Chapter 15

HARD AND SOFT CLOSES: A FIELD EXPERIMENT ON AUCTION CLOSING RULES

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1. INTRODUCTION

The growth of auctions on the Internet raises new theoretical questions, provides a wealth of data on bidding behavior in auctions, and presents new opportunities for running experiments in the field. The present paper reports the results of a field experiment on the effects of closing rules on auction outcomes. Different auction sites have adopted different closing rules. On eBay, auctions have a "hard" close, with the seller specifying when it ends (either exactly 3, 5, 7, or 10 days after it is listed). On Amazon, auctions have a "soft" close, with the auction ending at the scheduled closing time if no bids arrive in the prior 10 minutes, but with the auction otherwise ending only after 10 minutes has elapsed without a bid.

The present study takes advantage of the fact that Yahoo! Auctions allows a seller, when listing an auction, to choose whether to end the auction with a hard or soft close.[1] In our experiment, identical pairs of $50 gift cards were auctioned simultaneously, with one card of the pair auctioned with a soft close and the other auctioned with a hard close. We find that soft-close auctions yield higher revenue than hard-close auctions, and this difference is statistically significant. Both types of auctions were equally likely to have a "late bid", i.e., a bid submitted within the last five minutes of the auction. However, our ability to detect differences in the frequency of late bidding is limited by the small sample size of our study.

Our study is motivated, in part, by Roth and Ockenfels' (2000, 2002) comparison of last minute bidding (also know as "sniping") on eBay and Amazon, on auctions of computers and antiques. Roth and Ockenfels find that there is significantly more late bidding on eBay auctions than on Amazon auctions. In their data set, more than two-thirds of the eBay auctions received a bid in the last 30 minutes of the auction, and about 40 percent received bids in the last five minutes. In contrast, on Amazon only about one quarter of the auctions received a bid in the last 30 minutes of the auction, and only 3 percent received a bid in the last five minutes.

This difference in the timing of bids is consistent with a theoretical analysis of hard and soft close auctions. One explanation for the difference stems from the fact that, in practice, there is some chance that an attempt to place a bid at the last minute of an auction will not be successful. When this is this case, Roth and Ockenfels (2000) show that for auctions with a hard close there is an equilibrium in which all bidders submit a bid equal to their value at the last minute (under some assumptions on the distribution of values). In this equilibrium the bidders tacitly collude – all the bidders respond to an early bid by bidding their values immediately. In equilibrium a bidder prefers to bid late, and face a smaller number of competing bids, rather than bid early and having his bid successfully placed, but face competing bids from all the other bidders. Roth and Ockenfels also show that last-minute bidding is a best response to an "incremental bidding" strategy by naïve bidders.[2] In soft-close auctions, a last-minute bid extends the bidding. Roth and Ockenfels show that in soft-close auctions it is not an equilibrium for all bidders to submit last-minute bids. Nor is last-minute bidding a best response to incremental bidding in soft close auctions.[3]

Both theoretical explanations of late bidding suggest that seller revenue is lower in auctions with a hard close. In the equilibrium with tacit collusion the seller receives (in expectation) fewer bids. Against an incremental bidder, a bidder who snipes pays less than the incremental bidder's value.

Several factors prevented Roth and Ockenfels from comparing seller revenue in hard and soft close auction. When their data was collected in the fall of 1999, eBay was already the dominant auction venue, with many more bidders than Amazon.[4] Even if the same items were sold on both sites, this alone would make it difficult to determine whether revenue differences between hard and soft close auctions were due to differences in the closing rule or in the number of bidders. In fact, the computers and antiques sold on each auction sites are heterogeneous both within and across the auction sites. The sellers on the two sites also have different reputations (represented by their feedback profiles), which influences the bidders' values for the items.[5] These factors prevent a straightforward comparison of revenues of hard-close (eBay) and soft-close (Amazon) auctions.

Our experiment had a paired design, with pairs of identical items auctioned at the same time (on Yahoo), with one item in the pair sold in a soft-close auction and the other sold in a hard-close auction. Hence the number of potential bidders and their characteristics were identical for both auctions in a pair. The same seller ID was used for both auctions, and hence the seller's feedback profile (called the seller "rating" on Yahoo) was also the same between paired auctions. This design allows for a test of the effect of the closing rule on revenue, and it has high power with even a small sample of auctions. The results of the present paper support the conclusion that revenue is lower in hard-close auctions.

2. RELATED EXPERIMENTAL LITERATURE

Several other papers have also investigated the effect of the closing rule on the timing of bids and seller revenue. We focus on the results for seller revenue. In a laboratory experiment, Ariely, Ockenfels, and Roth (2002) find that seller revenue is higher in the soft-close treatment than in the two hard-close treatments they consider. (In one hard-close treatment, last minute bids are processed with probability .8, while in the other they are processed for sure.) The soft-close also yields more revenue than a second-price sealed-bid auction.

In a paper closely related to our own, Gupta (2001) studies the effect of closing rules by comparing the outcomes of hard and soft-close Yahoo auctions. His approach involved selling forty matched pairs of identical sealed music CD's, with one CD from each pair being sold in an auction of each type. He found that the mean sale price in the soft-close auctions was $6.89, as compared to $6.60 in the hard-close auctions. However, he reports that this price difference is not statistically significant ($p = 0.31$). More generally, he found that "comparisons between the two treatment groups [hard and soft-close auctions] yielded no significant differences in either price, bid number or bid timing" (p. 26).

Gupta's study was carefully done. Nevertheless, one potentially important reason that he did not find differences in behavior between auction types is that the participants in his auctions might not have realized that they were bidding in a hard- or soft-close auction, and even if they recognized it, might not have understood the meaning of the closing rule. Evidence in support of this is that although several of his auctions were extended, none of his extended auctions received bids during the extended time. In the present study, we avoid this confound by making salient on our auction page the nature and meaning of the auction closing rule (see the Item Information in Figure 1). Another possible explanation for the difference between our results and Gupta's is that the stakes in his study are substantially smaller, and hence may not provide bidders with sufficient incentive to carefully time the placing of their bids.

Moreover, although Gupta auctioned matched pairs of items, it is not clear whether he auctioned each item in the pair concurrently. Final auction prices can vary for a large number of reasons, particularly because of variations in the number of potential bidders. As a result, the impact of closing rules can be obscured by other differences in the auction environment. As we describe in detail below, our design is to run each item in the pair at the same time, and therefore ensure a common auction environment. This reduces the effect of confounding factors on outcome differences and, consequently, allows relatively more compelling inference about closing rule effects.

3. EXPERIMENT DESIGN

Our design provides a clean and simple way to compare the effects of different closing rules on auction outcomes. The primary advantage of our field experiment is that we gain a subject pool and environment more closely tied to the naturally
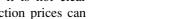
Figure 1. Typical Soft-Close Auction Page.

occurring world. At the same time, we inevitably lose some control that we have in the laboratory. Like all empirical analyses of field auction data, we lose control of the number of potential bidders (a number critical for the theory), as not all potential bidders are observable. (The number of actual bidders is of course observable, but this provides only a lower bound on number of potential bidders.) We also lose control over all dimensions of the set of competing auctions, including how many there are, how closely related they are to our product, and how they are advertised.

Our approach to mitigating the noise associated with the field experiment to adopt a randomized "paired" experimental design. The idea is to run two auctions simultaneously, where the auctions are identical in every way except the closing rule. In particular, one of the auctions is listed with a hard close, and one with a soft close. The main advantage to this randomized paired design is that differences in numbers of bidders, numbers of simultaneously occurring auctions and other sources of noise in bidding behavior are substantially controlled when drawing inferences with respect to closing rule effects. We chose Yahoo because Yahoo allows sellers to specify whether they want to use a hard or soft close.

One potential disadvantage of the paired design is that our auctions compete with each other, and some might argue that this creates an artificial environment that weakens our study's external validity. In fact, a casual inspection of any major

auction website reveals many essentially identical auction listings across many product categories. Our experience is that it is more the exception than the rule to have a unique item with few very closely competing auction listings. Consequently, although it forces a departure from some of the premises of standard auction theory, we believe a paired design enhances our study's ability to predict the effects of different closing rules as used in actual Internet auctions.

The item sold in each of our auctions was a $50 gift certificate that could be redeemed at a chain-store with outlets throughout the United States. Although each pair of auctions sold a gift certificate for the same store, the stores were varied across auction pairs. The stores were chosen in an effort to appeal to customers of varying demographic characteristics, so that we would obtain variety in the people interested in participating in our auctions. For example, we auctioned gift certificates to both Sears and Crabtree and Evylyn. While certainly there is some overlap in these stores' customers, this overlap is not likely perfect. The seven stores we included in our study are: Borders Books, Circuit City, Crabtree and Evylyn, Sears, Target, Toys-R-Us, and Victoria's Secret.

An important advantage of selling gift certificates, then, is that they allow high homogeneity within a pair yet provide heterogeneity across pairs. There are other substantial advantages to selling gift certificates. An important one is that gift certificate auctions are clearly *private value* auctions. That is, one bidder's bid does not convey any information to the other bidders about the value of the gift certificate. For example, a bidder's value for a Borders Books certificate will depend on idiosyncratic factors including his cost of traveling to the nearest Borders, and his preference for Borders products in relation to those available at other nearby bookstores. This latter could vary with, for example, relative return policies. Other practical advantages to selling gift certificates are that they are easy to obtain, easy and inexpensive to ship, easy to describe and, again, exceptionally homogenous.

Both auctions in a pair were posted at the same time and using a nearly identical page layout and item description. Figure 1 shows the auction page for a typical soft-close auction. The text "Auction may get automatically extended," which appeared in the page's "Notes" section, indicated to participants that the auction had a soft close. A hard-close auction contained, instead, the text "This auction does not get extended automatically." In addition, we described the closing rule for each type of auction in the item description. Soft-close auctions included the text "This auction is automatically extended an additional 5 minutes whenever a bid is placed within 5 minutes before the auction close," whereas in hard-close auctions we stated "This auction does not get automatically extended and ends at the close time given above." As discussed above, the reason for emphasizing the closing rule was to increase the likelihood that subjects would both notice and understand this auction feature. Note again that, other than differences regarding the closing rule, the auction pages were identical.
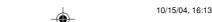
An undergraduate research assistant created a Yahoo account for the purpose of this project and posted each auction pair. The account was held fixed across auctions. All auction winners were promptly and appropriately sent the item they

had won. As a result, the seller's rating score increased over the course of the experiment. This is not a concern for our study, as each auction in a pair was held in the same reputation environment, and our inferences are based on the distribution of within-pair outcome differences.

4. RESULTS

We conducted 15 pairs of auctions during the Fall 2001 academic semester. One auction pair was lost due to a recording error (a Victoria's Secret auction) leaving 14 auction pairs in our data set. While this number is not large, it should be remembered that we base our results on differences in auction outcomes within pairs, a procedure that has relatively high statistical power. Indeed, we see below that even with this limited data set, statistical differences in outcomes between auctions with hard and soft closes are apparent.

Table 1 describes the outcomes of the 14 auctions in our data set. The first column lists the store associated with the auctioned $50 certificates. Note that five of our seven stores were used for two auction pairs, Sears was used for one and Borders for three. The next three columns describe the number of bids, revenue and whether there were late bids in each of the soft-close auctions. The number of bids ranged from a low of six (Sears) to a high of 33 (Toys-R-Us) with a mean of 18. Revenues varied between $27.25 (Borders) and $46.05 (Target), with an average of $36.15. Five of the soft-close auctions received late bids and were extended. Within this set, the number of bids ranged from 15 to 33, while revenues ranged from $27.25 to a maximum $35.33.

The next three columns of Table 1 detail the results of the hard-close auctions. The number of bids ranged from a low of 5 (Circuit City) to a high of 37 (Victoria's Secret), with a mean of just under 19. Revenue from the hard-close auctions was lowest in a Border's Books auction ($26) and highest in a Target auction ($47), averaging just under $35. There were five hard-close auctions in which bids were entered within 5 minutes before the close. (Of course, these auctions were not extended.) Among the late bid set, the number of bids ranged from 12 to 37, and revenues from $26 to $38.21. Four of the 14 hard-close auctions generated revenues greater than $40.

The price of the same gift card varied substantially across auctions at different times. Borders cards, for example, fetched as much as $37.01 in one soft-close auction, but received only $27.25 in another soft-close auction. This suggests that the Yahoo gift card market is relatively "thin," with the price depending heavily on the willingness to pay of the bidders who happen to be present. (Note that prices in the hard-close auctions are correlated with prices in the soft-close auctions.) This variation in prices highlights the advantage of the paired design. It controls for the substantial variation in price that is due to factors other than the auction closing rule.

The final two columns of Table 1 detail the differences in outcomes between the soft and hard-close auctions. The difference reported is outcome in the soft-close

Table 1. Auction Outcomes

Store	Soft Close			Hard Close			Difference (Soft − Hard)	
	Number of Bids	Revenue	Late Bids	Number of Bids	Revenue	Late Bids	Number of Bids	Revenue
Borders	17	$37.01	No	12	$35.01	No	5	2.00
Target	9	$46.00	No	19	$47.00	No	−10	−1.00
Victorias Secret	29	$34.00	Yes	37	$31.95	Yes	−8	2.05
Sears	6	$31.01	No	13	$32.01	No	−7	−1.00
Toys "R" Us	33	$35.33	Yes	32	$33.00	No	1	2.33
Circuit City	18	$34.33	No	5	$31.01	No	13	3.32
Crabtree & Evelyn	21	$32.06	Yes	27	$28.03	Yes	−6	4.03
Borders	21	$32.01	No	19	$32.01	No	2	0.00
Target	16	$46.05	No	23	$45.00	No	−7	1.05
Toys R Us	12	$41.00	No	15	$41.00	No	−3	0.00
Victorias Secret	10	$42.00	No	16	$43.00	No	−6	−1.00
Circuit City	28	$37.00	No	18	$38.21	Yes	10	−1.21
Borders	17	$27.25	Yes	12	$26.00	Yes	5	1.25
Crabtree & Evelyn	15	$31.11	Yes	17	$26.04	Yes	−2	5.07
Mean	18.00	$36.15		18.93	$34.95		−0.93	1.21

auction less the outcome in the hard-close auction. With respect to number of bids, this difference ranges from a low of −10 (Target) to a high of 13 (Circuit City). The average difference is about −1, but is not statistically significant. The implication is that the number of bids in the two environments is about the same. Revenue differences range from a high of about $5 (Crabtree and Evelyn) to a low of −$1.21 (Circuit City). There were two occasions in which the auction types earned identical revenue (Borders and Toys-R-Us.) In eight of 14 of our auction pairs the soft-close auction earned more revenue. The soft-close auctions generated an average (over all auctions) of $1.21 (3.5%) more than the hard-close auctions, and this difference is statistically significant (Wilcoxon signed-rank test for paired observations, $p < 0.05$).

A closer inspection of the revenue difference figures reveals a very close relationship of revenue to whether the soft-close auction was extended. In particular, on each of the five occasions where the soft close auction received late bids, it also generated higher revenue than the hard-close auction. Among this set, the average revenue advantage was about $3 (about 10%). The soft-close auction earned greater revenue in only three of the nine auctions that did not include late bidding, and among that set the mean revenues were almost exactly identical.

In summary, our results suggest that soft-close auctions produce statistically significantly greater revenue on average than hard close-auctions, but this is due to those cases where the auction is extended. An interesting feature of our data is that there are an equal number of late bids placed in each type of auction.

5. CONCLUSION

Laboratory evidence from Ariely, Ockenfels, and Roth shows that a seller obtains more revenue when they sell using a soft rather than a hard-close auction. This study presents evidence that the soft-close auction continues to be superior, even when it is employed in the field. Furthermore, the soft-close auction raises more revenue than a hard-close auction, even when both auctions must compete for bidders, as is the case in the field.

The difference between our results and Gupta's (2001) suggests that the size of the stakes may be important in understanding behavior in soft- and hard-close auctions. In particular, the revenue advantage we find for soft-close auctions may become insignificant in auctions of smaller denomination gift cards, if bidders believe is it not worth their effort to time the placing of their bids. This is an interesting direction for future research. A larger field study, using more auctions than the present study, would provide more insight into whether the closing rule affects the timing of bids.

NOTES

[1] The closing rules are slightly different between Amazon auctions and Yahoo soft-close auctions. A Yahoo soft-close auction ends at the scheduled closing time if there are no bids in the 5 minutes prior to the close. Otherwise, the auction is extended by 5 minute increments, until one of these increments passes without any bids. Hence, while an Amazon auction may end any number of minutes after the scheduled close, a Yahoo soft-close auction always ends a multiple of 5 minutes after the scheduled close.

[2] An incremental bidder raises his bid by the minimum increment whenever he is outbid, so long as this would not lead him to bid above his value.

[3] See also Ariely, Ockenfels, and Roth (2002) for theoretical models of late bidding in eBay and Amazon auctions. In common value auctions they show that an expert bidder, who is better informed about the item's true value, also has an incentive to bid late so that other bidders can not free ride on his information.

[4] Bidders may also self select into eBay or Amazon auctions in a way that depends on their characteristics, introducing the possibility of selection bias.

[5] In a study of Pentium processor auctions on eBay, Houser and Wooders (2000) show that positive and negative feedback both have a statistically significant effect on price.

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