



Outline

- The need for double-sided auctions
- □ Auction procedures.
- Problems and manipulations
- □ The NASDAQ opening auction.
- □ Other uses of auctions.
- The Facebook IPO

Auctions in securities markets

- Generally concentrate all buying and selling interest at a single point in time.
 - Unlike (e.g.) a sequence of bilateral bargains
- As points of comparison, eBay auctions are
 - single-unit
 - seller's auctions
 - open outcry (bidders see other bids and can make bids at any time)

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- $\hfill\square$ Most securities auctions are
 - Multiple unit
 - Many shares change hands
 - Double-sided
 - Both buyers and sellers participate
 - Use modified open outcry formats
- Most common use: opening and closing continuous trading sessions

Opening and closing a continuous market

- □ Most organized trading is not 24/7.
- Recall: liquidity is a network externality
 - Trading tends to cluster
- Many markets adopt implicit or explicit "regular trading hours"
 - Organized into one or more trading sessions
 - Example: the Tokyo Stock Exchange has a morning session (9:00am - 11:30am) and an afternoon session (12:30pm -3:00pm)

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Volume at the open and close

□ At the open, volume driven by

- Accumulated portfolio rebalancing needs.
- Accumulated information.

□ At the close, large volume pegged to closing prices.

- Mutual funds: closing prices → net asset values → used to price customer purchases and redemptions.
- On derivative final settlement days, closing prices used to compute settlement cash flows.

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Analyzing	, trader	s' p	rofi	ts ir	ı au	ctio	ns							
Start with the	e followin	g set	of lir	nit o	rders	s, ran	ked 1	from	most	to le	east agg	gressi	ve.	
\$20 \$19 \$16 \$15	Amy Bill	Buye	Dan	Eve		Art	Bev	Cam	Dora	Ed	\$18 \$17 \$16 \$15			
φ14								Copyri	ght 2015,	Joel Has	φ ιτ	rights res	served	15

The si	ngle	e-pr	ice	auc	tion	L	
\$20 \$19 \$18 \$17 \$16 \$15 \$14	Amy Amy Ant	Bill Bev	Cat Cam	Dora	Eve		The clearing price is \$16: • Amy, Bill and Cat are buyers • Art, Bev and Cam are sellers Profits: • Amy: $20 - 16 = 4$ • Bill: $19 - 16 = 3$ • Cat: $16 - 16 = 0$ Total buyers profits are \$7 • Art: $16 - 14 = 2$ • Bev: $16 - 15 = 1$ • Cam: $16 - 16 = 0$ Total sellers' profits are \$3 Total profits are \$10 Copyright 2015, Joel Hasbrouck, All rights reserved 16

An \$20 \$19 \$18 \$17 \$16 \$15 \$15 \$14	ny B	Sill Bev (Cat Cam	Dora	Ed Eve	The profits are indicated by shaded areas. Profits: • Amy: $20 - 16 = 4$ • Bill: $19 - 16 = 3$ • Cat: $16 - 16 = 0$ Total buyers profits are \$7 • Art: $16 - 14 = 2$ • Bev: $16 - 15 = 1$ • Cam: $16 - 15 = 1$ • Cam: $16 - 16 = 0$ Total sellers' profits are \$3 Total profits are \$9
Tl	he si	ingle	e pri	ice aı	action a	chieves the highest total profits

\$20	Amy													
φ <u>2</u> 0		Bill												
\$19											Ed			
										Dora		\$18		
			Cat						Cam			\$17		
\$16				Dan				Bev		1		\$16		
\$15				Dun	Eve		Art			-		\$15		
\$14					Eve		AIL					\$14		
Step 1: Pair o	off the	e mos	st agg	gressi	ive bı	uyer	(Amy	7) an	d the	e mos	t agg	gressive	seller	(Art
Cross them a	t the '	midp	oint	of th	eir li	mit ŗ	orices	. Am	y buj	ys fro	m Ar	t at \$17.		
Step 2: Pair o	ff Bill	l and	Bev	at the	eir m	idpo	ints.	Bill l	JUYS	from	Bev c	at \$17.		
Cton 2. Com c	nd C	at ar	o nai	rod o	ff at (\$16	Cat h	uve f	rom	Cam	at \$1	6		

\$20	ıy					
\$19		Bill				Count the areas: the total profits are
φ1) ¢10						the same as in the single-price
\$18						auction (\$10). Note
\$17 \$16				Cat	Cam	 Not everyone is not trading at the same price.
¢1 ⊑						• Buyers' and sellers' profits differ
\$15			Bev			from the single-price auction.
\$14	Art					The efficiency of the single price auction does not depend on there
						being one price.

	sell.	ers				
Aı	nv					
\$20	<u> </u>	Bill				
\$19 ¢10						If buyer and seller pairs are matched according to
\$18 ¢17						almost any pricing rule, the
φ1/ ¢16				Cat	Cam	profits will still be \$10.
\$10 ¢1 ୮						
\$15 ¢14			Bev			
\$14	Art					



\$2 \$1 \$1	Amy satis their their is \$2 Amy 9 9	and Ed are fied with trade, but max profit	Their is \$3. Bill	- max profit	•				No trade more tha wants at	e. (Cat won't pay an \$16; Dora : least \$17.)	
\$1 \$1 \$1 \$1 \$1 \$1 \$1	8 7 6 5 4			Cam	Dan	Bev	Eve	Art	Cat	Dora	
	The n in an	nax total pro open-outcry	ofit is \$ 7 floor 1	5. This is an market beco	n ineff ause ti	icient all he wrong	location. g people t _{Copyrig}	Trades rade. ht 2015, J	like this car	n happen All rights reserved	22

Economists call the "trading profits" the *surplus*.
It represents extra value gained from trade.
It is generally true that a single-price auction where everyone truthfully reveals their buying and selling limit prices achieves the largest total surplus.
Most economists believe:
"If you replaced the inefficient continuous trading mechanism with a single-price auction, everyone would on average be better off."
In practice, auctions can be difficult to run.



Manipulation Alan puts in two bids His genuine market order for 4 shares and an "artificial" bid for 10 shares, limit 9. The second bid discourages the other bidders (Beth, Cam, and Dana). They don't bid at all. At the last instant, Alan cancels his second bid.



Deadline effects

- When should we clear the market (that is, stop accepting orders and fix a price)?
- □ If we set a firm time, we often encounter *deadline effects*.
 - Everyone waits until the last moment.
 - These can lead to instabilities and manipulations.
- Should we extend the deadline until outcome looks stable?
 - The Facebook IPO

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Stabilization measures

- Randomization of clearing times
- □ Limited disclosure of demand and supply functions.
 - We don't always show the full supply and demand curves in real time.
- Special order types
- Early submission and cancellation deadlines for certain orders ("freeze periods")

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Randomization

- The auction deadline is a random time (within a narrow window)
 - The London Stock Exchange uses a 6- second window for FTSE-100 stocks
- You can't submit/cancel "at the last moment.
- Most US exchanges do not randomize.

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- There are two limit order books: the opening book and the regular continuous book.
 - They are combined in the open procedure.
- Opening orders must be received prior to 9:28am and cannot be canceled.
- Starting at 9:28am, the system transmits matched volume and imbalance information every five seconds.
- Between 9:28 and 9:30, the system accepts *imbalance-only* orders.
 - Imbalance only orders are only executed if they reduce the imbalance.
 - Example: if there is a buy imbalance (more buys than sells), a sell imbalance-only order would be executed.

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Other financial auctions

- □ Periodic calls for low-activity securities.
- Initial public offerings (of debt and equity)
- Credit default swap settlements.
- High-frequency auctions

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Auctions in low-activity securities Some stocks don't trade frequently enough to sustain a continuous market. The Euronext markets (Paris, Amsterdam, Brussels, Lisbon) use twice-daily single-price call auctions to trade stocks that average fewer than 2,500 trades per year.

US Treasury Auctions

- US T-bills, notes and bonds are sold in auctions conducted at the Federal Reserve Bank of NY.
 - T-bills are auctioned most Mondays and Thursdays
 - T-notes and bonds on Wednesdays
- Two types of bids
 - Competitive bids specify a price and a quantity.
 - Non-competitive bids specify a quantity. The price is determined in the auction.
 - □ Like a market order.

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IPO auctions Inderwriting banks bid to purchase issue. They then esel to investors. Equity Google IPO When henchet's OpenIPO (active, but lightly used)

High-frequency auctions

- Proposed as a replacement for continuous trading.
- □ Run a single-price call every minute.
- □ Proponents claim that trading once per minute would ...
 - satisfy most investors' needs
 - remove the millisecond advantages reputedly used by high-frequency traders.

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The NASDAQ opening cross for IPOs

- For the initial opening, orders are entered, canceled and revised during a *display-only period* (DOP).
- □ At the conclusion of the DOP, NASDAQ builds the supply and demand curves, and computes the price and quantity where supply≈demand.
- □ All eligible buyers and sellers are crossed at this price.
- Continuous trading commences.

What happened

- 7:56 NASDAQ announces that the DOP will run from 10:45 to 11:00.
- 10:58 Net Order Imbalance Indicator suggests an opening price of \$43. Morgan requests an extension of the DOP to 11:05
- ~11:05 NASDAQ systems construct a cross. This takes about 20 ms.
- □ NASDAQ systems perform a validation check.
- During the 20 ms computation time, one order had been cancelled. The validation check fails.

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- NASDAQ recomputes the cross, and performs a second validation check.
- During this computation, NASDAQ receives two more cancellations, so the second validation step fails.
- NASDAQ computes the cross (a third time), but fails to register one of cancellations, so the third validation fails.
- NASDAQ computes the cross (fourth time). One more cancellation. Validation fails.
- □ The procedure continues to loop.
- 11:05 NASDAQ management convenes a "code blue" conference call.

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The code blue call

- After a few minutes, the cross failure is attributed to the validation procedure.
- □ Is there a way to override the validation procedure?
- Yes. Move the cross to a duplicate system that has a few lines of code removed (the "failover" system)
- **u** 11:25 Management approves this action.
- 11:30:09 The failover system computes the cross.
 75.7 million shares trade at \$42.
- 13:50 NASDAQ learns that 38,000 orders entered between 11:11 and 11:30 weren't included in the cross.
- NASDAQ determined that it had a 3 million share *short* position.
 - ... which it closed (by buying shares at a lower price) at a profit of \$10.8 million.

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The aftermath

□ NASDAQ pays a US fine of \$10 million.

- ... and \$62 million to brokers.
- "NASDAQ will make technical changes to its ... Crosses ... NASDAQ will close its order ports to new orders and cancels after the calculation of a cross is triggered [started] ..."
- See: U.S. Securities and Exchange Commission, 2013. In the matter of the NASDAQ Stock Market LLC and NASDAQ Execution Services LLC ("Facebook").

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