

Duke University
Economics Department

ECON 676: Empirical Asset Pricing

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Class hours: MW 4:40pm–5:55pm, **1/9–4/24**
Office hours: W 2:00pm–3:00pm and by appointment

Prerequisites: ECON 471/571, 372/572, or equivalent.

Course Description

This course develops, examines, and applies models for portfolio decisions by investors and the pricing of securities in capital markets. While developing portfolio theory, we will study the extensive empirical work that characterizes movements in security prices, evaluates alternative investment and asset pricing models, and attempts to test those models and interpret the implications of those tests. This is a research oriented course with practical implementation of quantitative methods in finance, aimed at highly motivated and technically proficient undergraduate and master's students.

This course is designed for students who want a more detailed and up-to-date treatment of academic asset pricing theory and empirical work and its application to the practice of quantitative finance. The course is especially appropriate for students contemplating analytical finance and quantitative money management, and provides many tools and concepts that are essential for a career in quantitative investments. The material is covered in a rigorous analytical manner, and students must be comfortable with some technical methodologies (i.e., calculus, linear and matrix algebra, and statistical theory). The course is meant to be challenging, but accessible. The expectation is that the average student spends 10-20 hours per week on the course outside of class.

A good fundamental background in economics and especially statistics is required. The course is highly quantitative because the field is, and so relies heavily on analytical tools and economic theory developed throughout the course. Students should be comfortable with probability, statistics, and regression analysis. Students should also feel comfortable with the concepts of risk aversion, utility functions, and budget constraints. Use of a statistical package or programming language will be vital for the course, saving time and aiding in understanding the material. Many of the applications will move beyond simple spreadsheet packages such as Excel. A good statistical programming language such as Matlab, SAS, Stata, Python is even more useful. I will supplement the course with programming help and the data assignments will be done in groups (more below).

Course Requirements and Grading

The requirements for the course are nine problem sets (which include data manipulation), two referee reports on papers (described later in the course), and an open-note final exam. Problem sets will be done in groups, and only your best seven problem sets count toward your course grade. Class participation is also used to determine grades.

Your course grade will be determined as follows:

	Weight %
Class Participation:	15%
Referee Reports:	20%
Problem Sets:	35% (5%)
Final Exam:	30%

This course cannot be taken pass/fail. **No late assignments will be accepted.**

Class participation will be weighted heavily, as it is key to understanding the material in the course. Many topics and economic questions will not have a specific answer. Therefore, dialogue and debate are an important part of this course. Thus, students need to be prepared before class, and I will cold call to encourage participation. I want classroom discussion to be open; this will help immensely. Being present is necessary (though not sufficient): I excuse no more than two absences, and additional absences will decrease your participation score.

Problem sets will be due most weeks and are to be done in groups of 1-3 people (except for the first one—Problem Set #1—which must be done individually). The problem sets will consist mostly of data analysis and replication of studies with some extensions of the data analysis in those studies and some conceptual questions concerning the interpretation of the analysis. The goal is to generate a set of quantitative tools and programs throughout the course that are applied in practice. The problem sets cumulatively develop these tools by adding on to previous analysis so that extensive models are developed by the end of the course and similar routines are applied to multiple contexts.

Peer review provides you the opportunity to evaluate the contribution made by each of your group members with respect to the completion of the problem sets. Full credit will be awarded to students who contribute their share to the group's success. Unequal contributions as judged by other group members will result in deductions from your problem set score (up to 5%).

Students who are permitted special accommodations should inform me **immediately** by providing an "approved accommodation" letter in the first week of class.

Honor Code

Students are required to adhere to the standards of conduct of the Duke Community Standard. Each student will be required to sign the following pledge on her exam: "I pledge my honor that I have not violated the Duke Community Standard during this examination."

Readings for the Course

Texts

Recommended texts (none required):

- Ang, Andrew. *Asset Management: A Systematic Approach to Factor Investing*. Oxford University Press, 2014.
- Ilmanen, Antti. *Expected Returns: An Investor's Guide to Harvesting Market Rewards*. Wiley, 2011.
- Pedersen, Lasse Heje. *Efficiently Inefficient: How Smart Money Invests and Market Prices Are Determined*. Princeton University Press, 2015.

Journal Readings

- Articles can be found on the course site with links to the articles from academic journals. Some of the articles are challenging. However, I will assign certain portions of these articles that I feel are relevant to the topics discussed in class and will not hold you responsible for the most advanced material. In addition, I have included some optional readings, which may be discussed briefly in class. Most articles can also be found on JSTOR or Google Scholar.

Class Notes and Handouts

- Lecture notes will be posted on my website several days in advance. You should either take notes on the electronic copy or print them ahead of time to better follow the lecture as we discuss the various topics. However, much of the material will be presented in discussion format in class.

Feedback, Questions, and Concerns

- This course is conceptually and analytically challenging, and will require a large time commitment from students (10-20 hours per week). You are welcome to stop by my office to discuss specific questions, any of the course topics, or other interesting areas of finance. In addition, if you have any concerns about the course, please let me know. The best time to catch me is during my office hours. However, if you cannot meet with me then, please e-mail me to set up an appointment.

Course Outline

Annotations

* indicates required reading.

† indicates lecture note obtained from course website.

- indicates assignment due (**at the start of class**).

Bold indicates article to be presented in class by someone drawn at random and/or questions on the paper to be handed in.

Note: Schedule is approximate and subject to change.

Part 0: Background

0. Preliminaries: Background and Statistics

- **Problem Set 1 due (1/16).**

Course Outline and Introduction.

† Lecture 0: Stock Returns, Portfolio Mathematics, Return Distributions, and the Market Model.

* Fama, Eugene, *Foundations of Finance*, chapters 1-4.

John Cochrane's Investments Review.

Ang *Asset Management* chapter 2.

Ilmanen *Expected Returns* chapters 1-2.

Part 1: Pricing Tests and Market Efficiency

1. Portfolio Theory and the CAPM

† Lecture 1: Portfolio Theory and the CAPM.

* Roll, Richard, "A Critique of the Asset Pricing Theory's Tests," 1977, *Journal of Financial Economics*, 4, 129-176.

* **Jorion, Phillipe, "Portfolio Optimization in Practice," 1992, *Financial Analysts Journal*, 48, 68-74.**

Pedersen *Efficiently Inefficient* chapter 4.

Ang *Asset Management* chapter 3.

2. Cross-Sectional and Time-Series Asset Pricing Tests

- **Problem Set 2 due (1/23).**

† Lecture 2: Cross-Sectional and Time-Series Asset Pricing Tests.

* Fama, Eugene, and James MacBeth, "Risk, Return, and Equilibrium: Empirical Tests," 1973, *Journal of Political Economy*, 81, 607-636.

Gibbons, Michael, Steve Ross, and Jay Shanken, "A Test of the Efficiency of a Given Portfolio," 1989, *Econometrica*, 57, 1121-1152.

* **Fama, Eugene and Kenneth French, "The Cross-Section of Expected Stock Returns," 1992, *Journal of Finance*, 47, 427-466.**

3. Market Efficiency, Inefficiency, and Limits to Arbitrage

• **Problem Set 3 due (1/30).**

† Lecture 3: Market Efficiency/Inefficiency.

Fama, Eugene, “Efficient Capital Markets II,” 1991, *Journal of Finance*, 46, 1575-1617.

* **Fama, Eugene and Kenneth French, “Common Risk Factors in the Returns on Stocks and Bonds,” 1993, *Journal of Financial Economics*, 33, 3-56.**

* **Lamont, Owen and Richard Thaler, “Can the Market Add and Subtract? Mispricing in Tech Stock Carve-Outs,” 2002, *Journal of Political Economy*, 111, 227-268.**

Kaplan, Steven, Tobias Moskowitz, and Berk Sensoy, “The Effects of Stock Lending on Security Prices: An Experiment,” 2013, *Journal of Finance*, 68, 1891-1936.

Ang *Asset Management* chapters 6-7.

Part 2: Return Predictability and Performance Evaluation

4. Return Predictability

• **Problem Set 4 due (2/6).**

† Lecture 4: Return Predictability.

Cochrane, John, “Discount Rates,” 2011, *Journal of Finance*, 66, 1047-1108.

Cochrane *Asset Pricing* Chapter 20, “Time Series Predictability.”

5. Evaluating Portfolio Managers

† Lecture 5: Performance Evaluation.

* **Carhart, Mark, “On Persistence in Mutual Fund Performance,” 1997, *Journal of Finance*, 52, 57-82.**

* Daniel, Kent, Mark Grinblatt, Sheridan Titman, and Russ Wermers, “Measuring Mutual Fund Performance with Characteristic-Based Benchmarks,” 1997, *Journal of Finance*, 52, 1035-1058.

* Krueger, Samuel, 2007, “Persistence in Mutual Fund Performance: Analysis of Holdings Returns”, Manuscript, University of Chicago.

* **Fama, Eugene F. and Kenneth R. French, 2010, “Luck versus Skill in the Cross-Section of Mutual Fund Returns” *Journal of Finance*, 65, 1915-1947.**

* Berk, Jonathan, 2005, “Five Myths of Active Portfolio Management,” *Journal of Portfolio Management*, 31, 27-31.

* Mitchell, Mark and Todd Pulvino, 2001, “The Characteristics of Risk and Return in Risk Arbitrage,” *Journal of Finance*, 56, 2135-2176.

* Asness, Clifford, Robert Krail and John Liew, 2001, “Do hedge funds hedge?” *Journal of Portfolio Management*, 28, 6-19.

* Frazzini, Andrea, David Kabiller, and Lasse H. Pedersen, “Buffett’s Alpha,” 2013.

Chevalier, Judith and Glenn Ellison, “Risk Taking by Mutual Funds as a Response to Incentives,” 1997, *Journal of Political Economy*, 105, 1167-1200.

* Berk, Jonathan and Jules van Binsbergen, “Measuring Skill in the Mutual Fund Industry,” 2015, *Journal of Financial Economics*, 118, 1-20.

Part 3: Alphas and Betas

6. Value

† Lecture 6: The Value Premium

* Lakonishok, Josef, Andre Shleifer, and Robert Vishny, “Contrarian Investment, Extrapolation, and Risk,” *Journal of Finance*, 1994, 49, 1541-1578.

* Fama, Eugene and Kenneth French, “Multifactor Explanations of Asset Pricing Anomalies,” *Journal of Finance*, 1996, 51, 55-84.

* Daniel, Kent and Sheridan Titman, “Evidence on the Characteristics of Cross-Sectional Variation in Stock Returns,” *Journal of Finance*, 1997, 52, 1-33.

* Davis, James L., Eugene Fama, and Kenneth French, “Characteristics, Covariances, and Average Returns: 1929-1997,” *Journal of Finance*, 2000, 55, 389-406.

Berk, Jonathan, “Sorting Out Sorts,” *Journal of Finance*, 2000, 55, 407-427.

Ilmanen *Expected Returns* chapter 12.

7. Momentum / Investment Management in Practice (Guest Speaker)

• **Problem Set 5 due (2/27).**

† Lecture 7: Momentum

* Jegadeesh, Narasimhan and Sheridan Titman, “Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency,” *Journal of Finance*, 1993, 48, 65-91.

* Moskowitz, Tobias and Mark Grinblatt, “Do Industries Explain Momentum?,” *Journal of Finance*, 1999, 54, 1249-1290.

Grinblatt, Mark and Tobias Moskowitz, “Predicting Stock Price Movements from Past Returns: The Role of Consistency and Tax-Loss Selling,” *Journal of Financial Economics*, 2003, 71, 541-579.

Grundy, Bruce D. and J. Spencer Martin, “Understanding the nature of the risks and the source of the rewards to momentum investing,” *Review of Financial Studies*, 2001, 14, 29-78.

Hong, Harrison, Terence Lim, and Jeremy Stein, “Bad News Travels Slowly: Size, Analyst Coverage, and the Profitability of Momentum Strategies,” *Journal of Finance*, 2000, 55, 265-295.

* Hvidkjaer, Søren, “A Trade-Based Analysis of Momentum,” *Review of Financial Studies*, 2006, 19, 29-78.

* Daniel, Kent and Tobias Moskowitz, “Momentum Crashes,” *Journal of Financial Economics*, 2015, 122, 221-247.

Cohen, Lauren and Andrea Frazzini, “Economic Links and Predictable Returns,” *Journal of Finance*, 2008, 63, 1977-2011.

Part 4: New Directions in Empirical Asset Pricing

8. Robustness of Anomalies

- **Problem Set 6 due (3/6).**
- **Referee Report 1 due (3/6).**
- **Mid-semester feedback due (3/6).**

† Lecture 8: Robustness of Anomalies, Data Mining and Backtest Reliability.

* **Harvey, Campbell, Yan Liu and Heqing Zhu, “...and the Cross-Section of Expected Returns,” *Review of Financial Studies*, 2016, 29, 5-68.**

* **McLean, David and Jeff Pontiff, “Does Academic Publication Destroy Stock Return Predictability?” *Journal of Finance*, 2016, 71, 5-32.**

Fama, Eugene and Kenneth French, “Size, value, and momentum in international stock returns,” *Journal of Financial Economics*, 2012, 105, 457- 472.

* **Israel, Ronen and Tobias Moskowitz “The Role of Shorting, Size, and Time on Market Anomalies,” *Journal of Financial Economics*, 2013, 108, 275–301.**

* **Novy-Marx, Robert, “The Other Side of Value: The Gross Profitability Premium,” *Journal of Financial Economics*, 2013, 108, 1–28.**

* **Linnainmaa, Juhani T. and Michael R. Roberts, “The History of the Cross Section of Stock Returns,” 2016, Working Paper.**

Pedersen *Efficiently Inefficient* chapter 5.

9. Other Asset Markets

Lecture 9: Other Asset Classes

* **Fama, Eugene and Kenneth French, “Size, value, and momentum in international stock returns,” *Journal of Financial Economics*, 2012, 105, 457- 472.**

* **Asness, Cliff, Tobias Moskowitz, and Lasse Pedersen, “Value and Momentum Everywhere,” *Journal of Finance*, 2013, 68, 929-985.**

* **He, Zhiguo, Bryan Kelly, and Asaf Manela, “Intermediary Asset Pricing: New Evidence from Many Asset Classes,” forthcoming *Journal of Financial Economics*, 2016.**

* **Moskowitz, Tobias, “Asset Pricing and Sports Betting,” Working Paper, 2015.**

10. Constrained Intermediaries and Nonlinearities

- **Problem Set 7 due (3/27).**

† Lecture 10: The Risks, Costs, and Future of Quantitative Investing

* **Brunnermeier, Markus, “Deciphering the Liquidity and Credit Crunch 2007 - ?,” *Journal of Economic Perspectives*, 2009, 23, 77–100.**

* **Khandani, Amir and Andrew W. Lo, “What Happened to the Quants in August 2007? Evidence from Factors and Transactions Data,” *Journal of Financial Markets*, 2011, 14, 1-46.**

* **Adrian, Tobias and Hyung Song Shin, “Liquidity and Financial Contagion,” *Financial Stability Review*, 2008, 1-7.**

Gorton, Gary, “The Panic of 2007,” 2008, Working Paper.

Lo, Andrew W., Congressional testimony: “Hedge Funds, Systemic Risk, and the Financial Crisis of 2007-2008.”

Adrian, Tobias and Hyung Song Shin, “Liquidity and Leverage,” *Journal of Financial Intermediation*, 2010, 19, 418–437.

Adrian, T., E. Etula, and T. Muir, “Financial Intermediaries and the Cross Section of Asset Returns,” *Journal of Finance*, 2013, 69, 2557-2596.

CFTC and SEC, “Findings Regarding the Market Events of May 6, 2010,” 2010.

Pedersen *Efficiently Inefficient* chapter 9.

11. Big Data and Network Effects

• Problem Set 8 due (4/3).

† Lecture 11: Big Data, Machine Learning, and Network Effects

* Coval, Joshua and Tobias Moskowitz, “The Geography of Investment: Informed Trading and Asset Prices,” 2001, *Journal of Political Economy* 109, 4, 811-841.

* Cohen, Lauren and Andrea Frazzini, “Economic Links and Predictable Returns,” 2008, *Journal of Finance*.

* Chinco, Alex, Adam D. Clark-Joseph, and Mao Ye, “Sparse Signals in the Cross-Section of Returns,” 2017, *Journal of Finance*, Forthcoming.

* Kozak, Serhiy, Stefan Nagel, and Shrihari Santosh, “Shrinking the Cross Section,” 2017, Working Paper.

* Di Maggio, Marco, Francesco Franzoni, Amir Kermani, and Carlo Sommovilla, “The Relevance of Broker Networks for Information Diffusion in the Stock Market” Working paper Harvard University.

Part 5: Trading and Liquidity

12. Liquidity and Trading

† Lecture 12: Trading Costs, Liquidity, and Liquidity Risk.

* Korajczyk, Robert and Ronnie Sadka, “Are Momentum Profits Robust to Trading Costs?,” *Journal of Finance*, 2004, 59, 1030-1082.

* Frazzini, Andrea, Ronen Israel, and Tobias Moskowitz, “Trading Costs,” Working Paper, 2018.

* Korajczyk, Robert and Ronnie Sadka, “Pricing the Commonality Across Alternative Measures of Liquidity”, *Journal of Finance*, 2008, 87, 45-72.

* Patton, Andrew J. and Brian M. Weller, “What You See Is Not What You Get: The Costs of Trading Market Anomalies”, Working Paper, 2017.

* Nagel, Stefan, “Evaporating Liquidity,” *Review of Financial Studies*, 2012, 25, 2005-2039.

Acharya, V. V. and Pedersen, L. H., “Asset pricing with liquidity risk,” *Journal of Financial Economics*, 2005, 77, 375–410.

Pastor, L. and Stambaugh, R. F., “Liquidity risk and expected stock returns,” *Journal of Political Economy*, 2003, 111, 642-685.

Efficiently Inefficient Chapter 5

13. Algorithmic and High-Frequency Trading

- **Problem Set 9 due (4/17).**

† Lecture 13: High-Frequency Trading and Modern Equity Markets.

* Hasbrouck, Joel and Gideon Saar, “Low-Latency Trading,” *Journal of Financial Markets*, 2013, 16, 646–679.

* Hendershott, Terrence, Charles M. Jones, and Albert J. Menkveld, “Does Algorithmic Trading Improve Liquidity?,” *Journal of Finance*, 2011, 66, 1-33.

* **Brogaard, Jonathan, Terrence Hendershott, and Ryan Riordan, “High-Frequency Trading and Price Discovery,” *Review of Financial Studies*, 2014, 27, 2267-2306.**

* **Budish, Eric, Peter Cramton, and John Shim, “The High-Frequency Trading Arms Race: Frequent Batch Auctions as a Market Design Response,” *Quarterly Journal of Economics*, 2015, 130, 1547-1621.**

* Weller, Brian M., “Does Algorithmic Trading Deter Information Acquisition?,” *Review of Financial Studies*, 2017, Forthcoming.

Baron, Matthew, Jonathan Brogaard, Björn Hagströmer, and Andrei Kirilenko, “Risk and Return in High-Frequency Trading,” Working Paper, 2016.

Part 6: Wrap Up

14. Investment Management in Practice (Guest Speaker)

- **Referee Report 2 due (4/24).**

- **Peer evaluations due (4/24).**

* Prepare for final exam!

Exam. **Final Exam on TBD.**