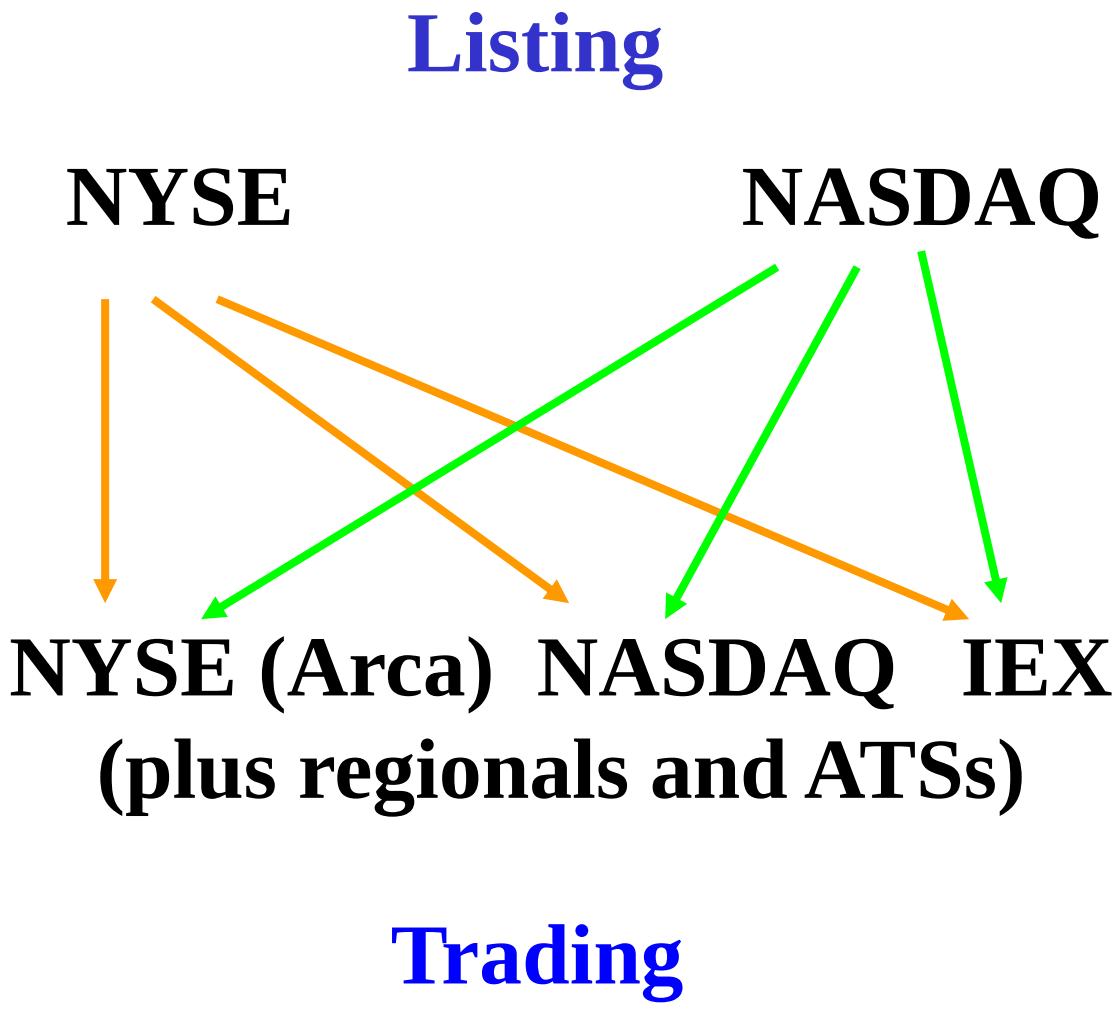
The Stock Exchanges and Alternative Trading Systems

... listing and trading conduits

Listing versus trading

... and for the retail trader, this doesn't really matter (much).



Electronic Communications Networks (ECNs) [1998 Reg ATS: Alternative Trading Systems]

- Authorized fully electronic trading and clearing networks
- Most were originally independent, and designed to compete with NASDAQ and NYSE, but many were absorbed (Instinet, Archipelago, the Island) and others have become exchanges.
- Oldest (pre reg-ATS) was Instinet (1960), specializing in institutional trades, purchased by NASDAQ.
- Some specialized in after-hours trades (normal trading hours are 9:30 to 4:00 EST).
- They introduced low-latency full automated (computerized) trading.

The 2005 Game-Changer Mandate:
The SEC Regulation National Market System (Reg NMS)

This massive mandate, created in 2005 and now being implemented, was intended to create a competitive, self-regulating, and largely automated **national market system** for securities.

Among its features:

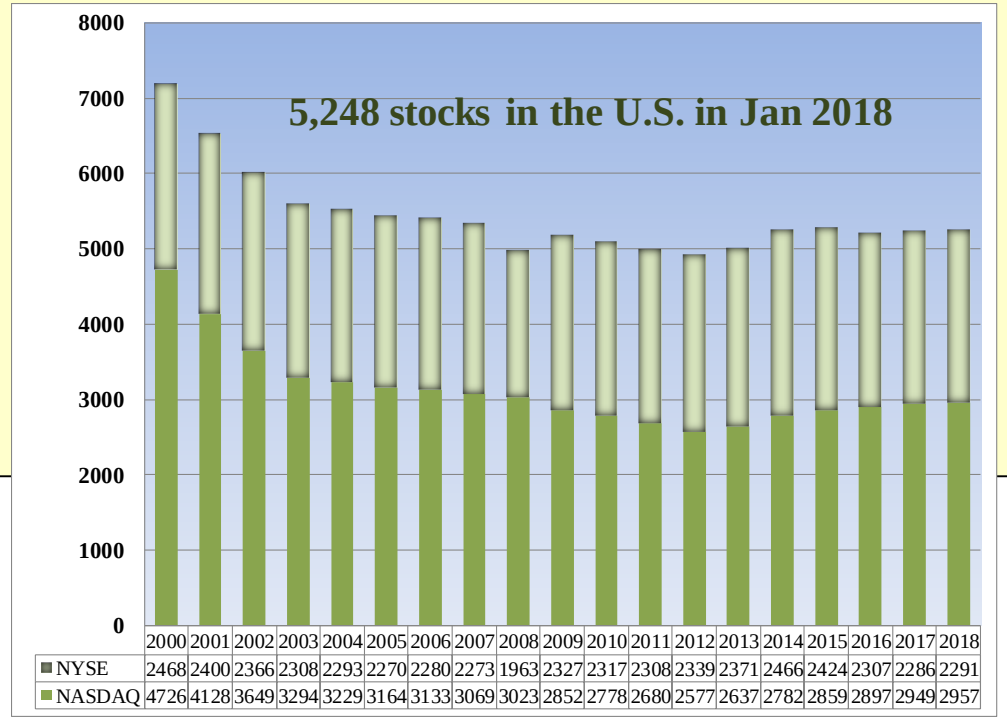
1. "Consolidated tape" for all exchanges.
2. Rule 611 – orders trade at the **best possible price** (NBBO).
3. **Standardized trading rules** to be followed.
4. Rule 610 - Equal access to all markets by all players.

So what, precisely, is a stock exchange?

A stock exchange is any ECN or physical exchange that legally adopts rules for itself and its members that comply with the requirements of Reg NMS, subject to approval of the SEC. The ***technology*** used by the exchange, for example for order routing, must be capable of insuring this compliance. There are currently 4 large trade groups that meet this criteria:

1. **NYSE**
2. **NASDAQ [OMX]**
3. **Cboe (BATS Global)**
4. **IEX**

really 2 ...



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
NYSE	2468	2400	2366	2308	2293	2270	2280	2273	1963	2327	2317	2308	2339	2371	2466	2424	2307	2286	2291
NASDAQ	4726	4128	3649	3294	3229	3164	3133	3069	3023	2852	2778	2680	2577	2637	2782	2859	2897	2949	2957

Source: **World Federation of Exchanges Monthly Report,** September 2018.

NYSE – 3 US dedicated exchanges

1. **NYSE/Floor** – the traditional physical exchange located at 1 Wall Street, hybridized electronic but with many people still on the floor (formerly open-outcry).*
2. **NYSE Arca** – the fully electronic exchange
   - Purchased Archipelago, an ECN, in 2005.
3. **NYSE MKT** – now dedicated to listing and trading small-caps.
   - Historically evolved from the NYSE purchase of the old American Stock Exchange.

*I no longer describe the workings of the physical exchange in these lectures.

Major Exchanges – NYSE [owned by ICE]

- Retains physical exchange - 1 Wall St. NYC
- Oldest and most traditional of US exchanges 1792
- Originated the open outcry system, but slowly converted to pure electronic, except, notably, NYSE/Floor, still important in closing auctions.
- Merged with EuroNext in 2007.
  - which was formed by merging Amsterdam, Brussels, and Paris exchanges (2000), then acquired London derivatives market (LIFFE) and Portuguese exchange, making it the largest cross-border market in the world.
- Was bought by a Intercontinental Exchange (ICE) in 2013
  - which is a holding company that began as a natural gas trading company (!) and now trades, through subsidiaries like NYSE and Euronext, stocks, options, ETPs, commodities, credit instruments, futures, foreign exchange – essentially everything!
- NYSE opens stocks with the result of an electronic auction.

NASDAQ OMX Group

- **N**ational **A**ssociation of **S**ecurities **D**ealers **A**ctive **Q**uotation system - no longer associated w/ NASD
- Decentralized electronic exchange since 1971
- 3,900 companies listed on **NASDAQ OMX** in 50 countries (2,957 in the U.S.).
- **INET** global high-speed trading platform (former ECN acquired in 2007)
- NASDAQ listing and trading are separate functions
- Still a huge player, but now the market is chopped up.

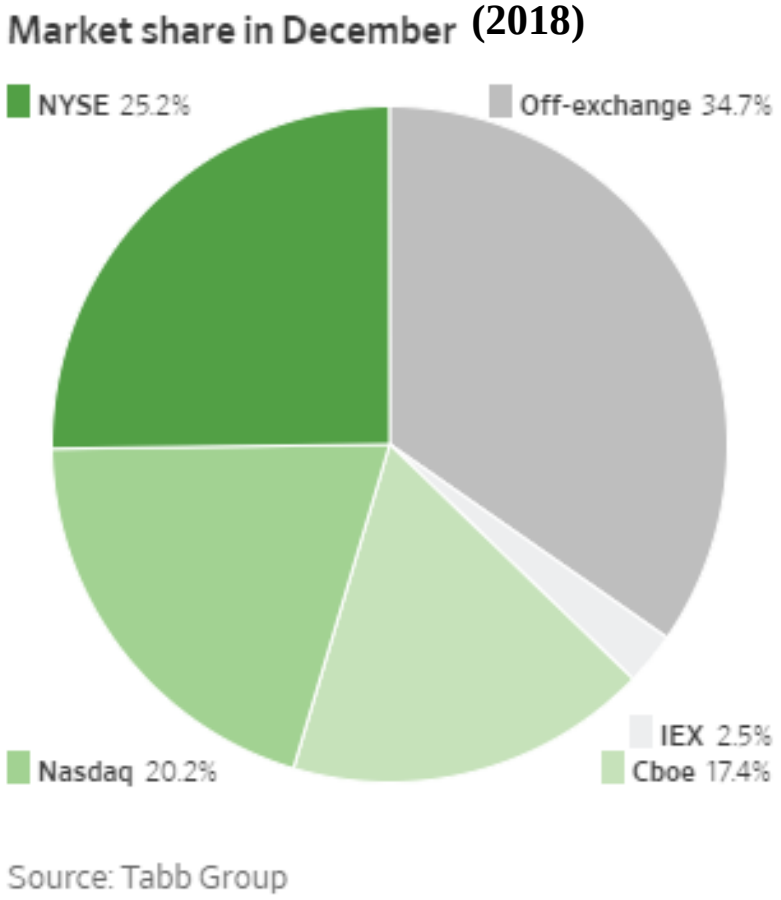
The newcomers – BATS Exchange and Direct Edge
(now BATS Global, the pure technology play)

- Both started as ECNs (ATCs)
- Both aspired to **SEC Reg NMS** comp
- Both were global
- Both sold mostly **speed** and **low cost** (and NMS compliance)
  - The secret on speed is **order routing** that is NMS Rule 611 compliant.
- Both were active in options trade (Tape B trade).
- BATS Global bought Direct Edge on August 26, 2013.
- BATS scans against **dark pools** (explained later).
- BATS appeared to be aggressive at attracting algos and market makers.

all absorbed, all gone by 2017

BATS Making Markets Better® | U.S. Stock Exchanges

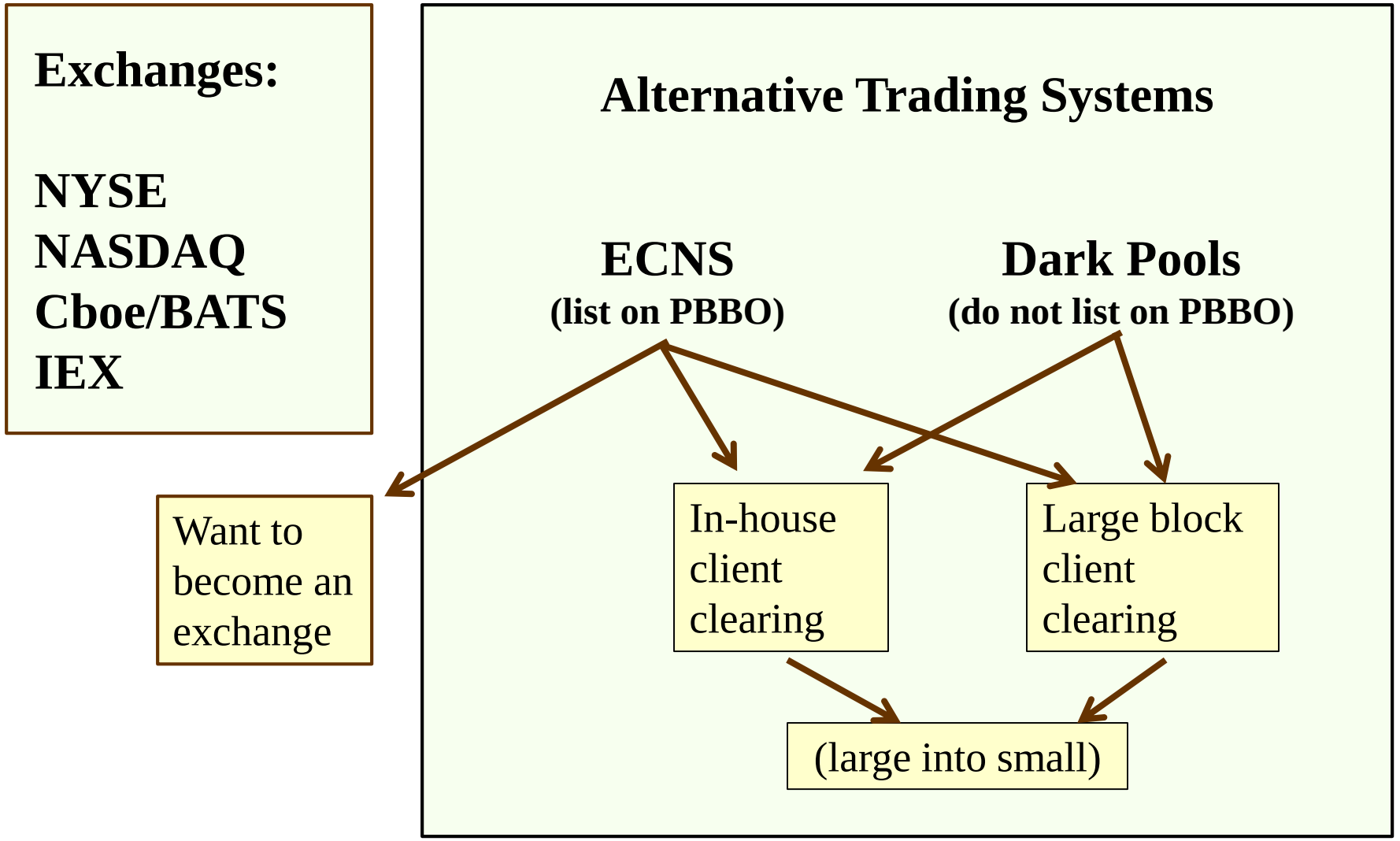
Market Share (exchanges)



This was shown in the article below suggesting that a new exchange, Members Exchange, is being developed by some major players, like Morgan Stanley and Citadel.

https://www.wsj.com/articles/wall-street-firms-plan-new-exchange-to-challenge-nyse-nasdaq-11546866121?mod=hp_lead_pos7

Taxonomy: Exchanges, ECNs, and Dark Pools



Big problem: Large trades and market impact!

Large institutional traders like mutual funds and hedge funds often want to trade huge blocks of the same stock (e.g. 100,0000 shares) over a short period of time. But they want to do it anonymously, because if the market knew their intentions, other traders could game the transaction. They want to trade without **market impact**!

So the market must provide liquidity to these traders (have enough stock out there being sold and bought on spec and arbitrage to offer sufficient volume for these large block trades) without market impact. REG NMS doesn't do this.

Traditionally these large block trades were broken up and handled anonymously in pieces, and they still are to some extent, but now they are just as likely to be handled by **dark pools.**

Reminder of HW coming up ...

Module 2 - Equity Performance

September 16 (Mon) to September 25 (Wed) : 4 sessions

History of the stock market, leverage, classes of stock, electronic trading, some stock selection and trading strategies

Read: Chapter 3 A Supply and Demand Model for Stocks and Chapter 4 Historical Stock Market Performance

Watch this video about The Beta and the Sharpe Ratio, estimating risk and performance.

Do Stock Portfolio Assignment 1 (short and easy) after reading Chapter 4 and then between Friday, September 20, 1:30 PM and Monday, September 23, 6:00 AM (i.e. when the markets are closed), complete Stock Portfolio Assignment 2, print it, and bring it to class on Monday, September 23, **or** put in in my inbox outside of Parsons 1261. (No email accepted).

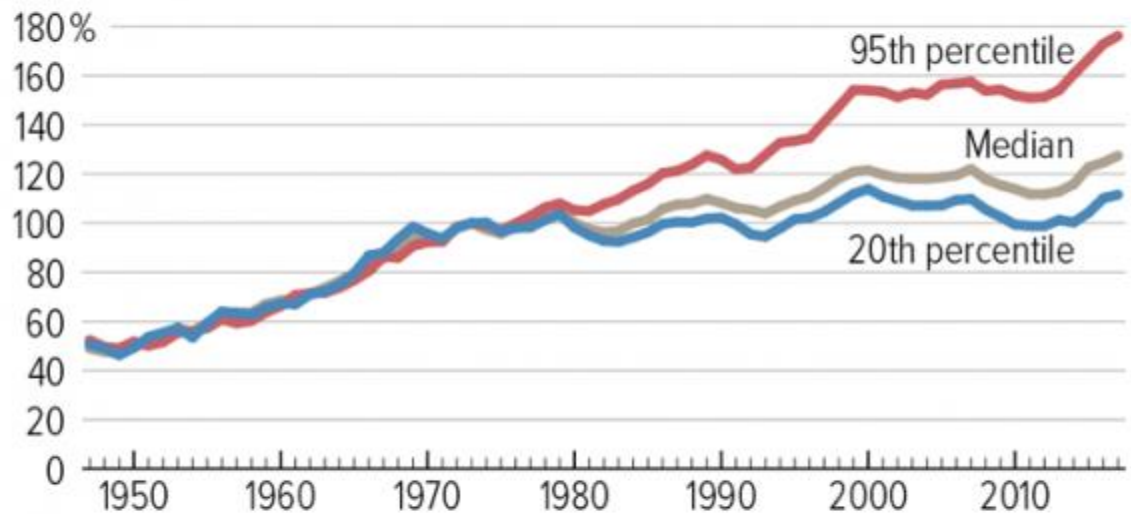
This weekend **... Assignment 1**

Next weekend and only next weekend **- Assignment 2**

FIGURE 1

Income Gains Widely Shared in Early Postwar Decades — But Not Since Then

Real family income between 1947 and 2017, as a percentage of 1973 level



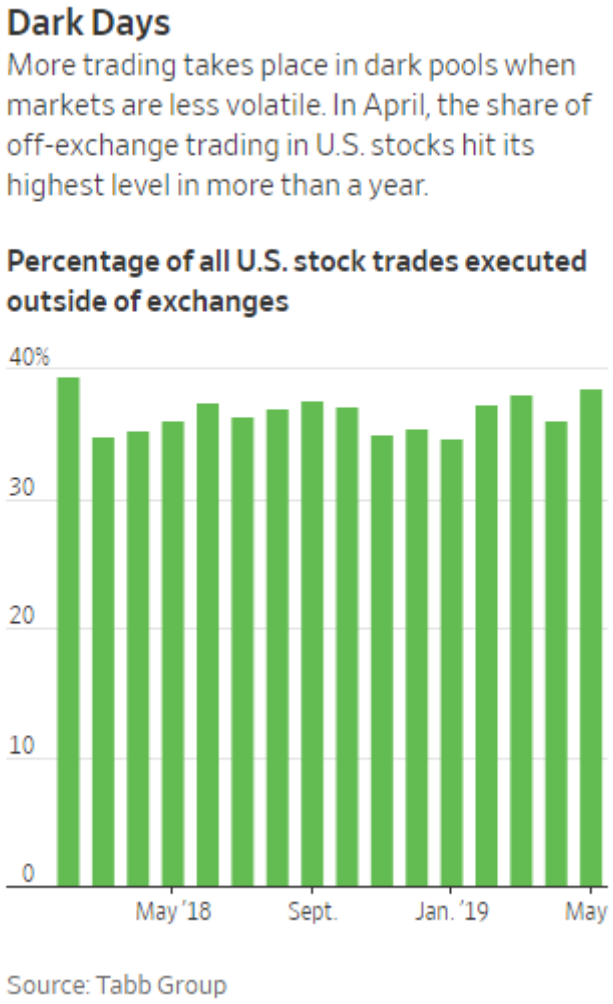
Note: In 2014 Census split its sample of survey respondents into two groups to test a set of redesigned income questions. In 2015 (reporting on 2014 income using the new questions), Census released two estimates of 2013 incomes, one based on the old questions and one on the new. The chart uses the estimate based on the old questions, based on CBPP's judgment that, due in part to sample size, it is likely more accurate for 2013.

Source: CBPP calculations based on U.S. Census Bureau Data

Dark Markets and Dark Pools

- Dark markets do not publicly post their transactions
  - you won't see large block transactions on NASDAQ TotalView, although you will see pieces of them if and when they are broken into smaller trades
  - **Crossing Networks** that match large blocks off-market (non PBBO)
  - 45 of them (ATS) currently.
- Dark pools are ECNs that trade dark market transactions
- The SEC allows them to facilitate secret large block trades
  - because an informed market would go against the trades
  - What if someone knew you were trying to sell 300,000 shares of F?
- Dark pools must report trades monthly on Reg NMS Rule 605.
- Dark pools seem to account for between 15% and 30% of total market volume.

Dark pool trades compared to the exchanges



Source: "*Dark Pools Draw More Trading Amid Low Volatility,*" by Alexander Osipovich, The Wall Street Journal, May 3, 2019

Example: Dark Pool reference point crossing

The NYSE crossing procedure involves finding a **reference price** from the mid-point of the NBBO quote randomly selected from predetermined one minute pricing periods. Periodically participants can **cross** at that price.

See http://www.nyse.com/pdfs/Matchpoint_One_Sheet.pdf. Also for a discussion and example of how Internet Sweep Orders can fit into this in procedures used by the NYSE, see NYSE *Hybrid Market Training Program*, Sept. 2006, available from the NYSE in pdf.

(ATS) trade size on average is small ... ???

Mudd Finance

Alternative Trading Systems Data Details

ATS Description	Shares	Shares Last Updated Date	Trades
UBSA UBS ATS	1,527,738	09/16/2019	16,110
CROS CROSSFINDER	789,550	09/16/2019	7,851
IATS IBKR ATS	431,847	09/16/2019	3,566
EBXL LEVEL ATS	356,859	09/16/2019	2,967
MSPL MS POOL (ATS-4)	284,000	09/16/2019	1,700
XSTM CROSSSTREAM	268,132	09/16/2019	1,085
JPMX JPM-X	263,185	09/16/2019	1,753
SGMT SIGMA X2	249,293	09/16/2019	2,633
LATS THE BARCLAYS ATS	224,500	09/16/2019	1,562
MSTX MS TRAJECTORY CROSS (ATS-1)	126,200	09/16/2019	588
MLIX INSTINCT X	119,314	09/16/2019	508
JPBX JPB-X	110,806	09/16/2019	1,402
CODA CODA	83,855	09/16/2019	690
ITGP POSIT	61,000	09/16/2019	466
DBAX SUPERX ATS	58,500	09/16/2019	528
KCGM VIRTU MATCHIT ATS	50,194	09/16/2019	683
BIDS BIDS ATS	47,100	09/16/2019	89
MSRP MS RPOOL (ATS-6)	42,300	09/16/2019	310
LQNA LIQUIDNET H2O ATS	41,200	09/16/2019	4
BLKX INSTINET BLOCKCROSS	31,172	09/16/2019	2
ICBX CBX	26,800	09/16/2019	164
INCR INTELLIGENT CROSS LLC	26,412	09/16/2019	130

ATS Weekly trade data for AAPL, week of 08/26/2019

Total shares: 5,238,837

Total trades: 44,803

94.8 shares!

10,300 shares

15,586 shares

Market Makers (a disappearing breed)

- Market Makers *were* large trading firms who are committed to provide market liquidity through active bidding, buying and selling in designated stocks. (Important – see Ch. 2).
- For NASDAQ, market participants have a Market Participant ID (MPID) ... these you see as 4-letter symbols on NASDAQ TotalView (Level II).
- Underwriters for an IPO are required to be market makers for the new stock.
- For the privilege of guaranteeing liquidity to the market, these MMs had the inside edge on ***spread arbitrage*** (defined in the chapter, example later in this set). BUT high-speed traders began to take over that oligopoly and do a better job of it, and they are not required to make the market.
- ***Implications!***

Who are the algo traders?

Algo(rhythm) traders use computer programs to generate trading signals.

There are two general categories of algo-trading: (1) High-frequency and/or high-speed trading, and (2) computerized strategy implementation based upon elaborate math models. The former can only be done by large trading firms, but the latter can be done by anyone, including the large trading firms of course, but also small-scale individual traders trading for their own portfolios.

I specialize in developing and encouraging students to develop "under-the-radar" algo trades using Python working in a Linux environment (palmislandtraders), knowing that certain kinds of trades are not sufficiently large to attact the attention or interest of large trading firms. This is now the primary objective of Econ 136.

The strategies are endless. Part of the purpose of the algo is to have your computer "watching" all day for anomalies or patterns to emerge for you to trade. Most of my models are daemons that monitor prices and make calculations and log them or notify me of threshold conditions.

High-frequency trading (HFT) and High-speed trading (HST)

High-frequency trading and high-speed trading are not the same thing, but are often done by the same large firms at the same time.

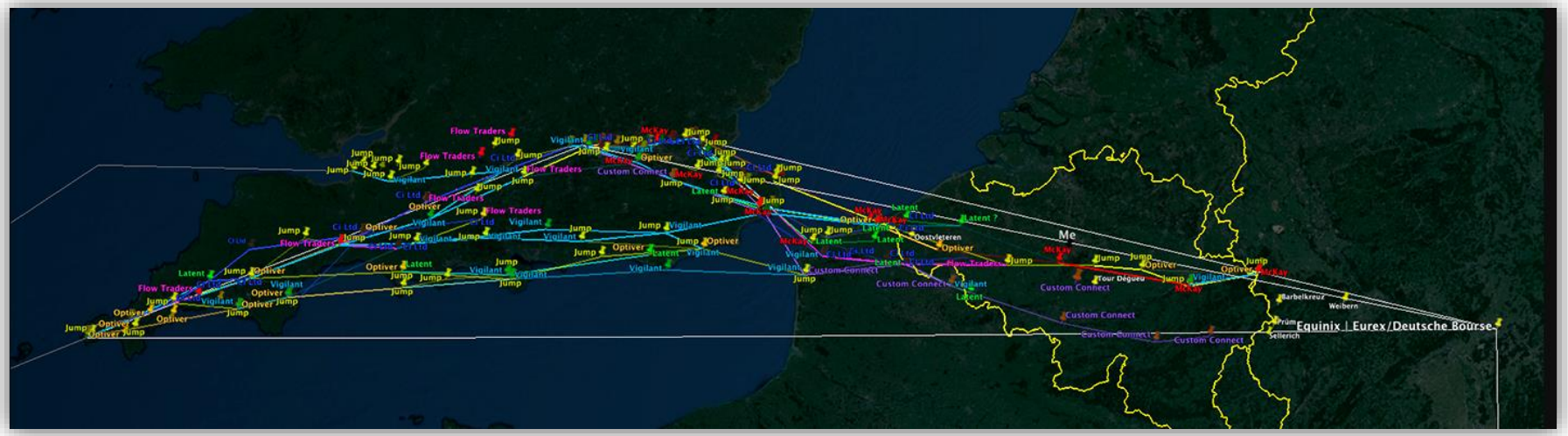
XYZZX	
BID	ASK
15.98	15.99

High-frequency trading typically involves placing and removing a huge volume of limit orders in multiple markets, whether in equities, futures, or options, at a very high pace for typically very short duration.

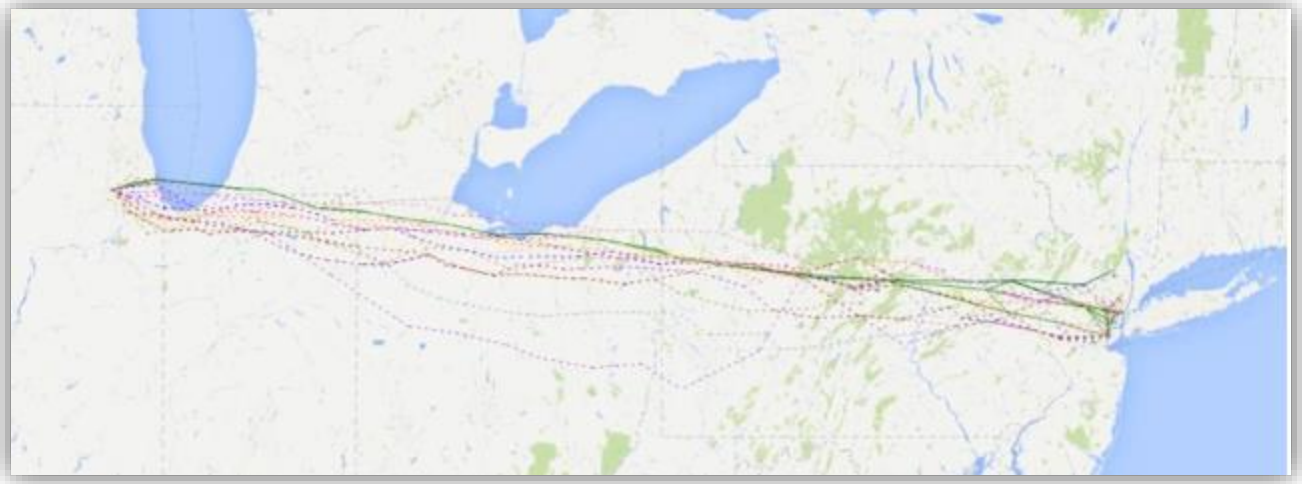
High-speed trading involves using a technology that minimizes the latency associated with any kind of trade that requires speed. High-speed traders want to be the first to see new limit orders and the first to respond.

Market-making and spread arbitrage (described below) both employ HFT and HST. The technology that allows this class of trading is extremely expensive so only the largest of trading firms can afford to to this: Getco, Jane Street, Headlands, Citadel, and many of the large bank trading subsidiaries. Any trading firm that is identified as a “market maker” or has a “market participant ID” is in this group.

Programming languages used are C++, Java, C itself, and specialized languages like O’Caml (used by Jane Street).



Britain-Germany HST microwave routes with owners named



Known Microwave HST Chicago-NJ networks

and **short pipes!!**

HST relies mostly upon microwave and to a lesser extent, fiber optic, but there is now some evidence that they may be experimenting with shortwave, which would be accessible to smaller-scale traders (potentially).

Fascinating, readable research sources:

"Mechanizing the Merc: The Chicago Mercantile Exchange and the Rise of High-Frequency Trading," by Donald MacKenzie

http://www.sps.ed.ac.uk/__data/assets/pdf_file/0006/93867/Merc21b.pdf

"HFT in my backyard – 1," Sniper in Mahwah blog, Sept, 22, 2014.

https://sniperinmahwah.wordpress.com/2014/09/22/hft-in-my-backyard-part-i/

"Shortwave trading – Part 1 – the West Chicago Tower Mystery,", Sniper in Mahwah blog, May 7, 2018.

https://sniperinmahwah.wordpress.com/2018/05/07/shortwave-trading-part-i-the-west-chicago-tower-mystery/

... and a really, really interesting video about the capabilities of shortwave for high-speed digital data transmission:

https://www.youtube.com/watch?v=3rivvZjgD3s

Note! I now require that students know how spread arbitrage works.

Market Makers, Algo Traders, Spread Arbitrage, and Mudd Algo Traders

Points:

1. How the market maker plays this and makes a profit through spread arbitrage
2. How the algo trader could trade it but might bail.
3. How ***you*** the Mudd algo trader might play this.

HFT algotraders are not required to be market-makers!

.. be aware of this controversy and its implications

See the discussion in Chapter 2, Section 6 ... this will be on the exam.

Most market makers are now also algo traders but not all algo traders are market makers. Market makers are *required* to make a market in their designated stocks, but algo traders in general are not (you can be an algo trader).

What happens, though, in the next market panic?? Will the model thresholds trigger a withdrawal (measured in nano-seconds)? Will the bid queues go black?

Some market makers pay for market order routing to come to them. Suppose the MM pays for XYZZX market orders. Suppose the Level 1 Bid and Ask above is represented by the MM. Then if MM gets a market order to buy and another to sell they execute at these prices and the MM makes a penny. This is how RobinHood makes revenue ... routing your order to someone who pays for it.

The flash crash of May 6, 2010

At 10:42 AM PDT I and millions of others watched the DJIA fall about 700 points in 15 minutes in an otherwise quiet day. Then it recovered nearly as fast. PG, a DJIA component, is shown here. Accenture and a handful of other stocks fell to one cent, and thousands of share were traded at the price.

What happened? Nobody is yet quite sure to this day. It appears that (and when I saw it happen I judged it to be this) that a large series of Wadell & Reed computer generated ISOs wiped off the top of a couple of key queues (like Dow component PG) which sent indexes tumbling, which triggered circuit-breaker shutdowns of algo trades, which removed liquidity and depleted the ask stacks and darkened the bid stacks taking bids and asks to stub quotes. (I have seen an entire bid stack disappear from time to time).

... and why you never use Stop Orders for ETPs (or anything else)

... from the ***Wall Street Journal*** story in the previous slide:

Lansing, Mich.-based financial adviser Theodore Feight had set up an automatic sale* for iShares Core U.S. Value ETF if it were to fall a certain amount. The ETF tumbled 34% in early trading, and instead of Mr. Feight's position selling at his target price of $108.69, down 14%, it sold at $87.32, off 31%. By noon, the ETF had bounced back, and it ended the day down 4.3% at $121.18.
"I'm really disappointed," said Mr. Feight, who invested in ETFs for more than a decade. "They weren't as liquid as they should have been."

***** probably a stop-loss market order (not clear from context).

Pig learns about the flash crash ...

Circuit Breakers

In 2012, the SEC reset system-wide trading stops called “circuit breakers,” where trade is suspended for a period of time because of extreme market declines. Circuit breakers are set for the market as a whole and "limit-up, limit-down" trading halts are also set for individual securities.

The system-wide circuit breakers:

Level 1 halt: 7% drop in S&P 500 before 3:25 PM (ET) halts trading for 15 minutes.

Level 2 halt: 13% drop in S&P 500 before 3:25 PM (ET) halts trading for 15 minutes (for the second time, given that there has already been an L1 halt).

Level 3 halt: 20% drop in S&P 500 suspends trading for the rest of the day.

These NYSE circuit breakers are reset periodically.

Over-the-Counter Bulletin Board (OTCBB) stocks

September 17, 2019

See *www.otcmarkets.com*

Note: Dollar volume

MOST ACTIVE

$ Volume | Share Volume | Trades

SYMBOL	PRICE	% CHANGE	$ VOL	SHARE VOL	TRADES
Pink ATHHF	25.08	+1.54	129,659,894	5,217,664	531
Pink TCEHY	44.12	+0.34	93,101,316	2,115,924	3,615
QB FNMA	4.04	+1.00	89,142,294	21,683,181	9,034
QB FMCC	3.82	+0.53	46,260,913	11,815,966	4,431
QB FNMAS	13.44	-0.81	36,825,340	2,710,325	1,879
Pink NPSNY	33.68	-32.68	32,890,670	978,412	4,442
Pink SFTBY	21.29	-2.07	32,478,427	1,523,556	2,423
Pink NSRGY	107.51	+1.53	23,305,248	217,035	1,645
QX GBTC	12.89	+5.22	23,132,019	1,835,348	3,073
Pink SNEJF	59.63	-1.43	23,037,649	386,408	5

MORE ›

Over-the-Counter Bulletin Board (OTCBB) stocks

September 17, 2019

Note: Share volume

MOST ACTIVE

$ Volume | Share Volume | Trades

SYMBOL	PRICE	% CHANGE	$ VOL	SHARE VOL	TRADES
Pink LIBE	0.001	+900.00	1,375,353	2,354,873,245	1,886
Pink ASTI	0.0001	-50.00	30,000	291,674,948	84
Pink MMEX	0.0002	0.00	26,863	202,704,043	170
HMNY	0.0022	+57.14	355,214	179,802,808	1,034
PBHG	0.0006	+20.00	87,351	173,914,103	97
AITX	0.0001	-50.00	17,503	173,210,301	64
Pink ASCK	0.0003	0.00	60,862	170,768,499	91
Pink PHIL	0.0001	0.00	16,424	166,586,437	47
Pink ISWH	0.0005	-16.67	65,909	163,762,907	76
Pink DKSC	0.0023	+130.00	370,923	160,385,222	990

MORE >

Remember them?

OTCBB (continued) .. the true penny stocks

September 17, 2019

ADVANCERS

Over $1 | Over $0.05 | All

SYMBOL	PRICE	% CHANGE	$ VOL	SHARE VOL	TRADES
Pink AGOWF	0.01	+4,900.00	2	160	1
Pink APEOF	0.041	+4,000.00	358	7,500	3
Pink CPPWF	0.0013	+1,200.00	1	732	2
Pink LIBE	0.0011	+1,000.00	1,293,308	2,276,576,410	1,756
STOP ENTI	0.0001	+900.00	95	950,000	2
Pink CNYCF	0.025	+900.00	3	100	1
STOP NYLE	0.004	+700.00	1	200	1
STOP DEQI	0.0055	+400.00	20,180	2,569,100	103
Pink AMDDW	0.10	+397.51	25	246	1
STOP NVES	0.02055	+387.80	37	939	8

MORE >

NYSE pre-market open auctions (price discovery)

(This is too much to expect a beginner to understand, but it is useful to know in times of Trubba. This slide is explained by example).

Example #2

Book at 4:00 a.m. ET: Previous Closing Price $18.50

ENTRY TIME	BUY LIMIT ORDERS	SELL LIMIT ORDERS	ORDER PRICE	MATCHABLE VOLUME	IMBALANCE	INDICATIVE MATCH PRICE
3:31	1,000		$19.00	0	1,000	$19.00
3:38		1,000	$18.00	1,000	0	$18.50
3:53	1,000		$20.00	1,000	1,000	$19.00
3:56		1,000	$19.00	2,000	0	$19.00

Result: 2,000 shares match at $19.00

Source: **NYSE ARCA Auctions** (pdf)

https://www.nyse.com/publicdocs/nyse/markets/nyse-arca/NYSE_Arca_Auctions_Brochure.pdf

Example: Using limit orders wisely

Algo captures my attention at -1.5 sigma (25.72).

I immediately submit a limit order, but not at 25.72, instead at 25.45.

This is what I call a "Ricardian" strategy: "Investors over-react to distressing news." Here we are either just trying to buy low (swing trade or long trade) or intend to sell on the recovery (day trade).