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# AN EMPIRICAL EVIDENCE OF WINNER'S CURSE IN ELECTRONIC AUCTIONS

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## Abstract

Winner's curse theories in case of (almost) common-value auctions have long been in existence and fiercely debated in the economic literature. The implications of this theory are far reaching for the fast emerging electronic auction markets. Businesses can make strategic uses of the auction markets ranging from estimation of demand curve for their products to achieving individual price discrimination and liquidating their inventory at the highest possible price. However, the implications of the possible existence of winner's curse are far reaching for both businesses and consumers. In this paper, we seek to investigate the existence of winner's curse and establish its determinants.

**Keywords:** Electronic commerce, electronic auction, winner's curse, market efficiency, mechanism design

## 1. INTRODUCTION

Electronic commerce (EC) offers a variety of market mechanisms in the Cyberspace as does its counterpart in non-electronic world. While the electronic "auction" has attracted relatively less research interest compared to the electronic "spot" market, it has nevertheless advanced at a striking pace. Electronic auction markets have existed for quite some time, but were primarily limited to business-to-business (B2B) transactions. Adoption of the Internet for electronic auctions started in 1995 and has since shown phenomenal growth in terms of business-to-consumer (B2C) and consumer-to-consumer (C2C) transactions. Owing to their structure and cost benefits, electronic auctions are being increasingly used as a mainstream method for selling all types of consumer goods ranging from books, CDs, and airline tickets, to electronic and computer equipment. According to a recent article in *The Wall Street Journal*, in 1998, electronic auctions accounted for about 20% of \$13 billion in total Internet commerce. Given the surge in sales through electronic auctions, more businesses are beginning to sell part of their goods and services through electronic auctions. For example, Cathay Pacific auctions a portion of seats on its flights; companies such as Sony, Toshiba, Epson, Hewlett Packard, Intel, and many others have also, in recent times, started to participate in these auctions.

We argue that participation by a potentially very large number of individuals in the B2C and C2C electronic auctions raises interesting issues different than those in the context of the conventional auctions. Furthermore, the goods that are traded through the electronic auctions are also sold through electronic spot markets. This multiplicity of mechanisms provides us with an opportunity to study the hitherto unknown nature of the electronic economic institutions. Recent studies have compared the electronic markets against traditional ones to test if electronic market are "frictionless" (e.g., Brynjolfsson and Smith 1999). However, the transaction costs factors involved in electronic and non-electronic media are different and it is rather difficult to account for all of them, making direct comparison of the observed prices in the two market mechanisms arguable and difficult to defend. We maintain that the existence of electronic spot and auction markets for the same goods results in a lot of common transaction costs and thus allows for more meaningful examination of the efficiency of electronic commerce. This coexistence of multiple economic institutions (spot and auction) raises interesting questions: (1) Which institution dominates and why? (2) How efficient are these institutions?

Recent articles in popular financial newspapers have focused on stories about fraudulent claims and false “bargain-buys” through the Internet auctions (*Wall Street Journal* 1999), illustrating the phenomenon widely known in academic circles as “lemon market” resulting from information asymmetry and lack of trust between the trading partners. Issues associated with information asymmetry have attracted attention widely among researchers in economics beginning with the seminal work of Akerlof (1970). When sellers are well known business entities, the problems associated with lack of trust become less significant to those where the information regarding seller is far from complete, as in the case of C2C auctions. However, it is well-known that under information asymmetry, the (almost) common-value auction mechanism inherently exhibits a serious welfare problem known as the winner’s curse, stating that the winner of the auction always overbids, i.e., pays a price higher than the rational value of the item. If electronic medium is as efficient as speculated, we may conjecture its non-existence in electronic auctions, resulting from the “easily” available public price information from other market mechanisms. As we discuss in the following section, many commercial products are traded simultaneously through electronic auction and electronic retail channels. In this paper, given the multiplicity of trading channels, we investigate the existence of the so-called winner’s curse. The main objectives of this paper are (1) to discuss how industry (sellers) is taking advantage of these new mechanisms, (2) empirically test for existence of winner’s curse in electronic auction, and (3) identify the determinants of the curse.

Our preliminary results confirm the existence of the winner’s curse in electronic auctions. The amount overbid is especially pronounced for items where potential information asymmetries exist as a result of the nature of the product and it is further augmented in cases where the product is relatively new and not much information regarding it exists in the retail channels.

The rest of the paper is organized as follows. The relevant literature review along with the research motivation is presented in the section 2. The research model and hypotheses are discussed in the section 3, followed by the research methodology and data collection procedures in section 4. Section 5 presents empirical results and discussions. We outline our plan for presentation in the last section.

## 2. THEORETICAL FOUNDATIONS

Transaction-cost economic models have been employed to explain the changes in the organization of economic transaction. This theory identifies two forms of coordination mechanisms for economic transactions—market and hierarchy—and a continuum of hybrid forms between the two ends. Transaction costs of economic transactions explain a prevailing form of coordination mechanism from this spectrum. Malone, Yates and Benjamin (1987) predicted that the market structure would shift from the hierarchy to market in electronic commerce with the development of information technology and, following transaction cost economics (Williamson 1989), also identified the two types of transaction costs that will decide the consumer’s choice between *traditional* and *electronic* institutions: standardization of goods and complexity of description. A few empirical studies have been done to investigate efficiency of the electronic market (Brynjolfsson and Smith 1999) against its traditional counterpart.

While it is not clear if the definition by Malone, Yates and Benjamin of market systems excludes *auction* mechanism, what really draws our interest is that there have been many successful “electronic” (or computer-mediated) trading systems that are mostly based on auction and seem to defy many predictions made by prior literature. There is a rich accumulation of research on auction and bidding in economics as well reviewed by McAfee and McMillan (1987). However, to our best knowledge, studies on the auction market from the context of the electronic market are at best scant. Lee (1998), Lee and Clark (1996), and Lee, Wetland and Hong (1998) studied these narrowly defined old B2B auction markets. Lee and Yoon (1999) theoretically explain how they have devised workaround mechanisms to cope with the lemon market problem. In the meantime, Beam and Segev (1998), in a survey of the electronic auction market, find that as compared to about 25% of the sites that deal with C2C markets, 52% of the electronic auction sites deal with B2C markets.

The rapidly burgeoning C2C electronic auction market has brought serious concerns about fraudulent claims and false “bargain-buys” through Internet auctions. While these horror stories may be attributed to newness of the electronic auction market, implications are far reaching. All the horror stories have certain things in common: (1) they deal with consumer to consumer auctions and (2) they involve products for which a high degree of information asymmetry can exist, such as antiques and collectibles, that require a great deal of expertise and need to be physically examined. As mentioned earlier, the seller, in most instances, is a well-reputed firm, which in the long-term stands to lose goodwill capital from inappropriate business conduct. The share of the C2C auction market in comparison to the total auction market is rather large at present. This might be a result of the individual’s ability to react quickly to the formation of the auction market and the low cost of participation for an individual.

The market for B2C auctions is comparatively slower in gaining momentum because the relatively larger scale of operations involved require a greater amount of time and monetary investment for formulating the strategy for a long term presence in a completely new market. The authors believe that the B2C market will eventually constitute a much larger share (much like the flea markets and classified ad markets in comparison to the regular retail markets). In view of the potential growth of the B2C auction market, a study is warranted into the advantages of electronic auctions for businesses and the implications of the same for consumers.

There has been much debate regarding the existence of information asymmetries in the pricing of products. Economists led with the seminal work of Akerlof (1970), contending that markets would cease to function if information asymmetries persist. Other researchers have shown that the winner of the auction always overbids, i.e., pays a price higher than the rational value of the item, and thereby incurs what is termed as winner's curse (Thaler 1991). Because of the difficulty in estimating the value of the product, the estimates of the bidders vary substantially. The bidder with the highest estimate will win and this bid would be higher than the true value of the product. Researchers from various disciplines have sought to demonstrate the existence of winner's curse through either field studies or experiments (Giliberto and Varaiya 1989; Lind and Plott 1991; Kagel 1995 Shaffer 1998; Simonson 1987; Thiel 1988; Varaiya 1988).

In the case of market-based empirical research, it is hard to prove the existence of winner's curse owing to the problem of obtaining an accurate *a priori* estimate of the true value of the object auctioned. However, as mentioned earlier, the multiplicity of trading channels in EC offers a unique opportunity to study the existence of the winner's curse since we can safely compare the clearing prices of the electronic auction market with those from other electronic sales channels (retail spot markets in this study). Other studies involved the comparative efficiency of electronic markets vis-à-vis traditional non-electronic ones, which suffer a major drawback if the transaction cost factors involved in the two markets are significantly different. As a result, the consumers may obtain different utilities from the two markets, making the two markets essentially non-comparable without factoring in the difference in transaction costs. In our paper, we compare two electronic market systems, hence capturing a more reliable measure for market friction. This paper seeks to investigate the consumer's bidding behavior and analyze the determinants as explained in the later sections. Specifically, we seek to investigate the existence of winner's curse in B2C auctions due to the potential information asymmetries or sub-optimal consumer behavior.

Implications of the (non-)existence of the winner's curse in the electronic market are far reaching and go beyond the theoretical debate we introduced so far. Observations reveal novel uses of e-auction by the industry, beyond our traditional concepts of the auction market: (1) Firms offer their newly released "top-of-the-line" products in an electronic auction, possibly with the goal of obtaining estimates of the demand curve for a product. The distributions of bids obtained reveal the willingness-to-pay on the part of consumers at large, thus making this strategy for pricing far more cost-effective than conventional marketing tests. (2) Liquidating the inventory of old/perishable products at the highest possible price. (3) Achieve price-discrimination at the individual level; for example, auctioning a portion of airline tickets and hotel rooms allows the seller to achieve individual price-discrimination and sell their product at the highest possible price. We believe such strategic use of the electronic auction is on the rise and the existence of the winner's curse has enormous welfare implication to today's digital economy.

### **3. RESEARCH MODEL**

The English auction is the most commonly used form of auction. Also known as the ascending bid auction, the bidding begins at a minimum starting bid and is successively raised until only one bidder remains. The key feature of the English auction is that, at any point in time, each (potential) bidder knows the level of current best bid. A minimum acceptable increment to the current best bid is also set (Yamey 1972). In the Yankee auction<sup>1</sup> (a variation of the English auction), one or more identical items are offered for sale at the same time. When the auction closes, the highest bidders win the available merchandise at their bid price. Bids are ranked in order of price, then quantity, then time of initial bid. The product page lists the scheduled closing time for each auction. All bids are subject to a minimum bid and bid increment, as posted with each item.

The goods sold through e-auction are simultaneously available from competing electronic retail channels. Thus, rational consumer behavior would predict that the clearing prices in the electronic auction should not be higher than the lowest retail values for those

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<sup>1</sup>For more information, see <http://www.onsale.com>.

individual items. However, since at the end of an auction there are N winners, any occurrence of winner's curse should reflect in the highest bidder's bid.

### 3.1 Research Hypothesis

The root cause for the occurrence of winner's curse, keeping in mind rational behavior, is lack of information on the part of the bidder regarding the true value of the item. In the case of the electronic auction, the lack of information would arise from either lack of expertise (information regarding the product being auctioned) on the part of the bidder or lack of pricing information in the retail market.

#### 3.1.1 Expert vs. Non-expert

*The bidder is a non-expert and thus is not "fully aware" of the retail values for the same product, leading to overestimation of the value of the product.*

For auctions of products that would attract both experts and non-experts alike, the non-expert(s) bidder(s) will always have the highest winning bid(s) at the end of the auction. As a result, for auction of certain product categories, the non-experts will always dominate the auction market and thus are likely to incur the winner's curse. Product categories, which require specialized knowledge, would attract only the experts who are better aware of the pricing for the product and thus unlikely to overestimate.

#### 3.1.2 Age of Product

*Bidders are more likely to overestimate the true value of newly released products.*

As products become older, more information becomes available, forcing retailers to cut prices resulting in bidders' estimates being close to the rational value. For new products, the retail pricing information is not widely available and is thus likely to contribute to overestimation on the part of the bidders.

#### 3.1.3 Inventory Liquidation

*Items for which the manufacturer has discontinued production are likely to fetch less than the retail price of the item (since retail prices tend to be "sticky").*

#### 3.1.4 Model

We model the auction's highest clearing price as a function of the equilibrium price, expertise of the buyer, the age of the product, and inventory liquidation.

$$\frac{P_A}{P_E} - 1 = \alpha\gamma_1 + \beta\gamma_2 + \lambda\gamma_3 + \epsilon \quad (1)$$

$P_A$  highest winning bid

$P_E$  rational equilibrium price

$\gamma_1$  dummy for buyer's product expertise (0 if expert, 1 otherwise)

$\gamma_2$  dummy variable for age of product (0 if old, 1 otherwise)

$\gamma_3$  dummy variable for inventory liquidation (1 if inventory liquidation, 0 otherwise)

$\epsilon$  error term

#### 4. DATA AND METHODOLOGY

The data regarding the final winning bids was collected from UBid (<http://www.ubid.com>), which conducts electronic auctions (using the Yankee method) for various consumer goods. The data was collected for non-customizable computer hardware parts, so that the retail value for same item could be collected from a large number of retailers over the Internet. The closing bids were noted and the cost for identical items obtained from various retailers on the same day. The average of the two lowest quoted prices was used as the rational equilibrium price.<sup>2</sup> Table 1 shows all the categories and products for which data was collected. The last two columns indicate whether or not data was available for products of different product expertise classifications and different ages. All of the product categories other than motherboards contain items that are classified either as expert or non-expert. For example, heavy-duty postscript and color laser printers were also categorized as expert products, whereas conventional color inkjet printers were classified as non-expert. Auction data for refurbished products was rejected. Newness of the product was decided based on what was the current top-of-the-line item for the product. For example, in April, a 6.4 GB hard drive would be considered old, while a 13.2 GB hard drive would be considered relatively new. Table 2 shows the number of observations by item and classification category. Linear regression model was adopted for obtaining the coefficient estimates of the model as described in equation 1.

**Table 1. All Categories and Products**

<i>Category</i>	<i>Products</i>	<i>Expertise</i>		<i>Age</i>	
		Yes	No	New	Mature
Storage devices:	CD-ROM drives, Hard Drives		X	X	X
Digital Imaging:	Digital cameras, Flatbed Scanners	X	X	X	X
Printing Devices:	Laser and Inkjet Printers	X	X	X	X
Circuit Boards:	Motherboards	X		X	X

**Table 2. Number of Observations by Item and Classification Category**

<i>Category</i>	<i>Products</i>	<i>Number of Auctions</i>
Storage devices:	CD-ROM drives, Hard Drives	28
Digital Imaging:	Digital cameras, Flatbed Scanners	24
Printing Devices:	Laser and Inkjet Printers	15
Circuit Boards:	Motherboards	19
<b>Total</b>		<b>86</b>
<i>Expertise</i>		
Non-Expert		50
Experts		36
<b>Total</b>		<b>86</b>
<i>Age</i>		
Newly Released		14
Mature Products		40
Liquidation Products		32
<b>Total</b>		<b>86</b>

<sup>2</sup>In most of the instances, more than two retailers quoted almost the same price for the items.

**Table 3. Summary of Results**

<i>Regression Statistics</i>			
Adjusted R Square	<b>0.7076</b>		
Observations	86		
<i>Coefficient</i>	<i>Estimate</i>	<i>t-statistic</i>	<i>P-Value</i>
Intercept	-0.0367	-1.3413	0.1835
Expertise, $\alpha$	0.1851	6.1920	0.0000
Newness, $\beta$	0.0758	1.8849	0.0630
Liquidation, $\lambda$	-0.2743	-8.8962	0.0000

## 5. RESULTS AND DISCUSSION

The summary of results of the multivariate linear regression is shown in Table 3. The coefficient estimates  $\alpha$  (buyer expertise) and  $\lambda$  (liquidation) are statistically significant at 99%, while the estimate for  $\beta$  (newness of product) is significant at 93%, thereby confirming our conjectures presented earlier. The intercept term is not significantly different from zero, implying sufficiency in the parameters accounted for in our model. Qualitative interpretation of our results implies:

- Highest bidder among non-experts on an average pays 18.5% more than what would be considered as the rational price, the absence of intercept implying the absence of winner's curse in case of the experts.
- Highest winning bid for a newly released product fetches an average of 7.6% higher.
- In the case of inventory liquidation, the highest bidder pays 27.4% less than the lowest retail price. It is significant to note that by the time a product is phased out, the consumer's willingness to pay for the same product is way lower, possibly due to (a) the consumer being the well aware of the true value of the product or (b) the lower utility derived from not buying a top-of-the-line item is compensated by an increase in utility from having bought a "bargain-buy."

## 6. PRESENTATION

In order to strengthen our arguments, the following research work is being undertaken and we expect that it will be included in our conference presentation.

1. More data from multiple auction sites: We are still in the process of continuing to collect data from the auctions and would be able to further reinforce our results with additional data from the same and other auction sites.
2. Investigation of the relationship between auction rules and winner's curse. A classification of e-auction rules is under development for this end.
3. Analytical modeling in order to capture distinct characteristics of electronic auctions. From the analytical modeling and simulation, we predict the outcomes of e-auctions.

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