

Investments

Course Description. The rapid growth in financial technology over the past three decades, and the parallel growth in computational power and the internet as a distribution channel, has had profound implications for the investment process. This course covers the most important innovations in financial technology within an integrative framework in which individual retirement planning, corporate financial strategy, and proprietary trading can be analyzed quantitatively and implemented efficiently. The course contents can be loosely divided into the four sectors of the economy that comprise the domain of financial technology (see the flowchart on page 3): (1) the household sector; (2) the nonfinancial corporate sector; (3) the financial intermediaries sector; and (4) the capital markets sector. We will develop the most important ideas of modern financial analysis in the context of sector-specific applications, e.g., elicitation of risk preferences and retirement planning in the household sector, corporate and financial risk management in the nonfinancial corporate sector, asset allocation and stock selection in the financial intermediaries sector, and trading technology and transactions costs control in the capital markets sector. We will also examine several non-standard approaches to financial analysis, e.g., chaos theory, neural networks, and technical analysis.

Each topic will be motivated by specific industry-driven issues in the investment process, and lectures and group projects will develop in detail the key analytical tools that comprise modern financial technology. These tools include: (1) static and dynamic portfolio optimization; (2) Monte Carlo simulation; and (3) financial econometrics. Each of these techniques will be covered in some depth—along with its implementation on PC's and various internet platforms—however, the emphasis will be on financial *applications*, not on methodology. To ensure that the focus of the course is properly directed towards the practical application of these quantitative methods, the material will be presented in a unique way: the entire course will be devoted to solving successively more complex versions of a single problem: how should a rational investor decide to allocate his wealth among a collection of risky investments? By starting with a relatively simple static version of this problem (basic portfolio theory), and then adding more realistic features incrementally (dynamics, trading costs, securities with nonlinear payoffs, etc.), the motivation for each quantitative method will become apparent before the method is introduced.

Course Materials. The following materials will be used in this course (required texts are indicated by asterisks):

- Lo*, 2000, *15.433 Lecture Notes*, MIT Graphic Arts.
- Bodie, Kane, and Marcus*, 1999, *Investments* (4th Edition), Irwin McGraw.
- Bernstein, 1992, *Capital Ideas*, Free Press.
- Bernstein, 1996, *Against The Gods*, John Wiley & Sons.

Prerequisites. This course is intended for Sloan Master’s students, hence the prerequisites include 15.401 and the Sloan first-year core. Some basic computer literacy will be assumed—projects will make use of standard web browsers, Excel, and Matlab (though prior exposure to these languages is not expected). Students without these pre-requisites may enroll only with the permission of the instructor.

Course Requirements and Grading. Course requirements include: regular attendance and class preparation/participation in lectures and recitations (10 percent), three group projects (25 percent), a mid-term (25 percent) and a final (40 percent) examination. *The closed-book mid-term examination will be given during the recitation section on Friday March 31st, and the closed-book final examination will be given during the MIT-scheduled final examination date—please reserve these dates immediately and schedule your interviews and travel plans accordingly.*

Class Preparation and Participation. Class preparation and participation are important components of this course. Students are expected to come to each class well prepared to discuss the materials assigned (see the attached *15.433 Schedule of Classes and Assignments*). Assignments marked “Review” refers to material already covered in one of the prerequisites such as 15.415 or the Sloan core—students without such prerequisites should read this material thoroughly. Assignments marked “Read” should be read thoroughly with the expectation that it will be required for class discussion. In addition, there may be short assignments distributed in each class for discussion during the following class. Such assignments are to be treated like “case-study” assignments that require considerable advance preparation, and students should expect to be “cold-called” in class to present the results of their analyses.

Group Projects. There are three group projects that will provide students with additional opportunities to apply the methods covered in the lectures to new investment problems. Each project covers a broad application area and involves both quantitative analysis and industry research. Students will be assigned to project groups based on computer skills, industry experience, etc. so that each group will have a good balance of quantitative expertise and institutional background. The three projects and their distribution and due dates are:

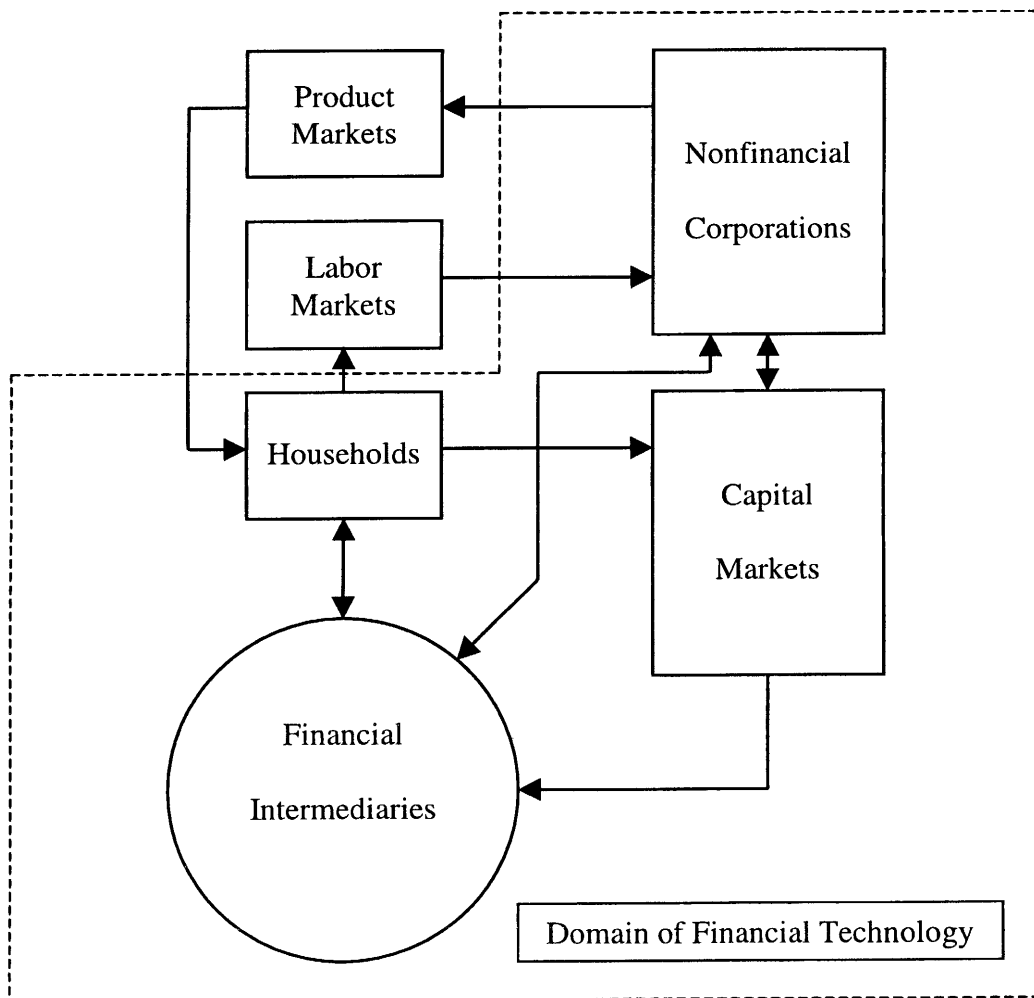
<u>Project</u>	<u>Topic</u>	<u>Distributed</u>	<u>Due</u>
A	Risk Preferences and Life-Cycle Investing	February 7	March 1
B	Corporate and Financial Risk Management	March 1	March 29
C	Portfolio Management and Trading Technology	March 29	April 26

Projects are due at the start of class on the due date. Projects submitted after the due date will be subject to a 25% grade-deduction for each day they are late. There will be no exceptions to this policy so please plan your interview and travel schedules accordingly.

Other Resources. If you are planning for a career in the investments area, there are several additional resources that you should keep in mind:

- Association of Investment Management Research (AIMR, www.aimr.org)
- International Association of Financial Engineers (IAFE, www.iafe.org)
- Securities Training Corporation (STC, www.stcusa.com)
- *Financial Analysts Journal*
- *Journal of Portfolio Management*
- *Pensions and Investments*
- *RISK*

Non-Disclosure Agreements. If you register for this course, you will be required to submit project reports, examinations, and other written materials. If you fail to submit any of these required materials for any reason other than documented incapacitating medical conditions, you will receive no credit for such materials in the computation of your course grade. Any conflicts arising from non-disclosure and patent-assignment agreements that you have signed will be your responsibility to manage, and no special dispensations will be granted to any student in such circumstances.



Source: R. Merton

15.433 Schedule of Classes and Assignments

- Class 1: Introduction, Course Overview, and Course Mechanics** **W: February 2**
- Read course syllabus thoroughly
 - Read Bodie, Kane, and Marcus (BKM) Chapters 1–3
 - Read Merton (1990)
- Class 2: Mathematical and Statistical Preliminaries** **M: February 7**
- Read BKM Appendix A.1–A.2
 - Review 15.060, Lectures 3–9
 - Project A distributed (due Wednesday March 1)
- Class 3: Household Preferences For Risk and Expected Return** **W: February 9**
- Read BKM Chapters 6–8
 - Read Kahneman and Tversky (1982), Bodie and Crane (1997)
- Class 4: Life-Cycle Investing and Risks in the Long Run** **M: February 14**
- Review Brealey and Myers (BM) Chapter 7
 - Read BKM Chapter 26
 - Read Bodie (1995)
- Class 5: Market Equilibrium and the Informational Role of Prices** **W: February 16**
- Review BM Chapters 8–9, BKM Chapter 8
- Class 6: Market Efficiency, Part I (Trading Lab)** **T: February 22**
- Review BM Chapter 13
 - Read BKM Chapter 12
 - Prepare CRL trading exercise
- Class 7: Market Efficiency, Part II** **W: February 23**
- Read BKM Chapter 13
- Class 8: Corporate Preferences For Risk and Expected Return** **M: February 28**
- Review BM Chapters 17–18
 - Read Harrington and Niehaus (1999) Chapter 9
- Class 9: Treasury Operations** **W: March 1**
- Read Finnerty (1988, 1992)
 - Project A due
 - Project B distributed (due Wednesday March 29th)
- Class 10: Risk Management, Part 1** **M: March 6**
- Read BKM Chapter 27
 - Read Harrington and Niehaus (1999) Chapters 1–2
 - Read Lo (1999)

Class 11: Risk Management, Part 2	W: March 8
<ul style="list-style-type: none"> • Read Harrington and Niehaus (1999) Chapters 3–4 	
Class 12: Financial Intermediation	M: March 13
<ul style="list-style-type: none"> • Read Mishkin (1998) Chapters 1–3 	
Spring Break	W: March 16–26
Class 13: Introduction to Asset Management	M: March 27
<ul style="list-style-type: none"> • Read BKM Chapters 23–24 • Read Ambachtsheer (1994) 	
Class 14: The CAPM and APT, Part 1: Theory and Evidence	W: March 29
<ul style="list-style-type: none"> • Read BKM Chapters 9–13 • Read Black (1995) • Project B due • Project C distributed (due Wednesday April 26th) 	
Mid-Term Examination	F: March 31
Class 15: The CAPM and APT, Part 2: Current Trends	M: April 3
<ul style="list-style-type: none"> • Read Jagannathan and McGratten (1995) 	
Class 16: Security Analysis and Stock Selection	W: April 5
<ul style="list-style-type: none"> • Review BM Chapter 4 • Read BKM Chapters 17–19 • Read Treynor and Black (1973) 	
Class 17: Asset Allocation	M: April 10
<ul style="list-style-type: none"> • Review BKM Chapter 6–7 • Read BKM Chapter 26 • Read Samuelson (1990) and Sharpe (1990) 	
Class 18: Introduction to Fixed Income Securities	W: April 12
<ul style="list-style-type: none"> • Read BKM Chapter 14 	
Patriot’s Day: No Class	M: April 17
Class 19: Models of the Yield Curve	W: April 19
<ul style="list-style-type: none"> • Read BKM Chapter 15 	
Class 20: Fixed Income Asset Management	M: April 24
<ul style="list-style-type: none"> • Read BKM Chapter 16 	
Class 21: Market Microstructure and Trading Technology	W: April 26
<ul style="list-style-type: none"> • Review BKM Chapter 3 • Read Keim and Madhavan (1998) • Project C due 	

Class 22: Introduction to Hedge Funds and Proprietary Trading

M: May 1

- Read Fung and Hsieh (1999)

Class 23: Finance and Insurance

W: May 3

- Review Harrington and Niehaus Chapters 1–4 and 9

Class 24: Technical Analysis, Neural Networks, and Fringe Finance

M: May 8

- Read Pruitt and White (1988) and Lo (1994a,b)

Class 25: Course Summary and Future Trends

W: May 10

- Review lecture notes

Course Schedule

February

- 2/15 **Opening Session** with Andrew W. Lo and ML senior managers in NYC
- 2/21 **Online Office Hours Chat Training** by TA, Learning Director, for Participants, 7–8 pm ET
- 2/23 **Lecture 1: Household Preferences for Risk and Return**(CD-ROM)
- 2/28 **Online Office Hours Chat Training** by TA, Learning Director, for Participants, 7–8 pm ET

March

- 3/2 **Lecture 2: Life Cycle Investing and Risks in the Long Run** (CD-ROM)
- 3/9 **Lecture 3: Market Equilibrium and the Informational Role of Prices** (CD-ROM)
- 3/12 **Online Office Hours**, 7–8 pm ET
- 3/16 **Lecture 4: Corporate Preferences for Risk and Expected Return**(CD-ROM)
- 3/23 **Lecture 5: Millennium Pharmaceuticals Presentation** (CD-ROM)
 - **Project Part A: Defining the Client's Objectives** due
- 3/30 **Lecture 6: Risk Management, Part 1** (CD-ROM)

April

- 4/6 **Lecture 7: Risk Management within a Hedge Fund Presentation** (CD-ROM)
- 4/9 **Online Office Hours**, 7–8 pm ET
- 4/13 **Lecture 8: Risk Management, Part II** (CD-ROM)
- 4/20 **Lecture 9: Risk Management, Part II continued** (CD-ROM)
 - **Project Part B: Candidate Solutions and Analyses** due
- 4/27 **Lecture 10: Financial Intermediation** (CD-ROM)

May

- 5/4 **Lecture 11: Finance and Insurance** (CD-ROM)
- 5/7 **Online Office Hours**, 7–8 pm ET
- 5/11 **Lecture 12: Introduction to Hedge Funds and Proprietary Trading** (CD-ROM)
- 5/23 **Closing Session** with Professor Andrew W. Lo and ML senior managers in NYC
 - **Project Part C: The Finished Product** due and presented

Please note: Syllabus and Course Schedule subject to change with notice. Course material readings, CD-ROM viewing, and assignments are due by dates listed.

Optional lectures 1–6 and associated lecture notes will be delivered to course participants in mid-

March. Online TA and Learning Director support will be available for these lectures until the Closing session on 5/23.

Optional Lecture 1: *Introduction to Asset Management*

Optional Lecture 2: *The CAPM and APT, Part I: Theory and Evidence*

Optional Lecture 3: *The CAPM and APT, Part II: Current Trends*

Optional Lecture 4: *Security Analysis and Stock Selection*

Optional Lecture 5: *Asset Allocation*

Optional Lecture 6: *Guest Lecturer Janet Campagna, Managing Director, Deutsche Bank*

SloanSpace: <http://sloanspace.mit.edu>

15.433 Readings

1. Ambachtsheer, K., 1994, "The Economics of Pension Fund Management", *Financial Analysts Journal* 50, 21–31.
2. Black, F., 1993, "Beta and Return", *Journal of Portfolio Management* 20, 8–18.
3. Bodie, Z., 1995, "On the Risk of Stocks in the Long Run", *Financial Analysts Journal* 52, 18–22.
4. Bodie, Z. and D. Crane, 1997, "Personal Investing: Advice, Theory, and Evidence", *Journal of Portfolio Management* 53, 13–23.
5. Finnerty, J., 1988, "Financial Engineering in Corporate Finance: An Overview", *Financial Management* 17, 14–33.
6. Finnerty, J., 1992, "An Overview of Corporate Securities Innovation", *Journal of Applied Corporate Finance* 4, 23–39.
7. Fung, W. and D. Hsieh, 1999, "A Primer on Hedge Funds", *Journal of Empirical Finance* 6, 309–332.
8. Harrington, S. and G. Niehaus, 1999, *Risk Management and Insurance*. New York: Irwin/McGraw-Hill. (Chapters 1–4, 9)
9. Jagannathan, R. and E. McGrattan, 1995, "The CAPM Debate", *Federal Reserve Bank of Minneapolis Quarterly Review* 19, 2–17.
10. Kahneman, D. and A. Tversky, 1982, "The Psychology of Preferences", *Scientific American* 246, 160–173.
11. Keim, D. and A. Madhavan, 1998, "The Cost of Institutional Equity Trades", *Financial Analysts Journal* 54, 50–69.
12. Lo, A., 1994a, "Data-Snooping Biases in Financial Analysis", in H. Russell Fogler, ed.: *Blending Quantitative and Traditional Equity Analysis*. Charlottesville, VA: Association for Investment Management and Research.
13. Lo, A., 1994b, "Neural Networks and Other Nonparametric Techniques in Economics and Finance", in H. Russell Fogler, ed.: *Blending Quantitative and Traditional Equity Analysis*. Charlottesville, VA: Association for Investment Management and Research.
14. Lo, A., 1999, "The Three P's of Total Risk Management", *Financial Analysts Journal* 55.
15. Merton, R., 1990, "The Financial System and Economic Performance", *Journal of Financial Services Research* 4, 263–300.
16. Mishkin, F., 1998, *The Economics of Money, Banking, and Financial Institutions*, 5th Edition. Reading, MA: Addison Wesley Longman. (Chapters 1–3)

17. Pruitt, S. and R. White, 1988, "The CRISMA Trading System: Who Says Technical Analysis Can't Beat the Market?", *Journal of Portfolio Management* Spring, 55–58.
18. Samuelson, P., 1990, "Asset Allocation Could Be Dangerous to Your Health", *Journal of Portfolio Management* Spring, 5–8.
19. Sharpe, W., 1990, "Asset Allocation", in J. Maginn and D. Tuttle, eds., *Managing Investment Portfolios: A Dynamic Process*. Boston: Warren, Gorham & Lamont.
20. Treynor, J. and F. Black, 1973, "How to Use Security Analysis to Improve Portfolio Selection", *Journal of Business* 46, 66-86.