A Test of Bargaining Theory in the Auto Retailing Industry*

Fiona Scott Morton
Yale University and NBER

Florian Zettelmeyer
University of California at Berkeley and NBER

Jorge Silva-Risso
University of California, Riverside

July 2004

*We thank Linda Babcock, Severin Borenstein, Colin Camerer, Yesim Orhun, Jose Silva, and seminar participants at the University of British Columbia, New York University, University of California at Berkeley, and the University of Southern California for helpful comments. We are particularly indebted to Meghan Busse for extensive comments and suggestions. Addresses for correspondence: School of Management, Yale University, PO Box 208200, New Haven CT 06520-8200; Haas School of Business, UC Berkeley, Berkeley CA 94720-1900; Anderson School at UCLA, 110 Westwood Plaza, Los Angeles, CA 90095. E-mail: florian@haas.berkeley.edu, fiona.scottmorton@yale.edu, jorge.silva-risso@anderson.ucla.edu

A Test of Bargaining Theory in the Auto Retailing Industry

Abstract

This paper tests predictions from bargaining theory about how private information, patience, and bargaining disutility affect the division of surplus between negotiating parties. We do so using the responses to a novel survey of 1,500 new car buyers in California that asks buyers detailed questions about their bargaining behavior, their search for information, and their individual characteristics. We match the answers to this survey with detailed transaction data on the purchased car and its negotiated price. Consistent with theoretical predictions we find, first, that consumers who know the invoice price of the vehicle (a measure of the dealer's reservation price) pay on average 0.6% less than consumers who do not. Second, we find that consumers who have an offer from a competing dealer (a measure of how much consumers know about their outside options) pay 0.6% less. Third, we find that buyers who indicated that they were patient during search paid 0.5% less than other consumers. Finally, we find that a buyer who according to our measures had the lowest bargaining disutility paid on average 1.5% less than a buyer who had the highest bargaining disutility. This paper confirms that the factors predicted to matter by bargaining theory really do—including knowledge of the other party's position, knowledge of one's own outside options, patience, and bargaining disutility. To the best of our knowledge, this paper is among the first to analyze how private information affects price negotiations between individuals outside the laboratory.

1 Introduction

Negotiation is a common way to determine transaction prices in a market economy. In the United States the prices of large consumer purchases such as houses and cars are negotiated. In other countries, price negotiations take place over less expensive products as well. Common to most of these bargaining situations is that one or multiple parties to the negotiation lack information that is likely to affect the negotiated outcome. For example, potential house buyers may not know how eager the seller is to finalize the transaction quickly. Similarly, car buyers may not know what is the reservation price of a car dealer. The importance of incomplete information for bargaining has, over the last two decades, led to a large theoretical literature on bargaining with private information.

Despite a substantial set of theoretical predictions and the importance the topic, there is next to no empirical evidence outside the laboratory about the effect of private information on price negotiations between individuals.[1] This is because of the difficulty associated with finding bargaining situations which are similar across multiple instances, and the difficulty of collecting data on negotiator characteristics and bargaining behavior. Most importantly, it is usually not possible to measure the private information of a negotiating party.

This paper overcomes these difficulties by using the responses to a novel survey of 1,500 new car buyers in California that asks buyers detailed questions about their bargaining behavior, their search for information, and their individual characteristics. We match the answers to this survey with detailed transaction data which records the make, model and trim level of the purchased car, its negotiated price, trade-in information, and dealer cost. Studying new car sales allows us to examine hundreds of negotiations over a homogeneous product; we observe bargaining outcomes for sets of exactly identical cars. Unlike house negotiations and other settings in which product quality cannot be perfectly observed, this eliminates the important problem that differences in bargaining outcomes can result from buyer characteristics proxying for unobserved quality.[2] The new car market is also a good research setting because common search and bargaining behaviors can be precisely described (for example "Did you research the invoice price of the car?" or "Did you get an offer from a competing dealer?"). Our survey

[1] Most of the focus of the non-experimental empirical literature in economics is on labor negotiations between unions and firms (Kennan and Wilson 1993).

[2] For example, suppose wealthy individuals are more likely to buy houses with central air-conditioning, an attribute that is unobservable to the researcher. If such houses sell for a premium compared to houses without central air-conditioning, the researcher will concluded that wealthy individuals are worse off in price negotiations than other individuals, controlling for all observable product characteristics.

therefore yields good measures of the information of individuals and their bargaining behavior. The final advantage of our approach is that we can rely on transaction data—and not survey responses—for outcomes measures. This solves the problem that different consumers may recall the price of a car differently, depending of whether they consider taxes, destination charges, dealer-added accessories, and rebates as part of the purchase price (Goldberg 1996).

Our aim is to test whether key predictions from bargaining theory have empirical support in a real-world bargaining situation. Our main interest is in the effect of private information on the distribution of surplus between the buyer and the seller. As we will show in Section 2, bargaining theoretic models predict that a negotiating party that has incomplete information about its opponent's reservation price will obtain a smaller share of the surplus in the negotiation than if that party were better informed (Chatterjee and Samuelson 1983, Fudenberg, Levine, and Tirole 1985, Gul, Sonnenschein, and Wilson 1986, Ausubel and Deneckere 1998). Hence, our first test will be of the prediction that consumers who are better informed about the dealer's reservation price will do better in price negotiations. Our findings are consistent with this prediction: We find that consumers who know the invoice price of the vehicle (a measure of the dealer's reservation price) pay on average 0.6% less than consumers who do not, controlling for consumer types, car fixed effects, and dealer fixed effects. The magnitude of this price decrease corresponds to 10% of the average dealer margin.

We would also like to test predictions about how a buyer's information about her outside options affects the distribution of surplus. Surprisingly, in the existing bargaining literature neither search cost nor equilibrium search behavior for alternatives are monotonically related to the share of the surplus obtained by the buyer (Lee 1994, Chatterjee and Lee 1998). As a result, the existing bargaining theory leaves the effect of price search at competing dealers on the division of surplus as an empirical question. Hence, the second part of our empirical analysis is to determining the effect of buyers' information about their own outside options on negotiated prices. We find that each increase in response scale category for the number of visited dealers (a measure of how much consumers know about their outside option) decreases price by 0.43%. Similarly, consumers who have an offer from a competing dealer (another measure that is related to the consumer's reservation price at a given dealer) pay 0.6% less.

Our third test is of the prediction common to many bargaining models that a party's patience (discount factor) is positively related to the share of the surplus they obtain (Stahl 1972, Rubinstein 1982, Ausubel, Cramton, and Deneckere 2002). In the context of car negotiations we will test whether buyers who indicate that they are more patient will indeed do

better in price negotiations. Our empirical results are consistent with the theoretical predictions. Buyers who indicated that they were patient during search paid 0.5% less than other consumers.

Our fourth and final test concerns the predicted effect of bargaining disutility on bargaining outcomes. If bargaining disutility is modelled as a per period bargaining cost which is known only privately, the theory predicts that a buyer will in expectation obtain a larger share of the surplus the lower her bargaining disutility (Perry 1986, Kennan and Wilson 1993). Using survey measures of buyers' bargaining disutility we will thus test whether consumers with lower bargaining disutility will do better in price negotiations. Again, our empirical results are consistent with the theoretical prediction: A buyer who according to our measure had the lowest bargaining disutility paid on average 1.5% less than a buyer who had the highest bargaining disutility.

All the results obtained above control for detailed consumer demographics and characteristics, such as willingness to search and car knowledge in addition to disutility of bargaining. These (usually unobservable) survey-based measures allow us to partially eliminate the concern that the search behavior and bargaining strategies we study are simply proxying for consumer characteristics.

This paper is among the first to analyze how private information affects price negotiations between individuals outside the laboratory. In a paper that surveys models of bargaining with private information, Kennan and Wilson (1993) discuss the difficulty of testing theoretical bargaining models: "testing of the [bargaining] hypothesis is difficult ... because the information known privately by some of the parties is inaccessible to econometricians" (page 54). In this paper we have combined transaction data with survey information about customers' knowledge, information search activities, typical bargaining behavior, and buyer characteristics; this gives us substantially better measurements of private information than is normally accessible to researchers. This paper validates that the factors that bargaining theory predict should matter really do—including knowledge of the other party's position, knowledge of one's own outside options, patience, and bargaining disutility. Our results also suggest that tactical decisions consumers make to improve their price negotiation outcomes—such as improving their information, getting a competing offer, being willing to walk out of a negotiation—have a real effect on the prices paid by these consumers and are not simply proxying for consumer types.

We proceed as follows. Section 2 summarizes the theoretical literature we will be able to test and describes previous empirical work in the area. Section 3 describes the survey and

transaction data. Section 4 contains the empirical analysis. Section 5 discusses the results and concludes the paper.

2 Theoretical predictions and empirical evidence

There is a large game-theoretic literature analyzing bargaining situations. In this section we first discuss several strands of this literature that are relevant for understanding price negotiations between car dealers and buyers. We are particularly interested in models that illustrate the role information plays in the bargaining process. We will also describe the theoretical predictions we will be able to test empirically. The second part of this section summarizes the relevant empirical literature.

2.1 Theoretical predictions

Buyer information about the dealer's reservation price

In keeping with the first-order concern that economists generally place on economic efficiency, the division of surplus is a concern secondary to efficiency in most papers on bargaining with incomplete or private information. In practical terms, this means that the focus of most papers in this literature is on whether bargaining leads to inefficient outcomes, either because there is no agreement in equilibrium despite gains from trade, or because there is costly delay in reaching an agreement (see the excellent review papers by Kennan and Wilson (1993) and Ausubel, Cramton, and Deneckere (2002) for an overview of this literature).

From the point of view of dealers, consumers, and policy makers, however, the question of how the division of surplus is affected by information asymmetries between the bargaining parties is extremely important. Fortunately, some of the important papers in this literature make clear predictions not only about efficiency, but also with regards to the effect of asymmetric information on the division of surplus.

Beginning with static bargaining models, Chatterjee and Samuelson (1983) propose a simultaneous offer bargaining game in which one seller faces one buyer and each party is uncertain about the other's reservation price. In this model Chatterjee and Samuelson (1983) show that an increase in one party's uncertainty (a mean preserving spread) about the opponent's reservation price makes that party worse off.

One unattractive feature of static models is that the solutions can require a commitment to walk away from known gains from trade (Cramton 1985). An alternative is to model bargaining

as occurring through a dynamic process of bilateral negotiation. The models that apply to our setting follow the seminal paper by Rubinstein (1982) but assume that one of the bargaining parties has incomplete information about the reservation price of the opponent. Suppose that the buyer is the uninformed party. There are two bargaining protocols that are commonly considered. In the first protocol, the "buyer-offer game," only the buyer (the uninformed party) is allowed to make offers, the seller can only reject or accept an offer. Should the offer be rejected, the buyer can make another offer. The game ends when an offer is accepted. While such games can have a great many Bayesian equilibria (see Fudenberg and Tirole (1991), p. 399), Fudenberg, Levine, and Tirole (1985) and Gul, Sonnenschein, and Wilson (1986) show that under the "stationary equilibrium" refinement, the buyer-offer game allows the buyer to screen seller types by a series of sequential, increasing price offers. The important result for our empirical prediction is that, as long as buyers are not infinitely patient, the buyer's screening is imperfect and the buyer is thus worse off than in a situation in which the buyer has complete information about the seller's reservation price.

This basic result also extends to the "alternating-offer game," in which buyer and seller alternate in making proposals. Here, Ausubel and Deneckere (1998) show that under an equilibrium refinement termed "assuredly perfect equilibrium," there exists a unique equilibrium in which the buyer is able to screen seller types, albeit imperfectly. As in the buyer-offer game, the buyer's equilibrium payoff is bounded from above by what the buyer could extract in the complete-information game.

Taken together, these models suggest that a negotiating party that has incomplete information about its opponent will obtain a smaller share of the surplus in the negotiation than if that party were better informed. This is one of the theoretical predictions that we would like to take to our data.

In the context of car negotiations, we will be interested in variation among consumers in how well informed they are about the dealer's reservation price. The predictions from the theoretical models is that more informed buyers will do better in price negotiations.

Buyer information about outside options

One important feature of car negotiations is that buyers can (temporarily) suspend the negotiation process with a given dealer and opt to search for price offers from competing dealers. Models by Lee (1994) and Chatterjee and Lee (1998) incorporate such search in a bilateral bargaining setting.

In our empirical analysis we will observe whether buyers obtained price offers from compet-

ing dealers. We will also have measures of consumers' willingness to search. Consequently, we are interested in comparative statics that relate equilibrium search behavior or buyer search cost to the share of the surplus a buyer can obtain in the negotiation. One might intuitively predict that buyers with lower search cost or buyers who search more in equilibrium would be able to appropriate a larger share of the surplus. Surprisingly, in Lee (1994) and Chatterjee and Lee (1998), neither search cost nor equilibrium search behavior are monotonically related to the share of the surplus obtained by the buyer. As a result, the existing bargaining theory leaves the effect of price search at competing dealers on the division of surplus as an empirical question.

While the role of information in bargaining is an important focus of this paper, there are other factors that influence bargaining outcomes and on which our survey gives us information. Two of these are patience and disutility from the bargaining process.

Buyer patience

The role that patience plays in bargaining is illustrated by Stahl (1972) and Rubinstein (1982), who were the first to consider that bargaining is usually a dynamic process. They show that a bargaining party's patience (discount factor) is positively related to the share of the surplus they obtain. While Stahl (1972) and Rubinstein (1982) are models of complete information, this result also carries over to the buyer-offer and alternating-offer models with private information discussed above (see Ausubel, Cramton, and Deneckere (2002)). In our later empirical analysis of car negotiations, we will test whether buyers who indicate that they are more patient do indeed obtain a larger share of the surplus.

Bargaining disutility

From a modelling perspective, patience and what we have termed "bargaining disutility" appear similar since both can be seen as per-period or per-bargaining-round losses. Conceptually, however, the two are very different. A person who is impatient is eager to realize the outcome of the negotiations in real time. A person with a high disutility of bargaining is eager to minimize the number of rounds of back-and-forth, perhaps because he or she dislikes confrontation or dislikes the effort of reformulating a new offer. For example, an impatient person with little bargaining disutility might be perfectly willing to engage in a shouting match with the dealer as long as he or she could obtain the car the same day. A patient person with a high bargaining disutility, however, might prefer to conduct negotiations via e-mail leaving the dealer hanging for days at a time between exchanges. Our survey data contains information on both impatience

to conclude a transaction and disutility realized from the process. We can thus test the effect of each separately on bargaining outcomes.

A higher bargaining disutility can be modelled most naturally as a higher per-period bargaining cost rather than a lower discount factor. Such a situation is considered by Perry (1986) who considers a bargaining model in which the discount factor is 1 but each party incurs a fixed cost each period until agreement is reached. If the buyer and seller each privately know their per period bargaining cost, the buyer will in expectation obtain a larger share of the surplus if her bargaining disutility is lower (see Kennan and Wilson (1993), Section 5.3).

2.2 Empirical evidence

Empirical evidence from the laboratory

There is a large body of experimental work examining the outcomes of negotiations in the laboratory. A subset of these focus on the information available to the bargaining parties (see Thompson (1990), Kennan and Wilson (1993), and Roth (1995) for excellent surveys of this literature). We are interested in whether more information about an opponent's reservation price improves the bargaining outcome of the party with the information. As in the theoretical literature, this question is not the primary concern of most experimental papers. Nonetheless, several papers support this theoretical prediction. For example, in an experiment simulating the real estate market Valley, Blount White, Neal, and Bazerman (1992) show that transaction prices are lower when the seller's reservation price is common knowledge as opposed to only known to the seller. In another example, Croson, Boles, and Murnighan (2003) find in an ultimatum game that when a proposer goes from the knowledge that the bargaining opponent has an alternative payoff to knowing its exact level, the opponent's payoff falls. A similar effect is common in ultimatum games with one-sided incomplete information: As Croson, Boles, and Murnighan (2003) summarize "These studies consistently show that proposers make (and responders accept) significantly lower offers when responders do not know the size of the pie and when this lack of information is common knowledge" (p. 145). A related result has also been found in the behavioral literature. Neale and Bazerman (1983) run an experiment comparing negotiators with high and low "perspective-taking ability." Negotiators with a high perspective-taking ability are able to assess an opponent's reservation price more accurately. The authors find that such negotiators are able to do better in negotiations than those with low perspective-taking ability. Overall, there is significant experimental support for the theoretical prediction that more information about an opponent's reservation price improves the bargaining outcome

of the party with the information.

We are not aware of any experimental work that analyzes the role of search in a bargaining setting. Hence, we know of no prior evidence on the effect of buyer search for her outside option on bargaining outcomes.[3]

The empirical findings on the effect of patience on bargaining outcomes are ambiguous. For example, in an experiment modelled after the Fudenberg, Levine, and Tirole (1985) paper discussed earlier, Rapoport, Erev, and Zwick (1995) show that – contrary to prediction – the initial prices set by an offering party makes this party *worse off* if the party is more patience. In another violation of the predicted outcome, Weg, Rapoport, and Felsenthal (1990) find that the more patient player did not gain a larger share of the pie. Rather, the two players split the pie evenly, or split the pie in such as way as to compensate for the different discount factors and leave each player the same net amount. In contrast, Bolton (1991) finds – consistent with theoretical predictions – that the initial prices set by the offering party makes this party better off if the party is more patience. The opening offers to players with higher discount factors are significantly higher than for the low-discount factor players. Overall, the experimental literature is not conclusive in its support for the theoretical predictions discussed above (see pp. 266-270 in Roth (1995) for a good discussion of this point).

Finally, if we interpret a higher bargaining disutility as a higher per period bargaining cost, there is strong experimental evidence for the prediction that a party will in expectation obtain a larger share of the surplus if her bargaining disutility is lower. This is shown both in Rapoport, Weg, and Felsenthal (1990) and Weg and Zwick (1991) where players pay a fixed cost for each round of bargaining.

Empirical evidence from the field

The empirical literature on bargaining with private information is mainly concerned with union contract negotiations and—mirroring the theoretical literature's concern with efficiency—focuses on strike activity and strike duration.[4] There is evidence that more uncertainty about the opponent's private information increases strike activity and strike duration (Tracy

[3]There is, however, experimental work on the effect of (exogenously imposed) outside options on bargaining outcomes. For example, Binmore, Shaked, and Sutton (1998) perform an experiment in which they give an outside option (of varying levels) to one subject in a pair of bargainers. The bargainers take turns proposing divisions of the pie, which shrinks by $\delta < 1$ each period that there is no agreement. At any time, player two may end the game and collect her outside option. They find that when the outside option is more attractive than staying in the game (when the outside option is larger than (approximately) half the pie), agreements result in player two collecting more surplus.

[4]See Kennan and Wilson (1993) and Ausubel, Cramton, and Deneckere (2002) for a detailed discussion.

1986, Tracy 1987), however, we are not aware of any study that confirms the theoretical prediction that that a negotiating party that has less information about its opponent's reservation price will do worse in the negotiation than if that party were better informed.

While there are empirical bargaining papers in settings other than union contract negotiations, most are not directly concerned with testing theoretical predictions from bargaining theory. For example, a number of papers focus on the demographic factors that affect bargaining outcomes. In the context of real estate sales, Harding, Rosenthal, and Sirmans (2003) examine whether differences between buyer and seller demographics influence the negotiated price, while using the sum of buyer and seller demographics to control for unobserved features of the house. In the context of car sales, Ayres and Siegelman (1995) perform an experiment in which they send trained "buyers" to car dealerships in Chicago to negotiate for a car using a prepared script. They find that dealers' final offers are correlated with the race and gender of the buyer. Scott Morton, Zettelmeyer, and Silva-Risso (2003) also analyze the effect of race and gender on car sales negotiation, however, using a large dataset of new car transactions which includes car characteristics, seller financial incentives, and demographic characteristics of the buyer. Another paper is interested in discovering the factors affecting bargaining outcomes between pharmacies and insurers for prescription drugs (Brooks, Doucette, and Sorofman 1999).[5]

Our paper differs from the above empirical literature in two ways. First, we are interested in testing theoretical predictions from bargaining theory, in particular the effect of private information, search for outside options, patience, and bargaining disutility. Second, our approach has several methodological advantages. Unlike house negotiations and other settings in which product quality cannot be perfectly observed (Harding, Rosenthal, and Sirmans 2003, Bearce 2002), the fact that we analyze negotiations for sets of identical cars eliminates the problem that differences in bargaining outcomes can result from buyer characteristics proxying for unobserved quality. In contrast to Ayres and Siegelman (1995) we have extremely accurate measures of bargaining outcomes in the form of transaction prices, rather than final offers to experimental subjects.

We know of two empirical papers which are also concerned with the effects of incomplete information on negotiated prices. Zettelmeyer, Scott Morton, and Silva-Risso (2002) analyze a large dataset of transaction prices supplemented with information on whether a buyer used an Internet referral service (Autobytel.com). They find that consumers pay 2.2% less as a result of using Autobytel.com. Since Autobytel.com makes available to consumers purchase-relevant

[5]There is also a literature on negotiations between countries, see for example Bearce (2002).

information, including dealer invoice prices, the result suggests that this information helps buyers negotiate lower prices. Busse, Zettelmeyer, and Silva-Risso (2004) show that buyers obtain a larger fraction of manufacturer rebates for new cars if they know that the rebate is offered. The main disadvantage of these two papers is that they don't have direct measurements of private information. Also, these papers have limited measures of consumer types, and no information on patience and bargaining disutility.

3 Data

Our data come from two sources. The first source is a survey instrument which we mailed to 5250 consumers who purchased one of eight popular new car models in California during April and May 2002 and whose transactions are captured by a major supplier of marketing research information (henceforth MRI). We match the individual survey responses - by name and address - to the correct transaction record which contains car characteristics and price.

3.1 Survey data

Survey instrument: The survey asked questions about the number of dealers a buyer visited, the buyer's communication with the dealer, the sources of information the buyer used, the information the buyer learned at each of these information sources, demographics, and personal attitudes towards bargaining and information search. A copy of the survey can be found in the appendix.

For the purposes of this paper we are interested in the survey questions which tell us about (1) the negotiation-relevant information of the buyer, (2) the patience and bargaining disutility of the buyer, and (3) other measures of consumer types.

To get at the negotiation-relevant information of buyers we asked respondents what information they researched, including "which car to purchase," "which dealers to visit or buy from," "dealer cost (invoice/hold-back)," or "fair price or market value for the car" (questions 16 and 18). We also asked each buyer where she had collected any information specific to the vehicle that he or she ended up purchasing (question 24). We also wanted to know whether buyers had investigated alternatives to buying from a particular dealer. Hence, we asked buyers whether they had a price offer from a competing dealer (question 10), and how many competing dealers they visited (questions 2 and 5).

To learn about buyer patience the survey asked each respondent what she would have done

if the dealer had not been willing to sell her the car at the negotiated price (question 14). We classified consumers who indicated that "I would not have bought a car at that time" as patient. The other answer categories describe courses of action in which the buyer would have paid a higher price or would have purchased a different car had negotiation broken down.

We measured buyers' bargaining disutility as well as several other consumer traits by asking respondents to rate their agreement or disagreement with a list of statements (question 31). The purpose of these questions is to get measures of usually "unobservable" buyer characteristics that may affect both negotiated prices and negotiation behavior. Hence, by controlling for consumers' traits in the empirical analysis we will correct for potential selection effects. These traits are (1) whether a consumer has a high willingness to search, (2) whether a consumer is a car enthusiast, and (3) whether a consumer has a high disutility of bargaining. To get answers that are reliable and as comparable as possible across respondents we ask survey participants questions about their behavior or attitudes, not about the traits directly. For example, we are interested in the "car enthusiast" trait, so we ask respondents to agree or disagree with "I read car- and/or truck-enthusiast magazines regularly" and "I tend to visit dealers whenever a new model is introduced." Similarly, we get at consumers' willingness to search with statements such as "I do a lot of price comparison when making large purchases," "I am the kind of person who gathers as much information as possible before visiting car dealers," and "I frequently use the Internet to obtain information about products I am interested in."

To assess whether a consumer derives a high disutility from the bargaining process, we present consumers with the statements "I am afraid that I will be taken advantage of by a dealer when negotiating the price of a new car," and "It is hard for me to find time to shop for a new vehicle." The response to the first statement measures how vulnerable a consumer feels in the negotiation. We assume that consumers who feel very vulnerable will dislike bargaining more than consumers who do not feel vulnerable. The response to the second statement measures the consumer's assessment of her opportunity cost of being engaged in a bargaining interaction.

Finally, the survey also asks respondents for demographic information such as gender, age, education, race/ethnicity, and household income (questions 26 through 30).

Sample: We chose our sample by car type and then mailed the survey to every purchases of the selected car types for whom we had transaction data in April and May 2002. We chose only a few popular car types to keep the number of different cars small in order to be able to control for car fixed effects without losing too many degrees of freedom. We defined a "car" as the interaction of make, model, body type, transmission, displacement, doors, cylinders, and

trim level (for example, one "car" is a 2002 Honda Accord sedan with automatic transmission, a 2.2 liter engine, 4 doors, 4 cylinders, and the EX trim). We added the purchases of the most common "cars" for a variety of car categories until we reached our desired sample size. This yielded the most popular variants of the following cars: Honda Accord, Chrysler PT Cruiser, Nissan Altima, Chevrolet Silverado, Toyota Corolla, Jeep Grand Cherokee, Honda Odyssey, and Chevrolet Tahoe.

Procedure: Each potential respondent received three mailings. The first mailing contained a letter announcing the arrival of the survey, introducing ourselves as the researchers and explaining the purpose of the project. The second mailing was sent out 5 days later and contained a cover letter, the survey, a pre-stamped return envelope, and a $1 bill. The third mailing was sent out 5 days after the second mailing and consisted of a postcard thanking buyers for their participation and reminding them to return the survey. Of the 5250 surveys we sent, 2470 were returned completed or partially completed, for a response rate of 47%.

Response issues: Some survey participants filled out the survey in an internally inconsistent manner. For example, some buyers checked off that they did not use the Internet to search for a car but then continued to indicate which websites they had visited. In another example buyers said that they researched two types of car but later reported that they spent zero hours on research. We left most inconsistent answers unedited, except when there was a second way to confirm an answer was erroneous. For example, if a person indicated he had researched zero cars *and* also spent zero hours doing research online *and* zero offline, then we did not allow him to be "informed about the car eventually purchased."

Since we have census-based demographic information in the transaction data, we can compare respondents and non-respondents. We find that buyers who did not respond to the survey live in census blocks with a lower percentage of college graduates, a higher percentage of high school drop-outs, a higher percentage of Hispanics and blacks, a lower household income, and lower house values (see Table 1 in the appendix). There is no difference between the two groups in the percentage of buyers who are identified as female on the basis of their first name. We are not concerned about the demographic differences between respondents and non-respondents because our results rely on between-consumer differences in search and purchase behavior and there remains much variation in such behavior among our respondents.

3.2 Transaction data

MRI collects transaction data from a sample of dealers in the major metropolitan areas in the US. These data include some customer information, the make, model and trim level of the car, financing information, trade-in information, dealer-added extras, and the profitability of the car and the customer to the dealership.

The price observed in the dataset is the price that the customer pays for the vehicle including factory installed accessories and options and the dealer-installed accessories contracted for at the time of sale that contribute to the resale value of the car.[6] The *Price* variable we use as the dependent variable is this price, minus the *ManufacturerRebate*, if any, given directly to the consumer, and minus what is known as the *TradeInOverAllowance*. *TradeInOverAllowance* is the difference between the trade-in price paid by the dealer to the consumer and the estimated wholesale value of the trade-in vehicle (as booked by the dealer). We adjust for this amount to account for the possibility, for example, that dealers may offer consumers a low price for the new car because they are profiting from the trade-in.

We control for car fixed effects according to the definition of a "car" above. While our car fixed effects will control for many of the factors that contribute to the price of a car, it will not control for the factory- and dealer-installed options which vary within trim level. The transaction price we observe covers such options but we do not observe what options the car actually has. In order to control for price differences attributable to options, we include as an explanatory variable the percent deviation of the *dealer's* cost of purchasing the vehicle (from the manufacturer) from the average vehicle cost of that car in the dataset. This percent deviation, called *VehicleCost* will be positive when the car has an unobserved option (for example a sunroof) and is therefore relatively expensive compared to other examples of the same car as specified above. Our measure of cost also takes into account any variation in holdback and transportation charges.

To control for time variation in prices, we define a dummy *EndOfMonth* that equals 1 if the car was sold within the last 5 days of the month. A dummy variable *WeekEnd* specifies whether the car was purchased on a Saturday or Sunday to control for a similar, weekly effect. In addition, we include month dummies to control for other seasonal effects.

We control for the competitiveness of each dealer's market. For each dealership we count the number of dealerships with the same nameplate that fall in a zip code that is within a

[6]Dealer-installed accessories that contribute to the resale value include items such as upgraded tires or a sound system, but would exclude options such as undercoating or waxing.

10 mile radius of the zip code of the focal dealership. We take into account cases where one owner owns several franchises in close proximity so that our measure counts only the number of separately-controlled entities.

We also supplement the demographic information from the survey with census data that MRI matches with the buyer's address from the transaction record. The data is on the level of a "block group," which makes up about one fourth of the area and population of a census tract. On average, block groups have about 1100 people in them. Finally, we control for whether the car was sold in Northern or Southern California. More detail on all of the control variables can be found in our previous work Scott Morton, Zettelmeyer, and Silva-Risso (2003).

Combining the two datasets results in about 1,500 observations. This is smaller than the number of returned surveys because of missing information in the transaction dataset and some surveys that were only partially completed.

3.3 Survey findings and summary statistics

In this subsection we present basic findings from our survey and summary statistics from our transaction data. From the answers to questions 16 and 18 we find that 77% of buyers collected information relevant to their choice of car model. 54% of buyers collected information to help them determine the "fair price of market value" for a car, while 50% collected information to help them choose "dealers to visit or buy from." Most important for our interest in bargaining, 47% collected information on the dealer's invoice price. Overall, we know from question 24 that 82% of respondents had collected at least some information specific to the vehicle they ended up buying.

Regarding buyer price search at competing dealers we know from question 10 that 40% of buyers responded that they had a price offer from a competing dealer when they negotiated for the car they eventually purchased. Consistent with this result, question 2 indicates that 39% of our respondents had visited only one dealer while another 45% visited 2-3 dealers; the remaining consumers visited 4 or more dealers. To obtain a better understanding of car negotiations, we asked buyers about their negotiation with dealers. A full 57% of the sample had only negotiated price with one dealer (question 6). Of the buyers who had a competing offer, 74% made use of the competing offer by explicitly mentioning it to their dealer (question 9).

We found considerable heterogeneity in what buyers would have done if the dealer had not been willing to sell them the car at the negotiated price (question 14). 30% of buyers stated "I

would not have bought a car at that time"; these are the consumers we classify as patient. 50% percent of buyers indicated that they would have bought the same car at another dealership. Another 11% said that they would have paid a higher price for the car at the same dealership; 8% would have purchased a different type of car.

We find ample variation in consumer traits across our respondents. The standard deviation on a four point scale is approximately 0.9 for all the statements in question 31. For example, 26% of buyers agree strongly with the statement "I am afraid that I will be taken advantage of by a dealer when negotiating the price of a new car"; another 34% agree with the statement but not strongly so. 28% of consumers disagree with the statement; 11% strongly so. A summary of the other responses to the consumer trait questions can be found in Table 2.

Table 3 reports summary statistics for the demographic information from the survey and the transaction data. The average age of our respondents is 35-49 years (question 27). The average response to our question about education (question 28) is 4.82 where "Some College" is coded as "4" and "College Degree" is coded as "5". The average income category is 5.18 where "$60,000-74,999$" is coded as "5" and "$75,000-99,999$" is coded as "6" (question 30). From question 29 we know that 3% of buyers classify themselves as Black/African American and 20% as Hispanic/Latino. 40% of buyers report being female (question 26). From the census data we know that house ownership in the average census block group is 67% and median house value is $228,000. Other demographic variables are summarized in Table 3.

The last part of Table 3 reports summary statistics for the transaction data used in the paper. The average price paid in the sample is $23,285. 30% of all transactions include a trade-in. On average, there are 4.5 competing dealerships of the same nameplate within a 10-mile radius of the zip-code of the transaction dealer. 30% of all sales occur on weekends, 20% within the last five days of any given month. Sales are split evenly between April and May 2002. Finally, 62% of sales take place in Southern California.

4 Results

We now investigate how information possessed by buyers about the dealer's reservation price and their own outside option affects negotiated prices. We also analyze the implication of buyer patience and bargaining disutility on negotiated prices. For this analysis we combine the survey responses from each consumer with information on the outcome of that consumer's car purchase.

Our dependent variable is *Price* as defined in the data section. In order to provide the appropriate baseline for the price of the car, we use a standard hedonic regression of log price. We work in logs because the price effect of many of the attributes of the car, such as being sold in Northern California or in May, are likely to be better modeled as a percentage of the car's value than a fixed dollar increment. We estimate the following specification:

$$\ln(Price_i) = X_i\alpha + D_i\beta + S_i\gamma + \epsilon_i$$

The X matrix is composed of transaction and car variables: car, month, and region fixed effects, car costs, and controls for whether the car was purchased at the end of month or the weekend. The matrix also contains an indicator for whether the buyer traded in a vehicle. The D matrix contains demographic characteristics of the buyer and her census block group. To this basic specification we add a matrix S which contains survey responses that indicate the search behavior and information of a buyer.

We use demographic information on gender, age, education, income, and race from the survey. We use information on house ownership, median house value, and type of occupation in the census block group in which the buyer resides. In our base specification we find that education, house value, and gender are the only statistically significant demographic variables (see column 1 of Table 4; note that we have multiplied all coefficients by 100, i.e. a coefficient of 0.1 implies that a unit increase in the variable would increase price by 0.1%). Higher levels of education and higher house values are associated with lower transaction prices. Each higher educational level the buyer attains is associated with a 0.45% price decrease. The fact that other demographic variables are not significant is most likely the result of our small sample size; in our previous work with a larger sample of transaction data we found that age and income, for example, were also significant. In the smaller sample considered here, the coefficient on income is negative but statistically insignificant (-0.30, p-value 0.24). The coefficient on squared income (0.04, p-value 0.04), which is statistically significant, suggests that those with the highest incomes pay more, all else equal.

Women pay on average half a percentage point more for their cars than men. The Hispanic and African-American coefficients indicates that these groups also pay on average 0.5% more, about half the size of our estimates in other work with a large national sample (Scott Morton, Zettelmeyer, and Silva-Risso 2003). Note however, that the race coefficients are estimated imprecisely, presumably because we have a low number of minority buyers in our sample (only

51 buyers in our final sample classified themselves as African-Americans). The female coefficient is identical to our previous estimates.

4.1 The effect of buyer information about the seller's reservation price

We begin by looking at very general measures of whether a buyer is informed. Our first specification accounts for whether the buyer reported collecting any information at all that is specific to the vehicle that she ended up purchasing. We find that the negotiated prices of such buyers are on average 1.09% lower than those prices negotiated by other buyers (see column 2 in Table 4).

Having found that collecting information matters in negotiating lower prices, we are interested in testing the prediction of bargaining theory that consumers who know more about the seller's reservation price pay lower prices. In questions 16 and 18 we asked respondents what information they researched, including "which car to purchase," "which dealers to visit or buy from," "fair price or market value of the car," or "dealer cost (invoice/hold-back)." We find that buyers who report having used at least one source of information to find the invoice price pay on average 0.88% less than other buyers (see column 3 in Table 4). Knowledge of other pieces of information seems not to affect price.

The invoice price of a car is a key determinant of the dealer's reservation price. At first blush, one might think that the invoice price is a sunk cost (and therefore should not be part of the reservation price) since a dealer takes possession of the car and cannot return the car to the manufacturer. However, the invoice price is tied closely to the dealer's reservation price for two reasons: First, the dealer is in an ongoing business to sell vehicles of the same type repeatedly. If the dealer sells a car today and expects to sell an identical vehicle in the future, then the invoice price is the replacement value of the car. Second, dealers frequently trade vehicles among themselves. Such dealer trades always occur at invoice prices.[7] For these reasons, the invoice price of a car is closely tied to the dealer's reservation price. Hence, our empirical result that consumers who know the dealer's invoice price pay lower negotiated prices seems to directly confirm the first key prediction from bargaining theory.

Before we conclude with some degree of certainty that our findings are consistent with the predictions from bargaining theory, we need to account for two alternative explanations. First, it could be that consumers who reported knowing the invoice price of a car also gathered information about which are low-price dealerships. For example, these consumers may have

[7] According to industry participants 20% of all cars sold are the result of dealer trades.

enquired among friends who have recently purchased a car. Then these consumers would be paying lower prices not because knowing the dealer's reservation price improves their bargaining outcome, but because these consumers are benefitting from search by choosing low-price dealers. Second, while we have estimated the difference in negotiated prices between consumers who know and do not know the dealer's invoice price, this average likely does not measure the expected return to a customer of deciding to learn the dealer's reservation price. The reason is that the average effects include selection effects, or effects that are attributable to customer traits which are correlated with the choices. We address these two alternative explanations in sequence.

The first alternative explanation, namely that the negative coefficient on *KnowInvoice* reflects the returns to search for low-price dealerships instead of the returns to knowing more about the dealer's reservation price, is not consistent with our empirical findings. To see this consider the specification in column 3 in Table 4. In this specification we included a question which explicitly asked whether a consumer has collected information on "which dealers to visit of buy from." Consumers who answered affirmatively paid the same prices as those who did not. This finding is confirmed when we add dealer fixed effects to the specification in column 3. In this regression, the estimated coefficient on the *KnowInvoice* variable is identified by *within-dealer* variation in whether consumers are informed or not. Since identification in this specification does not rely on differences in average price levels between dealers, the results cannot be due to consumers searching for low-cost dealerships. Despite reducing the degrees of freedom by 170, the coefficient on *KnowInvoice* remains highly significant and changes little (to -1.01%, see column 4 in Table 4). As before, knowledge of other pieces of information does not affect price.

We now investigate the second alternative explanation, namely that the negative coefficient on *KnowInvoice* reflects unobserved differences between types of consumer instead of the returns in negotiation to knowing more about the dealer's reservation price. In order to estimate the treatment effect of knowing a dealer's reservation price, we examine what knowing the dealer's invoice prices mean for price negotiations, controlling for consumer types.[8]

Recall that the consumer traits we measure are (1) whether a consumer has a high willingness to search, (2) whether a consumer is a car enthusiast, and (3) whether a consumer has

[8]The consumer traits we construct are based in part on consumer's assessment of their bargaining disutility. These assessments are made 6-12 weeks after the consumers purchased a car. If consumers infer their bargaining disutility from the price they obtained for this particular vehicle, there could be an endogeneity between prices and consumer traits. Please see page 22 for an investigation of this issue.

a high disutility of bargaining. We repeat the specification from column 4 of Table 4, adding measures of consumer traits. The coefficient on *KnowInvoice* decreases from −1.01 to −0.66 (see column 5 in Table 4), implying that 1/3 of the effect picked up by *KnowInvoice* is due to selection, while 2/3 is due to treatment. Consumer traits are related to price as following: buyers who were more afraid of being taken advantage of by the dealer pay more, suggesting that they had reason to be afraid. Consumers who indicated that they had a high willingness to search by stating that they did "a lot of price comparisons when making larger purchases" paid less for cars. Finally, the marginally significant coefficient on *ReadCarMagazine* indicates that car enthusiasts pay slightly more for cars, perhaps because their willingness to pay for cars is higher overall. A Hausman test rejects the hypotheses that the model without consumer traits in column 4 of Table 4 is correctly specified. Hence, our consumer trait variables seem to play a role in controlling for selection.

We conclude that our empirical findings are consistent with the first key prediction of bargaining theory, namely that consumers who know more about the dealer's reservation price pay less in price negotiations. Knowing the dealer's invoice price reduces the average price a consumer can negotiate by 0.66%, or 10% of the average dealer gross margin.

For the rest of the analysis we settle on a specification which includes *KnowInvoice* and all consumer traits but excludes dealer fixed effects, since the fixed effects do not change our results appreciably but lead to a large reduction in degrees of freedom.

4.2 The effect of buyer information about outside options

One important feature of car negotiations is that buyers can suspend the negotiation process with a given dealer and opt to search for price offers from competing dealers. As we have discussed in Section 2, the theoretical bargaining literature does not yield clear predictions about how equilibrium search behavior or buyer search cost relate to the division or surplus. Hence, the existing bargaining theory leaves the effect of price search at competing dealers on negotiated prices as an empirical question.

From the survey we know whether a buyer has investigated alternatives to buying from a particular dealer, in particular whether the buyer obtained a price offer from a competing dealer. We find that buyers with a price offer from a competing dealer pay on average 0.55% less than those who did not obtain one (see column 1 in Table 5).

We designed our survey to ask several related questions about what we anticipated would be key elements of the negotiation process. For example, in addition to asking whether a buyer

had a competing offer, we asked how many other dealerships the buyer visited. If we repeat the prior specification including the number of visited dealers, having obtained a competing offer becomes insignificant, but each increase in response scale category for the number of visited dealers decreases price by 0.43% (see column 2 in Table 5). This indicates that the number of dealers visited by a buyer is a good alternative measure for having a competing offer. The point estimate for having a competing offer is, loosely speaking, approximately equivalent to visiting at least one dealership in addition to the one where the car was purchased.

While this finding, namely that consumers who are better informed about their own outside option pay less in price negotiations, is not unequivocally predicted by existing models in bargaining theory, it is not surprising. This is because it is in the dealer's interest in the bargaining process to inflate the consumer's reservation price. For example, the dealer can claim "this car is currently in short supply in this area." This can increase the reservation price of the buyer because her reservation price depends not only on the utility she derives from the vehicle itself but also on her outside option. Our empirical result is consistent with a story in which a buyer who has investigated alternatives to buying from a particular dealer is (partially) inoculated from such dealer bargaining strategies.

4.3 The effect of buyer patience and bargaining disutility

One of the most common predictions in bargaining-theoretic papers is that a bargaining party's patience (discount factor) is positively related to the share of the surplus they obtain. We now analyze the price effect of a variable which describes patience during search. We asked buyers about their alternative course of action had negotiations with the dealer broken down (see question 14). We find that the 30% of buyers who indicated that they were very patient by responding "I would not have bought a car at that time" paid 0.47% less than other buyers (see column 3 of Table 5). Henceforth, we refer to this variable as *WillingnessToWait*. This finding, namely that more patient buyers pay less in price negotiations is consistent with the predictions of bargaining theory. The effects of *KnowInvoice* and *CompetingOffer* are largely unchanged in this specification.

Notice that all the specifications in this table also allow us to test whether consumers with a high disutility of bargaining pay higher prices, as we have discussed in Section 2 would be predicted by bargaining theory. Two measures among the consumer traits in column 3 of Table 5 that capture aspects of bargaining disutility are the responses to the statement "I am afraid that I will be taken advantage of by a dealer when negotiating the price of a new car" and "It is

hard for me to find time to shop for a car" (four categories range from 1 ="Disagree Strongly" to 4 ="Agree Strongly"). The response to the first statement measures how vulnerable a consumer feels in the negotiation. We assume that consumers who feel very vulnerable will dislike bargaining more than consumers who do not feel vulnerable. The response to the second statement measures the consumer's assessment of her opportunity cost of being engaged in a bargaining interaction. All the consumer traits are included as explanatory variables in columns (1) through (4).

For each increase in response category for the statement *AfraidTakenAdvantage*, a consumer pays 0.45% more. Hence, a consumer who agrees strongly with this statement pays approximately 1.8% more for the identical car than a consumer who strongly disagrees with our measure of bargaining disutility. For each increase in response category for the statement *NoTimeToShop*, a consumer pays 0.25% more, however, the coefficient is not significant at conventional levels (p-value 0.10).

One concern in this specification is that buyers who indicate that they have a low disutility of bargaining do so because they happen to have negotiated a good price, not – as we have suggested – the other way around. To investigate this alternative explanation we add to the specification a variable that measures independently how well the buyer thought he or she did in the negotiation. Question 15 asks consumers: "How happy are you with the price you paid for your car?" If a buyer reports a low disutility of bargaining because the buyer was happy with the price obtained during the negotiation, controlling for this *GoodPrice* variable should eliminate our finding that consumers with a low disutility of bargaining pay less. However, as column 4 in Table 5 shows, the coefficient *AfraidTakenAdvantage* does not change much (-0.37) and remains highly significant. This is the case despite the fact that buyers' estimate of how well they did is strongly correlated with the price they actually negotiated; each increase in response category of *GoodPrice* is associated with a -0.44% lower price. Hence, we conclude that consistent with the theoretical predictions, consumers with a high disutility of bargaining pay more in price negotiations than consumers with a low disutility of bargaining.

5 Discussion and Conclusion

We have analyzed empirically how (1) buyer information about the seller's reservation price, (2) buyer information about her outside options, (3) buyer patience, and (4) bargaining disutility affect negotiated prices. The bargaining theory presented in Section 2 predicted, regarding

(1), that buyers who are better informed about the seller's reservation price should do better. Our empirical results are consistent with this prediction. We find that consumers are able to obtain lower prices when they have more information about a dealer's reservation price. For example, column 5 of Table 4 shows that consumers who know the invoice price of the vehicle (a measure of the dealer's reservation price) pay on average 0.6% less than consumers who do not, controlling for consumer types and dealer fixed effects.

Regarding (2), the theory left as an empirical question the effect of buyer price search on negotiated prices. We find that each increase in response scale category for the number of visited dealers (a measure of how much consumers know about their outside option) decreases price by 0.43%. Similarly, consumers who have an offer from a competing dealer (another measure that is related to the consumer's reservation price at a given dealer) pay 0.6% less (see, for example, column 1 of Table 5).[9]

Regarding (3), the theory predicted that more patient consumers and consumers who have a low disutility of bargaining should do better. Our empirical results are consistent with these predictions. Buyers who indicated that they were patient during search (the indicator *WillingnessToWait* equal one, see page 21), paid 0.5% less than other consumers (see column 3 of Table 5).

Finally, regarding (4), a buyer who according to our measure had the lowest bargaining disutility paid on average 1.5% less than a buyer who had the highest bargaining disutility, controlling for the buyer's perception of how good a price she was able to negotiate (see column 4 of Table 5).

To the best of our knowledge, this paper is among the first to analyze how private information affects price negotiations between individuals outside the laboratory. We are able to examine these negotiations in detail by combining transaction data on bargaining outcomes with survey-based direct measures of bargaining behavior, buyer search for information, and buyer characteristics. This paper confirms that the factors predicted to matter by bargaining theory really do —including knowledge of the other party's position, one's own outside options, patience, and bargaining disutility. Our results also suggest that tactical decisions consumers make to improve their price negotiation outcomes—such as improving their information, getting a competing offer, being willing to walk out of a negotiation—have a real effect on the prices paid by these consumers and are not simply proxying for consumer types.

[9]In column 2 of Table 5 this variable is not significantly different from zero because it is highly correlated with the number of dealers visited).

References

Ausubel, L. M., P. Cramton, and R. J. Deneckere (2002): "Bargaining with Incomplete Information," in *Handbook of Game Theory*, ed. by R. J. Aumann, and S. Hart, vol. 3. Elsevier, Amsterdam.

Ausubel, L. M., and R. J. Deneckere (1998): "Bargaining and Forward Induction," mimeo, University of Maryland University of Wisconsin-Madison.

Ayres, I., and P. Siegelman (1995): "Race and Gender Discrimination in Bargaining for a New Car," *American Economic Review*, 85(3), 304–321.

Bearce, D. H. (2002): "Institutional Breakdown and International Cooperation: The European Agreement to Recognize Croatia and Slovenia," *European Journal of International Relations*, 8(4), 471–97.

Binmore, K., A. Shaked, and J. Sutton (1998): "An Outside Option Experiment," *Quarterly Journal of Economics*, 104, 753–770.

Bolton, G. E. (1991): "A Comparative Model of Bargaining: Theory and Evidence," *American Economic Review*, 81(5), 1096–1136.

Brooks, J., W. Doucette, and B. Sorofman (1999): "Factors Affecting Bargaining Outcomes between Pharmacies and Insurers," *Health Services Research*, 34(1), 439–451.

Busse, M., F. Zettelmeyer, and J. Silva-Risso (2004): "$1000 Cash Back: Asymmetric Information in Auto Manufacturer Promotions," mimeo, University of California at Berkeley, Berkeley, CA.

Chatterjee, K., and C. C. Lee (1998): "Bargaining and Search with Incomplete Information about Outside Options," *Games and Economic Behavior*, 22, 203–237.

Chatterjee, K., and L. Samuelson (1983): "Bargaining under Incomplete Information," *Operations Research*, 31(5), 835–851.

Cramton, P. (1985): "Sequential Bargaining Mechanisms," in *Game Theoretic Models of Bargaining*, ed. by A. Roth. Cambridge University Press, Cambridge, England.

Croson, R., T. Boles, and J. K. Murnighan (2003): "Cheap talk in bargaining experiments: lying and threats in ultimatum games," *Journal of Economic Behavior and Organization*, 51, 143–159.

Fudenberg, D., D. K. Levine, and J. Tirole (1985): "Infinite-Horizon Models of Bargaining with One-Sided Incomplete Information," in *Game Theoretic Models of Bargaining*, ed. by A. Roth. Cambridge University Press, Cambridge, England.

Fudenberg, D., and J. Tirole (1991): *Game Theory*. The MIT Press, Cambridge, Massachusetts.

Goldberg, P. K. (1996): "Dealer Price Discrimination in New Car Purchases: Evidence from the Consumer Expenditure Survey," *Journal-of-Political-Economy*, 104(3), 622–654.

Gul, F., H. Sonnenschein, and R. Wilson (1986): "Foundations of Dynamic Monopoly and the Coase Conjecture," *Journal of Economic Theory*, 39, 155–190.

Harding, J., S. Rosenthal, and C. Sirmans (2003): "Estimating Bargaining Power In The Market For Existing Homes," *Review of Economics and Statistics*, 85(1), 178–188.

Kennan, J., and R. Wilson (1993): "Bargaining with Private Information," *Journal of Economic Literature*, 31(1), 45–104.

Lee, C. C. (1994): "Bargaining and Search with Recall: A Two-Period Model with Complete Information," *Operations Research*, 42(6), 1100–1109.

Neale, M. A., and M. H. Bazerman (1983): "The role of perspective-taking ability in negotiating under different forms of arbitration," *Industrial and Labor Relations Review*, 36, 378–388.

Perry, M. (1986): "An Example of Price Formation in Bilateral Situations: A Bargaining Model with Incomplete Information," *Econometrica*, 54(2), 313–321.

Rapoport, A., I. Erev, and R. Zwick (1995): "Bargaining behavior in a bilateral monopoly with one-sided incomplete information," *Management Science*, 41, 377–394.

Rapoport, A., E. Weg, and D. S. Felsenthal (1990): "The effects of fixed costs in two-person sequential bargaining," *Theory and Decision*, 28, 47–72.

Roth, A. E. (1995): "Bargaining Experiments," in *The Handbook of Experimental Economics*, ed. by J. H. Kagel, and A. E. Roth. Princeton University Press, Princeton, N.J.

Rubinstein, A. (1982): "Perfect Equilibrium in a Bargaining Model," *Econometrica*, 50, 97–109.

Scott Morton, F., F. Zettelmeyer, and J. Silva-Risso (2003): "Consumer Information and Discrimination: Does the Internet Affect the Pricing of New Cars to Women and Minorities?," *Quantitative Marketing and Economics*, 1(1), 65–92.

Stahl, I. (1972): *Bargaining Theory*. Economics Research Institute, Stockholm School of Economics, Stockholm.

Thompson, L. (1990): "Negotiation Behavior and Outcomes: Empirical Evidence and Theoretical Issues," *Psychological Bulletin*, 108(3), 515–532.

Tracy, J. S. (1986): "An Investigation into the Determinants of U.S. Strike Activity," *American Economic Review*, 76, 423–436.

——— (1987): "An Empirical Test of an Asymmetric Information Model of Strikes," *Journal of Labor Economics*, 5, 149–173.

Valley, K., S. Blount White, M. Neal, and M. Bazerman (1992): "Agents as Information Brokers: The Effects of Information Disclosure on Negotiated Outcomes," *Organizational Behavior and Human Decision Processes*, 51, 220–236.

Weg, E., A. Rapoport, and D. S. Felsenthal (1990): "Two-Person Bargaining Behavior in Fixed Discounting Factors Games with Infinite Horizon," *Games and Economic Behavior*, 2(1), 76–95.

Weg, E., and R. Zwick (1991): "On the robustness of perfect equilibrium in fixed cost sequential bargaining under an isomorphic transformation," *Economics Letters*, 36(1), 21–24.

Zettelmeyer, F., F. Scott Morton, and J. Silva-Risso (2002): "Cowboys or Cowards: Why are Internet car prices lower?," mimeo, UC Berkeley, Berkeley, CA.

Table 1: Response bias

	Non-respondents					Respondents				
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
%CollegeGrad	2580	27.0	16.4	0	100	1948	30.5	16.41	0	83.6
%<HighSchool	2580	17.7	15.9	0	100	1948	13.70	12.81	0	79.3
%Female	2715	30.8	46.10	0	1	2021	30.3	45.90	0	1
%Black	2580	5.3	12.3	0	98.3	1948	4.0	9.35	0	96.8
%Hispanic	2580	20.5	14.0	0	55.7	1948	16.7	12.30	0	56.4
Med.HHInc.	2578	54732	24158	12608	150000	1948	58945	23661	12975	150000
Med.HouseVal.	2516	213529	98012	22500	500000	1921	227345	103293	19063	500000

Table 2: Distribution of Consumer Trait Answers (question 31)

Statement	Number of repondents who...			
	Disagree Strongly	Disagree	Agree	Agree Strongly
I do a lot of price comparison when making larger purchases	20	79	545	792
I frequently use the Internet to obtain information about products I am interested in	138	246	493	559
I am the kind of person who gathers as much information as possible before visiting car dealers	41	244	603	548
I read car- and/or truck- enthusiast magazines regularly	555	627	175	97
I tend to visit dealers whenever a new model is introduced	687	574	135	40
I am afraid that I will be taken advantage of by a dealer when negotiating the price of a new car	165	409	490	372
It is hard for me to find time to shop for a new vehicle	123	555	564	194

Table 3: Summary Statistics[†]

	Obs	Mean	Std. Dev.	Min	Max
Demographic Variables From Survey					
Age	1436	3.03	0.91	1.00	5.00
Education	1436	4.82	1.44	1.00	7.00
Income	1436	5.18	2.19	1.00	10.00
Black	1436	0.03	0.18	0.00	1.00
Hispanic	1436	0.20	0.40	0.00	1.00
Female	1436	0.40	0.49	0.00	1.00
Demographic Variables From Census					
%HouseOwnership	1436	0.67	0.24	0.01	1.00
MedianHouseValue	1436	2.28	1.06	0.19	5.00
%Professional	1436	0.16	0.08	0.00	0.62
%Executives	1436	0.17	0.08	0.00	1.00
%BlueCollar	1436	0.27	0.16	0.00	0.91
%Technicians	1436	0.03	0.02	0.00	0.16
Summary Statistics from Transaction Data					
Price	1436	23284.92	5499.61	9800	38750
TradeIn	1436	0.30	0.46	0.00	1.00
EndOfMonth	1436	0.20	0.40	0.00	1.00
Weekend	1436	0.30	0.46	0.00	1.00
Competition	1436	4.50	3.06	0.00	16.00
MonthMay	1436	0.52	0.50	0.00	1.00
SouthernCal	1436	0.62	0.48	0.00	1.00

[†] Age, education, income represent response categories.
MedianHouseValue in $100,000.
Competition: number of dealers of same nameplate in a 10 mile radius of dealership.

Table 4: Price effects of buyer information about the dealer's reservation price[†]

Dep. Var. ln(price)	(1)	(2)	(3)	(4)	(5)
Informed		−1.09			
		(0.37)**			
KnowCars			0.51	0.37	0.44
			(0.33)	(0.33)	(0.33)
KnowDealers			−0.22	−0.30	−0.25
			(0.26)	(0.27)	(0.26)
KnowInvoice			−0.88	−1.01	−0.66
			(0.29)**	(0.30)**	(0.30)*
KnowMarketPrice			−0.22	0.10	0.19
			(0.28)	(0.28)	(0.28)
AfraidTakenAdvantage					0.30
					(0.13)*
NoTimeToShop					0.17
					(0.16)
DoPriceComparisons					−0.63
					(0.24)**
InternetForInfo					−0.25
					(0.16)
GatherMuchInfo					−0.20
					(0.21)
ReadCarMagazine					0.28
					(0.17)+
VisitDealerForFun					−0.11
					(0.21)
CustomerAge	−0.01	−0.04	−0.07	0.07	−0.01
	(0.14)	(0.14)	(0.14)	(0.14)	(0.15)
Education	−0.45	−0.42	−0.44	−0.38	−0.36
	(0.10)**	(0.10)**	(0.10)**	(0.11)**	(0.11)**
Income	−0.30	−0.25	−0.31	−0.18	−0.07
	(0.26)	(0.25)	(0.26)	(0.27)	(0.27)
Income^2	0.04	0.04	0.05	0.03	0.02
	(0.02)*	(0.02)+	(0.02)*	(0.02)	(0.02)
Black	0.51	0.51	0.76	0.41	0.60
	(0.87)	(0.88)	(0.84)	(0.89)	(0.88)
Hispanic	0.52	0.41	0.45	0.72	0.66
	(0.38)	(0.38)	(0.39)	(0.40)+	(0.40)+
OtherRace	0.18	0.24	0.09	−0.12	−0.01
	(0.45)	(0.45)	(0.45)	(0.46)	(0.44)
Female	0.48	0.47	0.43	0.36	0.25
	(0.26)+	(0.26)+	(0.27)	(0.27)	(0.28)
%HouseOwnership	−0.83	−0.75	−1.03	−1.27	−1.16
	(0.57)	(0.57)	(0.57)+	(0.57)*	(0.56)*
MedianHouseVal. (000s)	−0.44	−0.46	−0.44	−0.24	−0.25
	(0.14)**	(0.14)**	(0.15)**	(0.18)	(0.18)
%Professional	0.60	0.59	0.56	−0.33	−0.38
	(2.19)	(2.19)	(2.21)	(2.32)	(2.29)
%Executives	2.82	2.93	3.24	1.39	1.91
	(2.55)	(2.52)	(2.65)	(2.98)	(2.91)
%BlueCollar	0.03	0.01	0.21	−0.99	−0.79
	(1.71)	(1.69)	(1.75)	(1.79)	(1.76)
%Technicians	−10.28	−10.06	−8.83	−0.62	−0.18
	(6.05)+	(6.01)+	(6.00)	(6.25)	(6.20)
Trade	0.69	0.68	0.59	0.78	0.70
	(0.29)*	(0.29)*	(0.29)*	(0.29)**	(0.29)*
VehicleCost	98.11	98.22	98.30	103.11	103.64
	(2.31)**	(2.32)**	(2.37)**	(2.54)**	(2.49)**
Competition	0.05	0.05	0.04	0.00	0.00
	(0.05)	(0.05)	(0.05)	(0.00)	(0.00)
Car Fixed Effects	*yes*	*yes*	*yes*	*yes*	*yes*
Dealer Fixed Effects	*no*	*no*	*no*	*yes*	*yes*
Constant	1,006.47	1,007.18	1,006.93	1,004.34	1,005.62
	(1.43)**	(1.46)**	(1.44)**	(1.51)**	(1.74)**
Observations	1436	1436	1406	1406	1406
R-squared	0.96	0.96	0.96	0.97	0.97

* significant at 5%; ** significant at 1%; + significant at 10% level. Robust SEs in parentheses.

† Unreported are car, month, and region fixed effects, *EndOfMonth*, and *Weekend*.
All coefficients are multiplied by 100. MedianHouseValue in $100,000.
Response scale on trait variables (question 31) is reversed: Now 1="Disagree Strongly", 4="Agree Strongly."

Table 5: Price effects of buyer information about outside options, patience, and bargaining disutility†

Dep. Var. ln(price)	(1)	(2)	(3)	(4)
KnowInvoice	−0.58	−0.57	−0.58	−0.54
	(0.27)∗	(0.27)∗	(0.27)∗	(0.27)∗
#DealersVisited		−0.43		
		(0.17)∗		
WillingToWait			−0.47	−0.43
			(0.28)+	(0.27)
GoodPrice				−0.44
				(0.16)∗∗
CompetingOffer	−0.55	−0.35	−0.59	−0.61
	(0.26)∗	(0.27)	(0.26)∗	(0.26)∗
AfraidTakenAdvantage	0.44	0.44	0.45	0.37
	(0.13)∗∗	(0.13)∗∗	(0.13)∗∗	(0.13)∗∗
NoTimeToShop	0.25	0.23	0.25	0.23
	(0.15)	(0.15)	(0.15)	(0.15)
DoPriceComparisons	−0.38	−0.35	−0.36	−0.30
	(0.24)	(0.24)	(0.24)	(0.24)
InternetForInfo	−0.17	−0.19	−0.17	−0.19
	(0.16)	(0.16)	(0.16)	(0.16)
GatherMuchInfo	−0.30	−0.24	−0.32	−0.27
	(0.21)	(0.21)	(0.21)	(0.21)
ReadCarMagazine	0.24	0.24	0.24	0.23
	(0.17)	(0.17)	(0.17)	(0.17)
VisitDealerForFun	−0.05	−0.08	−0.05	−0.04
	(0.21)	(0.21)	(0.21)	(0.21)
CustomerAge	−0.10	−0.10	−0.11	−0.12
	(0.15)	(0.15)	(0.15)	(0.15)
Education	−0.38	−0.38	−0.39	−0.39
	(0.10)∗∗	(0.10)∗∗	(0.10)∗∗	(0.10)∗∗
Income	−0.26	−0.21	−0.26	−0.26
	(0.26)	(0.25)	(0.25)	(0.25)
Income^2	0.04	0.04	0.04	0.05
	(0.02)∗	(0.02)+	(0.02)∗	(0.02)∗
Black	0.92	0.89	0.92	0.94
	(0.81)	(0.81)	(0.81)	(0.81)
Hispanic	0.42	0.40	0.41	0.45
	(0.39)	(0.39)	(0.39)	(0.39)
OtherRace	0.23	0.24	0.25	0.32
	(0.42)	(0.42)	(0.42)	(0.42)
Female	0.28	0.24	0.29	0.35
	(0.27)	(0.27)	(0.27)	(0.27)
%HouseOwnership	−0.93	−0.96	−0.91	−0.89
	(0.57)+	(0.56)+	(0.57)	(0.57)
MedianHouseVal. (000s)	−0.44	−0.45	−0.45	−0.43
	(0.15)∗∗	(0.15)∗∗	(0.15)∗∗	(0.15)∗∗
%Professional	0.44	0.40	0.22	0.21
	(2.17)	(2.18)	(2.17)	(2.16)
%Executives	3.77	4.11	3.61	3.77
	(2.58)	(2.55)	(2.58)	(2.60)
%BlueCollar	0.45	0.59	0.33	0.33
	(1.72)	(1.71)	(1.72)	(1.71)
%Technicians	−7.20	−7.28	−7.21	−7.01
	(5.95)	(5.96)	(5.95)	(5.90)
Trade	0.52	0.49	0.55	0.46
	(0.29)+	(0.29)+	(0.29)+	(0.29)
VehicleCost	98.58	98.51	98.47	98.24
	(2.34)∗∗	(2.35)∗∗	(2.33)∗∗	(2.35)∗∗
Competition	0.03	0.04	0.03	0.03
	(0.05)	(0.05)	(0.05)	(0.05)
Car Fixed Effects	*yes*	*yes*	*yes*	*yes*
Constant	1,007.23	1,007.97	1,007.50	1,009.22
	(1.79)∗∗	(1.82)∗∗	(1.80)∗∗	(1.93)∗∗
Observations	1406	1402	1406	1404
R-squared	0.97	0.97	0.97	0.97

∗ significant at 5%; ** significant at 1%; + significant at 10% level. Robust SEs in parentheses. All coefficients are multiplied by 100.

† Unreported are car, month, and region fixed effects, *EndOfMonth*, and *Weekend*. Response scale on trait variables (question 31) is reversed: Now 1="Disagree Strongly", 4="Agree Strongly."