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The English Auction Method Based on Offline Artwork the Auctioneer Moderates the Impact of the Cognitive and Emotional Processes of the Bidders in the Bidding Behaviour

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stract
This paper aims to investigate the dynamics of bidder behaviour in offline English auctions, focusing on participants' cognitive and emotional processes. The study provides a comparative analysis of Standard English auctions and resale-based auctions under various informational settings to understand how the auction mitigates cognitive biases that drive bidding. The study shows that resale possibilities positively affect the bidding process, and participants are likely to bid differently from the Nash equilibrium. There is evidence of overbidding, which emerges that the auctioneer's task is essential in regulating these deviations, both in terms of cognitive distortion and emotional response on the part of the bidders. This is because signalling behaviour is prominent and critical, particularly under uncertain resale outcomes. These results advance the auction theory by introducing cognitive and affective factors into the analysis of bidding competition. These ideas provide a prescriptive application for auctioneers in any provenance from the art world to real estate, with implications for increasing bidder accountability and proceeding with efficiency. Due to these reasons, future research should extend the analysis to higher numbers of bidders and other forms of auctions. It should investigate the behaviour of speculators in resale-based markets.
Keywords: English auction, Auctioneer behaviour, Cognitive Processes, Emotional bidding, Offline art auctions

1. Introduction

Resale opportunities frequently follow auctions, particularly for durable goods. While resale may be explicitly prohibited, workarounds often exist. For instance, in mobile phone and wireless spectrum auctions, "use-it-or-lose-it" conditions are frequently imposed to prevent resale. However, these restrictions can be avoided. The company holding the license can be acquired, and specialised companies have even been used to purchase and resell licenses. Resale was not extensively studied in auction models until relatively recently. Haile's [1][2][3][4] demonstrated the significance of resale opportunities and their potential to alter auction theory results. For resale to be meaningful, the initial auction outcome must have a positive probability of being inefficient. In Haile's 2003 paper, the highest-value player may not win the initial auction due to imperfect value knowledge or non-participation. Asymmetries in bidder values [5][6] or the arrival of new participants in the resale stage [1] can also induce resale in equilibrium.

In real-world situations, restrictive assumptions about market structure or bidder private information are unnecessary to induce resale. A sufficient condition, as demonstrated, is a small amount of noise. Such noise exists even in high-stakes financial markets [7]. It can arise from experimentation, inexperience, rules misunderstandings, false information transmission, order execution mistakes, liquidity constraints, or other exogenous factors not fully modelled in theory but undeniably present in fundamental markets. Two experimental English auction treatments with resale were designed and conducted to examine the significance of resale opportunities and the impact of noise in a controlled environment. These treatments are called informational assumptions while setting the same equilibrium bidding functions bidding players' values. Participants and other subjects showed a marked change in their behaviour compared to theory and other auction experiments with no resale functionality. Overall, they overbid the value of both treatments in equilibrium when modelling all resale rents accurately while underbidding when resale outcomes were ambiguous.

This cannot be explained by irrationality in the laboratory but by rationality based on the expectations of the mistakes likely to be committed by other people. The subjects attempt to reach goals, seek to gain the most, and try to align decision-making according to the other's potential for error. This paper concerns a previously unexplored case from a more significant game class in which noise anticipation shifts players' best response strategies. In such a setup, the strategy that is best for standard neo-classical game theory loses much of its force while concepts such as Quantal Response Equilibrium [8]and levels of reasoning [9][10][11][12] demonstrate superior performance.

This paper experimentally tests auctions with resale based on a simplified [1] and finds that noisy or erroneous decision-making is a different rationale for resale. In emerging from these simple models of perfect rationality, it was confirmed that bidding their value still forms a symmetric equilibrium. This overbidding with an anticipation of resale is incongruent with this equilibrium. Resale can become unprofitable if others bid their values because positive profits can be achieved only if one bids one's value, which is more than anyone else predicts. However, this is the case only when assuming that the bidders have no errors, which rarely happens in practice. Likewise, the available economic textbooks and casual field observations reveal that humans can, and often do, make mistakes. The expectation of high value bidders to make mistakes can influence low value bidders to bid above their capability. In turn, high-value bidders may bid lower to acquire these and plan to buy them cheaper at the resale. This is called high-value post-bid behaviour. Resale possibilities can, therefore, be sold even where simple theory suggests otherwise, resulting in more elaborate bids than theory anticipates. However, as expected, this deviation from standard models is quite natural.

The literature under experimental economics has not substantially examined the auctions with resale because the theoretical models have not been sufficiently explored until recently. Four other papers related to the experimental auction with resale are available. Two of these consider symmetric auctions in the vein of [4], including [13], as part and independent work by [14]. First, they used first-price sealed-bid auctions, and second, they informed players about their private values with noisy signals. They discovered that they had departed from the equilibrium and attributed this to risk aversion.

Although theoretical works have highlighted the role of resale at an early stage [17][18], analytical frameworks incorporating resale have been limited until very recently. Again, one argument has been that the assumption of common values entails coverage of resale. However, [4] showed common values in the first auction among players when resale is possible. Nevertheless, valuations are endogenous, and equilibrium strategies differ from those in the simple standard value model. However, revenue equivalence is maintained only under certain assumptions, unlike the standard value. According to [4], the bidders must complete information about the value in initiating the auction. These noisy signals work the same manner as the noisy bids in this paper, hence the inefficient outcomes and highly profitable resale. [15] They also conducted experiments of English auctions with resale, using different surplus divisions of the actual resale market. After this paper, Georganas and Kagel (forthcoming) discussed such auctions with resale. They found evidence for the equilibrium that weaker bidders should bid more aggressively than in the case where resale is not an option. However, this result depends on the asymmetry size: a slight magnetic field asymmetry does not lead to observable rotation in the neutrino spin.

Other circumstances can also make resale potentially profitable apart from noise. [1] assumes that in the second period, some known number of bidders will be added to the bidder pool. These may be new participants in resale auctions and may have a higher private value than the first auction winner, making the resale opportunities. Nevertheless, it is possible to prove models with asymmetric equilibria. Resale indeed appears credible in such an equilibrium, given that the strategies associated with the asymmetry entail the realistic possibility of the highest-value player not being the winning bidder in the first auction. [6] extend this in a similar setting, allowing for zero valuations for speculators, and find asymmetric equilibria where the speculator is more likely to win than the bidder. [19][5], Building from the Georganas above and Kagel paper allows for bidders with positive use values but are asymmetrically distributed. It also results in inefficient results and resale in this kind of setup.

The main research question of the present work can be formulated as follows: how can auctioneers influence the cognitive and emotional regulation of bidders at offline artwork auctions when resale possibility is present? The research aims to discover overbidding and underbidding regularities attributable to an amalgamation of models of bounded rationality, including Quantal Response Equilibrium (QRE), and analyse how uncertainty, noise and signalling affect bidders' decisions. Also, it aims to make a theoretical contribution by focusing on auctions as the primary mediator of the sophisticated behaviour of bidders in a competitive setting and the role of the auctioneer.

1. 2. Experimental designs

A game has two phases it involves. In the first stage, four potential buyers ($i = 1, 2, 3, 4$) are engaged in an English auction for one unit of an indivisible good. Company 1 has an independent identical use value vi from a discrete uniform distribution with support $[0;\ 100]$. Actual use-values belong to the public domain; the distribution of use-values is a matter of common knowledge. Significantly must be distinguished between the use value, i.e. the value of owning the object without the possibility of resale, on the one side, and the bidder's valuation, that is, the value of winning the auction determined endogenously, with the resale opportunity in mind, on the other. An ascending clock design [21] is implemented for the auction. The PC monitors have a digital clock that starts ticking at zero simultaneously, and each second, it gains one unit. In the first study, bidders can withdraw from the auction anytime by simply pressing a button. There is no coming back once outside. Other bidders can gather information on the exit price. Once three bidders exit the game, the final bidder gets the goods and pays them at p1, which is the exit price. This concludes the first stage of the study.

The second stage is an English auction where the seller selects a resale reservation price, possibly leading to a resale. There are differences in the informational background for the second stage of resale treatments. Two such values were chosen to cover all the possibilities midway between the extremes. In the incomplete information treatment (INC), the only information bidders have about the others' values are the first bids at the auction. The seller sets her reservation price, and then the remaining bidders decide whether to enter the resale auction. If no bidder comes forward, ownership remains the same as in the first stage and pays off with it. If a single bid is offered, the bidder acquires the good and pays the owner the reserve price. If competitors are interested, an English auction starts with the reserve price.

The last bidder with remaining competition gets the good to be auctioned and pays the price (p2) where the previous bidder dropped out. The following payoffs are then communicated to subjects: while the first stage winner takes vi p2, the second stage winner takes p2 p1, and the rest of the competitors get zeros. In addition, a user can review the first price auction, the reserve price, the number of bidding participants, and the resale price (if any). This equals zero if no resale occurred, which is the highest private value and data in the previous periods. This forms rich information feedback that helps learning, providing bidders with more frequent winning experiences and more learning. In particular, it is made of thirty periods per experiment, and subjects manage to win at most a quarter of their challenges or, on average, 7 to 8 wins per experiment.

Table 1: Summary of sessions

Session	Treatment	Exchange	Paying Periods	Players	Location
1	COMP	20	30	16	UPF
2	COMP	20	30	16	UPF
3	INC	25	30	16	UPF
4	INC	25	35	16	UPF
5	ENG	20	30	16	UPF
6	COMP	20	30	16	Bonn
7	COMP	20	30	16	Bonn
8	INC	25	30	16	Bonn
9	INC	25	30	16	Bonn
10	ENG	20	30	16	Bonn

The second treatment with full information, COMP, follows where, after the first stage, bidders know other's use values as in [19]. They would ask for a reservation price equal to the highest private value; that is, they would make the individual with the highest private value take it or leave it. However, experiments expose self-interested subjects to the 50-50, even if it means a surplus, the fair motive [21]. To reduce reliance on bargaining games, the study made the first-stage winner resell the object to the second-stage highest bidder at a price that the highest bidder has to pay. The first auction winner got the difference between the highest private value and the prices paid for the item. The players who sold the good had a zero payoff, and the rest, including those who obtained the good after resale, also had a zero payoff. As in INC, players can observe their payoffs, private values, auction prices, winners' private values, highest private values, and information about past periods during each round.

The subject resale treatments were compared with bidding behaviour in English clock auctions where there was no resale. Although lots of research has dealt with such auctions, ensuring that the results in COMP and INC are not due to framing effects or an unusual pool of subjects is essential. Thus, a standard English auction (ENG) was also conducted, with IPV equal to IPV U (uniform distribution [0, 100]). All other aspects of the experimental mechanism were similar to those used for COMP and INC, which permitted direct comparison. In most of the experimental sessions, there were 31 periods. The first was a practice period that cannot be included in player payoffs and is only to be excluded statistically. After that, subjects were given a starting [balance] of 150 units of the experimental currency, the drachma. In the following periods, subjects received their pay-offs according to performance, with the gains or losses incorporated into a subject's capital. Although bidding was sometimes quite aggressive, there were no cases of bankruptcy, although two of the subjects were in a critical zone. At the end of each session, the experimental currency was exchanged with euros at an exchange rate of 25 drachmas per euro in COMP and 20 drachmas/ euro in INC. This was because of work complexity, which was a characteristic of INC. We hoped to keep constant average profits per hour while sessions were twenty-seven and a half minutes longer than in COMP. Therefore, the total profit of COMP was 10.56 euros while that of INC was 15.5 euros. This difference in goods and services is not only due to the difference in the exchange rates but also in the bidding behaviour.

2. 3. Equilibrium predictions

2.1 3.1 Complete information (COMP)

In the complete information treatment (COMP), the symmetric bid-your-value equilibrium from the original auction without resale remains a valid strategy even when followed by a resale opportunity. This equilibrium is characterised by bidders valuing the auction based on their valuations, considering the potential resale market dynamics. The resale market is modelled with a reserve price set by the first-stage winner and subsequent bidding among remaining bidders. The author demonstrates that bidding one's valuation is a weakly dominant strategy, meaning it is always at least as good as any other strategy.

2.2 3.2 Incomplete Information – INC

In both the COMP and INC treatments, the second bid-your-value equilibrium from the original auction remains a viable strategy without the option of resale. This is a strange equilibrium where the bidders treat the auction by its valuation, these valuations taking into account the possible conditions in the resale market. Second, the resale market benchmark is where the first-stage winner implements a reserve price, and subsequent bidding continues amongst the remaining bidders. The author proves that bidding on one's valuation is a weakly dominant strategy that is always better than any other strategy. As pointed out earlier, the equilibrium strategy for the second-stage auction is the same across both treatments. However, the resale market environment differs depending on the second-stage bidders' information set. The efficiencies that can be achieved with risk-neutral risk-neutral bidders are similar in each of the auctions; the difference is that in COMP, bidders know the values of the other bidders, allowing for more efficient resale. In INC, however, bidders have information only up to the first bids in the auctions, and as such, the reserve price determination becomes more complicated. However, one can observe that the equilibrium strategy of bidding one's valuation is optimal for both treatments.

3. 4. Observation

This section reports the results of the experimental auctions intended to capture bidder behaviour, particularly when resale options are allowed. The two auction treatments include COMP Complete Information and INC–Incomplete Information. In both setups, bidders engage in a two-stage process: an entry auction followed by an auction of the owned goods. **COMP Treatment**: In the case of the experiments carried out for the COMP treatment, the players overbid consistently. Generally, the bids in the first auction were overpredicted by 8 % on average. Four units. This overbidding, observed in 40 of the 64 players, led to higher-than-expected prices, particularly in early auction periods. Despite the overbidding, players who won the first auction often realised positive profits by reselling the item during the second stage. Resale occurred in about 25.6% of cases, and resale prices were higher than the initial auction prices.

The section also noted that COMP auctions typically resulted in prices about 18% higher than those predicted by symmetric Nash equilibrium (SNE). The empirical results for COMP treatments were found to deviate from theoretical predictions primarily due to behavioural tendencies like fairness concerns and decision biases that led to higher auction prices and profitability from resale. **INC Treatment**: In the INC treatment, the initial auction gives bidders some information about others' values, but complete information is revealed only during the resale stage. This setup creates uncertainty, encouraging bidders to adjust their strategies. The study showed that contrary to the COMP state, underbidding was more prevalent in the INC, especially with high-value bidders in roughly 13. Specifically, only four per cent of cases in which the player with the highest value could not bid in the initial auction. Such behaviour can be explained by higher prices waiting for the players in the secondary market.

The analysis deduced several observations: the average resale prices in INC were lower than those of COMP but above the prices of the first auction. As the results imply, the players in the INC treatment were more conservative in their bidding and set reserve prices during the resale stage to make high profits. **Behavioural Observations**: The psychological study's peculiarity is that low players are overbid more often than high ones. These distortions of overbidding behaviour can be explained by one 'auction fever' occasioned by the spirit of auctions, though sometimes overboard. This suggests that the actual profits of the auctions that went to winners were higher than the theoretical equilibrium, especially with a positive average profit in both COMP and INC auction treatments.

Models of Bounded Rationality and Noisy Decision-Making

This section provides several models of bounded rationality that seek to rationalise observed departures from equilibrium behaviour, notably overbidding in auctions. The models presume that the participants can make errors at a certain level of noise and would be driven by factors other than the rationality of the decision. **Noisy Bidding in COMP**: The first model analysed is where players introduce a stochastic error term into the bid amount. This noise represents what is known about human decision-making: the noise unit comprises many random erratics. As reported in the earlier studies, the online auction NN is less inward; perfect information works unfavourably; the focal firm's bidding strategies incorporate noise into the bid; and deviations away from the theoretically anticipated Nash equilibrium are substantial. The experiment shows that even small perturbations in strategy can lead to drastically different auction prices and profits.

The study showed that with the introduction of noise, high-use players underbid relative to low-use players, while low-use players overbid. This can be attributed to the possibility of overbidding in the initial auction, thus reducing the likelihood of competitive bidding among the high-value players. Besides, the noises generated by other players regarding their bidding strategies make the playing field less stringent regarding the equilibrium bidding strategies. **Rationality Index and INC**: In the INC treatment, the new variable 'Rationality Index' (RatR) was incorporated to reflect how well the actual reserve price corresponds to the rational behaviour. As the index forecast, most sellers implemented their reserve prices congruent with the rational choice theory as they opted for prices higher than their worth. However, there were significant differences between sessions, which meant that some players placed suboptimal reserve prices, which most likely stemmed from their misjudgment or misinterpretation of how the second stage bidding process should work.

Overbidding as a Response to Signaling: The signalling effect significantly explains overbidding. Although various factors could explain why bids are higher than estimated, the signalling effect is more dominantly observed in the COMP treatment. They tend to overbid during the initial auction to signal strength or control other's actions in the resale stage. This strategy is beneficial when bidders assume that the other party will revise his bids based on the behaviour noticed in the previous auctions. This form of signalling brings an extra level to the auction where contestants are not only bidding for this particular item but also for the future negotiation power for returning the product to the auction again through the resale segment. **Bounded Rationality and Learning**: The section presented the concept of models characterised by bidders modifying their behaviour with time in the process of learning from past auctions. Learning process observed in both treatments Since the beginning period of the auctions, the bidders made mistakes. They were far from equilibriums, and more rational bids were observed in the latter periods of the auctions. However, the learning process ensures that some fluctuation from the equilibrium still prevails during the entire experiment period since people are trying to be rational and strategic while at the same time being probabilistic and random.

Thus, Nash equilibrium gives the basic framework for representing auction solutions when only the supply side is considered. The presence of resale options, asymmetric information, and noise skew the auctions' picture and add more colour and variation to the corresponding behaviours. The results bring behavioural issues like fairness concerns, signalling, and learning issues to the forefront of the theory and the practical application of auction theory. Hence, these insights offer a better theoretical understanding of auctions, especially within markets characterised by reselling.

Auctioneer's Role in Moderating Cognitive and Emotional Influences

This paper has identified several other implicit obligations that the auctioneer has in shaping bidding behaviour in offline English auctions besides the mere role of directing the auction. An auctioneer facilitates the auction between the bidders and ensures that the environment leads to efficient bidding. On the one hand, they act as information porters; on the other hand, they act as moderators of the cognitive and emotional factors that shape the bids for the auction. As predicted in the cognitive hierarchy theory, decision-making in auctions may need to be more rational, especially where high-risk items like artwork are being auctioned. Thus, it is necessary to determine how auctioneers can manage the environment to lessen the emergence of shallow bounded rationality while improving auction results.

Expectations and emotional influences significantly affect the judgements bidders make in auctions. Auction psychology data also reveal that ‘auction fever’ is a phenomenon whereby the competitive atmosphere of an auction means a participant will make a higher bid than they thought was reasonable when in a calm state of mind [23]. This over-bidding is often an outcome of the desire to win a particular asset, evidenced by the fact that the endowment’s capacity to make rational decisions is usually overcome when items of high esteem or value, such as artworks, are in dispute. These emotional impulses depend on the opportunities of the auctioneer and the outcomes for the seller and participants.

Furthermore, it is also imperative to consider the impact of cognitive biases. Bidders also tend to use heuristics or rules of thumb while making only sometimes correct decisions. For instance, when working in a specific bidding context, the anchoring effect may mislead people to rely on the initial price when making decisions. At the same time, it may be higher or lower than the value of the good [24]. Likewise, the bidder falls into an endowment effect whereby he overvalues an item because of the time and energy this or that bidder spends on the auction [25]. Although they are premeditated, these attitudes are subconscious and can significantly skew the bids. That is why the auctioneer's opportunity to set reasonable starting prices, influence the rhythm of the auction and offer proper signals to the bidders about the real value of the thing as a reply to their bidding can reduce the influence of those biases.

The auctioneer also has significant responsibilities related to bidder activation, involved in adjusting bids in ways which prevent the bidders’ cognitive load from becoming too heavy and impeding the immediate contiguity of the auction. In more intense auctions, bidders are quickly subjected to a flood of information and are most likely to be fatigued when making decisions [26]. Auctioneers can control the timing and ask for breaks at proper intervals, making sure the bidders are allowed sufficient thinking time. This approach minimises the chances of bidding with emotional highs or lows and low-quality decisions from cognitive limitation.

A significant issue confronting auctioneers is the capacity to achieve the maximum desirable bid for the seller while keeping the bidders in the ‘rational’ category. Excessive control of the bidding can also be counterproductive. For example, if bids are rushed through or competitive strategies are used to induce bidders, this may lead to bidder unrest and even decrease the credibility of the auction house. That being said, it is necessary to consider both cognitive and affective elements to achieve a higher level of success in the auction and even higher total satisfaction of the seller and buyers.

However, before the bidders get emotional or cognitive, the auctioneer must deal with the signalling behaviours prevalent within the auctions. According to the signalling theory, the bidders may act in certain ways to inform other participants that they are strong or committed [27]. For instance, actual bids could be very high initially to deter other bidders. This confirms that the bidder has a lot of financial capacity to participate, mainly with high participation costs. They must be aware of these cues and regulate them correctly: sometimes to increase competition among bidders to achieve a desired result and sometimes to prevent a situation when signalling results in aggressive bidding detrimental to bidders and the auctioneer.

In offline artwork auctions, where people bidding for the pieces have some form of attachment to the artworks, these forces are even more apparent. Artwork is priceless by its very nature, and people who participate in the bidding process have immense personal attachment to the artwork they desire to purchase. These feelings can cause unpredictable bidding action if the auctioneer needs to be more attentive. The job description of an auctioneer thus involves managing these emotions while at the same time helping the bidders arrive at the correct value-based decisions.

4. 5. Discussion

All models except Nash anticipate bidders to overbid in the resale treatment COMP. Consequently, qualitative predictions alone cannot differentiate these models. However, their predictions diverge when the number of bidders varies. Nash predicts no effect, while LOR consistently predicts a rise in overbidding. QRE initially predicts an increase but a slight decline in the bidding function for middle-range use values when there are many bidders. Therefore, an experiment with COMP and at least five bidders could effectively distinguish these models. A future experiment could involve human players competing against computerised opponents to test the hypothesis of subjects anticipating mistakes. Since computerised opponents are error-free, similar behaviour is expected across all three treatments. However, whether such behaviour accurately predicts how players interact with real humans is uncertain.

Another promising avenue for future research is the explicit inclusion of a speculator, as done in the [6] paper. This experiment would be valuable for comparing with INC and could provide insights into the underlying causes of the asymmetric behaviour observed in our data. Sealed-bid auctions could be used to test the theoretical equivalence of English and second-price sealed-bid auctions under complete information in the resale stage, as [4] explored. Additionally, these experiments could be designed to replicate the findings of [3] empirical study on US Forest Service timber auctions. [14] conducted first-price sealed bid experiments and compared them to these timber auctions, finding evidence of significant risk aversion. While risk aversion is a plausible explanation, the combination of risk aversion and noisy behaviour likely contributes to their results.

In light of the analysis objectives, additional insight is offered regarding behavioural tendencies that occur when auction mechanisms activate cognitive bias and emotional responses. In particular, this paper aims to investigate how bidders behave regarding the expected opportunity to resell the good in question, given various levels of information. Based on the analysis of the psychological literature, real-life behaviour during auctions is explained by the so-called auction fever, which causes bidders to continue their bids regardless of the actual cost. This behaviour is associated with competitive activation and emotions during bidding activity. It conforms to how the participants may overprice items according to social comparison prices rather than applying market prices.

In this analysis, the idea of bounded rationality is the major one in the assessment method. This paper establishes that bidders may only sometimes act rationally economically, especially in auctions related to artworks. This is most evident because the decisions they make are therefore extraneous, with additional input coming in the form of others' bidding behaviour, perceived tendencies in the industry, and lastly, self-preference through an attachment to the piece of art. These factors disturb the decision-making system and do not follow the Nash equilibrium, which assumes rationality. It is simply impossible to exclude errors or even emotional impact on decisions made by people, including auctions which result in overbidding or underbidding, which goes beyond theory.

Furthermore, this scholarly work analyses signalling in auctions. It's usually implemented when the bidders wish to convey information to other bidders, for instance, relative strength or financial capacity, in situations where the probable resale consequences cannot be predicted. Despite not being fully efficient in the respected economic sense, this kind of signalling behaviour is a calculated risk to bring change in the behaviour of other bidders in subsequent rounds of bidding or resale auctions. Such strategic bidding may assist a bidder to effectively create a controlled market to overshadow competition during the resale stage. This strategy is most probably witnessed when buyers feel so sure about the times that they can resell the bid that they are willing to bring up the first auction prices higher than they can even resell.

The practical implication of this study may be used by auctioneers who work in sectors where they sell expensive items such as art, real estate, and other valuable and valuable assets. When the thinking and feelings of bidders are considered, auctioneers can properly control how the bidding process unfolds to improve auction speed and profitability. These might involve some ways of controlling the amount of information shared during the auction in a bid to reduce the amount of emotion that permeates the decision-making process, such as the use of controlled breaks, which helps to lower total emotional levels, or a more detailed formal control of bidders to reduce the incidence of overbidding. In addition, the auctioneers can use the information from the bidding activity to contain noise, which distorts the rational bidding system and brings the auction format closer to the theoretical assumptions.

This study contributes to the auction theory because it reveals how psychological aspects might affect economics in auctions. As in most models of auctions developed in the past, this study shows that actual auctions are far from simple, and the bidders, in particular, are often far from ideal. Feelings, perceiving, and ambiguity are influential factors that shape the actions of bidders with a focus on resale options. The presence of resale makes an ordinary externalities layer, which leads to more critical common values since bidders revise their bids concerning the expected behaviour of other bidders.

Moreover, the experimental features of the study, including the critical difference between complete and incomplete informational backgrounds, show how far the bidders are from sophisticated strategic thinking compared to how much their feelings direct them. Hence, with incomplete information and its attendant higher risk, there will be more conservative bidding than in auction environments that offer complete information and are consequently marked by higher confidence in resale profits. This comparison shows how auctioneer interventions can be made to avoid or take advantage of these patterns depending on the intended goal of the auction.

Therefore, the knowledge about behaviour collected in the framework of this study might be helpful for the auctioneer and the market designer. In this paper, the cognitive and emotional factors that may influence the bids placed by the bidders have been identified, and how auctioneers need to understand those factors that allow for efficient auctions, especially for valuable goods and services. For a similar reason, these results stress the need to incorporate the behavioural approach in the auction theory to explain observed bidding behaviours.

5. 6. Conclusions

In conclusion, for resale treatment under complete information, the paper encounters a situation similar to the "ten little treasures" experiment by [22]. The simple English auction resembles the "treasure treatment," where Nash's theory accurately predicts subject behaviour. When introducing a resale opportunity, Nash equilibrium still predicts bidding one's value. However, subjects perceive a difference that the theory overlooks. They significantly overbid in the presence of a resale opportunity, even under complete information, and this overbidding persists over time, suggesting that learning has little effect. The results differ significantly when there is incomplete information in the resale market. Low-value subjects bid slightly above their values, while high-value subjects bid much below them. This suggests a pooling equilibrium similar to [2], where high-value players underbid to secure better resale offers. Adding a resale opportunity significantly alters subject behaviour in both treatments compared to simple English auctions. This change in bidding behaviour leads to substantially different revenues for the initial seller. Therefore, a resale opportunity is a crucial factor in auction analysis.

The paper also highlights the importance of considering noisy decision-making and the precise form of expected payoff functions. Despite having the same Nash equilibrium, the three treatments tested yielded distinct subject behaviours. This discrepancy was attributed to errors made by some players, even if minor. These errors could be due to strategy experimentation, trembling, or idiosyncratic preferences. In real-world auctions, liquidity constraints can also contribute to seemingly noisy behaviour. Even in high-stakes financial markets, errors and noise are prevalent [7]. However, these errors are not entirely random. Subjects systematically attempt to avoid the costliest errors, indicating that payoff functions are a good predictor of the empirical distribution of player errors. The reaction to errors can be more crucial than the errors themselves. When anticipating errors has a minimal impact on best responses, Nash's predictions can be qualitatively accurate.

However, in cases where best responses are sensitive to even small amounts of noise, the anticipation of errors can lead human subjects to deviate significantly from Nash equilibrium strategies, potentially invalidating comparative statics, such as regarding the number of players. These findings should be carefully considered for policy recommendations. While some laboratory experiment features might not apply to fundamental markets (e.g., fairness concerns or altruistic behaviour), noisy behaviour and its anticipation are likely to be present and significant. Therefore, models of noisy behaviour (including QRE and level-k) can provide more realistic results than simple Nash equilibrium analysis.

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