14 weeks, 3 credits

Course description

This course introduces risk management principles, with an emphasis on their practical implementation and application. It presents standard market, liquidity and credit risk measurement techniques, as well as their drawbacks and limitations. The course will convey much of the quantitative and technical material by working through calculation examples using market data and simple models. The example also introduce many sources of financial and statistical data, enabling students to better grasp the realities behind abstract financial concepts.

Students will understand risk management techniques from the viewpoint of practitioners, such as banks and other intermediaries. Many of these techniques have been adopted into financial regulatory standards. Especially since the crisis, regulatory standards have exerted great influence over firms’ risk management practices. The course will help understand this interaction, and the role of risk management in regulatory compliance.

Lecture materials will be available on CourseWorks.

Prerequisites

The course assumes basic familiarity with probability and statistics, instruments of the financial markets, and asset pricing models, and is appropriate for graduate students, as
well as advanced undergraduates who meet these requirements. Students should also be comfortable with programming numerical examples using software of their choice.

**Schedule, location and office hours**

Tuesdays and Thursdays 2:40–3:55 p.m., Sep. 5–Dec. 7, 2017

My office hours are Tuesdays and Thursdays 2:00–2:30, and by appointment, at the IEOR offices in Mudd. If you’d like to meet, please send me an e-mail ahead of time so that I can be sure to be available.

**Assignments and grades**

There will be three or four assignments, giving students the opportunity to practice the quantitative techniques and concepts presented, and midterm and final exams. Grades will be based primarily on the assignments and exams, but some weight may also be placed on class discussion.

Problem sets will be posted and answers should be submitted electronically on CourseWorks.

**Textbooks and resources**

Assignments and exams will be based primarily on material presented in class. The main textbook is


There’s a short bibliographical essay at the end of each chapter of the textbook, and I’ve listed more recent publications and other additional readings for most of the lectures here.

Students are encouraged to become familiar with economic and financial data. The captions of the graphs in the lecture slides contain detailed information on data sources.

Among the rich resources on the Internet are:

**Bank for International Settlements** invests reserves on behalf of some central banks and hosts regulator groups and research conferences. A large number of key regulatory documents are posted on its website: [http://www.bis.org/](http://www.bis.org/)
Central banks such as the Bank of England and the European Central Bank publish research on risk management and other topics. Some have recently begun to publish separate journals devoted to financial stability issues. A good starting point is the BIS links collection: http://www.bis.org/cbanks.htm.


International Monetary Fund has a crucial role in the international financial system, particularly as a lender to poor countries. Its research includes the Global Financial Stability Report: http://www.imf.org/external/pubs/ft/GFSR/index.htm

Session 1  Overview of financial risks

- Market risk
- Credit, counterparty and liquidity risk
- Operational, model, reputational and compliance risk

Readings

Malz [2011], chap. 1, sec. 2.

Session 2  Risk, return distributions and portfolios

- Defining returns: arithmetic and logarithmic
- Total, nominal and real returns
- Univariate and multivariate return distributions
- Return characteristics
- Portfolios and diversification

Readings

Malz [2011], chap. 2, sec. 2 and 4.
Session 3  Market equilibrium

- Risk, expectations and asset prices
- Investor choice
- Capital asset pricing model

Readings
Malz [2011], chap. 2, sec. 2.

Session 4  Asset prices over time

- Forecasting asset returns
- Random walks
- The standard model of asset price dynamics: and geometric Brownian motion
- The information in asset prices
- Capital market efficiency

Readings
Malz [2011], chap. 2, sec. 3.

Session 5  Volatility behavior

- Time variation in return behavior across assets
- Return volatility measurement and forecasting

Readings

Session 6  Volatility forecasting

- Estimating volatility via GARCH
- Estimating volatility via EWMA
Readings

Malz [2011], chap. 3, sec. 2.

Session 7 Value-at-Risk

- Definition and motivation of Value-at-Risk
- Computing Value-at-Risk: parametric, Monte Carlo, and historical simulation approaches
- Value-at-Risk for short positions

Readings

Malz [2011], chap. 3.

Session 8 Market risk measurement in practice

- Value-at-Risk for nonlinear positions: delta-gamma and full revaluation
- Delta-normal Value-at-Risk
- Value-at-Risk for portfolios
- Value-at-Risk for options and fixed income

Readings

Malz [2011], chap.s 4 and 5.

Session 9 Extreme events in asset markets and market risk measurement

- Limitations of the standard model of asset price dynamics
- Behavior of asset prices in normal and in stress periods
- Alternative models of asset price behavior
- Extreme Value Theory
- Alternatives to Value-at-Risk: expected shortfall
- Alternatives to Value-at-Risk: stress testing
Readings

Malz [2011], chap. 10, chap. 3, sec. 5.

Session 10  Assessing the accuracy of Value-at-Risk

- Limitations of Value-at-Risk
- Coherent risk measures
- Backtesting Value-at-Risk estimates
- Variability Value-at-Risk estimates

Readings

Malz [2011], chap. 2, sec. 2–3.

Session 11  Credit and counterparty risk

- Financial distress: default, ratings migration, insolvency and bankruptcy
- Treatment of insolvency for financial firms
- Counterparty risk
- Forms of debt, capital structure and collateral

Readings


Session 12  Default analytics

- Hazard rates and default analytics
- Credit spreads and credit spread risk

Readings

Malz [2011], chap. 7.
Session 13  Funding liquidity

- Sources of liquidity risk: credit, maturity and liquidity transformation
- Commercial banking and liquidity
- Collateralized securities markets

Readings

Malz [2011], chap. 12.

Session 14  Midterm exam

Session 15  Liquidity risk

- Funding liquidity risk and risk management by financial firms
- Financial distress: solvency and liquidity
- Market liquidity risk and risk management

Readings


Session 16  Leverage risk

- Defining and measuring leverage for the financial industry
- Leverage risk and the attractions of leverage
- Forms of leverage: carry trades and embedded leverage

Readings

Session 17  Credit portfolios

- Overview of credit portfolio risk
- Behavior of credit portfolios: credit diversification and default correlation

Readings

Malz [2011], chap. 8, sec. 1–2, 4.

Session 18  Portfolio credit risk models

- Copula models
- Default correlation in the single-factor model
- Credit Value-at-Risk in the single-factor model

Readings

Malz [2011], chap. 8, sec. 3.

Session 19  Financial crises

- Banking, currency, and sovereign and external debt crises
- Typical features of financial crises
- Illiquidity and insolvency during crises
- Bubbles, market crashes and financial crises

Readings


Session 20  How asset prices express the risk of extreme events

- Option-implied return distributions
- Implied correlation
- Base correlation, default correlation and widespread financial distress
Session 21  Securitization

_Rescheduled class meets 10:30–11:45 a.m. in 303 Mudd_

- Basics of structured credit and securitization
- Tranching and the waterfall
- Tranches as options
- Tranche leverage and risk

Readings

Malz [2011], chap. 9, sec. 1–2.

Session 22  Structured credit risk

- Impact of default rates and default correlation on structured credit risk
- Tranche credit VaR

Readings

Malz [2011], chap. 6, sec. 3.

Session 23  Overview of regulatory policy

- Organization of regulation: governments, central banks, and international coordination
- Regulation and supervision of individual financial firms
- Pitfalls of regulation

Readings

Session 24  Economic and regulatory capital

- Concept of economic capital
- Risk contributions
- Evolution of capital standards: Value-at-Risk, internal models and pre-crisis risk management practice
- Imposition of higher capital standards: Basel 2.5, III and beyond

Readings

Malz [2011], chap. 15, sec. 2.

Session 25  Financial stability regulation

- Regulatory stress testing and its impact on firm practice
- Rationale of macroprudential policy
- Tools of macroprudential policy
- Anticipating financial stress and financial warning indicators

Readings

Malz [2011], chap. 6, sec. 1–6.

Session 26  Liquidity regulation

- Addressing liquidity and run risk
- Basel III liquidity standards
- Money market mutual fund reform
- Addressing counterparty risk: capital standards and derivatives clearing mandates

Session 27  Financial market impact of the crisis and policy response

- Financial imbalances
- Reaching for yield and other targeted behaviors
Session 28  Final exam

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