



COMPUTATIONAL FINANCE & RISK MANAGEMENT

UNIVERSITY *of* WASHINGTON

Department of Applied Mathematics

How your order gets filled (supplemental)

CFRM 522 (002a)

Introduction to Trading Systems

Lecture References

- Readings (assignment)
 - Aldridge, Ch 1
 - Narang, Ch 7
- Bloomberg: *How Your Buy Order Gets Filled*
<https://www.bloomberg.com/news/articles/2012-12-20/how-your-buy-order-gets-filled>
 - Unfortunately behind a paywall now
 - Diagram is useful, though (we will refer to it shortly)
- money.stackexchange: *If NYSE has market makers, what is the role of NYSE ARCA which is an ECN?*
<http://money.stackexchange.com/questions/27780/if-nyse-has-market-makers-what-is-the-role-of-nyse-arca-which-is-an-ecn>

- Market Maker
 - SEC: A firm that stands ready to buy or sell a stock listed on an exchange at publicly quoted prices
 - Wikipedia: A company or an individual that quotes both a buy and a sell price in a tradable asset held in inventory, hoping to make a profit on the bid–ask spread
 - Investopedia: Market makers are compensated for the risk of holding assets because they may see a decline in the value of a security after it has been purchased from a seller and before it's sold to a buyer
- Examples:
 - Wholesale brokerages (could be internal to a trader's brokerage)
 - Proprietary traders
 - Swap desks at investment banks

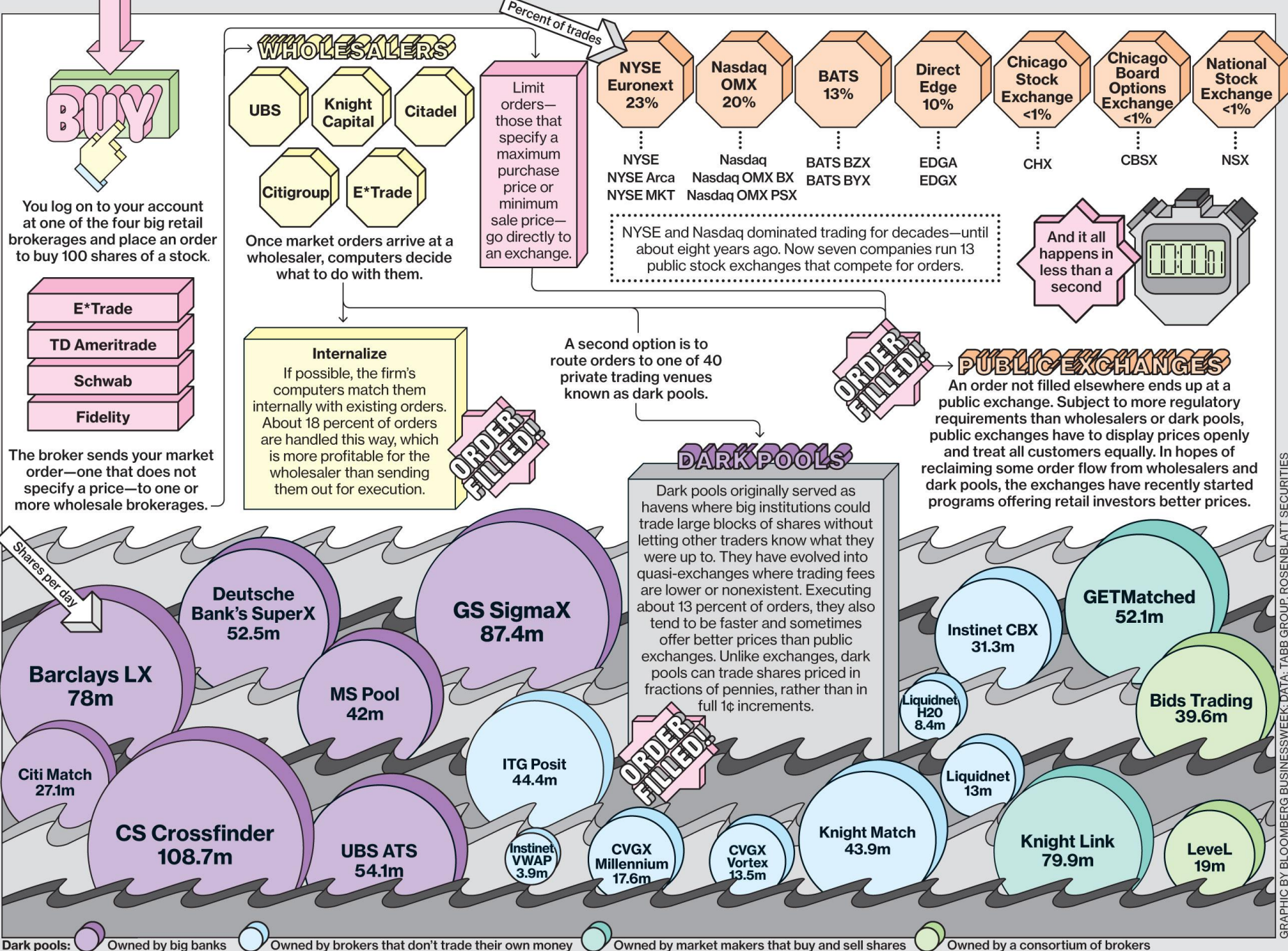
Electronic Communication Networks (ECN's)

- An ECN (*Electronic Communication Network*, also *Electronic Crossing Network*) is a virtual exchange that works with market makers and uses a rebate structure that works by paying for orders adding liquidity and charges a fee for removing liquidity
- NYSE ARCA and other ECN's are where market makers do their jobs. These market makers can be floor traders or algorithmic.

(money.stackexchange reference)

Order to Execution (money.stackexchange reference)

- Liquidity is created by encouraging what are essentially limit orders, orders that are outside of the current market price and therefore not immediately executable. These orders stay in the book and are filled when the price of the security moves and triggers them.
- When you send an order through your brokerage, your broker has a number of options. Your order can be
 - sent directly to an ECN/exchange such as NYSE ARCA
 - sent to a market making firm like KCG Americas (formerly Knight Capital),
 - or internalized: when the broker uses an in-house service to execute your trade.
- Brokerages must disclose what they do with orders (see charts from E-Trade in following slides), also available on <https://content.etrade.com/etrade/powerpage/pdf/OrderRouting11AC6.pdf>
- The next slide is taken from the Bloomberg reference...



Some Definitions

- Market Order: An order to buy or sell at the prevailing best market price available, without conditions or limits.
- Limit Order: An order to buy or sell where the customer limits the acceptable buying or selling price. A limit order can be executed only at the specified price or better.
- Directed Order: An order that the customer specifically instructed the broker or dealer to route to a particular venue for execution. (The exception more than the rule)
- Non-Directed Order: Any customer order other than a directed order.

Some Definitions

- NBBO: National Best Bid and Offer
 - Under SEC rules, the NBBO consists of the highest displayed buy and lowest sell prices among the various exchanges trading a security
 - Exchanges and liquidity providers can route orders to the exchange with the best quote represented in the NBBO, or alternatively, can match or improve those prices and execute on their own market venue
 - Trades must be routed to or executed at the NBBO price, with few exceptions (SEC)

Exchanges	Bid	Ask
Exchange 1	25.26	25.31
Exchange 2	25.24	25.32
Exchange 3	25.25	25.30
Exchange 4	25.24	25.32
Exchange 5	25.25	25.33



<https://www.schwab.com/execution-quality/price-improvement>

E*TRADE Rule 606 Disclosure

- New York Stock Exchange Listed Securities

<i>For quarter ending 12/31/2016</i>	Non-Directed Orders	Market Orders	Limit Orders	Other Orders
Orders Routed to:				
G1 Execution Services, LLC¹	43.97%	51.66%	28.09%	83.50%
Citadel Securities, LLC²	18.60%	31.97%	6.94%	4.22%
Bats EDGX Exchange, Inc.³	13.47%	0.00%	30.57%	0.00%
KCG Americas, LLC⁴	9.49%	14.96%	3.09%	12.10%
Citigroup Global Markets, Inc.⁵	8.17%	0.00%	18.54%	0.00%
Nasdaq OMX⁶	5.50%	0.00%	12.49%	0.00%
Wolverine Securities, LLC⁷	0.81%	1.41%	0.28%	0.18%
Total E*TRADE Orders	95.01%	47.50%	44.05%	8.44%

E*TRADE Rule 606 Disclosure

- NASDAQ Stock Market Listed Securities

<i>For quarter ending 12/31/2016</i>	Non-Directed Orders	Market Orders	Limit Orders	Other Orders
Orders Routed to:				
G1 Execution Services, LLC ¹	42.74%	53.09%	26.36%	83.71%
Citadel Securities, LLC ²	18.46%	33.41%	7.92%	4.32%
Bats EDGX Exchange, Inc. ³	18.31%	0.00%	37.59%	0.00%
Nasdaq Stock Market ⁴	12.20%	0.00%	25.04%	0.00%
KCG Americas, LLC ⁵	7.60%	12.27%	2.76%	11.80%
Wolverine Securities, LLC ⁶	0.65%	1.23%	0.23%	0.14%
Citigroup Global Markets, Inc. ⁷	0.03%	0.00%	0.07%	0.00%
Total E*TRADE Orders	93.51%	42.58%	48.71%	8.71%

E*TRADE Rule 606 Disclosure

- Exchange Listed Options

<i>For quarter ending 12/31/2016</i>	Non-Directed Orders	Market Orders	Limit Orders	Other Orders
Orders Routed to:				
NASDAQ Options Market	22.89%	0.79%	27.26%	0.01%
Chicago Board Options Exchange	15.11%	25.06%	12.33%	47.03%
BATS BZX Exchange	14.35%	1.12%	16.97%	0.44%
NASDAQ PHLX	12.15%	18.64%	9.95%	43.06%
NYSE Arca	9.36%	0.73%	11.07%	0.23%
MIAX Options	8.14%	24.83%	5.80%	0.01%
International Securities Exchange	5.73%	1.38%	6.48%	4.25%
ISE Gemini Exchange, LLC	5.65%	1.45%	6.42%	2.69%
Total E*TRADE Orders	98.93%	13.25%	83.60%	3.15%

Interactive Brokers and Course Assignments

- For some of our assignments, we will be using Interactive Brokers paper trading accounts, and the IBrokers R package
- IBrokers trading functions for equities and FX provide defaults for exchanges:
 - Equities: SMART – IB SmartRouting submits each leg of a trade to the best possible venue. Takes into account
 - The exchange with the highest rebate.
 - The highest volume exchange that has a rebate for adding liquidity.
 - The highest volume exchange that charges the lowest fee for taking liquidity.
 - See <https://www.interactivebrokers.com/en/index.php?f=1685&ns=T>
 - FX: IDEAL – IdealPro Forex Market Center
 - A Large-Size Order facility specifically intended for orders in quantities greater than standard order maximums
 - willing to trade outside the NBBO associated with the standard order bands in an attempt to obtain faster fills.
 - For our purposes, at least to start out, it will probably be sufficient to use the default, but there might be alternatives that are better for particular strategies
 - See <http://ibkb.interactivebrokers.com/node/1708>

- For futures, however, an exchange will need to be specified, as there is no default
 - More about this later
 - Need to find out the exchanges where the contracts you wish to trade are available

[END]