**Electronic trading in modern limit order book markets**

Most financial markets are becoming electronic, and typically operated as limit order books. This course will provide an overview of electronic trading, with primary focus on short-term limit order book dynamics. We will overview the practical reality of the equities market, study the literature on a select set of topics that play an important role on short-term market dynamics and execution quality, and get the opportunity to interact with a rich set of market data. In the press, many of these topics are lumped up under the term “High-Frequency Trading (HFT),” and I will try, on the margin, to offer a reasonable and nuanced overview of the area from the broker / HFT / traditional buy-side / regulator viewpoints.

The topics that we will cover:

- algorithmic trading:

+ high-level overview; popular execution strategies; trading technology overview

+ market data inputs to algorithmic strategies: trading volume; volatility; spreads; depth; market impact models

+ review literature on optimal execution: different modeling frameworks; key findings; what happens in practice

- limit order book:

+ overview

+ point process view

+ queueing model of LOB

+ four illustrative problems: a) estimating time until an order fills; b) optimal execution in LOB and market impact modeling; c) order routing in fragmented markets; d) adverse selection

- data:

+ trades and quotes (TAQ) data for US equities with millisecond timestamps going back 4-5 years; starting July 27 the timestamps have microsecond timestamps

+ sample of proprietary trade data 2012-2014 (not current)

+ a software development environment that allows to query and analyze that data (“Onetick”) and one to design strategies and backtest them against TAQ data (the latter, “Lime’s Strategy Studio,” requires coding in C++… ouch!)

+ database of reference data, e.g., 1 min summaries of US equity activity during 2013-15

Course organization & goals:

This course will be an advanced MBA / PhD course. I am aiming for a 50/50 mix inside the class.

A significant part of the course will be on modeling and academic research in the above area; this will leverage and expand on a set of lectures I prepared and gave last spring in London. Another part of the course will review practice and give access to data for students to explore. The methodological content will likely be heavy when compared to quantitative MBA courses (i.e., they will be well beyond the level of our quant core courses) – I am sharing this as an important disclaimer. The ideas, however, are very useful, they will be accessible, practical and interesting. So, despite the fact that part of the course will be focusing on cutting-edge methodological research in the area, MBA students should learn a ton about electronic trading, market microstructure, and get exposure on empirical analysis of the very rich data that will be made available.

For PhD students, the course will offer an overview of a very interesting and dynamic area, focusing on the mathematical modeling of limit order book markets, and, as explained above, also give broad access to rich data to get a closer view of the short-term behavior of these HFT markets.

I had the opportunity to build and direct a team that designed, built and operated such a trading system for about 5-6 years, and fortunately (or unfortunately) had to grapple with all types of problems, from the most interesting and mathematically challenging, to the most mundane (but necessary). And hopefully some of that will also be exposed in the course.