

## SYLLABUS FOR MARKET MICROSTRUCTURE

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### COURSE DESCRIPTION

Welcome to *Market Microstructure* at Peking University HSBC Business School! For simplicity, most finance courses assume that securities trade in an idealized costless, frictionless world. In reality there are many frictions: bid-ask spreads, trade impact on price, brokerage commissions, quantity limitations, time delays, etc. This field of study is known as “market microstructure.” Microstructure has grown rapidly into one of the largest sub-disciplines of finance and has had a profound impact on the real world. For example, one research study uncovered evidence of implicit collusion by NASDAQ dealers. This led to a class action lawsuit that was eventually settled when 30 brokerage firms paid a total of \$1 billion in damages!

By the end of this course you should be able to

- Understand how financial markets are organized
- Analyze trade and quotes information
- Understand the role of informed trading
- Understand how financial markets evolving

### COURSE MATERIAL

- “Algorithmic Trading & DMA” by Johnson, 4Myeloma Press
- Lecture notes, assignments, and other useful information will be posted on the course web page at <http://www.danskim.com/mm.html>. You are expected to download and print the required material before coming to the class.

### CLASS FORMAT

The course is a mix of lecture and discussion. Lecture notes and excel files must be downloaded from the course website before class. I expect students to come to class prepared for active participation. Class attendance is strongly encouraged and is required during group presentations. To make the most efficient use of limited class time, students who miss a class or are late are responsible themselves for getting notes, assignments, and announcements from their classmates. It is your responsibility to keep yourself informed of important developments pertaining to the course. Keeping your University email account updated is important. We do problems in class, so bring a calculator. A basic financial calculator is best, though a good basic scientific calculator that does powers is fine. Solutions to in-class exercises will not be distributed or posted.

Please remember to turn off your cell phone before class. No notebook computers are allowed in the classroom.

## GRADING

The grades for this course are determined on a relative basis (i.e., your grade will depend on where you stand with respect to the rest of the class). Grades will be determined as follows:

| <b>Component</b>                            | <b>Weightage</b> |
|---|------------------|
| Two Projects:                               |                  |
| Individual project                          | 10%              |
| Group project                               | 30%              |
| In-class group assignments & participation: | 20%              |
| Exams:                                      |                  |
| Mid-term Exam                               | 20%              |
| Final Exam                                  | 20%              |
| <b>Total</b>                                | <b>100%</b>      |

## EXAMS

You will be required to take two exams -- one mid-term exams and a final exam. All of these are **closed-book, closed-notes exams**, and will only focus on material covered in class since the last exam (i.e., all exams including the final exam are **non-cumulative**). You will be provided with a sheet containing the important formulae. You must bring your own calculators though.

Two remarks on exams. First, no computers or programmable calculators are allowed. Second, you may use a financial calculator, but you must nevertheless convince me that you know what you are doing: just writing down a result or the variables you keyed in is not convincing, you should write down both the correct formula and the correct result. **If your answer seems unconvincing, you won't get full credit, even if the numbers are right.**

If you anticipate any conflicts with the exam times, you must inform me by the end of the second week of the course so that I can schedule an *early* exam for you. *Do not make any travel plans or schedule job interviews that conflict with exam times, especially the final exam; I will not accept that as a legitimate conflict.* You have to take the final exam at the designated time and place.

What if you miss an exam?

- I do not offer make-up exams. If you miss the mid-term exam because of a valid reason (described below), the credit for that exam *will be redistributed over the final exam*.
- Please understand that I am **not offering you an option** to miss a mid-term exam that you can exercise at will. You may miss a mid-term only for a valid reason: *family or health emergency, backed by documentary evidence*<sup>1</sup> (phone calls from parent(s) will not suffice).
- If you miss a mid-term exam, you must notify me immediately (by email) and provide the necessary documentation within a week's time. If you fail to do so or if you miss a mid-term for non-valid reasons, you will get a score of 0 on it, without any grade redistributions.
- Missing the final exam will automatically result in the course grade of 0 no matter how good you performed prior to the final exam.

Even if some medical/family problem does arise, you should try and resist the temptation of missing a mid-term exam because:

- You diversify your risks better if you take two exams.

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<sup>1</sup> At a minimum, a signed note from the doctor/ nurse on an official letterhead attesting that you were advised a day's rest. It is not enough to show me a slip proving that you visited a clinic.

- We cover more and more difficult topics as we progress through the semester. You might find the Final more difficult than Mid-Term.

## PROJECTS

You have to complete an individual project and a group project as part of this course. In TAQ project, you will analyze trade and quotes database for a firm individually. In final project, you will identify a possible informed trading in a US stock as a group.

For final project, each group will pick a different firm. You will get to analyze a firm of your choice as long as your preference doesn't clash with anybody else's. In case of a clash of preferences, I will do the allocation of firms.

These projects are expected to be professional work, and presentation is as important as the content. At a minimum:

- All text should be typed and presented in a case-like format. You should include a cover page with project title, and names of group members. The project report should be stapled or submitted in a folder.
- Apart from a *one-paragraph abstract* summarizing your findings, the report should have at least *three sections*:
  1. *Introduction*: Explain and motivate your research project. Discuss expected results. The reader should get the big picture about your project after reading the introduction.
  2. *Data and Analysis*: Discuss the project and procedures used in detail. This part can consist of several subsections. These subsections should be labeled, and must contain a brief description immediately preceding the spreadsheet and qualitative analysis.
  3. *Conclusion*: Summarize your results; keep it brief.
- Tables and figures must be clearly labeled, and must contain a description of the analysis. Each table or figure must fit on one page, or be separated in a logical manner. Tables and figures may either be incorporated into the text or included separately in the Appendix. Make sure you refer to each table and figure within the text.
- An Excel formula sheet attached in an appendix (i.e. re-print with formulas showing by using Tools/Options/View/Formulas and lengthening cells). You should also print this to expose the column and row headings (letters and numbers in Excel).
- *Submit a zip file containing all your Excel files* along with the project report. The grader will use this to verify that your analysis has been done correctly.

Each group will get around 15 minutes to make its presentation of final project. Presentations must be concise, and must focus on analysis and results. Your presentation grade will depend on how well you defend your valuation technique. *Attendance on all presentation days is mandatory (even if your group is not presenting), and will be reflected in your final project grade.*

**Groups:** Projects will be done in *groups of 5 members*. Please note that I will not adjudicate any intra-group disputes. Learning to cope with intra-group conflicts is part of your training.<sup>2</sup> Of course, you will get an opportunity to submit *confidential evaluations of your group members*, when you take your final exam (Specific guidelines for the evaluation will be provided along with the final exam). Each student's project grade will be adjusted to reflect these evaluations.

Following are the *important deadlines* pertaining to the projects. To receive full credit, submit the project at the beginning of class on the date it is due; late projects will be penalized **significantly**.

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<sup>2</sup> Once groups are assigned, it is your responsibility to figure out who your group members are, how to contact them, etc. I will only grade one report submitted by the entire group, and will not accept multiple reports by factions within groups.

| <b>Task</b>                        | <b>Deadline</b>           |
|------------------------------------|---------------------------|
| Submission of TAQ project          | November 25 <sup>th</sup> |
| Final project firm request         | December 2 <sup>nd</sup>  |
| Submission of final project report | January 8 <sup>th</sup>   |
| Group presentation                 | January 12 <sup>th</sup>  |

### **IN-CLASS ASSIGNMENTS AND PARTICIPATION**

Every new concept we learn will be applied to a real-life example (a small numerical problem, a mini-case, or a full-fledged case), which we will collectively solve in the class. You are expected to attend the class, actively participate in this exercise, and take down notes; *I will not post any solutions to in-class examples on the web page.*

Every now and then, I will assign one of these examples as an in-class group assignment, and will give 10-15 minutes to collectively solve the problem on a piece of paper. I will then grade your submissions, which will contribute to the “in-class group assignments and participation” component (20% weight) of your overall grade.

Note that the in-class assignment is not a surprise quiz; it is only meant to be an active participation exercise, and will be graded accordingly. *Needless to say, if you miss a class, you will miss out on any in-class assignments assigned that day. Regardless of the reasons for your absence, there will be no make-up assignments.*

### **MISCELLANEOUS INFORMATION**

**Integrity and Academic Dishonesty:** All students enrolled in a course taught through the Peking University HSBC Business School are expected to uphold the highest standard of academic honesty. Activities violating the standards will result in a **Fail**. I wish to specifically draw your attention to the plagiarism: *“Plagiarism is defined as presenting someone else’s work, including the work of other students, as one’s own. Any ideas or materials taken from another source for either written or oral use must be fully acknowledged...”* It is very important to keep this in mind as you submit your project reports. Please ensure that you cite every source of information you use (say analyst reports, Wikipedia, etc.).

## CLASS SCHEDULE

This is a tentative schedule, and is subject to change (not the exam or submission dates, though).

| <i>Class Number</i> | <i>Topics Covered</i>  | <i>Notes</i>                      |
|---------------------|--|-----------------------------------|
| 1 (Sep 1)           | <u>Introduction</u> <ul style="list-style-type: none"> <li>• Syllabus</li> <li>• SAS</li> <li>• PowerPoint: Lecture 01</li> </ul>  |                                   |
| 2 (Sep 4)           | <u>Trading industry and orders</u> <ul style="list-style-type: none"> <li>• PowerPoint: Lecture 02</li> <li>• Harris, Pages 11-19</li> <li>• Excel: NBBO Example</li> <li>• Harris Chapter 3</li> </ul>  |                                   |
| 3 (Sep 10)          | <u>Market structure around the world</u> <ul style="list-style-type: none"> <li>• PowerPoint: Lecture 03</li> <li>• Jain #1, pages 2955, 2966, 2983</li> <li>• Jain #2, pages 40-43</li> </ul>   | <u>Discuss TAO Project</u>        |
| 4 (Sep 11)          | <u>Transaction cost measurement</u> <ul style="list-style-type: none"> <li>• PowerPoint: Lecture 04</li> <li>• Five Transaction Cost Measurement Methods</li> <li>• Credit Suisse, pages 1-11</li> <li>• Hasbrouck and Saar, pages 1-4, 40-41, 48-55</li> <li>• Excel: Five Transaction Cost Measurement Methods</li> </ul>  | <u>Submit TAO project</u>         |
| 5 (Sep 15)          | <u>Limit Order Book vs. Call Markets</u> <ul style="list-style-type: none"> <li>• PowerPoint: Lecture 05</li> <li>• Excel: LOB and Call Markets</li> <li>• Angel, Harris, and Spatt, pages 1-20</li> </ul><br><u>Recent developments</u> <ul style="list-style-type: none"> <li>• Hendershott and Moulton, pages 568-577, 581-582, 583</li> <li>• Hendershott, Jones, and Menkveld, pages 1-4, 8-10, 12, 20-21</li> <li>•</li> </ul>   |                                   |
| 6 (Sep 18)          | <u>Block traders</u> <ul style="list-style-type: none"> <li>• PowerPoint: Lecture 06</li> <li>• Angel, Harris, and Spatt, pages 20-53</li> <li>• “Price of Liquidity,” Traders Magazine</li> </ul><br><u>Day traders</u> <ul style="list-style-type: none"> <li>• Video: Risky Business: The Day Traders</li> <li>• Articles by CNN Money</li> <li>• NASAA Report, pages 1, 9-13, 44-46</li> <li>• “Gambling Man,” Wall Street Journal Article</li> <li>• Barber and Odean, pages 773-776</li> </ul> | <u>Final project firm request</u> |

| <i>Class Number</i> | <i>Topics Covered</i>   | <i>Notes</i> |
|---------------------|---|--------------|
| 7 (Sep 22)          | <p><u>Market manipulation</u></p> <ul style="list-style-type: none"> <li>• PowerPoint: Lecture 07</li> <li>• Video: <i>Next: The Future Just Happened</i></li> <li>• Lebed Posting</li> </ul> <p><u>Insider trading</u></p> <ul style="list-style-type: none"> <li>• Bhattacharya, Daouk, Jorgenson, and Kehr (2000), pages 69-70,73-74, 82-83, 93</li> <li>• Bhattacharya and Daouk, pages 75, 80-84, 89, 92-93</li> <li>• Excel: Specialist Strategies</li> </ul>     |              |
| 8 (Sep 25)          | <p><u>Bid-ask spreads</u></p> <ul style="list-style-type: none"> <li>• PowerPoint: Lecture 06</li> </ul> <p><u>Probability of informed trading (PIN)</u></p> <ul style="list-style-type: none"> <li>• PIN project</li> <li>• Easley, Kiefer, O'Hara and Paperman, pages 1405-1410, 1418, 1421</li> <li>• PIN Sampler (Vega; Agudelo; Easley, Engle, O'Hara, and Wu; Easley, de Prado, and O'Hara)</li> <li>• Excel: PIN Model Estimation, PIN Model Dynamics</li> </ul> |              |
| 9 (Sep 29)          | <p><u>Floor traders and Brokers</u></p> <ul style="list-style-type: none"> <li>• Video: Floored</li> <li>• Harris, Hillary Clinton's Futures Trading Profits Clinton, Living History, pages 86-87</li> </ul>  |              |
| 10 (Oct 9)          | <p><u>Arbitrageurs</u></p> <ul style="list-style-type: none"> <li>• Harris, Lecture 13 Arbitrage, pages 1-5</li> <li>• Gagnon and Karolyi, page 60</li> </ul> <p><u>Informed traders</u></p> <ul style="list-style-type: none"> <li>• Gatev, Goetzmann, and Rouwenhorst, pages 797-799, 803-804, 807, 809, 812, 817</li> <li>• Bowen, Hutchinson, and Sullivan, pages 31-35</li> </ul>  |              |
| 11 (Oct 12)         | <p><u>Individual trading</u></p> <ul style="list-style-type: none"> <li>• Bessembinder, Maxwell, and Venkataraman, pages 251-254, 268-269</li> <li>• Edwards, Harris, and Piwowar, pages 1421-1423, 1437, 1441</li> <li>• Barber and Odean, pages 785-788, 797, 799-800, 802, 804</li> <li>• Barber, Lee, Liu, and Odean, pages 609-611, 614-615, 619, 621</li> </ul> <p><u>Review for midterm</u></p>  |              |
| (Oct 16)            | <b>MIDTERM</b>  |              |

| <i>Class Number</i> | <i>Topics Covered</i>  | <i>Notes</i> |
|---------------------|--|--------------|
| 12 (Oct 22)         | <p><u>Short-selling, lock-ups, Tobin's tax</u></p> <ul style="list-style-type: none"> <li>• PowerPoint: Lecture 12</li> <li>• Ofek &amp; Richardson, pages 1113-1116, 1127-1128</li> <li>• Schultz, pages 351-352, 354, 358, 360, 370</li> <li>• "Nasty, brutish and short," The Economist</li> <li>• "Taxing the Speculators," New York Times</li> <li>• "A Transaction Tax Would Hurt All Investors," Wall Street Journal</li> <li>• "EU proposes 0.1 percent financial transactions tax"</li> <li>• Beber and Pagano, pages 1-4, figures 1-7, tables 1-2, 4</li> </ul> <p><u>Discuss midterm results</u></p>                                      |              |
| 13 (Oct 23)         | <p><u>Crashes</u></p> <ul style="list-style-type: none"> <li>• PowerPoint: Lecture 13</li> <li>• "Stocks Plunge As Rescue Plan Fails To Gain House Approval," Wall Street Journal</li> <li>• Roll, pages 19-26</li> <li>• Shiller, Irrational Exuberance, pages 82-95</li> <li>• "Repeating the 1920s?" Wall Street Journal</li> <li>• "Market at a Crossroads," Wall Street Journal</li> <li>• "Time To Stand Tight," Wall Street Journal</li> <li>• Joint Preliminary Report on the Flash Crash, pages 11-15, 35, 46, 51, 54</li> <li>• Joint Final Report on the Flash Crash, pages 1-8, 19-22, 24-26, 30, 33, 61, 88, 90, 94, 98, 100</li> </ul> |              |
| 14 (Oct 27)         | <p><u>Deception and bias</u></p> <ul style="list-style-type: none"> <li>• PowerPoint: Lecture 14</li> <li>• Hanke and Hauser, pages 57-66, 76, 81-82</li> <li>• Bhattacharya, Holden, and Jacobsen, pages 1-3, 7-10, 14-15</li> <li>• Grinblatt and Keloharju, pages 549-556, 569, 574</li> </ul> <p><u>Competitive Dynamics</u></p> <ul style="list-style-type: none"> <li>• PowerPoint: Lecture 15</li> <li>• Biais and Green, pages 3-7, 40-41, 43-46, 50-51</li> <li>• Mayhew, pages 931, 933-934, 948-949, 955</li> <li>• Battalio, Hatch, and Jennings, pages 933-936, 944-945, 948-949, 952-953, 955</li> </ul>                               |              |

| <i>Class Number</i>          | <i>Topics Covered</i>   | <i>Notes</i> |
|------------------------------|---|--------------|
| 15 (Oct 30)                  | <u>Competing by Cross-Listing and innovating</u> <ul style="list-style-type: none"> <li>• PowerPoint: Lecture 16</li> <li>• Doidge, Karolyi, and Stulz, pages 253-259, 267</li> <li>• Moulton and Wei, pages 570-572, 575, 580, 587-588</li> <li>• Fernandes and Ferreira, pages 216-218, 231-233</li> <li>• Kavajecz and Keim, pages 465-472, 478, 480, 487</li> <li>• Boehmer, Saar, and Yu, pages 783-787, 791, 793, 795, 801-802, 805-806</li> <li>• Barclay and Hendershott #1, pages 1041, 1044-1045, 1047-1048, 1053</li> <li>• Barclay and Hendershott#2, page 689</li> </ul> |              |
| (Nov 2)<br><b>8:00-12:00</b> | Group Presentations<br><br><b><i>MANDATORY ATTENDANCE DAY</i></b>   |              |