Last Minute Bidding in eBay Charity Auctions

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1. Introduction

Last-minute bidding is widespread in on-line consumer product auctions. This phenomenon is somewhat startling in light of standard models of bidding behavior. On-line auctions resemble Vickrey and English auctions, and when bidders have private values for the auctioned item there is no advantage to bidding later rather than earlier. The phenomenon of last-minute bidding has recently received extensive theoretical and empirical attention (Roth and Ockenfels, 2002; Ockenfels and Roth, 2003; Ariely, Ockenfels, and Roth, 2005; Ely and Hossain 2006; Steiglitz 2007). These papers explore the conditions under which individuals optimize their private benefits by engaging in last minute bidding. Leading explanations include delaying the release of private information in common value auctions, efforts to avoid price wars among strategic bidders, and attempts to avoid having naive bidders drive up the price. This paper complements the prior work on bid timing by empirically examining the degree to which bid timing changes when an auction generates a benefit that is not completely internalized by the winner of the auction. In particular, we examine the degree to which bid timing is shifted in auctions in which some or all of the proceeds go toward a charitable cause.

This paper is part of a more general investigation that compares consumer responses to charity-linked and "normal" products. Consumers are frequently presented opportunities to purchase products that are linked to a charitable causes, green production, or fair trade practices. These products may be offered by nonprofit organizations or for-profit firms.[1] Several theories describe how consumers will respond to charity-linked products. One possibility is that consumers will have no response at all; they will ignore the charity link established by the seller and make direct donations to causes that align perfectly with their tastes. A second theory is that consumers' demand is increased by charity links, and this increase is entirely due to benefits that are private to the individual consumer. For example, a consumer could experience an egoistical "warm glow" from the activity of purchasing the product, or the consumer could interpret the charity link as a signal about product quality that is completely unrelated to charitable fundraising. A third possibility is that demand shifts because consumers perceive auction revenue as a public good. This implies that individual consumers' demand for the product may be affected by other consumers' actions.

In Elfenbein and McManus (2007) we use a matched sample of eBay auctions to establish that consumers respond positively to charity-linked products. We find that consumers will pay a premium of about 6% in a charity auction relative to a non-charity auction for an otherwise identical product. This examination of auction prices establishes a premium but does not allow us to discern completely between the private benefits and public goods theories described above. For evidence on this question, Elfenbein and McManus (2007) examine the lag in days between when a bid is placed and when an auction closes. We find that bidders in charity auctions bid up to half a day earlier than in non-charity auctions, and we ascribe this timing shift to bidders' desire to increase the payments of their competitors. This evidence supports a public goods interpretation of auction revenue.

Our investigation of bid timing in eBay auctions follows from the results of Ely and Hossain (2006), who compare bidding strategies of "sniping" (bidding very late) versus "squatting" (bidding very early). Ely and Hossain (2006) consider which strategy is optimal for a sophisticated bidder who may bid against both other sophisticated bidders and naive bidders who follow "incremental" bidding strategies. These naive or incremental bidders will observe

[1] In the former case, a nonprofit may offer a line of products to supplement traditional fundraising through direct donations. In the latter case, a firm may pursue "cause-related marketing" to satisfy philanthropic objectives or to opportunistically stimulate demand.

the current price in an auction and submit a series of bids, each slightly higher than the last, until they either lead the bidding or they learn that the current price exceeds their maximum willingness to pay.[2] By sniping, a sophisticated bidder can avoid giving naive bidders a relatively high hurdle to clear when they choose to end their bidding, and thereby reduce the price at which the sniping bidder can win the auction. Despite this advantage of sniping, Ely and Hossain (2006) argue that the private net benefits from sniping and squatting are nearly equal, and the most substantial differences are in auction revenue and the expected payments of other bidders. These are aspects of an auction that a bidder should care about if he views auction revenue as a public good, which is valuable regardless of the person who pays.

The matched auction data we use in Elfenbein and McManus (2007) does not permit analysis of sniping as it is usually defined. Sniping is the practice of bidding in the very last moments of an auction to prevent other bidders from noticing one's bid and responding to it.[3] In order to detect sniping, a data set must contain variation in the prevalence of bidding in a fairly short interval of time. This is not a feature of the data in Elfenbein and McManus (2007).

In the present paper we explore a considerably larger data set than the one in Elfenbein and McManus (2007). While the present data are not matched at the product level, as are the data in our earlier study, the present data allow us to investigate the incidence of sniping in the last minute and last seconds of an auction. As in our previous paper, we find a significant shift in the timing of charity auction bids. No matter the percentage of revenue dedicated to charity, charity auction bids occur earlier, on average, than those in non-charity auctions. When we focus on traditional sniping measures, we find that auctions with all revenue dedicated to charity have significantly less sniping, while other types of charity auctions are not different from non-charity auctions in most cases. Auctions in which all revenue is donated to charity have fewer bids both in the last minute and in the last fifteen seconds. These results support the conclusion in Elfenbein and McManus (2007) that bid timing and sniping are significantly different in charity auctions. The results also suggest that a significant fraction of charity bidders view the auction revenue as a public good.

[2] See Elfenbein and McManus (2007) for institutional details about the eBay bidding system which support this practice.

[3] See Bajari and Hortacsu (2004) for a review of eBay conventions and institutional details. Literal sniping has been shown to occur in Roth and Ockenfels (2002) and Ariely, Ockenfels, and Roth (2003)

2. Data

Elfenbein and McManus (2007) employ a data set that matches identical products sold in charity and non-charity auctions. While that dataset is sufficiently large to estimate price premiums with precision and allows us to perform some analysis about differences in bid timing, a broader data set, assembled here, is required to test more nuanced questions about differences in sniping across charity and non-charity auctions. Towards this end, we created a data set based on all eBay charity listings ending in October 2006. All auction details and bidding histories were collected for these listings. We identified the top 48 eBay product categories by total number of product listings among the charity items and subsequently downloaded auction details for up to 2000 non-charity auctions in each of these categories.[4] All of the non-charity auctions for which we collected data ended in the month of October. We restrict our analysis to auctions that ended in a sale via eBay's traditional auction mechanism. Listings that did not result in a sale and listings that resulted in sales via "buy-it-now" are excluded from the data set. In addition, we eliminate all auctions that ended with prices below $2 or which lasted more than 10 days. In total, the data we employ is comprised of just over 26,000 completed auctions. We refer to this data as "category-level" data to distinguish it from the matched sample we employ in prior work.

Summary statistics on the category-level data are in Tables 1 and 2. Table 1 reports the attributes of auctions and bidders in the charity sub-sample and Table 2 reports the attributes of auctions and bidders in the non-charity "control" sample. Average prices of the charity and non-charity samples are similar, $76.45 vs. $78.45, as are median prices which are $15.50 and $15.82, respectively. Completed auctions in the charity sub-sample received slightly more bids on average, 5.67, compared with an average of 5.19 in the non-charity sub-sample. Seller attributes in the two groups were also similar, although charity auctions' sellers were slightly more experienced (a median feedback level of 850 vs. 737 for non-charity sellers) and slightly less likely to be "Power sellers" (33.0% in charity auctions vs. 34.7% in non-charity auctions). Charity auctions lasted longer on average than non-charity auctions, 7.04 vs. 6.26 days; the median auction length for both groups was identical. Additionally, charity auctions were more likely to end in the afternoon and less likely to end in the evening than non-charity auctions, and

[4] eBay's product categories have a hierarchical structure, with the base category containing many types of items (e.g. Consumer Electronics) and lower categories defined more narrowly (e.g. Portable MP3 Players). For the data collection exercise described here, we define the product category at the third level within the eBay hierarchy. A list of product categories is available from the authors upon request. Base product categories heavily represented include Books, Collectibles, Entertainment Memorabilia, Home & Garden, and Pottery and Glass.

charity auctions were less likely to end on Sunday and more likely to end on Saturday than non-charity auctions. In the regressions below we employ controls for auction length, seller characteristics, and auction ending time to account for bid timing differences that may stem from these factors.

At the sub-sample level, there are major differences in the frequency of last-minute bidding, the presence of incremental bidders, and the timing of bidders' final bids. The fraction of winning bids arriving in the last 15 seconds, 1 minute and 5 minutes are 13.0%, 18.3%, and 23.3% in the charity sub-sample, and 14.9%, 19.4%, and 24.9% in the non-charity sub-sample. Furthermore, a bidder's final bid occurs on average 2.34 days before the end of the auction in the charity sub-sample vs. 1.79 days before the end of the auction in the non-charity sub-sample. These figures translate to final bids being submitted by bidders at points in which 33.2% of the time remains in the auction (charity) vs. 28.5% of the time remains in the auction (non-charity). Finally, in charity auctions, bidders are more likely to be incremental bidders (i.e., bidders who submit multiple bids) despite the fact that these bidders are, on average, more experienced than bidders in non-charity auctions.

Finally, it is worth mentioning that the majority of auctions in the charity sub-sample are auctions in which 100% of revenue is dedicated to charity. Slightly more than 90% of the auctions in the charity sub-sample are 100%-share auctions. Of the remainder, approximately 7% of charity auctions dedicate 10% of revenue to charity. Fewer than 3% of charity auctions dedicate a share of revenue between 15% and 95%, inclusive.

3. Empirical analysis

In this section we provide three separate analyses of bid timing and its implications in charity auctions.

3.1 Days between bid and auction close

We begin by estimating the lapsed time (in days) between a bidder's final bid and an auction's closing. The econometric model is:

$$days_{ij} = \alpha_c + CHARITY_j\beta + AUCTION_j\gamma + SELLER_j\delta + BIDDER_i\phi + \varepsilon_{ij}. \quad (1)$$

The dependent variable $days_{ij}$ is the number of days between bidder i's final bid in auction j and the auction closing time. $CHARITY_j$ is a vector of indicator variables for whether an auction has 10% of revenue donated to charity, 100% of revenue, or some share strictly between 10% and 100%. These dummy variables are, respectively, *10%-SHARE*, *100%-SHARE*, and *MID-SHARE*. $AUCTION_j$ is a vector of auction characteristics including the scheduled duration via four categorical variables, the time of day as represented by five dummy variables, and there are six dummy variables for the days of the week the auction might end. $SELLER_j$ describes the seller's percentage positive rating in four categorical variables, logged feedback score, and "Power Seller" status. The vector $BIDDER_i$ includes quadratic terms for bidder i's feedback score to control for the bidder's prior experience in eBay auctions. Finally, the model includes a set of category-level dummy variables in α_c to account for differences in bidding practices across product classes. These category-level dummies also control for differences in the prevalence of items with private-value versus common-value taste distributions in the bidder population.

We estimate equation (1) with OLS and report the results in Table 3. As the vectors *AUCTION*, *SELLER*, and *BIDDER* include 21 control variables and would substantially clutter results, we suppress the coefficient estimates for these variables in Table 3 and all subsequent tables. We focus exclusively on the three variables in the vector *CHARITY*.

When we include the final bids of all bidders who appear in our sample (Column 1 of Table 3), we find that each class of charity auction has its bidders submitting their bids significantly earlier than in non-charity auctions. This shift in timing ranges from a quarter of a day for auctions with *100%-SHARE* = 1 to nearly half a day for auctions with *MID-SHARE* = 1. We repeat the analysis in Column 2 after dropping the bidders who bid more than once. We are primarily interested in whether sophisticated bidders shift the timing of their bids in charity auctions. While the magnitudes of our coefficient estimates change between Columns 1 and 2, we again find that bidding is substantially earlier in charity auctions.

3.2 Discrete measures of sniping

In addition to analyzing the lapsed time between final bids and the scheduled auction end, we estimate whether bidders are less likely to place their bids in the final moments of the auction. For each bidder who bids only once in a single auction (and therefore is not observed as an incremental bidder), we ask whether the bid was placed in the final S seconds of the auction.

The indicator variable $FINAL_S$ tracks this aspect of bid timing. Bidders with their only bids in the final S seconds have $FINAL_{Si} = 1$, and all other bidders with a single bid have $FINAL_{Si} = 0$. We consider values of $S = 60$ and $S = 15$, and estimate the probability that $FINAL_S = 1$.

We estimate this probability with a probit model. The explanatory variables mirror the structure of equation (1), including the set of category dummies (α_c), our descriptors of charity status (*CHARITY*), and other controls for the auction, seller, and bidder attributes. We limit the analysis to bidders who are observed to bid only once in an auction; we interpret these bidders as sophisticated and aware of the strategic value of shifting bid timing. Our results, which are presented in Table 4, demonstrate that these sophisticated bidders bid significantly less frequently in the last moments of charity auctions with all revenue dedicated to charity. Bids in the last minute of the auction are about 9% less common in these auctions. The reduction in sniping when *100%-SHARE* = 1 is even greater when we focus on the last 15 seconds of an auction. We find negative point estimates for other types of charity auctions too, but these results typically are not statistically significant. In contrast with our estimates from equation (1), we find here that the auctions with the greatest share of charity revenue (and thus the greatest public goods charity value at stake) have the only significant shift in bid sniping.

3.3 Timing shifts and incremental bidding

In order for a shift in bid timing to affect revenue, a sophisticated bidder's earlier bidding must result in more "aggressive" bidding by naïve bidders. We investigate this issue by looking at the number of bids per bidder and whether an auction included a bidder who bid more than once. The results from this analysis are in Table 5. We retain the full set of product, auction, seller, and bidder controls in equation (1) in addition to the vector *CHARITY* for the empirical analysis. In Columns 1 and 2 of the Table we show that charity auctions with *100%-SHARE* = 1 are significantly more likely to include a bidder who bids multiple times. The 5.3 percentage point increase in Column 1 represents a 16.4% increase over the average for all auctions in the sample. In terms of number of bids per bidder, we find that bidders in full charity auctions submit, on average, an extra 0.09 bids. Finally, in Column 3 we examine whether bidders who bid multiple times are more likely to win charity auctions. Indeed, if the shifted bid timing of sophisticated bidders did not result in more frequent sales to bidders who were induced to bid aggressively, then it would be unlikely that the public goods nature of auction revenue would cause timing

shifts. The results in Column 3 show that bidders in auctions with *100%-SHARE* = 1 are 27% more likely to be won by a bidder who has bid aggressively.

4. Conclusions

The analysis in this paper suggests that bidding in charity auctions occurs earlier than bidding in normal, non-charity auctions. Last-minute bidding is less common in auctions in which 100% of the proceeds are donated to charity. These 100%-share auctions attract more incremental bidders and are more likely to be won by incremental bidders. Taken together, these results suggest that the timing of many bidders' bids is influenced by the public good nature of the charitable donation that results. The observation that bid timing is shifted more in 100%-share auctions than in 10%-share auctions is also consistent with this interpretation of the analysis. Bidding earlier in 100%-share auctions may be more likely to generate an extra dollar in revenue for a charity than bidding earlier in a 10%-share auction, where the final price would have to rise by $10 to achieve the same result.

References

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Table 1: Summary Statistics on Charity Auctions

	Obs.	*Average*	*Median*	*Std Dev*	*Min*	*Max*
Auction Level Data:						
Price ($)	7654	76.45	15.50	354.64	2	11101
Donation (%)	7654	92.1	100	24.8	10	100
Number of Bids	7654	5.67	3	6.56	1	71
Seller Rating (/1000)	7654	5.54	.85	19.85	.001	129.3
Percent Positive Ratings (%)	7654	99.5	99.7	.8	88.9	100
Powerseller (dummy)	7654	.330	0	.470	0	1
Length (days)	7654	7.04	7	1.26	1	10
Monday (dummy)	7654	.162	0	.369	0	1
Tuesday (dummy)	7654	.145	0	.352	0	1
Wednesday (dummy)	7654	.144	0	.351	0	1
Thursday (dummy)	7654	.118	0	.322	0	1
Friday (dummy)	7654	.092	0	.289	0	1
Saturday (dummy)	7654	.155	0	.362	0	1
Sunday (dummy)	7654	.184	0	.387	0	1
Midnight – 4am (Pacific) (dummy)	7654	.008	0	.089	0	1
4am – 8am (Pacific) (dummy)	7654	.062	0	.241	0	1
8am – noon (Pacific) (dummy)	7654	.185	0	.388	0	1
Noon – 4pm (pacific) (dummy)	7654	.281	0	.449	0	1
4pm – 8pm (Pacific) (dummy)	7654	.409	0	.492	0	1
8pm – Midnight (Pacific) (dummy)	7654	.05	0	.228	0	1
High bid came in last …						
… 15 seconds (dummy)	7654	.130	0	.336	0	1
… 1 minute (dummy)	7654	.183	0	.387	0	1
… 5 minutes (dummy)	7654	.233	0	.423	0	1
Bidder-Level Data:						
Time of highest bid before end of auction (days)	21298	2.34	.978	2.67	0	9.994
Incremental bidder (dummy)	21298	.188	0	.390	0	1
Bidder Rating (/1000)	20831	.290	.077	.765	-.005	25.298

Notes: The sample includes only auctions that lasted 10 days or fewer and ended in a sale, with a price of $2 or more. All "buy-it-now" sales have been eliminated from the sample.

Table 2: Summary Statistics on non-Charity Auctions

	Obs.	*Average*	*Median*	*Std Dev*	*Min*	*Max*
Auction Level Data:						
Price ($)	18347	78.25	15.82	893.68	2	79400
Donation (%)	18347	0	0	0	0	0
Number of Bids	18347	5.19	3	5.88	2	55
Seller Rating (/1000)	18347	4.77	.737	18.443	0	243.077
Percent Positive Ratings (%)	18347	99.5	99.9	1.6	50.0	100.0
Powerseller (dummy)	18347	.347	0	.476	0	1
Length (days)	18347	6.26	7	1.69	.003	10
Monday (dummy)	18347	.139	0	.346	0	1
Tuesday (dummy)	18347	.162	0	.368	0	1
Wednesday (dummy)	18347	.112	0	.316	0	1
Thursday (dummy)	18347	.149	0	.356	0	1
Friday (dummy)	18347	.107	0	.309	0	1
Saturday (dummy)	18347	.125	0	.330	0	1
Sunday (dummy)	18347	.206	0	.404	0	1
Midnight – 4am (Pacific) (dummy)	18347	.012	0	.108	0	1
4am – 8am (Pacific) (dummy)	18347	.058	0	.233	0	1
8am – noon (Pacific) (dummy)	18347	.199	0	.399	0	1
Noon – 4pm (pacific) (dummy)	18347	.178	0	.382	0	1
4pm – 8pm (Pacific) (dummy)	18347	.459	0	.498	0	1
8pm – Midnight (Pacific) (dummy)	18347	.095	0	.293	0	1
High bid came in last …						
… 15 seconds (dummy)	18347	.149	0	.356	0	1
… 1 minute (dummy)	18347	.194	0	.395	0	1
… 5 minutes (dummy)	18347	.249	0	.432	0	1
Bidder-Level Data:						
Time of highest bid before end of auction (days)	50629	1.79	.639	2.27	0	9.998
Incremental bidder (dummy)	50629	.168	0	.373	0	1
Bidder Rating (/1000)	49584	.239	.067	.619	-.008	20.166

Notes: The sample includes only auctions that lasted 10 days or fewer and ended in a sale, with a price of $2 or more. All "buy-it-now" sales have been eliminated from the sample.

Table 3: Timing of a Bidder's Final Bid

Dependent Variable:	Days before Auction Close	
Included bidders	All	Bid once
Column:	(1)	(2)
Charity Variables		
10%-SHARE	***.354 [.065]	**.201 [.084]
100%-SHARE	***.262 [.022]	***.374 [.028]
MID-SHARE	***.477 [.093]	***.625 [.122]
R^2	0.125	0.141
Number of observations	70,415	46,863

Notes: *** = significant at $p \leq 0.001$; ** = significant at $p \leq 0.01$; * = significant at $p \leq 0.05$; † = significant at $p \leq 0.10$. The models include (unreported) controls for: Day of week for auction close (six dummies), time of day for auction close (five dummies), seller rating, seller percentage positive rating (four dummies), length of auction in days (four dummies), bidder feedback rating (quadratic). 47 category-level dummy variables are also included. Coefficient estimates for these variables are available on request.

Table 4: Discrete Measures of Sniping

Dependent Variable:	Only bid in last minute? (*Yes* = 1)	Only bid in last 15 seconds? (*Yes* = 1)
Column:	(1)	(2)
Charity Variables		
10%-SHARE	-.003 [.010]	-.003 [.009]
100%-SHARE	**-.009 [.003]	***-.012 [.003]
MID-SHARE	-.010 [.014]	*-.027 [.010]
Sample average	.101	.079
Number of observations	46,863	46,863

Notes: *** = significant at $p \leq 0.001$; ** = significant at $p \leq 0.01$; * = significant at $p \leq 0.05$; † = significant at $p \leq 0.10$. Results are given as marginal effects. See notes for Table 3 for additional details.

Table 5: Incremental Bidding

Dependent Variable:	Incremental bidder present? (Y*es* = 1)	Bids per bidder	Incremental bidder wins? (Y*es* = 1)
Estimation method	Probit	OLS	Probit
Column:	(1)	(2)	(3)
Charity Variables			
10%-SHARE	-.020 [.023]	-.035 [.049]	-.004 [.017]
100%-SHARE	***.053 [.008]	***.091 [.016]	***.039 [.006]
MID-SHARE	.048 [.034]	†.133 [.070]	.036 [.026]
Sample average	.323	--	.146
R^2	--	.031	--
Number of observations	26,001	70,415	26,001

Notes: *** = significant at $p \leq 0.001$; ** = significant at $p \leq 0.01$; * = significant at $p \leq 0.05$; † = significant at $p \leq 0.10$. Results in columns 1 and 3 are marginal effects. See notes for Table 3 for additional details.