Haas School of Business
UC Berkeley

Marketing Working Paper No. 01-1

Yale School of Management
Yale University

Working Paper No. ES-16

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October 2001

*We thank Meghan Busse, Judy Chevalier, Stephen Latham, David Levine, Daniel Snow, and seminar participants at LSE and the NBER IO Summer Institute for helpful comments. We gratefully acknowledge support from the Economics Program of the National Science Foundation, Grant #: SES-0111885.

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Abstract

This paper addresses the question of how much the Internet lowers prices for new cars and why. Using a large dataset of transaction prices for new automobiles and referral data from Autobytel.com, we find that online consumers pay on average 1.2% less than do offline consumers. After controlling for selection, we find that using Autobytel.com reduces the price a consumer pays by approximately 2.2%. This suggests that consumers who use an Internet referral service are not those who would have obtained a low price even in the absence of the Internet. Instead, our finding is consistent with consumers choosing to use Autobytel.com because they know that they would do poorly in the traditional channel, perhaps because they have a high personal cost to collecting information and bargaining. This group disproportionately uses Autobytel.com because its members are the ones with the most to gain. We estimate that savings to consumers who use Autobytel.com alone are at least $240 million per year. Since there are other referral and informational sites that may also help consumers bargain more effectively with dealers, we conclude that the Internet is facilitating a large transfer of surplus to Internet consumers in the retail auto industry.

1 Introduction

Widespread use of the Internet has led to the creation of a large number of sources that offer high-quality information about products at little or no cost to consumers. While some of this information is provided by manufacturers' own websites, consumers have come to rely on third-party "infomediaries" that aggregate information across many manufacturers' products and refer consumers to a subset of firms. Not surprisingly, given the magnitude of consumers' average expenditure and the confrontational nature of the purchase process, infomediaries have become popular in the automotive industry. In 2000, according to J.D. Power and Associates (2000a), 48% of new car buyers visited at least one independent vehicle site such as Autobytel.com, Carpoint.com, Edmunds.com, ConsumerReports.com, and KelleyBlueBook.com.

Industry participants have been concerned that the popularity of infomediaries—particularly that of referral services such as Autobytel.com and Carpoint.com—may negatively affect profits within the automotive industry. Indeed, in an earlier paper we show that prices paid by California consumers who use an Internet referral service are on average 2% lower than those paid by traditional California consumers for the same car (Scott Morton, Zettelmeyer, and Silva-Risso 2001a).

These findings, however, do not imply that the Internet is shifting rents from car retailers to consumers. Just because Internet consumers are paying less than offline consumers does not mean that they are paying less than they would have if the Internet did not exist. If online car buyers are those who would also have negotiated low prices in the offline world, the "cowboys" of our title, then the Internet does not affect the division of surplus between consumers and retailers, it merely provides an alternative channel for consumer-dealer interaction. If users of Internet referral services are instead those who are averse to comparison shopping and haggling, the "cowards" of our title, then the Internet, by aiding these consumers in obtaining lower prices than they would have received offline, has a real effect on the division of surplus in car retailing.

This paper addresses the question of whether, how much, and why an Internet referral service lowers prices for new cars. We analyze transaction data on over 700,000 new car purchases nationwide in combination with referral data from Autobytel.com. Autobytel.com is an independent Internet referral service that offers consumers detailed information about individual cars, including current market conditions and invoice pricing. Autobytel.com also has contractual relations with approximately 5,000 of the 22,000 US dealerships (in Q1, 2001). At any point a consumer may submit a free purchase request that is forwarded to one of Autobytel.com's contracting dealers.

We find in our national sample that consumers who use Autobytel.com pay on average 1% less than do traditional buyers for an identical car. Purchasing from an Autobytel.com affiliated dealer, regardless of what channel was used to buy the car, results in price that is lower by about 0.5%. After instrumenting for Autobytel.com usage, our estimate of the price difference between Internet and traditional buyers increases to 2.2%, suggesting that online consumers would have paid above average prices had they not used Autobytel.com to buy a car.

Our finding is consistent with consumers choosing to use Autobytel.com because they know that they would do poorly in the traditional channel, perhaps because they have a high personal cost to collecting information and bargaining. This group disproportionately uses Autobytel.com because its members have the most to gain. We conclude that using an Internet referral service lowers the price a consumer pays for a new car.

We also find that consumers who purchase at the Autobytel.com dealer to whom they were referred pay, on average, approximately the same as consumers who switch to another dealer. While this suggests that the information provided by Autobytel.com is portable, it also suggests that consumers, on average, do not benefit from switching away from the referral dealer. Further, we compare the prices paid by online consumers who obtained a referral for the specific make and model that they purchased with the prices paid by online consumers who requested a referral for a car different from the one they ultimately bought. While the former group pays about 1% less than do offline consumers, the latter groups pays only 0.5% less. This suggests that a make- and model-specific price quote matters beyond mere Internet usage related to a car purchase. This finding is also consistent with our selection result, namely that the mere fact that a consumer has chosen to use the Internet in searching for a new car cannot explain the lower prices Autobytel.com consumers obtain.

Our results show that car retailers gain lower gross margins from online consumers. We find that dealerships may nonetheless benefit from an affiliation with Autobytel.com because they derive incremental sales from referrals. We find no evidence that dealerships use their affiliation with Autobytel.com to "dump" slow-moving inventory. The Internet seems to be shifting rents from car retailers to consumers. However, it may be that selling to online consumers costs less than selling to offline consumers, a conjecture we cannot test because we do not have dealer-level overhead cost data.

This paper contributes to a small body of empirical literature analyzing the effect of Internet institutions such as referral services and shopping agents on firms' product market behavior. Brynjolfsson and Smith (2000), Ellison and Ellison (2001), and Iyer and Pazgal (2000) analyze the effect of comparison shopping agents on firms' pricing strategies. Brown and Goolsbee (2000) shows that the Internet may have helped to lower prices for term life insurance. In a recent theoretical paper, Chen, Iyer, and Padmanabhan (2001) analyze "referral infomediaries" and argue that referral services help retailers price discriminate and that referral infomediaries should contract only with a subset of retailers.

Our work is also related to the literature on automobile pricing. Goldberg (1995) and Berry, Levinsohn, and Pakes (1995) estimate structural models of demand for automobiles. Pashigian, Bowen, and Gould (1995) investigate within-season pricing patterns for automobiles. Verboven (1999) tries to determine whether pricing practices on base cars differ from those on cars with options. In contrast with these previous studies, our focus is on the Internet and how it affects the level and distribution of auto prices. Our previous work (Scott Morton, Zettelmeyer, and Silva-Risso 2001a) also analyzes the effect of Internet referral services on prices of new cars. However, in that paper we only had access to data from California and could not control for selection or the effects of competition.

We proceed as follows. In section 2, we discuss why an Internet referral service may change vehicle prices. In section 3, we discuss the data. Section 4 is a comparison of online and offline prices for cars. We also examine how the price paid by Autobytel.com users varies with level of competition in the retail auto market. In section 5, we control for selection and derive the average savings that result from using Autobytel.com. Section 6 is an analysis of which aspect of a referral enables consumers to obtain a lower price. In section 7, we investigate what drives dealerships to join the Autobytel.com network. Section 8 concludes the paper.

2 Hypotheses

A consumer who submits a purchase request on an Internet referral service provides her name, address, contact information, and the type of car she is looking for. The dealership contacts the consumer within 48 hours (often much sooner) with a "fixed" price.[1] In this way, a consumer may purchase a car without setting foot in the dealership until she picks up the vehicle. Autobytel.com assigns dealers an exclusive territory; any leads generated within that territory are passed on to the dealer in exchange for a dealer subscription fee. In this section, we discuss several reasons for which Internet referral service users might pay prices different from those paid by traditional consumers.

2.1 Possible reasons for offline vs. online price differences

Online consumers are better informed: The higher quality and lower price of online information may lead consumers to consume more information than they would have offline. Consumers who are better informed about market prices, the characteristics of their preferred cars, and

[1] According to J.D. Power and Associates (2000b), 42% of dealerships claim that their initial price contains no room for further negotiation. 42% give discounts but leave room for negotiation. 14% will quote a discounted price only if the customer insists by e-mail or phone. 2% of dealerships don't give discounted price until the consumer comes to the dealership.

negotiation strategies may be better “armed” to bargain with the dealer and thus receive, on average, a lower price. Better information is likely to be particularly important because prices for cars are not posted but rather are individually negotiated.

Bargaining on behalf of consumers: The contract between the Internet referral service and the dealer contains incentives that may cause the dealer to offer referred customers low prices. While an Autobytel.com dealer may decide whether and how to convert each lead into a sale, the service expects a substantial proportion of leads to result in a sale.[2] If the percentage of “closed” (sales/leads) is too low, the dealer may be terminated by the Internet referral service and replaced by another dealer in that area. Provided the stream of customers generated by the Internet referral service is valuable to the dealership, it has an incentive to quote prices low enough to keep its “close” percentage sufficiently high. In a sense, the referral service bargains on behalf of a group of consumers, although that group is not yet formed.[3]

Salesperson compensation: Autobytel.com stipulates in its contracts that the “Internet salesperson” at a dealership should handle only Internet referrals and not “walk-ins.” Also, this salesperson is supposed to be compensated on sales volume rather than on margin. This encourages the Internet salesperson to focus on closing additional sales rather than on maximizing unit profits.

Lower selling cost: It is possible that an Internet sale is less costly to carry out than a conventional sale. Online buyers may be low cost because they have searched already (perhaps test-driving at another dealership), have decided what car they want, and are ready to buy. Therefore, the dealer may be able to spend less time selling and haggling. Because Internet sales typically are performed by an “Internet Sales Department” with profit and loss responsibility separate from conventional sales, we would expect lower costs in that department to translate into lower equilibrium prices for cars sold to Internet customers.

Lower cost dealerships: In addition, consumers may gain from shopping online even if Internet referral services do not cause dealers to offer different prices to online and offline consumers. This is because referral services may simply sign up the lowest-cost/lowest-price dealers in each region. In this way a consumer gains by using the service because she does not have to search for the cheapest dealership in her area. In such a world, the Internet causes mean prices to decline by reducing search costs.

[2] Autobytel.com monitors this with customer satisfaction surveys. These surveys are the only way the referral service knows if its customers are happy.

[3] Autobytel’s bargaining is effective partially because the consumers in the group are incremental to the dealership. Autobytel.com dealers have told us that they consider the subscription fee to be a kind of dealer advertising; the cost of attracting one customer using Autobytel.com is less than that of using traditional advertising.

There is also an argument for why consumers who use referral services may pay more than do other consumers.

Online consumers are less price sensitive: Internet referral services are convenient because they allow a consumer to engage in the car purchase process at any time of day or night without leaving her home. In addition, referral services reduce consumers' direct interaction with dealers. To the extent that consumers with a high utility for convenience are less price sensitive, we should expect that dealers charge referral customers a higher price—not lower prices as claimed by Internet referral services.

Considering these arguments, we expect the role of an Internet Referral Service in informing consumers, bargaining on their behalf, and changing salesperson compensation to outweigh the potential effect of convenience. Therefore, we make the following empirical predictions:

- Consumers who submit a purchase request pay a lower price than other consumers at that dealership.
- Dealerships that contract with an Internet referral service have lower offline prices than other dealerships.

2.2 Selection

Even if we observe that average online prices are lower than average offline prices, it could still be the case that a referral site has no effect on the price a particular consumer receives. Suppose that Autobytel.com consumers would have obtained information from books and friends in the absence of the Internet, or that these are customers who are already good bargainers ("cowboys"). Then Autobytel.com might simply substitute for other information sources and mechanisms which existed before the advent of the Internet; consumers are paying the same prices they would have without the Internet, but because these consumers disproportionately use the Internet, Internet prices are lower than average. The distinction is between a "treatment" and "selection" effect.

Note, however, that the selection effect could also work in the opposite direction from that just described. Suppose that Autobytel.com users have a high personal cost to collecting information and bargaining. Such consumers know that they will pay a relatively high offline price for a car because they find it costly to, for example, comparison shop and haggle ("cowards"). If so, they will benefit more than will an average buyer from a service that provides information and "bargains" on behalf of a user. This should make them more likely to use Autobytel.com.

We are agnostic about whether there is selection at work and the direction it may take. However, suppose that, as conjectured above, consumers who submit a purchase request pay a lower price than other consumers. If we then find that selection plays a role in who uses an Internet referral service, we can infer from the direction of the selection effect whether the Internet has a real effect on the division of surplus in car retailing, or whether it merely provides an alternative channel for consumer-dealer interaction

- If controlling for selection lowers the estimate of the average price paid by a referred consumer, consumers who use Internet referral services are likely to have paid an above average price, had they not used the Internet. The Internet then shifts surplus to consumers.

- If controlling for selection increases the estimate of the average price paid by a referred consumer, consumers who use Internet referral services are likely to have paid a below average price, had they not used the Internet. The Internet then has little or no effect on the distribution of surplus in car retailing.

2.3 Portability of information

A substantial part of the Autobytel.com service consists of information about cars and market prices. Such information is not relationship specific and could be useful in negotiating with a non-Autobytel.com dealer. In addition, we expect that the price quoted by the referral dealer is useful in obtaining price concessions from competing dealers.

- Consumers will benefit from a referral from Autobytel.com even if they decide not to purchase at the dealership to which they were referred.

3 Data

Our data come from from a major supplier of marketing research information (henceforth MRI) and Autobytel.com. MRI collects transaction data from a sample of dealers in the major metropolitan areas in the US. We have data containing every new car transaction at these dealerships from January 1, 1999 to February 28, 2000. These data include 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.

We add to these data information on whether a consumer submitted a purchase request using Autobytel.com during 1999. We consider a match between observations from Autobytel.com and MRI when either the geocoded address or the phone number associated with the referral and the purchase transaction are the same. Each observation in the new dataset is a transaction from the MRI data, augmented by the information from the Autobytel.com data if there was a match. We have (1) an indicator variable for Autobytel.com customer (*Autobytel*) marking whether the customer who purchased the car submitted a purchase request using Autobytel.com (irrespective of whether this purchase request went to the dealer that sold the car), (2) an indicator variable for Autobytel.com franchise dealer (*AutobytelFranchise*) indicating whether the dealer that sold the car is an Autobytel.com affiliated dealer, i.e. is under contract with Autobytel.com and receives purchase requests, (3) an indicator (*SameDealer*) marking cases in which the dealer that sold the car is the same dealer to which the purchase request was submitted (given that *Autobytel=1*), and (4) an indicator variable (*ChangeCar*) that marks whether an Autobytel.com user bought a make and model for which she did not obtain a referral. Autobytel.com was the leading Internet Referral Service in 1999 with slightly over 2 million referrals.[4] However, since there are online referral services other than Autobytel.com, the customers in the combined dataset who are not identified as using Autobytel.com may have used one of its competitors. This biases our test against our hypotheses since we will be comparing a group that used Autobytel.com with a group that may include users of competing services.

Within the group that used Autobytel.com, about half of consumers buy a make and model for which they did not request a purchase referral. We restrict ourselves to observations in which an Autobytel.com user purchased a make and model for which she requested a referral; these consumers are informed about the car they buy and therefore have the most bargaining "clout." Thus, the main dataset, results, and summary statistics exclude the consumers who buy a make and model different from the one they requested. Later in the paper we return to the remaining Autobytel.com consumers. After dropping observations with missing data, our dataset has 671,468 transactions at 3562 dealerships. Summary statistics are in the Appendix.

3.1 Dependent variable

We define *Price* as the price that the customer pays for the vehicle, its 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. We subtract the *ManufacturerRebate*, if any, given directly to the consumer. We also subtract what is known as the *TradeInOverAllowance*. This 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

[4]Autobytel.com had between 45 and 50% market share of online car shopping in 1999 (LA Times, 3/28/2000, "Mergers and Acquisitions Report," Securities Data Publishing 6/12/2000). According to J.D. Power and Associates (2000a), Autobytel.com is the most visited purchase referral site. It is visited by 33% of consumers that researched online to shop for a car, followed by Autoweb.com (18%), and Carpoint.com (17%).

for the new car because they are profiting from the trade-in.[5]

3.2 Controls

We control for car fixed effects. A "car" in our sample is the interaction of make, model, body type, transmission, displacement, doors, cylinders, and trim level. This leaves 834 "cars" after dropping "cars" with fewer than 300 sales. We do not have information on options that are outside of trim levels, which is why we include the percent deviation of the dealer's *VehicleCost* from the average *VehicleCost* of that car in the dataset. The *VehicleCost* is the deviation from the retailer's average 'net' cost for the vehicle and includes the cost of accessories added by the factory and/or retailer and included in the customer's contract, that add to the vehicle's book value. The measure takes into account holdback and includes 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. Dealers that want to meet volume targets for the month often have sales or other inducements to purchase near the end 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 introduce dummies for each month in the 14 month sample period to control for other seasonal effects and inflation.

We control for the number of months between a car's introduction and when it was sold. This proxies for how "hot" a car is and for the dealer's opportunity cost of not selling the car. Judging by the distribution of sales after car introductions, we distinguish between sales in the first four months, months 5-13, and month 14 and later and assign a dummy variable to each category.

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 10 mile radius of the zip code of the focal dealership. We control for cases where one owner owns several franchises. Hence, our measure counts only the number of separately-controlled entities.

We also control for the income, education, occupation, and race of buyers by using 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 in which of 17 regions the car was sold.

[5]For a more detailed description of the variables in the data, see our earlier paper Scott Morton, Zettelmeyer, and Silva-Risso (2001a).

3.3 Summary statistics

We present descriptive statistics by whether a consumer used Autobytel.com to get a price quote for the make and model car they purchased. Table 1 shows that 3.1% of the buyers in the sample used Autobytel.com, while 24% of the cars in the sample are sold at dealerships that have a contract with Autobytel.com.[6] Of consumers in the sample, 40% trade in a vehicle, and 70% obtain some amount of dealer financing. About 36% of customers are female, and the average age of all buyers in the sample is 44. Among consumers who used Autobytel.com, 28% buy from the dealer they were referred to (see Table 2). The average price of the cars bought by Autobytel.com consumers is higher and their *TradeInOverAllowance*, the amount the dealer subsidizes the trade-in, is considerably lower. The gross profit margin does not differ greatly between online and offline sales. The average offline car earns a dealer $1438 compared to $1376 for a sale through Autobytel.com.

Autobytel.com affiliated dealers are clearly different from others (see Table 3). They are larger, fewer of their sales involve a trade-in vehicle, and they are located in areas that are slightly more competitive. Autobytel.com franchises have customers who are from higher income neighborhoods, but on average, they serve people from minority census tracts as often as do other dealerships. The average age of customers at the two types of dealerships is similar.

4 Price Estimation

Our primary interest is whether use of Autobytel.com alters the average price a consumer pays for her car. The dependent variable we use is *Price* as defined above. In order to provide the appropriate baseline for the price of the car, we use a standard hedonic regression on log price. We work in logs because many of the attributes of the car, such as being sold in Northern California or in December, are not appropriate to model as a fixed dollar increment, but will be a percentage of the car's value. We estimate the following specification:

$$\ln\left(Price_i\right) = \alpha_1 Autobytel_i + \alpha_2 AutobytelFranchise_i + \beta X_i + \epsilon_i$$

The X matrix is composed of transaction and car variables: car, month, and region fixed effects, controls for model recency, whether the consumer traded in a vehicle, and car cost.

[6]This proportion of Autobytel.com users approximately doubles if one includes those who purchase a car different from the one they requested a purchase referral for.

4.1 Full sample results

Prices paid by Autobytel.com users are 1% lower than those paid by other customers (see column 1 in Table 4). This estimate is smaller than the 1.5% we found in an earlier paper in which we had data only from California (Scott Morton, Zettelmeyer, and Silva-Risso 2001a). Purchasing from an Autobytel.com affiliated dealer, regardless of what channel was used to buy the car, results in a price that is lower by about 0.5%, unchanged from our earlier estimates.

The second column of Table 4 adds demographics. Because an individual buyer is assigned the demographic characteristics of her census block group, the explanatory variables are either a probability that applies to the customer (*%CollegeGraduates*) or an average (*MedianHHIncome*). The two exceptions to this are *Age*, which is the actual age of the customer, *Over64*, which is a dummy indicating if the person's age is above 64, and *Female*, which is inferred by MRI based on an analysis of the buyer's first name.

The Autobytel.com results in column two are very similar to those in column one. The Autobytel.com coefficient falls by 10% to -.89%. Again, using an Autobytel.com franchise lowers price. The demographic coefficients have the expected signs. In particular, older people pay more for cars (0.2% increase if age moves from 20 to 64) until a consumer hits retirement age, whereupon a negative indicator variable of -0.17% takes effect. People who have a higher probability of being a disadvantaged minority (black and Hispanic) pay more. An increase of ten percent black (Hispanic) in a census tract raises the expected price of the car by 0.14% (0.11%). For more details on the effect of race on car prices, see **?**). Women pay about 0.21% more than do men for a given car. We expect income and education to be correlated, and we also expect them to have opposite effects on car prices. High income indicates a lower elasticity of demand, while high educational levels may make a person a more effective bargainer. Hence, we have few priors on the signs of these neighborhood variables. They are mostly significant: more income and high house values lower car prices, while a more "professional" neighborhood raises prices. Home ownership, a proxy for good credit, lowers prices. The level of *%CollegeGraduates* lowers prices, as we expected, while an increase of ten percent in the probability of not finishing high school in a census tract increases a resident's price by 0.04% on average.

4.2 Results by vehicle segment

We find that there is considerable variation in the Autobytel.com discount by vehicle subsegment (see Table 5). MRI separates the cars in the dataset into sixteen subsegments such as "compact pickup" and "premium sporty." Four subsegments—Basic Large, Luxury SUV, Near Luxury, and Premium Sporty—have Autobytel.com coefficients that are smaller than one-half percent and/or are not statistically different from zero. Consumers may have received little or no Autobytel.com discount because there was strong demand for the cars in these subsegments in 1999. We check for the strength of demand in a subsegment by comparing average *DaysToTurn* across subsegments. This variable measures how long a car sits on a dealer's lot and therefore how "hot" it is. The subsegments with the fastest turnover (lowest median days to turn) are: International Luxury (11), Luxury SUV (10), Near Luxury (14), and Premium Sporty (10). This list includes three out of the four subsegments with the lowest Autobytel.com discounts. The mean subsegment, Premium Compact, has a median number of days to turn of 25. The Basic Large subsegment does not have excess demand by this metric, but the segment is small, dominated by institutional purchases (Police Departments), and is therefore atypical. Consumers who buy cars in the "entry" and "compact" subsegments such as "Compact Pickup," "Entry Sporty," "Premium Compact," and "Entry Compact" receive the largest Autobytel.com discount. It appears that Autobytel.com has the most effect for car categories that are not supply constrained.

4.3 Competitive Effects

Prices are higher when dealers are in areas with fewer other dealers of the same nameplate (see column 1 in Table 6). Moving from zero to ten other dealers of the same nameplate within ten miles lowers the average price by approximately 0.3% ($69 on the average car). This effect may be small because our data do not include sales in rural areas, so we do not have as much variation in market structure as do some other studies.

We are also curious as to whether Autobytel.com creates an effect similar to adding another competitor to the marketplace. For example, in a concentrated local market, the availability of getting a price quote over the web might be equivalent to increasing competition in the local market. If so, we would expect the price discount obtained by using Autobytel.com to be higher in less competitive markets. As the market becomes more competitive, the addition of another competitor should have less effect on equilibrium prices (Bresnahan and Reiss 1991).

The institutional role of Autobytel.com suggests that Autobytel.com could also have the opposite effect. Bargaining may occur at the level of the dealer and Autobytel.com, rather than between the customer and the dealer. In such a case, more dealers in an area will strengthen the hand of Autobytel.com because it can credibly threaten to move its franchise to another dealer more easily. This may allow it to pressure dealers into offering lower prices to consumers. We find that the interaction between Autobytel.com and the number of dealers of the same nameplate in the area is negative (see column 2 in Table 6). It appears that Autobytel.com has more influence on dealer pricing in more competitive markets.

4.4 Discussion

The results are consistent with our hypotheses, namely that dealerships that contract with an Internet referral service set lower offline prices than do other dealerships, and that consumers who submit a purchase request pay a lower price than do other consumers at that dealership. Any potential convenience and income effect is dominated by price-reducing effects. Since the average customer has a 25% likelihood of shopping at an Autobytel.com dealer at random (weighted by sales volume), online consumers who buy through Autobytel.com pay on average 0.9% plus 0.3% (three-quarter of .45%), or 1.2% less than do offline consumers, for the same car. All consumers who shop at an Autobytel.com contract dealer gain slightly. The payoff from using Autobytel.com increases as the local market becomes more competitive.

To test for whether the volume-based compensation that Autobytel.com encourages for Internet salespeople may be contributing to lower prices, we limit the sample to cars purchased on the last two days of the month. The volume incentives facing dealers on those days are similar to the volume incentives Autobytel.com suggests dealers use for salespeople handling its leads. Thus the two groups should be more similar at this time of the month if part of what is driving the Autobytel.com "discount" is dealer behavior. As expected, we find a small drop in the Autobytel.com coefficient to about -.77% in this specification (see column 3 in Table 4).

5 Selection

Thus far we have not attempted to discriminate between two different interpretations of the finding that Autobytel.com customers pay less. If Autobytel.com educates previously naive consumers, or bargains on their behalf, then the referral service enables consumers to pay lower prices than they would have if Autobytel.com had not been available. Alternatively, if Autobytel.com is used by consumers who are already well informed or are good bargainers, the referral service only substitutes for information sources and mechanisms which already exist—consumers are paying the same prices they would have in the absence of the Internet. The former is a "treatment" and the latter, a "selection" effect. The distinction clearly matters to the retail auto industry, which may face a redistribution of rents if referral services cause lower prices.

Formally, consider the following set of equations where B is an individual specific characteristic that is unobserved and forms part of the error term.

$$\begin{aligned} Autobytel_i &= \gamma Z_i + \alpha B_i + \mu_i = \gamma Z_i + \epsilon_{1\,i} & (1) \\ \ln(Price_i) &= \phi Autobytel_i + \beta X_i + \delta B_i + \nu_i = \phi Autobytel_i + \beta X_i + \epsilon_{2\,i} & (2) \end{aligned}$$

Suppose that B is desire and ability to bargain. This desire leads the buyer to use Autobytel.com to strengthen her bargaining position, leading to positive α and a negative δ. Since B is unobserved, *Autobytel* will be correlated with equation 2's error term. In this scenario the estimated coefficient on *Autobytel* will be negatively biased relative to the true coefficient. Consequently it would be incorrect to treat the lower price as having been caused by Autobytel.com (Heckman 1979).

The selection effect could also work in the opposite direction. Suppose that characteristic B indicated that the buyer is a busy person, with a high personal cost to collecting information and bargaining. Then α would be positive, but δ would be positive also. Hence, the estimated Autobytel.com coefficient will be biased upward and the true savings from using the service are larger than the OLS estimates. This latter direction of the selection effect is consistent with users of Internet referral services being the ones with the most to gain: those who for whatever unobserved reason, pay a high price in the traditional channel.

5.1 Instrumental Variables Estimation

In order to consistently estimate the effect of Autobytel.com usage on price, we use IV estimation to account for selection. Two unobserved characteristics could potentially determine both Autobytel.com usage and negotiated prices: a willingness to gather information and bargaining ability. Our instruments must therefore predict usage of Autobytel.com but be uncorrelated with these two characteristics. In some settings, demographic information can be used to predict Internet usage. In the case of negotiated prices, however, almost all demographic indicators (for example, income or education) are likely to be also correlated with price.

Instruments: Our first instrument is the average family size in the customer's census block group. Having children in the local neighborhood may affect the probability of using Autobytel.com (more likely to have computers in the local public library or school), but should not affect an individual customer's propensity to bargain. We also use the square of this variable.

Our second instrument is the number of Autobytel.com users in the customer's zip code that did not purchase a car from a dealership in our sample. We call this variable *AutobytelUseInZip*. After eliminating consumers in our sample from Autobytel.com's referral database, we aggregate the remaining 1,600,000 referred consumers by zip code and divide by the zip code population. This zip code-level measure is correlated with the propensity of consumers in our sample to use Autobytel.com. This measure eliminates any endogeneity problems that may arise because of an *individual* characteristic that drives both a consumer's likelihood to use Autobytel.com and her ability to obtain a lower price. Notice that our proposed instrument still picks up characteristics common to consumers in the zip code that may drive consumers' probability of using Autobytel.com and their ability to obtain a good price. However, in contrast to individual characteristics, we can control for such neighborhood characteristics with our census block group data. One might also be concerned that a zip code with high Autobytel.com usage is one in which the local Autobytel.com affiliated dealer charges low prices. We find no such correlation (0.007 with a p-value of .63). This instrument measures idiosyncratic variation in the diffusion of Autobytel.com use across neighborhoods.

Finally, we use the number of transactions in the sample for a particular "car." The popularity of certain bundles of characteristics should affect the benefit to searching for the car on the Internet. This variable varies at the individual customer level. (We also include this measure squared and cubed because we find that consumers looking for very rare and very common "cars" are less likely to use Autobytel.com.)

Estimation results: We estimate the use of Autobytel.com in a probit specification on our instruments and all demographics used in the price equation. The pseudo R^2 of about .06 is quite low, partly because we do not know which consumers used Autobytel.com's two largest competitors (Carpoint and Autoweb), so our dependent variable undercounts total Internet referral usage. We use the predicted values from the probit, along with an indicator when a predicted value is in the top 3%, as additional instruments in a two stage least squares regression of $\ln(Price)$, with *Autobytel* as the endogenous variable. The predicted values from the probit play an important role because they are nonlinear transformations of the instruments.

In this specification the coefficient on Autobytel.com increases in magnitude to -1.9%, twice the magnitude of the OLS estimate (see column 4 in Table 4). The coefficient on *AutobytelFranchise* remains stable at -.45%. The instruments pass an exogeneity test described in Hausman (1983). The test statistic is $N * R^2$ from a regression of the IV errors on all the exogenous variables in the system. It is distributed χ^2 with K-1 degrees of freedom, where K is the number of instruments.

5.2 Discussion

Our instrumental variables estimate of the effect of Autobytel.com is larger in magnitude than the OLS result. Since the average customer has a 25% likelihood of shopping at an Autobytel.com dealer at random (weighted by sales volume), the total savings to a consumer of buying through Autobytel.com is 2.2% (1.9% + 3/4*0.45%), corresponding to $500 on the average car.

The difference between the OLS and the IV estimates indicates that it is not hard bargainers who choose to use Autobytel.com. Rather, our IV results support the hypothesis that consumers who use Autobytel.com would have paid above average prices offline, perhaps because they have a high personal cost to collecting information and bargaining. After using Autobytel.com, these consumers pay approximately 1% below the mean, implying that before using Autobytel.com these consumers would have paid about 1% above the mean. Our IV result also confirms that the negative sign of the OLS coefficient is not an artifact of selection. It appears that consumers who use Autobytel.com are those who previously did not have the skills or time to seek out knowledge that would help them get a low price offline.

5.3 Dispersion

The distribution of prices within and across dealerships provides additional evidence on the pattern of selection into Autobytel.com use. If the Internet is helping some of those consumers that otherwise would have paid above average prices, dealerships with a high proportion of Autobytel.com sales should sell relatively fewer cars at a high markup.

We define a "high markup" sale as one where the residual from our price regression in column 1 in Table 4 is at least +2%. We calculate the percentage of sales that are "high markup" for each dealer in each two month period in the sample. We regress this measure on the proportion of Autobytel.com sales at that dealer in the same two month period and include franchise fixed effects. We find that the higher the proportion of a franchise's sales to consumers who used Autobytel.com, the lower the proportion of high margin sales. This is true for Autobytel.com franchises, but not for non-Autobytel.com franchises.[7] The negative correlation between high-margin sales and Autobytel.com sales is consistent with our earlier results; it appears that shoppers who use Autobytel.com are less likely to pay a substantial positive premium for their cars.

Figure 1 on page 33 plots the distribution of residuals from our basic price regression (excluding Autobytel.com related explanatory variables). Residuals from Autobytel.com sales are plotted below those of non-Autobytel.com sales. The distribution of residuals for Autobytel.com sales is of lower mean and variance than those of "street" sales. Notice also that the Autobytel.com distribution has a much thinner upper tail than the non-Autobytel.com distribution. The lower tails of the two distributions are very similar. This is what we would expect to see if consumers who would have paid an above average price pay a price closer to the mean after using the Internet.

6 Car and dealer switching

In this section we attempt to understand better what aspect of a referral enables consumers to obtain a lower price. We do so by exploiting differences in make, model, and dealer, between

[7] The coefficient estimate is -.14, p<.01, N=2849, Adj. $R^2 = .53$

the Autobytel.com referral and the actual transaction.

6.1 Referral versus transaction dealers

We first analyze whether Autobytel.com usage leads to savings only at the dealer to whom the consumer was referred, or whether the referral is useful for negotiating with other dealers also. Consumers can take the price quote in response to a referral and the information obtained during the process, and try to negotiate a low price from a dealer not affiliated with the referral service.

We add to our basic specification an indicator identifying those Autobytel.com consumers who purchased the car from their referred dealer, *SameDealer* (see column 1 in Table 7). These consumers are "doing what they are supposed to" from the point of view of the dealer and the Autobytel.com business model. The coefficient on *SameDealer* is 0.2%. Given that all $SameDealer = 1$ consumers but only 20% of $SameDealer = 0$ consumers who use Autobytel.com purchase at an Autobytel.com contract dealer, we weigh the *AutobytelFranchise* coefficient in comparing the two groups. Consumers who continue their (costly) search after having received a referral pay slightly more than do consumers who do not continue searching $(-.46\% * 20\% - (-.46\% + 0.2\%) = 0.17\%)$. While this suggests that the information provided by Autobytel.com is portable, it also suggests that consumers, on average, do not benefit from switching away from the referral dealer.

6.2 Referred versus purchased make and model

Next, we analyze whether consumer savings from using Autobytel.com are associated with the mere fact of submitting a referral, or whether it matters that consumers submit a referral for the specific make (nameplate) and model that they purchase. We can analyze this question because 51% of the consumers who use Autobytel.com do not purchase the car for which they made a purchase request.[8]

We define these consumers as *ChangeCar* buyers rather than *SameCar* buyers. Of these *ChangeCar* buyers, 30% end up purchasing a car of the same make (but not model) than the car for which they made a purchase request. We previously noted that 28% of *SameCar* consumers buy from their referred dealer. For consumers who change make and model, only 6.75% buy from the referred dealer.

To compare a buyer's requested versus purchased model, we calculate the average price of each make and model in the dataset. We then compare the prices of the referred cars versus the

[8] Our statistic includes consumers who submit multiple referral requests; if any of the requests matches the car bought, then the consumer is defined as *SameCar*.

purchased cars. We do this for the 79% of buyers who make exactly one referral request. We ignore the remaining observations because otherwise we would have to choose arbitrarily which request to analyze. We find that buyers who change cars, on average, request a price quote for a more expensive car than the one they buy. The median *ChangeCar* consumer buys a car that costs $500 less and that was on the lot for two more days than the requested car. Consumers seem to be searching for the lowest price on their "dream car" before resigning themselves to buying a less expensive alternative. Interestingly, we find that consumers who change models but not dealers, buy cars that are, on average more expensive than the ones they requested.

We add a second Autobytel.com variable to our standard price specification. *Autobytel∗ChangeCar* is one if a consumer purchases a different make or model than the one requested through Autobytel.com. *Autobytel* continues to capture the effect of Autobytel.com for consumers who buy a make and model they requested. The sample size increases by 22,000 observations because we add consumers who purchased a different make or model from the one requested through Autobytel.com.

We find that the *Autobytel∗ChangeCar* coefficient is half the size of the *Autobytel* coefficient, -0.46% versus -0.90% (see column 2 in Table 7). We can further distinguish between consumers who change make and model and those who only change model but purchase a car of the requested nameplate. We find that consumer who change make and model receive a -0.36% discount, those who stay with the same make get -0.71% and those who buy the car they asked about receive a -0.90% discount (see column 3 in Table 7). Finally, among *ChangeCar* consumers, there is no difference between the price paid by those who purchase from the referred dealer and those who switch dealership (see column 4 in Table 7).[9]

In conclusion, it seems beneficial to have a competitive price quote for a specific make and model and not just general information from Autobytel.com or the Internet. This is consistent with our IV results: choosing to shop for a car online does not indicate that a consumer is a good bargainer.

7 Dealer behavior

Our findings raise the question of why dealers affiliate with Autobytel.com, given that Autobytel.com seems to lower the prices consumers pay. To approach this question we investigate some of the costs and benefits of an affiliation with the Internet referral service.

The cost of joining Autobytel.com is a subscription fee and a potential "cannibalization" of walk-in sales. Dealers pay an annual fixed fee based on the size of the dealership, on average

[9] Recall that for *SameCar* consumers, buying from the referral dealer is slightly more expensive (and more convenient) than continuing to price shop (by 0.2%).

$1607/month. Since the closing ratio (sales/referrals) is about 13% for Autobytel.com, dealers pay on average $135 per sold vehicle to Autobytel.com.[10]

Dealerships may feel that they lose from "cannibalization" of existing sales when their high margin customers move to the Internet and become low margin customers. Although our results indicate that the Internet transforms some high-margin customers into low margin customers, this is a secular change that is not related to a given dealership's Internet strategy. It seems very unlikely that a customer would start using Autobytel.com *because* the local dealership where she intended to buy her car belongs to Autobytel.com's network. Consumers do not know which dealership is affiliated unless they have already used Autobytel.com and submitted a referral. Hence, by not affiliating with an Internet referral service, a dealership cannot prevent high-margin customers from becoming low-margin customers. It can only choose whether to serve these consumers.

The gains from joining Autobytel are any incremental sales from the affiliation with the referral service, a potential reduction in selling cost due to Autobytel.com, and the potential use of Autobytel.com to "dump" excess inventory. We are limited in our analysis by the transactional nature and short horizon of our data. In particular, we have neither data on the fixed cost associated with selling cars, nor data on the conduct of dealerships before their affiliation with Autobytel.com. However, we can indirectly analyze the potential benefits of an affiliation.

7.1 Incremental sales

Dealers are assigned exclusive territories by Autobytel.com. All customers who submit a purchase referral for a particular nameplate within that territory are referred to the same dealer. Hence, Autobytel.com dealers are likely to draw to their dealerships some consumers who would otherwise have purchased elsewhere. Autobytel.com defines territories so that size, number of other dealerships of the same nameplate, number of car registrations, and rate of Internet access create high enough usage rates to form a viable market for the dealership.

The results presented thus far in this paper show that dealers that choose to affiliate with Autobytel.com are much larger than are others; this increases the chance that the dealership stocks the car a customer requests. A large dealership also has the economies of scale to support a full-time Internet salesperson. This increases the likelihood that a Autobytel.com consumer receives "Internet-quality" service rather than being exposed to a salesman who uses traditional sales methods. Autobytel.com franchises also charge slightly lower prices on average.

We cannot empirically predict *ex ante* which dealerships will join the Autobytel.com network

[10] Youngme Moon (1999), "Autobytel.com," HBS Case Study, and J.D. Power and Associates (2000b)

because we do not know among which set of dealers Autobytel.com chooses. However, we can analyze the *ex post* amount of business stealing. We know the Autobytel.com customer zip codes associated with each dealer, as well as the zip codes that make up the dealership's offline sales. We define an Autobytel.com sale as "incremental," when the customer lives in a zip code with very few standard sales. We define "very few" as less than 0.225% of sales in the zip code, recognizing that the definition of "very few" is necessarily arbitrary. At this cutoff, only 10% of all car purchases fall into zip codes with "very few" standard sales; the median car is sold to a person in a zip code that generates 2% of the dealership's sales. The median zip code for a franchise has 0.4% of a dealership's sales because the distribution is highly skewed toward many zip codes with small numbers of sales. In addition, this method defines "incremental" sales only using geography. There are undoubtedly more consumers that might be attracted from a competitor, but they live in zip codes that are heavily populated with consumers and so we can't identify them.

Note that some of the sales we identified as offline sales are, in fact, Internet sales made through other referral services. We can control for one additional affiliation, since we have data on the dealerships that also contracted with Autoweb.com. However, some of the remaining dealerships will be affiliated with Carpoint. Thus, our measure of business stealing is likely to be conservative. We estimate a tobit regression of the number of Autobytel.com sales in the year that are "incremental" on a number of dealership characteristics. We include the number of dealerships of the same nameplate within a ten mile radius of a given dealership. These represent the dealerships from which business stealing is easiest. We also include two measures created from residuals of the basic price equation (excluding demographics). First, we include the dealership's average price to non-Autobytel.com customers. Second, we include the standard deviation of prices to non-Autobytel.com customers.

We find that belonging to the Autobytel.com network increases incremental sales by 5.5 in a two month period (see column 1 in Table 8). Autoweb affiliation increases incremental sales by 1.8. Note that the magnitude of these coefficients depends entirely on the definition of "incremental sales," which we cannot measure well. As expected, more competition within ten miles increases incremental sales; an increase of three competitors raises incremental sales by 1. Lower average price and variance for non-Autobytel.com sales are also associated with higher incremental sales. A one-standard deviation decrease in average price increases sales by 0.2 cars in two months. Low and uniform prices may be characteristics that appeal to the kind of customer who uses Autobytel.com. We also run the specification with a zip code cutoff level of 0.65%, which corresponds to 25% of the cars in the sample, and find similar results (not reported).

7.2 Selling costs and invoice prices

Autobytel.com may reduce the selling costs of dealers by increasing the productivity of a salesperson. Since much of the customer communication is handled by e-mail, a sales person can potentially spend less time for each sale. As mentioned before, we cannot test this hypothesis because we do not have detailed data on overhead cost.

We can test, however, whether Autobytel.com affiliated dealerships pay lower invoice prices than do other dealerships. We expect them not to, because according to franchise laws, manufacturers have to sell the same car at the same price to all dealers. We compare the vehicle cost at Autobytel.com affiliated dealerships with those at other dealerships. This measure is a retailer's 'net' cost for the vehicle and includes the cost of accessories added by the factory and/or retailer and included in the customer's contract, that add to the vehicle's book value. The measure takes into account holdback and includes transportation charges.

We find in a level regression that the vehicle costs of Autobytel.com affiliated dealerships are on average \$63 higher per car. In a log regression, costs are higher by 0.29%, or \$67 on the average car (see columns 2 and 3 in Table 8). As expected, any potential cost savings from selling to Autobytel.com customers must come out of dealers' overhead cost; it does not come from lower vehicle cost.

Our finding that vehicle cost are slightly higher for Autobytel.com affiliated dealerships indicates that those dealerships sell cars with more expensive options which are not captured by our car dummies. Because we control for *VehicleCost* in our price regressions, this has no effect on our previous results.

7.3 "Dumping" inventory:

Dealers may also join Autobytel.com to "dump" excess inventory. If dumping is an important reason why dealers sign up with Autobytel.com, the referral service is unlikely to have a long-run effect on the structure of the retail auto industry. This is because using Autobytel.com would not be beneficial to mainstream consumers.

To examine this claim, we look at the frequency with which dealers sell "hot" cars through Autobytel.com. Dealers may not view it as a bone fide channel for desirable cars, but as a way of disposing of excess inventory. We calculate two measures of "hotness". The first is a model's average days to turn (the number of days a car sits on a dealer's lot), excluding sales to consumers referred by Autobytel.com. The second is a model's average markup, subtracted from the average markup of the subsegment in order to control for different fixed costs of retailing across subsegments.

Both of these measures are used to explain the probability of consummating the transaction at the referred dealer, restricting the sample to sales with an Autobytel.com referral. We find that "hotness" is associated with a lower likelihood of an Autobytel.com sale through the referring dealer. However, the marginal effects are low. A one standard deviation increase in the margin measure measure causes a 2.1% reduction in the probability of sale, while a one standard deviation increase in days to turn causes a 1.1% increase in the probability of sale (not reported). If dealers were using Autobytel.com primarily to "dump" slow-moving inventory, these marginal effects should be much larger.[11]

7.4 Discussion

Dealerships need to derive some benefit from their affiliation with an Internet referral service to offset the cost of membership fees. We find evidence that Autobytel.com dealers gain incremental sales from their affiliation, and this may be one of the benefits of belonging to the network. The cost of purchasing the car (marginal cost) does not differ much between dealer types, although Autobytel.com dealers seem to pay slightly more. We do not find evidence that dealers join Autobytel.com to "dump" excess inventory, although less popular cars have a slightly greater chance of "closing". There are many more interesting questions to be asked about dealer incentives and strategies with respect to the Internet, but we will leave them to future research with a more appropriate dataset.

8 Conclusion

We have analyzed how much an Internet referral service, Autobytel.com, lowers prices for new cars and why. We find that online buyers pay on average 1.2% less than do offline consumers, for the same car. After controlling for selection, we find that buying a car through Autobytel.com reduces the price a consumer pays by approximately 2.2%. This suggests that consumers who use an Internet referral service are *not* those who would have obtained a low price even in the absence of the Internet. Instead, our finding is consistent with consumers choosing to use Autobytel.com because they know that they would do poorly in the traditional channel, perhaps because they have a high personal cost of collecting information and bargaining. This group disproportionately uses Autobytel.com because its members are the ones with the most to gain. As suggested by these IV results, we find that a dealership's Autobytel.com sales are associated with a reduction in high margin sales both statistically and graphically. We also find

[11]Note that we have no way of knowing if the behavior of dealers towards Autobytel.com customers is any different from their behavior to offline customers. We cannot create analogous estimates for customers who arrive through conventional channels because we only know their final purchase location and not which dealer they initially contacted.

that that a make and model-specific price quote matters beyond mere Internet usage related to a car purchase. This finding is also consistent with our selection result, namely that the mere fact that a consumer has chosen to use the Internet in searching for a new car cannot explain the lower prices paid by Autobytel.com consumers.

We also estimate the extent of business stealing by Autobytel.com franchises and find that those franchises with low average prices and a low variance of prices are most successful at attracting more sales. Our results imply that the advent of auto Internet referral services benefits Internet consumers by raising their consumer surplus. In 1999, the consumers in our sample saved \$10 million in aggregate. If we extrapolate the results here to the portion of the market not covered by the MRI data, the aggregate savings to Internet consumers would be as much as \$240 million per year, assuming only 3% of consumers use Autobytel.com. Since there are other referral and informational sites that may help consumers bargain more effectively with dealers, we conclude that the Internet is facilitating a large transfer of surplus to Internet consumers in the retail auto industry.

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Appendix

Table 1: Summary statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
Autobytel	671468	0.03	0.17	0	1
AutobytelFranchise	671468	0.24	0.43	0	1
SameDealer	671468	0.009	0.09	0	1
Price	671468	23367	8103	5957	100190
TradeInOverAllowance	270157	958	1734	-10000	19956
VehicleProfit	671468	1436	1298	-4894	13902
DaysToTurn	642323	45.09	56.93	1	642
AnyTrade	671468	0.40	0.49	0	1
AnyFinancing	671468	0.75	0.43	0	1
Competition	671468	2.98	2.28	0	23
MedianHHIncome	671468	56597	24905	10403	150000
%CollegeGrad	671468	30.95	17.71	0	100
%<HighSchool	671468	12.47	10.54	0	100
%HouseOwn.	671468	72.99	22.38	0.14	100
MedianHouseVal.	671468	164642	99728	7500	500000
%Professional	671468	16.42	8.42	0	100
%Executives	671468	17.39	8.06	0	100
%BlueCollar	671468	26.27	14.99	0	100
%Technicians	671468	2.99	1.97	0	100
CustomerAge	671468	43.90	14.13	16	100
Age> 64	671468	0.09	0.29	0	1
%Asian	671468	4.93	7.94	0	100
%Black	671468	5.95	14.49	0	100
%Hispanic	671468	8.25	10.27	0	55.33
Female	671468	0.36	0.48	0	1
EndOfMonth	671468	0.22	0.42	0	1
Weekend	671468	0.23	0.42	0	1
ModelMonth5-13	671468	0.73	0.44	0	1
VehicleCost	671468	0.0004	0.06	-0.64	0.73
#ofCarsSold	671468	2701	2262	300	12063
FamilySize	671468	2.99	0.55	1.5	6
%ReferralsInZip	625722	1.22	8.13	0.004	1700

Table 2: Summary statistics by *Autobytel*

	Autobytel=0					Autobytel=1				
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
AutobytelFran.	650850	0.23	0.42	0	1	20618	0.39	0.49	0	1
SameDealer	650850	0.00	0.00	0	0	20618	0.28	0.45	0	1
Price	650850	23333	8124	5957	100190	20618	24448	7317	6995	89900
Tr.InOverAll.	264081	969	1741	-10000	19956	6076	486	1324	-6250	17590
VehicleProfit	650850	1438	1300	-4894	13902	20618	1376	1231	-2559	11801
DaysToTurn	622727	45.48	57.15	1	642	19596	32.43	47.55	1	479
AnyTrade	650850	0.41	0.49	0	1	20618	0.29	0.46	0	1
AnyFinancing	650850	0.75	0.43	0	1	20618	0.63	0.48	0	1
Competition	650850	2.99	2.28	0	23	20618	2.86	2.11	0	18
MedianHHInc.	650850	56311	24819	10403	150000	20618	65623	25906	10675	150000
%CollegeGrad	650850	30.71	17.65	0	100	20618	38.45	17.86	0	100
%<HighSchool	650850	12.57	10.60	0	100	20618	9.23	7.94	0	74.7
%HouseOwn.	650850	72.95	22.36	0.14	100	20618	74.36	22.84	0.14	100
Med.HouseVal.	650850	163491	99162	7500	500000	20618	200957	110186	7500	500000
%Professional	650850	16.33	8.40	0	100	20618	19.30	8.70	0	100
%Executives	650850	17.31	8.05	0	100	20618	20.15	7.93	0	100
%BlueCollar	650850	26.44	15.02	0	100	20618	20.84	12.73	0	100
%Technicians	650850	2.98	1.97	0	100	20618	3.16	2.00	0	27.6
CustomerAge	650850	43.99	14.18	16	100	20618	41.32	12.00	16	96
Age> 64	650850	0.10	0.29	0	1	20618	0.04	0.20	0	1
%Asian	650850	4.89	7.91	0	100	20618	6.13	8.91	0	97.19
%Black	650850	6.00	14.61	0	100	20618	4.21	9.83	0	100
%Hispanic	650850	8.30	10.33	0	55.3	20618	6.53	7.87	0	53.73
Female	650850	0.36	0.48	0	1	20618	0.33	0.47	0	1
EndOfMonth	650850	0.22	0.42	0	1	20618	0.24	0.43	0	1
Weekend	650850	0.23	0.42	0	1	20618	0.22	0.41	0	1
ModelMo.5-13	650850	0.73	0.44	0	1	20618	0.72	0.45	0	1
VehicleCost	650850	0.00	0.06	-0.64	0.73	20618	0.00	0.05	-0.48	0.34
#ofCarsSold	650850	2696	2263	300	12063	20618	2873	2217	300	12063
FamilySize	650850	2.99	0.55	1.5	6	20618	2.97	0.55	1.5	6
%Refer.InZip	606621	1.21	8.08	0.004	1700	19101	1.57	9.72	0.005	508

Table 3: Summary statistics by *AutobytelFranchise*

	AutobytelFranchise=0					AutobytelFranchise=1				
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
Volume	2109	281	448	1	4835	310	556	671	1	4124
Sales	2109	6.53MM	10.7MM	9000	128MM	310	12.8MM	14.9MM	20337	95.5MM
%ABT	2109	0.04	0.06	0	1	310	0.08	0.05	0	0.33
%Financing	2038	0.69	0.18	0.05	1	309	0.67	0.15	0.18	1
%TradeIn	1911	0.45	0.2	0.008	1	309	0.37	0.14	0.06	1
%Same	2109	0.0003	0.0037	0	0.1	310	0.04	0.03	0	0.17
%Black	2109	6.27	8.31	0	80.07	310	5.77	5.46	0	29.49
Cust.Age	2109	45.6	8.42	19	83	310	44.4	6.22	34.4	69.5
Cust.Income	2109	52605	15816	16573	150000	310	57356	12235	25200	97232
Competition	2109	2.34	2.09	0	17	310	2.49	2.08	1	15

[*] The low minimum for *Volume* and *Sales* is due to the fact that some dealerships only started reporting to MRI towards the end out our sample period.

Table 4: OLS and IV results†

	(1)	(2)	(3)	(4)
Dep. Variable ln(price)	Full Sample	Full Sample	EndOfMonth = 1	IV
Autobytel	-0.98618 (0.02828)**	-0.89015 (0.02830)**	-0.76593 (0.05736)**	-1.93010 (0.92415)*
AutobytelFranchise	-0.49334 (0.01509)**	-0.45052 (0.01507)**	-0.45944 (0.03148)**	-0.44578 (0.02554)**
CustomerAge		0.00442 (0.00062)**	0.00495 (0.00130)**	0.00362 (0.00070)**
Age> 64		-0.16517 (0.02908)**	-0.21670 (0.06122)**	-0.17160 (0.03008)**
%Black		0.01417 (0.00053)**	0.01409 (0.00115)**	0.01428 (0.00050)**
%Hispanic		0.01055 (0.00100)**	0.01458 (0.00214)**	0.01129 (0.00100)**
%Asian		-0.00444 (0.00093)**	-0.00224 (0.00199)	-0.00263 (0.00096)**
Female		0.20507 (0.01360)**	0.15740 (0.02849)**	0.19735 (0.01526)**
MedianHHIncome		-0.00002 (1.36e-06)**	-0.00001 (2.84e-06)**	-0.00002 (1.45e-06)**
$(\text{MedianHHInc.})^2$		1.19e-10 (7.38e-12)**	1.20e-10 (1.52e-11)**	1.16e-10 (8.31e-12)**
%CollegeGrad		-0.00251 (0.00092)**	-0.00546 (0.00195)**	-0.00245 (0.00101)*
%<HighSchool		0.00364 (0.00126)**	0.00131 (0.00268)	0.00478 (0.00123)**
%HouseOwn.		-0.00250 (0.00044)**	-0.00346 (0.00094)**	-0.00290 (0.00045)**
MedianHouseVal.		-2.64e-06 (1.24e-07)**	-2.57e-06 (2.61e-07)**	-2.50e-06 (1.38e-07)**
%Professional		0.00397 (0.00136)**	0.00663 (0.00290)*	0.00522 (0.00146)**
%Executives		0.00021 (0.00143)	0.00046 (0.00301)	0.00075 (0.00152)
%BlueCollar		0.00093 (0.00099)	0.00144 (0.00208)	0.00043 (0.00101)
%Technicians		0.00531 (0.00339)	0.01124 (0.00701)	0.00768 (0.00358)*
AnyTrade	0.32820 (0.01344)**	0.31634 (0.01348)**	0.30169 (0.02851)**	0.30036 (0.01563)**
EndOfMonth	-0.34194 (0.01506)**	-0.33607 (0.01501)**		-0.33732 (0.01565)**
Weekend	0.10048 (0.01547)**	0.11080 (0.01543)**	0.07796 (0.03336)*	0.10702 (0.01591)**
VehicleCost	88.161 (0.13149)**	88.184 (0.13156)**	88.243 (0.27373)**	88.051 (0.10942)**
ModelMonth5-13	0.16493 (0.03060)**	0.16387 (0.03050)**	0.04323 (0.06397)	0.16576 (0.03234)**
ModelMonth14+	-0.32283 (0.05290)**	-0.33896 (0.05272)**	-0.60219 (0.11671)**	-0.34311 (0.05302)**
Competition				-0.02898 (0.00347)**
Constant	1,001.3 (0.11703)**	1,001.8 (0.13842)**	1,002.2 (0.26207)**	1,001.7 (0.13576)**
Observations	671468	671468	150281	625722
R^2	0.97	0.98	0.98	

* significant at 5%; ** significant at 1%
Robust standard errors in parentheses

† Unreported are car, month, and region fixed effects. Instruments for column 4: references in the zip code, family size linear and squared, number of cars linear, squared, and cubed, predicted probability of using Autobytel.com.

Table 5: Subsegment results†

Autobytel∗...		Autobytel∗...	
Basic Large	-0.390 (0.394)	Lower Midsize	-1.285 (0.139)**
Compact Pickup	-1.687 (0.179)**	Luxury SUV	-0.420 (0.188)*
Compact SUV	-0.601 (0.066)**	Mid Sporty	-0.935 (0.140)**
Compact Van	-0.477 (0.085)**	Mini SUV	-1.203 (0.098)**
Entry Compact	-1.795 (0.800)*	Near Luxury	-0.286 (0.076)**
Entry Sporty	-3.237 (0.964)**	Premium Compact	-1.467 (0.095)**
Fullsize Pickup	-1.324 (0.325)**	Premium Sporty	0.273 (0.269)
Fullsize SUV	-0.779 (0.148)**	Traditional Luxury	-0.738 (0.474)
Fullsize Van	(No obs.)	Upper Midsize	-1.054 (0.058)**
International Luxury	-0.577 (0.123)**		

* significant at 5%; ** significant at 1%
Robust standard errors in parentheses
† Specification as in column 2 in Table 4, excluding *Autobytel*, including *Autobytel*∗subsegment interactions.

Table 6: Competition results[†]

	(1)	(2)
Dep. Variable ln(price)	Full Sample	Full Sample
Autobytel	-0.89116 (0.02829)**	-0.74216 (0.04861)**
AutobytelFranchise	-0.45953 (0.01511)**	-0.45960 (0.01511)**
Competition	-0.02965 (0.00346)**	-0.02826 (0.00350)**
Autobytel∗Competition		-0.05191 (0.01455)**
EndOfMonth	-0.33681 (0.01501)**	-0.33688 (0.01501)**
Weekend	0.11161 (0.01543)**	0.11157 (0.01543)**
ModelMonth5-13	0.16461 (0.03050)**	0.16463 (0.03050)**
ModelMonth14+	-0.33971 (0.05272)**	-0.33960 (0.05272)**
VehicleCost	88.19368 (0.13157)**	88.19345 (0.13158)**
AnyTrade	0.31193 (0.01350)**	0.31206 (0.01350)**
Constant	1,001.87233 (0.13872)**	1,001.86723 (0.13873)**
Observations	671468	671468
R^2	0.98	0.98

[*] significant at 5%; ** significant at 1%
Robust standard errors in parentheses

[†] Unreported are *CustomerAge, Age>64, %Black, %Hispanic, %Asian, Female, MedianHHIncome, (MedianHHInc.)^2, %CollegeGrad, %<HighSchool, %HouseOwn., MedianHouseVal., %Professional, %Executives, %BlueCollar, %Technicians*, car, month, and region fixed effects

Table 7: Car and dealer switching results[†]

	(1)	(2)	(3)	(4)
Dep. Variable ln(price)	Full Sample	Full Sample w/ ChangeCar	Full Sample w/ ChangeCar	Full Sample w/ ChangeCar
Autobytel	-0.94241 (0.03350)**	-0.89532 (0.02826)**	-0.89428 (0.02826)**	-0.94711 (0.03347)**
Autobytel∗ChangeCar	-0.94241	-0.46120 (0.03224)**	-0.35723 (0.03878)**	-0.45869 (0.03354)**
Autobytel∗ChangeMake			-0.71093 (0.05570)**	
AutobytelFranchise	-0.46496 (0.01536)**	-0.46224 (0.01479)**	-0.46126 (0.01479)**	-0.46726 (0.01508)**
SameDealer	0.18556 (0.05961)**			0.18743 (0.05953)**
SameDealer∗ChangeCar				-0.03475 (0.11225)
EndOfMonth	-0.33680 (0.01501)**	-0.33176 (0.01472)**	-0.33189 (0.01472)**	-0.33175 (0.01472)**
Weekend	0.11166 (0.01543)**	0.10613 (0.01515)**	0.10601 (0.01515)**	0.10617 (0.01515)**
ModelMonth5-13	0.16454 (0.03050)**	0.16438 (0.02986)**	0.16430 (0.02986)**	0.16430 (0.02986)**
ModelMonth14+	-0.33983 (0.05272)**	-0.34265 (0.05164)**	-0.34235 (0.05164)**	-0.34275 (0.05164)**
Competition	-0.02955 (0.00346)**	-0.02990 (0.00340)**	-0.02988 (0.00340)**	-0.02980 (0.00340)**
VehicleCost	88.19395 (0.13157)**	88.18386 (0.12949)**	88.18314 (0.12949)**	88.18407 (0.12949)**
AnyTrade	0.31190 (0.01350)**	0.32038 (0.01327)**	0.32015 (0.01327)**	0.32034 (0.01327)**
Constant	1,001.87306 (0.13872)**	1,002.13713 (0.13704)**	1,002.13690 (0.13703)**	1,002.13779 (0.13704)**
Observations	671468	692336	692336	692336
R^2	0.98	0.98	0.98	0.98

[*] significant at 5%; ** significant at 1%
Robust standard errors in parentheses
[†] Unreported are car, month, and region fixed effects

Table 8: Dealer behavior results[†]

Dep. Variable	(1) Incr. Sales		(2) VehicleCost	(3) ln(VehicleCost)
AutobytelFranchise	5.50962 (0.40416)**	AutobytelFranchise	63.21925 (4.02636)**	0.00291 (0.00018)**
AutowebFranchise	1.84076 (0.45174)**	EndOfMonth	0.13793 (3.98295)	0.00003 (0.00018)
Competition	0.34468 (0.07876)**	WeekEnd	-51.87566 (4.01766)**	-0.00227 (0.00018)**
PriceMean	-6.97104 (6.70412)	ModelMonth5-13	15.55806 (8.21193)	0.00045 (0.00036)
PriceStd.Dev.	-50.19854 (10.27819)**	ModelMonth14+	22.14717 (13.47216)	0.00154 (0.00060)**
Constant	-10.05341 (2.83534)**	Constant	22,003.43001 (28.96310)**	9.95324 (0.00128)**
Observations	2136	Observations	671468	671468
		R-squared	0.97	0.96

[*] significant at 5%; ** significant at 1%
Robust standard errors in parentheses

[†] Unreported: Column 1: region fixed effects. Columns 2 and 3: month, region, and car fixed effects.

Figure 1: Dispersion of residuals by *Autobytel*