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Contact

chandrima.sikdar@nmims.edu

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Auction vs. 'posted price' in online sale: Role of impatience cost

Debabrata Datta* and Souvik Dhar**

Abstract

If all customers participate in the auction process, the price of a product will weakly dominate the price which is posted for buy it now option (BIN) for the product. But online auction requires waiting and therefore all customers may not participate in the auction process. So posted price may become a better option for both the buyers and the sellers, as shown in this article. One reason for non-participation may be impatience cost. Another reason for non-participation may be 'dissuasion' – non – participation on account of failure to win in the previous auction. The paper carried out an experiment to verify the presence of 'impatience cost' and 'dissuasion factor' among the management students, who are regular participants in online purchase. The experiment suggests the existence of 'impatience cost' and 'dissuasion factor'.

Key words: Auction, BIN, Non-participation, Impatience, Dissuasion, Experiment, Posted Price

* Visiting faculty and former senior Professor, Institute of Management Technology, Ghaziabad
Email: d.debabrata@gmail.com

** Assistant Professor, School of Business Management, NMIMS, Mumbai
Email: souvik.dhar@sbm.nmims.edu

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1. Introduction

With the advent of digital technology and internet in the early 21st century, online market has become increasingly popular. From the 1990s "eBay" has become a household name in USA in the auctions of consumer durables, car accessories, antiques, books and various collectors' items. In the online market, the aggregator provides a platform where seller offers his product for sale. The buyer also uses the platform in order to buy the product, provided there is a matching of demand and supply price.

In the early days of online sale, the sellers usually took recourse to auction sale in order to discover the maximum demand price. In the month of January 2003, roughly 95% of commodities were put for auction in eBay (Einav et.al, 2016). Auction sale is a mechanism for price discovery and it is a natural choice of the sellers. However, over time the popularity of auction sale waned and posted price (buy it now - BIN) emerged as the popular method of sale. In January 2013 less than 15% of the commodities were put for auction sale (Einav et.al, 2016). It is observed from the eBay site that sellers prefer to put their commodities for 'buy it now (BIN)' option rather than putting the commodities in the auction block. Einav et.al (2016) pointed out that popularity of Auction continuously declined since 2003.The rate of decline was mild initially. From 2006 it started declining drastically. Popularity of auction declined from a level of 70% in January 2008 to a level of 30% in January 2009. Einav et.al (2016) also pointed out that Google search for auction is also losing popularity. Kleinman (2013) says that In September 2008, eBay allowed 30 day posted price listings to be rolled over with automatic payment of the monthly listing free. It indicates that eBay is following the Amazon's way of listing when it comes to 'Buy it now (BIN)' option. A drastic fall in the number of commodities put for auction definitely shows the sellers' preference for the BIN option. This must be a natural response to the buyers' reluctance to participate in the auction process.

One interesting trend is that collectors' items like paintings, coins and stamps are also put for the BIN option quite frequently. An important purpose for putting a commodity in the auction block is price-discovery. It may be the case that price discovery is not needed for these collectors' items too. We conducted a scan with eBay USA as well as with eBay India from April 20 to June 20, 2017 in various categories of items. The survey shows majority of the commodities are put for the BIN option. Durable commodities like motor boats, automobiles and gym equipment are put for "buy it now auction". In the 'buy it now' auction category a commodity is posted for a fixed price but the seller is ready to sell the commodity to a buyer who is offering a best offer less than the quoted fixed price. Now an impatient or rich customer can immediately pay the fixed price to get the commodity and the auction will be ended. For example in eBay USA a "Custom Non reverse Firebird style guitar" was posted for $600 or for the best offer more than $450.Interestingly in eBay India this 'buy it now' option is not available. In case of auction both eBay USA and eBay India follow the conventional English auction. The on line auction starts with a starting bid. The duration of the auction process is given. The display shows number of participants as well as number of bids. The overall outcome of the survey shows strong dominance of 'posted price option' over auction indicating some benefit of posted pricing for the auctioneer.

This plummeting popularity of auction in auction sale appears to be a puzzle, since in theory auction is the selling mechanism to ensure discovery of highest demand price. Since seller does not know the valuation of the buyers for the sale item, posted price is less than the highest valuation with positive probability. Auction is thus a dominant strategy for the seller. Therefore, growing popularity of 'posted price' needs an explanation, an attempt we make in the present paper in terms of theoretical exercise and behavioural experiments. We put forward the argument that impatience on the part of the buyers with regard to completion of the act of purchase can explain the decline of on line auction and ascendancy of 'posted price'.

2. Literature review

Literature on auction and posted price in online sale is large. Grether et.al (2011) point out that "impatience" of the bidders can be a major cause why bidders put jump bid. They reported the results of a large scale field experiment in which a major firm in online automobile auctions allowed them to change some of the parameters of auctions. They point out that people opt for jump bidding due to two reasons, namely, 1) Strategic signalling and intimidation and 2) Impatience. They show that participants jump bid due to intimidation and strategic signalling leads to fall in sellers' revenue. On the contrary when bidders jump bid due to impatience, sellers' revenue increases. Their findings say that bidders in Texas jump bid due to impatience whereas bidders in New York jump bid due to strategic signalling and intimidation.

Wang (1998) addresses the issue of what determines the seller's choice between holding an auction and posting a fixed price when the seller faces a finite number of potential buyers. He has derived two different sets of sufficient conditions under which auction dominates posted price option in selling an object. He shows that auction is preferable on occasions when the value of the object is relatively high or when valuation of the object is more dispersed.

Wang et al. (2009) has made a survey with eBay and has pointed out that when customers make endogenous participation decisions according to their participation costs, "buy it now auction" can increase both customers' utility and sellers' profit. Pure auction will be inferior in such a case. Their model considers a potential customer's optimal bidding strategy, willingness to pay, probability of winning and costs of participating in an auction. In their two stage "sequential game" modelling they consider customers' auction participation cost at auctions. Their research findings have important implications for understanding consumer behaviour in the competitive environments found within auctions.

Caldentey and Vulcano(2007) analysed a revenue management problem. The seller operates an online multiunit auction and faces strategic consumers. Consumers can get the product from an alternative list price (posted price) channel. They considered two variants of the problem. In the first variant, the list price is an external channel run by another firm. In the second one, the seller manages both the auction and the list price channels. As they say: Each consumer trying to maximise his own surplus, must decide either to buy at posted price and get the item at no risk, or to join the auction and wait until it ends. They show that for consumers with values below the list price, the optimal strategy is always to participate in the auction. For consumers with higher values the threshold is non-decreasing in their own valuation.

Reynolds et.al (2009) conducted a survey with eBay and Yahoo and pointed out that both eBay and Yahoo allow sellers to list their auctions with a buy price at which the bidder can purchase the item immediately. They say that on eBay the buy price option vanishes immediately after a bid is placed. On yahoo the buy price option remains even after bid is placed. When bidders are risk averse both types of auctions raise seller revenue for a wide range of buy prices. Risk - averse buyers have a natural tendency to pay risk premium.

Durham et.al (2004) points out that for American Silver dollars, auctions listed with buy price option yields a higher selling price than that of those listed for pure auction. Anwar and Zheng (2012) provide a rationale for buy price auction selling mechanism. When many identical items are offered for sale by several sellers and there are many buyers, random matching between auctions and the bidders can cause allocative inefficiency. They show that with the buy it now option, some high valuation buyers buy the item before the start of the auction. In the case of a single seller with many items for sale, this not only reduces the allocative inefficiency but also increases seller's expected revenue.

Hammond (2008) points out that in CD's listings in eBay sellers prefer to post a fixed price rather than putting the commodities in the auction block. There is revenue dominance property of auctions. Still

the sellers prefer posted price over auction.He points out that posted price goods sell for higher prices,while auctioned goods sell with a higher probability.

Budish and Takeyama (2001) introduced a two bidder model and show that if customers are risk averse the seller feels an incentive to use a buy it now auctions.

There is not much literature on "impatience" and non-participation in the auction process but "customer impatience" might be a reason why people prefer posted price to auction. Authors like Daley (1965), Choi et.al (2001), Boxma et al (2010) talked about customer impatience in the context of queuing theory. BBC news (2008) tells that people are becoming much less patient when they go online. They do not like dawdling on websites. Users want simply to reach a site quickly, complete a task and leave.

There has been literature on experiments in the conduct of internet auction. Ariely et.al (2005) point out different ending rules in Amazon and eBay auctions. As they say, eBay has a fixed ending rule whereas Amazon allows extension of the auction after the ending time. If no bid is submitted in ten minutes the auction is ended. Bidders display different behavioural patterns in Amazon auction and eBay auction. In eBay majority of the bidders put their bids towards the end of the game. In contrast in Amazon few bidders put their bids at the end of their game. They conducted a laboratory experiment with the following different types of auctions: a) Sealed bid b) Amazon c) e-Bay8 and d) e-Bay1. Their experimental results show, as bidders get experience they are more likely to bid late under eBay conditions and less likely to bid late under Amazon condition.

Bohacek (2002) conducted a classroom experiment demonstrating the price mechanism and the clearing of markets in an endowment economy, in University of Chicago. The author says that this experiment has become a reference point in teaching many advanced concepts in economics.

Dixit and Nalebuff (2010), say about various experiments that relate to Dictator's game and Ultimatum game. These experiments have been conducted in classrooms as well as among various tribal groups.

The purpose of these games is to see how the proposer divides a given sum of money between himself and the responder. The outcomes interpret certain aspects of altruism and selfishness in human psychology among the participants.

Kagel (2016) argues that internet auction offers good opportunities for experimentation. Garratt et al. (2004) conduct a second-price auction with subjects, who have substantial experience of eBay. Roth and Ockenfels (2002) find that in eBay last minute bidding is more common than in Amazon, which automatically extends the deadline in response to last minute bids.

So far our knowledge goes, the literature has not elaborated on the point that non-participation of customers in the auction process makes posted price option a better alternative to both buyers and sellers and this paper looks at this issue. There is also novelty in our analysis because the paper has simulated real life auction in the classroom environment to experiment on impatience of the subjects. By reducing impatience cost we have obtained different result.

3. The Model:

We consider an environment where the online seller offers a good for sale. The seller has two options, either to go for auction or posting a price at which the good is available. In case of auction, there is a reservation price, above which the buyers have to bid. But this bidding process goes on for some period and only at the end of the period the highest bidder gets the good. In case of posted price the buyer need not wait. Simply by offering the willingness to buy she gets the good. Thus, in case of auction, the buyer has to bear a cost of waiting, although there is a possibility that she gets the good at a price, much less than her reservation price, provided that minimum reservation price is below the maximum demand price of the buyer. There is n number of prospective buyers, each of which is assumed to have a cost of waiting. It is also assumed that in view of impatience on account of waiting cost, some buyers do not join the auction. Thus z is the number of participating buyers, where $z \leq n$.

We further assume that the valuations of the buyers are uniformly distributed.

In this scenario, we put forward the following propositions.

We have the following propositions:

Proposition 1: *If every customer participates in the auction process, the auction mechanism of sale weakly dominates the 'posted price' mechanism from seller's side. If everybody does not participate in the auction process, this weak dominance no longer exists and 'posted price' mechanism may be better than auction mechanism of sale for the seller.*

Proof: Let us assume the bids are uniformly distributed in an English auction set up. If X is a random variable representing bid, then the probability density function is given by:

$$f(x) = \frac{1}{\beta - \alpha} if\ \alpha < x < \beta$$

=0 otherwise.

Where β and α are the highest and lowest value respectively.

The cumulative distribution function of f(x) is given by:

$$F(x) = 0 \quad \text{If} \quad x \leq \alpha$$

$$= \int_{\alpha}^{x} f(x)dx = \frac{x - \alpha}{\beta - \alpha} \text{ If } \alpha < x < \beta$$

$$= 1 \text{ If } x \geq \beta$$

Let us assume that every potential customer of n numbers of potential customers is participating in the auction process.

The pdf of the rth order statistic $(X_{(r)})$ is given by: $g(x)=\frac{n!}{(r-1)!(n-r)!}[F(x)]^{r-1}f(x)[1-F(x)]^{n-r}$

If W is the nth order statistic i.e. $W=\max(x_1,x_2,.....x_n)$ where x_i is the ith individual's bid, then we can say:

$$g(w)=\frac{n!}{(n-1)!}[F(w)]^{n-1}f(w)=\frac{n(w-\alpha)^{n-1}}{(\beta-\alpha)^n}$$

The mathematical expectation is:

$$E(w)=\int_{\alpha}^{\beta}wg(w)dw=\frac{n}{(\beta-\alpha)^n}\int_{\alpha}^{\beta}w(w-\alpha)^{n-1}dw=\frac{n\beta+\alpha}{n+1}$$

We got the result by applying integration of substitution.

$\frac{n\beta+\alpha}{n+1}$ is the expected highest demand price and expected winning bid provided all potential customers are participating in the auction process.

Let us now show that auction price mechanism is the weakly dominant strategy in this case for the seller, vis a vis 'posted price'. Let *b** is the 'posted price'.

Full participation

If $b^*>\frac{n\beta+\alpha}{n+1}$ then nobody would buy the commodity with posted price. Hence auction would be a better option to the seller as well as to the buyers than the posted price b*.

a) If $b^*=\frac{n\beta+\alpha}{n+1}$, then seller is indifferent between auction and posted price.

b) If $b^* < \frac{n\beta+\alpha}{n+1}$, then auction is preferred to the sellers.

This shows that given that everyone participates, auction is weakly better than 'posted price'.

Now, let us assume that every potential customer is not participating in the auction process. If z be the numbers of customers, participating in the auction process. Then the expected winning bid is

$$E(w^*) = \frac{z\beta+\alpha}{z+1} \ .$$

When all customers are not participating in auction, w^* is the winning bid as opposed to w when everyone does.

Here $n > z$ and also $\frac{n\beta+\alpha}{n+1} > \frac{z\beta+\alpha}{z+1}$ given that $\frac{dE(w)}{dn} > 0,$ when $\beta > \alpha$..

It means expected winning bid is more, if everybody participates in the auction process than if everyone does not.

We can compare auction price with posted price in this case of non-participation.

Partial participation

If everybody does not participate in auction, namely, z customers are participating in auction where $n > z$,the following situations emerge:

a) If $\frac{z\beta+\alpha}{z+1} < b^* \leq \frac{n\beta+\alpha}{n+1}$, then posted price b* would be a better option than auction from the sellers' perspective.

b) If $b^* = \frac{z\beta+\alpha}{z+1}$, the sellers would be indifferent between the two.

c) If $b^* < \frac{z\beta + \alpha}{z+1}$, the sellers would prefer auction to posted price.

We thus see that depending on the value of b^*, 'posted price' may be better than auction.

Now larger is the gap between z and n, that is lower the percentage of participation, posted price would become more desirable to the sellers than the auction.

The above proposition is a theoretical explanation why posted price option is gaining popularity and auction is losing popularity. For example we can assume that there are two potential customers, one with maximum demand price of 500 and another with maximum demand price of 300. Let the consumer with maximum demand price of 500 is impatient and does not want to spend time and wait for the final result under the auction process. If the wrist watch is put for auction the maximum bid will be 300. In this case seller gains more than auction, if the posted price is in between 300 and 500.

Posted price is a better option due to the existence of impatient customers. We have developed an experimental design and carried out the subsequent experiment to verify the existence of impatience among a set of subjects. In this experiment we have verified another plausible proposition. It is likely that a potential buyer, who is enthusiastic initially, will start losing interest in auction, if the experience is a failure. He eventually starts preferring posted price option. We have done another experimental design and the subsequent experiment to verify this phenomenon. We verify the following proposition in terms of experiments.

Proposition 2: *Customers may be enthusiastic in auction for novelty factor for the first time. But when they do not succeed, they become reluctant to participate in the auction process in a similar situation next time. Bad experience is a dissuading factor.*

If proposition 2 is true then the same set of customers who were enthusiastic initially, will start losing interest in auction and eventually start preferring posted price option. We have done another experimental design and the subsequent experiment to verify this phenomenon. We have done an experimental design and also conducted the subsequent experiments to examine "impatience" among a set of subjects and also for the verification of proposition. Our simulation has mimicked the 'auction vs posted price' scenario to capture idea about impatience, opportunity cost and dissuasion because of non-favourable experience of the past.

4. Experiments

Experimental design and treatment

In an online auction sale, the potential buyer has to bid and then wait for the final outcome. He may be required to revise the bid from time to time during the pendency of the auction process and therefore has to bear time cost. At the end of the auction, the potential buyer may or may not win. In case of win, there is gain but in case of unsuccessful bid there is loss due to waiting cost. Thus the gain of the potential customer is probabilistic. In our experiment, we make an attempt to capture behaviour of the subject with regard to waiting cost.

We choose those subjects in our experiment, who regularly participate in online purchases. We communicated with 50 such persons, all of whom are young students. They were requested to participate in the experiment process but participation was optional. As per the design of experiment, each participant was briefed about the experiment. They were to wait for some time of uncertain duration after which one fair die would be thrown. If "at most 2" comes up in the upper surface of the die then each of the persons, still present in the room would be entitled to get INR 300. So provided one is waiting till the die is thrown, there is a probability of winning the money is 1/3. Thus the experiment

introduced two uncertainties – one was regarding waiting time and the second was with regard to winning, which was probabilistic.

This experiment resembles the online auction purchase scenario in the sense that there is waiting cost after which there is gain in probabilistic term. It was expected that if a person was impatient, he / she would leave without waiting for the final draw.

1st experiment:

In the actual experiment, initially the subjects were requested to wait for 25 minutes. After the 25th minute they were requested to wait for another 15 minutes. After the 40th minute (25+15) they were requested to wait for another 10 minutes. Finally after 50th minute (25+15+10) the die was thrown. Here waiting was optional. It was clearly communicated that they could leave the class room any moment, if they wished to do so.

2nd experiment:

The second experiment was to organize a second draw with enhanced prize. The subjects, who waited till the end, would be invited to participate in the draw. Some more subjects, who left before draw in the first game, were chosen on random basis and they were invited to participate. The aim of this experiment was to verify whether failure in the first experience has any impact on desire to participate or not.

3rd experiment

The third experiment reduced the waiting cost and also increased the prizes. The objective of this experiment was to verify whether reduction in waiting cost and increase in possible reward had an impact on the participation decision.

5. The outcome of this impatience test

First experiment

Out of 50 invited subjects, 32 subjects turned up for the experiment. We serially numbered them from 1-32. They were told that they would have to wait for 25 minutes after which either the die would be thrown or they would be asked to wait for a few more time. At the 25th minute, when it was communicated that they would have to wait for another 15 minutes, 14 subjects left the classroom. At the 40th minute, when subjects were requested to wait for 10 more minutes, another 9 subjects left the room. The remaining 9 subjects waited till the end.

After the "die" was thrown, the number "4" turned up in the upper surface of the die. So, none of the students, who waited till end, got any money.

The outcome of this experiment shows existence of impatience. The participation of 64% subjects initially shows that there was an initial euphoria. But during the game, 70% subjects left on account of delay. 43% left just after the first postponement of draw and then among the remaining subjects another 50% dropped out. There was no other cost and there was a positive probability of gain. Only impatience cost can explain this behaviour of leaving.

5.1 Statistical test:

Let p is the population proportion of people who are waiting till the end. Here $\overline{p}$ is the corresponding sample statistic. Null hypothesis is that there is no impatience, namely, $H_0 : p = 1$ against the alternative hypothesis that there is impatience, namely, $H_1 : p < 1$. The one tail t test is as follows.

Computed value of t is -9.043512. And the critical value of t at 1% level of significance and Student's t table shows that at 30 degrees of freedom is -2.457 for the lower tail. Since the computed value is

smaller we reject H_0 in this lower tail test. Thus existence of impatience among the subjects appears to be statistically significant.

5.2 Second experiment

The 9 subjects who waited till the end of the "impatience test" were invited again. We also communicated 6 subjects, chosen at random, who did not wait till the end in the previous test.

5.2*a. How the game was played*

The subjects were communicated that in this fresh game with their participation, we would give them a better incentive. Now the prize money was increased to Rupees 400. Probability of winning was kept at p=1/3 as before. It was told that the money would be given if "at most 2" came up in the upper face of the die.

5.2b. Participation in this game

Out of these 15 students only 4 students turned up for this round. They were having serial numbers 2,5,13 and 31. (Serial number was given when we conducted the test in the first round to test impatience). Serial number 2, 13 and 31 waited till the end in the previous game of impatience. Serial number 5 left the previous game after 25th minute but made herself available for this game till the end.

5.2c. Outcome

The die was thrown after 30 minutes. The uppermost face of the die turned out to be "6". Interesting thing is that all the four students who participated waited till end. But none of them got anything again.

5.2d. Statistical test:

We have conducted a similar t test to see the statistical significance. Here the null hypothesis is, $H_0 : r = 1$ as opposed to the alternative hypothesis $H_1 : r < 1$. Here r is the proportion of people who

are not affected by the *bad experience factor*. In other words it is the proportion of people who are not dissuaded because of not winning any money in the first round.

The computed t value is -6.423. The critical t value for 1% level of significance and 13 degrees of freedom is -2.650. Clearly the null hypothesis is rejected. Hence, the proposition that bad experience dissuades people to participate is proved to be statistically significant.

5.3 Reduction in impatience cost and another experiment

We conducted another experiment to see the effect of reduction in cost of impatience. We reduced the impatience cost. The *experiment* was as follows: We communicated 30 different set of students of our part time programme in our institute. We announced them the date and time of the game two days in advance. The prize money was Rs.300 which would be given if the number appearing in the uppermost face of the die is either 1 or 2. They were asked to give missed call in a particular mobile phone, one or more times to show their interest, in the span of two days, before the die is actually tossed. On the prescribed date and time, they were asked to be present in the classroom physically for observing the cast of die.

5.3a. *Outcome*

Out of these 30 subjects, who were communicated twenty subjects gave missed call, although all the 30 students agreed to play initially. Among the 20 students who gave the missed call, 4 subjects gave it three times, 9 subjects gave it twice and the remaining 7 only once. On the day when the die was tossed 17 subjects were physically present in the classroom. Out of these 17 subjects 15 gave missed calls in these two days. Two students did not give any missed call but made themselves available. The die was tossed. The number appeared in the uppermost face of the die happened to be 2. Thus, total pay-out was Rs. 5100.

This experiment shows a marked improvement in participation in this case of reduced waiting cost. While in the first experiment, out of 50 invited subjects, only 9 subjects participated finally, the participation figure is 17 out of 30 in this third experiment.

5.3b. *Statistical test:*

A similar lower tail t test shows that the computed value of the t statistic is -4.7897. The critical value of t for 1% level of significance and 28 degrees of freedom is -2.467. So the null hypothesis is rejected here too. Thus impatience exists when the impatience cost is low too. It is also important to see whether participation has significantly increased or not after the reduction in impatience cost. To see this we have tested $H_0 : p_1 - p_2 = 0$ against $H_1 : p_1 - p_2 < 0$. Here p_1 and p_2 are proportions of subjects keeping patience in the 1st experiment and the 3rd experiment respectively. The computed value of t statistic is -3.6682.The critical value at 1% level of significance and 78 degrees of freedom is -2.375. Hence H_0 is rejected. It means participation increases significantly when impatience cost is reduced.

6. Some words about our experiments

Our aim was to simulate participation in an activity with waiting cost in the classroom environment. In our experimental design we tried to introduce cost of waiting and uncertainty to see the existence of *impatience*. In the first experiment the impatience cost was kept high. The students were asked to be physically present in the classroom and we requested them to wait till the die was thrown. We wanted to bring an element of uncertainty in their waiting time too. That is why we initially told them to wait for 25 minutes. After 25 minutes they were asked to wait for another 15 minutes and so on. In our 3rd experiment we reduced the *impatience cost*. Students were asked to give missed call in the mobile phone. Physical presence in the classroom was requested only when the die was supposed to be thrown. We presumed that giving missed call is less costly as compared to be physically present in the

classroom. It was expected that it would improve participation. The 2nd experiment was designed to see the *bad experience factor*. We invited only those students who have already played the first game but did not win any money. As shown before the null hypothesis in each case has been rejected.

7. Conclusion

Since non-participation is prevalent, buy it now option is becoming a better option to both buyers and sellers. The best bidder wins the auction. So we took the nth order statistic to find out the expected winning bid. Existence of impatience is quite evident from our experiments. We can say that impatient customers are unlikely to participate in the auction process. The outcome of the 2nd experiment shows *bad experience factor* also exists as a dissuading factor. The non – participation leaves the possibility of auction price being less than the posted price. This explains why online seller introduces posted price and buy it now option.

Our experiments have certain limitations too. These experiments were conducted in a classroom environment. The role that the students played was not of a buyer in an auction market. We offered them prize money to be won by luck. Their role was of passive player and they did not have the opportunity to make gain by intelligent exercise of their judgement. But purpose of the experiment is to capture the impatience that the experiment has succeeded to achieve.

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