

Internet Car Retailing*

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First version: September 2000

This version: December 2000

*We thank Melanie Webber and Craig Ima from Autobyte.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 Ian Ayres, Meghan Busse, Chris Denove, Jonathan Feinstein, Thomas Hubbard, Ganesh Iyer, Barry Nalebuff, Sharon Oster, Scott Stern, Ivo Welch, and seminar participants at Harvard, U.C. Berkeley, and Yale Universities for helpful comments and suggestions. All errors are the responsibility of the authors. Fiona Scott Morton was partially supported by NSF grant 9810178. Florian Zettelmeyer was partially supported by the UC Berkeley Junior Faculty Research Grant. Addresses for correspondence: School of Management, Yale University, PO Box 208200, New Haven CT 06520-8200, and Haas School of Business, UC Berkeley, Berkeley CA 94720-1900. E-mail: fiona.scottmorton@yale.edu, florian@haas.berkeley.edu

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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 than an equivalent offline sale. However, because online consumers may be cheaper to serve and online sales are likely to 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.

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 2000, for example, 54% of all new vehicle buyers used the Internet in conjunction with buying a car (J.D.Power & Associates, 2000b).

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 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. Nonetheless, web-affiliated dealers are likely to be better off working with Autobytel.com. This is because dealerships may be able to adjust their business processes to realize potentially lower cost of selling to Internet consumers, and online sales are likely to be new business for the dealerships.

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.

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 dissatisfaction of consumers with the car buying process by shielding consumers to some degree from direct interaction with dealers and “arming” them with information.¹ 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.² 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 to responding to Internet purchase requests. Consumers are typically called back or e-mailed within 24-48 hours with a (supposedly) fixed price.³ 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 3,700

¹For a description of the car buying process see “Disintermediation in the US Auto Industry,” Stanford GSB Case Study EC10

²Recently Autobytel.com has started selling directly to consumers and Autoweb.com has partnered with CarsDirect, a direct sales site.

³Note that the price offer from the dealer (by phone or email) is not a binding commitment.

dealers under contract, and Autoweb.com and Autobytel.com each contracted with 5,000 dealerships.⁴ Dealers either pay an annual fixed fee based on the size of the dealership (\$1607/month on average for Autobytel.com) or a combination of annual fee and a per referral charge (\$500-\$1000 annual fee and \$29 per referral for Autoweb, averaging \$1135/month).⁵ 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 “Internet sales consultant” 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 but are not always adhered to by dealerships.⁶ 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. For dealerships, the average conversion rate is about 8 leads from an Internet referral service 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 refers consumers to 1700 dealerships nationwide, however, in contrast to Internet referral services they (not consumers) negotiate prices with the dealerships. Greenlight works with the Asbury automotive group, a large owner of dealerships and and sells consumers cars owned by the 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

⁴Carpoin.com website, Autoweb.com Website, Autobytel.com interview. These self reported numbers should be used with caution since each service has a different way of counting affiliated dealerships.

⁵Youngme Moon (1999), “Autobytel.com,” HBS Case Study, and J.D.Power and Associates (2000a)

⁶In a J.D.Power and Associates (2000a) survey 43% of dealerships state that the quoted price leaves room for additional discount, 41% state that the quoted price leaves no room for additional discount, and 16% say that they prefer not to quote a price until the customer comes in.

⁷See Lehman Brothers, “Autobytel.com,” 5/12/1999 and J.D.Power and Associates (2000a) for information about conversion rates and dealer turnover.

stands in contrast to some other industries such as stock 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.

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 Autobyte.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 enough 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 less costly than conventional sales. Online buyers may be 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 less time selling and 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 potentially lower-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

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

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 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 Autobyte.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 Autobyte.com prices will be lower than average, but the cause of the lower prices would be unclear. If this story were true and affiliated dealerships did not gain additional customers, the distribution of prices would remain unchanged with the introduction of the Internet.

We don't expect this to hold in our data. Instead, we expect the distribution of prices to change as a result of the Internet. This is because, first, at least some consumers will pay lower prices because information on the Internet is cheaper, faster to get, and more comprehensive than from pre-Internet sources. Second, since Internet referral services typically assign exclusive territories to a dealer of a specific nameplate, the affiliation with the service is likely to lead

to additional customers. As price quotes to an Internet customer are more standardized than to walk-in customers, we expect the distribution of prices at a dealership to change. Therefore we hypothesize:

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

Assuming that the distribution of prices is unimodal (which holds in our data), the price dispersion at a dealership is likely to increase in the percentage of Internet customers if these customers move from the middle to the lower end of the price distribution. Price dispersion is likely to decrease if Internet customers move from the top to the middle of the price distribution.

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 consumer 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 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.

⁹Autobytel.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 (2000b), 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%).

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

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 $ABT=1$). Currently we do not know if the customer purchased the same car he or she requested from Autobytel.com. We have this information, but it will require further work with the data to get it into usable form.

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 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 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 many 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.

¹¹46.5% 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.

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
Midsized	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

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. 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 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 wholesale value of the trade-in vehicle (as booked by the dealer). 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.¹² 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.

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

¹²If online buyers have unobservably higher quality trade-ins than offline buyers (which we have no reason to think is true), our measure will systematically overstate the price paid by online buyers.

	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
<i>TradeInOverAllowance</i>	1,000	-1,000
<i>Price</i>	20,000	20,000

vehicle’s book value. The measure takes into account holdback and includes transportation charges.¹³ We do not have any information on the existence or extent of nonlinear, volume-based discounts. Volume discounts would make any additional sales due to Autobytel.com even more valuable because they would lower inframarginal costs.

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.

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.”

¹³ “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.

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 29 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%).

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

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	195,772	0.759	0.427	0	1
AmountFinanced	148,713	22,350.4	9,018.5	500	106,431
FinancingProfit	145,962	312.0	600.9	0	9,758

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 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; 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

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

four days quicker than non-*ABTFranchise* dealers. The appendix compares demographics and further summary statistics by *ABTFranchise* (Tables 16 and 17 on page 32).

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

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

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 18 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 lower margins on those cars are simply additional profit, not losses. In addition, it may be cheaper for a dealer to sell to Internet consumers, however, our evidence is mixed. Our confirmatory evidence stems from the 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.¹⁴ The difference between

¹⁴We use the profit margin from NADA of \$198 and the JDPA median gross margin of \$1773 to infer average cost.

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

the average total cost of a traditional sale in our data (\$1575) and his Autobytel.com average cost (\$940) is over \$600. Comparing this number to our estimate of the expected price drop for Internet sales of between \$300 and \$500 provides one reason for some dealers to sign up with Autobytel.com: their margins may increase. However, a survey (J.D.Power & Associates, 2000a) finds that 51% of dealerships report that it takes *more* man-hours to complete a sale with Internet customers from an Internet referral service. The report states that this may be because the “invoice up” style of negotiating is unfamiliar to many dealerships who are used to “MSPR down” negotiations. The study also finds that dealers that have more experience with referral services are much more likely to report that Internet customers are more enjoyable to work with (and presumably more profitable) than traditional customers. This suggests that dealerships need to adjust their business processes to realize potentially lower cost of selling to Internet consumers. The dealership described above may have done just that. This particular dealership also estimates that 60% of its Internet sales are incremental and 40% are cannibalization of traditional sales. Notice that while these calculations suggest that referral services could be beneficial to some affiliated dealers, 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

Table 5: OLS of $\ln(\text{price})$ on reported variables

	I	II	III
ABT	-0.0160 (0.00103)	-0.0161 (0.00121)	-0.0141 (0.00146)
ABTFranchise		-0.0044 (0.00041)	-0.0044 (0.00041)
SameDealer		0.0022 (0.00224)	0.0021 (0.00224)
ABT48hrs			-0.0050 (0.00204)
EndOfMonth	-0.0039 (0.00044)	-0.0038 (0.00044)	-0.0038 (0.00044)
Weekend	-0.0020 (0.00038)	-0.0019 (0.00038)	-0.0019 (0.00038)
SouthernCal	0.0072 (0.00038)	0.0074 (0.00038)	0.0074 (0.00038)
ModelMonth5-13	0.0005 (0.00091)	0.0006 (0.00091)	0.0006 (0.00091)
ModelMonth14+	-0.0045 (0.00152)	-0.0044 (0.00152)	-0.0044 (0.00152)
Constant	10.0155 (0.00094)	10.0167 (0.00095)	10.0167 (0.00095)
Car Fixed Effect	...	...	...
Month Fixed Effect	...	...	...
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*, and *ModelMonth5-13*

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.

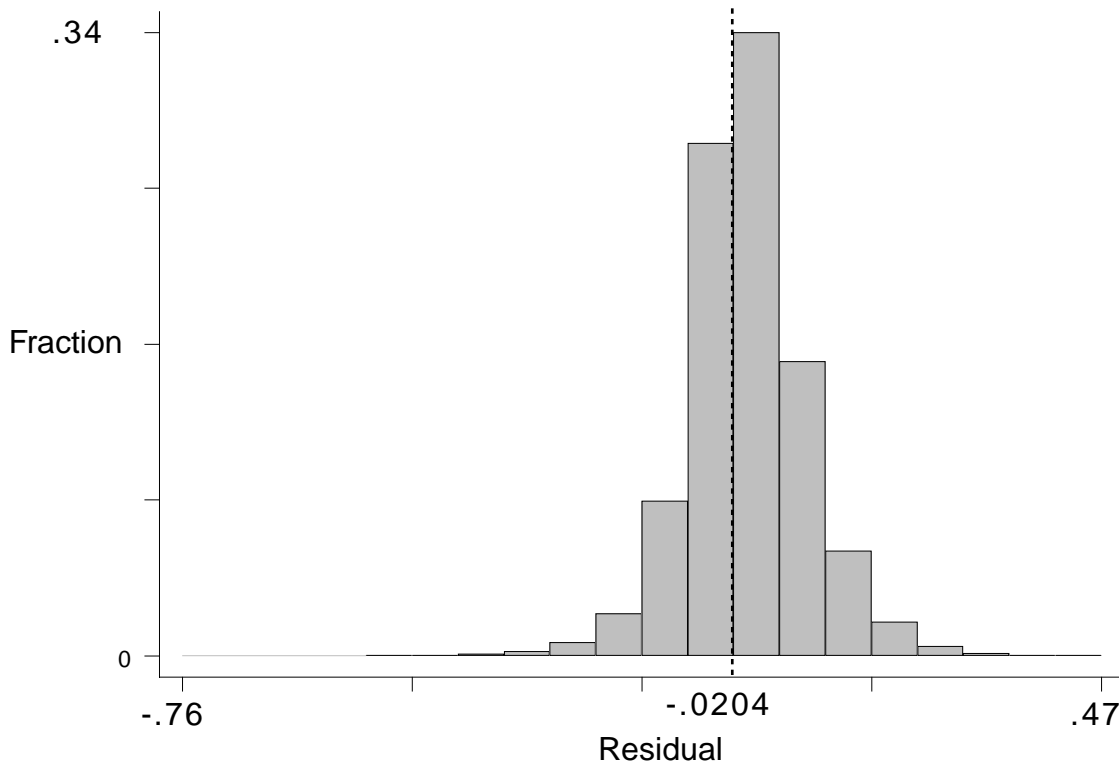


Figure 1: Histogram of residuals from Table 5 column 1 for ABT=0

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 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 considerable 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 reported having 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

Table 6: Other dependent variables

	log(Price w/ AMOs)	TrOverAll.	log(Price)
ABT	-0.0199 (0.00126)	-354.31 (59.35)	-0.0161 (0.00130)
ABTFranchise	-0.0064 (0.00042)		-0.0042 (0.00041)
SameDealer	0.0032 (0.00234)	-32.45 (109.47)	0.0020 (0.00224)
AnyTrade			0.0071 (0.00040)
ABT*AnyTrade			0.0034 (0.00258)
EndOfMonth	-0.0041 (0.00046)	-66.15 (17.57)	-0.0038 (0.00044)
Weekend	0.0016 (0.00040)	-78.95 (15.65)	-0.0020 (0.00038)
SouthernCal	0.0047 (0.00040)	(dropped)	0.0072 (0.00038)
ModelMonth5-13	0.0011 (0.00095)		0.0007 (0.00091)
ModelMonth14+	-0.0042 (0.00159)		-0.0045 (0.00152)
Constant	10.0354 (0.00099)	802.16 (27.28)	10.0147 (0.00096)
Car Fixed Effects	...		...
Month Fixed Effects	...	...	...
Dealer Fixed Effects		...	
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*, and the model month dummies.

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 receive less for their trade-in, 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). 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. An interesting industry fact is that dealers pay on average \$770 above the “actual cash value” (wholesale price) of the trade-in. This does not represent a loss to the dealer because average new car prices are adjusted up to compensate, resulting in cross-subsidization from the new car to the trade-in. (For example, Goldberg (1996) analyzes contract prices and finds that customers with trade-in vehicles pay on average \$600 more for their new car.) 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.

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. It appears that a small overall price premium is charged to both online and offline consumers who take advantage of the convenience of trading in their old car to the dealer.

Table 7 shows that the cost of acquiring the vehicle is not different between ABT customers and non-ABT customers (column 1). In addition, ABT franchises face a slightly higher cost

Table 7: Financing and cost regressions

	log(VehicleCost)	log(Price) if Financing	FinancingProfit (Tobit)
ABT	-0.0013 -0.00076	-0.0171 -0.0016	-87.58 -19.93
ABTFranchise	0.0024 -0.0003	-0.0058 -0.0005	18.26 -6.08
SameDealer		0.0029 -0.0028	-40.1 -36.51
EndOfMonth		-0.0039 -0.0005	-24.79 -6.57
Weekend		-0.0029 -0.0004	-26.57 -5.68
SouthernCal	0.0105 -0.00028	-0.0102 -0.0005	-67.62 -5.8
ModelMonth5-13	-0.0002 -0.00068	0.0006 -0.0011	-9.57 -13.68
ModelMonth14+	0.0016 -0.00113	-0.0033 -0.0018	29.89 -22.64
Constant	9.9475 -0.00069	10 -0.0011	541.77 -64.42
Car Fixed Effects	...	...	...
Month Fixed Effects		...	...
Observations	187810	147857	145962
Adj./Pseudo R^2	0.9677	0.944	0.0088

*All reported coefficients are significant at the 5% level or better except *SameDealer* and the model month dummies. Column 2: 70437 left-censored observations at FinancingProfit \leq 0, 75525 uncensored observations

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 finding that Autobytel.com customers pay less. If Autobytel.com or the Internet in general is helping to educate previously naive 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 three 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. 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 repeat our basic specification of vehicle price and find that the coefficient on using Autobytel.com increases (in absolute value) to 1.7% on the car (2.2% total) for this unsophisticated group (see column 2 of Table 7). Since the selection effect should operate most strongly for the excluded group, the coefficient should drop, not increase, in absolute value if our results are due to only selection. Secondly, Autobytel.com and the Internet provide information and bargaining power that could help customers get the best financing rate. We also 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. Finally, we divide the ABT customers by quarter and estimate a separate coefficient for each quarter of the sample.¹⁵ We assume that because market growth has been so large, ABT customers at the beginning of 1999 were less representative of the general population than those at the end of that year, and therefore any selection effect should be falling over time. Declining coefficients would provide evidence for a strong selection effect. Instead we find that the coefficients are nearly constant over time, with a small increase in absolute value in the last quarter of 1999.

Table 8 examines how price dispersion at the dealer level varies with the amount of Autoby-

¹⁵We exclude the last quarter because it has fewer observations.

Table 8: Price dispersion regressions: Dependent variable is dealer level price variation

Sample:	All consumers All dealers	Non-ABT cons. All dealers	All consumers Non-ABT dealers	Non-ABT cons. Non-ABT dealers
Dealer%ABT	-0.0239* (0.0066)	-0.0243* (0.0067)	-.0241 (0.0083)	-.0248 (0.0083)
DealerVolume	3.68E-07 (2.74E-07)	3.95E-07 (2.75E-07)	3.72E-07 (3.58E-07)	3.99E-07 (3.60E-07)
Constant	0.0059* (0.0002)	0.0059* (0.0002)	0.0058 (0.0003)	0.0058 (0.0003)
Observations	715	715	572	572
Adj. R^2	0.0158	0.0164	0.0117	0.0126

* indicates significance at the 5% level or better

tel.com business the dealership has. We use residuals from our baseline regression without any ABT variables to construct residuals. We create a *dealer variance* variable, which is simply the variance of those error terms by dealer. We create a second dealer variance variable that omits all sales to ABT customers; if these customers are reducing variance, the second measure will not reflect that and will only pick up price dispersion in other customers. We then regress both measures on the percentage of the dealer’s sales that are to Autobytel.com customers and the dealership’s size. We see for both dependent variables that the coefficient on Autobytel.com percentage is negative and significant. Selling more cars through Autobytel.com reduces price dispersion at the dealership level. We would expect this result if ABT dealerships were attracting new customers through Autobytel and placing them in the middle of its price distribution. Therefore, we also run these specifications on a sample of only dealerships without a contract with Autobytel.com. We again see that the proportion of ABT sales at these dealerships is associated with lower price dispersion. These patterns indicate 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. We plan to investigate dispersion across and within dealerships more fully in future research.

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 expect dealer pricing to continue as long as manufacturers rely on dealers to estimate demand and to bear the risk of selling their inventory.¹⁶ 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 Autobyte.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. Also, profits earned by the dealer on extra services are lower for an online than offline customer. Nonetheless, web-affiliated dealers are likely to be better off from working with Internet purchase referral services. This is because dealerships may be able to adjust their business processes to realize potentially lower cost of selling to Internet consumers, and online sales are likely to be new business for the dealerships.

We examine price dispersion at the dealership level and find that it declines in the amount of Autobyte.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.

¹⁶i.e. The existence of make-to-order cars would remove the role of the dealer in estimating demand and reduce the need for dealer pricing.

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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	Midsized	Pickup	SUV	Sporty	Van
ABT	-0.0236 (0.0032)	-0.0048 (0.0024)	-0.0213 (0.0023)	-0.0405 (0.0077)	-0.0121 (0.0023)	-0.0235 (0.0059)	-0.0071 (0.0034)
ABTFranchise	-0.0031 (0.0011)	-0.0020 (0.0008)	-0.0046 (0.0008)	-0.0085 (0.0012)	-0.0043 (0.0008)	-0.0061 (0.0019)	-0.0030 (0.0014)
SameDealer	0.0099 (0.0062)	-0.0056 (0.0050)	0.0019 (0.0042)	0.0147 (0.0130)	0.0023 (0.0040)	0.0127 (0.0111)	-0.0020 (0.0069)
EndOfMonth	-0.0025 (0.0011)	-0.0015 (0.0009)	-0.0040 (0.0009)	-0.0048 (0.0014)	-0.0048 (0.0009)	-0.0031 (0.0022)	-0.0034 (0.0016)
Weekend	-0.0032 (0.0009)	0.0005 (0.0009)	-0.0037 (0.0008)	0.0026 (0.0012)	-0.0019 (0.0008)	-0.0057 (0.0019)	-0.0010 (0.0014)
SouthernCal	0.0163 (0.0009)	-0.0056 (0.0009)	0.0112 (0.0008)	0.0104 (0.0011)	0.0040 (0.0008)	-0.0007 (0.0018)	-0.0009 (0.0013)
ModelMonth5-13	-0.0004 (0.0026)	-0.0035 (0.0018)	-0.0021 (0.0024)	0.0087 (0.0034)	0.0000 (0.0016)	0.0121 (0.0045)	-0.0063 (0.0033)
ModelMonth14+	-0.0113 (0.0042)	-0.0302 (0.0038)	0.0023 (0.0037)	0.0101 (0.0046)	-0.0066 (0.0028)	0.0018 (0.0073)	-0.0277 (0.0062)
Constant	9.5808 (0.0026)	10.5074 (0.0020)	9.9472 (0.0022)	9.9209 (0.0036)	10.2800 (0.0017)	10.0320 (0.0049)	10.0535 (0.0034)
Car Fixed Effects	...	...	...	...	...	...	...
Month Fixed Effects	...	...	...	...	...	...	...
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