WARRANTY, SELLER REPUTATION, AND BUYER EXPERIENCE: EVIDENCE FROM EBAY USED CAR AUCTIONS*

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Abstract

Using data from the eBay car auction market, we test several predictions regarding warranties, seller reputation, and buyer experience in the determination of the final price. We find that the presence of a warranty generates a price premium, but that its magnitude decreases when the seller has a more established reputation. Compared to private sellers, professional dealers, who are 'repeated-game players' in the market, benefit less from a warranty and its substitutability for seller reputation is relatively small. In addition, a buyer with greater experience tends to pay less for a warranty or for a professional dealership.

I. INTRODUCTION

A warranty plays a particularly important role in online market places, where buyers consider purchasing products only by seeing their image on the screen or sometimes

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only by reading descriptions of the products.[1] Despite the importance of warranties in online market places, however, only a handful of studies (e.g., Lewis [2011]; Dewally and Ederington [2006]) have examined the extent to which the presence of a warranty influences the final price (i.e., the price premium from a warranty). Moreover, the reported results are rather equivocal in that the premium is not always found to be statistically significant.

To contribute to the empirical literature on warranties, this study aims to provide additional evidence on the price premium from a warranty in online market places. For this purpose, we use data from eBay used car auctions, where detailed information is available for each completed listing about the warranty status, the car's characteristics, and the auction's characteristics including the number of bidders and bids, as well as the seller's characteristics (e.g., a professional dealership). eBay's bidding system is essentially a second-price auction, which facilitates measurement of buyers' willingness to pay.[2]

The most important contribution we attempt to make is, however, to closely explore possible interactions between warranties and seller reputation in the determination of equilibrium prices. Seller reputation can be interpreted as a summary of the historical performance of a seller, helping buyers infer the quality of the product and thus playing a role as quality signaling (e.g., Shapiro [1983]). Studying their interactions is of great importance for at least two reasons. First, it helps better understand how different mechanisms can be used to eliminate the issues related to asymmetric information. Second, such knowledge may be useful for the creation of reputation rating systems as well as information disclosure policies in marketplaces.

It should be noted that existing empirical studies on warranties (e.g., Lewis [2011]; Dewally and Ederington [2006]) and a large body of the empirical literature on seller reputation (e.g., Eaton [2002]; McDonald and Slawson [2002]; Livingston [2005]; Li [2010]) have rarely examined possible interactions between warranties and seller reputation, partly because the two strands of literature have evolved rather independently. To fill this gap, we empirically examine several questions regarding interactions between warranties and seller reputation.

[1] Warranties have been widely discussed in the literature as instruments to reduce information asymmetry and uncertainty about the quality of a product or service (Spence [1977]; Matthews and Moore [1987]). For a general review, see the study by Murthy and Djamaludin [2002].

[2] In a second-price (English ascending) auction, it is a weakly dominant strategy for a bidder to bid his/her true valuation.

The first question we ask is whether a warranty and a seller's reputation can substitute for one another, in other words, whether a seller with a more established reputation will obtain a relatively lower premium from a warranty. To the extent that a warranty and a seller's reputation share a similar role in reducing information asymmetry and uncertainty about the quality of a product or service, it is reasonable to expect that a warranty and a seller's reputation interact as substitutes in the final price determination. To the best of our knowledge, this issue has been formally examined only by Roberts [2011]. Using data from an online tractor auction market, Roberts [2011] provided evidence that a market-level warranty, offered by the market in the form of a 'guaranteed or your money back' promise, cannot substitute for an individual seller's reputation in the determination of the final price. The current study departs from a market-level warranty by examining warranties offered by sellers, based on detailed warranty information at the individual-item level. By doing so, we attempt to provide insight into the source of the substitutability between a warranty and a seller's reputation.

Second, we address whether private sellers enjoy a higher premium from a warranty than professional dealers, and further, how the substitutability of a warranty for seller reputation varies across the two types of sellers. A professional dealer is akin to a 'repeated-game player,' while a private seller can be considered as a 'one-shot player' in the market. Professional dealers and private sellers in eBay used car auctions therefore provide an excellent opportunity to examine the empirical validity of a well-known theoretical prediction: when repeated interactions are possible in the market, frictions due to asymmetric information can be eliminated or at least mitigated and thus do not significantly affect a buyer's willingness to pay (Mailath and Samuelson [2006], [2015]). In our context, this theory provides the testable hypotheses that a professional dealer will benefit less from a warranty than a private seller and that the magnitude of the substitutability between a warranty and a seller's reputation is smaller for a professional dealer than for a private seller.

To provide further insight into warranties and seller reputation, we also examine how buyers' responses to warranties and seller reputation vary with different levels of market experience. Intuitively, the more experience a buyer has, the better he/she is at estimating the quality of the product. To the extent that buyer experience plays an important role in determining willingness to pay for a product in a market, warranties and seller reputation are expected to have less (more) of an effect on willingness to pay when a buyer has more (less) experience in the market. Whether or not this argument holds is the last question that we attempt to explore.

To measure seller reputation and buyers' market experience, we exploit the fact that eBay has a well-designed system for rating sellers and buyers, called a feedback score. A participant's feedback score, which is the cumulative record of all comments provided by partners in previously completed transactions, can be used as a proxy for the reputation of a seller and for the market experience owned by a buyer. Generally, a seller with a higher feedback score has a better reputation, while a buyer with a higher feedback score has more market experience.

For estimation, we use a so-called quasiexperimental approach, which was first introduced by Elfenbein and McManus [2011] and has been widely used in the empirical auction literature.[3] The idea is that auction listings in the sample are matched into groups with the same combination of seller identity, car body type, and start price (rounded to the nearest thousand) but with a variation in terms of warranty status. The advantage of matching sellers' identities and similar car features, along with controlling for group fixed effects, is that we can mitigate bias due to selection on observables and on unobservables (including unobserved seller heterogeneity and idiosyncratic characteristics in the listings). In addition to the use of matching and fixed effects, we control for other car and auction characteristics in estimation.

Our results show that the presence of a warranty in an auction listing leads to a significant increase in the final price, suggesting that buyers positively respond to the presence of a warranty. The results also show that the interaction term between a warranty and a seller feedback score is negatively and significantly associated with the final price, revealing that the price premium from a warranty varies across different levels of seller reputations. These findings support that a warranty can substitute for a seller's reputation.

The presence of a warranty is found to have a greater effect on the final price for private sellers than for professional dealers, in line with the theoretical view that information asymmetry becomes a more serious issue when the trading is a one-time purchase. It is further found that the price premium from a warranty decreases as a private seller has a better reputation; the premium decreases by 0.15 percentage points as the seller feedback score increases by 1 percent. For professional dealers, the magnitude of the substitution does not appear to be as large as that for private sellers. These results

[3]For example, this approach is used by Elfenbein, Fisman, and McManus [2012] who investigate the impacts of charity in auctions and by Elfenbein, Fisman, and McManus [2015] who estimate the value of quality certifications of sellers in eBay online markets. Einav, Farronato, Levin, and Sundaresan [2013] and Einav, Kuchler, Levin, and Sundaresan [2015] also use the same technique to study the performance of different selling strategies.

suggest that a warranty's impact is amplified for sellers who have not yet had the chance to prove their reliability to potential buyers through publicly observable information, i.e., feedback scores or professional dealerships. We further find that the price premium for warranties decreases as buyers have more experiences. Similar patterns are observed for professional dealerships. These results suggest that a more experienced buyer relies less on information about product warranties and seller reputation to determine his or her willingness to pay.

II. RELATED LITERATURE

We first provide a brief review for existing studies on warranties. Thereafter, we review studies on the relationship between seller revenue and reputation, in particular, those studies based on eBay data, and then discuss the contributions of our research to the literature.

Warranties. By definition, a warranty is a guarantee issued to a buyer as a promise to repair or replace the product within a specified time period or under certain conditions. Various models have been developed to explain the prevalence of warranties in markets. The literature launched by Spence [1977] mainly focuses on quality signaling. For example, Matthews and Moore [1987] consider signaling effects of warranties within a relatively complicated trading environment where warranties have multidimensional interactions with other selling strategies including price discrimination and bundling. Lutz [1989] shows that warranties can be used to signal the quality of products when information asymmetry exists between sellers and buyers. The studies that address related issues include those by Courville and Hausman [1979]; Grossman [1981]; Gal-Or [1989]; Mann and Wissink [1990]; Shieh [1996]; and Balachander [2001]. For a survey, see Emons [1989].

The prevalence of warranties in markets has also been examined from some other aspects. Heal [1977], for example, argues that when uncertainty about the quality of a product or service exists, a warranty can be used as insurance by which the risk is shared between the buyer and the seller. Kubo [1986] examines the impacts of warranties when buyers are heterogeneous and shows that warranties can work as a price-discrimination mechanism, in which buyers choose appropriate warranty plans according to their different income levels.

To the best of our knowledge, a few empirical studies have looked at the effects of warranties on buyer demands and seller revenues. Specifically, Dewally and Ederington

[2006] examine comic book sales in eBay auctions and find that the price of a comic book with a warranty is not statistically different from that without a warranty. This finding contrasts with that of Lewis [2011] who finds that the presence of a warranty yields a significant increase in the final price in the eBay Motors auction market, although warranties are not the main focus of the study. Recent work by Choi and Ishii [2010] uses data from a survey on new automobiles to investigate the impact of manufacturer-provided power train warranties in automobile markets. Their results show that consumers significantly value a warranty as a signal of the unobserved quality of products.

Other empirical studies on warranties have somewhat different scopes. For example, Douglas, Glennon, and Lane [1993] use survey data and examine whether or not a warranty induces lower quality of repair services ex-post in a less competitive automobile market. Gill and Roberts [1989] attempt to investigate the correlation between the quality of sellers and their willingness to offer a warranty.

Reputation. Starting with the work by Shapiro [1983], many theoretical studies have analyzed the relationship between transaction prices and seller reputations, mainly concluding that sellers with better reputations should obtain price premiums, as reputations signal product quality (Shapiro [1982]; Allen [1984]).

With the development of online markets in the last two decades, empirical research on online reputation systems has burgeoned. The majority of studies are based on eBay's reputation system, providing results that suggest that eBay's feedback rating system plays an important role in the marketplace. For example, Livingston [2005] finds that sellers benefit from the first few reports that they have behaved honestly, while the marginal returns to additional reports are severely decreasing. Resnick, Zeckhauser, Swanson, and Lockwood [2006] also find that an established reputation increases the selling price by approximately eight percent. Further, Jolivet, Jullien, and Postel-Vinay [2016] provide evidence that ratings are positively and significantly associated with transaction prices and that the association differs across products and seller categories. Further results can be found in Eaton [2002]; McDonald and Slawson [2002]; Melnik and Alm [2002]; Houser and Wooders [2006]; Lucking-Reiley, Bryan, Prasad, and Reeves [2007]; Li [2010]; and Bolton, Greiner, and Ockenfels [2013].

According to the brief review, prior empirical studies have rarely examined the effect of a warranty on the final price, not to mention the interaction effect of a warranty with a seller's reputation. This study addresses these underexplored issues, with an attempt to provide insight into the roles of warranties and seller reputation in the determination of final prices (buyers' willingness to pay). In this sense, our study complements Roberts

[2011], which focuses on the substitutability of market-wide warranty policies for an individual seller's reputation.

Broadly, our study is linked to the literature on information disclosure and quality signaling. As Akerlof [1970] shows, information asymmetry may create the problem of adverse selection, possibly preventing sellers with products of high quality from making profits. One of the solutions for this problem is to conduct (costly) quality signaling. For this and related issues, a number of studies provide empirical evidence (Jin and Leslie [2003]; Jin and Kato [2006]; McDevitt [2011], [2014]). We hope to add to these studies by providing insight into how sellers can utilize alternative signaling mechanisms to reputation in order to remedy nonobservability of the quality of products.

Our study is also related to the new and growing literature on reputation system design in online marketplaces (Li and Xiao [2014]; Cabral and Li [2015]). To maintain performance, an online marketplace as a pure market intermediary needs to consider designs for both information disclosure and a reputation rating system. By demonstrating that eBay's reputation rating system is of benefit for improving trading opportunities, this study may provide a further rationale for reputation system design.

III. THE DATA

As a central market organizer, eBay provides a platform for sellers and buyers to trade items. The auction format is second-price (English ascending), where bidding true values is a weakly dominant strategy for bidders.[4] Hence, transaction prices and bids in the auctions give us a direct measure for buyers' willingness to pay. This particular feature helps us measure changes in buyers' willingness to pay in the presence of a warranty and across different types of sellers.

The data collected from the eBay Motors website include detailed information on car auction listings that were successfully sold between November 2014 and October 2016 and between June 2018 and September 2018. We make several sample restrictions before conducting our analysis. To measure changes in buyers' willingness to pay with and without a warranty, we exclude auctions in which the sellers use other selling mechanisms such as the buy-it-now option, posted price offers, and best offers. In addition, we

[4]The bidder with the highest bid wins the item or product but only pays the maximum between the second highest bid and the starting price. If the auction has a secret reserve price, the second highest bid must be greater than the secret reserve price; otherwise, the seller does not need to commit to the sale. If there is only one bidder submitting a valid bid (greater than the secret reserve price), the bidder wins the item and pays the reserve price.

eliminate listings for which sellers are not based in the United States. We then exclude observations with unclear settings or missing data on the listing characteristics, i.e., no information on make, mileage, and/or production year. We also drop observations in which a car no longer functions but some parts are available for sale. To measure the impact of a warranty more precisely, we further eliminate listings in which a warranty is not clearly stated, such as '407-832-1759 Don't Miss IT MAke Call NOW!' As a result, we obtain data on 9,005 auctions and 1,439 auctions for the periods between November 2014 and October 2016 and between June 2018 and September 2018, respectively.

For each sampled listing, we observe the characteristics of the car (e.g., body type, age, and mileage) as well as the characteristics of the auction listing, including a warranty status, start price, listing duration (days), number of photos, whether or not the auction has a secret reserve price, and who (either the buyer or the seller) pays the shipping fee after the transaction. We also observe other listing information, including the seller's feedback score, the seller's geographical location (state level), professional dealership status, bid history, number of bidders, and number of bids submitted by each bidder, as well as start and end times of the listing.

Feedback rating system. eBay's feedback system, by which sellers and buyers assess their transactions, is designed to mitigate information asymmetry between sellers and buyers and their commitment problems. For each completed transaction, the winning bidder can rate the seller in the form of a positive $(+1)$, negative (-1), or neutral (0) response, and the seller can also leave a positive $(+1)$ or neutral (0) response for the winning bidder. The feedback system consists mainly of two measures: feedback score and positive feedback percentage. Feedback score is the record of overall responses. The more trading experience a seller/buyer has on eBay, the higher the feedback score that the seller/buyer obtains. Positive feedback percentage is the percentage of positive responses out of the overall number of responses. In addition to these ratings, buyers can collect additional information on a seller's performance by reviewing comments in past transactions.

Following most of the previous related studies, we use seller feedback scores as the main measurement of seller reputation.[5] It should be acknowledged that the origins of seller feedback scores are somewhat different between professional dealers and private sellers. For professional dealers, their scores are based mainly on car sales. For private sellers who typically have a history of selling zero or only a handful of cars, their scores

[5]See discussions by Rob and Fishman [2005] and Roberts [2011] on why it is appropriate to use the aggregate level of comments, such as seller feedback score, as a proxy for seller reputation.

may be largely based on non-car sales and therefore should be interpreted as capturing their overall reputation in the online marketplace.

Warranty classification. Four options are available on eBay for a seller to indicate warranty information/coverage for a car being listed: 'Existing warranty,' 'NO existing warranty,' 'Unspecified,' and 'Enter your own choice.' When using 'Enter your own choice,' a seller can enter a specific description of the warranty, including mileage, duration, power train, engine, transmission, or a combination of the preceding, and different types of warranties such as manufacturer-approved and extended. When warranty information is included in the listing, it is visible in the 'Item specifics' section.

The key regressor in this study is an indicator variable for whether a car has a warranty ($Warranty$). To construct the variable, we classify warranty information provided by the seller in a listing as follows: $Warranty = 1$ if the auction listing indicates an 'Existing warranty' or includes any specified warranty information (e.g., 90 days, 3-month warranty, and $10,000$ miles) or similar descriptions (e.g., 'only power train') under the option of 'Enter your own choice,' and $Warranty = 0$ if the seller has chosen the option of 'No existing warranty' or ' Unspecified,' or has provided any information indicating the lack of a warranty (e.g., 'no warranty included') or similar descriptions (e.g., 'expired' and 'sold as is') under the option of 'Enter your own choice,' or has left that section blank. For robustness checks, we will also account for the types of warranties.

Matching strategy. We use a quasi-experimental approach for estimation. Specifically, we match auction listings into groups based on seller identity, car body type (Convertible, Coupe, Hatchback, Sedan, SUV, and Van), start price (rounded to the nearest thousand), but with a variation in warranty status. This approach results in each group consisting of at least one auction listing with a warranty status equal to one and at least one auction with a warranty status equal to zero. Then, we can use group fixed effects to control for car body type, start price, and the idiosyncratic characteristics of sellers including professional dealership and geographical location. This approach accounts for the possibility, for example, that some buyers strictly prefer to purchase cars from professional dealers or from specific regions due to the consideration of shipping costs. Accordingly, this estimation strategy helps control for observed heterogeneity in car/auction characteristics and unobserved heterogeneity in seller characteristics, allowing us to focus on systematic differences between auctions with and without warranties.

Car body type and start price are used as the key variables in the matching procedure, because cars with the same body type and similar start prices are likely to be substitutes. For body type, it appears that buyers prefer to search the car listings within the same

body type rather than within a particular brand. This observation is suggested by the fact that one of the commonly used search algorithms on eBay Motors, called 'shop by type,' returns all listings of the selected body type. For example, a Mercedes-Benz C-class and a BMW 3 series are comparable models in terms of body type.

Buyers are also likely to consider price as the main factor on eBay, just as they usually do so in the second-hand car market, as almost all auction listings on eBay are for used and well-traveled cars. In addition, in the purchase guide 'What to Look for When Buying a Used Car Online' on the eBay Motors website, the first suggestion for potential buyers is that 'it is important to set up a budget before searching for a used car online.' Therefore, the pool of buyers who are interested in purchasing in the market are expected to be more sensitive to price than to brands.

We now explain the definition of seller identity used in the matching process. Sellers in the eBay car auction market can be distinguished by their usernames. For professional dealers who normally sell multiple cars on eBay, we use their eBay usernames as their identities. However, we cannot do the same for private sellers, as they usually sell one car on eBay (approximately 63 percent of the private sellers in our sample list only one car). Instead, we use the combination of a private seller's geographic location (state level) and the feedback score quartile as the private seller's identity. The reason for including private sellers' geographical locations is that the shipping cost, which is an additional cost to the price paid to the seller, may not be negligible and that potential buyers possibly take the cost into account when submitting their bids.

Summary statistics. The data consist of $10,444$ cars successfully sold through auction listings, with $112,377$ bidders in total. By using the matching strategy, we obtain $3,911$ auction listings matched into 243 groups. Table I presents summary statistics for the matched sample, which we will mainly use for our analysis. On average, cars sold in the auction listings are relatively new with reasonably traveled miles; the mean and the median car age are 2.37 years and 2 years, respectively, and the mean and the median mileage are $25,223$ miles and $19,529$ miles, respectively. The average listing duration is 6.92 days and 95 percent of the auction listings require the winners to pay the shipping costs.[6] 5 percent of all auction listings have a secret reserve and the auction listings include 18 photos on average. Each listing attracted 13 bidders on average and received 38 bids

[6]Most eBay listings in other item categories, including books, cell phones, and computers, charge flat fees or no fee for shipping within the United States. However, in most eBay car auctions, the winners are required to pay the shipping fees, likely because it is expensive to ship cars, especially across different states. Regarding the impact of shipping cost on prices and bidding behavior, see the studies by Tyan [2005]; Hossain and Morgan [2006]; Brown, Hossain, and Morgan [2010].

during the bidding process. Overall, 64 percent, or $2,506$ auctions, have a warranty status equal to one. Although 91 percent of the car auctions are listed by professional dealers, there are still 365 listings by private sellers in the matched sample, which is sufficient for reasonable precision.

According to seller feedback score (which is the average of seller feedback scores across listings within each matched group), the sellers appear to be well experienced; the mean and median are 567 and 529, respectively, suggesting that they understand the rules of the marketplace and seller feedback rating system. It is also observed that professional car dealers have more experience than private sellers, as expected. In addition to the variables listed in Table I, we also observe the seller's geographical location, as well as the bid history for each auction listing that includes bidders' names and the number of bids submitted by a bidder.

Place Table I about here.

Table A1 of the Appendix presents summary statistics for the full sample with $10,444$ car listings. For most variables, the means and medians are similar to those in the matched sample. However, sizable differences exist across the two samples in terms of the proportion of car listings with warranties as well as those from professional dealers; specifically, in the matched sample, 64 percent of the car listings were provided with warranties, and 91 percent were made by professional dealers, as opposed to 44 and 79 percent, respectively, in the full sample. These differences may seem to introduce doubt regarding whether they lead to biased results in our study. To address this, in Section V(i)., we show that our main results hold regardless of whether we use the matched sample or the full sample.

In Table A2 of the Appendix, we report percentage shares of all car makes in the matched sample. In the same table, we also present all manufacturers' warranties for the brands observed in the matched sample. When a new car is purchased, the manufacturer usually provides a warranty covering a certain time period and/or mileage traveled. For example, a Mazda warranty covers 3 years or $36,000$ miles, whichever comes first, for a new car.

In Table A3 of the Appendix, we present descriptive statistics conditional on warranty status for professional dealers and private sellers separately. For both professional dealers and private sellers, the final price of a listing appears to be higher, on average, when it has a warranty than when it does not. Contrastingly, the listings with warranties appear to have lower mileage than those without warranties. Seller feedback score has

a somewhat interesting pattern; the scores are higher for the listings with warranties among professional dealers, while lower among private sellers. The opposite pattern is observed for the start price. Other variables are broadly similar in terms of the mean across warranty status categories.

In Table A4 of the Appendix, we report the results for regressing each of the other listing choices that a seller can make, specifically, number of photos, duration, and shipping fees, on the warranty dummy and its interaction with the natural log of the average seller feedback score across matched listings in each group (Columns (1), (2), and (3)). The results show that the listing choices are not significantly associated with the warranty dummy or its interaction term. Similar results are obtained, when we replace the average feedback score with the dummy variable for professional dealership (Columns (4), (5), and (6)). These results appear to suggest that a warranty cannot be substituted by other listing choices.

IV. EMPIRICAL HYPOTHESES

When a car is listed on eBay, the quality of the car is known to the seller, but the winning bidder does not have this information until after the transaction has taken place. This information asymmetry causes uncertainty on the buyer's side and therefore may reduce the buyer's willingness to pay. The feedback rating system on eBay was designed to mitigate this issue. The feedback score reflects a seller's trading history and experience in the marketplace; it can be interpreted as the overall level of product quality the seller provided previously, helping potential buyers infer the quality of the items currently being auctioned. Intuitively, the higher the seller's feedback score, the more reliable and reputable the seller is, making it more likely that the item is of high quality as well.

In the meantime, warranty protection not only reduces the uncertainty about the unobserved quality for potential buyers but also (partially) covers the costs of future car repairs that buyers may incur. Hence, a buyer's willingness to pay for a car is expected to be higher under a warranty than under no warranty, all else being equal.

From these arguments, it is clear that both warranties and seller reputations essentially serve the same purpose, that is, to eliminate information asymmetry about product quality. Therefore, conditional on facing a reputable seller, the quality of the car can be inferred through the seller's reputation, which in turn lowers buyers' incentives to pay a price premium for a warranty. In other words, a substitutability exists between

seller reputations and warranties. Based on this argument, we propose the following hypothesis:

Hypothesis 1. *Seller feedback scores and warranties are substitutes; that is, a seller with a more established reputation (higher seller feedback score) will obtain a relatively lower premium from a warranty, all else being equal.*

We will test this hypothesis by regressing the final price of an auction listing on the warranty dummy, the interaction term of the warranty dummy and a measure for seller reputation as well as control variables. This hypothesis will be supported by the data if the interaction term is negatively and significantly associated with the final price. We will detail our estimation models and methods in the next section.

It is also of interest to examine how a warranty affects bidders' bidding strategies and the associated revenues across sellers. As mentioned in the Introduction, it is theoretically well-known that information asymmetry becomes relatively less important when repeated interactions are possible (Mailath and Samuelson [2006], [2015]). In the eBay car auction market, professional dealers can be considered as 'repeated-game players' and private sellers as 'one-shot players.' Thus, we expect that warranties are more effective for private sellers to use to eliminate information asymmetry.

Hypothesis 2. *Compared to professional dealers, private sellers enjoy more benefits from warranties, all else being equal.*

We further investigate the substitutability of warranties for feedback scores across the two types of sellers. Since a warranty is more useful for private sellers, the substitutability of a warranty for a private seller's reputation is expected to be stronger than that for a professional dealer's reputation. If so, the coefficient on the interaction term of interest should be larger in magnitude for private sellers than that for professional dealers.

Hypothesis 3. *The substitutability between warranties and feedback scores for private sellers is larger than that for professional dealers, all else being equal.*

We next illustrate how buyers with different levels of experience respond to the presence of a warranty and to different types of sellers in the auctions. Note that a professional dealership can be interpreted as another measure for seller reputation. eBay buyers have their own feedback scores that reflect the number of transactions each buyer has completed. We can use the scores to measure buyers' experiences in the marketplace. Intuitively, a less experienced buyer would need more information, such as whether a car

is sold with a warranty or whether a seller is a professional dealer, to evaluate the quality of the car and then decide willingness to pay. At the same time, the more experience a buyer has, the better he/she will be at estimating the quality of the car. This argument leads to the following testable hypothesis:

Hypothesis 4. *A buyer with more experience (as measured by buyer feedback score) is less willing to pay a premium for the presence of a warranty or for a professional dealership, all else being equal.*

V. EMPIRICAL ANALYSIS

V(i). *The Impacts of Warranty and Substitution for Seller Feedback Score*

We assume that the natural log of the final price ($Final\ Price$) depends on the presence of a warranty ($Warranty$), the level of seller reputation as measured by average seller feedback score ($AVESFeed$) across matched listing observations in each group, and a set of control variables ($Controls$) in the following manner:

$$\ln(Final\ Price_{ig}) = \alpha_g + \beta Warranty_{ig} + \gamma Warranty_{ig} \times \ln(AVESFeed_g) + \delta Controls_{ig} + \varepsilon_{ig}, \tag{1}$$

where g indexes a group of auction listings matched by seller identity, car body type, and start price; i indexes a specific listing within the matched group; α_g captures the group fixed effect; and ε_{ig} is an error term that captures unobserved characteristics varying within the group. The interaction term in equation (1) captures the substitutability of a warranty for a seller's reputation and its coefficient γ reflects how buyers' responses to warranties vary with average seller feedback scores. Since there is no variation in $AVESFeed_g$ across matched listings within each group, its effect per se is absorbed by the group fixed effect α_g (and hence, $AVESFeed_g$ cannot be included as an individual regressor). See the study by Elfenbein, Fisman, and McManus [2012] for a similar estimation approach.

In equation (1), $Controls$ contain observable variables of the characteristics of the car and of the auction listing, specifically, the make of the listed car (make fixed effects), the natural log of car age,[7] the natural log of mileage, the number of photos, who pays

[7]Since we cannot observe the exact purchasing time of a car by the original seller and the transaction time after the auction ends, the car age is computed by using the product year for the car and the year of the auction listed on eBay.

shipping costs (equal to one if the winner pays for shipping), secret reserve status, listing duration, number of entering bidders, and week fixed effects (which week of the year the listing starts). For inference, we use robust standard errors clustered at the seller level.

Place Table II about here.

The estimation results for equation (1) are presented in Column (1) of Table II. We find that buyers respond positively to warranties; the average price premium in the auction listings with warranties is an increase in the final price by approximately 68 percent for a seller with the minimum transaction history in the market. The coefficient on the interaction term is negative and significant at the one percent level; on average, the price premium for listings with warranties is decreased by 0.1 percentage points for each percent the seller's feedback score increases, suggesting that a better seller reputation lowers the price premium from a warranty. There appears to exist a significant substitutability between a warranty and seller reputation.

To further investigate how a warranty affects the final price of an auction for different levels of seller reputation, we classify all sellers in the matched sample by average feedback score quartiles (the cutoffs are 180, 529, and 892). We then estimate a variant of equation (1):

$$\begin{aligned} \ln(Final\ price_{ig}) = {} & \alpha_g + \beta Warranty_{ig} \\ & + \sum_{j=2}^{4} \gamma_j \Big(Warranty_{ig} \times AVESFeedQ(j)_g \Big) \\ & + \delta Controls_{ig} + \varepsilon_{ig}, \end{aligned} \tag{2}$$

where $AVESFeedQ(j)_g$ ($j = 2, 3, 4$) is a dummy variable that equals one if the average feedback score belongs to the jth quartile (the first quartile is the base category). Because $AVESFeedQ(j)_g$ is constructed from $AVESFeed_g$, it does not vary across matched listings within each group; its effect is therefore fully captured by the group fixed effect α_g in a similar manner to $AVESFeed_g$ in equation (1). The coefficients of interest are γ_j ($j = 2, 3, 4$), which capture the effects of the warranty on the final price in each of the seller feedback score quartiles. As presented in Column (2) of Table II, these results are consistent with Hypothesis 1 that there exists a substitutability between seller reputations and warranties. Notably, the coefficients on the interaction terms are not significantly different from one another; the substitutability between a warranty and a seller's reputation may not differ across feedback score quartiles.

We drop the variable for the number of bidders and then re-estimate equations (1) and (2), as entry by bidders may be an endogenous variable that would result in a bias in our estimators. As reported in Columns (3) and (4) of Table II, our results remain unchanged; the presence of a warranty significantly increases the final price, and the price premium decreases as a seller has a more established reputation.

We also run regressions with the full sample of $10,444$ auction listings without grouping but including the natural log of start price, body type fixed effects, and seller fixed effects. We use seller feedback score ($SFeed_{ig}$) as a proxy for reputation, instead of average seller feedback score across matched listings ($AVESFeed_g$). This estimation serves as a benchmark to examine whether and to what extent our main results from the matched sample are driven by dropping unmatched observations. As presented in Columns (5) and (6) of Table II, the coefficients on the interaction terms are negative and significant at the one percent level, indicating that our main results do not depend on whether we drop unmatched auction listings from the estimation sample. Furthermore, Columns (7) and (8) show that the results still hold even when we exclude the variable for the number of bidders from a set of regressors.

All the estimated coefficients on the control variables for Columns (1) - (8) are reported in Table A5 for the sake of space. To summarize briefly, the coefficients are found to be consistent with what would be intuitively expected. For example, car age and mileage, the most important characteristics of a used car, are negatively correlated with the final price; the sellers' choices for the auction listing such as having a secret reserve also influence the final price.

Place Table III about here.

To investigate Hypothesis 2, we replace average seller feedback score with the dummy variable for professional dealership in equation (1), thereby inquiring as to whether or not a warranty and professional dealership status are substitutes. We present the results in Column (1) of Table III. Consistent with our hypothesis, the coefficient on the interaction term is negative and significant at the one percent level. While a warranty generates a price premium of 44 percent for private sellers, professional dealers obtain a very small price premium in auction listings with a warranty. This result provides supporting evidence that a professional dealer will enjoy less of a price premium from having a warranty in an auction listing. Furthermore, these empirical findings still hold (i) when we exclude the variable for the number of bidders from a set of control variables (Column (2)) and (ii) when we use the full sample of auction listings without grouping

but control for the natural log of start price, body type fixed effects, and seller fixed effects (Columns (3) and (4)).

We next examine professional dealers and private sellers separately by estimating equation (1) for each seller type. This approach allows us to further check whether professional dealers obtain a relatively lower price premium in auction listings with a warranty than private sellers and, more importantly, to examine the empirical validity of Hypothesis 3, i.e., whether the magnitude of the substitutability between warranties and feedback scores for professional dealers is smaller than for private sellers. Columns (5) and (6) in Table III report the estimation results for private sellers and professional dealers, respectively. We find that the effect of a warranty on the final price is far larger for private sellers (100 percent) than for professional dealers (29 percent). More importantly, the estimated coefficients on the interaction terms reveal that for each additional percent increase in seller feedback score, the effect of a warranty decreases by 0.15 percentage points for private sellers, but only by 0.04 percentage points for professional dealers. These results are consistent with Hypothesis 3.

Interaction between a warranty and an optional choice. In addition to warranties, other mechanisms can be used to eliminate information asymmetry about the quality of cars in auction listings. For example, Lewis [2011] shows that posting more photos reduces information asymmetry between sellers and buyers and therefore increases the price of the listing. Bajari and Hortacsu [2003] empirically show that a secret reserve price is more often used with high-value items than with low-value items. If a warranty is correlated with an auction attribute chosen by the seller (e.g., number of photos and secrete reserve price), then the substitutability of a warranty for a seller's reputation that we have identified may be an artifact of omitting the interaction term of the warranty dummy with the auction attribute. To address this possibility, we estimate equation (1) by adding an interaction term of the warranty dummy with each optional choice, namely, number of photos, start price, secret reserve, listing duration, and buyer shipping.

The results are reported in Columns (1) to (5) of Table A6. We find that our main results do not change at least qualitatively; the final price is positively (negatively) and significantly associated with the warranty dummy (its interaction term with the average feedback score). Similar results are obtained, when we replace average feedback scores with professional dealerships (Columns (6) to (10)). Overall, our main results appear to be robust to including an additional interaction term of the warranty dummy and an optional choice.

Interaction between a warranty and mileage. Buyers' willingness to pay for the presence of a warranty may be directly related to the mileage of a car. In particular, it is possible that as a car is nearing the expiration of the warranty's mileage, the value of the warranty lowers. To examine this possibility, we explore the interaction between a warranty and mileage, and further, the triple interaction between a warranty, mileage, and seller reputation. For this purpose, we examine the auction listings for which their manufacturer warranties cover $36,000$ miles, which consists of a majority of matched observations (see Table A2 of the Appendix).

To capture both mileage and the closeness of the expiration of a warranty's mileage in a simple fashion, we construct three mutually exclusive dummy variables for mileage: (1) $TM1 = 1$ if the mileage falls under the range $0 - 18,000$; (2) $TM2 = 1$ if it falls under the range $18,001 - 36,000$; and (3) $TM3 = 1$ (which is used as the base category) if it is greater than $36,000$. We then regress the natural log of final price on the warranty dummy, mileage dummies, the interaction terms between the warranty dummy and mileage dummies, and the triple interaction terms among the warranty dummy, mileage dummies and the natural log of average seller feedback score, as well as control variables.

As reported in Column (1) of Table A7, the warranty dummy is positively and significantly associated with the final price. Consistent with intuition, a monotonic and decreasing trend emerges in the coefficients on mileage categories; on average, buyers appear to be willing to pay more for cars with lower mileage. The interaction terms between the warranty dummy and mileage dummies are not found to be significant at the ten percent level; in other words, there is little evidence that buyers' willingness to pay for a warranty varies with different mileage.

Place Figure 1 about here.

Notably, the coefficients on the triple interaction terms are negative and significant at least at the ten percent level, indicating that the substitutability of a warranty for a seller's reputation exists regardless of mileage categories. The substitutability is also supported by the average marginal effects of a warranty across average seller feedback score quartiles; as is illustrated in Figure 1, the effect of a warranty on the final price appears to be smaller for more established sellers. A similar pattern is also observed for each mileage category (Figure 2). We further find that the coefficients on the triple interaction terms are not significantly different from one another; the substitutability between a warranty and a seller's reputation may not significantly differ across mileage categories. For the robustness check, we drop car listings in the $TM3$ category from

the estimation sample and rerun the regression. The results exhibit generally similar patterns as before (Column (3)), suggesting that our results are not driven by car listings with mileage greater than $36,000$. Furthermore, at least qualitatively, all these results do not change when we examine professional dealerships as a measure for seller reputations (Columns (2) and (4)).[8]

Place Figure 2 about here.

The option of 'Unspecified.' We have treated the option of 'Unspecified' as no warranty and set the warranty dummy equal to zero for the listings that choose this option. If potential buyers consider 'Unspecified' as being different from no warranties, the warranty dummy would be subject to measurement error due to misclassification, which may result in a bias in our estimators. To address this issue, we exclude all the listing observations with the option of 'Unspecified' from the sample and then regroup the rest of the listings ($3,413$ observations in total). As presented in Columns (5) and (6) of Table A7, the results show that a warranty still significantly affects the final price and can substitute for seller feedback score and professional dealership status.

Bidders' entries and bidding times. We have provided evidence that the presence of a warranty has an effect on the final price, interpreting it as the warranty increasing bidders' willingness to pay. It is possible, however, that the effect of a warranty on the final price is a consequence of the warranty attracting more entries by bidders and/or inducing each bidder to submit more bids. To determine whether this is the case, we examine the impacts of a warranty on bidders' entries and bidding times by estimating a variant of equation (1) where the dependent variable is separately replaced by each of these two variables and all control variables (except bidders' entries) are included as before. As presented in Columns (7) to (10) of Table A7, the estimated coefficients on warranty and on its interactions are not significant, suggesting that the presence of a warranty does not influence bidders' entries or bidding times. This observation supports that our main results are not attributed to more entries or more frequent bidding times by bidders.

Other bidders' willingness to pay. In the auction listings, the final price is the second highest bid; therefore, the value of the winning bid is not observable in the data. One might wonder if our results only hold true for winners but not for other bidders, as

[8]We also estimate the same models for the auction listings in which their manufacturer warranties cover 50,000 miles. The results show that the final price is not significantly associated with the warranty dummy or the interactions of the warranty dummy with mileage dummies, which may be attributed to a smaller sample size along with collinearity resulting from the interaction terms.

only the winners who prefer a warranty may be attracted to entering auctions with a warranty and submitting higher bids. To address this question, we estimate equation (1) by replacing the dependent variable with the natural log of the b-highest bid where $b = 3, 4, 5$. As reported in Table A8, even for the third, fourth, and fifth highest bids, the results are largely consistent with the relationships we hypothesize between a warranty and the average seller feedback score/professional dealership.

V(ii). *Buyer Experience*

In this subsection, we examine the last hypothesis – Hypothesis 4 – regarding how buyers' responses to warranties and professional dealerships vary with their experience in the marketplace. Our first interest here is in analyzing bidders who participate in auction listings both with and without warranties to identify the effect of a warranty on a buyer' willingness to pay. This analysis will also help us clarify the concern that the price premium from a warranty, as presented above, may result from distinct segments of consumers being systematically attracted by auctions with and without a warranty.

For this purpose, we modify the matching strategy as follows: We match the auction listings into groups with the same combination of bidder identity, car body type, and start price (rounded to the nearest thousand), but with a variation in warranty status. Since a bidder may submit multiple bids in an auction, we restrict our attention to the maximum bid submitted by the bidder as the dependent variable in each auction listing in the matched groups. After matching, the matched sample consists of $7,026$ groups (i.e., the number of bidders who submitted bids in auctions with and without warranties), and each group contains 13.2 auction listings on average.

We regress the maximum bid on the warranty dummy and its interaction term with the natural log of average buyer feedback score ($AVEBFeed$) across the matched listings (which is used to capture the buyer's experience), along with control variables related to the characteristics of the car, the auction, and the seller. As presented in Column (7) of Table III, the estimated coefficient on the warranty dummy is positive and significant at the one percent level, suggesting that the price premium from a warranty is not a result of systematically attracting distinct segments of buyers. More notably, the coefficient on the interaction term is found to be negative and significant, indicating that buyers with more market experience tend to pay less for warranties.

We next investigate the relationship between buyer experience and their responses to professional dealerships. In particular, we examine whether or not buyers with more

experience (represented by higher feedback scores) will pay less in auctions run by professional dealers. For this purpose, we match the auction listings into groups with the same combination of bidder identity, car body type, and start price (rounded to the nearest thousand), but with a variation in professional dealership status. As reported in Column (8) of Table III, the coefficient on the dummy variable for professional dealership is positive and significant, indicating that buyers respond positively to professional dealerships. This effect becomes smaller as the buyer experience increases, represented by the estimated coefficient on the interaction term between professional dealership and the natural log of average buyer feedback score across matched listings in each group. According to the point estimates of these coefficients, the buyer's maximum bid is 20 percent higher for professional dealers than that for private sellers, when the buyer has the minimum experience (i.e., the feedback score equals one); for an additional percent increase in the feedback score, the maximum bid for professional dealers decreases by 0.05 percentage points.

Overall, Hypothesis 4 is supported by the data; buyers respond positively to the presence of a warranty and to professional dealerships, suggesting that both have effects that reduce information asymmetry and increase buyers' willingness to pay. Their willingness to pay for both decreases, however, when buyers become more experienced and familiar with the market.

V(iii). *Specified Warranties*

We have used the dummy variable for warranties to examine whether and how the final price depends on the presence of a warranty. It should be noted, however, that regarding the warranty classification in Section III., there exists a variety of warranties, including different protection policies covering different parts of a car. Moreover, the option of 'Existing warranty' seems to be outside the seller's control because it carries over from the original purchase, whereas the option of 'Enter your own choice' could be viewed as a strategic choice for the seller to reveal quality and substitute for seller reputation. It is therefore of interest to inquire whether types of warranties matter to our main results.

To answer this question, we use detailed warranty information provided in each auction listing and thereby classify auction listings with warranties into three subcategories. The first subcategory consists of those with 'Existing warranty.' The auction listings for which the warranty has been extended or a certified warranty is provided, are also classified into this subcategory. The rest of the auction listings with warranties (including

specified warranty information under the option of 'Enter your own choice') are broadly classified into two other subcategories, specifically, 'Day and/or mileage' (DM for short) and 'Warranty on parts' (Parts for short). The former consists of the listings for which the seller includes any warranty specifications for duration and/or mileage; the latter comprises those for which the seller specifies a warranty covering any specific parts of the car, such as power train and engine. For each subcategory, we set up a dummy variable; for example, if the listing belongs to DM, the DM dummy takes a value of one for that listing.

We next follow our matching strategy to group the listings separately for the three warranty subcategories. For a specific warranty subcategory, we ensure variation in each matched group such that (1) at least one listing should belong to that warranty subcategory and (2) at least one listing does not have any warranty. Based on this matched data, we then re-estimate equation (1) for each subcategory. The results are reported in Table IV.

Place Table IV about here.

As presented in Columns (1) and (2), 'Existing warranty' exhibits the same pattern as before; it increases the final price and its price premium decreases for higher seller feedback scores and for professional dealers, consistent with Hypotheses 1 and 2. For the DM category, the coefficients on the DM dummy and its interaction with seller reputation are consistent in sign with Hypothesis 1, although not significant (Column (3)). The results also show that the price premium from a warranty is smaller for professional dealers than that for private sellers (Column (4)), as predicted by Hypothesis 2. Similar results are obtained for the Parts category (Columns (5) and (6)). Overall, this analysis largely confirms our findings that a warranty and seller reputation are substitutes.

V(iv). *Manufacturer Warranty vs. Nonmanufacturer Warranty*

A manufacturer warranty may considerably differ from an extended warranty or a warranty provided by a professional dealer in terms of its value to buyers. It is then possible that the substitutability of a warranty for seller reputation differs between a manufacturer warranty and a nonmanufacturer warranty. To explore this possibility, we use information on the standard warranties provided by manufacturers (see Table A2) and thereby classify a car listing as being under a manufacturer warranty if both the car age and mileage are less than the standards specified in the manufacturer warranty.

Table A9 presents the fractions of car listings under manufacturer and nonmanufacturer warranties across seller types. Approximately 70 percent of car listings with warranties are under manufacturer warranties for professional dealers, as opposed to 55 percent for private sellers. At the same time, most of the car listings under no warranty are no longer covered by manufacturer warranties (95 percent for professional dealers and 97 percent for private sellers).[9]

Place Table V about here.

Using data on car listings with warranties only, we regress the natural log of final price on the dummy variable for whether the warranty is a manufacturer one, its interaction with average seller feedback score (or professional dealership) and control variables. As presented in Columns (1) to (4) in Table V, the coefficients of interest are not significant even at the ten percent level; in other words, there is minimal evidence for differences between a manufacturer warranty and a nonmanufacturer one in terms of price premium and substitutability. These results suggest that in a used car market, buyers may not distinguish between manufacturer and nonmanufacturer warranties in their bids.

V(v). *Lemon Laws*

In the United States, ten states have used car laws,[10] providing legal remedies for buyers who purchase a used car that does not meet certain standards of quality or performance. Such laws are often called lemon laws. Generally, they require used car sellers to offer buyers a warranty (certain numbers of days and miles). The existence of lemon laws may render individual warranties less consequential and as a result, the quality of cars sold in a specific state is possibly systematically correlated with warranty status. To address this issue, we generate an indicator variable for whether the state is one of the ten states with lemon laws and examine whether or not our main results are robust to controlling for implementation of lemon laws.

Place Table VI about here.

[9] Although 68 car listings (62 for professional dealers and 6 for private sellers) satisfy the specified standards of the manufacturer warranty, they are reported by the sellers as having no warranties. This may be attributed to the fact that a car's manufacturer warranty can be invalidated for reasons such as particular modifications, being misused for racing, being unserved on time, or being served by an unapproved warranty provider.

[10] The ten states are Arizona, Connecticut, Hawaii, Illinois, Massachusetts, Minnesota, New Jersey, New Mexico, New York, and Rhode Island.

As reported in Columns (1) to (4) in Table VI, the coefficients on the warranty dummy and on its interaction terms remain statistically significant with the same sign as before. The results also provide minimal evidence for the association between the laws and the final prices; for three models out of the four, the coefficient on the dummy for lemon laws is not significant even at the ten percent level. Further, we explore the possibility that both the price premium from a warranty and the substitutability of a warranty for seller reputation depend on lemon laws. For this purpose, we interact the lemon law dummy with the warranty dummy and its interaction terms with seller reputations (feedback and dealership). The estimation results are reported in Columns (5) to (8), showing that most of the interaction terms that involve the lemon law dummy are not significant. Our main results therefore do not appear to depend on those laws.

V(vi). *Different Categories for Body Types*

It is possible that buyers' responses to warranties and seller reputation vary across different car categories. To examine this possibility, we broadly divide auction listings into four categories according to car body types: (1) Sedan and Hatchback, (2) SUV, (3) Coupe and Convertible, and (4) Van. For each category, we then estimate equation (1). For this estimation, we use matched data where the auction listings are regrouped according to the combination of seller identity and start price rounded to the nearest thousand (which results in 142 groups for Sedan and Hatchback, 48 for SUV, 35 for Coupe and Convertible, and 18 for Van). The results are reported in Columns (1), (3), (5), and (7) of Table VII.

Place Table VII about here.

For Sedan and Hatchback (Column (1)) and Coupe and Convertible (Column (5)), the price premium from a warranty is positive and significant and decreases as the seller has a higher reputation, consistent with Hypothesis 1. According to the point estimates, the premium from a warranty as well as the magnitude of its substitutability for seller reputation are larger for Coupe and Convertible than for Sedan and Hatchback. Contrastingly, the presence of a warranty and its interaction with average seller feedback score do not appear to play a role in the determination of the final price for SUV (Column (3)), although each of the coefficients of interest has an expected sign. For Van (Column (7)), we obtain imprecise estimates of the coefficients of interest, possibly due to a relatively small sample size.

We also examine the interaction between a warranty and professional dealership status for each category, as presented in Columns (2), (4), (6), and (8). For each category, the results are consistent with Hypothesis 2 in that professional dealers enjoy less benefits from warranties than private sellers, as evident from the negative sign of the coefficient on the interaction term. The price premium from a warranty and its substitutability for professional dealership are similar in size across the four categories. Overall, our main results appear to be robust to accounting for different car categories.

VI. Conclusion

Using data from the eBay car auction market, we examined several predictions regarding warranties, seller reputation, and buyer experience in the determination of the final price with close attention to their interactions. We found that the presence of a warranty induces higher willingness to pay on the part of buyers and that the price premium from a warranty varies across different seller reputation levels: the better the seller reputation is, the lower the premium becomes, implying that an individual-level warranty and seller reputation, both of which can be used to eliminate information asymmetry, have a substitution relationship. This finding contrasts with the result that a market-level warranty cannot substitute for an individual seller's reputation, as found in Roberts [2011].

We also found that the effect of a warranty on the final price varies across different types of sellers. Specifically, compared to private sellers, professional sellers, who are long-term players in the market and therefore have higher incentives to maintain better reputations, obtain less benefit from warranties; further, the substitutability of a warranty for a seller's reputation is smaller for professional dealers than for private sellers, which is in line with theoretical predictions in the literature. Finally, our findings show that buyer experience plays an important role in determining willingness to pay; a buyer who has more market experience will pay less of a premium for a warranty and for buying from a professional dealership.

A possible limitation of this study is that although we used a matching technique along with group fixed effects for estimation, we might not have fully controlled for unobserved car characteristics, some of which may be correlated with whether sellers provide warranties for car listings. To address this source of bias, one could use instrumental variables; however, we do not have relevant instruments, as in many other studies. The results of this study, therefore, should be interpreted with this caveat in mind.

Although this study focused on the eBay car market, our findings are particularly relevant to inquiries into the impact of information disclosure mechanisms on buyers' willingness to pay. On this point, we stress the importance of paying attention to the interactions among the signaling mechanisms and their effects on consumer preferences. We also hope that our results help better understand how trust can be established between market participants through different forms of information disclosure. We conclude this study with a suggestion that online marketplaces not only continuously innovate and improve their reputation rating systems for monitoring sellers but also take into account the impacts of other factors, such as seller types and buyer experiences.

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Table I.
DESCRIPTIVE STATISTICS FOR
THE MATCHED SAMPLE OF AUCTION LISTINGS.

	Obs.	Mean	S.D.	Median	Min	Max
Auction Characteristics						
Final Price	3911	19342.40	10043.79	17801.00	200.00	121000.00
Start Price	3911	467.45	1573.47	200.00	0.01	26999.00
Secret Reserve	3911	0.05	0.22	0.00	0.00	1.00
Photos	3911	18.09	4.84	20.00	1.00	20.00
Buyer Shipping	3911	0.95	0.21	1.00	0.00	1.00
Duration	3911	6.92	1.05	7.00	3.00	10.00
Number of Bidders	3911	13.44	4.31	13.00	1.00	29.00
Number of Bids	3911	38.60	16.48	37.00	1.00	149.00
Car Characteristics						
Car Age	3911	2.37	1.04	2.00	1.00	4.00
Mileage	3911	25223.77	26873.30	19529.00	1.00	999999.00
Body Type						
Convertible	3911	0.01	0.12	0.00	0.00	1.00
Coupe	3911	0.07	0.25	0.00	0.00	1.00
Hatchback	3911	0.03	0.17	0.00	0.00	1.00
Sedan	3911	0.54	0.50	0.00	0.00	1.00
SUV	3911	0.30	0.46	0.00	0.00	1.00
Van	3911	0.05	0.21	0.00	0.00	1.00
Seller Characteristics						
Seller Feedback Score	3911	567.00	405.89	529.00	1.00	1772.00
Professional Dealership	3911	0.91	0.29	1.00	0.00	1.00
Warranty Status						
Warranty	3911	0.64	0.48	1.00	0.00	1.00
Seller Feedback Score (By Auction Listings)						
Professorial Dealers	3546	610.00	399.72	583.00	5.00	1772.00
Private Sellers	365	149.25	143.45	95.00	1.00	606.00

Note: Convertible, Coupe, Hatchback, Sedan, SUV, and Van are dummy variables.

Table II.
MAIN RESULTS 1.

ln(Final Price)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Warranty	0.683***	0.256***	0.686***	0.252***	0.451***	0.283***	0.450***	0.282***
	(0.12)	(0.05)	(0.12)	(0.05)	(0.08)	(0.03)	(0.07)	(0.04)
WarrantyXln(AVESFeed)	-0.103***		-0.103***					
	(0.02)		(0.02)					
WarrantyXAVESFeedQ(2)		-0.145***		-0.138***				
		(0.05)		(0.05)				
WarrantyXAVESFeedQ(3)		-0.245***		-0.241***				
		(0.05)		(0.06)				
WarrantyXAVESFeedQ(4)		-0.247***		-0.242***				
		(0.05)		(0.05)				
ln(SFeed)					-0.035		-0.039	
					(0.02)		(0.02)	
WarrantyXln(SFeed)					-0.049***		-0.049***	
					(0.02)		(0.02)	
SFeedQ(2)						-0.024		-0.036
						(0.05)		(0.06)
SFeedQ(3)						-0.037		-0.054
						(0.06)		(0.06)
SFeedQ(4)						-0.135**		-0.152**
						(0.07)		(0.07)
WarrantyXSFeedQ(2)						-0.071		-0.069
						(0.04)		(0.04)
WarrantyXSFeedQ(3)						-0.169***		-0.167***
						(0.06)		(0.06)
WarrantyXSFeedQ(4)						-0.170***		-0.168***
						(0.05)		(0.06)
Number of Bidders	0.012***	0.012***			0.013***	0.013***		
	(0.00)	(0.00)			(0.00)	(0.00)		
Matched Groups	Y	Y	Y	Y	N	N	N	N
Make Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y
Week Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y
Seller Fixed Effect	-	-	-	-	Y	Y	Y	Y
Body Type Fixed Effect	-	-	-	-	Y	Y	Y	Y
R^2 (Adjusted)	0.43	0.43	0.41	0.42	0.45	0.45	0.43	0.44
Observations	3911	3911	3911	3911	10444	10444	10444	10444

Note: For convenience, we denote the natural log of average seller feedback score (seller feedback score) by ln(AVESFeed) (ln(SFeed)), professional dealership by Dealer, private sellers by Private, and average seller feedback score quartiles (seller feedback score quartiles) byAVESFeedQ(j) (SFeedQ(j)), where $j = 2, 3, 4$. Control variables are included into each of the models and their results are presented in Table A5 of Appendix. Standard errors clustered at the seller level are in parentheses. $***$, $**$, and $*$ denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table III.
MAIN RESULTS 2.

	(1)	(2)	(3)	(4)	Private (5)	Dealer (6)	ln(Max Bid) (7)	ln(Max Bid) (8)
Warranty	0.436***	0.432***	0.407***	0.408***	1.024***	0.289**	0.410***	
	(0.06)	(0.06)	(0.03)	(0.03)	(0.28)	(0.14)	(0.03)	
WarrantyXDealer	-0.392***	-0.388***	-0.358***	-0.359***				
	(0.06)	(0.06)	(0.04)	(0.04)				
WarrantyXln(AVESFeed)					-0.147**	-0.042*		
					(0.06)	(0.02)		
WarrantyXln(AVEBFeed)							-0.015***	
							(0.01)	
Dealer								0.199***
								(0.05)
DealerXln(AVEBFeed)								-0.050***
								(0.01)
Number of Bidders	0.013***		0.013***		0.010	0.013***		
	(0.00)		(0.00)		(0.01)	(0.00)		
Matched Groups	Y	Y	N	N	Y	Y	Y	Y
Make Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y
Week Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y
Seller Fixed Effect	-	-	Y	Y	-	-	-	-
Body Type Fixed Effect	-	-	Y	Y	-	-	-	-
R^2 (Adjusted)	0.43	0.42	0.46	0.45	0.61	0.41	0.06	0.06
Observations	3911	3911	10444	10444	365	3546	92449	73837

Note: For convenience, we denote the natural log of average seller feedback score by ln(AVESFeed), the natural log of avergae buyer feedback score by ln(AVEBFeed), professional dealership by Dealer, private sellers by Private. All other control variables are also included. In Columns (1) to (6), standard errors clustered at the seller level are in parentheses. In Columns (7) and (8) standard errors clustered at the buyer level are in parentheses. $***$, $**$, and $*$ denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table IV.
THE IMPACTS OF SPECIFIED WARRANTIES.

ln(Final Price)	(1)	(2)	(3)	(4)	(5)	(6)
Existing	0.773***	0.430***				
	(0.12)	(0.06)				
ExistingXln(AVESFeed)	-0.104***					
	(0.02)					
ExistingXDealer		-0.331***				
		(0.06)				
DM			0.138	0.215*		
			(0.14)	(0.11)		
DMXln(AVESFeed)			-0.03			
			(0.02)			
DMXDealer				-0.266**		
				(0.11)		
Part					0.363	0.238*
					(0.22)	(0.12)
PartXln(AVESFeed)					-0.062*	
					(0.03)	
PartXDealer						-0.280**
						(0.12)
Matched Groups	Y	Y	Y	Y	Y	Y
Make Fixed Effect	Y	Y	Y	Y	Y	Y
Week Fixed Effect	Y	Y	Y	Y	Y	Y
R^2 (Adjusted)	0.44	0.44	0.42	0.42	0.43	0.43
Observations	3621	3621	2760	2760	2407	2407

Note: For convenience, we denote Day and/or Mileage by DM, Warranty on Parts by Parts, the natural log of seller feedback score by ln(AVESFeed), and professional dealership by Dealer. Standard errors clustered at the seller level are in parentheses. $***$, $**$, and $*$ denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table V.
MANUFACTURER WARRANTY.

ln(Final Price)	(1)	(2)	(3)	(4)
Manufacturer	0.005	0.21	0.037	0.217
	(0.11)	(0.18)	(0.11)	(0.18)
ManufacturerXln(AVESFeed)	0.003		-0.002	
	(0.02)		(0.02)	
ManufacturerXDealer		-0.191		-0.194
		(0.18)		(0.18)
Number of Bidders			0.014***	0.014***
			(0.00)	(0.00)
Make Fixed Effect	Y	Y	Y	Y
Week Fixed Effect	Y	Y	Y	Y
R^2(Adjusted)	0.39	0.39	0.41	0.41
Observations	2506	2506	2506	2506

Note: For convenience, we denote the natural log of average seller feedback score by ln(AVESFeed), professional dealership by Dealer, and manufacturer warranty dummy by Manufacturer. Columns (1) to (4) are the results conditional on Warranty Dummy = 1 and other controls and group fixed effect are also included. Standard errors clustered at the seller level are in parentheses. $***$, $**$, and $*$ denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table VI.
LEMON LAWS.

Ln(Final Price)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Warranty	0.684***	0.431***	0.680***	0.434***	0.641***	0.631***	0.413***	0.422***
	(0.12)	(0.06)	(0.12)	(0.06)	(0.12)	(0.13)	(0.06)	(0.07)
Lemon Law	-0.075	-0.092	-0.112	-0.130*	-0.089	-0.089	-0.100	-0.097
	(0.08)	(0.08)	(0.07)	(0.08)	(0.07)	(0.07)	(0.08)	(0.08)
WarrantyXln(AVESFeed)	-0.103***		-0.102***		-0.097***	-0.095***		
	(0.02)		(0.02)		(0.02)	(0.02)		
WarrantyXDealer		-0.389***		-0.393***			-0.374***	-0.385***
		(0.06)		(0.06)			(0.06)	(0.07)
WarrantyXLemonLaw					0.135*	0.210	0.080	0.039
					(0.07)	(0.26)	(0.08)	(0.12)
WarrantyXln(AVESFeed)XLemonLaw						-0.015		0.072
						(0.05)		(0.17)
WarrantyXDealerXLemonLaw								0.072
								(0.17)
Number of Bidders			0.012***	0.013***				
			(0.00)	(0.00)				
Matched Groups	Y	Y	Y	Y	Y	Y	Y	Y
Make Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y
Week Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y
R^2(Adjusted)	0.41	0.42	0.43	0.43	0.41	0.41	0.42	0.42
Observations	3911	3911	3911	3911	3911	3911	3911	3911

Note: For convenience, we denote the natural log of average seller feedback score by ln(AVESFeed), professional dealership by Dealer, and lemon law dummy by Lemon Law. Standard errors clustered at the seller level are in parentheses. $***$, $**$, and $*$ denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table VII.
THE IMPACTS OF A WARRANTY ACROSS DIFFERENT CAR BODY TYPE CATEGORIES.

ln(Final Price)	SH		SUV		CC		Van	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Warranty	0.668***	0.414***	0.279	0.399***	0.757**	0.399**	0.023	0.454***
	(0.17)	(0.07)	(0.20)	(0.12)	(0.33)	(0.18)	(0.20)	(0.08)
WarrantyXln(AVESFeed)	-0.099***		-0.033		-0.124**		0.014	
	(0.03)		(0.03)		(0.06)		(0.03)	
WarrantyXDealer		-0.365***		-0.341**		-0.430**		-0.385***
		(0.08)		(0.13)		(0.18)		(0.10)
Matched Groups	Y	Y	Y	Y	Y	Y	Y	Y
Make Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y
Week Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y
R^2 (Adjusted)	0.47	0.48	0.34	0.35	0.49	0.49	0.40	0.42
Observations	2229	2229	1173	1173	320	320	189	189

Note: For convenience, we denote the natural log of average seller feedback score by ln(AVESFeed), and professional dealership by Dealer. Columns (1) and (2) are for Sedan and Hatchback, denoted by SH; Columns (3) and (4) for SUV; Columns (5) and (6) for Coupe and Convertible, denoted by CC; Columns (7) and (8) for Van. All other control variables are also included. Standard errors clustered at the seller level are in parentheses. $***$, $**$, and $*$ denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Appendix

Table A1.
DESCRIPTIVE STATISTICS FOR THE FULL SAMPLE OF AUCTION LISTINGS.

	Obs.	Mean	S.D	Median	Min	Max
Auction Characteristics						
Final Price	10444	19028.49	13684.12	15900.00	200.00	284999.00
Start Price	10444	3770.89	10103.67	200.00	0.01	284999.00
Secret Reserve	10444	0.17	0.38	0.00	0.00	1.00
Photos	10444	15.29	6.72	20.00	0.00	20.00
Buyer Shipping	10444	0.92	0.28	1.00	0.00	1.00
Duration	10444	6.68	1.52	7.00	3.00	10.00
Number of Bidders	10444	10.76	5.79	11.00	1.00	34.00
Number of Bids	10444	31.61	19.93	31.00	1.00	171.00
Car Characteristics						
Car Age	10444	2.53	1.09	3.00	1.00	4.00
Mileage	10444	33338.29	32603.43	25000.00	1.00	999999.00
Seller Characteristics						
Seller Feedback Score	10444	440.94	393.54	327.00	1.00	1795.00
Professional Dealership	10444	0.79	0.41	1.00	0.00	1.00
Warranty Status						
Warranty	10444	0.44	0.50	0.00	0.00	1.00

Table A2.
MAKES AND MANUFACTURER WARRANTIES
IN THE MATCHED SAMPLE.

			Manufacturer Warranty	
Make	Freq.	Percent	Year	Mileage
Acura	20	0.51	4	50,000
Audi	145	3.71	4	50,000
BMW	204	5.22	4	50,000
Buick	159	4.07	4	50,000
Cadillac	646	16.52	4	50,000
Chevrolet	51	1.30	3	36,000
Chrysler	181	4.63	3	36,000
Dodge	81	2.07	3	36,000
Fiat	15	0.38	3	36,000
Ford	951	24.32	3	36,000
GMC	139	3.55	3	36,000
Honda	235	6.01	3	36,000
Hyundai	73	1.87	5	60,000
Infiniti	39	1.00	4	60,000
Jeep	77	1.97	3	36,000
Kia	60	1.53	5	60,000
Land Rover	32	0.82	4	50,000
Lexus	44	1.13	4	50,000
Lincoln	207	5.29	4	50,000
Mazda	26	0.66	3	36,000
Mercedes-Benz	121	3.09	4	50,000
Nissan	140	3.58	3	36,000
Subaru	37	0.95	3	36,000
Toyota	144	3.68	3	36,000
Volkswagen	84	2.15	3	36,000
Total	3911	100.00		

Table A3.
DESCRIPTIVE STATISTICS CONDITIONAL ON WARRANTY STATUS
ACROSS DIFFERENT SELLER TYPES.

	Warranty = 1			Warranty = 0		
	Obs.	Mean	S.D.	Obs.	Mean	S.D.
Professorial Dealers						
Final Price	2349	20374.80	8921.16	1197	17196.16	9175.58
Start Price	2349	290.96	735.30	1197	525.94	1427.18
Secret Reserve	2349	0.02	0.12	1197	0.03	0.17
Photos	2349	19.09	3.65	1197	17.11	6.00
Buyer Shipping	2349	0.98	0.15	1197	0.91	0.28
Duration	2349	7.10	0.70	1197	6.70	1.28
Number of Bidders	2349	13.99	4.07	1197	13.28	4.18
Number of Bids	2349	39.26	15.63	1197	38.74	16.11
Car Age	2349	2.28	1.00	1197	2.43	1.08
Mileage	2349	21349.37	16984.24	1197	29185.64	25977.87
Seller Feedback Score	2349	681.03	374.13	1197	470.61	411.61
Private Sellers						
Final Price	157	25699.98	20279.32	208	15235.67	10955.02
Start Price	157	1502.13	4081.25	208	1342.98	3788.89
Secret Reserve	157	0.41	0.49	208	0.27	0.44
Photos	157	14.71	5.73	208	15.05	4.98
Buyer Shipping	157	0.94	0.23	208	0.94	0.24
Duration	157	6.60	1.68	208	6.49	1.66
Number of Bidders	157	9.97	4.64	208	10.80	5.20
Number of Bids	157	34.02	21.86	208	33.80	21.28
Car Age	157	2.62	1.16	208	2.87	1.02
Mileage	157	28449.24	20917.31	208	43743.93	74340.42
Seller Feedback Score	157	127.34	129.46	208	165.79	151.38

Table A4.
TESTING CORRELATION BETWEEN WARRANTY STATUS AND OTHER LISTING CHARACTERISTICS.

	Photos (1)	Duration (2)	Shipping (3)	Photos (4)	Duration (5)	Shipping (6)
Warranty	-0.008	-0.175	0.119	0.034	0.087	-0.005
	(0.82)	(0.27)	(0.08)	(0.57)	(0.20)	(0.03)
WarrantyXln(AVESFeed)	0.036	0.032	-0.013			
	(0.14)	(0.04)	(0.01)			
WarrantyXDealer				0.19	-0.095	0.057*
				(0.58)	(0.20)	(0.03)
Make Fixed Effect	Y	Y	Y	Y	Y	Y
Week Fixed Effect	Y	Y	Y	Y	Y	Y
R^2(Adjusted)	0.01	0.01	0.04	0.01	0.01	0.04
Observations	3911	3911	3911	3911	3911	3911

Note: For convenience, we denote the natural log of average seller feedback score by ln(AVESFeed), professional dealership by Dealer. Group fixed effects are controlled for in each of the models. $***$, $**$, and $*$ denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table A5.
EFFECTS OF OTHER LISTING CHARACTERISTICS ON AUCTION PRICES.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln(Car Age)	-0.160***	-0.191***	-0.166***	-0.199***	-0.155***	-0.159***	-0.157***	-0.161***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
ln(Mileage)	-0.051***	-0.041***	-0.052***	-0.042***	-0.057***	-0.056***	-0.059***	-0.058***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Secret Reserve	0.196***	0.205***	0.149***	0.160***	0.212***	0.212***	0.195***	0.195***
	(0.05)	(0.05)	(0.05)	(0.06)	(0.02)	(0.02)	(0.02)	(0.02)
Buyer Shipping	0.103	0.109	0.095	0.099	0.080**	0.078**	0.078**	0.076**
	(0.06)	(0.07)	(0.07)	(0.07)	(0.04)	(0.03)	(0.04)	(0.03)
Photos	0.005	0.005	0.006	0.006	0.021	0.021	0.025	0.024*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)
Duration_3 Days	-0.025	-0.051	-0.024	-0.05	-0.154***	-0.152***	-0.162***	-0.160***
	(0.09)	(0.09)	(0.09)	(0.09)	(0.04)	(0.04)	(0.04)	(0.04)
Duration_5 Days	-0.056	-0.08	-0.051	-0.077	-0.097**	-0.101***	-0.109***	-0.113***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.04)	(0.04)	(0.04)	(0.04)
Duration_7 Days	-0.016	-0.037	-0.019	-0.041	-0.074**	-0.076**	-0.081**	-0.083***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)
ln(Start Price)					0.039***	0.040***	0.028***	0.029***
					(0.00)	(0.00)	(0.00)	(0.00)

Note: Each column in this table corresponds to that in Table 2, presenting the results for control variables. For convenience, we denote the natural log of car age by ln(Car Age), the natural log of traveled mileage by ln(Mileage), the natural log of start price by ln(Start Price), Duration_3, 5, 7 Days are dummy variables to denote auction time with 3, 5, 7 days. Standard errors clustered at the seller level are in parentheses. $***$, $**$, and $*$ denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table A6.
INTERACTIONS OF WARRANTIES AND OTHER OPTIONAL CHOICES.

ln(Final Price)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Warranty	0.835***	0.870***	0.579***	0.706***	0.685***	0.594***	0.500***	0.390***	0.464***	0.465***
	(0.12)	(0.14)	(0.12)	(0.14)	(0.15)	(0.07)	(0.09)	(0.06)	(0.14)	(0.10)
WarrantyXln(AVESFeed)	-0.093***	-0.103***	-0.088***	-0.102***	-0.103***					
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)					
WarrantyXDealer						-0.363***	-0.374***	-0.351***	-0.391***	-0.401***
						(0.06)	(0.06)	(0.07)	(0.06)	(0.06)
Photos	0.010*					0.010*				
	(0.01)					(0.01)				
WarrantyXPhotos	-0.012***					-0.011***				
	(0.00)					(0.00)				
ln(Start Price)		0.021					0.014			
		(0.02)					(0.02)			
WarrantyXln(Start Price)		-0.035***					-0.015			
		(0.01)					(0.01)			
Reserve			0.042					0.102		
			(0.07)					(0.07)		
WarrantyXReserve			0.264***					0.136		
			(0.08)					(0.09)		
Duration				0.008					0.006	
				(0.02)					(0.02)	
WarrantyXDuration				-0.004					-0.004	
				(0.02)					(0.02)	
Shipping					0.108					0.096
					(0.07)					(0.06)
WarrantyXShipping					-0.003					-0.018
					(0.01)					(0.08)
Matched Groups	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Make Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Week Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
R^2 (Adjusted)	0.43	0.43	0.43	0.43	0.43	0.44	0.43	0.43	0.43	0.41
Observations	3911	3911	3911	3911	3911	3911	3911	3911	3911	3911

Note: For convenience, we denote the natural log of seller feedback score by ln(AVESFeed), professional dealership by Dealer, secret reserve price by Reserve, and buyer shipping by Shipping. In the regressions above, all other control variables are also included. Standard errors clustered at the seller level are in parentheses. $***$, $**$, and $*$ denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table A7.
ROBUSTNESS CHECKS 1.

	Ln(Final Price)						Ln(bidders)	Ln(bidders)	Ln(bids)	Ln(bids)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Warranty	0.570***	0.464**	0.344**	0.227**	0.746***	0.487***	0.046	0.007	0.12	0.038
	(0.21)	(0.18)	(0.16)	(0.10)	(0.14)	(0.07)	(0.08)	(0.04)	(0.11)	(0.06)
WarrantyXln(AVESFeed)					-0.115***		-0.008		-0.022	
					(0.02)		(0.10)		(0.02)	
WarrantyXDealer						-0.464***		-0.006		-0.047
						(0.07)		(0.04)		(0.06)
TM1	0.265***	0.255***	0.083**	0.088***						
	(0.05)	(0.05)	(0.03)	(0.03)						
TM2	0.139***	0.130***								
	(0.04)	(0.04)								
TM1XWarranty	-0.278	-0.107	0.027	0.208						
	(0.19)	(0.23)	(0.13)	(0.17)						
TM2XWarranty	-0.143	-0.130								
	(0.18)	(0.20)								
TM1XWarrantyXln(AVESFeed)	-0.045*		-0.055*							
	(0.02)		(0.03)							
TM2XWarrantyXln(AVESFeed)	-0.056**		-0.050*							
	(0.02)		(0.03)							
TM3XWarrantyXln(AVESFeed)	-0.071**									
	(0.03)									
TM1XWarrantyXDealer		-0.354***		-0.409**						
		(0.12)		(0.16)						
TM2XWarrantyXDealer		-0.260***		-0.182*						
		(0.09)		(0.10)						
TM3XWarrantyXDealer		-0.356*								
		(0.19)								
Matched Groups	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Make Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Week Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
R^2(Adjusted)	0.26	0.27	0.15	0.16	0.43	0.44	0.06	0.06	0.05	0.05
Observations	1958	1958	1377	1377	3413	3413	3911	3911	3911	3911

Note: For convenience, we denote the natural log of seller feedback score by ln(AVESFeed), professional dealership by Dealer. In Columns (1) and (2) TM1 (TM2) represents a dummy variable for the mileage falling under the range 0-18,000 (18001-36,000). TM3 is also a dummy for the mileage greater than 36,000. Columns (3) and (4) provide the estimation results after deleting observations with mileage greater than 36,000. Columns (5) and (6) give the estimation results after deleting observations where unspecified and blank are observed in the warranty choice. All other control variables are also included. Standard errors clustered at the seller level are in parentheses. $***$, $**$, and $*$ denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table A8.
ROBUSTNESS CHECKS 2.

	ln(3rd) (1)	ln(3rd) (2)	ln(4th) (3)	ln(4th) (4)	ln(5th) (5)	ln(5th) (6)
Warranty	0.654***	0.395***	0.629***	0.443***	0.621***	0.453***
	(0.13)	(0.06)	(0.14)	(0.07)	(0.16)	(0.08)
WarrantyXln(AVESFeed)	-0.100***		-0.093***		-0.091***	
	(0.02)		(0.02)		(0.03)	
WarrantyXDealer		-0.361***		-0.399***		-0.407***
		(0.07)		(0.07)		(0.08)
Matched Groups	Y	Y	Y	Y	Y	Y
Make Fixed Effect	Y	Y	Y	Y	Y	Y
Week Fixed Effect	Y	Y	Y	Y	Y	Y
R^2(Adjusted)	0.41	0.42	0.40	0.40	0.37	0.37
Observations	3878	3878	3853	3853	3837	3837

Note: In each column, the dependent variable is the natural log of the b-highest bid (b = 3,4,5). For convenience, we denote the natural log of seller feedback score by ln(AVESFeed), professional dealership by Dealer. All other control variables are also included. Standard errors clustered at the seller level are in parentheses. $***$, $**$, and $*$ denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table A9.
MANUFACTURER WARRANTY
CONDITIONAL ON WARRANTY STATUS.

Warranty = 1	Dealers		Private	
Manufacturer Warranty	Obs.	Percentage	Obs.	Percentage
0	701	29.84	70	44.59
1	1648	70.16	87	55.41
Warranty = 0				
Manufacturer Warranty				
0	1135	94.82	202	97.12
1	62	5.18	6	2.98

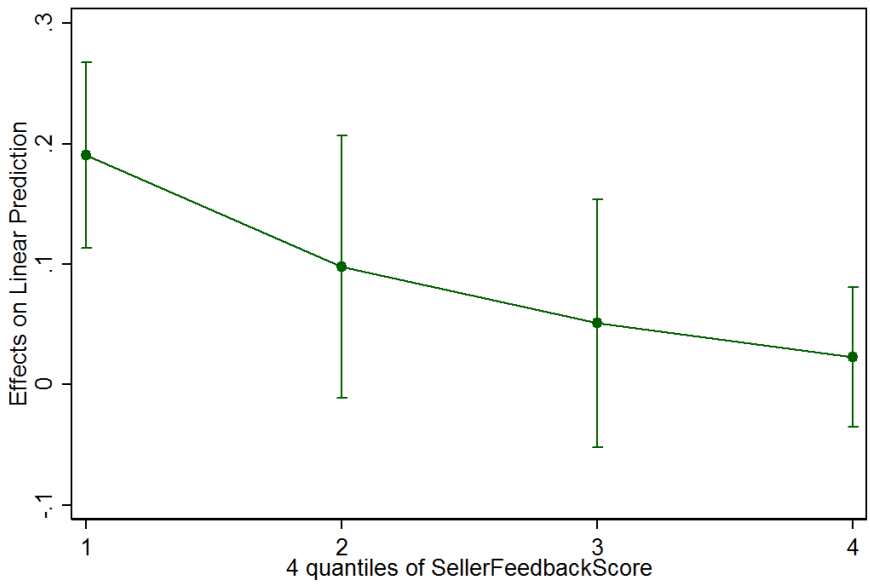

Figure 1. Average Marginal Effects of a Warranty with 95 percent CIs.

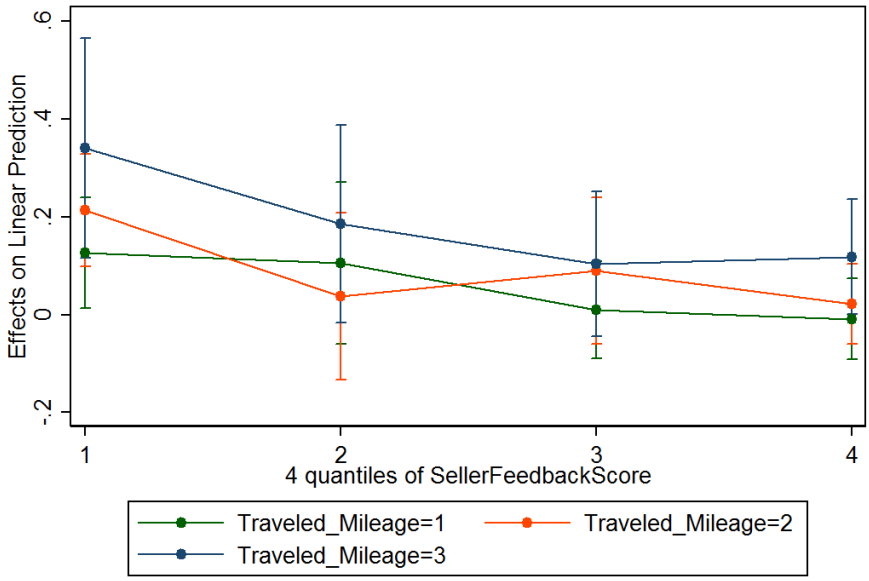

Figure 2. Average Marginal Effects under Different Traveled Mileage Quartiles.