

# Auctions, their types, modeling

Prof. Andriy Stavytskyy



# Outline

1. Auction concept
2. Types of auctions
3. Bazerman phenomenon

# Auction concept



# Definition

- ▶ Auction is a pricing mechanism in which any product is sold at a specific public auction at a price set in the sales process.

# Actors at auctions

- ▶ several (potential) participants;
- ▶ seller (auctioneer).

# Auction properties

- ▶ Resistance to conspiracy
- ▶ Difficulty of entry and maintenance activities
- ▶ Reserve prices and political motives
- ▶ Adherence to a priori established rules
- ▶ Market structure

# The importance of auctions

- ▶ Approximately 30% of US GDP goes through auctions:
  - Flowers
  - Wine
  - Works of art
  - Fish
  - Electronics
  - Treasury bills

# Formalization of the auction – 1

- ▶ object for sale;
- ▶ each participant knows the price of this object only for himself;
- ▶ in each participant has a probabilistic distribution of value;
- ▶ the participant knows some outcome of this distribution, and the other participants and the seller – only the distribution itself;
- ▶ the values of the object are distributed independently; if they are dependent, then, knowing the value of the object for themselves, you can draw some conclusions about the value of the object for competitors;



# Formalization of the auction – 2

- ▶ the strategy of displaying a set of values in the pond;
- ▶ Nash equilibrium;
- ▶ each participant's personal strategy is the best answer to the strategy of others.

# Classification of auctions

- ▶ simultaneous (for one object);
- ▶ consistent (for multiple objects);
  
- ▶ open (*sealed-bid*);
- ▶ closed (*ascending*);
  
- ▶ *optimal* (get as much money for the object that for sale);
- ▶ *effective* (object gets the participant who needs it more all).

# Advantages auctions

- ▶ a real competitive mechanism where big money circulates;
- ▶ easily implemented in practice;
- ▶ high transparency, which reduces the probability of conspiracy to 0;
- ▶ certain rules of the game, which can be clearly explained and changed depending on the purpose of the auction;
- ▶ depending on new theoretical results and developments, the rules of the game may also change.

# Disadvantages of auctions

- ▶ auctions force participants to anticipate the behavior of other participants;
- ▶ participants do not have a full information;
- ▶ in a closed auction – you need to guess the bids of others;
- ▶ the probability of suboptimal result increases;
- ▶ determining the rate (strategy) becomes a difficult task;
- ▶ it can be difficult to explain to the community why the auction format was chosen this way and not the other way around;
- ▶ it is likely that those who won the same objects will pay a different price;
- ▶ high cost of error;
- ▶ poorly formulated rules can lead to suboptimal closing of the auction.

# Types of auctions



# Types of auctions

- ▶ English auction
- ▶ Auction of the first price
- ▶ Dutch auction
- ▶ Second price auction
- ▶ The perfect auction
- ▶ Online auction
- ▶ Auzubel auction

# English auction

- ▶ open auction with growing prices;
- ▶ participants take turns calling the price higher and higher. The object goes to the last person that raised the price;
- ▶ May have limited step;
- ▶ may be anonymous or electronic;
- ▶ sell antiques, paintings (companies Sotheby's and Christie), houses and land

# Japanese auction

- ▶ As a partial case of an English auction, there may be a Japanese auction, when the price rises by itself, and participants leave the hall when the price rises.



# Auction of the first price

- ▶ closed auction;
- ▶ participants place bets in envelopes;
- ▶ the object goes to the participant who offered the highest bid;
- ▶ the winner pays the first price;
- ▶ 75% of all auctions in the world are first price auctions;
- ▶ government contracts, government securities, property.

# Example

**WINNER!**  
Pays \$ 700



# Dutch auction

- ▶ open auction with decline prices;
- ▶ the seller starts with some fairly high price and then lowers its step by step;
- ▶ as soon as anyone reports that he agrees to pay the price, the auction ceases;
- ▶ perishable goods are sold.

# Auction of the second prices (Vikri)

- ▶ closed auction;
- ▶ participants bet on envelopes;
- ▶ object gets to the bidder who proposed the highest bet;
- ▶ the winner pays the second price – the second largest bet;
- ▶ the second price has a natural economic meaning – it is the minimum price at which demand is equal to supply;
- ▶ used in some countries for sale property.

# Example

**WINNER!**  
Pays \$500

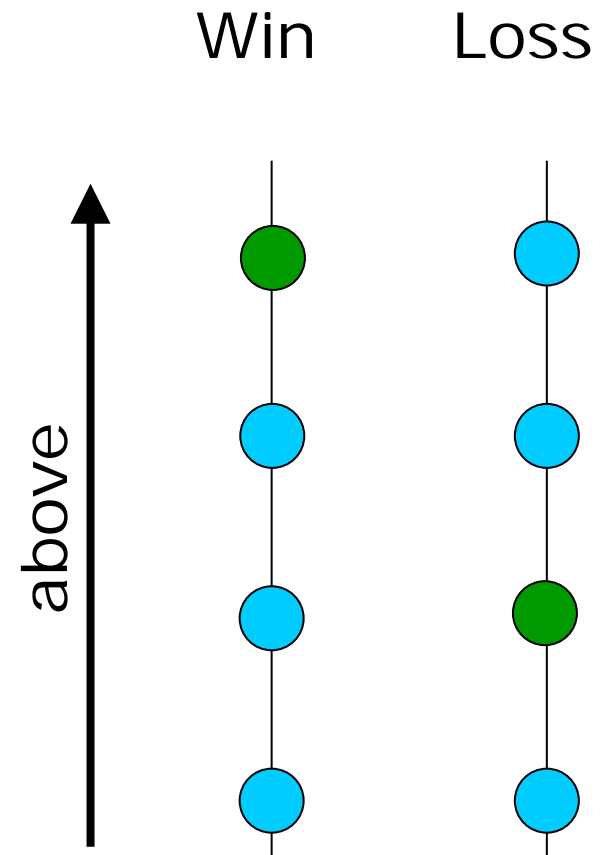


# The best pricing strategy at the second price auction

● Your price offer

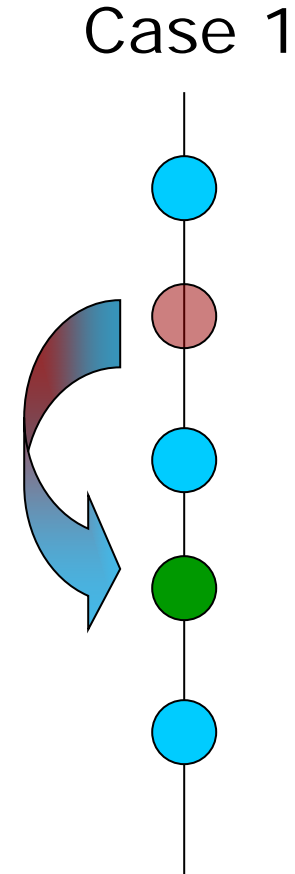
● Price offer of others

● Lot value



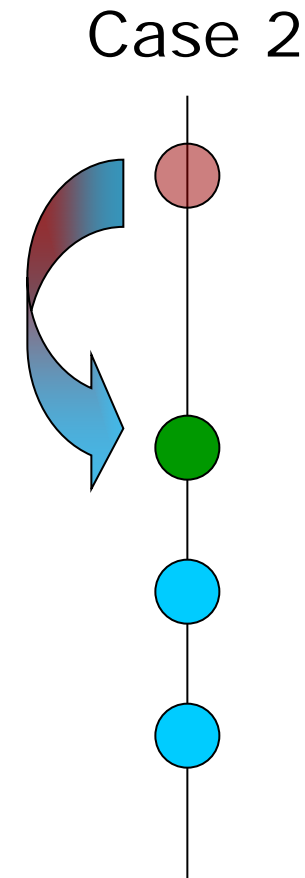
# The price is lower than our value – 1

- ▶ The winner of the auction is another buyer. The price we offered is lower than the value of the lot for us.



# The price is lower than our value – 2

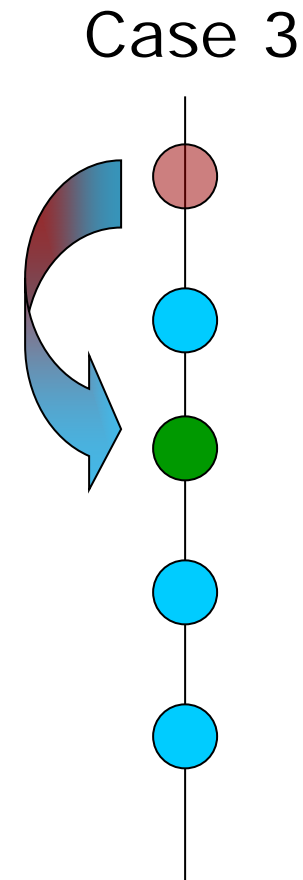
- ▶ Our offer is the highest, so we are the winner of the auction. Our price is lower than the value of the goods for us.





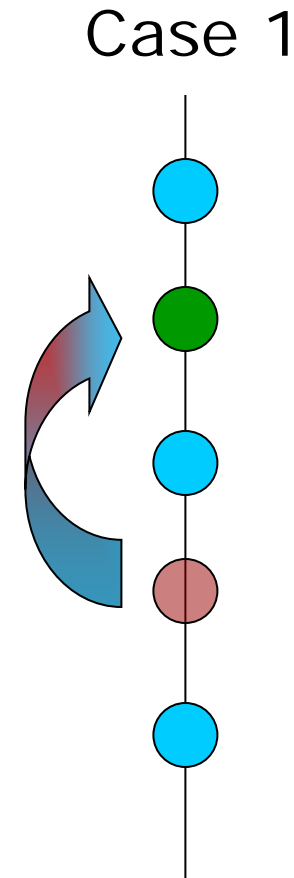
# The price is lower than our value – 3

- ▶ This case shows that we are not only losing the fight for the lot, but also that our competitor is paying the price could we offer. Thus, this situation is completely losing for us.



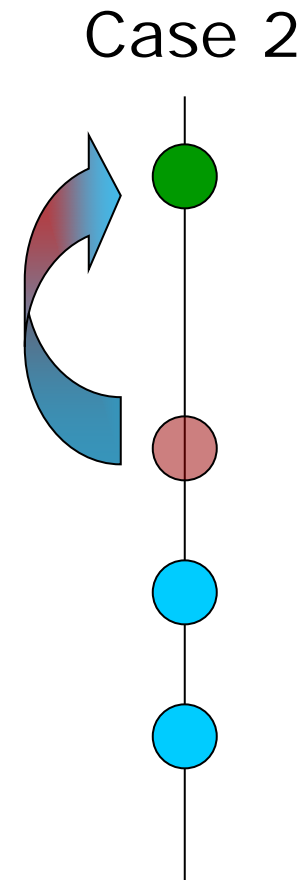
# The price is higher than our value – 1

- ▶ The price we are willing to pay for a lot is higher than the value of this good for us. But the winner of this auction is our competitor.



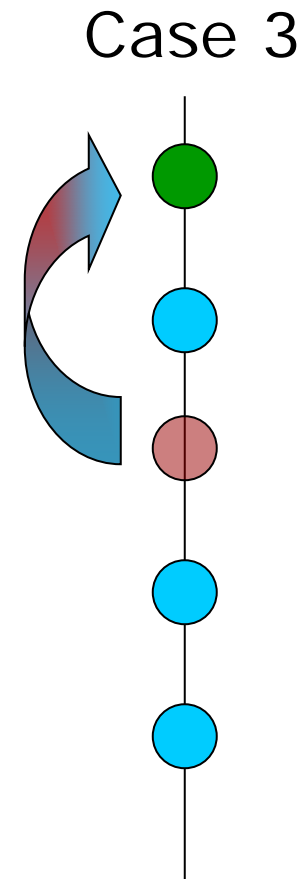
# The price is higher than our value is 2

- ▶ Our price is higher than the price of others and real value lot. But since we pay a lower price, the situation is considered favorable for us.



# The price is higher than our value is 3

- ▶ We are the winner of the auction. But in this situation we are not absolute winners, because the real price of the product is lower than what we paid for it.



# What is better?

- ▶ Buyers offer a price lower than the real value of the lot
- ▶ The auctioneer accepts the highest bid
- ▶ Buyers offer price that equal to the true value for them
- ▶ The auctioneer accepts the second highest bid

Auction of the first price

Second price auction

# Example

- ▶ Second price auction
- ▶ Every buyer has an assessment of values \$ 20 and \$ 40, each with equal probability
- ▶ What will be the expected income?

# Solution – 1

- ▶ Two buyers:
- ▶ Each has two price offers 20\$ or 40\$
- ▶ There are four price combinations:

$$\Pr\{20,20\} = \Pr\{20,40\} = \Pr\{40,20\} = \Pr\{40,40\} =$$

- ▶ Expected price =  $1/2 (20) + 1/4 (40) = 25$

# Solution – 2

- ▶ Three buyers
- ▶ Each has two price offers 20\$ or 40\$
- ▶ There are eight price combinations:

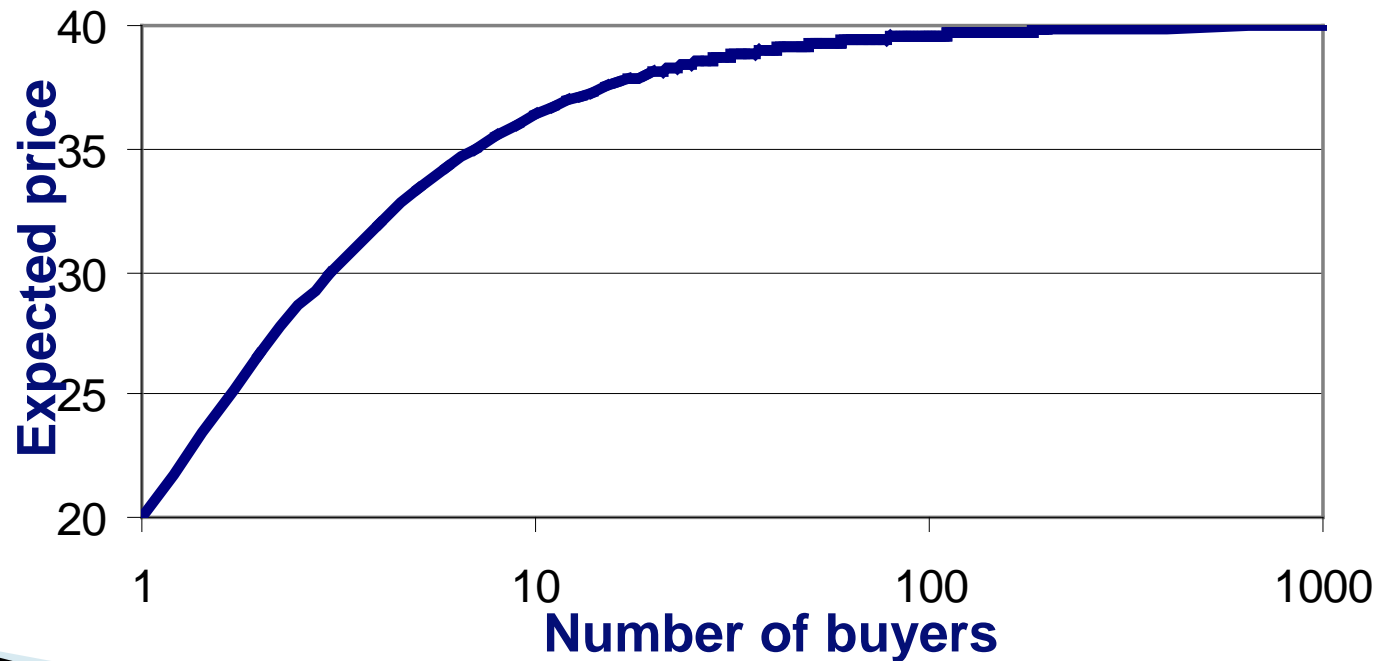
$$\begin{aligned}\Pr\{20,20,20\} &= \Pr\{20,20,40\} = \Pr\{20,40,20\} \\ &= \Pr\{20,40,40\} = \Pr\{40,20,20\} = \Pr\{40,20,40\} \\ &= \Pr\{40,40,20\} = \Pr\{40,40,40\} = 1/8\end{aligned}$$

- ▶ Expected price =  $\frac{1}{2} (20) + \frac{1}{2} (40) = 30$



# Solution – 3

- ▶ Let's assume that the estimate is in the range [20.40]



# Online auction

- ▶ the most modern type of auction, which is developing due to the development of telecommunications technologies;
- ▶ convenient and cheap in conducting;
- ▶ duration the auction is determined participants;
- ▶ winner pays the highest price he himself calls;
- ▶ the most modern type of auction.

# The perfect auction

- ▶ the price paid by the participant upon receipt of the object should depend as little as possible on his own rate;
  - ▶ the presence of greater incentives to identify their own preferences;
  - ▶ as much information as possible should be revealed during the auction;
  - ▶ simplicity of the auction;
  - ▶ keeping your own private information.
- 
- ▶ Not yet developed

# Auzubel auction

- ▶ several identical objects are sold;
- ▶ the price is constantly rising;
- ▶ participants show how many objects they need at the current price;
- ▶ participants do not have the right to increase demand;
- ▶ ends at the moment when total amount is equal to the total supply;
- ▶ participants pay different prices for different objects.

# Auction rule

- ▶ If the price  $p$  a certain participant withdraws their request to unit of goods through which it turns out, that one of the other participants provided right to one object, this participant pays for this object equally  $p$ .

# Example – 1

- ▶ Let there be 5 identical licenses for selling;
- ▶ none may obtain more than three licenses from participants (rule auction).

Lot	Participants					
	A	B	C	D	E	F
1	123	75	125	85	45	49
2	113	5	125	65	25	9
3	103	3	49	7	5	3

# Auction process

Price	Demand						Total	Winners
	A	B	C	D	E	F		
10	3	1	3	2	2	1	12	-

# Auction process

Price	Demand						Total	Winners
	A	B	C	D	E	F		
10	3	1	3	2	2	1	12	-
25	3	1	3	2	1	1	11	-



# Auction process

Price	Demand						Total	Winners
	A	B	C	D	E	F		
10	3	1	3	2	2	1	12	–
25	3	1	3	2	1	1	11	–
45	3	1	3	2	0	1	10	–

# Auction process

Price	Demand						Total	Winners
	A	B	C	D	E	F		
10	3	1	3	2	2	1	12	–
25	3	1	3	2	1	1	11	–
45	3	1	3	2	0	1	10	–
49	3	1	2	2	0	0	8	–

# Auction process

Price	Demand						Total	Winners
	A	B	C	D	E	F		
10	3	1	3	2	2	1	12	–
25	3	1	3	2	1	1	11	–
45	3	1	3	2	0	1	10	–
49	3	1	2	2	0	0	8	–
65	3	1	2	1	0	0	7	A

# Auction process

Price	Demand						Total	Winners
	A	B	C	D	E	F		
10	3	1	3	2	2	1	12	–
25	3	1	3	2	1	1	11	–
45	3	1	3	2	0	1	10	–
49	3	1	2	2	0	0	8	–
65	3	1	2	1	0	0	7	A
75	3	0	2	1	0	0	6	A & C

# Auction process

Price	Demand						Total	Winners
	A	B	C	D	E	F		
10	3	1	3	2	2	1	12	-
25	3	1	3	2	1	1	11	-
45	3	1	3	2	0	1	10	-
49	3	1	2	2	0	0	8	-
65	3	1	2	1	0	0	7	A
75	3	0	2	1	0	0	6	A & C
85	3	0	2	0	0	0	5	A & C

# Winners:

- ▶ And will receive one license for the price of 65
- ▶ A, C receive one license for the price of 75
- ▶ A, C receive another license for the price of 85

# Bazerman phenomenon



# Phenomenon Bazerman

- ▶ The auctioneer shows a \$ 20 bill and says he will give it to the person who will give the most money for it, provided that the person who was immediately after the winner will have to give the professor the amount he was willing to pay for \$ 20.



# Bazerman's phenomenon: an example

- ▶ Suppose the two biggest troubles were \$ 15 and \$ 16.
- ▶ The winner will receive \$ 20 in exchange for \$ 16, and the other person will have to pay \$ 15.

# Bazerman's phenomenon: auction progress – 1

- ▶ At first, everyone thinks that they have the opportunity to get “free” money.
- ▶ As soon as the auction reaches \$ 12 – \$ 16, the second person realizes that he is in danger of serious loss, so he begins to bet more than he intended until the auction reaches \$ 21.

# Bazerman's phenomenon: auction progress – 2

- ▶ At this stage, both participants will lose money. But someone will lose only a dollar, and someone twenty. To minimize losses, everyone tries to become a winner.
- ▶ However, this race only leads to the fact that both participants in the auction lose more and more.

# Bazerman's phenomenon: conclusion

- ▶ Instead of recording a loss, a person hopes to win back, and almost always loses more and more money.

# Bazerman's phenomenon: record

- ▶ Every year, Professor Max Bazerman sells a twenty-dollar bill to Harvard Business School MBA students well above face value.
- ▶ His record is selling \$ 20 for \$ 204.

Thank you!