

2015

A Look at How Timing Affects Price of Used Car Auctions on eBay Motors

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Recommended Citation

wood, warren, "A Look at How Timing Affects Price of Used Car Auctions on eBay Motors" (2015). *CMC Senior Theses*. Paper 1079.
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Claremont McKenna College

**A Look at How Timing Affects the Selling Price of Used Car Auctions on eBay
Motors**

Submitted to
Professor Yaron Raviv
and
Dean Nicholas Warner

by
Warren Wood

for
Senior Thesis
Spring Semester 2015
4/27/15

Acknowledgments

I would like to thank many people for making this study possible and who helped me during the research process. Professor Yaron Raviv helped clean up the idea and provided valuable feedback whenever I needed it. Rohan Shankar of Harvey Mudd College helped by creating the spider program that gathered the data for this study. I would also like to thank my parents, Kevin and Christine Wood for putting me through college and supporting me every step of the way. This paper is dedicated to my good friend Ali Mirza who instilled a love of cars in me that drove me to research this topic.

May he rest in peace.

Abstract

This study looked at 7194 completed listings from eBay Motors. Each observation contained a make, model, year, mileage, seller feedback rating, selling price, time of day ended, day of the week auction ended, auction duration, number of bidders, and number of bids for a car that had been sold on eBay Motors between March 16th and April 5th. Using this information this study looked at how timing affected the selling price of each vehicle, while holding the other variables constant. The observations are split up into four different time periods of the day (times are in Pacific Standard Time): morning (3am-8:59pm), midday (9am-2:59pm), evening (3pm-8:59pm), and night (9pm-2:59am). The regression results show that the midday time period increases the selling price of the vehicle by an average of \$1445.41 for this data set. This is likely because the demand and supply side of the eBay Motors market are most equivalent during this time period compared to the other time periods.

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I. Introduction

For my senior thesis I will be doing an empirical analysis of used car auctions. On eBay there is a huge market for buying and selling used cars through the eBay Motors search engine. America does not use auctions to buy and sell many cars compared to some other countries, like Japan, but eBay has become the largest used car marketplace in the United States (Lewis, 2011). Using data from eBay I will look for price anomalies that have to do with the time of day that each auction ends. There is something called “sniping” that occurs at the end of an auction that can drive the price up (Roth and Ockenfels, 2002a). Intuition leads us to believe that auctions that end at midnight or 2am on Sunday or Monday are going to get less traffic at these times because the auction closes at an irregular time compared to an auction that would end at 6pm on Wednesday. If your auction ends at a time when people in your country or area are generally sleeping, there might be less “snipers” trying to find the deals on auctions that are ending during that time period. However, there have been findings that support the theory that supply actually outweighs demand during these peak times on eBay (Gürtler and Grund, 2006), they named this phenomena the “eBay Evening Fallacy”.

This topic could have implications on prices and when people would want to start and end their auctions. The seller may be able to use this knowledge to receive a better price for selling his/her product, in this case a car, if they are able to pick a time where demand is at its highest point relative to supply. This paper will be focusing on recent auctions from eBay to see if there is a difference in the selling prices of vehicles holding as many things as possible constant except for the time the auctions close.

II. Literature Review

The previous literature that analyzes Internet auctions is quite extensive and looks at many different types of auctions across all sorts of Internet sites. eBay bidders behave quite differently from bidders on other websites, such as Amazon, because of the way that the auctions are set up and hosted (Ockenfels and Roth, 2002a). One major part of the eBay bidding market is a practice called “sniping”. This is partly because eBay uses a fixed ending time that cannot be changed, whereas other auction websites, such as amazon, use a model that pushes the end time of an auction back for each bid that occurs near the end of each auction (Roth and Ockenfels, 2002a). Roth and Ockenfels (2002a) find that the fraction of bids submitted near the end of auctions on eBay are much larger than the amount of bids submitted near the end of auctions on Amazon. Another study by Asker et al. (2002) created 24 auctions in a classroom environment at Harvard business school. Out of these 24 made-up auctions, 13 of the winners used the sniping tactic. Some of the bidders were also informed or uninformed about the price of the goods being sold. For the informed students to win the auction, they had to use sniping in order to hide the information from the uninformed students (Asker et al., 2002). Information through early bidding can help other bidders realize the value of a good, or increase the other bidders’ willingness to pay for a good (Landsburg, 1999). eBay lets the bidders look at who is bidding on each item, and experienced bidders are able to identify other bidders with information in order to better understand the value of an item for auction (Landsburg, 1999). Experienced eBay users realize that if they can obtain information from other bidders, then those other bidders can gain information from them (Landsburg, 1999). This incentivizes bidders to use sniping

tactics in order to hide their knowledge as long as possible and allow other bidders the least amount of time possible to react to their informative bid (Landsburg, 1999).

There is a problem with submitting so many bids late on eBay: some of the bids do not go through properly and some bidders get left out (Roth and Ockenfels, 2002a). There are many disclaimers from eBay about trying to post last-minute bids stating how they are not responsible if your bid is not properly accepted by the system. They also encourage their customers to bid earlier on an item and set a maximum bid that they would be willing to pay for that item. This is how the eBay system was meant to work, but experienced snipers have found a way to exploit this for undervalued items. The existence of websites that try to place last-minute bids has been steadily increasing and has created a separate third party market for placing last second bids. These sites often have disclaimers as well, warning their customers that their bids will not always go through because of the high amount of traffic for an auction in the closing seconds. Roth and Ockenfels (2002a) also suggest that it might not always be a good strategy to place your maximum bid early because that often gives people time to inflate the price. Incremental late bidders often increase the price point drastically as an early bid on an item can force that bidder to accept paying a higher price if late incremental bidders force the price up (Ockenfels and Roth, 2002a). A website called Esnipe.com discusses the advantages of sniping and claims that a lot of people that bid on an item will bid again if they find they have been outbid, which can quickly lead to a bidding war. This can result in someone paying more than they intended to for an item. Sniping allows bidders to avoid these bidding wars and also allows experts to wait

until the last second to bid on something instead of letting others know the true value early on (Roth and Ockenfels, 2002a).

In a follow up paper Roth and Ockenfels (2002b) identified other factors dealing with the timing of bids in auctions on eBay and Amazon. They created a model for bidder behavior and identified experience and information as key factors for the selling price of auctions on eBay. As bidders gain experience they are able to learn about the incentives and demands that other bidders place on the market, and this causes them to have an increased need for third party sniping companies (Roth and Ockenfels, 2002b). Wilcox (2000) also looked at the affect of bidder experience on price and find that more experienced bidders are more likely to follow Nash equilibrium strategies, while less experienced bidders are less likely to follow game-theory predictions when it comes to bidding in internet auctions. Since this study was conducted, there has been an increase in third party sniping websites that allow less experienced bidders to behave in ways that align better with the game-theory predictions (Roth and Ockenfels, 2002b). Roth and Ockenfels (2002b) believe that if the demand for third party sniping companies continues to increase, eventually eBay could become a sealed bid second price auction. This means that bidders would use these third party sites in order to place bids mainly at the last second and whichever bid was able to both make it into the system and have the highest price would win the auction (Roth and Ockenfels, 2002b).

Reiley et al. (2007) studied 20,000 auctions of pennies in order to look for determinants of price. They find that the seller's feedback rating is a major contributor to the final price of an auction. Within this finding they also conclude that negative ratings have a much larger affect on the price than positive feedback ratings. Houser and

Wooders (2000) also investigate seller and bidder feedback and its affect on price. They find that only seller rating has a significant affect on price, with bidder rating having no affect. When a seller receives a single negative feedback this has much more influence on his future sales than most of the seller's previous positive feedback ratings (Reiley et al., 2007). Moreover, Reiley et al. (2007) find that setting a reserve price on an auction positively increases the selling price. The reserve price is a set price that the seller's good must achieve for the sale to actually occur, if the price of a good does not reach this reserve price in an auction, the good will not sell unless the seller agrees to the lower price. Setting a minimum bid also had a positive affect on the final price of a good (Reiley et al.,2007) . When a seller sets a minimum bid, this means that the price must increase by at least that amount for a new bidder to obtain the highest bid. Reiley et al. (2007) also looked at how auctions ending on the weekend are affected. The results were relatively small and also insignificant at the 5% level. The length of the auction is also found to be a significant factor in determining auction price (Reiley et al., 2007). The 3 and 5 day auctions had relatively similar price points, but when the length was increased to a 7 day auction, the price increased by 24% and there was a 42% price increase for auctions that lasted 10 days (Reiley et al., 2007).

Grund and Gürtler (2006) also perform a study that identified reputation as a key factor when determining price for auctions on eBay. They look at the percentage of negative ratings and find that this is a statistically significant factor when determining the price for DVDs sold on eBay. This same study also looks at the affects of auctions that end in the evening and how that affects price. Grund and Gürtler (2006) determined that selling prices are actually significantly lower for auctions that end in the evening. This

suggests that sellers only take into account the demand side of eBay and assume that more buyers are on eBay during evening hours, which will increase the price of their auction. However, this is not the case in reality because the supply side of the market outweighs the increased demand and drowns out any potential gains from increased demand (Grund and Gürtler, 2006).

III. Methods

This study used 7195 car listings that were sold on eBay Motors during the 21 day span of May 16th to April 5th. A spider program was used to collect the data that was created by Rohan Shankar of Harvey Mudd College. The program looked at completed listings between the specified time period and collected the following information: number of bidders, number of bids, feedback seller rating, mileage, make, model, year, auction duration, time auction ended, vehicle title, and winning price. Once this information was obtained, STATA was used to drop all the observations that did not have a clean title so that salvage cars were not included. Then all observations that did not have a single comparative car in the data were deleted as well. So if there were only one Nissan GTR that was collected during the 21-day period, then that one observation would be dropped. Using those 7195 observations that were left, I created dummy variables to signal the day of the week and the time that the auction ended. The time of day was split into morning (3am-8:59am), midday (9am-2:59pm), afternoon (3pm-8:59pm), and night (9pm-2:59am). The times that were collected and used were all in Pacific Standard Time. Dummy variables were also created for all 63 different makes and 473 different models for the regression. The variable for the year of the car was the year of the model minus

2015, so that this variable became age of the car from 2015. Once all of this was done, a regression was run on all the different variables with the dependent variable being selling price of the vehicle.

IV. Results

Table 1 Summary Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Selling Price	7195	9194.686	11838.33	0	289900
Mileage	7195	115949.8	105643.6	0	999999
Auction Duration	7195	6.532175	1.691172	3	10
Age of Car	7195	22.10118	16.34283	0	104
# of Bidders	7195	8.21237	5.164509	1	30
# of Bids	7195	22.605	16.99611	1	192
Morning	7195	0.0999305	0.2999282	0	1
Midday	7195	0.3011814	0.4588032	0	1
Evening	7195	0.552467	0.4972742	0	1
Night	7195	0.0464211	0.21041	0	1
Seller Feedback Rating	7195	851.5682	2571.728	0	47948

Table 2 Regression Results

	Regression 1	Regression 2 [robust]
Mileage	-.019** (.0010629)	-.0588 ** [.0020945]
# Of Bidders	-133.479** (34.72462)	-154.145** [37.10269]

# Of Bids	74.228** (10.43205)	67.848** [12.88635]
Auction Duration	642.900** (67.18354)	546.756** [64.14327]
Age of Car	-107.160** (11.81998)	-124.119** [17.45483]
Midday	1445.413** (538.7624)	1285.098 ** [453.8149]
Morning	581.448 (609.013)	607.674 [536.0467]
Evening	690.184 (523.7195)	508.139 [508.1385]
Monday	-370.933 (446.5586)	-114.413 [480.5903]
Tuesday	-350.303 (441.9187)	-62.494 [484.3479]
Wednesday	-368.900 (455.1127)	-186.786 [478.6789]
Thursday	-63.533 (447.2439)	-118.551 [475.1996]
Saturday	-301.607 (467.9287)	-193.568 [473.2838]
Sunday	-530.044 (410.971)	-476.248 [428.987]
Seller Feedback	-.037 (.0441783)	.003 [.0310496]
Rating		

** Denotes significance at the 1% level

* Denotes significance at the 5% level

Numbers in parentheses () are the standard errors of the coefficient, the numbers in brackets[] are the robust standard errors

The following equation is the regression equation used for this model:

$$\begin{aligned}
 Y = & \beta_0 + \beta_1(\text{mileage})_i + \beta_2(\# \text{ of bidders})_i + \beta_3(\# \text{ of bids})_i \\
 & + \beta_4(\text{auction duration})_i + \beta_5(\text{age of car})_i \\
 & + \beta_6(\text{seller feedback rating})_i + \theta_{li} + \tau_{ki} + \delta_{mi} + \alpha_{ni} + \varepsilon_i
 \end{aligned}$$

The δ_{mi} variable in the equation is a vector of dummy variables corresponding to days of the week and α_{ni} is a vector of dummy variables corresponding to the time of day the auction was completed. The variable θ_{li} represents the state fixed effect accounting for the model of the car, and the τ_{ki} variable represents the state fixed effect accounting for the make of the car. For the first regression the model that I used was able to explain 47.94% (R^2) of the variation in selling price for car auctions held on eBay Motors. As we can see in Table 2, most of the results do not have significance even at the 10% level. However the significant results are able to tell us some important information. The mileage coefficient was -.0199 and significant, which means that for every mile on the used cars being sold, the selling price will decrease by almost 2 cents. Both number of bidders and number of bids also obtained significance, but number of bidders actually had a negative affect on selling price. For every extra bidder that an auction had, the selling price of the car decreases by \$133.48. Number of bids moved the selling price in a logical direction where every extra bid increased price by \$74.23. Auction duration also had significance and for each day that your auction was on eBay, the price would increase by \$642.90. The age of the car being sold effected price and for each year older that the car was, the price decreased by \$107.16. The variable of interest that was significant was the midday coefficient. Recall that midday was between 9am and 2:59pm, and if your auction ended during that time period, price was increased by

\$1445.41 on average compared to cars sold during the night period. Both the Friday variable and the Night variable was omitted in order to avoid the dummy variable trap. And because of this each one of the dummy variables for day of the week and time ended coefficients is in comparison to Friday and Night (9pm-2:59am). The only other variables that approached significance at all were the Evening and Sunday variables, which had significance at the 20% level.

V. Discussion

The regression results offer reasonable evidence that there is indeed a “eBay Evening Fallacy” (Gürtler & Grund, 2006). The midday variable was highly significant and showed a \$1445.41 price increase on average for cars sold during that time period. A possible explanation for this could be that the supply side of the eBay market is smaller relative to demand when compared to later times of the day. Keeping in mind that the times were in PST, the midday variable also included a 12pm-5:59pm time period for cars being bought and sold on the East Coast. In general most people are working during daytime periods and are unable to post their advertisement for their cars during these hours. They would most likely create the posting once they got home from work and this creates a large difference between the supply and demand on eBay Motors during the midday time period. From Table 1, the evening time period contained 55% of the data set, the morning time period contained 10% of the data set, the midday period contained 30% of the data set, and the night period contained 5% of the data set. It is much easier for people to explore eBay and bid on items during the workday because it requires less time than creating a new listing for a used vehicle. This might be one of the reasons that

the demand and supply are closer to equilibrium during the midday time period. Unfortunately none of the other time periods were significant, but the evening variable had a p-value of .17; so it is approaching significance. The fact that the other variables related to the time of day the auction ended suggests the importance of the midday variable and how meaningful the significance of this variable is. As we can see in Table 1, over 55% of the data was from the evening time period, showing that the supply is higher during that period. Although there are more people on eBay during evening hours, the affect of “sniping” during those hours are not enough to outweigh the supply during that time period. The act of “sniping” is something that more experienced bidders might do in order to get better prices on goods being sold on eBay. There are probably less people who engage in “sniping” for something like a car when compared to pennies that are sold on eBay. This is because purchasing a vehicle requires more thought and time when considering the purchase than smaller cost items.

Each specific day of the week did not have significance, but Thursday had a much smaller negative affect on price than all of the other days of the week. They are all in comparison to Friday because that was the omitted variable, so the fact that all of the days other than Thursday have highly negative coefficients could suggest that Thursday and Friday are better days to sell your car than other days. Unfortunately the lack of significance with these variables leaves us to question if it matters at all, and this could be an area for future research to be conducted. The second robust regression results show that each day of the weeks’ coefficients were closer to zero except for Sunday, which still had a highly negative coefficient. The seller feedback rating variable had an interesting negative coefficient, suggesting that a higher seller feedback rating actually results in a

lower selling price. This is contrary to previous research such as the Reiley et al. (2007) study that showed how experience increases the selling price. The robust regression resulted in a (barely) positive correlation between seller feedback rating and selling price of their vehicle that is more intuitive, but it was barely above zero so the change is not very big (only about 3.4 cents). Unfortunately the seller feedback rating variable was insignificant, which could be another area for future research. The last variable that was surprising was the number of bidders variable. This variable had a negative coefficient of \$133.48, which is surprising. This could be because once bidders are aware of a high number of other bidders; they may stop bidding on that item. If they think there are a low number of bidders, they may feel that they have a higher chance of winning the auction and thus will bid more on that item. Total number of bids, mileage, age of the car, and auction duration variables all moved the selling price in the intuitive direction. The robust standard errors were similar to the original regression standard errors, suggesting that there is no misspecification in the original regression.

VI. Limitations of the Study

Some limitations of this study could be that the set of observations was not polished as much as it could be. The maximum for mileage was 999,999 and this is clearly not the correct mileage for a car. Sellers will use this tactic to get potential buyers to call and inquire about the actual mileage as a sort of “foot in the door” sales tactic. These observations could skew the mileage coefficient, although there are only 64 observations over 500,000 miles in the data, so the impact is not very large. There are also 148 observations for cars that are older than 61 years old or more that may be

impacting the data on a small scale. Another limitation of this study could be omitted variable bias. Although I looked through the previous literature to determine the variables that would be collected, there could be a missing variable that could increase the significance and change the coefficients of the variables in a meaningful way.

VII. Directions for Future Research

This topic must be explored further before there is any conclusive evidence that selling your car in the midday time period increases selling price. Research investigating the demand side of the eBay market may be useful for determining market behavior. Looking at when the most bids are placed on eBay is one to look at the demand, and determining what day of the week and time of the day the most bids are placed would help uncover the demand side better. Future research needs to take into account things like the word count of the vehicle description because that could be a factor in the change in selling price. Other variables such as the car options that are listed on eBay, for example heated seats, or a sunroof most likely have a positive affect on selling price and could help increase the significance of some of the variables. Other variables that were not taken into account for this study was reserve price and minimum bid. Reiley et al. (2007) found that when a seller sets a reserve price or minimum bid, this has a positive affect on price, and taking this into account could increase the effectiveness of the model. Taking into account more variables would help increase the validity of the study and possibly clear up the results of how timing affects selling price on eBay.

VIII. Conclusion

In conclusion, this study showed that there is a positive correlation between selling price and having your auction end between 9am and 2:59pm. From Table 1 we can see that about 55% of the auction data fell into the evening time period (3pm-8:59pm). This shows that the supply side is at its peak during these hours, most likely drowning out any increases in demand that occur during this time period. The lack of significance for the day of week variables leads to an unclear conclusion about what day of the week might be the best time to have your auction end. The coefficients for day of the week were interesting however, because the Friday and Thursday coefficients were both vastly different from the other day of the weeks' coefficients. It is difficult to tell the affect that "sniping" may have on the selling price for cars on eBay because it is most likely a good that involves fewer snipers than other goods because of the high value of the item. In terms of future research adding more meaningful variables, such as car auctions or reserve price, to the model may increase some of the significance for the variables. Overall the model shed light on some interesting trends in the eBay car auction market. The highly significant positive coefficient for midday means that there could exist a "eBay Evening Fallacy" in which supply outweighs demand during the evening hours. This also means that during the midday time period the supply and demand of the eBay car auction market is closer to equilibrium than at any other time of the day.

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