Risk Management Course Syllabus

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Course Objective

This course deals with the practice of risk management. We will focus especially on risk measurement and the techniques and real-world practices of risk management. We will cover the theory fully, but for the homework we will concentrate on computational techniques and what traders and risk managers actually do in practice. For the homework, we will use some combination of Excel, RStudio and python. These tools are becoming the most important to use in finance, so it is in your best interest to be familiar with each of them.

We will start by surveying pre-VaR risk management and factor models. We will cover Value at Risk and computational techniques in detail as this is still the predominant risk measure used in practice. Coherent risk measures like Expected Shortfall are also being increasingly considered and used. Both of these measures are used for uniform report and managing risk levels, however a trader’s view of hedging typically focusses more on risk factors and specific techniques for computing hedge ratios and for explaining P&L. We will also cover these topics in detail using interest rates and mortgages as examples. Other topics include credit risk, MC simulation, stress testing, time series techniques, extreme value theory.

Required Text

Supplementary Readings
2) Correlation Risk Modeling and Management by Gunter Meissner, 2014
3) Fixed Income Securities, 3rd Edition by Bruce Tuckman and Angel Serrat, 2012


Reference: Dowd, Chapters 1-4 (VaR and market risk)
**Week 2. Factor Models For Risk/Return and Portfolio Optimization.** Markowitz MV Analysis, Mean-CVaR, CAPM, Arbitrage Pricing Theory, Portfolio Optimization, Black-Litterman.

**Reference:** Elton, Gruber, Brown, Goetzmann Chapters 4,5,6,13 (MV Portfolio Theory, CAPM)

**Week 3. Value at Risk I.** Computing VaR, Backtesting VaR, Portfolio VaR

**Reference:** Jorion Chapters 5,6,7 (Computing/Backtesting VaR)

**Week 4. Value at Risk II.** Covariance Estimation, Forecasting Risk and Correlations, Garch, EWMA, implied vol

**Reference:** Jorion Chapters 8,9 (multivariate models and forecasting risk/vol/correlations)

**Week 5. Value at Risk III.** Delta-normal VaR, Delta-Gamma VaR

**Reference:** Jorion – Chapter 10 (VaR Methods)

**Week 6. Interest Rate Risk.** Yield Curve Basics. Yield Curve Risk, Key Rate Durations, Yield Curve Input Sensitivities, PCA risk factors. Yield Curve Risk for Forwards/Futures.

**Reference:** Tuckman, Serrat, Chapters 4-7 (interest rate/yield curve risk techniques)


**Reference:** Hull, Chapter 8 (trader view of risk)
Tuckman, Serrat, Chapter 20 (mortgages)


**Reference:** Meissner, Sections 4.3, 5.1-5.4 (Gaussian copula, pricing CDOs)


**Reference:** Jorion, Chapter 14 (stress testing)
Hull, Chapters 15,16,17 (regulatory issues)
**Week 10, Model Risk and Transparency.** Sources of model risk (specification, application, implementation), quantifying model risk, managing model risk. Case Studies: Equity, Credit Derivatives.

**Reference:** Dowd, Chapter 16.


**Reference:** Jorion, Chapter 17 (VaR and Risk Budgeting)

**Week 12. Monte-Carlo methods and variance reduction techniques.** Applications to insurance, credit risk and pricing equity derivatives.

**Reference:** Jorion, Chapter 12 (MC methods)

**Week 13. Time-series methods.** Application: Using ARCH / GARCH models to construct dynamic estimates of VaR and CVaR using forecasting of volatility, covariance, correlation.

**Reference:** Dowd, Chapter 5 (forecasting vol, cov, correl)

**Week 14. Special Distributions and Extreme value theory (EVT).** Multivariate normal, spherical and elliptical distributions. EVT and using EVT to estimate VaR and CVaR.

**Reference:** Dowd, Chapter 7 (extreme value)

Several important topics that are not listed above include liquidity risk and insurance risk. They will be discussed by way of examples during the lectures and course assignments. Credit risk is a particularly important topic that we will not discuss formally. We will, however, introduce various credit models and examples (including the infamous Gaussian copula model) during the course that will provide some exposure to this important topic. Liquidity risk and the concept of a “crowded trade” are also enormously important in practice and these are topics that we will also discuss on occasion. Another important topic that we will not cover is systemic risk which has become a very hot research topic in recent years (for obvious reasons). We will have little to say about this as it not yet well understood.