

Current and Future Insights From Online Auctions

A Research Framework of Selected Articles in Online Auctions

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Abstract

Internet technology can alter business models within organizations. Nowhere is this more evident than in online auctions. Participation in business-to-consumer (B2C) auctions has vastly increased over the last several years, and the number of companies participating in business-to-business (B2B) “reverse auctions” is also up significantly each year for the last several years. In this article, a research framework is presented that describes how the research of online auctions has progressed and what areas still need to be examined in future research.

1. Introduction

Information technology, specifically the Internet, has significantly changes the way people exchange information and participates in business transactions in electronic commerce, allowing business models whose definition and scope are unattainable in traditional markets. Furthermore, these electronic markets are still growing at a phenomenal rate. Of all business models that have been impacted by the Internet, *online auctions* and business-to-business (B2B) *reverse auction exchanges* have had some of the largest impact.

Online auctions, in particular, exemplify a huge growth rate that was made possible by Internet technology. eBay, the premier online auction retailer with over 80% of the online auction market, boasts that, on any given day, there are more than 12 million items listed on eBay across over 18,000 categories. In the second quarter of 2003, eBay reported record net revenues of \$509.3 million, up 91% from the same period in 2002. This massive sales and growth resulted in record operating income of \$168.7 million, up 109% from 2002. Users, too, have flocked to eBay, with 34.1 million active users (the number of users on the eBay platform who bid, bought or listed over the trailing twelve months) in the second quarter of 2003, a 57% increase over the 21.8 million active users for the same period in 2002.¹

In conventional auctions, the “host” of the auction is the *seller* who is auctioning *assets* to bidders, where the *highest* bid wins. However, in *reverse auctions*, the host of the auction is the *buyer* who is auctioning *production contracts* to the bidders, where the *lowest* bid wins. Reverse auction exchanges grew at an incredible rate during the 1998-2000. The “dot-com bubble burst” that occurred in 2000-2001 resulted in flat or reduced demand for B2B services, as many of the B2B providers went out of business or switched strategies to implement a more feasible business model (Tulder & Mol, 2002). However, in 2002, B2B ecommerce has once again found favor with businesses, and as a result has also seen tremendous growth. According to figures from the European Commission, 90 percent of European online sales occur in the B2B space.² A study from the Institute for Supply Management and Forester Research reveals that 84% of large companies now use

¹ Based on eBay’s quarterly report, available online at <http://www.shareholder.com/ebay/releases-earnings.cfm>.

² See <http://www.ecommercetimes.com/perl/story/31195.html> for more information

the Web to purchase materials and services, and that the overall percentage (large and small companies) of B2B online purchasing increased steadily during 2002.³ Much of the B2B activity is done through reverse auction exchanges, where buyers place contracts online so that suppliers can bid for these contracts, the lowest bidder often winning the contract. Such exchanges have led to some extremely high initial savings. For example, *General Electric Transportation Systems*, one of the world's leading suppliers to the railroad, transit, and mining industries, now processes its approximate 100,000 invoices through *Global eXchange Services* and projects an annual savings of \$900,000 because of the move.⁴ In another example, *Covisint*, a relatively new online exchange for automobile manufacturers, projects savings for its members that range from 5% to 30%, and has over 103,000 member businesses with 4,800 auctions.⁵

As with the explosive growth of activity in online auctions, there has been a corresponding explosive growth in research in online auctions and exchanges as researchers and professors try to understand this relatively new phenomenon at a deep level. This article examines the current state of online auction research to examine two research questions:

- *What topic matter is being examined in online auction research*
- *How can these topics be characterized in the context of online auctions?*
- *What auction topics, auction behaviors, and auction designs need further examination?*

³ Reported in <http://www.ecommercetimes.com/perl/story/20603.html>.

⁴ From a GXS press release on October 28, 2002, available at <http://www.gxs.com/gxs/press/release/press20021028>.

⁵ See <http://covisint.com/>.

These questions are examined through an intense literature review. Each article in the review is categorized based upon its examined topic matter and examined behavioral traits. A framework is developed that shows what topics seem to be of great interest, in that certain topics are being researched intensely, and which topics could use further study in the future.

2. Characterizing Seller and Bidder Interaction in Online Auctions

In online auctions, research is dedicated to examining how *sellers* and *bidders* interact through the online auction market structure. As such, auction research can be characterized as typically concentrating on one of the following three auction characteristics: *Seller Behavior*, *Bidder Behavior*, and *Auction Design*.

Seller Behavior. Research on seller behavior includes set-up strategies, seller opportunism (such as shilling, which is the act of bidding on your own item to drive up the price other bidders pay), and seller comments left in an online reputation system.

Bidder Behavior. Research on bidder behavior includes the price a bidder pays, the bidding strategy employed by a bidder, buyer comments left in an online reputation system, buyer opportunism (such as colluding with each other when bidding) and factors that can cause a bidder to pay more or less for the same item. Note that, in auctions, sellers don't set the price (although they do set the starting bid), so most research that examines the price paid in an auction is investigating a bidder behavior, not a seller behavior.

Auction Design. Research on online auction design typically involves the use of an analytical model that describes an optimal design of an entire online auction or some

facet of an online auction, such as the optimal design of a reputation system. Other research can include

This section describes how articles are selected for this review, and describes a grid framework that groups articles by topic and auction characteristic. This framework is intended to show areas of research that researchers find interesting, and areas that have not, as of yet, received much attention.

2.1 Rules for Article Selection

To develop an online auction research framework, rules were established upon which topics are relevant to this study, and which must be excluded from this study. This research includes any article that lists online auctions as of primary interest, through mentioning online auctions in the title, the abstract, or the keywords. This research excludes research that discusses auctions in general, but not primarily online auctions. For instance, there are many articles, especially from the economics literature, that discuss auction theory in general (e.g. Vickery, 1963; Riley & Samuelson, 1981; Milgrom, 1989). While these articles are important in the understanding of auction theory as it relates to online auctions, they are not specifically concerned with online auctions *per se*, and thus are not included in this sample.

Similarly, research is excluded that discusses topics that may affect online auctions, but are not specifically about online auctions. For instance, there are many articles that discuss reputation systems in general and are important to the understanding of how reputation systems can affect online auctions (e.g., Resnick et al., , Dellarocas, 2002). However, while these studies often bring up online auctions as a predominant beneficiary or implementer of reputation systems, the thrust of the articles is *primarily*

concerning general online reputation systems and *not primarily* concerned with auction reputation systems, as noted by the lack of the word “auction” (or related words, like eBay, OnSale, etc.) in the title, abstract, or keyword listing. Conversely, there are those who specifically study auction-based reputation systems (e.g., Wood et al., 2003; Resnick & Zeckhauser, 2002; Dellarocas, 2003). Thus, these studies are included in our sample. In this vein, meta-research topics (e.g.,) where research is primarily concerning other online auction research (similar to this article) are excluded from this study.

We also excluded B2B research that dealt only with electronic data interchange (EDI) through the Web without specifically dealing with an exchange. EDI and electronic purchasing are important for cost reduction, specifically with the implementation of XML as a vehicle for transmitting data from one corporate database to another. However, these articles are not specifically about reverse auction exchanges and thus are excluded from this research.

Finally, research was not included when it discusses auction houses without specifically dealing with the *process* of the auction were excluded. For example, research dealing with legal liability of online auctions houses (e.g., Antonelli et al., 2001) and similar topics were discarded.

The resulting collection of research included *76 articles* that deal specifically with online auctions. Journals articles, conference proceedings, and working papers were among the articles examined in this research.

2.2 Framework for Online Auction Research

In the literature review required for this article, four main areas of research emerged as the primary focus of online auction research. These topic areas are:

- **Auction Bids, Winner's Curse, Selling Prices, and Bundling** – This topic area is primarily concerned with the price that is received in an online auction. Included are articles that describe non-reputation factors that cause a bidder to bid more or less for the same item, literature on the winner's curse, where a buyer pays more than market value for an item and later feels remorse that so much was paid, and the effect that bundling or de-bundling items has on the price received for those items within an auction. Note that there were enough articles on pricing behavior due to seller reputation and trust that this trust and reputation systems were split into their own topic.
- **Selling and Buying Strategies and Decision Processes** – This topic area is primarily concerned with bidding and selling strategies employed by online auction bidders and sellers. Included are articles about bidder types, economic motivations for bidding techniques,
- **Auction Fraud, Opportunism, Reputation Systems, and Trust** – This area is concerned with seller fraud, buyer collusion, misrepresentation or low-quality service, the effect of reputations systems (especially when new reputation system designs are proposed) and the effect of trust within an online auction.
- **B2B Reverse Auction Exchanges** – In this area, we concentrate on reverse auctions typically used within a B2B framework. This includes buyer behavior and strategies with suppliers, supplier strategies with buyers, supply chains that incorporate a reverse auction, and B2B exchange design.

Figure 1 describes the online auction research framework proposed by this article.

Figure 1 – Online Auction Research Framework

	<i>Articles on Host's Behavior</i>	<i>Articles on Bidder Behavior</i>	<i>Articles on Auction Design</i>	<i>Total Articles</i>
Auction Bids, Winner's Curse, Selling Prices, and Bundling	2	10	1	13
Selling and Buying Strategies and Decision Processes	7	8	5	20
Auction Fraud, Opportunism, Reputation Systems, and Trust	7	11	6	24
B2B Reverse Auction Exchanges	7	2	10	19
Total	23	31	22	76

Figure 1 shows how the three aforementioned auction characteristics (*host behavior, bidder behavior, and auction design*) are juxtaposed against four topics of discussion.⁶ In Figure 1, we show how the number articles selected from our literature review fit within our framework, shedding light on those areas that appear to be of great interest and those where more research is suggested. In the next section, we describe these topics of discussion in detail, and discuss work that has been done in these areas as well as areas that still need investigating.

3. Auction Research Framework Applied to Online Auction Research

In this section, we describe various articles as they apply to the topic matter shown in the framework in Figure 1.

3.1 Articles on Auction Bids, Winner's Curse, Selling Prices, and Bundling

One of the primary topics in online auction research is the investigation of how much a bidder is willing to pay for an item. Figure 2 lists the research done in this area.

⁶ Note that in most auctions, the *host* is the seller, who sells some asset to the highest bidder. However, in reverse auctions, the *host* is the buyer, who lists a purchasing contract for suppliers to bid upon, and the lowest bid wins.

**Figure 2 – Auction Bids, Winner’s Curse, Selling Prices, and Bundling
in Online Auction Research Framework**

<i>Host (Seller) Behavior</i>	<i>Bidder Behavior</i>	<i>Auction Design</i>
Bajari & Hortacsu, 2003b Kung et al., 2002	Ariely & Simonson, 2003 Eaton, 2002 Kauffman & Wood, 2003a List & Lucking-Reiley, 2000 List & Lucking-Reiley, 2002 Lucking-Reiley, 1999 Lucking-Reiley et al., 2000 Massad & Tucker, 2000 Wilcox, 2000 Yin, 2002	Lucking-Reiley, 2000

Much online auction research deals with factors that affect price.⁷ Kauffman and Wood (2003) track individual bidders in online auctions point out that items typically sell for less than the real world counter, and find a *weekend effect* that was not found in Lucking-Reiley (1999), though both articles agree on other factors that affect price in online auctions. List and Lucking-Reiley (2001 and 2002) discuss the effect of bundling in online auctions. Eaton (2002) also looks at factors that affect price, especially concentrating on the effect that additional information (provided by the seller) has on the bid level. Massad & Tucker (2000) find the surprising result that online auctions exceed in-person auctions in price. Yin (2002) finds that the Nash-equilibrium predictions regarding the winner’s curse are accurate in online auctions. Ariely and Simonson (2003) find that bidders *undersearch*, and therefore *overpay* in online auctions, and that online auctions yield high prices only when competing products are not available.

Notably lacking from this topic area are discussions on seller behavior. Albeit that many factors at the auction level that affect buyers are controlled by sellers, still there seems to be little articles on seller strategies (other than reputation) that can be

⁷ Articles whose primary focus is to discuss how reputation affects price are placed in a different category, discussed later in this article. However, many papers that list multiple factors that affect price, including reputation, are included in this section.

employed to gain a larger price paid. Included in this area would be the effects of advertising or other marketing promotion, the choice between online auction and traditional markets, and the effect of online auction competition. Of all the articles in this survey, only Kung, Monroe, and Cox (2002) discuss brand loyalty, packaging, and promotion as they apply to online auctions, and Bajari and Hortacsu (2003b) discuss how the winner's curse can be affected by the starting bid set by the seller. More research in this area could help shed light on business practices and strategies that could be employed by online auction sellers to become more profitable in this new channel.

Also under-researched are online auction design mechanisms that maximize or minimize the price that a bidder pays in an online auction. Part of the reason for this lack is that traditional, non-online auction literature covers this topic extensively (e.g., Vickery, 1963). However, as technology for online auction has become more sophisticated and more advanced, online auction mechanisms could be developed that consider the new level of technology to develop online auction mechanisms that can affect price. While Lucking-Reiley et al. (2000) don't suggest a new auction design, they do track and discuss online auction mechanisms from before the World Wide Web up until the current incarnations.

3.2 Articles on Strategies, Techniques, and Decision Processes

How sellers and bidders behave inside the online auction mechanism has long been an area of interest in economics research. Figure 3 shows research on the strategies, techniques, and decision processes used within online auctions.

**Figure 3 – Strategies, Techniques, and Decision Processes
in Online Auction Research Framework**

<i>Host (Seller) Behavior</i>	<i>Bidder Behavior</i>	<i>Auction Design</i>
Bapna et al., 2002 Beam & Segev, 1998 Dans, 2002 Gilkeson & Reynolds, 2003 Halstead & Becherer, 2003 Heck & Vervest, 1998 Wang et al., 2002	Bajari & Hortacsu, 2003a Bapna et al., 2001a Bapna et al., 2001b Bapna et al., 2003b Bapna et al., 2000 Easley & Tenorio, 2003 Roth & Ockenfels, 2002 Wilcox, 2000	Bapna, 2003 Bapna et al., 2003a Happel & Jennings, 2002 Liu et al., 2003 Rafaeli & Noy, 2002

The area least researched is bidder strategies and techniques. This is in sharp contrast with research that examines the price paid by bidders, which continues to be examined quite extensively. Bapna, Goes, & Gupta are very prolific in this area, examining bidder types (2001a and 2001b), economic theory as it relates to bidder strategies in online auctions (2000) and how bidding strategies are affected by the bid increment set by the seller (2003b). Roth & Ockenfels (2002) examine bid sniping and bid timing. Easley & Tenorio (2003) also examine bid timing and why it is economically feasible to “jump bid” by bidding higher than the minimum bid dictated by the bid increment. Wilcox (2000) also examines bid timing as it relates to bidder experience, and finds that sniping increases as experience also increases. Bajari and Hortacsu (2003a) discuss how structural estimates of online auctions, despite their assumptions, appear to predict behavior quite well.

Much interest has been shown in seller behavior and strategies in online auctions. Many authors discuss online auctions as a viable business strategy to supplement or replace the current method of sales within a company (e.g., Beam & Segev, 1998; Dans, 2002; Heck & Vervest, 1998). Bapna, Goes, Gupta, & Karuga (2002) show analytically and empirically that sellers often set up auctions that are often far from their optimal. Gilkeson & Reynolds (2003) illustrate the importance of a proper starting bid price to

attract more bidders and make an auction successful. Halstead and Becherer (2003) point out how diversification and cost leadership are still present in online auctions, making market friction and allowing price differences within this electronic market. Wang, Wang, and Tai (2002) discuss online auction strategies as they relate to the auction market structures in Taiwan.

There are many studies that examine auction structural design to motivate different seller and buyer behaviors. Bapna (2003) examines new auction design mechanisms to eliminate the detrimental effect of bidder sniping (bidding at the last possible minute), while Bapna, Goes, and Gupta (2003a) take empirical results to design optimal bid increment inside auctions. Happel and Jennings (2002) discuss the design for a workable futures market used to speculate on future prices in online auctions. Liu, Wang, and Fei (2003) discuss how auctions typically use unicast communication by only communicating about one seller auction at a time, and they show how multicast auctions will perform better than unicast auctions. Rafaeli and Noy (2002) add social facilitation elements, found in face-to-face communication, to online auctions and find that bidders prefer to stay longer on the auction site and prefer these auctions to traditional auction design.

3.3 Articles on Auction Fraud, Opportunism, Reputation Systems, and Trust

Many articles investigate the role that trust and fraud play within online auctions. Figure 4 describes lists these articles within the research framework shown in Figure 1.

Figure 4 – Auction Fraud, Opportunism, Reputation Systems, and Trust in Online Auction Research Framework

<i>Host (Seller) Behavior</i>	<i>Bidder Behavior</i>	<i>Auction Design</i>
Albert, 2002	Ba & Pavlou, 2002	Ba et al., 2003
Bywell & Oppenheim, 2003	Brinkmann & Seifert, 2001	Dellarocas, 2003
Kauffman & Wood, 2003b	Dellarocas et al., 2003	Resnick & Zeckhauser, 2002
Lansing & Hubbard, 2002	Dewan & Hsu, 2001	Snyder, 2000
Sinha & Greenleaf, 2000	Ederington & Dewally, 2003	Wang et al., 2003
Standifird, 2001	Lee, 1998	Yamagishi, 2003
Wood et al., 2003	Livingston, 2002	
	Houser & Wooders, 2000	
	Melnik & Alm, 2002	
	Ow & Wood, 2003	
	Resnick et al., 2003	

Internet fraud has been a concern in online auctions since their inception, ranking the highest in the number of reported fraud cases compared to any other type of online auction enterprise. The *Internet Fraud Watch* (www.fraud.org) reports that, in 2002, online auctions accounted for 90% of the online fraud cases, reportedly receiving 33,122 online auction fraud complaints in 2002, close to *triple* the 11,105 online auction fraud complaints filed in 2001. Thus, fraud and trust have become important topics in online auction research. Kauffman and Wood (2003b) and Wang, Hidvegi, and Whinston (2003) investigate *shilling*, a type of fraud where a seller secretly sets up another identity to bid on his own item, thus driving up the price for the final bidder. Sinha and Greenleaf (2000) discuss how bidder aggressiveness can lead to shilling, and how this is a particular problem within electronic markets. Lansing and Hubbard (2002) and Albert (2002) examines how fraud can be mitigated through regulation, while Bywell and Oppenheim (2003) suggest that bidders be more aggressive in fraud complaints. Finally, Ederington and Dewally (2003) find that warranties do not seem to impact bid level, but that third party certifications cause a significant price increase.

The converse of fraud in the online environment is trust. Lee (1998) examines *AUCNET*, the Japanese used car online auction. He finds that bidders are willing to pay *more* than for used cars bought through *AUCNET* when compared to traditional used car lots because of procedures put in place by the *AUCNET* auction house that helps ensure higher-quality used cars. Ow and Wood's (2003) research reaffirms Lee's reported trust effect with an analytical and empirical investigation and find, surprisingly, that more bidder experience leads to *higher* prices paid by bidders, since more experienced bidders are more likely to develop trust in the online auction market structure.

Most researchers find that a low reputation can deter participation in an auction (e.g., Brinkmann & Seifert, 2001). However, there is some disagreement in the literature of the effect of reputation on price paid. Standifird (2001), Livingston (2002), Melnik & Alm (2002), Dewan & Hsu (2001), Ba and Pavlou (2002), Houser and Wooders (2002) empirically show that the reputation score can increase the price paid by a seller, while Eaton (2002) and Kauffman and Wood (2003a) can not find a significant effect of reputation on price despite relatively large data sets. Most probably, there are other factors which increase or reduce the effect of reputation on price, and these need to be researched in future research to resolve this disagreement, while Yamagishi (2003) argues that the lack of a closed market among online traders benefits the reputation mechanism.

Many authors suggest auction designs that can minimize fraud through reputation system design. Resnick and Zeckhauser (2002) do an in-depth examination of the current reputation design at eBay and find several flaws in the reputation system, including detrimental effects of reciprocated comments, and Pollyanna assessments of

reputation. Ba, Whinston, and Zhang (2003) suggest adding a *trusted third party* to the auction mechanism to reduce the chance of fraud, echoing Ederington and Dewally (2003) who empirically show that third party certification can increase prices received in an auction over 50%. With an assumption of opportunistic sellers, Dellarocas (2003) finds, surprisingly, that the sanctioning effect of a reputation system to screen out opportunistic sellers cannot be improved by increasing the number of transactions reported. Snyder (2000) suggests that auction houses step up detection of online auction fraud to enhance the online auction marketplace.

Thus far, not much work has been done in the area of participation within reputation systems. Wood, Fan, and Tan (2003), and Resnick, et al. (2003) both show about a 50% participation rate in online auctions, while Dellarocas, Fan, and Wood (2003) show that buyer participation levels drop off in online auctions as reputation increases.

3.4 Articles on B2B Reverse Auction Exchanges

As mentioned in the introduction B2B exchanges have seen significant growth in the last two years. eMarketer (www.emarketer.com) reports that world-wide B2B sales have increased from \$474.32 billion dollars in 2001 to 823.48 billion dollars in 2002 and are expected to exceed one trillion dollars in 2003. Despite this huge level of transactions, B2B reverse auctions, often used within B2B e-commerce for bidding on production contracts, does not have near the same number of articles as B2C auctions, like eBay.⁸ Figure 5 lists the articles that discuss B2B reverse auctions.

⁸ Sometimes, B2C (business-to-consumer) auctions like eBay are also referred to as P2P (peer-to-peer) auctions since buyers can easily become sellers and sellers can easily become buyers.

Figure 5 – B2B Reverse Auction Exchanges in Online Auction Research Framework

<i>Host (Buyer) Behavior</i>	<i>Bidder Behavior</i>	<i>Auction Design</i>
Emiliani & Stec, 2002a Emiliani & Stec, 2002b Emiliani & Stec, 2001 Jap, 2000 Kwoka, 2001 Mullane et al., 2001 Tulder & Mol, 2002	Bajari & Summers, 2002 Jap, 2003	Arcelus et al., 2002 Dias et al., 2002 Emiliani, 2000 Jap, 2002 Lightfoot & Harris, 2003 Lucking-Reiley & Spulber, 2001 McAfee, 2000 Sairamesh et al., 2002 Segev et al., 2001 Wise & Morrison, 2000

As can be seen in Figure 5, the majority of research into reverse auctions is at the auction design level, with relatively little attention given to the bidder behavior inside these auctions. This is surprising, since bidder behavior is probably one of the most interesting to companies who participate in these B2B exchanges. Jap (2003) finds that reverse auction implementation increases the belief that the buyer is opportunistic among bidders, yet Jap finds the surprising result that, in reverse auctions, buyers seem more willing to make dedicated investments to transact with the buyer. Bajari and Summers (2002) discuss the possibility and detection of *bidder collusion*, where suppliers collude so that a higher bid can win a contract, via some mechanism such as taking turns.

More work has been done on buyer behavior and strategy in reverse auctions. Mullane, Peters, and Bullington (2001) and Tulder and Mol (2002) describe the costs and benefits of implementing a B2B reverse auction, while Tulder and Mol go on to describe how reverse auction should fit within a business strategy. Jap (2000) issues similar cautions, noting that reverse auctions can save large amounts of money but can also undermine the supply base and probably should be coupled with at least some long-term sourcing contracts. Emiliani and Stec (2002a) continue this discourse and note that buyers, who host auctions in a B2B reverse auction mechanism, can save quite a lot when

suppliers are forced to bid against each other for production contracts. However, these same authors also note that online auctions can cause divisiveness between seller and buyer and that buyers must take a long-term view of purchasing (Emiliani & Stec, 2002b), with careful attention to ensure their technology choices fit with their business model (Emiliani & Stec, 2001) to be ultimately successful. Kwoka (2001) investigates reverse auction exchanges in the automobile industry, such as Covisint (www.covisint.com), and notes how reverse auctions have raised questions about the impact of excessive buyer power and how these auctions can transform an industry.

The largest amount of research in B2B reverse auctions is in the area of reverse auction exchange design. Many pieces investigate the basic functionality of a reverse auction, especially as they relate to current economic theory (e.g., Emiliani, 2000; Jap, 2002; Lightfoot & Harris, 2003; Lucking-Reiley & Spulber, 2001) or the design of a single B2B product, such as IBM's *WebSphere Commerce Suite* (e.g., Dias et al., 2002; Sairamesh et al., 2002). Some authors advocate new designs. For example, Arcelus, Pakkala, and Srinivasan (2002) advocate a 2-price purchasing policy that alleviates the immediate negative impact of online auctions to suppliers by coupling the auctions with long term supply contracts, and McAfee (2000) advocates a new peer-to-peer exchange format that reduces supply chain fees. Segev, Beam, and Shanthikumar (2001) model a reverse auction in terms of a Markov chain on a state space defined by the current price of the item and the number of bidders who have been previously "bumped" in an effort to optimize auction satisfaction and predict final ending bids. Finally, Wise & Morrison (2000) use past technological acceptance in other technologies to try to predict how B2B business structures will be accepted in the future.

4. Conclusions

Online auction research has seen a remarkable growth in the last several years. This article examines this research and categorizes it within an online auction research framework. The result is that this article will help researchers to examine those areas that interest them, to gauge the interest level among other researchers, and to determine what areas need to be researched more intensely in the future.

Several insights are gained from this study. In particular, some research areas need more investigation, especially bidder behavior in B2B reverse auctions, and online auction design that shows how technology can be incorporated into auction design to affect the price paid by bidders. Also, more seller-level analysis, especially in the context of marketing research, could be performed to show how seller-level effects, such as promotion, market presence, etc., can affect the price paid in online auctions.

This study is limited by the vast amount of new working papers, conference proceedings, and journal articles that are being developed or have been published. Though an attempt was made to find and report on these articles, some relevant research is bound to be omitted from this study, despite efforts to be inclusive. Rather, this study should be looked at as an unbiased sample of current research so that researchers can glean levels of interest and areas of future research. Thus, this research should not be considered to be a substitute for a literature review, but instead can be used as a springboard to delve into new research topics in online auctions.

5. References

- Albert, M. R. (Summer 2002). E-buyer Beware: Why Online Auction Fraud Should Be Regulated. *American Business Law Journal*, 39(4), 575-643.
- Antonelli, M., Kumar, C. R., McCann-Ezring, B., Peterman, C., & Roberto, S. (January 2001). Online Auction Company Immune From Liability for Sales of Bootleg

- Sound Recordings. *Intellectual Property & Technology Law Journal*, 13(1), 16-18.
- Arcelus, F. J., Pakkala, T. P. M., & Srinivasan, G. (Fall 2002). A Purchasing Framework for B2B Pricing Decisions and Risk-Sharing in Supply Chains. *Decision Sciences*, 33(4), 645-666.
- Ariely, D., & Simonson, I. (2003). Buying, Bidding, Playing, or Competing? Value Assessment and Decision Dynamics in Online Auctions. *Journal of Consumer Psychology*, forthcoming.
- Ba, S., & Pavlou, P. A. (Sep 2002). Evidence of the Effect of Trust Building Technology in Electronic Markets: Price Premiums and Buyer Behavior. *MIS Quarterly*, 26(3), 243-268.
- Ba, S., Whinston, A. B., & Zhang, H. (June 2003). Building trust in online auction markets through an economic incentive mechanism. *Decision Support Systems*, 35(3), 273-286.
- Bajari, P., & Hortacsu, A. (2003a). *Are Structural Estimates of Auction Models Reasonable? Evidence from Experimental Data* Working Paper, Stanford University. Stanford, CA.
- Bajari, P., & Hortacsu, A. (Summer 2003). The Winner's Curse, Reserve Prices and Endogenous Entry: Empirical Insights from eBay Auctions. *The Rand Journal of Economics*, 34(2), 329-355.
- Bajari, P., & Summers, G. (2002). Detecting Collusion in Procurement Auctions: A Selective Survey of Recent Research. *Antitrust Law Journal*, 70(1), 143-170.
- Bapna, R. (2003). When Snipers Become Predators: Can Mechanism Design Save Online Auctions? *Communications of the ACM*, Forthcoming.
- Bapna, R., Goes, P., & Gupta, A. (January 2000). A Theoretical and Empirical Investigation of Multi-Item On-line Auctions. *Information Technology and Management*, 1(1), 1-23.
- Bapna, R., Goes, P., & Gupta, A. (December 2001a). Comparative Analysis of Multi-Item Online Auctions: Evidence From the Laboratory. *Decision Support Systems*, 32(2), 135-153.
- Bapna, R., Goes, P., & Gupta, A. (November 2001b). Insights and Analysis of Online Auctions. *Communications of the ACM*, 44(11), 42-50.
- Bapna, R., Goes, P., & Gupta, A. (January 2003a). Analysis and Design of Business-To-Consumer Online Auctions. *Management Science*, 49(1), 85-101.
- Bapna, R., Goes, P., & Gupta, A. (September 2003b). Replicating Online Yankee Auctions to Analyze Auctioneers' and Bidders' Strategies. *Information Systems Research*, 14(3), 244-268.
- Bapna, R., Goes, P., Gupta, A., & Karuga, G. (Fall 2002). Optimal Design of the Online Auction Channel: Analytical, Empirical, and Computational Insights. *Decision Sciences*, 33(4), 557-577.

- Beam, C., & Segev, A. (1998). *Auctions on the Internet: A Field Study* Working Paper, University of California, Berkeley98-WP-1032. Berkeley, CA.
- Brinkmann, U., & Seifert, M. (February 2001). 'Face to Interface': Zum Problem der Vertrauenskonstitution im Internet am Beispiel von elektronischen Auktionen ('Face to Interface' - The Establishment of Trust in the Internet - The Case of E-Auctions). *Zeitschrift für Soziologie (Journal for Sociology)*, 30(1), 23-47.
- Bywell, C. E., & Oppenheim, C. (July/August 2001). Fraud on Internet Auctions. *Aslib Proceedings*, 53(7), 265-272.
- Dans, E. (February 2002). Existing Business Models for Auctions and Their Adaptation to Electronic Markets. *Journal of Electronic Commerce Research*, 3(2), 23-31.
- Dellarocas, C. (2002). *The Digitization of Word-of-Mouth: Promise and Challenges of Online Reputation Mechanisms* Working Paper, Massachusetts Institute of Technology. Cambridge, MA.
- Dellarocas, C. (2003). *Efficiency and Robustness of eBay-like Online Feedback Mechanisms in Environments with Moral Hazard* Working Paper, Massachusetts Institute of Technology. Cambridge, MA.
- Dellarocas, C., Fan, M., & Wood, C. A. (2003). *Reciprocity and Participation in Online Reputation Systems* Working Paper, University of Notre Dame. Notre Dame, IN.
- Dewan, S., & Hsu, V. (2001). *Trust in Electronic Markets: Price Discovery in Generalist Versus Specialty Online Auctions* Working Paper, University of Washington. Seattle, WA.
- Dias, D. M., Palmer, S. L., Rayfield, J. T., Shaikh, H. H., & Sreeram, T. K. (2002). E-commerce interoperability with IBM's WebSphere Commerce products. *IBM Systems Journal*, 41(2), 272.
- Easley, R. F., & Tenorio, R. (2003). *Jump-Bidding Strategies in Internet Auctions* Working Paper, University of Notre Dame. Notre Dame, IN.
- Eaton, D. H. (2002). *Valuing Information: Evidence from Guitar Auctions on eBay* Working Paper, Murray State University. Murray, KY.
- Ederington, L. H., & Dewally, M. (2003). *A Comparison of Reputation, Certification, Warranties, and Information Disclosure as Remedies for Information Asymmetries: Lessons from the On-line Comic Book Market* Working Paper, University of Oklahoma. Norman, OK.
- Emiliani, M. L. (2000). Business-to-business online auctions: key issues for purchasing process improvement. *Supply Chain Management*, 5(4), 176-186.
- Emiliani, M. L., & Stec, D. J. (2001). Online Reverse Auction Purchasing Contracts. *Supply Chain Management*, 6(3/4), 101-104.
- Emiliani, M. L., & Stec, D. J. (2002). Realizing Savings from Online Reverse Auctions. *Supply Chain Management*, 7(1), 12-23.
- Emiliani, M. L., & Stec, D. J. (2002). Squaring Online Reverse Auctions with the Caux Round Table Principles for Business. *Supply Chain Management*, 7(2), 92-100.

- Gilkeson, J. H., & Reynolds, K. (June 2003). Determinants of Internet auction success and closing price: An exploratory study. *Psychology & Marketing*, 20(6), 537-566.
- Halstead, D., & Becherer, R. C. (2003). Internet auction sellers: Does size really matter? *Internet Research*, 13(3), 183-194.
- Happel, S. K., & Jennings, M. M. (Winter 2002). Creating a Futures Market for Major Event Tickets: Problems and Prospects. *Cato Journal*, 21(3), 443-461.
- Heck, E. V., & Vervest, P. (July 1998). How Should CIOs Deal with Web-Based Auctions? *Communications of the ACM*, 41-42(7), 99.
- Houser, D., & Wooders, J. (2000). *Reputation in Auctions: Theory and Evidence from eBay* Working Paper, University of Arizona. Tuscon, AZ.
- Jap, S. D. (November/December 2000). Going, Going, Gone. *Harvard Business Review*, 78(6), 30-31.
- Jap, S. D. (Fall 2002). Online Reverse Auctions: Issues, Themes, and Prospects for the Future. *Academy of Marketing Science. Journal*, 30(4), 506-525.
- Jap, S. D. (July 2003). An Exploratory Study of the Introduction of Online Reverse Auctions. *Journal of Marketing*, 67(3), 96-107.
- Kauffman, R. J., & Wood, C. A. (2003a). Doing Their Bidding: An Empirical Examination of Factors that Affect a Buyer's Utility in Internet Auctions. *Information Technology and Management*, forthcoming.
- Kauffman, R. J., & Wood, C. A. (October 2003b). *Why Does Reserve Price Shilling Occur in Online Auctions?* Paper presented at the International Conference on Electronic Commerce (**ICEC '03**), Pittsburg, PA.
- Kung, M., Monroe, K. B., & Cox, J. L. (2002). Pricing on the Internet. *The Journal of Product and Brand Management*, 11(4/5), 274-287.
- Kwoka, J. E. (August 2001). Automobiles: The Old Economy Collides with the New. *Review of Industrial Organization*, 19(1), 55-70.
- Lansing, P., & Hubbard, J. (January 2002). Online Auctions: The Need for Alternative Dispute Resolution. *American Business Review*, 20(1), 108-116.
- Lee, H. G. (January 1998). Do Electronic Marketplaces Lower the Price of Goods? *Communications of the ACM*, 41(1), 73-80.
- Lightfoot, W., & Harris, J. R. (2003). The Effect of the Internet in Industrial Channels: An Industry Example. *Industrial Management + Data Systems*, 103(1/2), 78-84.
- List, J. A., & Lucking-Reiley, D. (September 2000). Demand Reduction in Multi-Unit Auctions: Evidence from a Sportscard Field Experiment. *American Economic Review*, 90(4), 961-972.
- List, J. A., & Lucking-Reiley, D. (October 2002). Bidding Behavior and Decision Costs in Field Experiments. *Economic Inquiry*, 40(44), 611-619.

- Liu, H., Wang, S., & Fei, T. (2003). Multicast-based Online Auctions: A Performance Perspective. *Benchmarking*, 10(1), 54-64.
- Livingston, J. A. (2002). *How Valuable is a Good Reputation? A Sample Selection Model of Internet Auctions* Working Paper, University of Maryland. College Park.
- Lucking-Reiley, D. (December 1999). Using Field Experiments to Test Equivalence Between Auction Formats: Magic on the Internet. *American Economic Review*, 89(5), 1063-1080.
- Lucking-Reiley, D. (September 2000). Auctions on the Internet: What's Being Auctioned, and How? *The Journal of Industrial Economics*, 48(3), 227-252.
- Lucking-Reiley, D., Bryan, D., Prasad, N., & Reeves, D. (2000). *Pennies from eBay: The Determinants of Price in Online Auctions* Working Paper, University of Arizona. Tuscon, AZ.
- Lucking-Reiley, D., & Spulber, D. F. (Winter 2001). Business-to-Business Electronic Commerce. *Journal of Economic Perspectives*, 15(1), 55-68.
- Massad, V. J., & Tucker, J. M. (September/October 2000). Comparing Bidding and Pricing Between In-Person and Online Auctions. *The Journal of Product and Brand Management*, 9(5), 325-332.
- McAfee, A. (November/December 2000). The Napsterization of B2B. *Harvard Business Review*, 78(6), 18-19.
- Melnik, M. I., & Alm, J. (September 2002). Does a Seller's Ecommerce Reputation Matter? Evidence from eBay Auctions. *The Journal of Industrial Economics*, 50(3), 337-349.
- Milgrom, P. (1989). Auctions and Bidding: A Primer. *Journal of Economic Perspectives*, 3(3), 3-22.
- Mullane, J. V., Peters, M. H., & Bullington, K. E. (2001). Entrepreneurial Firms as Suppliers in Business-To-Business E-Commerce. *Management Decision*, 39(5/6), 388-393.
- Ow, T., & Wood, C. A. (October 2003). *The Conflicting Effect of Experience on Buying and Selling in Online Auctions: An Empirical Examination of the Effect of Trust in Electronic Markets*. Paper presented at the Conference for Information Systems and Technology (CIST '03), Atlanta, GA.
- Rafaeli, S., & Noy, A. (September 2002). Online Auctions, Messaging, Communication and Social Facilitation: A Simulation and Experimental Evidence. *European Journal of Information Systems*, 11(3), 196-207.
- Resnick, P., & Zeckhauser, R. (2002). *Trust Among Strangers in Internet Transactions: Empirical Analysis of eBay's Reputation System* (Vol. 11). Amsterdam: Elsevier Science.
- Resnick, P., Zeckhauser, R., Friedman, E., & Kuwabara, K. (December 2000). Reputation Systems. *Communications of the ACM*, 12(45), 43-46.

- Resnick, P., Zeckhauser, R., Swanson, J., & Lockwood, K. (2003). *The Value of Reputation on eBay: A Controlled Experiment* Working Paper, University of Michigan. Ann Arbor, MI.
- Riley, J. G., & Samuelson, W. F. (June 1981). Optimal Auctions. *American Economic Review*, 71(3), 381-392.
- Roth, A. E., & Ockenfels, A. (September 2002). Last-Minute Bidding and the Rules for Ending Second-Price Auctions: Evidence from eBay and Amazon Auctions on the Internet. *The American Economic Review*, 92(4), 1093-1103.
- Sairamesh, J., Mohan, R., Kumar, M., Hasson, L., & Bender, C. (2002). A Platform for Business-To-Business Sell-Side, Private Exchanges and Marketplaces. *IBM Systems Journal*, 41(2), 242-252.
- Segev, A., Beam, C., & Shanthikumar, J. G. (April 2001). Optimal Design of Internet-Based Auctions. *Information Technology and Management*, 2(2), 121-163.
- Sinha, A. R., & Greenleaf, E. A. (Summer 2000). The Impact of Discrete Bidding and Bidder Aggressiveness on Sellers' Strategies in Open English Auctions: Reserves and Covert Shilling. *Marketing Science*, 19(3), 244-265.
- Snyder, J. M. (March 2000). Online Auction Fraud: Are the Auction Houses Doing All They Should or Could to Stop Online Fraud? *Federal Communications Law Journal*, 52(2), 453-472.
- Standifird, S. S. (May/June 2001). Reputation and e-commerce: eBay auctions and the asymmetrical impact of positive and negative ratings. *Journal of Management*, 27(3), 279-296.
- Tulder, R. V., & Mol, M. (October 2002). Reverse Auctions or Auctions Reversed: First Experiments by Philips. *European Management Journal*, 20(5), 447-458.
- Vickery, W. (March 1961). Counter-Speculation Auctions and Competitive Sealed Tenders. *Journal of Finance*, 41(1), 8-37.
- Wang, K., Wang, E. T. G., & Tai, C. (April 2002). A Study of Online Auction Sites in Taiwan: Product, Auction Rule, and Trading Type. *International Journal of Information Management*, 22(2), 127-142.
- Wang, W., Hidvegi, Z., & Whinston, A. B. (2003). *Shill Bidding in English Auctions* Working Paper, Emory University. Atlanta, GA.
- Wilcox, R. T. (2000). Experts and Amateurs: The Role of Experience in Internet Auctions. *Marketing Letters*, 11(4), 363-374.
- Wise, R., & Morrison, D. (November/December 2000). Beyond the Exchange: The Future of B2B. *Harvard Business Review*, 78(6), 86-99.
- Wood, C. A., Fan, M., & Tan, Y. (2003). *An Examination of the Reputation Systems for Online Auctions* Working Paper, University of Notre Dame. Notre Dame, IN.
- Yamagishi, T. (2003). *The Role of Reputation In Open and Closed Societies: An Experimental Study of Internet Auctioning* Working Paper, Hokkaido University.

Yin, P. (2002). *Information Dispersion and Auction Prices* Working Paper, Stanford University. Stanford, CA.