



PPHA 42525 FINANCIAL RISK MANAGEMENT TOOLS

DRAFT SYLLABUS

Fall 2026

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Office hour: TBD

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Lecture time: Monday, Wednesday | 10:30am-11:50am

TA session: Friday | 2:30pm-3:20pm

COURSE SUMMARY

This course is for students who have taken a finance course (or courses) and want to learn more about risk management and securities valuation.

Every trade, every loan, every investment carries risk - the chance that things don't go the way you planned. This course teaches you how professionals at banks, hedge funds, and asset managers actually measure that risk, manage it, and make decisions under it. You'll learn the tools traders and risk managers use every day, focusing on *practical* risk management. Most importantly, we will also discuss the limitations of these tools – understanding the limitations is particularly important. Managing risk requires management and people-skills to lead, motivate, and make decisions. The ultimate goal is to make better decisions – to combine deep understanding of the technical tools with the common sense and experience to use those tools in making decisions.

We start with a review of valuation for fixed income instruments. We will then turn to sensitivity reports and the exposure calculation and reporting that is performed for a single trading desk or trading unit. We will discuss the difference between exposure (or sensitivity) and risk – how much we invest versus how risky that investment is. We will also discuss P&L – decomposition and hedging. Finally we will cover the firm-wide risk tools used for aggregating and managing risk across multiple trading operations.

Along the way, we'll dig into some of the most notorious blow-ups in financial history: the collapse of Silicon Valley Bank, the implosion of Long-Term Capital Management, JPMorgan's "London Whale", AIGFP's collapse in 2008 – and this summer's addition, Situational Awareness. These stories are genuinely entertaining, but they are also case studies in exactly how smart, well-resourced people lose enormous amounts of money. The lesson behind each of them: risk management is ultimately about people – the choices we make, the incentives we respond to, and the mistakes we're all capable of.

The end goal for this course is to be conversant with the risk tools used by firms in the financial industry: Volatility, VaR, Contribution to Risk, Best Hedges, and Replicating Portfolios. The most effective approach is to work with practical portfolios and so we will build a risk management system – translating the sample portfolio and risk reporting in Chapter 10 of *Quantitative Risk Management* from Mathematica into python. You'll leave with actual code you built yourself, not just concepts on a slide.

Students must have taken an investments or corporate finance course.

COURSE STRUCTURE

You will split into teams of 3 or 4. The task for the course is to translate my original Mathematica code into python. The course goals are:

- To learn about risk measurement tools such as Value at Risk, contribution to risk, best hedges, replicating portfolios
- To sharpen your python coding skills through a practical and useful project
- To have a working risk management package that you can use for learning and testing risk measurement ideas

PRE-COURSE REVIEW

We will dive right into bond sensitivity – duration and DV01 – so you should review bond yield / price calculations prior to the course.

CALCULATORS, Mathematica, etc.

We will be using a hand calculator for the first few days – yes, rather old-school but there is no better way to learn how sensitivity, DV01 and duration actually work than to do it. You must have a calculator – HP 17BII+ is best, HP 10bII+ will work, the iPhone / iPad HP 17bII+ app from RLM software works nicely.

- The actual calculator, on-line at Amazon for somewhere between \$30 & \$90. Very retro.
- iPhone and iPad app: RLM Software has an excellent \$4.99 HP 17BII+ app: Search for "rlm-17BII" or "r.l.m software" in the App Store. Also <http://www.rlmtools.com/iPhone/17BII/Detail.html>

TEXTBOOKS, SOFTWARE:

TEXT:

- We will focus on the sample portfolio and the risk reports covered in Chapter 10 of my book *Quantitative Risk Management*. You are not required to buy the book, although I think it will be valuable for you.
 - Available on Amazon as hard-copy and Kindle: https://www.amazon.com/Quantitative-Risk-Management-Website-Practical/dp/1118026586/ref=sr_1_4
- Here are the other options you have (instead of buying the book):
 - I will post a copy of Chapter 10 on Canvas
 - You can find chapters 1-4 on “thinking about risk” in the CFA monograph *A Practical Guide to Risk Management* available as Kindle (https://www.amazon.com/Practical-Guide-Risk-Management/dp/1934667412/ref=sr_1_1) or as PDF (<https://rpc.cfainstitute.org/en/research/foundation/2011/a-practical-guide-to-risk-management>)

SOFTWARE:

- You will need to work with both *Mathematica* and Python.
- MATHEMATICA
 - This is a commercial product but the university has a site license – as a student you will have access
 - This link has directions for downloading and activation: https://uchicago.service-now.com/it?id=kb_article&kb=KB00015443
 - I originally wrote my code for the sample portfolio in Mathematica. Your task is to translate the code for risk reports from Mathematica to python.
- PYTHON
 - You will need a working installation of python.
 - We will be using both Jupyter Notebooks and some Integrated Development Environment (IDE)
 - You will need to use an interactive debugger, so learn how to use it if you do not know already
- GITHUB
 - You will need a GitHub account
 - I will post the Mathematica code, and update your various python versions, using a (private) git on GitHub

POLICY ON AI

You may use AI for assistance in your course study, problems, and coding. In fact I encourage you to use AI. But you will need to review and edit any generated content to avoid inaccuracies, biased outputs, or misinterpretations. My experience from a few years ago was that such models did a good job at translating pieces, but a poor job at translating the overall structure. AI models have advanced considerably and part of our learning process will be learning how to better use the tools. Reviewing and editing is crucial to avoid mistakes, and to avoid unintentional plagiarism.. You must exercise caution to ensure your contributions are correct and appropriately credited. And you must cite any LLM that you use.

WEEKLY SYLLABUS

WEEK	TOPIC	PROBLEM / ASSIGNMENT
1	Introduction: - Procedural: lectures, problem sets, risk system project, presentations, grading - What is risk? How do we think about risk? What is risk versus uncertainty? How do we measure risk? - Some of the exciting “risk events” over the past 30 or 40 years: LTCM, JPM “London Whale”, Silicon Valley Bank. The difference between systemic and idiosyncratic risk events	Start translating Mathematica code for single instruments - PV: bondpv, swappv, cashpv - dv01, dv01posn - populate SecDV01s, populatePortDv01s, populateEqvDV01s
2	Basic Risk Reporting and P&L Prediction: BPV and DV01, Curve Risk, Spread Risk - Review BPV, DV01, duration. Risk along the curve. - P&L prediction and decomposition	Problem Set on BPV, DV01, P&L Decomposition
3	Using our Risk Reporting Tools to understand interesting blow-ups - What was Silicon Valley Bank’s and duration exposure? - Can we predict losses at LTCM and AIGFP? Swap spread, volatility exposure, and CDS exposure - Understanding JP Morgan’s “London Whale” losses “Trading Losses” from Chapter 4 of “A Practical Guide to Risk Management”	
4-5	Advanced Risk Reporting and P&L: Value-at-Risk, Best Hedges, Contribution to Risk - What is Value-at-Risk (VaR)? What is contribution to risk (aka beta) - How to Calculate VaR, volatility, and other statistics by variance-covariance methods - Using risk reports for P&L prediction and decomposition	Translate Mathematica code for portfolios populate SecDV01s, populatePortDv01s, populateEqvDV01s Midterm – calculation-based questions for risk and hedging
6-7	Derivative Instruments - Swaps: Interest Rate Swaps. Credit Default Swaps. - Options: Equity Options. Bond Options (Swaptions). Exotic Options - Black-Scholes valuation	Translate Mathematica code for VaR calculation by Variance-Covariance method, risk reports - secVolbyVCV, rfVolbyVCV, portVolbyVCV - portVolbyVCVextended – most important, calculates all statistics
8	Other Types of Risk - Credit Risk - Operational Risk - Liquidity Risk	
9	Risk events & trading losses –It’s All About People - Trading losses and analysis - Avalanche Risk - The JP Morgan Whale and How Not to Run a Bank	Complete python risk system Choose group portfolio and develop risk reports
10	Final Exam (presentations)	15-minute group presentations – portfolio risk