Online Auctions and Multichannel Retailing

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Abstract
An advantage of online auctions is the ability to offer an item at auction while simultaneously using other offline and online channels. Despite the potential of interactions between channels, little is known regarding how multichannel-retailing strategies may influence outcomes for online auctions. Using data collected from eBay Motors and dealer websites, this paper examines how resources and capabilities of sellers related to multichannel retailing influences online auction outcomes—with findings indicating that auction outcomes are influenced by seller activities in other channels. In particular, this paper finds that the quality of the retail location (accessed through the total household income for the surrounding 30 miles of the seller’s location) and the seller’s electronic commerce capabilities (accessed through the seller’s website and use of other online channels) are each associated with increases in auction sale price, a lower percentage of auctions in which the reserve price is met (closing ratio), and a lower percentage of vehicles which sell through the online auction channel (sell-through ratio).

1. Introduction
The Internet has decoupled the information component of transactions from the logistics component [32], enabling sales processes in which retailers can offer products through traditional offline retail channels and a wide variety of online channels—including online auctions—without changing the products’ physical location(s). Recent research has begun to identify ways in which auction outcomes are influenced by market dynamics outside of the seller or bidders directly involved in bidding [2, 7, 22], but it is unknown whether online auction outcomes are influenced by simultaneous offerings of the same product in other channels. Related work has examined interactions between pricing in online and local channels for books [18], suggesting that retailers may incorporate activities across channels when making decisions regarding online auctions. While multichannel retailers do not “choose” to make a sale in one channel over another in the same way as customers chooses to purchase from a channel, retailers make choices of where to list products and the minimum price (i.e., reserve price) under which they will complete a transaction.

To develop an understanding of retailers’ multichannel strategies we draw upon search theory [16] and the resource-based view (RBV) of the firm [10, 9, 34]. Just as search processes have been used to understand how consumers search across the variety of channels available to them [31, 30], sellers can be conceptualized as searching for buyers of their products, attempting to optimize the cost of search and the price obtained [19, 22]. We use search theory and the resource based view to develop specific hypotheses as to how seller resources and capabilities influence online auction outcomes. Sellers are differentiated in the resources and capabilities that enable them to attract buyers outside of the auction channel, and we argue that these differences influence the sellers’ reserve prices and important resulting auction outcomes. We test the hypotheses using 327 professional car dealerships that sell vehicles through eBay motors and other channels.

This research makes a contribution to the understanding of seller behavior in multichannel sales processes, an important and growing domain of research. While a great deal of research has examined online auction outcomes, this is among the first papers to empirically examine how online auction outcomes can be influenced by seller activities in other channels. Specifically, we find that resources and capabilities of retailers across both offline and online channels outside of the online auction channel influence online auction channel outcomes—including the price premium, the percentage of auctions in which the reserve price is met (closing ratio), and the percentage of vehicles which sell through the online auction channel (sell-through ratio). A framework describing these relationships is found in Figure 1.

2. Theory
This section first reviews the detailed aspects of how search theory has been used to understand outcomes resulting from the auction channel. It then further describes research investigating multichannel retailing with an emphasis on price outcomes. Finally, it reviews past research on the role of firm resources and capabilities in influencing outcomes related to the online channel. With this foundation, the specific hypotheses are described in the next section.

2.1 Online auctions and search theory

This research utilizes search theory as a way of understanding seller behavior in online auctions. Search theory specifies that the process of search is influenced both by the potential benefits and the costs of search [16]. When applied to the study of online auctions, search is used to understand seller rational in setting her reserve price. Setting a high reserve price decreases the chance that the reserve price will be met and the auction will end in a sale but increases the minimum sale price. Conversely, lowering the reserve price increases the likelihood of sale but decreases the minimum sale price. In other words, the seller faces a tradeoff regarding the sale price and the time required to find a buyer, making search a relevant foundation through which to understand the process through which sellers set and adjust their reserve price over time.

Ashenfelter [3] first suggested that search theory may explain aspects of how sellers set and then adjust their reserve price over time. Genesove [19] empirically tested a model of search in the context of wholesale autos, examining how the mean and variance of market prices for a particular vehicle type influenced the search process of sellers. Building on this work, Ashenfelter et al. [4] also modeled the sale rate of art as a search process, and Genesove and Mayer [20] found that sellers who originally paid higher prices for condominiums also set higher asking prices when subsequently selling. Kuruzovich et al. [22] examined how seller search across sequential online auctions influenced the price the seller obtained. Overall, these findings suggest that search is useful to understanding the reserve setting processes of sellers.

The search processes of auto retailers can be expected to involve multiple channels. Sellers can search using the traditional retail channel, in which they place ads in newspapers or rely upon their location to attract floor traffic. They can also utilize fixed price online channels such as Cars.com or Autotrader.com to list their vehicle. Finally they can list their vehicles in online auctions. These channels can be selected individually by project or systematically across the inventory of the seller.

For multichannel sales processes involving sequential use of different channels, benefits from search have been found to vary according to the relative price within and between channels [19]. A key insight from this work relevant to understanding online auctions as a component of multichannel retailing is that the reserve price in the online auction will be influenced by the reserve price in the offline retail channel even when channels are used simultaneously. As such, retailer resources and capabilities that increase the likelihood of locating a high valuation buyer through channels other than the online auction will also increase the seller’s reserve price in the online auction channel.

While it is not possible to directly observe the reserve price of the seller, examining relevant channel outcomes enables us to infer how resources and capabilities of the seller impact the seller’s reserve price. Much prior work on online auctions has focused almost exclusively on the determinants of sale price [5, 24], meaning the analyses included only those auctions in which bidding exceeded the reserve price. However, when considering auction behavior in the context of multichannel retailing it is worthwhile to consider how frequently items are sold in the auction channel along with price, as these are tradeoffs relevant to the search process [20].

Specifically, this research examines three related auction channel outcomes: (1) the seller’s price premium, (2) the seller’s the closing ratio, and (3) the seller’s sell-through ratio. Examining each of these outcomes separately helps to disassociated seller characteristics that primarily influence the bidder’s valuation from others that primarily influence the seller’s valuation. While it should be noted that buyer and seller valuation are not completely independent—an increase in the bidder’s valuation causes sellers to increase their reserve price by a percentage of that increase [19]—disassociating these effects helps to create a richer picture of how sellers use online auctions as part of a multichannel sales process.

The seller’s price premium—defined as the average value the seller receives relative to the predicted market-clearing price—will increase with seller characteristics that increase the seller’s valuation as well as those that increase the bidder’s valuation. As a seller’s reserve is the minimum price that a vehicle can be sold for, sellers with systematically higher reserve prices are likely to exhibit a higher price premium relative to other sellers in the market. While the reserve price typically cannot be directly observed, past findings have indicated that the presence of a reserve price is associated with a higher sale price [24]. Seller characteristics important to the valuation of the bidder have included primarily those that increase bidder trust in the seller. As a result, sellers with high levels of positive feedback and low levels of negative
feedback are able to obtain a price premium for their items [24, 25].

The closing ratio—defined as the percentage of auctions in which the seller’s reserve price is met—decreases with seller characteristics that increase the seller’s valuation and increase with seller characteristics that increase the bidder’s valuation. The willingness of a seller to pass on an offer in a marketplace is one way of characterizing the willingness of the seller to search. Past research by Genesove [19] operationalized the search process of the seller using the likelihood the reserve price would be met in a given auction, examining how specific market characteristics (the mean and the variance of the expected price) influenced the search of the seller. Here, the closing ratio captures the same effect—i.e., the willingness of a seller to have an auction fail to end in a sale—averaged across all auctions in which the seller participates.

The sell-through ratio—defined as the percentage of vehicles that a seller lists in the auction channel which eventually sell through the auction channel—can be expected to decrease with seller characteristics that increase the seller’s valuation and increase with seller characteristics that increase the bidder’s valuation. The examination of the sell-through ratio indicates whether a seller characteristic is associated with actual sales opportunities outside of the online auction channel or just a willingness to search. For example, seller characteristics that increase the willingness to search but don’t indicate opportunities outside of the online auction channel will influence the closing ratio but not the sell-through ratio—i.e., sellers will slowly drop their reserve price until eventually a sale occurs. Conversely, if seller characteristics enable sales through channels other than the online auction this should reduce both the closing ratio and the sell-through ratio. In addition, while the majority of related work has been conducted at the level of the auction, it should be noted that this analysis is conducted at the level of the seller to incorporate an overall understanding of how seller resources and capabilities lead to the channel outcomes of price premium, closing ratio, and sell-through ratio.

2.2 Mulitchannel retailing

As the Internet and electronic commerce provide numerous different mechanisms through which sellers and consumers can transact, this work also draws directly upon the prior research examining multichannel retailing. Past research in this area has examined differences in price outcomes between channels as well as the behavior of consumers and sellers. Online markets typically have a lower price than offline channels for posted price selling [13, 27] or when prices are negotiated through information intermediaries [26]. Lower search costs online for consumers have been identified as the key driver of this effect [6]. Because consumers can quickly locate the price of a number of online retailers, this creates pressure for retailers to offer low prices. In addition, recent research has found complex price dynamics between online and offline channels when search costs change (such as when a new store opens) [18].

Research results have been mixed when comparing price outcomes between online auctions and other channels. In general, sale prices of online auctions are typically lower than reference valuations linked to offline channels [5, 24]. However, when comparing online auction outcomes with alternatives available through fixed price channels, Ariely and Simonson [1] found that participants in online auctions often undersell and as a result frequently overpay for items though online auctions. In addition, features such as “buy-it-now” enable sellers to obtain a price premium from individuals unwilling to wait till the end of auctions [14]. In the context of wholesale auto auctions—where online and offline auctions exist as close substitutes—findings suggest that rarer vehicles with low quality uncertainty are more frequently sold online, and an online discount exists only for vehicles with high quality uncertainty [28]. Lee [23] found that when a traditional offline auction was replace with an online auction it was accompanied by an overall increase in the price of goods. Overall, research involving the role of online auctions in multichannel retailing indicates that relevant outcomes are influenced by a variety of aspects related to how the auction is implemented and used by both buyers and sellers across channels.

2.3 Seller resources and capabilities

Just as specific consumer characteristics are used to understand the search processes of heterogeneous customers, specific conceptualizations of resources and capabilities provide a way of understanding how firm attributes are associated with important firm outcomes [11, 33]. When considering how online auctions may be influenced by seller activities in other channels, it is relevant to consider both the offline auction channel and other online channels. To understand success in the offline retail channel, a long stream of research in marketing as well as common wisdom has pointed to the importance of location in influencing firm performance [17, 15]. For other online channels, researchers have identified electronic commerce capabilities as key to driving online retailing success and overall firm performance [35, 36]. As a result, in
this research we argue that both the retail location quality and the electronic commerce capabilities of the retailer are important in understanding online auction channel outcomes.

Retail location quality is defined as the relative ease by which the seller can find a consumer from the local population to purchase a vehicle. This is measured using the total income of all households within a 30-mile radius of the offline retail location, incorporating both the density and the relative affluence of the population. Just as the availability of local stores influences the search and purchase behavior of consumers [18], the availability of local high-quality customers is likely to be important in the search and sales behavior of retailers, thus influencing outcomes for the online auction channel.

Electronic commerce capabilities are defined as the capability of the seller to utilize online channels to reach customers and have been found to be one indicator of firm performance in the area of online retailing [35]. Similar to prior arguments regarding the quality of the retail location, electronic commerce capabilities represent a way of characterizing the costs of the seller present when searching for consumers using online channels outside of the online auction channel. As a result, the ability to locate high-quality customers through online channels other than the online auction channel (such as the retailer’s own website or the websites of other information intermediaries) is likely to be important in the search and sales behavior of retailers and the associated outcomes for the online auction channel.

### 3. Hypotheses

This section introduces two sets of hypotheses that are based upon the premise that resources and capabilities relevant to other channels will influence online auction channel outcomes. When specific resources and capabilities provide sellers with access to customers outside of the online auction channel it increases the reserve price of the seller in the online auction channel. This increase in the seller’s reserve price increases the seller premium when a sale does occur in the online auction channel while simultaneously decreasing the closing ratio and the sell-through ratio. First arguments related to the quality retail location are presented. This is followed by arguments for electronic commerce capabilities.

#### 3.1 Retail location quality and online auction channel outcomes

The quality of the offline retail location is expected to be important in determining outcomes from the online auction channel. A long series of works in the marketing literature have identified location as the most important property of a retail venture [17, 15], influencing both the ability to attract customers and pricing power. When considering multichannel retailers, increasing the quality of the retail location increases the likelihood that the seller will locate a high valuation buyer in the offline retail channel. In other words, sellers with high quality locations can be conceptualized as having lower search costs as they search for customers. This has the effect of increasing the seller’s reserve price in the online auction channel [19], as discussed earlier. This increase in the reserve price will increase the seller’s price premium, decrease the closing ratio, and decrease the sell-through ratio. As a result, it is hypothesized that:

- 
  - \( H1a \). The quality of the offline retail location will be positively associated with the price premium.
  - \( H1b \). The quality of the offline retail location will be negatively associated with the closing ratio.
  - \( H1c \). The quality of the offline retail location will be negatively associated with the sell-through ratio.

#### 3.2 Electronic commerce capabilities and online auction channel outcomes

Electronic commerce capabilities are expected to be important in determining outcomes from the online auction channel. Higher levels of electronic commerce capabilities are likely to lower the associated costs of attracting customers through the retailer’s own website or other online infomediaries. Past research has found that electronic commerce capabilities improve firms’ operational performance [35, 36]. Thus, increasing the possibility of locating a high-value customer through electronic commerce channels outside of the online auction channel should increase the reserve price for the online auction channel [19]. Like the arguments for the quality of the retail location, this increase in the reserve price will increase the seller’s price premium, decrease the closing ratio, and decrease the sell-through ratio. Thus, it is expected that:

- \( H2a \). Electronic commerce capabilities will be positively associated with the price premium.
- \( H2b \). Electronic commerce capabilities will be negatively associated with the closing ratio.
- \( H2c \). Electronic commerce capabilities will be negatively associated with the sell-through ratio.
4. Methodology

4.1 Data

Our hypotheses involve measuring the influence of multichannel seller resources and capabilities on outcomes from seller’s use of the online auction channel, including the price premium of the seller. Our data and analysis strategy thus involved identifying multichannel sellers who had adequate auction activity on eBay Motors in a class of vehicles in which the price outcomes can be adequately predicted. Toward this end, we collected data from eBay Motors from September 2006 to June 2007 on the vehicles (year, color, vin, miles, certified, inspected, warranty), the seller (positive and negative feedback), and the auction (start and end time, minimum bid, presence of a reserve price, and whether the auction ended with a sale, with no sale, or with the buy-it-now option). We then selected a subset of the auctions for vehicles in which the characteristics of the vehicles were such that it enabled a calculation of an expected market-clearing price. As a result, we dropped auctions involving vehicles with a model year prior to 2000, those sold outside of the United States, and those with a compromised title.

We then selected sellers who had at least 20 completed sales in the reduced dataset, resulting in a subset of 347 sellers. We examined the auction pages for these sellers to determine the website and offline location of the retailer. As our population of interest involved multichannel retailers, we eliminated all sellers in which we could not find information regarding other channels, resulting in 327 multichannel retailers.

For these retailers, we assessed location quality using the total household income (THI) within a 30 mile radius of the seller’s address using the software AnySite v8.8. AnySite is a commercial database that incorporates a variety of public and private datasets to enable assessment of retail locations. Total household income was used because it incorporates both population density and affluence.

Electronic commerce capabilities (ECC) were measured using specific functionality from the seller’s website (ECC_WEB) and measures of the seller’s search in other websites (ECC_SOW). To determine ECC_WEB two research assistants examined the websites of the retailer and noted the presence of eight website characteristics relevant to auto retailing. These characteristics were adapted from a survey created by J.D. Power and Associates and included functionality such as “lists price on website,” and “schedule vehicle appointment.” A complete list of the metrics used is found in Appendix A. This procedure of capturing specific IT functionality relevant for websites (w_j) as a way of capturing electronic commerce capabilities is consistent with prior work in retail organizations [36]. For each seller, the website characteristics were summed using the formula:

\[ ECC_{WEB}(j) = \sum_{j=1}^{8} w_j \]  

(1)

Electronic commerce capabilities were further characterized through a Google search of each 17 digit VIN offered by the seller. This Google search returned a number (filtered pages) indicating the number of unique websites on which the VIN was listed. By removing websites associated with eBay, this measure gives us a way to characterize seller’s capability to search using other websites (ECC_SOW), as shown in equation 2 below:

\[ ECC_{SOW}(j) = \sum_{i=1}^{N_j} SOW_{ij} \]  

(2)

4.2 Analysis

Calculation of the price premium of the seller involved assessment of the price received relative to the expected market-clearing price. We calculated the expected market-clearing price of the vehicles (i) across a wide variety of sellers (j) participating in the auction while controlling (c_{ij}) for those vehicle characteristics exogenous to the search process of the seller (miles, certified, inspected, warranty, time (since start of data collection), vehicle year, color, and vehicle model). To ensure that we could include model as a control we limited our analysis to include only vehicle models (as characterized by the first 8 digits of the vin) in which there were at least 15 vehicles sold.

\[ E[P_{ij}|c_{ij}] = c_{ij} \beta \]  

(3)

The price premium (PREM_j) was then calculated for our selection of sellers by averaging the difference between the sale price and the expected sale price for all vehicles sold by the seller:

\[ PREM_j = \frac{1}{n_j} \sum_{i=1}^{n_j} [P_{ij} - E[P_{ij}|c_{ij}]] \]  

(4)
The closing ratio (CR) for each seller was estimated by dividing the total number of vehicles sold through the auction channel (\(n_j(SOLD)\)) by the total number of auctions in which the seller participated (\(n_j(AUCTIONS)\)).

\[
CR_j = \frac{n_j(SOLD)}{n_j(AUCTIONS)}
\]  

(5)

The sell-through ratio (STR\(_j\)) was calculated by dividing the total number of unique vehicles sold through the auction channel (\(n_j(SOLD)\)) by the total number of unique vehicles listed (\(n_j(LISTED)\)).

\[
STR_j = \frac{n_j(SOLD)}{n_j(LISTED)}
\]  

(6)

As it is possible that the predictors for the three channel outcomes (premium, closing ratio, and sell-through rate) may be correlated, to obtain efficient estimators the analysis used seemingly unrelated regression (SUR). The model further controlled for the reputation of the seller. Following prior work in this area, the model used the number of positive feedback comments (PF) and the number of negative feedback comments (NF) separately. All seller variables were logged to enable them to more closely fit a normal distribution.

5. Results

Descriptive statistics and correlations between seller characteristics are found in Table 1. The regression model used to calculate the price premium included 23,581 auctions for vehicles in which the reserve price was met, and the results are found in Table 2. The results suggest that an increase in the number of miles decreased the expected sale price while being certified, inspected, or having a warranty each increased the resulting sale price. In addition, the analysis indicated that the expected price for the vehicle on average decreased through the period of time of the sample. Overall the controls associated with vehicle price explained 92.3% of the overall variance in price.

SUR estimates for 327 sellers are found in Table 3. Overall results support the hypothesized relationships. The seller’s quality of retail location—assessed through the total household income within a 30-mile radius of the seller—is associated with a higher seller price premium, a lower closing ratio, and a lower sell-through ratio. Similarly, both measures of electronic commerce capabilities are associated with a higher seller price premium, a lower closing ratio, and a lower sell-through ratio. Results also show that positive feedback is negatively associated with the sell-through ratio and not associated with either the price premium or the closing ratio while negative feedback is negatively associated with the price premium and not associated with the closing ratio or the sell-through ratio. Overall, the findings support the important role of seller resources and capabilities in influencing online auction outcomes, explaining 14.3% of the variance in price premium, 29.1% of the variance in closing ratio, and 31.1% of the variance in the sell-through ratio.

6. Discussion

This paper contributes to the stream of research involving electronic commerce and market outcomes, demonstrating the interdependent nature of the channels that sellers use to reach customers. Past research has identified significant differences between online channels and their offline counterparts, with offline prices generally higher than online prices [13, 26]. These findings show that price outcomes related to the online auction are dependent upon how sellers use the online auction as part of a multichannel search process. Specifically, online auction channel outcomes for an individual seller are dependent upon resources and capabilities that enable the seller to sell through channels outside the online auction. Sellers with preferable locations and electronic commerce capabilities have higher online auction price premiums, lower closing ratios, and lower sell-through ratios.

The mechanism argued to drive seller valuation is related to the sellers’ willingness to search. Opportunities outside of the online auction channel increase the willingness of the seller to search for a high valuation buyer, which cause the seller to have a higher reservation price. If instead the resources and capabilities influenced the bidders’ premium, the result would be an increase in the sale price, but the closing ratio and the sell-through ratio would increase rather than decrease. While past research has examined how such things as seller feedback will influence auction outcomes through mechanisms involving bidders’ premium, this is among the first works to incorporate related drivers of seller valuation into a model of online auctions. This also shows the importance of examining price along with other auction outcomes in generating an understanding of processes involving multichannel retailers.

6.1 Implications for theory

A key theoretical implication of this work is that it builds upon the small stream of research that has utilized search theory as a way to understand behaviors and associated channel outcomes for sellers. Search
theory has long been used as a way to understand the consumer shopping process as well as the impact of the Internet on commerce [29, 31] and to understand the implications of the Internet on market outcomes [6]. Consumers search for products until the benefits from search outweigh the costs, and by lowering search cost the Internet has both lowered costs of obtaining a low price and further increases welfare through increased product variety [12]. By showing that sellers similarly search for consumers, this sheds additional light on ways in which the lower search costs of the Internet influence outcomes in a way that can benefit sellers. As sellers similarly have a lower cost to search for customers, the Internet provides a way in which organizations can benefit through resources and capabilities that improve their ability to search.

For consumers, traits that facilitate the search process have been linked to improved search outcomes—i.e., lower prices or reduced costs [31]. This research makes the corresponding argument for sellers, as resources and capabilities can be thought of as the valuable traits of the organization. In addition, combining price, closing ratio and sell-through ration provides a methodology through which to analyze multichannel sales processes in which the same products are offered across different channels.

6.2 Implications for practice

This work also has several implications for practitioners. First, as pricing and behavior in a multichannel retail environment is likely to be very complex for organizations, conceptualizing outcomes as a search process provides a relevant framework upon which to optimize business processes. Optimal pricing could be obtained by understanding likelihood of sale at different prices within a specific channel as well as the cost of search. Given the complexity, it is likely that the organizations would benefit from a decision support system to help with the pricing process.

Second, price sensitive consumer may be able to improve their welfare by searching only for sellers who do not have access to other channels. As shown here, sellers with multichannel operations are more likely to expect higher sale prices without providing any specific benefit—such as the increased trust associated with feedback.

6.3 Limitations

One key limitation of this work is that it involves only one class of products and as a result may be influenced by how that market functions with respected to alternate offline markets. For example, in this context the market on eBay acts as a discount channel to the retail channel, but one that provides retailers an alternative to the lower valuation wholesale channel. For other contexts, retailers may find the online auction market provides a context in which comparable prices can be obtained to other channels.

A second limitation is that we were unable to specifically understand the implications of use of other channels and sellers’ reserve price. Future work could incorporate experiments that capture sellers’ reserve prices in different contexts in order to gain more insights into the decision-making processes.

6.4 Conclusion

The Internet and electronic commerce business models have provided retailers with tremendous flexibility in the ways they transact with customers. This research show how outcomes related to the online auction channel are directly influenced by the resources and capabilities of the seller which facilitate sales through channels outside of the online auctions channel. While much work has examined outcomes of online auctions price outcomes, this is among the first to investigate aspects of how other channel outcomes are meaningful in understanding how sellers actually use the auction channel as part of retail operations.

7. References

[7] R. Bapna, P. Goes and A. Gupta, "Replicating Online Yankee Auctions to Analyze Auctioneers' and


Figure 1. Research framework

Table 1. Descriptive statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>STD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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</thead>
<tbody>
<tr>
<td>1 Quality of Retail Location</td>
<td>1.47x10^14</td>
<td>1.41x10^14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>2 Electronic commerce capabilities</td>
<td>4.95</td>
<td>2.03</td>
<td>-0.04</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Search in other websites</td>
<td>1.62</td>
<td>0.79</td>
<td>-0.01</td>
<td>0.29</td>
<td></td>
<td></td>
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<tr>
<td>4 Positive feedback</td>
<td>277.59</td>
<td>348.26</td>
<td>0.01</td>
<td>-0.18</td>
<td>-0.02</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>5 Negative feedback</td>
<td>2.65</td>
<td>4.49</td>
<td>-0.04</td>
<td>-0.20</td>
<td>-0.06</td>
<td>0.48</td>
<td></td>
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<td>6 Price premium</td>
<td>0.49</td>
<td>1.51</td>
<td>0.06</td>
<td>0.20</td>
<td>0.28</td>
<td>-0.10</td>
<td>-0.20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Closing ratio</td>
<td>0.24</td>
<td>0.22</td>
<td>-0.06</td>
<td>-0.42</td>
<td>-0.44</td>
<td>0.06</td>
<td>0.08</td>
<td>-0.37</td>
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<tr>
<td>8 Sell-through ratio</td>
<td>0.38</td>
<td>0.27</td>
<td>-0.02</td>
<td>-0.49</td>
<td>-0.44</td>
<td>0.10</td>
<td>0.08</td>
<td>-0.34</td>
<td>0.93</td>
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</table>

N=327; * Measured through total household income in 30 mile radius.

Table 2. Regression of auction sale price (used in price premium calculation)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Units</th>
<th>Sale Price</th>
<th>( R^2 )</th>
<th>Adj ( R^2 )</th>
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<tr>
<td>ln(Miles)</td>
<td>miles</td>
<td>-1.1031*** (0.028)</td>
<td>0.928</td>
<td>0.925</td>
</tr>
<tr>
<td>Certified</td>
<td>0/1</td>
<td>-0.102**** (0.201)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspected</td>
<td>0/1</td>
<td>0.043*** (0.051)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warranty</td>
<td>0/1</td>
<td>1.647*** (0.067)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>weeks</td>
<td>-0.021*** (0.004)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: * p<0.05, ** p<0.01, *** p<0.001, \( \Psi \) p<0.10;

*Dummy variables for vehicle model (856), vehicle year (7), and color (7) are not shown.
### Table 3. Seemingly unrelated regression results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Premium</th>
<th>Closing ratio</th>
<th>Sell-through ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>ln(Location quality(^2))</td>
<td>0.192** (0.070)</td>
<td>-0.022* (0.010)</td>
<td>-0.021'' (0.012)</td>
</tr>
<tr>
<td>ln(ECC(_{\text{WEB}}))</td>
<td>0.309'' (0.175)</td>
<td>-0.122*** (0.025)</td>
<td>-0.180*** (0.030)</td>
</tr>
<tr>
<td>ln(ECC(_{\text{SOW}}))</td>
<td>0.648*** (0.143)</td>
<td>-0.165*** (0.020)</td>
<td>-0.183*** (0.024)</td>
</tr>
<tr>
<td>ln(Positive feedback)</td>
<td>-0.013 (0.071)</td>
<td>0.009 (0.010)</td>
<td>0.034** (0.012)</td>
</tr>
<tr>
<td>ln(Negative feedback)</td>
<td>-0.277** (0.094)</td>
<td>-0.008 (0.013)</td>
<td>-0.026 (0.016)</td>
</tr>
<tr>
<td>(R^2)</td>
<td>0.143</td>
<td>0.152</td>
<td>0.291</td>
</tr>
<tr>
<td>N</td>
<td>327</td>
<td>327</td>
<td>327</td>
</tr>
</tbody>
</table>

Notes: * p<0.05, ** p<0.01, *** p<0.001, '' p<0.10

\(^1\)ECC=Electronic Commerce Capabilities

\(^2\)Measured through total household income in 30 mile radius.

### Appendix A. Measures for electronic commerce capabilities from websites (ECC\(_{\text{WEB}}\))

1. Lists price on website.
2. Lists options on website.
3. Lists all new vehicles on website.
4. Lists photo on website.
5. Links to independent sites.
6. Tool for credit application.
7. Price quote request form.
8. Online service/appointment scheduling.