring 2020

WPI

Professor: Marcel Blais
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Office Hours: Managed in Canvas

By Appointment

Class Info: Tuesday & Thursday, 4:00pm – 5:15pm, SH 306
Canvas will be used to manage the course details.

Text: *Quantitative Risk Management. Revised Edition*, by Alexander McNeil, Rudiger Frey, & Paul Embrechts, ISBN 978-0-691-16627-8

Overview: The objective of the course is to familiarize students with the most important quantitative models and methods used to measure and manage financial risk, with special emphasis on market and credit risk. The course starts with the introduction of metrics of risk such as volatility, value-at-risk, and expected shortfall and with the fundamental quantitative techniques used in financial risk evaluation and management. The next section is devoted to market risk including volatility modeling, time series, non-normal heavy tailed phenomena, and multivariate notions of codependence such as copulas, correlations, and tail-dependence. The final section concentrates on credit risk including structural and dynamic models and default contagion and applies the mathematical tools to the valuation of default contingent claims such as credit default swaps, structured credit portfolios, and collateralized debt obligations. (Prerequisite: knowledge of calculus-based probability & MA 571.)

Grading: The final grades will be computed using:
HW & Projects 75%
Midterm Exam 25%

Computing: Some assignments, including projects, will require computing resources. MATLAB, Python, Microsoft Excel, and Bloomberg will be used. Students will use paper trading accounts provided by Interactive Brokers LLC.

Exams: Midterm Exam, Thursday March 5, In Class

Make-up Exam Policy:

Make-up exams will only be allowed in the event of a documented emergency. You are responsible for avoiding conflicts with the exam and final presentations. Do not plan to leave campus for the semester before the midterm or final class.

Homework: There will be regular homework assignments. Students are allowed to work together on homework assignments, but solutions must be written up independently.

Projects: There will be multiple projects assigned. Students will work in groups of 2 for all projects. These will be implemented using Excel, Python or MATLAB, Bloomberg, & the Interactive Brokers paper trading account. Students will be required to present project results.

Late HW: Late assignments without prior consent of the professor will not be accepted and will receive a grade of 0. Extensions will be granted only in the event of unforeseen emergencies or extenuating situations that you discuss with the professor in advance.

**Capstone:
Option** This course can be used as a capstone course for the Financial Mathematics M.S. degree. Inform the instructor in the beginning of the course if you would like to take MA 575 as a capstone course. This requires instructor approval and depends on many factors. Extra work will be assigned for this option.

Additional References:

- *Risk Management and Financial Institutions*, by John C. Hull, ISBN 978-1-118-26903-9
- *Statistics and Finance: An Introduction*, by David Ruppert, ISBN 0-387-20270-6
- *Statistics and Data Analysis for Financial Engineering*, by David Ruppert, ISBN 978-1-4419-7786-1
- MATLAB materials: <http://www.cs.cornell.edu/courses/cs99/2003su/>

Writing Center: Located in Salisbury Labs 233, the Writing Center is a valuable resource for helping you improve as a writer. Writing Center tutors are your peers (other undergraduate and graduate students at WPI) who are experienced writers themselves and who enjoy helping others tackle thinking/writing challenges. Although a single tutoring session should never be seen as a quick fix for any writing difficulty, these sessions can help you identify your strengths and weaknesses, and teach you strategies for organizing, revising, and editing your course papers, projects, and presentations. Writing Center services are free and open to all WPI students in all classes, and tutors will happily work with you at any stage of the writing process (early brainstorming, revising a rough draft, polishing sentences in a final draft). Visit the Writing Center website <wpi.edu/+writing> to make an appointment.

**Academic
Honesty:**

WPI has an established academic honor code, described in *The WPI Student Judicial Policies and Procedures*. Each student is expected to familiarize him/herself with WPI's Academic Honesty policies which can be found at <https://www.wpi.edu/about/policies/academic-integrity> .

All acts of fabrication, plagiarism, cheating, and facilitation will be prosecuted according to the university's policy. If you are ever unsure as to whether your intended actions are considered academically honest or not, please see Prof. Blais.

Disability

Students with disabilities who need to utilize accommodations in this class are encouraged to contact the Office of Disability Services (ODS) as soon as possible to ensure that such accommodations are implemented in a timely fashion. This office can be contacted via email: DisabilityServices@wpi.edu, via phone: (508) 831-4908, or in person: 124 Daniels Hall. If you have approved accommodations, please request your accommodation letters online through the [Office of Disability Services Student Portal](#).

You can find more background and useful links on the ODS website at <https://www.wpi.edu/academics/faculty/disability-services>.

This syllabus is subject to change at the instructor's discretion