FIN 580: Market Microstructure and Trading
Finance Department
Fall 2013

Logistics

• Professor: Adam D. Clark-Joseph (adcj@illinois.edu)
• Lectures: Mondays and Wednesdays, 11:00AM – 12:20PM (130 Wohlers Hall)
• Office Hours: Mondays, 4:40PM - 6:00PM (435 Wohlers Hall)

Course Overview

The focus of this course is trading in financial markets. While economics and finance predominantly examine equilibrium outcomes, this course examines processes and mechanisms by which equilibrium outcomes are reached. In a perfect and complete equilibrium, all feasible trade would already have taken place, but scope for trade arises whenever prevailing equilibrium conditions are perturbed. The study and analysis of trading mechanisms in financial markets is known as market microstructure, and this course will introduce the foundations of market microstructure. Unlike a traditional introductory microstructure class, however, this course will emphasize applications to algorithmic trading, and you will learn how to use economic theory to better understand, utilize, and design trading algorithms.

Roughly speaking, this course will familiarize you with the guiding principles and rationale underlying what various market participants try to accomplish with trading algorithms, and why. Students who plan to pursue finance careers not directly connected to algorithmic trading can treat this as a stand-alone introduction to modern market microstructure. Students who plan to pursue careers explicitly focused on algorithmic trading can use this course to structure and/or leverage additional training (programming, computer science, electrical engineering, etc.) related to the efficient implementation of trading algorithms, i.e., related to how good trading algorithms should operate.

Learning Objectives

At the end of this course, you will be able to:

• Analyze trading in financial markets as an information-transmission mechanism
• Understand how to approach the challenges and opportunities facing different types of traders
• Apply your knowledge and understanding of economic microstructure principles to create and assess trading algorithms
Textbooks and Readings

Market microstructure is a broad and varied field, and one which has evolved rapidly in recent years. The curriculum of this course draws primarily from the three texts below:


This course loosely follows O’Hara’s exposition, but (in general) at a much lower level of technical rigor. I mark readings from the O’Hara text with an asterisk (*) as a reminder that you are not responsible for the technical parts.


Harris’ book provides a non-technical and very readable introduction to much of the institutional background relevant for this course. Some of the material is slightly out-dated, and some of the normative judgments may not necessarily reflect an academic consensus, but subject to those two caveats, Harris’ text is indispensable.


Joel Hasbrouck of NYU Stern has kindly made available his lecture notes from the half-semester MBA microstructure course that he teaches. Hasbrouck’s notes offer concise and up-to-date treatment of institutional material, and they provide clear expositions of some theoretical issues covered in this course.

Particularly in the early weeks of this course, the curriculum will include introductions to institutional details and background. This will provide concrete contexts and precise terminology to facilitate sophisticated analyses of theoretical issues throughout the rest of the term. Although current institutional nuances are apt to change in the face of technological innovation, regulatory reform, and industry turnover, the economic principles driving the structure of trading in financial markets are not.

In addition to the three main texts above, I may occasionally assign readings from journal articles, working papers, and practitioner publications/white papers.

Software

The two following pieces of software are required:

- Matlab (2013a)—Available for free to UIUC students at https://webstore.illinois.edu/Shop/product.aspx?zpid=1271

- Rotman Interactive Trader Client—Available for free at http://www-2.rotman.utoronto.ca/finance/lab/RITv2/client/

Matlab will be used for programming assignments (see next section). The Rotman Interactive Trader Client may be used for occasional in-class demonstrations, which I will announce ahead of time.

Assignments

Problem Sets

I will assign problem sets on approximately a weekly basis, and these problem sets will be primarily programming-based. The first problem set will entail constructing a matching engine for a limit-order
market and analyzing some features of a market populated by “background traders” who place orders in a simple stochastic manner. Subsequent assignments will involve writing and analyzing trading algorithms that accomplish specified objectives in simulated markets populated by various other types of traders. The programming assignments are intended to demonstrate and make concrete some of the theory that we discuss in lecture. Coding is not the emphasis of this course, but translating economic theory into algorithmic applications is. Your ability to analyze the instructive elements of an assignment, rather than the elegance of your code, will be the primary criterion upon which problem sets will be evaluated.

For a variety of logistical reasons, programs must be written in Matlab. Assignments will specify the required names of certain output variables, and this should allow me to run/check your code, and it should allow you to run the code that I post alongside problem set solutions. Also, Matlab is free to UIUC students, and it is fairly easy to use/learn (it’s designed for object-oriented programming). Early on, my expectations for coding will be very low, and throughout the course I will explain unusual features specific to Matlab that might be useful or important for upcoming assignments.

Problem sets are due at the beginning of lecture on the indicated dates. Except where otherwise specified, please turn in hard-copies of your problem sets. On some assignments, I will also ask you to send me parts of your code; please send these electronic portions between 12:01AM and 11:00AM on the indicated dates.

Collaboration on problem sets is both allowed and encouraged—unless otherwise noted—but please indicate on each problem set with whom you worked. However, if you collaborate on a problem set, you are still responsible for understanding exactly what every part of your code does, and why. If you are going to turn in exactly the same answers as some other student(s), please just turn in a single set of solutions.

Exams

There will be two midterm exams and a final exam. These will be sit-down exams (as opposed to take-home exams), and they will be conducted in a computer lab. You should bring all of the (corrected) code from previous problem sets to each exam, and you will be asked to make some minor modifications to your code to answer some questions that are slightly different from the ones on the problem sets, then explain what you changed and why. If you thoroughly understand your code and its relation to the material in the lectures/readings, modifying your programs to answer these exam questions should be extremely easy. The purpose of these assessments is to check that each student individually understands all of the material covered in the problem sets. The exams will also include some straight-forward questions about the material covered in assigned readings.

The exams are cumulative, but the second midterm will emphasize material from the problem sets that were due after the first midterm.

Grading

I will assign grades with pluses and minuses. Problem sets grades and exam grades contribute to overall course grades with the following weights:

- Problem sets: 45%
- Midterm #1: 15%
- Midterm #2: 15%
- Final exam: 25%

If your score on the programming component of the first midterm is more than 25 percentage points lower than your minimum score on the first four problem sets, or if your score on the programming
component of the first midterm is less than or equal to half of your minimum score on the first four problem sets, your scores on those four problem sets will be multiplied by your percentage score on the programming component of the first midterm. Similarly, if your score on the programming component of the second midterm is more than 25 percentage points lower than your minimum score on problem sets #5-#7, or if your score on the programming component of the second midterm is less than or equal to half of your minimum score on problem sets #5-#7, your scores on those five problem sets will be multiplied by your percentage score on the programming component of the second midterm. I expect that this mechanism will never turn out to be applicable, but I include it to remove the incentive to turn in problem sets that are highly unrepresentative of your own individual command of the material.

Grades will be curved to a median of A-.

Administrative Policies

The UIUC 2013-2014 Student Code specifies the policies on topics including (but not limited to): accommodations for students with disabilities, excused absences, sexual harassment, non-discrimination, make-up exams, and academic misconduct. Please note that students who require accommodations for disabilities must inform me of this within the first week of the course. Requests for special accommodation will require documentation from the Disability Resources and Educational Services (DRES).

Late work will only be accepted, and make-up exams will only be permitted in cases of the specific exceptions detailed in the Student Code. If you miss either or both of the midterm exams because of documentable conflicts with job interviews, your score on the final exam will replace your score on the missed midterm(s). Note that adjustments to your problem set scores, if applicable, will still be computed in the same manner detailed in the “Grading” section above.

Syllabus

Lecture material and readings are subject to revision. Assignment due-dates and the dates of the first midterm and the final exam are fixed.

1 Introduction to Limit-Order Markets

1.1 Background on financial markets (8/26)

- Hasbrouck Ch. 1, Ch. 2
- Harris Ch. 1, Ch. 3, Ch. 4.1-4.4 (pp. 68 - 77)

1.2 Introduction to limit-order markets (8/28)

- Hasbrouck Ch. 3
- (Hasbrouck Ch. 8, Ch. 9)
- Harris Ch. 5, Ch. 6
Assignment 1: Due 9/4

2 Market-Making: Inventory and Immediacy

• *O’Hara Ch. 1
• Harris Ch. 8, Ch. 14

2.2 Inventory risk/costs (9/9)
• *O’Hara Ch. 2
• Harris Ch. 13

Assignment 2: Due 9/16

3 Private Information

3.1 Beyond inventory risk (9/11)
• Harris Ch. 9, Ch. 10

3.2 Market-making I: Glosten-Milgrom (1985) (9/16)

3.3 Algorithmic Glosten-Milgrom (9/18)
• Hasbrouck Ch. 12
• Harris Ch. 4.5-4.14 (pp. 78 - 88), Ch. 7

Assignment 3: Due 9/23

3.4 Topics on Market-Making Algorithms (9/23)

Assignment 4: Due 9/30

4 Price-Impact and Trading Costs

4.1 (Not on midterm #1) Easley-O’Hara (9/25)
• *O’Hara Ch. 3
• Hasbrouck Chapter 7

4.2 Recap for midterm (9/30)

Midterm #1 (10/2)

[Lecture Canceled] (10/7)

4.3 Transient and permanent price-impact (10/9)
• Hasbrouck Chapter 13
4.4 Measuring trading costs (10/14)
   • Hasbrouck Ch. 11
   • Harris Ch. 21, Ch. 22

5 Agency Trading
5.1 Order splitting (10/16 - 10/21)
   • Hasbrouck Ch. 14
   • Harris Ch. 18, Ch. 19

Assignment 5: Due 10/21

6 Market-Making with Strategic Counterparties and Competitors
6.1 Order-splitting in limit-order markets (10/23)
6.2 Measures of liquidity; MM strategy; competition and “speed” for HFT and algo MMs (10/28)
   • Baruch-Glosten
   • *O’Hara Ch. 8.1-8.3
   • Harris Ch. 15

[Lecture Canceled] (10/30)
6.3 Dark trading (11/4)
   • Harris Ch. 4.5-4.14 (pp. 78 - 88)
   • Hasbrouck Ch. 10

6.4 (Not on midterm #2) Exploratory trading (11/6)
Assignment 6: Due 11/4/13

7 Informed Trading
7.1 Multiple markets; topics on fees, rebates, etc. (11/11)
   • *O’Hara Ch. 8.4
   • Harris Ch. 25, Ch. 26
   • Hasbrouck Ch. 15

7.2 Regulation NMS (11/13)
   • Hasbrouck Ch. 16
7.3 (Not on midterm #2) Fundamental news: Kyle, Grossman-Stiglitz (11/18)
   • *O’Hara Ch. 4
   • Harris Ch. 16, Ch. 17

Assignment 7: Due 11/13/13
Assignment 8: Due 12/4/13 (after midterm #2 and Thanksgiving break)

Midterm #2 (11/20)

8 Topics in Modern Market Structure

8.1 Market-based news and HFTs (12/2)
   • *O’Hara Ch. 6
   • Harris Ch. 11, Ch. 12

8.2 High-frequency trading; “speed”; (12/4)

8.3 Recap/ frontier research and strategies (12/9)

Final Exam (12/11)