

Analysis of the Interfering Factors about Auction Games

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Abstract. This essay simply explores the complex world of auctions and how they basically work. Start with a brief summary of auction's history, from the Babylonian era to the present, the essay shows how auctions have evolved over the history. Then, four typical auctions are introduced by listing their rules and how they are played. Most importantly, at the main body, the essay revealed various factors that have impact on how an auction is played, such as sunk cost fallacy, information dynamics, auction rules, and the existence of bidders with distinct motivations. In addition, Candle and dollar auctions are used to show the impact of information and rules on an auction respectively. In the end, the essay argues that auctions are complicated rather than just contests for riches and emphasizes the significance of comprehending these factors. The essay aims to inform people to make wise decisions in both auctions and everyday life.

1 Introduction

There are many movies and stories that have similar scenes: one or a group of millionaires gather and are bidding for a treasure, such as "Batman and Robin" or "Willy Wonka & the Chocolate Factory". They are eager for the bidding items, so they call enormous numbers trying to be the auction leader and then finally get that treasure. Moreover, the mental activities of these bidders are emphasized by their exaggerated movements or by the narrator's narration about their inner thoughts. This is really a good method to attract readers or audiences' attention because these scenes are usually tense, full of rich emotional descriptions, and can make the story more complex and interesting. However, these stories cause people to misunderstand about auctions although it clearly states the basic idea about how an auction works. By knowing these stories people may think that bidding is as easy as just calling out numbers and competing for the highest price they can afford. That's just an auction's basic principle, not the full complexity of auctions. There're much more details of auction types that makes them different and special. Auction is not only an easy game of wealth competition, but it will also be affected by various factors, such as nature of the auction or tactics that bidders used. This essay aims to give a simple introduction to auctions and discover some decisive factors that play important roles on affecting auctions. Therefore, this research can also explore some solutions to avoid the effects brought by these factors. Players' internal factors, auction rules, players' purposes that bring auctions great effects will be analyzed and clarified.

2 History of auction

To discuss factors of irrational biddings, the concept of auction should be claimed first. The Cambridge dictionary provides a clear statement: "*a usually public sale of goods or property, where people make higher and higher bids (= offers of money) for each thing, until the thing is sold to the person who will pay most.*" Fabio mentioned that players call bids is to discourage their opponents to stay the game [1]. The earliest auction recorded happened at about 2500 years ago, which is around 500 BC. The auction was described by the Greek historian Herodotus, who claimed that it was utilized in Babylon to sell women for marriage. The order in which the women were to be sold was decided by the auctioneer's subjective assessment. People aim to help their sisters to find a husband by sending them to this auction.

The earliest auction played a role as a tool, helping people to reach their purpose. Its essence is a market, a way people trade "the ownership of wife" for money. Then modern auctions emerge, bringing new rules and features to auctions. Their origin can be traced back to Roman Empire. At that time, because of the increasing number of wars, soldiers seized loots, including weapons and commodities. After they picked things they want and satisfied with, they will sell extra things for money. Auctions were existed from that time. There might be a possible explanation of the existence of auction is that the soldiers want to earn as much money as they can. If they sell things like marketing with a fixed price, their income will have a maximum quantity. The money they earn depends on the quantity of things sold. However, by holding auctions, soldiers can possibly have higher income. Since the price is called by bidders, the money the person who finally paid for that item would increase as the bid increased. People clearly know the price is increasing, but they didn't give up and kept calling bids because they were emulous. The auction increased the

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price of the item by using this identity, which could bring the soldier a great profit.

This is a milestone in the history of human auctions. It identified the basic form of modern auction and laying the foundation for modern auction.

3 Types of auctions

As time goes, the method for auction develops and finally there are four main forms play a dominant role.

3.1 English auction

It is the simplest and the most understandable form of auction. The price is gradually increased in an English auction from a low price, until there is only one bidder left, and that bidder pays the auctioned item's final bid amount. The first cost represents the reservation amount. The good is not sold if no one bids more than the amount reserved. This auction can be conducted in one of three ways: the seller announces the prices, the bidders announce the prices themselves, or bids are made electronically, and the top bid is posted. Since in an English auction, bidders' bids are public, it is also called an Open ascending auction.

3.2 Dutch auction

It is a variant of English auction. Unlike a standard ascending-price auction such as English Auction, where the auctioneer starts at a lower price, bidders increase their bids to compete to be the auction leader, Dutch Auction is totally different. In a Dutch auction, the auctioneer sets a very high offering price initially. Then

the auctioneer gradually lowers the price until there's a buyer places a bid and wins the item. Hence, the item is won by the first bidder who calls for the bid. This prevents a bidding battle that could impede the auction process, making Dutch auctions a dependable and efficient method for products that must be sold quickly. This form of auction was popular in Holland, where producers utilize this method to sell their flowers quickly. Therefore, Dutch Auction is usually used to sell something that need fast sales, such as fresh flowers and produce.

3.3 First price sealed auction

This type of auction is similar to Dutch Auction. In this auction, bidders submit their sealed bids to the auctioneer. The bidder who bids highest will win and pay his bid for the item. The two main components of a sealed-bid format are typically the bidding period, during which players submit their bids, and the resolution phase, which involves opening the bids and selecting the winner. Bids in this case are sealed, hence bidders should determine their bids by themselves instead of adding money based on bids from others.

3.4 Second price sealed auction

Second Price Sealed Auction, which can be also called a Vickrey Auction, can be considered as an updated version of First Price Sealed Auction. The principle of the auction doesn't change, which is bidders still seal their bids in this auction. What is different, however, is that when the high bidder wins, he only needs to pay for the second highest price. Because of its special rule, it is easy to be affected by some factors (see Table 1).

Table 1. How different auctions work.

Auction Type	Price determination	What the winner pays
English Auction (Open ascending price)	Starts from a low price, moves higher	Their own bids
Dutch Auction (Open descending price)	Starts from high price, moves lower	Their own bids
First-Price Sealed Bid Auction	Everyone submits their bid privately	Their own bids
Second-Price Sealed Bid Auction	Everyone submits their bid privately	The second highest bid

4 Influence factors

4.1 Sunk cost fallacy

Martin Shubik had introduced dollar auction in his *The Dollar Auction game: a paradox in noncooperative behavior and escalation* [2]. The game's rule is to bid for one dollar. Each bid should increase for 5 cents.

Moreover, there's a special rule in the game that makes it different to other types of auctions is that the second highest bidder should pay their own bid even though he doesn't win the game and get the one dollar. Hence, the second bidder is the biggest loser in this auction. Let's assume there's only 2 people are bidding at the end of the auction, when the bid comes up to 90 cents. Player 1 bid for 95 cents because he is eager to win. At this time, player 1's payoff will be 5 cent if he wins the game.

Then player 2 will bid for 100 cents because until then if he wins the game, he will have no gains or losses, which is an acceptable consequence for him. But then player 1 will lose 95 cents if he doesn't win the game, therefore he decides to bid for 105 cents, which is higher than 1 dollar, to decrease his loss. His net loss will be 5 cents if he bids 105 cents, which is far less than the loss of 95 cents. As the bids increase, player's decision is not to bid for the 1 dollar anymore. However, their final purpose is to minimize their net loss, so their best choice is to bid higher. The final price is inevitable. The individual choice seems irrational because nobody will pay more than 1 dollar for a dollar. In this case, players always make an irrational decision based on a sequence of apparently rational choices made throughout the game.

One reason of this phenomenon is the sunk cost fallacy [3]. The propensity for people to persist in a project or course of action when giving it up would be preferable is known as the "sunk cost fallacy." It is the main motivation why players don't give up when the price for a dollar comes higher than 1 dollar. In their thoughts, they considered that if they give up, they will pay an amount of money which is far higher than they price they need to pay if they win. In order to minimize their loss, they prefer to bid higher and strive to win the game.

There are many famous examples in our life, such as eating dessert and watching movies [4]. Most people will choose to eat dessert although they taste bad or keep watching the movie though it is boring. People continue what they are doing to ensure the money they paid earlier won't be wasted. In their mind, "paid but not do" is a failed investment, leading to a waste of money. However, the money they paid can't return. What really wasted is their time which can be used to create other beneficial outcomes. Sunk cost fallacy is inevitable because people don't treat gains and losses equally and often ignore opportunity costs.

4.2 Information

The information possessed by players can be considered as an important factor. This can be proved by comparing open and sealed auctions. Maskin and Riley's work proved showed that sealed biddings tend to favor weaker bidders [5]. In the open auction, player who has the highest wins. However, in sealed bid auctions, bidders are more incentive to shade their bids below their true valuations, because they hope to optimize payoffs by reducing the chance of winning. This leaves an opportunity for weak bidders to win the game, hence the attraction to weak bidders are stronger than that to strong bidders.

Sealing bids is beneficial to weaker bidders, however, there's another variable will both affect strong bidders and weak bidders. Time is an important factor in an auction. Candle auction is a variant of English auction which time is restrained – the auction ignites a candle for time recording. The candle flame expires to indicate the end of the auction. This was done to make sure that no one could bid at the last minute and know exactly when

the auction would end. This increases the difficulty for bidders to determine whether to bid or not.

The lack of access to information can mentally affects players to be anxious. Anxiety arises from uncertainty about a potential threat because it interferes with our ability to prevent it or lessen its negative effects [6]. In candle auction, a lack of time awareness increases bidders' anxiety, leading them make irrational decisions. In this case, bidders will feel difficult to decide when to bid or bid how much. Moreover, the value of the bid can also have great effect. If the bid called by previous bidder who coincide with another player's expectation, then more time will be taken by the player to consider whether his next choice is beneficial or not. In English auction, the person who called the highest bid finally gets the item. However, in this variant auction, winner doesn't need to call very high price to win. What they need to do is to ensure their bid can be the highest until the candle extinguish. Hence, the essence of candle auction is not to compete who has more money or can afford larger price, the tactics players used are more important. In this situation, a bid that is bided at the correct time and for an appropriate amount is better than bidding as much money as the player can.

4.3 The rule of the auction

Different types of auctions will bring various results. As two major auction types, first price sealed-bid auction and second price sealed-bid auction have distinct bidding methods. The only difference between them is that First price sealed-bid auction's winner should pay the amount that person paid, while in Second price sealed-bid auction, the winner only needs to pay the amount called by the second highest bidder. Since their bids are all sealed, they should determine how much they should bid. In First price sealed-bid auction, the amount that bidders prefer to bid is lower than their valuation because bidders want to get a profit. In this case, people who have more money or have higher valuation of the item have a bigger chance to win. However, if other bidders are rich or there are lots of people participating, bidders should shade less their bids for winning the auction. This is because rich people often have higher value than normal people based on their abundant finance. Moreover, large participants base will increase the competitiveness because it's hard to know each of their information and background to predict how much they will bid.

In second bid auction, the condition is more complex. The winner should pay the second highest bid, so the decisions of other bidders are the decisive factor of what premium the winner can get. In order to win the game, bidder should bid at least the value of the item to ensure his possibilities to win. Assume that there are several people are bidding for an item by using the form of Second price sealed bid auction. At last A and B are competing for the item. To analyze this case, focusing on the behavior of second highest bidder is necessary.

The difference of auction rules has an important impact on strategy selection and results. This can be shown in a simple example.

The item's value given by the winner is \$100. The first circumstance is that B bid less than the value, for example, \$80. When A bids \$150 which is higher than the value, his profit will be $\$100 - \$80 = \$20$. If A bids the value \$100, his profit will still be \$20 because he only needs to pay for the second highest bid. In this condition, bidding the value or bidding high are equally good. The second circumstance is that B bids more than the value, for example, \$120. If A bids \$100, his surplus will be 0 because he doesn't win the auction. If A bids \$150, his surplus will be -\$20. Thus, the dominant strategy for A in this case is to bid the true value. The last circumstance is that if B bids higher than A's bid, A's surplus will always be \$0 because he doesn't win the auction. Both bidding the true value and bidding high are equally good. Combine these three results together, the conclusion would be bidding true is the Second price sealed-bid auction's dominant strategy.

In different auctions, players will select diverse bidding strategies based on consideration of different auction rules. Therefore, auction rules can greatly affect players' tactics, which leads to distinct results.

4.4 Bidders who have special purposes

A fun phenomenon was mentioned in Tegar's "*Too much invested to quit*": *The escalation of commitment in individual and group decision-making*. Tegar mentioned that in an investigation, the final two competitors are a pair of girls who have never gotten along in life. It turns out that their animosity of each other originated from their simple desire to prevent the other from winning [7]. There's such kind of participants in auctions. They increase the bid intentionally because they only aimed to make troubles to other bidders instead of creating their own premium. Some are losers from the previous rounds, the loss of their money cause them changing their minds from a rational bidder into spiteful players. Wanick found that these players will be stimulated by both the loss of their own interests and the desire to harm their opponents. In this case, the balance point of the auction is determined by these players [8].

There's another type of special player whose action will bring a big effect to the auction. This kind of player will call a high bid at the beginning of the auction to show their determination for this auction [9]. Their purpose is to win the game, just like what others' are. However, they choose this specific method to ensure they can achieve their goal more easily. The method they used will cause others' hesitation because others may think that their initial high bid means they have great amount of finance can be used in bidding. Although this can only bring these players a small premium if they win, it's still an effective method for them to take the initiative. Wall had concluded this kind of behaviour as "people show up at an auction to see and be seen" [10].

5 Conclusion

Auctions have evolved over centuries. From Babylonian auctions to four main types of auctions today, auctions are gradually developing themselves. By listing four common auctions – English auction, Duction auction, First price sealed-bid auction, and Second price sealed-bid auction - rules of auctions are basically introduced and clarified. Then, some critical factors that have special effects on auctions are stated. The sunk cost fallacy, which is dominant in the Dollar auction, illustrates how people sometimes make irrational decision because they want to minimize their loss of payoffs. Sunk costs fallacy not only affect biddings in auctions, but it also influences the decision makings in our daily life. Another key factor is information, which plays an important role in affecting players' decisions. Time constraint, exemplified by the candle auction, can likely affect player's mentality. This further causes players to be anxious and make inappropriate decisions. Difference in information can be clearly seen by comparing open and sealed-bids auctions. Moreover, the internal reason of different auctions is their rules. By analyzing first and second price sealed-bid auctions, results of different circumstances are concluded, and dominant strategy is determined. Although they are both sealed-bid auctions, the difference of the amount of money the winner should pay changes the strategy of each game. Finally, one external factor is mentioned – special bidders. The presence of these specific players breaks auctions from working systematically. These players can break the balance and reshape the dynamics of the auction, whether they are motivated by unsatisfied or resentment, as Tegar's study found; or by a planned display of strength at the beginning of the auction to show their determination to win. In conclusion, auctions are complex social and economic events impacted by psychological tendencies, information dynamics, historical foundations, and strategic considerations, rather than just being competitions of wealth. Some factors in these auctions may also affect our decision-making in our daily lives. Although further research and analysis are needed for discovering the intricacies in these factors, it is necessary for everyone to have a brief understanding about auctions and considering how to avoid getting troubled with these factors, conversely, think about how to use their effects to make better decisions in their lives. By doing this, they can improve their life satisfaction.

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