Course description

This course introduces financial risk management principles, with an emphasis on practical implementation and application. It presents standard market, credit and liquidity risk measurement techniques, as well as their drawbacks and limitations. Students will understand risk management techniques from the viewpoint of financial intermediaries, such as banks, investment managers, and hedge funds, as well as that of financial regulators.

Extreme events in asset markets are a core risk management preoccupation, all the more so following the global financial crisis and the many still-unresolved issues it raised. This course will emphasize the ability of different risk management approaches to account for large market shocks. Students will study the effect of leverage, through borrowing or through the structuring of assets, in amplifying shocks and increasing risk, and the role of capital in mitigating them.

Many risk management techniques have also been adopted into financial regulatory standards, and regulatory standards have exerted greater influence over firms’ risk management practices since the crisis. In many financial institutions, risk management staff play a key role in interactions between their firms and regulators. The course will prepare future risk managers to understand their role in regulatory compliance and participate constructively in these interactions.

The course will convey quantitative and technical material primarily using graphical and numerical examples. The examples also introduce sources of financial and statistical data, enabling students to better grasp the realities behind abstract financial concepts.
Prerequisites

The course assumes introductory-level familiarity with probability and statistics, instruments of the financial markets, and asset pricing models. The lectures and assignments will apply basic statistics, algebra and calculus, rather than advanced mathematical techniques.

Examples of the concepts we'll use are: statistical distributions and distributional characteristics such as variance, how to read a simple corporate balance sheet, and present value and discounting in fixed income analysis. Students may have gained equivalent experience in finance.

The course focuses on intuition and understanding, and will convey quantitative and technical material primarily using graphical and numerical examples, as well as introducing students to sources of financial and statistical data. Students should be comfortable working with Excel, or programming software with equivalent capabilities.

Schedule, location and office hours

The class meets on Saturdays, Jan. 12–Apr. 27, 2018:

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<th>Week</th>
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Assignments and grades

There will be four problem sets, giving students the opportunity to hone their intuition and to practice some of the quantitative techniques and concepts presented, as well as a midterm and final exam. Grades will be based primarily on the problem sets and exams.

Problem sets will be posted and answers should be submitted electronically on Canvas. I’ll post solutions after the due dates. The weights on the formal assignments are approximate, and some weight will also be placed on constructive class discussion.
Grades will be based primarily on the problem sets and exams. Problem sets will have deadlines, with points deducted for late submissions. The contributions of the individual assignments to the assignment-based portion of the grade, the exam dates, and the approximate weeks of the course during which problem sets will be distributed and are due, are

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<td>Final exam</td>
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Textbooks and resources

The course content, including that covered in problem sets and exams, will be conveyed primarily through lectures. The lecture notes are posted on the web at [http://www.columbia.edu/~amm26/](http://www.columbia.edu/~amm26/). They cover a wider range of topics than we can study in this course; the pertinent lecture notes file for each topic is listed below in the readings.

I’ve listed specific readings for each topic below. A highly recommended textbook is:


Each chapter contains a short bibliographical essay. This syllabus lists background sections of the book for each lecture and other readings.

Other recommended textbooks in the field include:


The library has online copies of both.

Most financial risk management textbooks focus on quantitative techniques. An online resource that’s relatively light on mathematics is:

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](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](http://www.imf.org/external/pubs/ft/GFSR/index.htm)

**Session 1**

**Overview of financial risks**

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

**Readings**

Lecture notes: *Introduction to financial intermediation and financial risk.*

[Malz 2011](#), sec. 1.2.
Risk, expectations and asset prices

- Defining returns: arithmetic and logarithmic
- Total, nominal and real returns
- Univariate and multivariate return distributions
- Portfolios and diversification
- Investor choice: the risk-return tradeoff

Readings

Lecture notes: *Risk, expectations and asset prices.*

Malz 2011, sec. 2.4.

The sections on risk and return in most corporate finance textbooks cover this material as well. See, for instance, part 2 of:


Session 2

Volatility behavior and forecasting

- The random walk model of asset prices over time
- The behavior of return volatility over time: volatility regimes and other typical features
- Time variation in return behavior across assets
- Volatility models
- Simple techniques for estimating time-varying volatility

Readings

Lecture notes: *Behavior of asset prices over time, Volatility behavior and forecasting.*

Malz 2011, sec. 2.2–3, 3.2.
Market risk measurement

- Basic approaches to measuring market risk
- Scenario analysis and stress testing
- Risk, expectations and market prices: the Capital Asset Pricing Model

Readings

Lecture notes: *Market equilibrium and relative risk.*  
**Malz, 2011**, sec. 2.3.


Session 3

Value-at-Risk and its implementation

- Defining Value-at-Risk
- Methods of computing Value-at-Risk using simulation and historical data
- Identifying and measuring risk factors for fixed income, foreign exchange and equity
- Nonlinearity and Value-at-Risk: option gamma and fixed income convexity
- Value-at-Risk for portfolios

Readings

Lecture notes: *Value-at-Risk, Market risk measurement in practice.*  


Session 4

Credit and counterparty risk

- Financial distress: default, ratings migration, insolvency and bankruptcy
- The special treatment of insolvency for financial firms
- Counterparty risk
- Forms of debt, capital structure and collateral
- Quantitative measures of default risk
- Merton default model
- Hazard rates and default analytics
- Credit spreads and credit spread risk

Readings

Lecture notes: Credit and counterparty risk, Credit risk models, Fixed income risk. Malz 2011, sec. 6.1–6.6.


Session 5

Leverage and leverage risk

- Defining and measuring leverage in finance
- Leverage risk and the attraction of leverage
- Forms of leverage: carry trades and embedded leverage
- Economic capital and risk-adjusted return measurement
- Tail risk and economic capital
- Leverage risk and financial fragility
Readings

Lecture notes: Leverage risk, Forms of leverage.

Malz [2011], sec. 12.3.


Session 6

Liquidity risk

- Sources of liquidity risk: credit, maturity and liquidity transformation
- Commercial banking and liquidity
- Funding liquidity risk and risk management by financial firms
- Market liquidity risk and risk management

Readings

Lecture notes: Liquidity risk.


Midterm exam

Session 7

Extreme events and market risk measurement

- Behavior of asset prices in normal and in stress periods: tail risk and skewness
- Limitations of the standard model of asset price dynamics
- Alternative models of asset price behavior

Readings

Lecture notes: Extreme market risk events.
Malz 2011, chap. 10.

Assessing the accuracy of Value-at-Risk

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

Readings

Lecture notes: Critiques and accuracy tests of Value-at-Risk.
Malz 2011, sec. 11.2.

Incorporating extreme events into risk measurement

- Scenario analysis and stress testing
- Expected shortfall
- Extreme Value Theory

Readings

Lecture notes: *Incorporating extreme events into risk measurement*.  
Malz [2011], sec. 3.5, 13.3.  
Christoffersen [2012], chap. 2, sec. 7.

Session 8

Credit risk measurement

- Modeling the credit risk of a single borrower
- Expected and unexpected credit loss and credit Value-at-Risk
- Overview of credit portfolio risk: default rates, credit diversification and default correlation

Readings

Lecture notes: *Credit risk models, Credit portfolios*.  
Malz [2011], sec. 6.9.


Session 9

Portfolio credit risk measurement

- Default correlation in the single-factor model
- Portfolio credit risk models and Value-at-Risk
- Credit Value-at-Risk in the single-factor model

Readings

Lecture notes: Portfolio credit risk models.

Malz 2011, sec. 8.1–3.


Structured credit risk

- Basics of structured credit and tranching
- Tranching and the waterfall
- Tranches as options: embedded leverage
- Risk analysis of securitization tranches: impact of default rates and default correlation

Readings

Lecture notes: Securitization, Structured credit risk.
Session 10

Financial crises

- Financial crises: banking, currency, and sovereign and external debt crises
- Typical features of crises: extreme behavior of return volatility and correlation
- The role of illiquidity and insolvency during crises: shocks, runs and propagation mechanisms
- Anticipating financial stress and financial warning indicators

Readings


Overview of regulatory policy

- Rationale and scope of regulation: financial-firm risk management and externalities
- Organization of regulation: governments, central banks, and international coordination
- Regulation and supervision of individual financial firms
- Legislation, regulation and guidance
- Information and incentive problems in regulation
Readings

Lecture notes: *Overview of financial regulation.*


Session 11

Regulatory capital and liquidity standards

- Evolution of capital standards: Value-at-Risk, internal models and pre-crisis risk management practice
- Imposition of higher capital standards after the global financial crisis
- Liquidity regulation and run risk
- Basel III liquidity standards

Readings

Lecture notes: *Regulatory capital standards, Funding liquidity regulation.*

Malz [2011], sec. 15.2.


Session 12

Financial stability regulation

- Rationale and tools of macroprudential policy
- Regulatory stress testing and its impact on firms
- Money market mutual fund reform
- Private-risk taking and public guarantees: deposit insurance, Too-Big-to-Fail and the Volcker Rule
- Addressing counterparty risk: capital standards and derivatives clearing mandates
- Post-crisis policy impact on market, credit and funding liquidity risk management
- Limits to arbitrage in pricing risk: negative swap spreads and other anomalies

Readings

Lecture notes: Regulatory capital standards, Funding liquidity regulation, Financial stability regulation.


