

FRE7251 Algo Trading & High-frequency Finance HW1

Yixin Zhang, yz5811@nyu.edu

1. Describe major trader types.

There are two major groups: (1) profit-motivated traders and (2) utilitarian traders. **Profit-motivated traders** trade only when they rationally expect to profit from trading. **Utilitarian traders** trade if they expect some additional benefits besides (and sometimes even instead of) profits. For example, investors who trade for managing their cash flows are the typical example of utilitarian traders. Hedgers are another type of utilitarian traders. The goal of hedging is to reduce the risk of owning a risky asset. In the economic literature, utilitarian traders are often called liquidity traders to emphasize they consumer the liquidity that is provided by market makers.

What is the difference between dealers and brokers?

For **brokers** who execute orders for their clients, profits from trading may not be important since they receive commissions for trading and other services from their clients. Typical brokerage services include matching the clients' buy and sell orders, connecting to markets, clearing and settlement, providing market data and research, and offering credit. Besides brokers, the sell-side includes **dealers** who buy and sell securities upon their clients' requests. **In contrast to brokers, dealers trade for their own accounts.** Hence, they have a business model of proprietary traders. Dealers make profit by selling an asset at a price higher than the price at which they simultaneously buy the same asset.

2. Describe major order types.

There are two major order types: **market orders** and **limit orders**. For market orders, price is not specified for market orders and their orders are executed at the best price available at the order arrival time. Limit orders specify the worst price (highest offer or lowest bid) at which traders agree to trade. Limit orders are not guaranteed to be executed. Limit buy order that are not immediately filled are stored in the limit order book (LOB) until they are matched or cancelled.

What is the difference between stop orders and limit orders?

Stop orders can be treated as limit orders since they specify the execution price. However, price has a different role in stop orders: It constraints possible loss rather than yields the realized profit. a trader sells an instrument using a limit order at a higher price for locking in the profit after buying an instrument at a lower price. On the contrary, the sell stop order is filled when prices fall to the order price. Hence, traders submit stop orders for mitigating the risk of possible adverse price moves.

3. Describe the notion of market liquidity.

Liquidity is a notion that is widely used in finance, yet it has no strict definition and in fact may have different meanings. Generally, the term liquid asset implies that it can be quickly and cheaply sold for cash. In the context of trading, **liquidity characterizes the ability to trade an instrument without notable change of its price.** As popular saying defines liquidity as the **market's breadth, depth, and resiliency.** Breadth means that the bid/ask spread is small. Depth means that order cancellations and

transactions do not affect notably the total order inventory available for trading. Market resilient means that if some liquidity loss does occurs, it is quickly replenished by market makers.

As for liquidity measurement, sometimes inverse liquidity (illiquidity) based on the price impact caused by trading volume is used (Amihud 2002):

$$ILLIQ = \frac{1}{N} \sum_{k=1}^N |r_k| / V_k$$

where, r_k and V_k are the return and trading volume for time interval k .

4. Consider LOB below:

Order	Price	Size
Ask2	10.35	200
Ask1	10.30	200
Bid1	10.25	100
Bid2	10.23	200

1. How will be matched buy order of size 300?

200@10.30 + 100@10.35

2. What to do if you want to buy 500 units?

You can submit a limit order that will be stored in the LOB until a new seller decides to match it.

How will LOB look and how the bid / ask spread will change if you place

3. B3 = 150@10.27

Bid / ask spread = 0.03

Order	Price	Size
Ask2	10.35	200
Ask1	10.30	200
Bid3	10.27	150
Bid1	10.25	100
Bid2	10.23	200

4. B3 = 250@10.24

Bid / ask spread = 0.05

Order	Price	Size
Ask2	10.35	200
Ask1	10.30	200
Bid1	10.25	100
Bid3	10.24	250
Bid2	10.23	200

5. B3 = 180@10.23

Bid / ask spread = 0.05

Order	Price	Size
Ask2	10.35	200
Ask1	10.30	200
Bid1	10.25	100
Bid2	10.23	200
Bid3	10.23	180

5. (Bonus) Offer an example of pre-auction order book in which the minimum order imbalance rule must be applied.

An example of Pre-Auction Order Book:

Buyers			Sellers	
Order	Size	Order Price	Order	Size
		9.95	S1	700
B1	100	9.90	S2	300
B2	200	9.85	S3	700

B3	600	9.80		
B4	500	9.75	S4	800
B5	600	9.70		

Price Discovery in the Order Book Listed in table above

Price	Aggregate Demand	Aggregate Supply	Trading Vol.	Excess Demand
9.95 and higher	0	2500	0	-2500
9.90	100	1800	100	-1700
9.85	300	1500	300	-1200
9.80	900	800	800	100
9.75	1400	800	800	600
9.70 and lower	2000	0	0	2000

In this situation, only using the rule of maximum aggregated size does not yield a unique price which means that we will have the same trading volume @9.80 and @9.75. Hence, we must apply the minimum order imbalance rule to get a unique price. The excess demand is smallest @9.80.