NBER WORKING PAPER SERIES

# INTERNET CAR RETAILING

Fiona Scott Morton
Florian Zettelmeyer
Jorge Silva Risso

Working Paper 7961
http://www.nber.org/papers/w7961

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
October 2000

We thank Melanie Webber and Craig Ima from Autobytel.com for providing us with purchase referral data and Keiko Powers from J.D.Power and Associates for help with the transaction data. We thank Meghan Busse, Thomas Hubbard, Ganesh Iyer, Barry Nalebuff, and Sharon Oster for helpful comments and suggestions. Fiona Scott Morton was partially supported by NSF grant 9810178. This paper is part of the NBER E-Commerce project. The views expressed in this paper are those of the authors and not necessarily those of the National Bureau of Economic Research.

Internet Car Retailing
Fiona Scott Morton, Florian Zettelmeyer, and Jorge Silva Risso
NBER Working Paper No. 7961
October 2000
JEL No. L1, L8

**ABSTRACT**

This paper investigates the effect of Internet car referral services on dealer pricing of automobiles in California. Combining data from J.D. Power and Associates and Autobytel.com, a major online auto referral service, we compare online transaction prices to regular "street" prices. We find that the average customer of this online service pays approximately 2% less for her car, which corresponds to about $450 for the average car. Fifteen percent of the savings comes from making the purchase at a low-price dealership affiliated with the web service. The remaining 85% of the savings seem to be due to the bargaining power of the referral service and the lower cost of serving an online consumer. Dealer price dispersion declines with online sales, indicating we are picking up more than a selection effect. Online consumers who indicate they are ready to buy in the next two days pay even lower prices. Dealers pay less for an online customer's trade-in vehicle, although on-line customers are still better off overall than offline customers. Dealer average gross margin on an online vehicle sale is lower by about $300 than an equivalent offline sale. However, because online consumers are cheaper to serve and online sales may be new business for the dealerships, web-affiliated dealers are likely to be better off. Consumers who use the web do better than at least 61% of offline consumers.

Fiona Scott Morton
Yale University
School of Management
PO Box 208200
New Haven, CT 06520-8200
and NBER
fiona.scottmorton@yale.edu

Florian Zettelmeyer
University of California at Berkeley
Haas School of Business
Berkeley CA 94720-1900
florian@haas.berkeley.edu

Jorge Silva Risso
J.D. Power and Associates
30401 Agoura Road
Agoura Hills CA 91301
jorge.silva-risso@powerinfonet.com

# 1 Introduction

The Internet is expanding rapidly into every market and many geographic locations. While much attention focuses on so-called "new economy" businesses, an interesting aspect of the Internet revolution is the change being forced on traditional industries. The resulting threat to intermediaries such as traditional brokerage and music labels were not hard to predict, however, the impact of the Internet on some other industries was less clear. In 1995, for example, the popular press devoted much discussion to predicting the products for which the Internet would be a good sales channel. Cars were often considered to be a poor fit. After all, went the argument, consumers would always want to "kick the tires" before buying a car. While consumers remain interested in physically inspecting a car, the Internet has nonetheless become an important complement to the car-buying process. In 1999, for example, 25% of all consumers who were in the market for a new car used the Internet in conjunction with buying a car (J.D. Power and Associates, 1999).

This paper investigates web-based auto retailing to understand whether the Internet has changed the product market behavior of established firms. In particular we investigate how much and in what ways Internet car referral services affect dealer pricing of automobiles in California.

Internet car referral services are one of three types of sites related to new car purchases; the other two types are informational sites and sites that offer cars at posted prices. At the core of both informational and referral sites is detailed information about individual cars, including current market conditions and invoice pricing. While informational sites are only indirectly involved in the car purchase, referral sites such as Autobytel.com, Autoweb.com, and Carpoint.com establish contractual relations with dealers and pass on consumers' purchase requests or "qualified leads" to contract dealers. Recently, sites have started operating that offer cars at posted prices (although the actual sale is still performed through an affiliated dealership). These services are still in their infancy.

In this paper we capitalize on the fact that Internet purchase referral services do not control the prices offered by the dealer. This means that prices that are offered to consumers continue to be the choice variable of dealers, whether a consumer walked into the showroom or was referred by an Internet service. The referring Internet services do not systematically learn transaction prices. To date it has not been possible, except through self-reported surveys, to assess what impact Internet referral services have on prices. The first question we answer in this paper is whether consumers who use Internet purchase referral services to buy a car pay less for an equivalent car than consumers who do not. Analyzing purchase referral data from Autobytel.com in combination with transaction data from J.D. Powers and Associates (JDPA),

the answer is yes. Conditional on the car, consumers that submitted a purchase request pay on average $451 less than an offline customer. Of these savings $72 stem from the fact that Autobytel.com steers consumers to low-price dealerships. Conditioning on the dealership (in addition to the car), online consumers pay another $379 less than offline customer. We also find that the level of price dispersion at a dealer declines in the dealer's Autobytel.com business. This indicates that the lower prices we find are not entirely driven by the selection effect (good bargainers move online). The combination of results and the fact that referral services save consumers time seem to validate Autobytel.com's value proposition to consumers (and perhaps that of other referral services) and may explain why referral service usage has grown rapidly.

Secondly, we examine the level of dealer profits from the vehicle and from other products and services sold using the web. Dealer margins (price less invoice cost) on the sale of a vehicle through Autobytel.com are significantly lower than margins earned selling the vehicle the traditional way; prices are lower and the costs of acquiring the vehicle from manufacturers are not. In addition, profits from ancillary products like financing and service contracts are also lower (by about $160) when the customer arrives via the web. Because online customers are substantially cheaper to serve, however, the dealer is likely to be better off working with Autobytel.com.[1] To our knowledge this is the first study of the effect of Internet purchase referral services on car pricing using transaction data. This paper contributes to a small body of empirical literature analyzing the effect of the Internet on firms' product market behavior (Brown & Goolsbee, 2000; Brynjolfsson & Smith, 1999; Carlton & Chevalier, 2000; Clay, Krishnan, & Wolff, 2000; Clemons, Hann, & Hitt, 1999; Lucking-Reiley, 1999; Iyer & Pazgal, 2000). There are a number of papers that analyze automobile pricing (Ayres & Siegelman, 1995; Berry, Levinsohn, & Pakes, 1995; Goldberg, 1995, 1996; Pashigian, Bowen, & Gould, 1995; Verboven, 1999). Goldberg (1995) and Berry et al. (1995) estimate structural models of demand for automobiles. Pashigian et al. (1995) investigates within-season pricing patterns for automobiles, and Verboven (1999) tries to determine whether pricing practices on base cars differ from those of cars with options. Ayres and Siegelman (1995) and Goldberg (1996) analyze race and gender discrimination by car dealers. Our paper is closest to these in that we are explicitly interested in the differential pricing introduced by dealerships. However, in contrast to all previous studies, our focus is on the Internet and how it affects the level and distribution of auto prices.

We proceed as follows. Section 2 describes Internet car retailing. Section 3 discusses some of the effects that the Internet may have on car pricing. Section 4 describes the data. Section 5 presents the results, and section 6 concludes the paper.

[1] Lehman Brothers, "Autobytel.com," 5/12/1999

## 2 Internet car retailing

Informational sites do not have direct relationships with car dealers. Perhaps the best known example of a for-profit information site is edmunds.com, providing rich editorial content similar to a car magazine (review, long term tests, etc.) supplemented with information on exact options and invoice pricing for new and used vehicles. Sources of revenues are advertising, detailed reports on vehicles, and commissions to other Internet sites such as the auto-loan site peoplefirst.com, the insurance company geico.com, and referral sites such as Autobytel.com. There also exist many non-profit information sites typically run by "enthusiasts" that provide information about vehicles, options, and dealers. A good example is audiworld.com.

Purchase referral sites were the first Internet companies to contract directly with car dealers. They try to capitalize on the large dissatisfaction of consumers with the car buying process by shielding consumers as much as possible from direct interaction with dealers and "arming" them with information.[2] In light of the regulatory constraints in all US states that give dealers the exclusive right to sell cars to consumers, Autoweb.com, Autobytel.com, and Carpoint.com (to name some of the largest sites) focus on referring consumers to car dealers with which they have contracted.[3] Autobytel.com, the first of these sites, has been in operation since March of 1995. Referral sites offer consumers detailed information about individual cars, including current market conditions and invoice pricing as well as editorial content.

At any given point a consumer may submit a free purchase request in which the consumer specifies which car she is interested in (including options and color), within which time frame she intends to purchase, and where she can be reached. While there are some small differences between referral sites, these purchase requests are generally e-mailed to a salesperson within a dealership who is assigned exclusively to responding to Internet purchase requests. Consumers are typically called back or e-mailed within 24-48 hours with a (supposedly) fixed price.[4] They can buy the car, if they wish to do so, without setting foot in the dealership until they pick up the car. The referral service sends an e-mail to the customer a few days after the referral asking whether she has been contacted by the dealer. Two weeks later another survey is sent to consumers, inquiring whether a car has been purchased and whether the consumer was satisfied with the dealership.

Referral sites send submitted referrals to dealers with whom they have contracted. Out of the approximately 22000 dealers in the US as of 2000, Carpoint.com, for example, had

[2]For a description of the car buying process see "Disintermediation in the US Auto Industry," Stanford GSB Case Study EC10

[3]Recently Autobytel.com has started selling directly to consumers and Autoweb.com has partnered with CarsDirect, a direct sales site.

[4]Note that the price offer from the dealer (by phone or email) is not a binding commitment.

3,700 dealers under contract, and Autoweb.com and Autobytel.com each contracted with 5,000 dealerships.[5] Dealers either pay an annual fixed fee based on the size of the dealership (between $500 and $7500 for Autobytel.com) or a combination of annual fee and a per referral charge ($500-$1000 annual fee and $29 per referral for Autoweb).[6] In exchange, dealers are assigned exclusive or semi-exclusive territories such that customers in a specified geographic area that submit a purchase referral for a specific car get referred to one dealer only (or two dealers in the case of semi exclusivity). The contract usually also specifies that the sales person who responds to requests by the referral service does not sell to walk-in customers. This dedicated "Internet sales person" is usually trained directly by the referral service. In addition, dealerships are usually required to compensate this sales person by units sold, not as a percentage of car profit. These rules are intended to ensure that consumers receive a "no-haggle" price. Dealerships are encouraged to give referral consumers the lowest final price they would normally give a consumer on the sales floor. Purchase referral sites cannot monitor dealer performance directly. Instead they rely on customer satisfaction surveys and on their estimates of "conversion rates," i.e. how many referrals are sent to the dealer per sale made. Conversion rates are about 4 leads to 1 sale. If conversion rate numbers are low for a dealership, or many consumers complain about the dealership, a referral site will terminate the contract with the dealer. Autobytel.com, for example, terminated over 250 dealers between 1995 and 1999.[7]

Recently, some Internet sites have started offering cars at posted prices to consumers. The most prominent ones are CarsDirect.com and Greenlight.com. CarsDirect is an online broker that has contracts with 1700 dealerships nationwide. A consumers buys a vehicle at a fixed price on CarsDirect's site but still interacts with the dealer to sign the papers. Greenlight is founded by the Ashbury automotive group, a large owner of dealerships and and sells consumers cars owned by its dealerships.

## 3 Hypotheses

The Internet can be expected to have a strong effect on car retailing because many — if not most — customers actively dislike contact with car dealerships and particularly salespeople. This stands in contrast to some other industries such as brokerage, where customers might like, or at least feel neutral about, their broker. Consequently, online auto referral services advertise both their convenience and their ability to get low prices for consumers.

[5] Carpoint.com website, Autoweb.com Website, Autobytel.com interview

[6] Youngme Moon (1999), "Autobytel.com," HBS Case Study

[7] See Lehman Brothers, "Autobytel.com," 5/12/1999 for information about conversion rates and dealer turnover.

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 is causing mean prices to decline by reducing search costs.

The contract between the Internet referral service and the dealer contains incentives that may cause the dealer to offer referred customers low prices. An Autobytel.com dealer pays a yearly fee for the stream of leads and may decide whether and how to convert each lead into a sale. However, the referral service expects a substantial proportion of leads to result in sale, since this is the best way to keep customers happy.[8] If the percentage "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 low prices to keep its "close" percentage up. In a sense, the referral service is bargaining on behalf of a group of consumers, although that group is not yet formed. This bargaining feature of the referral service is one we expect to lead to lower prices for consumers who use the service.

However, referral services also must attract and partner with dealers, who would not participate if their outside option were better. It may be that dealers participate to gain incremental sales or to prevent incremental sales by a competing dealer that may otherwise sign up with the referral service. It is also possible, however, that lower-priced Internet sales may be as profitable as conventional sales, depending on the dealership's cost structure. Online buyers are low cost because they have searched already (test-driving at some other dealership perhaps), have decided what car they want, and are ready to buy. Therefore the dealer may be able to spend very little time selling and little time haggling. Any incremental sales (business stealing) may also create economies of scale for a dealership. Thus, dealers are put in contact with a large volume of low-cost consumers and expected to offer price reductions.

There are two arguments why consumers who use referral services may pay more than other consumers. First, Internet purchase referral services are convenient because they allow a consumer to engage in the car purchase process any time of day or night without leaving her home. In addition, referral services shield consumers to some extent from 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. Second, the Internet may attract those consumers

[8] This determination is made on the basis of customer satisfaction surveys.

who are bad bargainers because it allows them to avoid face-to-face negotiations. We would expect dealers to recognize this in the long run and thus price higher for referred customers. Overall, however, we expect bargaining on behalf of consumers and the lower cost of selling to outweigh the potential effect of convenience and negotiation avoidance.

Therefore, we hypothesize the following:

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

The referred customers may also face lower search cost in obtaining detailed information about current market conditions and invoice pricing from the referral site and other web sites. They may therefore be well informed about what the price of their preferred car ought to be. Dealers will have a harder time selling to this group with an unreasonably high price. If these consumers were previously uninformed (and perhaps paying an unreasonably high price), we expect to see the high end of the distribution of prices moving toward the mean as Autobytel.com sales rise.

It is important to note that it is possible that the referral site has no effect on the price a particular consumer receives, despite average on-line prices being lower than average off-line prices. Suppose that all the educated people received low prices before the Internet was invented because they read Consumer Reports and were good at bargaining. Now all the educated consumers use the Internet to obtain price information and to conduct bargaining over the purchase. The same customers continue to get lower prices than average, but because they disproportionately use the Internet, Internet prices are lower than average. In this case Autobytel.com prices will be lower than average, but the cause of the lower prices would be unclear. If this story were true, the distribution of prices would remain unchanged with the introduction of the Internet. Our conjecture above, that the Internet informs previously uninformed customers, implies that price dispersion will decline with Internet use if these consumers move from the far right of the price distribution toward the mean.

- The dispersion of prices within a dealership will decline with the amount of Internet (informed) customers.

In addition, we also explore how the price a consumer pays varies if that consumer uses the Internet referral service but then purchases from another dealer, as compared to purchasing from the dealer to whom she was referred. Normally, we would expect a consumer to abandon

one product choice in favor of another because it featured a lower price or higher quality. The same holds in this market. Consumers may search further with their Internet referral quote to extract more price concessions from other dealers. In this case, consumers who leave their referred dealer should pay a lower price than those who stay. However, a consumers may also leave the referred dealer because the competing dealer offers better quality: for example, a location near the customer's home or work. For these customers we should see transaction prices that are the same or higher in comparison with the prices of those who did not leave the referred dealer.

- If consumers who submit a purchase request and switch away from their referred dealer do so to obtain higher quality (lower prices), transaction prices of these consumers will be higher (lower) than those of consumers who purchase from the referred dealer.

This hypothesis also speaks to the convenience aspect of referral services. We do not expect this hypothesis to hold if many consumers use Internet referral services for convenience and dealerships price accordingly. Then, those consumers that are willing to spend time searching for a low price should find a better price by switching to a dealership other than the one to whom they were referred.

# 4 Data

Our data come from two sources. The first is a major online car referral service, Autobytel.com.[9] We have obtained the purchase requests submitted by consumers on Autobytel.com during 1999, yielding slightly over 2 million observations. An observation consists of customer information, desired car, the date the request was made, the dealer to whom Autobytel.com sent the referral, and the time frame within which the consumer is interested in buying the vehicle.

The second dataset we employ comes from J.D. Power and Associates (JDPA). JDPA collects transaction data from a sample of dealers in the major metropolitan areas in the US. We have data from California dealerships, containing every new car transaction at a sample of 1101 dealerships from January 1, 1999 to February 28, 2000. We take the extra two months of JDPA data to allow for referrals in late 1999 that result in a purchase in early 2000. Each observation in the JDPA data contains customer information, the make, model and trim level

[9] 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 February 2000 survey by Greenfield Online, Autobytel.com is the most visited Automobile site to research for a new car. It is visited by 25% of consumers that researched online to shop for a car, followed by ford.com (24%), gm.com (16%), toyota.com (14%), autoweb.com (12%), honda.com (12%), autovantage.com (12%), chryslercorp.com (11%), cars.com (11%), and autotrader.com (10%).

of the car, financing, trade-in information, dealer-added extras, and the profitability of the car and the customer to the dealership.[10]

We consider a match between observations from Autobytel.com and JDPA when both the address and the name associated with the referral and the purchase transaction are identical. Thus, our matching is conservative. For example, if the purchase referral was submitted by a family member with a different name from the person who purchased the car, we would not consider the observations to match, even if they live at the same address. Each observation in the new dataset is a transaction from the JDPA data, augmented with the information from the Autobytel.com data if there was a match. Hence, customers who get an Autobytel.com referral but subsequently do not purchase will not be in the combined dataset. We are not interested in these customers as there is no observable transaction. If the customer purchases a car, but not from a dealership in the JDPA sample, she will not be in our dataset either. This information is lost, but as we have no prices from Autobytel.com and no comparison data from JDPA, there is no analysis that can be done with this group. Finally, 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 their competitors. This strengthens our test since we will be comparing a group that used Autobytel.com to a group that may include users of competing services.

The combined dataset contains 360255 vehicle purchases between January 1, 1999 and February 28, 2000. There are 10288 customers in this dataset who submitted a purchase request in 1999 through Autobytel.com (2.9% of all transactions). The new variables created after the match between datasets are (1) an indicator for Autobytel.com customer ($ABT$) indicating that 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 for Autobytel.com franchise dealer ($ABTFranchise$) indicating that the dealer who sold the car is an Autobytel.com affiliated dealer, i.e. is under contract with Autobytel.com and receives purchase requests, (3) an indicator for same dealer ($SameDealer$) marking cases when the dealer that sold the car is the same dealer to whom the purchase request was submitted (given that ABT=1).

### 4.1 Car definition and selection

Since consumers who use Autobytel.com may prefer different cars than those who do not, it is very important to control for the exact car that was purchased. We define a "car" as

[10]The dealer can sell the customer extras like service contracts and life insurance that make car and customer profits different.

| Car segment | Obs. | % | Examples | Final Obs. |
|---|---|---|---|---|
| Compact | 52512 | 14.6 | Honda Civic, Toyota Corolla | 34794 |
| Large | 839 | 0.2 | Ford Crown Victoria, Chevrolet Impala | 0 |
| Luxury | 40203 | 11.2 | BMW 323i, Lexus GS400, Volvo S80 | 16743 |
| Midsize | 72726 | 20.2 | Honda Accord, Toyota Camry, Oldsmobile Cutlass | 45075 |
| Pickup | 61458 | 17.1 | Ford F150, GMC Sierra 1500, Toyota Tundra | 27064 |
| SUV | 78172 | 21.7 | Jeep Cherokee, Ford Explorer, Lexus RX300 | 44482 |
| Sporty | 21965 | 6.1 | BMW Z3, Honda Prelude, Mitsubishi Eclipse | 8485 |
| Van | 32380 | 9.0 | Dodge Caravan, Ford Club Wagon, Ford Windstar | 19129 |

every combination of *make and model* (e.g. Honda Accord, Toyota Camry), *body type* (e.g. convertible, coupe, hatchback, sport utility), *doors* (e.g. 2 door, 4 door, 4D Ext Cab), *trim level* (for Honda Accord, e.g. DX, EX, LX etc.), *drive train type* (e.g. 2WD, 4WD), *transmission type* (automatic, manual), *cylinders* (e.g. 4 Cyl, 6 Cyl), *displacement* (e.g. 3.0 liters, 3.3 liters), and *model year* (e.g. 1999, 2000).[11] This results in many different "cars," some of which comprise very few observations. We drop cars for which there are fewer than 500 observations, unless that car has has more than 1.5% share of its segment (as defined by JDPA). In addition, because there are so few units sold, we drop the "Large" segment.

Although we have a great deal of information about the car purchased, we do not know what options have been purchased unless they are represented by the trim level. While the trim level captures most options, we do not observe exact dealer and factory-installed options (a CD player for example). The prices we observe, however, will reflect all options. We believe that the bias generated by this omitted variable will make our test stronger. People using the Internet are on average more educated and more affluent than those not using the Internet. Therefore, we would expect them to purchase unobservably fancier cars than the average buyer. If this effect is strong, we will find a "buying online" indicator predicts higher prices, not lower ones.

Removing "cars" with a small number of observations reduces the sample size by 46% to 195772. The dataset now contains 204 different "cars" sold through 810 dealers.

### 4.2 Dependent variables

There are many different ways of defining the price of a vehicle, for example one can take into account the profit/loss from a trade-in, dealer installed accessories, or manufacturer rebates.

[11] 46.5% of the cars in the full dataset have a transmission coded as 'N/A' rather than automatic or manual. Most cars have observations in all three groups or in just automatic and N/A. We treat the N/A group as another type of transmission, since it is likely to be composed of both automatic and standard shift cars, but we cannot tell in what mix.

For our main specification we define *Price* as the price that the customer pays for the vehicle, factory installed accessories and options, and dealer-installed accessories contracted for at the time of sale, subject to two adjustments. First, we subtract the *ManufacturerRebate* given given directly to the consumer, if any, since this is simply cash that reduces the price of the car to the customer. Secondly, we 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 cash value of the trade-in vehicle (as booked by the dealer). This is the *negative* of the dealer's projected profit on the trade-in vehicle. We adjust for this amount to account for the fact that dealers may offer consumers, for example, a low price for the new car because they are making a profit off the trade-in. Table 4.2 shows an example where consumers A and B are contracting with the dealer for a different new car price but end up paying the same *Price* according to our definition.

| | Consumer A | Consumer B |
|---|---|---|
| Contract price of new vehicle | 21,000 | 19,000 |
| Actual cash value of trade-in | 9,000 | 9,000 |
| Trade-in vehicle price | 10,000 | 8,000 |
| *TradeInOverAllowance* | 1,000 | -1,000 |
| *Price* | 20,000 | 20,000 |

All factory and dealer accessories that contribute to the resale value of the car are contained in *Price*; so called "after market options (AMOs)" such as rustproofing or wax are not included, nor are service contracts and other sources of income for the dealer.

The *VehicleCost* is the 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.[12]

We define *VehicleProfit* as the dollar profit that the dealer makes on the vehicle, factory installed accessories and options, and dealer-installed accessories contracted for at the time of sale. Hence, $VehicleProfit = Price - VehicleCost + ManufacturerRebate$. We add manufacturer rebate since it goes directly from the manufacturer to the consumer. We also use *TotalProfit* which adds profits from financing, service contracts, and credit insurance.

[12] "Holdback" is the trade's term for additional profit to the dealer built in to the invoice for the car, but not itemized as such on the invoice. If a dealer sells a car at his invoice price, his profit on the car will equal the holdback amount on the car.

### 4.3 Controls

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 who 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 for the same reason. 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 when a car was sold and its introduction. This proxies for how "hot" a car is and what the opportunity cost of not selling it is for the dealer. 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.

Finally, we also control for the region in which the car was sold according to the definition of a region by JDPA as "Northern California" and "Southern California."

## 5 Results

We will first describe who uses Autobytel.com and how their behavior differs from others. Next we analyze whether use of Autobytel.com alters the average price a consumer expects to pay for her car using hedonic regressions. We end with a discussion of trade-ins, dealer profits, and dealer costs.

### 5.1 Unconditional differences across customers and dealers

Table 1 contains descriptive statistics for the entire dataset. Three percent of customers submitted a purchase request through Autobytel.com on average. There is variation in this percentage across segments in the data (see tables 9 to 15 starting on page 28 in the appendix). For example, less than one percent of pickup purchases but almost five percent of van purchases used the service. Twenty-eight percent of purchase requests resulted in a sale at the referred dealer, although this also varies by segment. The luxury and van segments have lower close rates, while pickup and SUV segments have higher rates. Thirty-three percent of transactions went through dealerships who are signed up with Autobytel.com. The average car in the sample sold for $23,580 and earned the dealer almost $1700 in gross profit. Most segments (van, sporty, SUV) earned close to $2000 profit, while luxury cars earned more and compact and mid-sized cars earned less ($1000) for the dealer. The price including aftermarket options, documentary preparation charge, service contract premium, license, title, registration, and sales taxes

is the *TotalPrice* listed in the table. It is three thousand dollars more than the vehicle price. Most customers finance their car through the dealer: about 75% in our sample. The average amount financed, conditional on any financing is $22,350, corresponding to 83% of *TotalPrice*. The average profit earned by the dealer on financing is $312. The average vehicle stayed on a dealer's lot for 40 days before being sold. There is not enough difference between Northern and Southern California to report the data separately, except that Southern Californians are more likely to purchase from their referred dealer (32% vs. 26%).

Table 1: Summary statistics (all segments)

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| ABT | 195,772 | 0.032 | 0.175 | 0 | 1 |
| ABTFranchise | 195,772 | 0.331 | 0.470 | 0 | 1 |
| SameDealer | 195,772 | 0.009 | 0.094 | 0 | 1 |
| Price | 195,772 | 23,580.4 | 8,848.9 | 5,946 | 106,370 |
| TotalPrice | 195,772 | 26,611.6 | 9,849.6 | 6,856 | 118,284 |
| TradeInOverAllowance | 56,174 | 769.3 | 1,782.3 | -9,980 | 18,500 |
| VehicleProfit | 187,810 | 1,689.9 | 1,398.0 | -4,894 | 13,384 |
| TotalProfit | 185,224 | 2,109.2 | 1637.2 | -1,425 | 16,853 |
| VehicleCost | 187,810 | 22,299.3 | 7,879.0 | 7,351 | 93,584 |
| DaysToTurn | 188,758 | 39.9 | 53.0 | 1 | 642 |
| EndOfMonth | 195,772 | 0.211 | 0.408 | 0 | 1 |
| Weekend | 195,772 | 0.327 | 0.469 | 0 | 1 |
| Female | 161,396 | 0.340 | 0.474 | 0 | 1 |
| AnyFinancing | 195772 | 0.759 | 0.427 | 0 | 1 |
| AmountFinanced | 148,713 | 22,350.4 | 9,018.5 | 500 | 10,6431 |
| FinancingProfit | 145,962 | 312.0 | 600.9 | 0 | 9,758 |

We expect to see a difference between customers who use Autobytel.com and those who don't if Autobytel.com users have higher incomes or education levels and therefore behave differently and buy different kinds of cars. Table 2 contains means and medians for a subset of variables according to whether the customer used Autobytel.com or not. Median price is higher for the ABT customers ($1,172), as we expected (since we are not conditioning on car type in any way). Mean profits on the vehicle earned by the dealers are very similar between the two groups; however, unconditional median profits are $169 higher for non-ABT customers. *TotalProfit* on the customer is also significantly lower for Autobytel.com customers. Perhaps because they are less affluent or less financially sophisticated, 76% of non-ABT customers obtain financing from the dealer, while only 64% of ABT customers do so. The amount customers finance, conditional on obtaining financing, is slightly higher for non-ABT customers. Other notable differences between the two groups are in *DaysToTurn*, which is very low for Autobytel.com customers. This reflects the practice of re-setting the "clock" to zero when the car changes dealerships. A car that is obtained from another dealership especially for an online customer

Table 2: Transaction summary statistics by Autobytel.com use

| ABT=0 | Obs | Mean | Median | Std. Dev. | Min | Max |
|---|---|---|---|---|---|---|
| Price | 189,594 | 23,576.6 | 22,264 | 8,903.3 | 5,946 | 106,370 |
| TotalPrice | 189,594 | 26,615.9 | 25,138 | 9,910.1 | 6,856 | 118,284 |
| TradeInOverAllowance | 54,999 | 781.2 | 0 | 1,790.7 | -9,980 | 18,500 |
| VehicleProfit | 181,820 | 1,692.0 | 1,422 | 1,398.9 | -4,894 | 13,384 |
| TotalProfit | 179,279 | 2,117.2 | 1,773 | 1,641.4 | -1,425 | 16,853 |
| VehicleCost | 181,820 | 22,299.4 | 21,161.5 | 7,928.3 | 7,351 | 93,584 |
| DaysToTurn | 182,840 | 40.3 | 20 | 53.1 | 1 | 642 |
| EndOfMonth | 189,594 | 0.210 | 0 | 0.408 | 0 | 1 |
| Weekend | 189,594 | 0.328 | 0 | 0.470 | 0 | 1 |
| Female | 156,319 | .341 | 0 | .474 | 0 | 1 |
| AnyFinancing | 189,594 | 0.764 | 1 | 0.425 | 0 | 1 |
| AmountFinanced | 144,791 | 22,383.5 | 20,948 | 9,050.4 | 500 | 106,431 |
| FinancingProfit | 142,086 | 314.4 | 78 | 604.3 | 0 | 9,758 |
| ABT=1 | Obs | Mean | Median | Std. Dev. | Min | Max |
| Price | 6,178 | 23,696.3 | 23,436 | 6,972.2 | 6,995 | 83,890 |
| TotalPrice | 6,178 | 26,476.7 | 26,062.5 | 7,765.6 | 7,961 | 96,148 |
| TradeInOverAllowance | 1,175 | 215.3 | 0 | 1,209.0 | -4,600 | 13,500 |
| VehicleProfit | 5,990 | 1,627.0 | 1,253.5 | 1,370.2 | -1,964 | 10,979 |
| TotalProfit | 5,945 | 1,868.6 | 1,482 | 1,483.9 | -974 | 14,863 |
| VehicleCost | 5,990 | 22,296.0 | 21,812.5 | 6,196.6 | 8,882 | 76,515 |
| DaysToTurn | 5,918 | 28.6 | 11 | 45.7 | 1 | 479 |
| EndOfMonth | 6,178 | 0.236 | 0 | 0.425 | 0 | 1 |
| Weekend | 6,178 | 0.304 | 0 | 0.460 | 0 | 1 |
| Female | 5,077 | 0.312 | 0 | 0.463 | 0 | 1 |
| AnyFinancing | 6,178 | 0.635 | 1 | 0.482 | 0 | 1 |
| AmountFinanced | 3,922 | 21130.0 | 20,085 | 7,648.8 | 2,407 | 87,163 |
| FinancingProfit | 3,876 | 222.1 | 67.5 | 448.4 | 0 | 7,425 |

will sit on its new lot a very short time. *TradeInOverAllowance* is lower for the ABT group, which is something we will discuss in detail later in the paper.

Eighteen percent of ABT customers buy insurance or a repair contract from the dealer, as compared to 29% of the rest of the sample. Table 3 contains demographics according to whether the customer used Autobytel.com or not. These are census data from the block where the customer lives. Unfortunately, we do not have individual buyer demographics. Autobytel.com customers come from census blocks that are more male, more professional, and higher educated. Average income in these census blocks is $67,000 rather than $58,000 for the non-Autobytel.com group. Census blocks with Autobytel.com customers also have fewer farm workers and fewer African-American residents.

ABT franchise dealers are also different from non-ABT franchise dealers as shown in Table 4. They are much larger: on average they sell 767 cars during our time period as compared to 346 for non-ABT franchise dealers. *ABTFranchise* dealers sell about 3.6% of their cars through Autobytel.com. Non-*ABTFranchise* dealers pick up some ABT customers who switch dealers;

Table 3: Demographics by Autobytel.com use

| ABT=0 | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Female | 156,319 | 0.341 | 0.474 | 0 | 1 |
| %Professional | 186,630 | 16.4 | 8.8 | 0 | 100 |
| %Farmer | 186,630 | 2.6 | 5.8 | 0 | 100 |
| MedianHHIncome | 185,891 | 58,348.4 | 25,551.2 | 10,500 | 150,000 |
| MedianAgeHeadHH | 185,891 | 45.2 | 6.7 | 13 | 70 |
| %CollegeGrad | 185,995 | 31.5 | 17.4 | 0 | 100 |
| %<HighSchool | 185,995 | 13.2 | 12.6 | 0 | 100 |
| %Black | 186,002 | 4.4 | 10.0 | 0 | 100 |
| ABT=1 | Obs | Mean | Std. Dev. | Min | Max |
| Female | 5,077 | 0.312 | 0.463 | 0 | 1 |
| %Professional | 6,113 | 19.5 | 8.9 | 0 | 66 |
| %Farmer | 6,113 | 1.6 | 3.7 | 0 | 59 |
| MedianHHIncome | 6,094 | 66,824.0 | 26,067.6 | 13,188 | 150,000 |
| MedianAgeHeadHH | 6,094 | 45.1 | 6.6 | 18 | 70 |
| %CollegeGrad | 6,098 | 39.2 | 17.1 | 0 | 95 |
| %<HighSchool | 6,098 | 8.9 | 8.6 | 0 | 87 |
| %Black | 6,098 | 3.2 | 6.4 | 0 | 99 |

their percentage is lower at 1.5%. Close to seventy percent of customers finance at both types of dealers. *ABTFranchise* dealers accept slightly fewer trade-ins and turn around their cars four days quicker than non-*ABTFranchise* dealers. The appendix compares demographics and further summary statistics by *ABTFranchise* (Tables 16 and 17 on page 31).

Table 4: Dealer summary statistics by ABTFranchise

| ABTFranchise=0 | Obs | Mean | Std.Dev. | Min | Max |
|---|---|---|---|---|---|
| DealerVolume | 667 | 346 | 542 | 1 | 4280 |
| DealerSales | 667 | 7766418 | 12200000 | 8550 | 105000000 |
| Dealer%ABT | 667 | 0.015 | 0.023 | 0 | 0.25 |
| Dealer%Financed | 650 | 0.695 | 0.189 | 0.050 | 1 |
| Dealer%TradeIn | 585 | 0.337 | 0.161 | 0.015 | 1 |
| Dealer%SameDealer | 667 | 0 | 0 | 0 | 0 |
| ABTFranchise=1 | Obs | Mean | Std.Dev. | Min | Max |
| DealerVolume | 143 | 767 | 825 | 11 | 4496 |
| DealerSales | 143 | 18700000 | 20700000 | 193917 | 149000000 |
| Dealer%ABT | 143 | 0.036 | 0.030 | 0 | 0.139 |
| Dealer%Financed | 143 | 0.682 | 0.155 | 0.272 | 0.967 |
| Dealer%TradeIn | 143 | 0.264 | 0.100 | 0.039 | 0.513 |
| Dealer%SameDealer | 143 | 0.022 | 0.027 | 0 | 0.131 |

## 5.2 Conditional Prices

As discussed above, our primary interest is whether use of Autobytel.com alters the average price a consumer expects to pay 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. Our explanatory variables are "car" dummies (which are make * model * body type * doors * drive train * trim * transmission * cylinders * displacement * model year), month dummies, an indicator for southern California, and indicators for whether the car was sold on a weekend or at the end of the month. An OLS regression of log price on only these controls (not reported) results in an adjusted R-squared of .94. Such a high R-squared is an indication that the options we cannot measure are not a large part of the variation in car prices.

Table 5 on page 17 shows the results when we include an ABT indicator in the regression. Its coefficient is -.016 and it is significantly different from zero at below the 1% level. This means a typical ABT consumer pays 1.6% less for her car, a savings of $379 for the average car purchased by this group. In another regression (not reported) we include fixed effects for each dealer and the ABT indicator. In this specification the coefficient on $ABT$ drops to negative 1.2%, which is a savings of $284 on the average ABT car. Again, these are conservative estimates because the comparison group contains both "street" and Internet sales.

What do these estimates say about dealership's profitability? It depends crucially on both how many of the Autobytel.com sales are incremental and the dealership's costs of selling over the Internet. If a dealer can use the low prices he offers through Autobytel.com to capture share from other dealers, the (possibly lower) margins on those cars are simply additional profit, not losses. In addition, the dealer may in fact earn a larger margin on his Autobytel.com sales than his traditional sales due to the low costs of serving Internet consumers. We obtained accounting data from one dealer in the midwest who breaks out his Internet sales separately. We compared his costs (phone, computer, managerial time, office supplies, delivery charges, etc.) to average dealer costs from the National Auto Dealers Association (NADA) and our estimates.[13] The difference between the average total cost of a traditional sale in our data ($1575) and his Autobytel.com average cost ($940) is over $600.[14] Comparing this number to our estimate of the expected price drop for Internet sales of between $300 and $500 provides one reason for dealers to sign up with Autobytel.com: their margins may increase. This particular dealership estimates that 60% of its Internet sales are incremental and 40% are cannibalization of traditional sales. The net profit per car sold through Autobytel.com at this dealership is

[13] We use the profit margin from NADA of $198 and the JDPA median gross margin of $1773 to infer average cost.

[14] Other estimates are higher. An analysts report states that "According to NADA numbers, the average new car sales costs a dealer about $1,270 in personnel and marketing costs. The Autobytel.com service reduces these costs by as much as $1,000." Lehman Brothers, "Autobytel.com," 5/12/1999

Table 5: OLS of ln(price) on reported variables

| | I | II | III |
|---|---|---|---|
| ABT | -0.0160 | -0.0161 | -0.0141 |
| | (0.00103) | (0.00121) | (0.00146) |
| ABTFranchise | | -0.0044 | -0.0044 |
| | | (0.00041) | (0.00041) |
| SameDealer | | 0.0022 | 0.0021 |
| | | (0.00224) | (0.00224) |
| ABT48hrs | | | -0.0050 |
| | | | (0.00204) |
| EndOfMonth | -0.0039 | -0.0038 | -0.0038 |
| | (0.00044) | (0.00044) | (0.00044) |
| Weekend | -0.0020 | -0.0019 | -0.0019 |
| | (0.00038) | (0.00038) | (0.00038) |
| SouthernCal | 0.0072 | 0.0074 | 0.0074 |
| | (0.00038) | (0.00038) | (0.00038) |
| Month2 | 0.0014 | 0.0014 | 0.0014 |
| | (0.00095) | (0.00095) | (0.00095) |
| Month3 | 0.0004 | 0.0004 | 0.0004 |
| | (0.00090) | (0.00090) | (0.00090) |
| Month4 | -0.0005 | -0.0005 | -0.0005 |
| | (0.00092) | (0.00092) | (0.00092) |
| Month5 | -0.0030 | -0.0030 | -0.0030 |
| | (0.00090) | (0.00090) | (0.00090) |
| Month6 | -0.0012 | -0.0012 | -0.0012 |
| | (0.00093) | (0.00093) | (0.00093) |
| Month7 | -0.0064 | -0.0063 | -0.0064 |
| | (0.00091) | (0.00091) | (0.00091) |
| Month8 | -0.0103 | -0.0102 | -0.0102 |
| | (0.00093) | (0.00093) | (0.00093) |
| Month9 | -0.0151 | -0.0150 | -0.0150 |
| | (0.00113) | (0.00113) | (0.00113) |
| Month10 | -0.0174 | -0.0174 | -0.0174 |
| | (0.00123) | (0.00123) | (0.00123) |
| Month11 | -0.0229 | -0.0229 | -0.0229 |
| | (0.00131) | (0.00131) | (0.00131) |
| Month12 | -0.0280 | -0.0281 | -0.0281 |
| | (0.00149) | (0.00149) | (0.00149) |
| Month13 | -0.0265 | -0.0266 | -0.0266 |
| | (0.00160) | (0.00160) | (0.00160) |
| Month14 | -0.0286 | -0.0287 | -0.0287 |
| | (0.00167) | (0.00167) | (0.00167) |
| ModelMonth5-13 | 0.0005 | 0.0006 | 0.0006 |
| | (0.00091) | (0.00091) | (0.00091) |
| ModelMonth14+ | -0.0045 | -0.0044 | -0.0044 |
| | (0.00152) | (0.00152) | (0.00152) |
| Constant | 10.0155 | 10.0167 | 10.0167 |
| | (0.00094) | (0.00095) | (0.00095) |
| CarDummies | ... | ... | ... |
| Observations | 195772 | 195772 | 195772 |
| Adj. $R^2$ | 0.947 | 0.947 | 0.947 |

*All reported coefficients are significant at the 5% level or better except *SameDealer*, months 2,4 and 6, and *ModelMonth5-13*

$440, while the average net profit per car sold in the traditional manner is $198 according to NADA. Summing the "lost" margin from the traditional sales (at $198) and the additional margin from Internet sales (at $440) leads to a net gain for this dealer of about thirty thousand dollars from selling 89 cars per month over the Internet. However, we do not have an estimate of the lost contribution to overhead from the traditional sales that now flow through the Internet division, nor do we have an estimate of rental costs for the Internet division. Any estimate of these costs that falls under $889 will leave the dealership better off from its Internet sales. Notice that while these calculations suggest that referral services are beneficial to an affiliated dealer, since many Internet sales seem to be incremental, non-affiliated dealerships are likely to be worse off as a result of referral services.

The second column of Table 5 shows the coefficients from our main specification with *ABT*, *ABTFranchise*, and *SameDealer* included. Purchasing a car from an Autobytel.com dealer saves the purchaser .44% of the cost of the car, regardless of whether the customer ever went online. Note, however, that the *ABT* coefficient is unchanged. There are two explanations for these results. One is that Autobytel.com chooses the lower-priced dealerships to partner with and this is another benefit users receive, or alternatively, lower-cost dealerships gain more from partnering with Autobytel.com. The second reason might be that dealerships interested in the web often sign up with more than one referral service. Thus the lower-than-average prices at these dealerships may represent sales to all online customers. However, because Autobytel.com had a large market share in 1999, one would expect the *ABTFranchise* coefficient in a regression by itself to be higher than when the ABT indicator is also included. However, the coefficient only differs by .0002, hardly any change at all. This favors the selection explanations above. Hence we will include the savings from being sent to an Autobytel.com dealer as part of the customer's total gain from the service. The combined savings from the two effects is $483 per Autobytel.com customer. Since the average customer has a 33% likelihood of shopping at an Autobytel.com dealer at random (weighted by sales volume), the overall expected savings to an average customer is $379 plus $72 (two-thirds of .0044 times average price), or $451.

*SameDealer*'s coefficient is insignificant, indicating consumers do not systematically gain or lose by staying with the dealer referred to them by Autobytel.com. This result is likely due to a mix of consumers who choose to leave their referral: some find a better price elsewhere, others accept a higher price from a better (e.g. more conveniently located) dealer.

Figure 1 represents the distribution of "bargaining outcomes" after we control for the characteristics of the car and transaction in the regression. It is a histogram of the residuals from our baseline specification (controls and an ABT indicator) omitting the residuals of customers who used Autobytel.com. The very small residuals represent offline consumers who received large discounts, while the long right tail represents customers who paid more than others. The

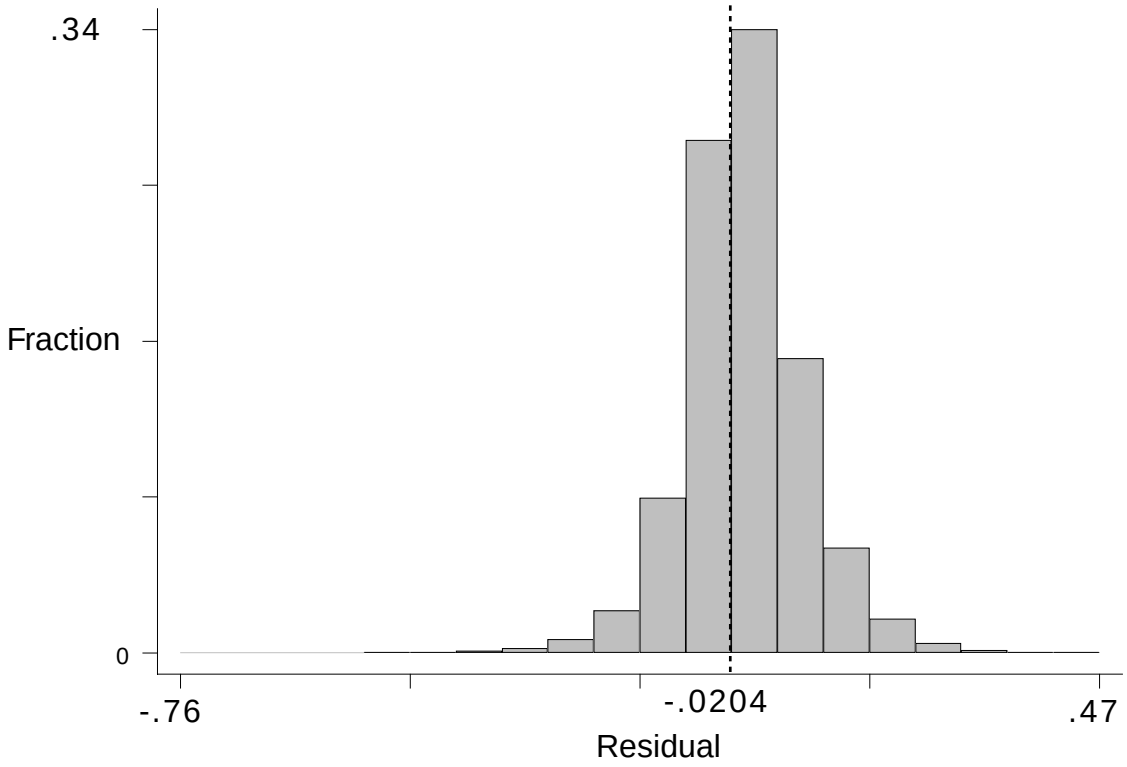


Figure 1: Histogram of residuals from Table 5 column 1 for ABT=0

coefficients on $ABT$ and $ABTFranchise$ from Table 5 column 2 sum to -2.04%. A vertical line at this point is drawn on the figure to show where the average Autobytel.com customer appears in the "bargaining outcome" distribution. The figure shows that a consumer receiving the mean Autobytel.com price does better than 61% of the customers who do not use the service. The spike of customers near the mean Autobytel.com discount suggests that other online purchases might be located around this level also. To the extent this is true, our calculation of the advantage of online purchasing is conservative.

We also run our main specification on each segment of the data separately, to see if the $ABT$ coefficient is sensitive to the class of car being sold. The results are reported in Table 18 on page 33 in the appendix. There is considerably variation across segment in the price discount for online consumers. Consumers who purchase a pickup truck on the Internet pay 4% less than offline consumers. Both "sporty" and "compact" customers pay 2.4% less. In contrast, the discount for luxury and van customers is below 1% and only significant at the 5% level, and the SUV discount is below average also. The anecdotal explanation for the "luxury" result is that due to the economic boom in 1999, demand was outstripping the supply of these cars so that no matter what channel a customer used, the price was not discounted significantly. A

similar story might hold for the SUV segment also.

We know the time frame the customer had in mind when at the Autobytel.com site: 48 hours, two weeks, or 30 days. We also know the number of days between submitting a purchase request and the formal sale of the vehicle. (Coding the first variable as 1,2,3 results in a significant correlation between them of 0.2.) If the Internet were primarily serving as a more convenient method of purchasing, we might see higher prices for those consumers who are in a hurry (time frame of 48hrs). If, instead, the consumers who use the Internet search, learn, and make decisions in advance, then a short time frame indicates someone who knows exactly what she wants. We include the buyer's time frame lag in the price specifications above and report the results in Table 5. We find that people "ready to buy" save 0.5% of the value of the car on top of the slightly smaller 1.4% saved by using Autobytel.com overall in this specification. In this specification the total decrease in price on the average car by a ready-to-buy consumer at an ABT dealer compared to a non-ABT dealer is $550.

The next set of results reports similar specifications on a measure of price that includes extra charges a customer can pay such as service contract premia and aftermarket options (AMOs). Aftermarket options are the fabric protectors and paint sealants that as JDPA politely states, "do not add to the blue book value of the car." We regress this *Price w/ AMOs* (logged) on the same set of controls as well as *ABT*, *ABTFranchise*, and *SameDealer*. Our results, reported in Table 6 on page 21, are very similar except that the *ABT* coefficient and the *ABTFranchise* coefficient increase in magnitude (total 2.6%). We suspect that consumers who use the Internet have better information about these high-margin products. Better information would lead a consumer to back away from buying fabric protectant and service contracts. Although it could be the case that educated customers choose to use Autobytel.com rather than the other way around, we do know that the percentage of customers who buy either a service contract or an aftermarket option or both is 10% higher for non-ABT customers.

### 5.3 Trade-in pricing, dealer profits, and financing

An interesting difference between Autobytel.com customers and others appears in the distribution of profits between the new vehicle and the trade-in. Autobytel.com customers make less profit on their trade-ins, although they end up better off overall. As reported in column 2 of Table 6, dealers offer on average $350 less for an Autobytel.com customer's old vehicle, conditional on the value of the vehicle (this specification does not contain car dummies, but does contain dealer dummies). Dealers seem to compensate with higher new car prices for the fact that they pay "too much" for trade-ins: an average of $770 above the "actual cash value"

Table 6: Other dependent variables

| | log(Price w/ AMOs) | TrOverAll. | log(Price) |
|---|---|---|---|
| ABT | -0.0199 | -354.31 | -0.0161 |
| | (0.00126) | (59.35) | (0.00130) |
| ABTFranchise | -0.0064 | | -0.0042 |
| | (0.00042) | | (0.00041) |
| SameDealer | 0.0032 | -32.45 | 0.0020 |
| | (0.00234) | (109.47) | (0.00224) |
| AnyTrade | | | 0.0071 |
| | | | (0.00040) |
| ABT*AnyTrade | | | 0.0034 |
| | | | (0.00258) |
| EndOfMonth | -0.0041 | -66.15 | -0.0038 |
| | (0.00046) | (17.57) | (0.00044) |
| Weekend | 0.0016 | -78.95 | -0.0020 |
| | (0.00040) | (15.65) | (0.00038) |
| SouthernCal | 0.0047 | (dropped) | 0.0072 |
| | (0.00040) | | (0.00038) |
| Month2 | 0.0022 | 49.52 | 0.0014 |
| | (0.00099) | (37.64) | (0.00094) |
| Month3 | 0.0017 | 67.58 | 0.0004 |
| | (0.00094) | (35.64) | (0.00090) |
| Month4 | 0.0008 | 21.60 | -0.0006 |
| | (0.00096) | (36.31) | (0.00092) |
| Month5 | -0.0024 | 37.45 | -0.0030 |
| | (0.00094) | (35.56) | (0.00090) |
| Month6 | -0.0006 | 47.08 | -0.0012 |
| | (0.00097) | (36.48) | (0.00092) |
| Month7 | -0.0059 | -41.83 | -0.0064 |
| | (0.00095) | (35.82) | (0.00091) |
| Month8 | -0.0093 | -29.28 | -0.0102 |
| | (0.00097) | (36.12) | (0.00093) |
| Month9 | -0.0141 | -31.88 | -0.0150 |
| | (0.00118) | (37.64) | (0.00113) |
| Month10 | -0.0169 | -41.43 | -0.0176 |
| | (0.00128) | (38.50) | (0.00123) |
| Month11 | -0.0217 | 25.03 | -0.0230 |
| | (0.00137) | (40.18) | (0.00131) |
| Month12 | -0.0269 | 7.68 | -0.0281 |
| | (0.00155) | (41.27) | (0.00149) |
| Month13 | -0.0270 | 52.77 | -0.0267 |
| | (0.00167) | (42.00) | (0.00160) |
| Month14 | -0.0294 | 75.03 | -0.0288 |
| | (0.00174) | (43.57) | (0.00167) |
| ModelMonth5-13 | 0.0011 | | 0.0007 |
| | (0.00095) | | (0.00091) |
| ModelMonth14+ | -0.0042 | | -0.0045 |
| | (0.00159) | | (0.00152) |
| Constant | 10.0354 | 802.16 | 10.0147 |
| | (0.00099) | (27.28) | (0.00096) |
| CarDummies | ... | | ... |
| Dealer dummies | | ... | |
| Observations | 195765 | 56174 | 195772 |
| Adj. $R^2$ | 0.941 | 0.120 | 0.947 |

*All reported coefficients are significant at the 5% level or better except *SameDealer*, *ABT*AnyTrade*, some months, and the model month dummies.

of the trade-in.[15] Therefore, the average trade-in customer in our dataset sees an ABT contract price that is about $800 less than non-ABT offline prices, but receives about $350 less for her trade-in, making the net savings about $450. It is also interesting to note that consumers who trade in their old vehicles pay on average 0.7% more for their new vehicle than consumers that have no trade-in (see the dummy *AnyTrade* in column 3 of Table 6). Recall that the dependent variable *price* above is adjusted for the *TradeInOverAllowance*. The interaction coefficient in the table shows that the price premium that ABT customers pay when they trade in their old car is no more or less than the premium paid by others whose transactions include trade-ins. Since an online consumer is more likely to be comparing prices before the trade-in is discussed, dealers may be unwilling to quote a high price for the new car in order to be able to subsidize a trade-in later. However, it appears that a small overall price premium is charged to both online and offline consumers who trade in an old car.

Perhaps the most interesting dependent variable to study is the profits the dealer earns on the car and on the customer. Since we do not have data on a dealership's overhead expenses, we will analyze the gross margin rather than true profits. We use a standard linear specification and measure margins in dollars. The results are reported in Table 7 columns 1 and 2 on page 23. Column 1 lists the results of regressing the dealer's gross margin on the vehicle on our set of controls and the ABT indicator. Autobytel.com customers earn dealers $303 less per car, on average. This point estimate compares well to the $379 discount estimated above. Evidence previously discussed suggests that these customers are cheaper to serve than traditional customers, so they may be as profitable to the dealership overall. Turning our attention to the total profit on the customer (financing, service plans, insurance, etc. plus the vehicle), we find that ABT customers give the dealer $464 less in profit. This complements the results above, where we saw that ABT customers pay less for, or are less likely to buy, these aftermarket items. This larger estimate also increases the dealer cost savings required to keep sales to ABT customers profitable.

Table 7 also shows that the cost of acquiring the vehicle is not different between ABT customers and non-ABT customers (column 4). In addition, ABT franchises face a slightly higher cost of vehicles: $57 according to the coefficient in the table. If Autobytel.com sales are lower cost than conventional sales, this must be due to lower overhead costs such as salespeople's salaries and real estate rents.

Note that we are unable to discriminate between two different interpretations of the above results. If Autobytel.com or the Internet in general is helping to educate previously naive

[15] This is consistent with Goldberg (1996) who analyzes contract prices and finds that customers with trade-in vehicles pay on average $600 more for their new car.

Table 7: Financing and cost regressions

| | VehicleProfit | TotalProfit | FinancingProfit (Tobit) | log(VehicleCost) |
|---|---|---|---|---|
| ABT | -303.85 | -464.34 | -87.58 | -0.0013 |
| | (16.44) | (26.53) | (19.93) | (0.00076) |
| ABTFranchise | -123.89 | -129.37 | 18.26 | 0.0024 |
| | (5.54) | (8.20) | (6.08) | (0.00030) |
| SameDealer | 23.41 | -40.47 | -40.10 | |
| | (30.36) | (48.07) | (36.51) | |
| EndOfMonth | -53.95 | -77.04 | -24.79 | |
| | (5.99) | (8.82) | (6.57) | |
| Weekend | 79.02 | 85.90 | -26.57 | |
| | (5.23) | (7.60) | (5.68) | |
| SouthernCal | -103.56 | -120.39 | -67.62 | 0.0105 |
| | (5.23) | (7.79) | (5.80) | (0.00028) |
| Month2 | 6.61 | -7.21 | -15.65 | 0.0020 |
| | (12.87) | (18.89) | (13.97) | (0.00070) |
| Month3 | -13.87 | -9.67 | -10.02 | 0.0041 |
| | (12.25) | (18.01) | (13.32) | (0.00067) |
| Month4 | -25.14 | -6.12 | -15.71 | 0.0049 |
| | (12.52) | (18.40) | (13.65) | (0.00068) |
| Month5 | -37.84 | -21.12 | -36.49 | 0.0054 |
| | (12.23) | (17.98) | (13.35) | (0.00066) |
| Month6 | -68.44 | -47.08 | -25.34 | 0.0075 |
| | (12.58) | (18.49) | (13.73) | (0.00068) |
| Month7 | -87.26 | -85.23 | -63.87 | 0.0050 |
| | (12.44) | (18.25) | (13.59) | (0.00068) |
| Month8 | -151.81 | -156.88 | -59.35 | 0.0052 |
| | (12.70) | (18.74) | (13.99) | (0.00069) |
| Month9 | -206.87 | -226.77 | -76.25 | 0.0039 |
| | (15.45) | (22.73) | (16.87) | (0.00084) |
| Month10 | -303.42 | -301.48 | -31.48 | 0.0074 |
| | (16.80) | (24.80) | (18.35) | (0.00091) |
| Month11 | -355.69 | -324.72 | -25.67 | 0.0068 |
| | (17.93) | (26.47) | (19.53) | (0.00097) |
| Month12 | -438.84 | -461.76 | -94.78 | 0.0078 |
| | (20.40) | (30.11) | (22.25) | (0.00111) |
| Month13 | -460.72 | -488.96 | -108.51 | 0.0093 |
| | (21.91) | (32.08) | (23.78) | (0.00119) |
| Month14 | -481.34 | -547.41 | -150.39 | 0.0111 |
| | (22.89) | (33.64) | (25.07) | (0.00124) |
| ModelMonth5-13 | -16.27 | -11.77 | -9.57 | -0.0002 |
| | (12.50) | (18.49) | (13.68) | (0.00068) |
| ModelMonth14+ | -33.29 | 3.10 | 29.89 | 0.0016 |
| | (20.78) | (30.45) | (22.64) | (0.00113) |
| Constant | 1958.96 | 2486.44 | 541.77 | 9.9475 |
| | (12.92) | (19.22) | (64.42) | (0.00069) |
| CarDummies | ... | ... | ... | ... |
| Observations | 187810 | 140522 | 145962 | 187810 |
| Adj./Pseudo $R^2$ | 0.436 | 0.360 | 0.0088 | 0.9677 |

*All reported coefficients are significant at the 5% level or better except *SameDealer*, some months, and the model month dummies. Column 3: 70437 left-censored observations at FinancingProfit<= 0, 75525 uncensored observations

consumers who then avoid aftermarket options and insurance, or bargain harder for them, then the use of the Internet by consumers is reducing dealer profits. On the other hand, if these customers would have obtained information from books and friends in the absence of the Internet, there is no change in dealer profits; this group would not have purchased aftermarket options or insurance regardless of the Internet.

We present two analyses that begin to separate the selection effect from the bargaining/lower-cost effect. Three-quarters of the customers in our sample obtain financing from the dealer. Sixty-four percent of ABT customers use dealer financing and 76% of non-ABT customers do. Autobytel.com and the Internet provide information and bargaining power that could help customers get the best rate. The most financially-savvy individuals will obtain financing over the web or from a non-dealer source. We restrict the sample to customers who obtained financing from the dealer in order to exclude these sophisticated buyers and weaken the selection effect. We run a tobit (censored regression) on dealer profit from financing, which is often zero. The results are reported in column 3 of Table 7. ABT customers contribute about $88 less to dealer profit from financing, although Autobytel.com franchises collect $18 more in financing profit from an average customer than other dealers. These results suggest Autobytel.com helps customers with information and bargaining clout.

Table 8 examines how price dispersion at the dealer level varies with the amount of Autobytel.com business the dealership has. We use residuals from our baseline regression (no ABT variables) to construct residuals. We create a *dealer variance* variable, which is simply the variance of those error terms by dealer. We then regress this measure on the percentage of the dealer's sales that are to Autobytel.com customers and whether or not the dealership has a contract with Autobytel.com. The second column in the table adds the dealership's size, the percentage of its customers who finance their cars, and the percentage of its Autobytel.com customers who do not switch dealerships. We see in both specifications that the coefficient on Autobytel.com percentage is negative and significant. Selling more cars through Autobytel.com reduces price dispersion at the dealership level. This indicates that we are not simply seeing the same customers and distribution of profit levels flowing through new channels. Instead, the Internet is altering the shape of the profit distribution. Dealerships that engage in more financing have higher levels of dispersion, but a contract with Autobytel.com is not related to dispersion levels. We plan to investigate dispersion across and within dealerships more fully in future research.

Table 8: Price dispersion regressions

| | I | II |
|---|---|---|
| ABTFranchise | 0.0007 | 0.0005 |
| | (0.00045) | (0.00054) |
| Dealer%ABT | -0.0245* | -0.0241* |
| | (0.00670) | (0.00812) |
| DealerVolume | | 1.42E-07 |
| | | (2.79E-07) |
| Dealer%SameDealer | | 0.0031 |
| | | (0.01625) |
| Dealer%Financed | | 0.0042* |
| | | (0.00105) |
| Constant | 0.0060* | 0.0031* |
| | (0.00022) | (0.00074) |
| Observations | 724 | 723 |
| Adj. $R^2$ | 0.0158 | 0.0337 |

* indicates significance at the 5% level or better

# 6 Concluding remarks

This paper investigates the effect of Internet referral services on retail auto prices and dealer profits. We show that the Internet has changed the product market behavior of dealerships. While the Internet performs the expected roles of reducing search costs and serving consumers' information needs, it also is changing firm pricing behavior in an important sector of the economy.

In this paper we capitalize on the fact that Internet purchase referral services do not control the prices offered by the dealer. This means that prices that are offered to consumers continue to be the choice variable of dealers, whether or not a consumer walked into the showroom or was referred by an Internet service. We show that conditional on the dealer, consumers that submitted a purchase request save about $379. Including the effect of being sent to a low-price dealer chosen by Autobytel.com the savings increase to $450. We also show that dealer gross margins on the sale of a vehicle to a customer with an Internet purchase referral are significantly lower than gross margins earned selling the vehicle the traditional way. However, because online customers are cheaper to serve, the dealer may nonetheless be better off working with Internet purchase referral services. We also find that profits earned by the dealer on extra services are lower for an online than offline customer. We examine price dispersion at the dealership level and find that it declines in the amount of Autobytel.com business the dealership has, indicating that the Internet referral service is altering the distribution of prices. We conclude that consumers can gain from using the Internet to help purchase a new car and that the Internet has changed the product market behavior of dealerships.

By altering the size and distribution of dealer profits, the Internet has the potential to

significantly change the structure of the retail automobile industry. There are a number of research avenues we intend to pursue that will help us understand these changes. We are interested in the effect of Internet sales on price dispersion within and across dealerships because this could shed light on how rents are shifting between consumers and dealers and among dealers themselves. We are exploring ways to decompose the online price decrease into the amount due to the bargaining power of the Internet referral service and the amount due to the cost savings inherent in being an online customer. We also plan to use the demographic information in the dataset to examine whether race and gender discrimination is present and whether it is affected by using an Internet purchase referral service.

## References


Ayres, I., & Siegelman, P. (1995). "Race and gender discrimination in bargaining for a new car." *American Economic Review*, *85*(3), 304-321.

Berry, S., Levinsohn, J., & Pakes, A. (1995). "Automobile prices in market equilibrium." *Econometrica*, *63*(4), 841-890.

Brown, J. R., & Goolsbee, A. (2000). *Does the internet make markets more competitive? evidence from the life insurance industry.* Mimeo, Harvard University University of Chicago, GSB.

Brynjolfsson, E., & Smith, M. (1999). *Frictionless commerce: A comparison of internet and conventional retailers.* Mimeo, MIT, Cambridge, MA.

Carlton, D., & Chevalier, J. (2000). *Free riding and sales strategies for the internet.* Mimeo, University of Chicago, Chicago, IL.

Clay, K., Krishnan, R., & Wolff, E. (2000). *Pricing strategies on the web: Evidence from the online book industry.* Mimeo, Carnegie Mellon University, Pittsburgh, PA.

Clemons, E., Hann, I.-H., & Hitt, L. M. (1999). *The nature of competition in electronic markets: An empirical investigation of online travel agent offerings.* Mimeo, University of Pennsylvania, Philadelphia, PA.

Goldberg, P. K. (1995). "Product differentiation and oligopoly in international markets: The case of the u.s. automobile industry." *Econometrica*, *63*(4), 891-951.

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.

Iyer, G., & Pazgal, A. (2000). *Internet shopping agents: Virtual co-location and competition.* Mimeo, University of California, Berkeley, Berkeley, CA.

Lucking-Reiley, D. (1999). "Using field experiments to test equivalence between auction formats: Magic on the internet." *American Economic Review*, *89*(5), 1063-1081.

Pashigian, P. B., Bowen, B., & Gould, E. (1995). "Fashion, styling, and the within-season decline in automobile prices." *Journal-of-Law-and-Economics*, *38*(2), 281-309.

Verboven, F. (1999). "Product line rivalry and market segmentation–with an application to automobile optional engine pricing." *Journal of Industrial Economics*, *47*(4), 399-425.

# Appendix

Table 9: Summary Statistics for JDPASegment=Compact

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| ABT | 34794 | 0.027 | 0.163 | 0 | 1 |
| ABTFranchise | 34794 | 0.278 | 0.448 | 0 | 1 |
| SameDealer | 34794 | 0.008 | 0.087 | 0 | 1 |
| Price | 34794 | 14716.3 | 2338.5 | 5946 | 26285 |
| TotalPrice | 34794 | 16929.8 | 2701.9 | 6856 | 29602 |
| TradeInOverAllowance | 8010 | 575.3 | 1307.6 | -8000 | 9240 |
| VehicleProfit | 33210 | 1017.4 | 872.5 | -2840 | 6388 |
| TotalProfit | 32964 | 1414.341 | 1130.24 | -498 | 9622 |
| VehicleCost | 33210 | 14121.2 | 1535.7 | 7351 | 24734 |
| DaysToTurn | 33740 | 38.4 | 48.0 | 1 | 502 |
| EndOfMonth | 34794 | 0.213 | 0.409 | 0 | 1 |
| Weekend | 34794 | 0.359 | 0.480 | 0 | 1 |
| Female | 28030 | 0.465 | 0.499 | 0 | 1 |
| AnyFinancing | 34794 | 0.785 | 0.411 | 0 | 1 |
| AmountFinanced | 27319 | 14524.6 | 3325.0 | 691 | 27314 |
| FinancingProfit | 27057 | 253.6 | 467.0 | 0 | 6837 |

Table 10: Summary Statistics for JDPASegment=Luxury

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| ABT | 16743 | 0.037 | 0.189 | 0 | 1 |
| ABTFranchise | 16743 | 0.441 | 0.496 | 0 | 1 |
| SameDealer | 16743 | 0.008 | 0.089 | 0 | 1 |
| Price | 16743 | 37718.1 | 13296.5 | 20706 | 106370 |
| TotalPrice | 16743 | 42206.3 | 15350.6 | 23900 | 118284 |
| TradeInOverAllowance | 3872 | 354.5 | 1566.2 | -9500 | 16400 |
| VehicleProfit | 16224 | 2999.6 | 1724.0 | -3247 | 13384 |
| TotalProfit | 16116 | 3404.241 | 2072.292 | -1425 | 16853 |
| VehicleCost | 16224 | 34600.8 | 11893.1 | 20445 | 93584 |
| DaysToTurn | 16409 | 22.3 | 38.8 | 1 | 418 |
| EndOfMonth | 16743 | 0.227 | 0.419 | 0 | 1 |
| Weekend | 16743 | 0.274 | 0.446 | 0 | 1 |
| Female | 12949 | 0.330 | 0.470 | 0 | 1 |
| AnyFinancing | 16743 | 0.681 | 0.466 | 0 | 1 |
| AmountFinanced | 11408 | 35200.3 | 15337.6 | 3169 | 106431 |
| FinancingProfit | 11299 | 478.0 | 863.9 | 0 | 9053 |

Table 11: Summary Statistics for JDPASegment=Midsize

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| ABT | 45075 | 0.037 | 0.188 | 0 | 1 |
| ABTFranchise | 45075 | 0.330 | 0.470 | 0 | 1 |
| SameDealer | 45075 | 0.011 | 0.102 | 0 | 1 |
| Price | 45075 | 20825.6 | 3281.6 | 10938 | 36100 |
| TotalPrice | 45075 | 23497.1 | 3701.2 | 13266 | 45575 |
| TradeInOverAllowance | 12689 | 753.3 | 1734.7 | -8000 | 11966 |
| VehicleProfit | 43569 | 1278.2 | 1048.4 | -4894 | 7678 |
| TotalProfit | 43301 | 1629.955 | 1260.436 | -820 | 10992 |
| VehicleCost | 43569 | 19875.0 | 2802.7 | 10917 | 36437 |
| DaysToTurn | 42942 | 41.0 | 52.8 | 1 | 606 |
| EndOfMonth | 45075 | 0.212 | 0.409 | 0 | 1 |
| Weekend | 45075 | 0.352 | 0.478 | 0 | 1 |
| Female | 36159 | 0.407 | 0.491 | 0 | 1 |
| AnyFinancing | 45075 | 0.742 | 0.438 | 0 | 1 |
| AmountFinanced | 33426 | 19790.3 | 4710.9 | 800 | 40045 |
| FinancingProfit | 33136 | 262.4 | 508.1 | 0 | 8633 |

Table 12: Summary Statistics for JDPASegment=Pickup

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| ABT | 27064 | 0.008 | 0.087 | 0 | 1 |
| ABTFranchise | 27064 | 0.308 | 0.462 | 0 | 1 |
| SameDealer | 27064 | 0.003 | 0.052 | 0 | 1 |
| Price | 27064 | 21162.5 | 5523.4 | 7899 | 38171 |
| TotalPrice | 27064 | 24065.3 | 6225.7 | 8934 | 50031 |
| TradeInOverAllowance | 8705 | 942.1 | 1780.5 | -9250 | 15242 |
| VehicleProfit | 26006 | 1678.7 | 1174.8 | -3447 | 8639 |
| TotalProfit | 25264 | 2174.636 | 1492.184 | -743 | 13662 |
| VehicleCost | 26006 | 19979.0 | 4665.0 | 9231 | 35038 |
| DaysToTurn | 25968 | 42.0 | 51.5 | 1 | 498 |
| EndOfMonth | 27064 | 0.203 | 0.402 | 0 | 1 |
| Weekend | 27064 | 0.304 | 0.460 | 0 | 1 |
| Female | 23709 | 0.189 | 0.391 | 0 | 1 |
| AnyFinancing | 27064 | 0.793 | 0.405 | 0 | 1 |
| AmountFinanced | 21474 | 20569.5 | 6063.7 | 653 | 46913 |
| FinancingProfit | 20690 | 318.0 | 597.4 | 0 | 9404 |

Table 13: Summary Statistics for JDPASegment=SUV

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| ABT | 44482 | 0.035 | 0.183 | 0 | 1 |
| ABTFranchise | 44482 | 0.352 | 0.478 | 0 | 1 |
| SameDealer | 44482 | 0.012 | 0.107 | 0 | 1 |
| Price | 44482 | 29442.1 | 6178.4 | 12602 | 58630 |
| TotalPrice | 44482 | 32923.5 | 6919.4 | 13045 | 73652 |
| TradeInOverAllowance | 14545 | 858.4 | 2038.1 | -9980 | 18500 |
| VehicleProfit | 43127 | 1960.6 | 1391.1 | -4584 | 10350 |
| TotalProfit | 42236 | 2417.126 | 1658.917 | -1151 | 14553 |
| VehicleCost | 43127 | 27773.5 | 5671.6 | 11547 | 55184 |
| DaysToTurn | 43037 | 39.7 | 53.3 | 1 | 501 |
| EndOfMonth | 44482 | 0.209 | 0.407 | 0 | 1 |
| Weekend | 44482 | 0.313 | 0.464 | 0 | 1 |
| Female | 37696 | 0.303 | 0.460 | 0 | 1 |
| AnyFinancing | 44482 | 0.772 | 0.419 | 0 | 1 |
| AmountFinanced | 34353 | 27900.5 | 7290.4 | 500 | 57500 |
| FinancingProfit | 33414 | 365.7 | 669.9 | 0 | 9758 |

Table 14: Summary Statistics for JDPASegment=Sporty

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| ABT | 8485 | 0.031 | 0.173 | 0 | 1 |
| ABTFranchise | 8485 | 0.326 | 0.469 | 0 | 1 |
| SameDealer | 8485 | 0.009 | 0.092 | 0 | 1 |
| Price | 8485 | 24044.1 | 9439.8 | 11538 | 61386 |
| TotalPrice | 8485 | 27179.8 | 10370.1 | 13665 | 69688 |
| TradeInOverAllowance | 2398 | 755.4 | 1638.3 | -8200 | 11737 |
| VehicleProfit | 8203 | 1907.4 | 1792.2 | -3827 | 10976 |
| TotalProfit | 8092 | 2335.819 | 2064.818 | -704 | 14941 |
| VehicleCost | 8203 | 22622.9 | 7963.8 | 11492 | 54901 |
| DaysToTurn | 8234 | 54.4 | 69.8 | 1 | 642 |
| EndOfMonth | 8485 | 0.204 | 0.403 | 0 | 1 |
| Weekend | 8485 | 0.329 | 0.470 | 0 | 1 |
| Female | 7304 | 0.374 | 0.484 | 0 | 1 |
| AnyFinancing | 8485 | 0.813 | 0.390 | 0 | 1 |
| AmountFinanced | 6900 | 22341.1 | 8256.3 | 3075 | 58017 |
| FinancingProfit | 6785 | 301.7 | 632.1 | 0 | 8910 |

Table 15: Summary Statistics for JDPASegment=Van

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| ABT | 19129 | 0.049 | 0.217 | 0 | 1 |
| ABTFranchise | 19129 | 0.313 | 0.464 | 0 | 1 |
| SameDealer | 19129 | 0.011 | 0.105 | 0 | 1 |
| Price | 19129 | 23404.6 | 3977.9 | 8139 | 36009 |
| TotalPrice | 19129 | 26584.0 | 4363.1 | 13904 | 46376 |
| TradeInOverAllowance | 5955 | 869.7 | 1887.9 | -9500 | 12700 |
| VehicleProfit | 17471 | 2025.2 | 1591.3 | -3124 | 8485 |
| TotalProfit | 17251 | 2474.438 | 1696.696 | -1194 | 14659 |
| VehicleCost | 17471 | 22256.1 | 2446.9 | 9908 | 32676 |
| DaysToTurn | 18428 | 46.9 | 60.8 | 1 | 524 |
| EndOfMonth | 19129 | 0.211 | 0.408 | 0 | 1 |
| Weekend | 19129 | 0.324 | 0.468 | 0 | 1 |
| Female | 15549 | 0.271 | 0.444 | 0 | 1 |
| AnyFinancing | 19129 | 0.723 | 0.447 | 0 | 1 |
| AmountFinanced | 13833 | 22380.8 | 5242.3 | 1500 | 40560 |
| FinancingProfit | 13581 | 274.8 | 550.9 | 0 | 7750 |

Table 16: Transaction summary statistics by Autobytel.com franchise

| ABTFranchise=0 | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Price | 131068 | 23076.8 | 8255.8 | 5946 | 106370 |
| TotalPrice | 131068 | 26017.5 | 9135.3 | 6856 | 118284 |
| TradeInOverAllowance | 38564 | 743.6 | 1754.7 | -9980 | 18500 |
| VehicleProfit | 125916 | 1678.7 | 1335.1 | -4894 | 12795 |
| TotalProfit | 93567 | 2180.0 | 1583.6 | -1425 | 16569 |
| VehicleCost | 125916 | 21785.7 | 7307.8 | 7351 | 93584 |
| DaysToTurn | 125129 | 41.5 | 54.9 | 1 | 642 |
| EndOfMonth | 131068 | 0.208 | 0.406 | 0 | 1 |
| Weekend | 131068 | 0.324 | 0.468 | 0 | 1 |
| Female | 108624 | 0.339 | 0.473 | 0 | 1 |
| AnyFinancing | 131068 | 0.751 | 0.432 | 0 | 1 |
| AmountFinanced | 98476 | 21895.7 | 8507.2 | 691 | 106431 |
| FinancingProfit | 96985 | 307.4 | 580.3 | 0 | 9758 |
| ABTFranchise=1 | Obs | Mean | Std. Dev. | Min | Max |
| Price | 64704 | 24600.5 | 9863.9 | 7499 | 101370 |
| TotalPrice | 64704 | 27814.9 | 11059.9 | 8463 | 115408 |
| TradeInOverAllowance | 17610 | 825.7 | 1839.9 | -9250 | 16489 |
| VehicleProfit | 61894 | 1712.7 | 1517.8 | -3929 | 13384 |
| TotalProfit | 46955 | 2254.9 | 1837.0 | -1137 | 16853 |
| VehicleCost | 61894 | 23344.4 | 8837.3 | 9139 | 93234 |
| DaysToTurn | 63629 | 36.7 | 48.7 | 1 | 502 |
| EndOfMonth | 64704 | 0.218 | 0.413 | 0 | 1 |
| Weekend | 64704 | 0.335 | 0.472 | 0 | 1 |
| Female | 52772 | 0.342 | 0.474 | 0 | 1 |
| AnyFinancing | 64704 | 0.776 | 0.417 | 0 | 1 |
| AmountFinanced | 50237 | 23241.8 | 9884.3 | 500 | 104430 |
| FinancingProfit | 48977 | 321.1 | 639.6 | 0 | 9697 |

Table 17: Demographics by Autobytel.com franchise

| ABTFranchise=0 | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Female | 108,624 | 0.339 | 0.473 | 0 | 1 |
| %Professional | 129,081 | 16.3 | 8.8 | 0 | 100 |
| %Farmer | 129,081 | 2.8 | 6.2 | 0 | 100 |
| MedianHHIncome | 128,576 | 57,563.7 | 25,288.3 | 10,500 | 150,000 |
| MedianAgeHeadHH | 128,576 | 45.2 | 6.8 | 13 | 70 |
| %CollegeGrad | 128,643 | 31.1 | 17.3 | 0 | 100 |
| %<HighSchool | 128,643 | 13.2 | 12.5 | 0 | 100 |
| %Black | 128,647 | 4.3 | 9.7 | 0 | 100 |
| ABTFranchise=1 | Obs | Mean | Std. Dev. | Min | Max |
| Female | 52,772 | 0.342 | 0.474 | 0 | 1 |
| %Professional | 63,662 | 16.8 | 9.0 | 0 | 100 |
| %Farmer | 63,662 | 2.0 | 4.6 | 0 | 100 |
| MedianHHIncome | 63,409 | 60,754.1 | 26,122.6 | 10,500 | 150,000 |
| MedianAgeHeadHH | 63,409 | 45.2 | 6.7 | 13 | 70 |
| %CollegeGrad | 63,450 | 33.2 | 17.6 | 0 | 100 |
| %<HighSchool | 63,450 | 12.8 | 12.6 | 0 | 100 |
| %Black | 63,453 | 4.6 | 10.4 | 0 | 100 |

Table 18: Regressions by JDPA Segment

| JDPA Segment | Compact | Luxury | Midsize | Pickup | SUV | Sporty | Van |
|---|---|---|---|---|---|---|---|
| ABT | -0.0236 | -0.0048 | -0.0213 | -0.0405 | -0.0121 | -0.0235 | -0.0071 |
| | (0.0032) | (0.0024) | (0.0023) | (0.0077) | (0.0023) | (0.0059) | (0.0034) |
| ABTFranchise | -0.0031 | -0.0020 | -0.0046 | -0.0085 | -0.0043 | -0.0061 | -0.0030 |
| | (0.0011) | (0.0008) | (0.0008) | (0.0012) | (0.0008) | (0.0019) | (0.0014) |
| SameDealer | 0.0099 | -0.0056 | 0.0019 | 0.0147 | 0.0023 | 0.0127 | -0.0020 |
| | (0.0062) | (0.0050) | (0.0042) | (0.0130) | (0.0040) | (0.0111) | (0.0069) |
| EndOfMonth | -0.0025 | -0.0015 | -0.0040 | -0.0048 | -0.0048 | -0.0031 | -0.0034 |
| | (0.0011) | (0.0009) | (0.0009) | (0.0014) | (0.0009) | (0.0022) | (0.0016) |
| Weekend | -0.0032 | 0.0005 | -0.0037 | 0.0026 | -0.0019 | -0.0057 | -0.0010 |
| | (0.0009) | (0.0009) | (0.0008) | (0.0012) | (0.0008) | (0.0019) | (0.0014) |
| SouthernCal | 0.0163 | -0.0056 | 0.0112 | 0.0104 | 0.0040 | -0.0007 | -0.0009 |
| | (0.0009) | (0.0009) | (0.0008) | (0.0011) | (0.0008) | (0.0018) | (0.0013) |
| Month2 | 0.0076 | -0.0023 | 0.0003 | 0.0054 | 0.0008 | -0.0015 | -0.0060 |
| | (0.0025) | (0.0022) | (0.0019) | (0.0028) | (0.0018) | (0.0048) | (0.0034) |
| Month3 | 0.0037 | 0.0015 | -0.0026 | 0.0052 | 0.0016 | 0.0003 | -0.0084 |
| | (0.0023) | (0.0021) | (0.0018) | (0.0027) | (0.0017) | (0.0045) | (0.0032) |
| Month4 | -0.0030 | 0.0039 | -0.0021 | 0.0022 | 0.0012 | 0.0020 | -0.0051 |
| | (0.0023) | (0.0021) | (0.0018) | (0.0028) | (0.0018) | (0.0046) | (0.0034) |
| Month5 | -0.0004 | -0.0012 | -0.0097 | 0.0024 | 0.0012 | -0.0046 | -0.0105 |
| | (0.0023) | (0.0020) | (0.0018) | (0.0027) | (0.0018) | (0.0044) | (0.0032) |
| Month6 | 0.0010 | -0.0067 | -0.0039 | 0.0037 | -0.0003 | -0.0047 | -0.0016 |
| | (0.0024) | (0.0021) | (0.0019) | (0.0028) | (0.0018) | (0.0045) | (0.0033) |
| Month7 | -0.0015 | -0.0053 | -0.0114 | -0.0048 | -0.0087 | -0.0098 | 0.0029 |
| | (0.0023) | (0.0022) | (0.0018) | (0.0028) | (0.0018) | (0.0044) | (0.0034) |
| Month8 | 0.0020 | -0.0122 | -0.0169 | -0.0115 | -0.0152 | -0.0060 | 0.0005 |
| | (0.0024) | (0.0021) | (0.0019) | (0.0031) | (0.0018) | (0.0048) | (0.0036) |
| Month9 | 0.0031 | -0.0161 | -0.0238 | -0.0167 | -0.0229 | -0.0091 | 0.0062 |
| | (0.0031) | (0.0024) | (0.0027) | (0.0034) | (0.0021) | (0.0053) | (0.0046) |
| Month10 | -0.0006 | -0.0107 | -0.0253 | -0.0239 | -0.0244 | -0.0155 | 0.0128 |
| | (0.0033) | (0.0026) | (0.0028) | (0.0038) | (0.0022) | (0.0062) | (0.0050) |
| Month11 | -0.0078 | -0.0130 | -0.0303 | -0.0281 | -0.0296 | -0.0203 | 0.0023 |
| | (0.0034) | (0.0029) | (0.0030) | (0.0043) | (0.0023) | (0.0066) | (0.0053) |
| Month12 | -0.0112 | -0.0157 | -0.0380 | -0.0355 | -0.0303 | -0.0212 | -0.0075 |
| | (0.0041) | (0.0029) | (0.0037) | (0.0045) | (0.0027) | (0.0076) | (0.0056) |
| Month13 | -0.0113 | -0.0143 | -0.0385 | -0.0356 | -0.0289 | -0.0310 | 0.0115 |
| | (0.0041) | (0.0034) | (0.0039) | (0.0047) | (0.0031) | (0.0079) | (0.0062) |
| Month14 | -0.0207 | -0.0127 | -0.0396 | -0.0395 | -0.0257 | -0.0414 | 0.0127 |
| | (0.0043) | (0.0036) | (0.0039) | (0.0050) | (0.0033) | (0.0082) | (0.0064) |
| ModelMonth5-13 | -0.0004 | -0.0035 | -0.0021 | 0.0087 | 0.0000 | 0.0121 | -0.0063 |
| | (0.0026) | (0.0018) | (0.0024) | (0.0034) | (0.0016) | (0.0045) | (0.0033) |
| ModelMonth14+ | -0.0113 | -0.0302 | 0.0023 | 0.0101 | -0.0066 | 0.0018 | -0.0277 |
| | (0.0042) | (0.0038) | (0.0037) | (0.0046) | (0.0028) | (0.0073) | (0.0062) |
| Constant | 9.5808 | 10.5074 | 9.9472 | 9.9209 | 10.2800 | 10.0320 | 10.0535 |
| | (0.0026) | (0.0020) | (0.0022) | (0.0036) | (0.0017) | (0.0049) | (0.0034) |
| Car dummies | ... | ... | ... | ... | ... | ... | ... |
| Observations | 34794 | 16743 | 45075 | 27064 | 44482 | 8485 | 19129 |
| Adjusted $R^2$ | 0.76 | 0.97 | 0.75 | 0.90 | 0.89 | 0.94 | 0.78 |