

FinTech 590 – Quantitative Risk Management

Synopsis

Quantitative Risk Management offers a hands-on introduction to the science and implementation of risk analytics. Topics include probability theory, regression and time series analysis, risk metrics such as Value at Risk and Expected Shortfall, derivative valuation methods, stress testing and scenario analysis, factor models, and portfolio construction and optimization.

Each week students will be expected to implement topics learned in either the C/C++, Python, or Julia programming language. This weekly project will test students' knowledge of the theory and their ability to solve real world risk management problems. In the final 3 weeks of the semester, students will work to consolidate their code into a risk management software platform. They will use that platform for the final exam.

Success in the risk management industry rests not just on good analysis, but also the ability to present results. Besides grading for correct answers, a component of the weekly grade will rest on the student's presentation of results.

Class Schedule

The class schedule is tentative and subject to change.

Date	Topics	Weekly Project
1/5/2022	Introduction, Course Syllabus and Expectations, Review Univariate Statistics	No
1/10/2022	Multivariate Statistics, Regression Models, Time Series	Yes
1/17/2022	No Class	
1/24/2022	Financial Data -- Common issues, Monte Carlo Methods	Yes
1/31/2022	Value at Risk, Delta Normal, Historical, Simulated	Yes
2/7/2022	Non-normal Monte Carlo, Gaussian Copula, Other risk measures	Yes
2/14/2022	Portfolio Construction and Risk. Factor Models, Risk Budgets, Optimization	Yes
2/21/2022	Forward Curve Construction, Rates, FX	Yes
2/28/2022	Bond Valuation, Derivatives – Futures, Forwards, and Swaps	Yes
3/7/2022	No Class	
3/14/2022	Options, Valuation Methods and Greeks	Yes
3/21/2022	Scenario and Stress Testing, Credit and Other Types of Risk	No
3/28/2022	Speaker	No
4/4/2022	Speaker	No
4/11/2022	Speaker	No
4/18/2022	No Class	
4/25/2022	Final	

Grading

Final grade will be calculated as

- 60% weekly projects
- 40% final exam

Weekly Projects

Each week students will be assigned a project testing and expanding on their knowledge from the topics presented up to that week. Projects will include data and questions – students are expected to analyze the data and present their findings.

Projects will be due electronically by 8am Saturday following the class. Students are expected to turn in the following

1. A paper in PDF format answering the questions presented.
2. A PowerPoint Slide Deck summarizing their results.
3. Code and other files used to create results.

Each week 1 or more students will be called upon to present their PowerPoint slides. Verbal presentation and defense of results will not harm the student's grade, but an excellent presentation can add bonus points. If a student feels strongly that they would like to present, please let me know prior to class (preferably on Saturday when you turn in your work).

Projects will be graded on a 10 point scale. 8 points will be awarded based on the paper and slide deck demonstrating a mastery of the subject matter. 2 points will be awarded based on clear and concise code.

The paper and slide deck must contain all findings and opinions and present them in a logical manner. Graphs, and tables are useful tools for presenting ideas. In the professional world, you will often be one of the smartest people in the room, and you will likely be the most knowledgeable on topics you present. Communication is key. Remember that not everyone has your knowledge, so present the logic behind a stated fact or opinion.

You must write good, well documented, code that someone else can read and follow. In practice, code you write will often be passed to others. Each week, I will attempt to run a select group of students' code. You must provide instructions on running your code and replicating your results.

In the professional world, your code will often outlive your time on a project. Your ability to write programs that can be picked up by others is a highly valued skill.

Code must be written in the C, C++, Python, or Julia programming languages. If a student wishes to use another language, it must be approved by the instructor first. Students can also use applications such as Excel for the creation of tables and charts. However, all analysis must be done in code.

Students are encouraged to work with their classmates on these weekly projects. Peer feedback is crucial to finding and filling the logical gaps in your arguments and to better understanding the topics. However, all work products must be the student's own. Sharing of code libraries (outside of libraries publicly available) is not permitted.

Final Exam

Prior to the final exam, students will have compiled a library of risk management analysis routines. These routines will be the culmination of the weekly projects.

The final exam will include data and questions. Students will use their libraries to analyze the data and answer the questions. Some questions will require discussion. The more complete and easy to use the analytic library, the more time the student will have to answer discussion questions.

Office Hours

I will not have set office hours. I will be available to meet with students on an as needed basis. Please email me with questions. I will attempt to answer via email. If needed, we will set up a time to meet in person to discuss.