M2 Research Internship: Liquidity provision and market order flow in equity markets

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Subject

The Limit Order Book (LOB) represents the venue where buyers and sellers interact in an order-driven electronic market. It summarises a collection of intentions to buy or sell shares at a given price (fig 1). The set of available prices is discrete with a basic unit step (tick size). The LOB is a self-organising complex process where a transaction price emerges from the interaction of a multitude of agents in the market. These agents interact through the submission of a range of order types in the market: most notably there are passive (limit) orders resting at a price and aggressive (market) orders that lead to an immediate transaction. The flow of market orders can have a complicated relation to the distribution of the resting limit orders in the book.
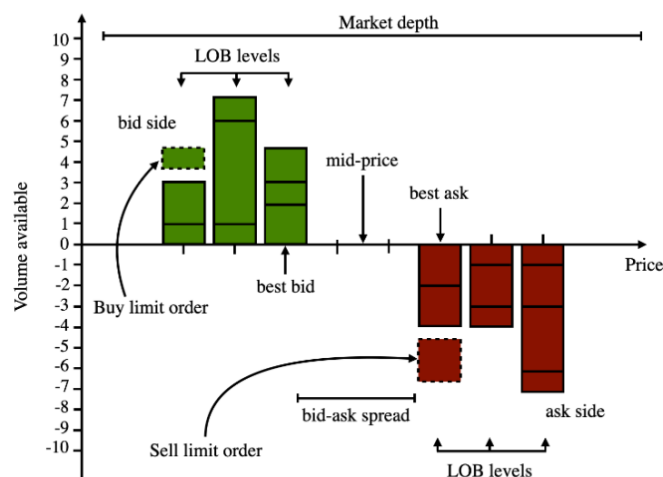

Figure 1: Illustration of a limit order book

The limit order imbalance in the limit order book seems to be a good predictor of the sign of the next market order, i.e. buy or sell, and also helps to predict price changes immediately after the arrival of a market order. This is shown for example in [1], [2]. Yet on a more macroscopic scale we find that consistently the order book posted volume imbalance is anti correlated to the trade flow [3]. This seems consistent with a scenario in which large displayed quantity in the order book attracts trades (on the same side). Large limit orders can be interpreted as a liquidity premium attracting a latent trader in order to send an aggressive order. Liquidity suppliers offering the limit order try to maximize the probability of executing their orders against latent more impatient trade demand. One could argue that an equilibrium can be reached where liquidity supply and (latent) liquidity demand is optimally synchronized, minimizing the costs of trading for all counterparties and avoiding frictions arising from sub-optimal coordination. We can refine our understanding including more technical aspects of trading as queue priority, hidden liquidity and dark pools.

Objectives

The subject of the internship is to bring understanding about the trade flows across time scales. We can address both US and European markets.

The work plan we suggest is the following:

1. Study book imbalance and trade imbalance on different time scales: from daily or minute binned data to microscales (real-time).

2. Study the book/trade correlation and the observed "flipping" of this correlation: properties and universality

   (a) Tick size dependence and time scales

   (b) Liquidity, volatility, sectors and other biases

   (c) Possible identification of activity footprints

3. Study the book trade relations in a fragmented market (multi venue trading)

4. Possible implications for pricing and scheduling of limit orders by algorithms

The internship will be held within the CFM Chair of Econophysics and Complex Systems at Ecole polytechnique (visit `www.econophysix.com`) in collaboration with the Execution strategies research team at CFM, composed of 7 researchers and traders working on the design of trading algorithms and in close collaboration with market data specialists and data scientists working on market data and signals.The work will involve large amounts of high frequency market data. The intern will have access to the powerful computing infrastructure of the research team. The recommended language will be **python**, knowledge of **C++** is a plus.

References

[1] M D Gould and J Bonart, MML 2 (02), 1650006, 2016 : Queue Imbalance as a One-Tick-Ahead Price Predictor in a Limit Order Book (also other references therein)

[2] Sasha Stoikov, Rolf Waeber (2016) Reducing transaction costs with low-latency trading algorithms, Quantitative Finance, 16:9, 1445-1451, DOI: 10.1080/14697688.2016.1151926

[3] V Volpati, M Benzaquen, Z Eisler, I Mastromatteo, B Toth, J-P Bouchaud: Zooming In on Equity Factor Crowding *https://hal.archives-ouvertes.fr/hal-02567503*