THREE ESSAYS ON AUTOMOBILE PRICING

by

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ABSTRACT

In North America, automobile prices are largely determined through negotiation. Recognizing that some consumers have a strong aversion to negotiation, some manufacturers and dealers are now offering consumers the option of buying cars at a "no-haggle", or fixed price. This dissertation consists of three essays which address how a fixed price alternative impacts both consumer behavior and firm strategies.

The first essay explores the conditions under which a dealer would simultaneously offer a "no-haggle" Internet price and a negotiable price on the lot (which we term a dual-channel), and studies the marketing strategies adopted under this structure. We use consumer haggling cost as a key to understanding a dealer's choice of pricing strategy. We find that a dual-channel is optimal for the dealer when there is sufficient diversity in consumer haggling cost. We also find that it is optimal for a dealer to specify a higher-than-cost "minimum acceptable price" to the salesperson as a price floor for negotiations. Surprisingly, a dual-channel may serve fewer customers while still being more profitable than a single channel structure.

The second essay examines the competitive implications of a no-haggle pricing policy. By using Toyota's fixed pricing policy in Canada as a natural experiment, we explore the impact of such a strategy on the prices and sales of Toyota and that of its close competitor, Honda. We find that the program has had important competitive consequences. While prices of both Toyota and Honda were higher in provinces with the program, there was an increase in Honda's sales but with no effect on the sales of Toyota.

The third essay determines the impact of a consumer's bargaining behavior and information she collects on the final price paid. Using an extensive dataset, we find that a consumer's negotiation skill and attitude toward negotiating significantly influences the negotiation outcome. In particular, consumers that enjoy negotiating have a greater propensity to search for price information which then allows them to obtain a better deal. In addition, we find that, while Internet users pay a lower price, the savings depend on the type of information collected by the buyer.

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CHAPTER 1 INTRODUCTION

1.1 Overview and Background

In North America, automobile prices are largely determined through bargaining. Typically, consumers devote a considerable amount of time and effort negotiating with salespeople in order to reach a mutually acceptable price. Recognizing that some consumers have a strong aversion to negotiation, some manufacturers and dealers are now offering consumers the option of buying cars at a "no-haggle", or fixed price. For example, a growing number of dealers are taking advantage of the Internet to implement a fixed price by either publishing a no-haggle fixed price on their website or revealing it through email in response to a consumer's request. Manufacturers such as Saturn have implemented a "No-haggle, no hassle" pricing philosophy that guarantees its customers that the same Saturn model will have the same price within each geographical region. A similar policy, termed the "Access" program, has been introduced in Canada by the Toyota Company. Despite these developments, there has been relatively little research on the implications of these policies for both consumers and firms.

The first two essays of this dissertation study the impact of no-haggle pricing policies in the context of the US and Canadian automobile markets. The first essay, which is theoretical in nature, analyzes a dealer's decision of adopting a no-haggle pricing policy, while the second essay uses an empirical approach to explore the competitive implications of a no-haggle pricing policy. The third essay confines itself to a traditional bargaining setting to examine the impact of factors, such as an individual's bargaining ability and information, on final prices.

1.2 Overview of Essay One

In the first essay, we develop a theoretical model to explore the conditions under which it is optimal for a dealer to simultaneously offer a "no-haggle" Internet price and a negotiated price on the car lot (which we term a "dual-channel" structure), and study the various marketing strategies that the dealer would adopt under such a structure. While previous studies have examined a seller's choice between a fixed price and bargaining,

almost all the studies focus on a seller's choice of a single pricing option (either fixed or bargaining) and do not consider the possibility that the seller may offer both simultaneously. Furthermore, according to the literature, a fixed price, due to its commitment effect, serves to reduce consumers' uncertainty about product quality. This rationale may not apply for new cars as consumers can easily search for product information online and from other sources. Therefore, we need an alternative rationale for why the fixed price option exists.

We therefore develop a model where a dealer has the option of introducing a fixed price option via the Internet alongside the traditional bargaining option. A critical feature of our model is the existence of consumer haggling cost, which is defined as the cost incurred from the time and effort spent in and the aversion to the negotiation process. We find that this cost is instrumental in determining whether a seller chooses to use a single pricing format (either fixed or bargaining) or to use both simultaneously. The other important feature of our model is to consider the salesperson's role in the negotiation process. Most bargaining frameworks ignore the role of the salesperson. Our model accounts for the salesperson's role by introducing another strategic variable, namely the salesperson's compensation plan, into the dealer's objective function.

The model allows us to determine the conditions under which a dealer would adopt a dual-channel and suggests optimal strategies under this structure. First, we find that it is optimal for a dealer to adopt a dual-channel structure when there is sufficient diversity in haggling cost among consumers. Second, while the previous literature assumes that the optimal sales compensation is based on the true marginal cost, as it aligns the incentive of the salesforce to the firm, we show that this does not hold in our context where the salesperson engages in price negotiation and when the firm manages multiple channels. We find that it is optimal for a dealer to specify a higher than cost "minimum acceptable price" in the compensation plan; this allows the salesperson to start negotiating with a higher price floor resulting in a higher final bargaining price and, in a dual-channel, it also softens the internal competition between the two channels. Third, surprisingly, under certain condition, a dual-channel dealer may serve fewer customers while still making a higher profit than under a single channel structure (i.e., either a lot channel offering a negotiable price, or an Internet channel offering a fixed price). Finally, we find that no

one channel structure is the best for every customer; while the traditional price negotiation generates the greatest welfare for low haggling-cost and low valuation customers, the fixed-price policy leaves high haggling-cost consumers better off. Overall, the fixed-price policy generates the greatest consumer welfare as it eliminates the cost of haggling and limits the dealer's ability to price discriminate.

1.3 Overview of Essay Two

The second essay, which is an empirical study, examines the competitive implications of a no-haggle pricing policy. We focus on the case where a manufacturer exclusively implements a no-haggle pricing policy among its downstream dealerships, while competitors' prices continue to be determined through bargaining. Our investigation is based on the case of Toyota's fixed price policy, or the "Access Toyota program", in Canada. This program was first introduced in Manitoba in 2000 and up to now all provinces in Canada except for Ontario have implemented this fixed price program. In contrast to Toyota's strategy, Honda, a close competitor of Toyota, still sells its car at negotiable prices in all places. The above creates a natural experiment that allows us to explore the effects of a fixed price strategy on competition. In examining the competitive consequences, we focus on the prices and sales of Toyota and that of Honda. We collect retail price and sales information for both brands across the major provinces of Canada.

To the best of our knowledge, this is the first empirical study on the competitive consequences of switching to a fixed price policy when other firms allow for negotiation. Our results suggest that the program has had important competitive consequences. Specifically, while prices of both Toyota and Honda were higher in provinces with the program, there was an increase in Honda's sales but no effect on the sales of Toyota. These findings suggest that this fixed price policy has benefited both firms. This research can be generalized to similar situations where competitive firms adopt different pricing formats (bargaining vs. posted price), which exist in markets besides automobiles, such as boats, musical instruments and jewelry. Our findings shed light on the impact of such pricing decisions on prices and consumer demand.

1.4 Overview of Essay Three

The third essay examines the determinants of negotiated price for individual consumers. The previous literature, which is largely theoretical or experimental, suggest that factors such as bargaining ability, information, situational and psychological factors all affect the price that a consumer ultimately pays. However, there is very little research that has established and quantified the impact of these factors on the actual negotiated price. This essay seeks to determine the impact of an individual's bargaining ability, attitude towards negotiation, and the information a consumer collects on the final price paid. We employ a unique dataset that combines transaction prices with survey data that includes measures of new car buyers' bargaining ability and enjoyment of negotiation. The survey also reports the various sources of information a consumer has access to, including the Internet, newspapers, magazines and television. While the impact of the Internet on prices has been well established, we contribute to the literature by also looking at the impact of offline information sources, such as newspapers, on prices. We further extend our findings by looking at the impact of information type, i.e., price versus non-price information, on the price paid. This allows us to better understand the manner in which sources such as the Internet help lower prices.

Essay three provides the following insights. First, we find that a consumer's negotiation skill and attitude toward negotiating significantly influence the negotiation outcome. Buyers who perceive themselves as better negotiators obtained a lower price than others, as did buyers who enjoyed negotiating. Further exploration indicates that consumers that enjoy negotiating have a greater propensity to search for price information which then allows them to obtain a better deal. Second, our results indicate that, despite the growing popularity of the Internet, certain offline sources are still important for people who pay lower prices. In particular, we find that people who use newspapers as part of their purchase process paid a lower price. In addition, we find that, consistent with earlier findings, Internet users pay a lower price, but that the savings depend on the type of information collected by the buyer. The savings are greater if the information collected is price-related. In contrast, information that is mostly product-related actually is associated with an increase in the average negotiated price.

CHAPTER 2 EFFECTS OF A "NO-HAGGLE" INTERNET CHANNEL ON MARKETING STRATEGIES

2.1 Introduction

2.1.1 The Emergence of a No-Haggle Pricing Option

Although bargaining is used in many product markets, recently, many retailers have begun offering consumers the option of buying their products at a fixed, "no-haggle" price. Often, this no-haggle price is implemented via the Internet. As a result, the Internet has now emerged as a major channel of distribution even for products that have traditionally relied on personal selling as a means of transaction. In the automobile market, for example, a growing number of dealers are allowing consumers to bypass the negotiation process entirely by contacting the dealer directly, either via email or phone, to quickly get a fixed price quote (Business Week, 2007).[1] In markets, such as furniture and musical instruments, prices are frequently negotiated in the store, but many retailers are also increasingly offering their goods at a fixed price online or via mail order catalogue.

Despite the growing popularity of such fixed, no-haggle prices, the existing literature does not satisfactorily explain its emergence. While there have been numerous studies that have examined a seller's choice between a fixed price and bargaining (e.g., Arnold & Lippman, 1998; Riley & Zeckhauser, 1983; Wang, 1995), almost all these studies have focused on a seller's choice of one pricing option over another and do not consider the possibility that the seller may offer both pricing options simultaneously. Furthermore, according to these studies, a fixed price, due to its commitment effect, serves to reduce consumers' uncertainty about product quality.[2] For products, such as new cars and furniture, however, quality uncertainty is unlikely to have much of an impact, as consumers can easily search for product information online and from other sources. Thus, not only do we need to explain why a retailer would offer both pricing

[1] A more detailed description of Internet car buying services is available on http://www.edmunds.com/advice/buying/articles/78913/article.html (accessed June 26, 2008).
[2] The commitment effect occurs when pre-evaluation of product quality is costly, so that the use of fixed prices allows a firm to commit not to exploit buyers after they come to the store to inspect the product (Riley & Zeckhauser, 1983; Wernerfelt, 1994).

formats simultaneously, we also need an alternative rationale for why the fixed price option even exists when the seller has the choice of discriminating among consumers by allowing them to negotiate.

In this chapter, therefore, we develop a model which explores the conditions under which a retailer would allow a consumer to choose either to negotiate or to accept a fixed, no haggle price for its product. We also explore the various marketing strategies a firm would adopt under such a structure. One of the key features of our model is the existence of consumer haggling costs. Typically, consumers devote a considerable amount of time and effort negotiating with salespeople in order to reach a mutually acceptable price. Surveys from the automobile market indicate that as many as two thirds of all car buyers have a strong aversion to the negotiation process.[3] Not only do they dislike the time and effort spent in negotiating, they are also afraid of being taken advantage of by the salesperson. We therefore define the cost incurred from the time and effort spent in and the aversion to the negotiation process as consumer "haggling cost". We find that this cost is instrumental in determining whether a seller chooses to use a single pricing format (fixed versus bargaining) or to use both simultaneously.

Another important characteristic of our model is that we assume that when prices are negotiated, the bargaining is performed by a salesperson acting on behalf of the retailer. Most bargaining frameworks (See a review by Muthoo, 1999) do not consider the use of a sales agent in price negotiation. Our model accounts for the salesperson's role by introducing another strategic variable, namely the salesperson's compensation plan, into the retailer's objective function. We find that the retailer's choice of the compensation plan has a direct effect on how prices, both negotiated and fixed, are determined.

2.1.2 Three Channel Structures in the Auto Market

For ease of exposition, we use the automobile market and the increasingly prevalent practice of auto dealers offering a fixed price alternative through the Internet as a representative example and develop our model in that context, even though it applies to other product markets.

[3] A market study by Toyota found that 80-86% of car buyers disliked the traditional negotiation experience (Marketing Magazine, 2000).

Traditionally, automobiles are sold through a process of negotiation. Despite the cost of employing additional staff, negotiation allows the seller to discriminate among different consumers: there is empirical evidence, for example, that auto dealers charge minorities and women higher prices than their counterparts (Ayres & Siegelman, 1995; Goldberg, 1996; Morton, Zettelmeyer, & Silva-Risso, 2003). Recently, however, dealers are taking advantage of the Internet to implement a fixed price, by either publishing a no-haggle fixed price on their website or revealing it through email in response to a consumer's request. Some dealers of brands, such as Subaru and Nissan, have an Internet department to respond directly to a consumer's request. Other dealers sign up with independent online companies, such as Autobytel and CarsDirect, who provide third party referral services. Typically, if a consumer accepts the quoted price, she may pay for the vehicle online and have it shipped to her door or she may, before purchasing, arrange with an Internet consultant for a test drive and a thorough inspection of the vehicle. Because of its convenience and speed, online buying services have attracted busy people who do not have time, and for cost conscious consumers who dread negotiating with dealers (The Economist 2006).[4]

Figure 2.1 illustrates three potential channel structures. The conventional "lot-only" channel (**Figure 2.1**(a)) allows for face-to-face negotiation with the consumer and is the channel through which the majority of vehicles are sold. The possibility of having an Internet channel leads to two other alternatives: a dealer can implement a "dual-channel" by adding a no-haggle Internet channel, thereby offering consumers a choice between a fixed price and a negotiated one (**Figure 2.1**(b)), or it can eliminate the conventional negotiation and offer only a no-haggle price through the Internet, i.e., a web-only channel (**Figure 2.1**(c)).

2.1.3 Research Issues and Summary of Findings

In this research, we address the following main questions: (1) when is a dual-channel optimal, (2) what are the optimal strategies (e.g., compensation contract, price)

[4]According to this article, J.D. Power and Associates estimates that, in the year 2005, nearly two thirds of all new car customers used the Internet in some way during their purchase, up from 25% in 1998. Auto Nation reports that, in 2005, car sales originating on the Internet were 25% of its total, up from 14% in 2002.

under such a structure, and (3) what implications does the no-haggle option have for consumer welfare? In order to study these questions, we model the interaction of three parties: a monopolist dealer who can sell either on the lot, the Internet or both, a salesperson that negotiates the price on the lot on behalf of the dealer, and the consumer.

Our model yields several interesting findings. First, given that there are two types of consumers in the market – those with a high cost of haggling and those with a lower cost – we find that a dual channel is optimal only when there are enough high haggling-cost consumers but not too many, and also when the difference in haggling costs between the two types of consumers is sufficiently high. Second, while the previous literature assumes that the optimal sales compensation is based on the true marginal cost, as it aligns the incentive of the salesforce to the firm (e.g., Churchill, Ford, & Walker, 1997; Joseph, 2001), we show that this does not hold in our context where the salesperson engages in price negotiation and when the firm manages multiple channels. We find that it is optimal for a dealer to specify a higher than cost "minimum acceptable price" in the compensation plan; this allows the salesperson to start negotiating with a higher price floor resulting in a higher final bargaining price and, in a dual-channel, it also softens the internal competition between the two channels. Third, surprisingly, under certain conditions, a dual-channel dealer may serve fewer customers while still making a higher profit than under a single channel structure, i.e., either a lot-only or web-only channel. This is because the minimum acceptable price set in a dual-channel is higher, allowing the dealer to charge a higher Internet price, which helps the salesperson negotiate a higher price on the lot. Finally, we find that no one channel structure is the best for every customer: the lot-only channel generates the highest welfare for low haggling-cost and low valuation consumers, while the web-only channel generates the highest welfare for high haggling-cost consumers. Overall, the web-only channel generates the highest welfare, the lot-only channel the lowest, while the dual-channel stands between the two.

Our work is closely related to Desai and Purohit (2004), who explore competing retailers' strategic incentives to adopt haggling or fixed price policies and identify consumer heterogeneity to be an important determinant of retailers' choice of pricing policies. The basic structure of their model assumes that there are two types of consumers: *non-hagglers* who have a high cost of haggling such that they never find it optimal to

haggle, and *hagglers* who have a lower cost of haggling such that if a retailer allows haggling, they may haggle. Our model is more flexible in that we allow all consumers to haggle as long as they foresee that the negotiated price is low enough to compensate for their haggling cost. Another major difference from Desai and Purohit (2004) is that we extend their investigation by explicitly considering the role of the salesperson. We believe sales compensation is an important decision for a dealer as it affects the outcome of the negotiation between the salesperson and the consumer. Our findings suggest that the dealer can strategically specify a price floor in negotiation to the salesperson and thereby influence final prices to its advantage.

Our research is also related to a number of articles that examine the impact of the Internet on prices in the automobile market. Zettelmeyer, Morton, & Silva-Risso (2001) find that consumers who are averse to comparison shopping and haggling are more likely to use an online referral service to get a price quote, which is somewhat similar to the no-haggle Internet price we discuss here.[5] This is consistent with our prediction that the no-haggle price option mainly attracts high haggling-cost consumers. Another study by the same authors (Zettelmeyer, Morton, & Silva-Risso, 2006) finds that consumers who used an online referral service during the buying process paid lower prices than consumers who did not. This is because the Internet offers greater price information that allows consumers to more effectively negotiate with the seller. Our dual-channel structure accounts for the above situation by allowing consumers to use the fixed price on the Internet as a starting point for negotiations in the traditional offline channel. However, our study extends the above studies by considering not only the information benefits of the Internet but also the transactional role of the Internet. In particular, the Internet facilitates the implementation of no-haggle prices so that consumers may bypass the negotiation process.

The rest of the chapter is organized as follows. In section 2.2 we develop a model of dual-channels for a monopolistic dealer. This is followed by the analyses of the model in section 2.3. In section 2.4, we present two extensions of the model which account for

[5] The price quotes examined in their study are not exactly the same as no-haggle prices, as some price quotes are still negotiable.

dealers' competition and the salesperson's effort choice, respectively. The overall conclusion of our study and directions for future research are outlined in section 2.5.

2.2 A Model of Dual Channels

In this section, we discuss the basic setup of the dual-channels model, as shown in **Figure 2.1**(b), lay out our assumptions about the consumer, salesperson and a monopolist dealer and describe the determination of the bargaining price reached between the salesperson and the consumer. We omit the discussion of the lot only and web only channels as they are special cases of the dual-channels model. For clarity, we provide a table of the notation that we use in the model (see **Table 2.1**).

2.2.1 Consumers

Let V be consumers' valuation of a car, which we assume follows a uniform distribution, *U(0,1)*. Consumers can either buy a car on the Internet at a fixed price, p^I, or they can negotiate a price, p^L, with the salesperson on the lot and by doing so incur a *haggling cost*, hc. Due to differences in factors such as personal bargaining experience, income and time constraints, consumers have different levels of haggling costs. We therefore allow consumers to be heterogeneous in hc. For simplicity, we assume that β proportion of consumers have a high cost of haggling, hc_h, while the remaining $1-\beta$ consumers incur a lower cost, hc_l.

We assume that consumers have the following decision making process: first, they obtain the Internet price, p^I, from the dealer's website or by directly contacting the dealer.[6] Based on p^I and other information, the consumer estimates the price she expects to pay if she negotiates with the salesperson. If buying the car through either channel does not generate sufficiently high utility, the consumer may choose an outside option, $U_C \geq 0$. An example of such an outside option can be the consumer's status quo (e.g.,

[6] In practice, vehicles may also have an advertised price on the lot (e.g., manufacturer suggested retail price), which may be argued to be an alternative "no-haggle" price. We do not model the advertised price because it is usually higher than the no-haggle Internet price and hence it has no impact on consumer choice. It is not optimal for the dealer to set an advertised price lower than the Internet price, because this makes consumers who would have bought via the web channel to buy on the lot and the dealer needs to pay additional commission to the salesperson.

driving her current car, taking public transportation). Thus, the consumer faces three alternatives, based on which we define her utility function as:

$$U = \begin{cases} V - p^I & \text{if the car is bought at the no-haggle Internet price} \\ V - p^L - hc & \text{if the car is bought at the negotiated price; } hc \in \{hc_l, hc_h\}. \\ U_C & \text{if the outside option is exercised} \end{cases} \quad (2.1)$$

The consumer's objective is to choose the option that maximizes *U*.

Note that the presence of an outside option, U_C, allows us to focus on a single brand while still ensuring reasonable pricing behavior by the dealer. As our research focuses on the vertical relationship among the dealer, salesperson and consumers, this simplification seems reasonable.

2.2.2 The Salesperson

Consumers who buy from the lot negotiate a price with a salesperson employed by the dealer. The salesperson receives a payment from the dealer according to a compensation plan, which we assume follows a linear form:[7]

$$\pi^S = A + \int_{V \in F_V} B\left[p^L(V) - M \right]. \quad (2.2)$$

The compensation plan specified by equation (2.2) consists of three elements: (i) a fixed salary, *A*, per time period (e.g., a month), (ii) a commission rate, *B* and (iii) a "minimum acceptable price", *M,* the details of which we discuss below. p^L is a function of consumers' valuation, as we will show in equation (2.5). F_V is the set of valuations of the consumers who buy from the lot. The salesperson receives a commission if and only if there is a sale. The commission is a proportion of the difference between the final price and a minimum price specified by the dealer, $p^L - M$. Let U_S be the salesperson's reservation utility that he can obtain from alternative employment. In order for the salesperson to work, it is required that $\pi^S \geq U_S$. In addition, we assume that the salesperson is risk-neutral.[8]

[7] The linearity assumption ensures analytical tractability. Furthermore, research indicates that restricting the analysis to linear contracts is reasonable (Fershtman & Judd, 1987; Holmstrom & Milgrom, 1987).

[8] We assume a risk neutral salesperson as the assumption of risk aversion makes the bargaining solution intractable. The existing bargaining literature does not provide a straightforward solution when the participants are not risk neutral (White, 2008). This assumption of risk neutrality is reasonable as it reflects

It is important to emphasize that the salesperson's commission is based on the "minimum acceptable price", *M*, which may or may not be equal to the true cost of the vehicle, *C*, as specified in most previous sales compensation studies (Churchill et al., 1997; Joseph, 2001). This specification is motivated by the following observation. Consumers typically observe a vehicle's invoice price, which is commonly available on websites such as Autobytel, Edmunds and Kelly Blue Book, and view this as the dealers' true cost. In reality, however, dealers' claimed invoice price is often different from the actual cost that the dealer incurs. This is because of hidden incentives offered to the dealer that are not reflected in the invoice price, such as allowances, dealer cash and dealer holdback and discounts,[9] all of which the dealer may not pass on to consumers (Besanko, Dube, & Gupta, 2005). Instead, the dealer can choose to reveal either all or some of these incentives to consumers and so can effectively set an *M* different from the true cost of the vehicle.[10] Therefore, we allow the dealer to specify an $M \geq C$ instead of making the assumption $M = C$.[11] In addition, for the reasons mentioned above, we assume that consumers have information regarding *M* but do not know *C*.

Next, we specify the determination of bargaining price, p^L. We assume that the negotiated price is given by the Nash axiomatic approach (Nash, 1950; Roth, 1979). In this bargaining mechanism, each party receives its reservation utility and any remaining surplus is split depending on the relative bargaining power of two parties. Thus, the party with either a higher bargaining power or a more appealing outside option, i.e., reservation utility, is able to extract a larger portion of the total surplus. Besides being widely used

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the characteristic of many car salespersons. Currently, in the auto industry, most of the compensation scheme is typically based on commissions, the salary component being very small. In other words, the risk pay accounts for the majority of the salesperson's compensation and thus this industry may attract individuals who are less risk averse than the general population (Compensation and Benefits Review, 2004).

[9] Dealer cash is an incentive offered to the dealer by manufacturers to stimulate sales or reduce inventory pressure. Dealer holdback is a percentage of either the MSRP or invoice price of a new vehicle that is repaid to the dealer by the manufacturer once a vehicle is sold. The holdback is designed to supplement the dealer's cash flow and indirectly reduce sales commissions by artificially elevating the dealership's nominal cost. See www.Edmunds.com for more details.

[10] Based on our personal talks with several dealers, it is common to have this minimum price component in the sales compensation plan. According to one car-buying guide book (Eskeldson, 2000), many salespersons are paid a commission which is based on dealer invoice, not the true cost, on every car they sell.

[11] This assumption excludes the case where a dealer may sell a car below its cost because, for example, the car has remained on the lot for a long time.

(e.g., Desai & Purohit, 2004; Neslin & Greenhalgh, 1983) and being a general and intuitive method by which to capture the bargaining process, the Nash axiomatic approach also allows us to incorporate competition between the two channels in a straightforward manner, something that would be difficult if an alternative approach (such as Rubinstein's sequential bargaining model (1982)) had been adopted.

Let α be the salesperson's bargaining power relative to the consumer, where $\alpha \in (0,1)$. The Nash solution to the bargaining process maximizes the following expression:

$$\underset{p^L}{Max}[V - p^L - hc - D_C]^{1-\alpha} \times [B(p^L - M) - D_S]^{\alpha}. \quad (2.3)$$

$V - p^L - hc$ and $B(p^L - M)$ represent the consumer's and the salesperson's gains, respectively from the transaction.[12] D_C and D_S are the utilities for the consumer and salesperson, respectively, from their best alternative in case of a disagreement. The negotiation will reach an agreement if and only if it makes both parties better off, i.e., $V - p^L - hc \geq D_C$ and $B(p^L - M) \geq D_S$. For the salesperson, we assume $D_S = 0$ as he makes no money if negotiations break down.[13] In such a case, the consumer either buys from the Internet at a no-haggle price, p^I, or she resorts to her outside option, U_C, depending on which alternative generates a higher surplus, i.e.,

$$D_C = Max\{V - p^I, U_C\}. \quad (2.4)$$

Intuitively, if negotiations are unsuccessful, this implies that consumers with a high valuation would prefer to buy from the Internet, while low valuation consumers would choose the outside option, U_C.

We assume that consumer characteristics, $\{V, hc\}$, are known to the salesperson. Then, depending on the consumer's best alternative, the bargaining price takes the following form:

[12] The fixed salary, *A*, does not enter in the equation as it is a fixed payment per time period (e.g., a month) and does not affect individual transactions.

[13] Given this assumption, the commission rate, *B*, does not impact the negotiated price, as suggested by Equation (2.3) and, as a result, *B* does not play a strategic role in the compensation plan in our main model. In our extended model in section 2.4, which accounts for the salesperson's effort choice, *B* has an impact on the effort choice.

$$p^L = \begin{cases} \alpha(p^I - hc) + (1-\alpha)M & \text{if } 1 \geq V \geq p^I + U_C \\ \alpha(V - hc - U_C) + (1-\alpha)M & \text{if } p^I + U_C > V \geq hc + U_C + M \end{cases}. \quad (2.5)$$

2.2.3 The Dealer

The objective of a dual-channel dealer is to maximize the joint profit from the two channels by setting (i) the no-haggle Internet price, p^I, and (ii) the compensation plan, *A*, *B* and *M*, for the salesperson, which in turn determines the negotiated price on the lot. To do so, the dealer must account for the fact that the salesperson must be guaranteed a minimum payoff, U_S, from the job. Formally, the dealer's optimal decisions will be a solution to the following problem:

$$\underset{(p^I, A, B, M)}{Max}\ \pi = (p^I - C)q^I + \int_{V \in F_V} \left[p^L(V) - C - B\left(p^L(V) - M \right) \right] - A \quad \text{subject to } \pi^S \geq U_S. \quad (2.6)$$

where *C* is the dealer's marginal cost and q^I is the unit sales on the Internet.[14]

2.3 Analyses and Results

We begin our analysis by solving for the conditions under which a dual-channel structure exists (i.e., both channels have positive sales). We then derive the optimal contract structure (e.g., the setting of the minimum acceptable price). This is followed by a set of results related to the dealer's pricing strategy, including a comparison of both negotiated and Internet prices, both within and across channel structures. Finally, we present the results for demand, channel profitability, and consumer welfare. The results pertaining to channel profitability and consumer welfare are derived using numerical analysis as the presence of the salesperson increases the complexity of the model preventing us from deriving analytical results.

2.3.1 Existence of the Dual-channel

We confine our analysis of the dual-channel to the case where both the Internet channel and lot channel have positive sales. If two channels are available but one of them has zero sales, we consider it to be a single channel structure. We present the following lemma (See proof in Appendix I):

[14] q^I is a function of p^I and of M.

Lemma 1. *(The existence of a dual-channel) For both the Internet channel and the lot channel to have positive sales, two conditions must be satisfied: (a) Two types of consumers exist, i.e.,* $0 < \beta < 1$ *and (b)* $hc_l \le p^I - M \le hc_h$.

Condition (a) states that, for the dual-channel to exist, there must be two types of consumers, each with different haggling costs; the fixed price Internet channel attracts those consumers with high haggling costs, while the lot-channel serves low haggling-cost consumers.

Condition (b) suggests that, in order for both channels to generate demand, the difference between the Internet price and the minimum acceptable price should be within a certain range. In other words, the minimum acceptable price, *M,* should be lower than the no-haggle Internet price, p^I, as consumers incur a haggling cost during the purchase. More specifically, *M* needs to be low enough to compensate for the haggling cost of low haggling-cost consumers, hc_l, so that they will prefer to haggle and buy on the lot. However, for the Internet channel to generate sales, *M* cannot be too low. Otherwise, even high haggling cost consumers will opt to buy from the lot, leaving no one to buy from the Internet.

Table 2.2 illustrates the market segments conditional on a given Internet price and minimum acceptable price. It illustrates that the dual-channel exists only if $hc_l \le p^I - M \le hc_h$, as otherwise one channel will have no sales and the dual-channel will be replaced by a single channel structure, i.e., either a lot-only or a web-only one.

For clarity, for the sections that follow, we identify the decisions under different channel structures by adding a subscript which denotes the channel structure, such as M_{dual}, $M_{lot-only}$, etc. Without the loss of generality, we assume that consumers' outside option $U_C = 0$ and the low haggling cost $hc_l = 0$. These only scale the solutions and do not change our conclusions. We also assume that $hc_h < 1 - C$, which implies hc_h should be below such a level that, when the vehicle is sold at the lowest possible negotiated price ($p^L = C$), at least some high haggling cost consumers within the range of valuation $V \in [0,1]$ will buy. The complete analytical solutions under the three channel structures can be found in Appendix II.

2.3.2 The Salesperson's Optimal Contract

Equation (2.2) describes the salesperson's problem, which is a function of a commission rate, *B*, a fixed salary component, *A,* and the minimum acceptable price, *M*. As *B* and *A* are well-studied components of the compensation plan, our major emphasis is on understanding how the dealer sets *M*. This is because existing research in marketing has not only analyzed *A* and *B* as strategic variables, but it has also assumed that the salesperson's commission pay is contracted on the dealer's actual marginal cost, *C* (e.g., Churchill et al., 1997; Joseph, 2001). In other words, the literature assumes that *M*=*C*. However, in the context of the automobile market, for the reasons discussed earlier, *M* is not necessarily equal to *C* and can be used by the dealer as an additional instrument over *A* and *B*.

In searching for the optimal contract structure, we focus on the case where the fixed salary component, *A*, is non-negative and the commission rate $B \in (0,1]$.[15] Therefore, we compare the following two contracts: (i) a compensation plan consisting of $\{A, B\}$ and *M*=*C*, which is consistent with the previous literature; (ii) a compensation plan consisting of $\{B, M\}$ and *A=0*. We prove that, at the optimum, the second contract generates higher profit (See proof in Appendix III). Therefore, we confine our discussion to the second one.

The optimal contract for the salesperson is described in the following proposition (See proof in Appendix IV):

Proposition 1(a). *Under both the lot-only channel and the dual-channel, it is optimal for the dealer to specify a minimum acceptable price that is greater than the marginal cost, i.e., M > C.*

The intuition behind this is as follows: the minimum acceptable price, *M*, allows the salesperson to commit to a higher price floor and hence, according to Equation (2.5), achieve a higher negotiated price, p^L. In this way, a higher *M* can complement the salesperson's bargaining skill in reaching a high bargaining price. This can be seen from

[15] An alternative contract is the fixed rent scheme under which the principal (e.g., the dealer) charges the agent (e.g., the salesperson) a fixed amount, i.e., *A* is negative, and gives him all the remaining output (Harris & Raviv, 1979). However, as the fixed rent scheme is not common in the auto industry, we exclude this situation in our analysis.

the expressions, $\frac{\partial\left(M_{lot-only}-C\right)}{\partial\alpha}<0$ and $\frac{\partial\left(M_{dual}-C\right)}{\partial\alpha}<0$. In other word, the lower the salesperson's bargaining power, α, the higher the difference between M and C.

In a dual-channel, the minimum acceptable price has a further strategic role. We first state the following proposition:

Proposition 1(b). *The minimum acceptable price in a dual channel is higher than that in a lot-only channel.*

When the dealer offers two channels, there is internal competition between the two channels. To accommodate the Internet channel, therefore, the dealer needs to prevent the price on the lot from being too low and does so by specifying a higher *M* as it would have been under a single channel structure. In other words, *M* can be used to soften the internal competition between the two channels.

Some comments on the compensation plan. Due to our assumption of a risk neutral salesperson, when *B<1*, the fixed salary component, *A*, is not required and can be set to zero (e.g., Basu, Lal, Srinivasan, & Staelin, 1985; Lazear & Rosen, 1981). The only case where *A* is set to a non-zero amount is when the commission rate, *B,* has already reached 1 (which usually occurs when the salesperson has a relative high alternative utility, U_S). This is because, to get the salesperson to work, the dealer can either lower *M* or offer a positive fixed salary, but the optimal strategy for the dealer is to increase *A* rather than lowering *M* so that the benefits from the higher *M* still accrue.

2.3.3 Prices

In this section, we analyze the prices that result from a dual-channel structure. In other words, we derive the optimal fixed Internet price set by the dealer and compare it to the prices on the lot. We also compare the price levels across three different channel structures, i.e. dual-channel, lot-only and web-only.

We begin by asking whether prices on the web are higher or lower than those on the lot. We answer this with the following proposition:

Proposition 2. *Under the dual-channel dealership, the no-haggle Internet price is higher than the price negotiated on the lot.*

The proof can be directly derived from consumers' utilities (Equation (2.1)). The intuition behind this is as follows: consumers incur a haggling cost when they buy at the negotiated price, therefore, in order for consumers to buy on the lot instead on the Internet, the negotiated price must be lower than the no-haggle Internet price. In other words, since the no-haggle Internet option saves consumers' time and effort, consumers are willing to pay a premium for this. This is consistent with evidence from the industry that is discussed more fully in Chapter 3 ("Competitive Implications of a "No-haggle" Price Policy: The Case of the Access Toyota Program"). In particular, although not completely analogous, when Toyota introduced a no-haggle pricing policy in some provinces in Canada, consumers paid a higher price under this policy than consumers did in areas without this policy (see Chapter 3, CBC Disclosure 2003). This may occur because the fixed-price policy makes the shopping experience more convenient, less unpleasant and speedier, thus allowing the seller to charge a premium.

Next, we compare the dispersion of negotiated prices under the dual-channel and lot-only channel. We measure the dispersion of negotiated prices by the difference between the lowest and highest negotiated prices. The dispersion therefore reflects the extent to which dealers are price discriminating among consumers. We present the following proposition (See proof in Appendix V):

Proposition 3. *The dispersion of prices on the lot under a dual-channel is lower than that in a lot-only channel.*

There are two reasons for this. First, the highest bargaining price in a dual-channel is lower than that in a lot-only channel. This is because, while in the lot-only channel, consumers with different valuations are charged different prices, in the dual-channel, some high valuation consumers can cite the Internet price when negotiating with the salesperson to obtain a lower price on the lot. As a result, they pay less than they would have had the Internet alternative not existed. Empirical evidence consistent with this finding can be found in Zettelmeyer et al. (2001; 2006). They show that new vehicle buyers who use the Internet referral service paid lower prices for their car than those who did not use it. Second, the lowest bargaining price in a dual-channel is higher than that in a lot-only channel, as the dual-channel dealer sets a higher minimum acceptable price (Proposition 1(b)).

Finally, we compare the Internet price in a dual-channel with that in a web-only channel. We present Proposition 4 (See proof in Appendix VI):

Proposition 4. *The Internet price in the dual-channel is higher than the Internet price in a web-only channel.*

The intuition is as follows. As the low haggling-cost consumers do not benefit as much from the Internet channel as the high haggling-cost consumers, the web-only channel cannot set a very high Internet price since it needs to attract both the high haggling-cost consumers and low haggling-cost consumers. In contrast, the dual-channel serves the two segments of consumers via different channels. As only the high haggling-cost consumers will buy on the Internet, the dual-channel dealer is able to charge a higher price than that in the web-only channel.

In addition, the dual-channel dealer has an incentive to set a higher price on the web to increase the negotiated prices in the lot. To see why this is the case, consider Equation (2.5): the negotiated price p^L is nondecreasing with p^I. This is because, as p^I increases, the outside opportunity for certain consumers becomes less attractive, making them more dependent on the negotiated outcome. The salesperson can therefore take advantage of this and increase the negotiated price.

2.3.4 Demand

Next, we compare the optimal demand under three channel structures. We put forward the following proposition:

Proposition 5. *When M>C, the dual-channel does not necessarily generate higher demand than the single channel structure, when each operates optimally.*[16]

We prove this proposition in Appendix VII. We show that, when the high haggling-cost is below a certain level, i.e., $hc_h < \frac{\alpha(1-C)}{\alpha(1-\beta)+2\beta}$, and M is a decision variable so that the dealer will choose $M > C$ at the optimum, the demand in the dual-channel is lower than that in the lot-only channel.

[16] In some of these cases, despite the lower demand, the dual channel will earn a higher profit than the single channel. We shall discuss this in subsection 2.3.5.

For illustrative purpose, we present the following numerical examples. In **Table 2.3**(a) and (b), we compute the demands of three channel structures while we vary β and hc_h, respectively. For other variables in this analysis and the subsequent numerical analysis for profitability and consumer welfare, we set $\alpha = 0.5, C = 0.8, U_S = 0.0001$. To make the numerical results easy to understand, we multiply all monetary amounts by \$20,000.

Dual channel vs. lot-only channel (M>C). In **Table 2.3**(a), when $\beta = 0.55$, the total demand in the lot channel (0.110) is greater than that in the dual channel (0.106). This is also true for $\beta < 0.55$. This seems to indicate that while generating higher demand is one rationale for why a firm may sell its products through multiple channels(Geyskens, Gielens, & Dekimpe, 2002), surprisingly, for a certain mix of two types of consumers ($\beta \le 0.55$), demand in the dual-channel is actually lower than that in the lot-only channel. We explain this by looking at the demand from the low haggling-cost consumers and high haggling-cost consumers. First, the dual-channel dealer always sells to fewer low haggling-cost consumers in the lot. This is because, according to Proposition 1(b), a dual-channel dealer will specify a higher *M* than a lot-only channel dealer does. The dual channel dealer may or may not sell to more high haggling-cost consumers than the lot-only channel dealer, depending on β. When there are more low haggling-cost consumers on the lot, the dual-channels dealer will have an incentive to charge a higher web price, even at the sacrifice of some demand, as it allows the dealer to charge a higher price on the lot (Equation (2.5)).

Haggling cost hc_h is another factor that creates differences in demand between the dual channel and lot-only channel. In **Table 2.3**(b), when $hc_h \le 0.05$, the total demand in the dual channel is lower than that in the lot-only channel. This is because, as the haggling cost, hc_h, goes down, the lot-only channel dealer is more willing to sell to the high haggling-cost consumers since it can lower the negotiated price less to compensate these consumers.

However, if hc_h or β is not too low, i.e., when $hc_h = 0.065$ and $\beta = 0.35$ or 0.55 (as shown in **Table 2.3**(a)) and when $\beta = 0.75$ and $hc_h = 0.035$ or 0.05 (as shown in **Table**

2.3(b)), then despite the lower demand, the profit in the dual channel is higher than that in the lot-only channel. This is because the dual-channel dealer is able to raise the web price and consequently lot prices high enough such that, even with lower demand, profit in this channel structure is higher.

Dual channel vs. lot-only channel (M=C). Allowing $M>C$ is important for deriving Proposition 5. When M is fixed, i.e., $M = C,$ then the total demand in the dual channel is never lower than demand in the lot-only channel (See proof in Appendix VII).

Dual channel vs. web-only channel. We start by noting that the demand in the web-only channel is independent of the value of either β or hc_h. This is because consumers incur no haggling in the purchase and hence the haggling cost does not influence the dealer's decision and consumers' choice. In **Table 2.3**(a) and (b) the demand in the dual-channel is higher than that in the web-only channel in most cases except for a very low haggling cost ($hc_h = 0.02$).

2.3.5 Profitability

In this subsection, we compare the profits from each channel structure to determine the conditions under which a particular channel structure is optimal. Consistent with Proposition 5, we find that haggling costs play an important role in determining the relative profitability of the channels.

The analytical results of channel profitability are derived in Appendix II. Due to the complexity of the results, we are not able to compare profits in closed forms. Therefore, we compare profits using a numerical procedure. In particular, we vary the values of β, hc_h and hc_l, which capture the mix of high- and low-haggling-cost consumers and the differences in their haggling costs. By doing so, we focus our investigation on heterogeneity of consumer market.

Specifically, we vary the proportion of high haggling-cost consumers, $\beta,$ in **Figure 2.2**(a), and heterogeneity in haggling costs, $hc_h - hc_l,$ in **Figure 2.2**(b), respectively. Heterogeneity in haggling costs is manipulated by varying hc_l and hc_h while

maintaining the same average haggling cost (e.g., $\{hc_l, hc_h\} = \{0, 0.07\}$, $\{0.01, 0.06\}$, and $\{0.02, 0.05\}$).

The results from the numerical analysis lead to Proposition 6:

Proposition 6. *The dual channel is the most profitable structure when (a) there are enough high haggling-cost consumers but not too many and (b) when the difference in haggling costs between the two types of consumers is sufficiently high.*

From Proposition 6, we see that, first, in order for the dual channel to be optimal, a certain mix of both types of consumers is required. To understand this, consider the extreme case when all consumers are of the low haggling cost type. In such a case, the lot-only channel is the most profitable structure as the dealer is able to compensate consumers for their low haggling cost, induce them to buy from the lot, and thereby continue to price discriminate. At the other extreme, when all consumers are of the high haggling cost type, the web-only channel is the most profitable as the cost of compensating consumers' haggling cost on the lot outweighs the benefits from being able to price discriminate. In such a situation, if a dual channel were to exist, all consumers would prefer to buy from the web, making the lot channel redundant. As a result, for the dual channel to be optimal there should be some, but not too many high haggling cost consumers, i.e., $0.36 \le \beta \le 0.88$ in our numerical example.

A second condition for the optimality of the dual channel is related to haggling cost heterogeneity. In particular, for a given β, the dual channel is the best strategy for the dealer when there is sufficient heterogeneity in haggling costs. From our numerical analysis, we find that if $hc_h - hc_l \ge 0.05$, a dual-channel strategy is optimal for the dealer. In contrast, when there is insufficient heterogeneity in haggling costs, the dual channel will not be optimal. This is in contrast to the general suggestion in the product differentiation literature that, when consumers are differentiated, a firm will attempt to discriminate among consumers to increase its profit, which implies in our context that the dealer would better serve the two types of consumers with two channels rather than one. However, we find that the optimality of the dual-channel needs sufficient consumer heterogeneity, for the following reasons: First, while the dual-channel structure allows the dealer to discriminate between consumers based on their haggling cost, the Internet

channel eliminates the valuation-based price discrimination among high haggling cost consumers which would have been achieved in the lot-only channel. Second, the presence of the Internet price impacts the price negotiation on the lot by serving as an outside option – it results in a lower price to some high valuation consumers than would have been without the Internet price. These two disadvantages of the Internet channel can be compensated through a sufficient high Internet price, which can be achieved only if some consumers have sufficiently high haggling cost.

In **Table 2.4**, we further illustrate this point by describing eight representative consumers from the population in our numerical example when $\beta = 0.5$. We list the prices that each consumer pays and compute the profits from these eight consumers:

In both the high heterogeneity case (**Table 2.4**(a)) and the low heterogeneity case (**Table 2.4**(b)), we can see that when the dealer adds a no-haggle Internet channel, the low haggling-cost consumers do not directly bring the dealer more profit. In fact, compared to the lot-only channel, the dealer has to lower the price to some low haggling-cost consumers (e.g., consumer C) as they are able to cite the Internet price to negotiate a lower price than would have been possible without this channel. It is the high haggling-cost consumers who actually increase profits for the dual channel dealer. As the Internet channel involves no haggling, it attracts the high haggling cost consumers (e.g., consumer B) who would have not bought in the lot-only channel due to their high haggling cost. Furthermore, as the heterogeneity of haggling cost increases, the dual-channel is more profitable as the dealer can charge a higher Internet price.

2.3.6 Consumer Welfare

We conclude this section with an examination of consumer welfare under the three channel structures, which we also analyze using a numerical approach. **Figure 2.3**(a) and (b) demonstrate how consumer surplus is distributed among different consumers.

We find that no single channel structure generates the highest level of consumer surplus for all consumers. Specifically, for low haggling-cost consumers with relatively low valuations (ranging from \$17,167 to \$18,580 in **Figure 2.3**(a)), the lot-only channel generates the highest consumer welfare. This is because the dual-channel results in higher negotiated prices for these consumers due to a higher minimum acceptable price

(Proposition 1(b)), while the web-only channel does not serve the consumers until their valuation exceeds $18,000. For low haggling-cost consumers with high valuation (higher than $18,580), the dual-channel generates the highest consumer welfare, as the presence of an Internet price allows these consumers to negotiate for a better price. For high haggling cost consumers, the web-only channel generates the highest welfare (**Figure 2.3**(b)). This is because the use of fixed price in the web-only channel allows these consumers to skip the costly negotiation process. Although they can also do this in the dual-channel, they are charged a higher Internet price (Proposition 4).

Figure 2.3(c) summarizes the overall welfare from the three channels. Overall, the web-only channel generates the highest consumer welfare, the lot-only channel, while most commonly used in practice, generates the lowest in most cases and the dual channel stands in between. The web-only channel benefits consumers in two ways. First, the fixed price prevents the dealer from price discriminating among consumers, which benefits, in particular, high valuation consumers. Second, and more importantly, the web-only channel eliminates the haggling costs that consumers incur when negotiating on the lot.

One surprising finding of our study is that the web-only channel provides the highest consumer welfare as compared to other channel structures. This may seem to contrast with the fact that a number of regulatory agencies and consumer groups have argued that a fixed price policy works against consumer interests (e.g., Automobile Consumer Coalition, Competition Bureau Canada).[17] Our results do not mean that all consumers will be better off from a fixed price policy. In particular, low haggling-cost customers are still better off by negotiating the price in a lot-only channel or a dual-channel structure. Nevertheless, our results suggest that a fixed price policy is valuable as a whole as it eliminates consumer haggling costs and limits the ability of dealers to price discriminate among consumers.

[17] For example, after Toyota introduced the no-haggle pricing policy in Canada, the Competition Bureau Canada and Automobile Consumer Coalition were concerned about the impact of possible price increase on consumer welfare (Automobile Consumer Coalition, 2006; Competition Bureau of Canada, 2003).

2.4 Extensions

2.4.1 Introducing Competition

In section 2.3, we discuss the case of a monopolist dealer. In practice, however, there is often more than one dealer in a local area, selling the same brand. Thus, it is of interest to evaluate the impact of competition on the dealer's pricing strategy and the compensation plan. A full investigation of this issue is beyond the scope of this chapter. Nevertheless, in order to gain some understanding of the implications of competition, we analyze the case where there is a single web dealer offering a fixed price and a single lot dealer who hires a salesperson to negotiate with consumers. The decision variables that we analyze are the web price and the compensation plan, with a focus on the level of the minimum acceptable price, *M*. The consumer market remains the same as that in the monopoly case. The analytical results are presented in Appendix VIII. For ease of exposition, we present a numerical example in **Table 2.5** for a given set of parameters: $\beta = 0.5,\ \alpha = 0.5, hc_l = 0, C = 0.8, U_S = 0.0001$. We vary hc_h and thus we focus on the impact of consumer haggling cost on several outcome measures. We also compare these results with the monopoly case.

Table 2.5 provides us with a number of implications. First, under the competition case, there is still *M*>*C* (=$16,000), which is consistent with Proposition 1(a). However, unlike the monopoly case, the minimum acceptable price does not dependent on hc_h. The reason is as follows. The monopoly dealer is concerned about sales in both channels and therefore, when the Internet channel cannot charge a high price, due to lower hc_h, the dealer sets a relatively high *M* to ensure there is demand on the web. This is not the case in the competition case, as the lot dealer is concerned only about the segment of low haggling-cost consumers that it serves.

Second, we compare the prices in the monopoly case and competition case. As expected, all the prices, including p^I, *M,* and average negotiated prices, are higher in the monopoly case than they are in the competition case. However, the difference between the prices is smaller when hc_h is higher. This is because, as the consumer heterogeneity of haggling cost goes up, there is less competition between the two dealers, as they focus on different segments, and therefore the price levels set by the two competitive dealers

are closer to those in the monopoly case. Given the price levels, the competition case generates higher demand than the monopoly case but lower joint profit, especially when hc_h is lower. If we calculate the difference of prices in the two channels (i.e., p^I minus the average negotiated price), then we find that the difference is larger in the monopoly case than that in the competition case. This is because, in the monopoly case, the difference of prices in the two channels only depends on consumer haggling cost, while, in the competition case, the price levels are also driven by the competition force and hence the price levels are closer than they are in the monopoly case.

Table 2.5 also provides the welfare implications of competition. It is not surprising that the total consumer surplus is higher in the competition case than it is in the monopoly case. However, it is somewhat interesting that an increase of haggling cost, hc_h, has different impacts on the lot consumer surplus in the monopoly case and the competition case: it increases the lot consumer surplus in the monopoly case but decreases it in the competition case. This is because, in the competition case, higher hc_h results in higher average negotiated price as the minimum acceptable price remains the same while consumers' outside option (i.e., buying on the web) becomes more costly. In the monopoly case, higher hc_h leads to lower minimum acceptable price and consequently lower average negotiated price.

When hc_h is above a certain level (i.e., $hc_h \geq 0.07$ in the monopoly case and $hc_h \geq 0.05$ in the competition case in **Table 2.5**), the pricing strategy becomes independent of hc_h and therefore the demand, profit and consumer surplus remain the same. This is because the effect of the constraint $hc_l \leq p^I - M < hc_h$ (Lemma 1) is no longer needed for the optimal minimum acceptable price and Internet price.

2.4.2 Considering the Salesperson's Choice of Effort

In this subsection, we extend our model by allowing the salesperson to choose his effort level and hence influence his bargaining power, α. Specifically, we assume that the more effort the salesperson exerts, the more likely he is able to persuade the consumer to accept a higher price. We capture this relationship by assuming a positive correlation between a salesperson's effort level and his bargaining power. Let e denote the

salesperson's effort level, which is unobserved by the dealer. For simplicity, we assume that effort takes on two possible levels, a high level, e_h, and a low level, e_l. Mathematically, we specify the relationship between *e* and α as:

(1) when $e = e_h$, the salesperson has bargaining power α_h with probability γ_h and α_l with probability $(1\text{-}\gamma_h)$;

(2) when $e = e_l$, the salesperson has bargaining power α_h with probability γ_l and α_l with probability $(1\text{-}\gamma_l)$;

where $\alpha_h > \alpha_l$ and $\gamma_h > \gamma_l$. This specification states that the price obtained on the lot is a function of effort, i.e., $p^L = p^L(e)$, and the probability of it being low decreases if the salesperson exerts a higher effort level, but some uncertainty regarding the effectiveness of his effort remains. This could be due to unpredictable market situations that may arise during the negotiation and affect the relative bargaining power of the salesperson.

As considering the salesperson's effort choice significantly increases the complexity of the model, we employ a numerical procedure to re-examine all the propositions that we derive in our main model. The details of these analyses are provided in Appendix IX. Based on an extensive numerical analysis, we find that the results are consistent with all the propositions that we derived for our main model.

2.5 Summary and Conclusions

The conventional wisdom in setting prices is that a firm is better off if it is able to price discriminate among consumers, using mechanisms such as negotiation. As a result, the recent emergence of a no-haggle, fixed price in markets that have traditionally relied on negotiation cannot satisfactorily be explained. Our research attempts to explain this phenomenon.

In particular, we explore the strategic implications of offering consumers the choice between negotiating a price and accepting a fixed, no-haggle price through such channels as the Internet. Using the automobile market as our context, we compare the profitability of three channel structures (lot-only, web-only and dual-channel) and derive the conditions under which a dual-channel is the most profitable structure. Our findings suggest that consumer haggling cost plays a critical role in determining when a particular

channel structure is optimal. In particular, we find that a dual channel is not always optimal: when either high or low haggling cost consumers account for a large proportion of the population, or when they do not have very different haggling costs, a single channel is optimal. Our conclusions provide guidance to auto dealers: no one strategy is always the best as the optimal strategy depends upon the magnitude and dispersion of haggling costs, which in turn may be related to such factors as customer bargaining experience, income and time constraints.

We also explore the role of the salesperson and derive the optimal sales compensation plan. We find that the dealer may not find it optimal to specify a contract based on the true marginal cost of the product. Instead, the dealer may be better off by specifying a higher than cost minimum acceptable price as the price floor of negotiation. The minimum acceptable price is found to have important implications for both the negotiated and no-haggle price as it affects the outcome of the negotiation. We therefore contribute to the salesforce literature by introducing a new strategic variable. Our analysis focuses on a linear contract and a risk neutral salesperson. Future research may consider a more general contract form and relax the assumption of risk neutrality.

Finally, we also consider a simple case of competition where a lot-only dealer competes with a web-only dealer. As expected, all the prices are higher in the monopoly case than that in the competition case. However, the difference between the prices is smaller when some consumers have very high haggling cost. This is because, as the consumer heterogeneity of haggling cost increases, there is less competition between the two dealers, as they focus on different segments. Our analysis is limited in the sense that we do not consider the impact of competition in a dual-channel setting, nor do we model the dealer's decision on the choice of channel structure. These interesting questions are beyond the scope of the present analysis. We leave them for future research.

Figure 2.1: Three Channel Structures

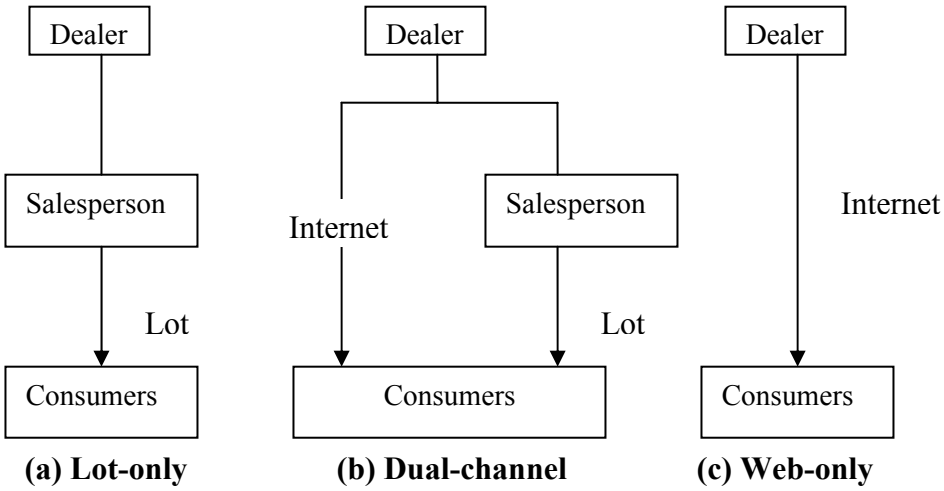
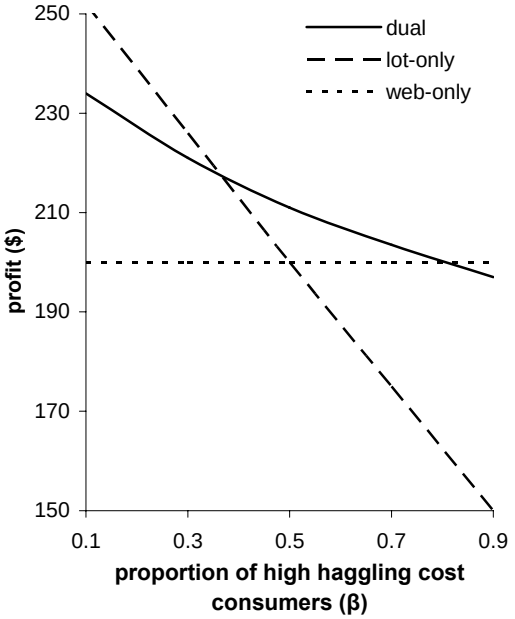
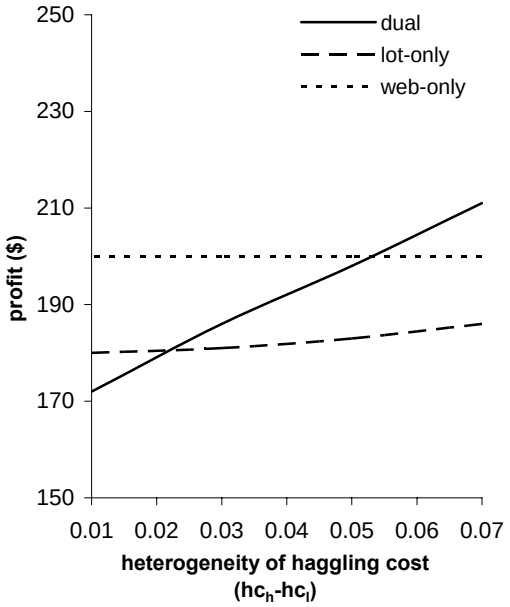


Figure 2.2: **Profit Comparison across Three Channels**

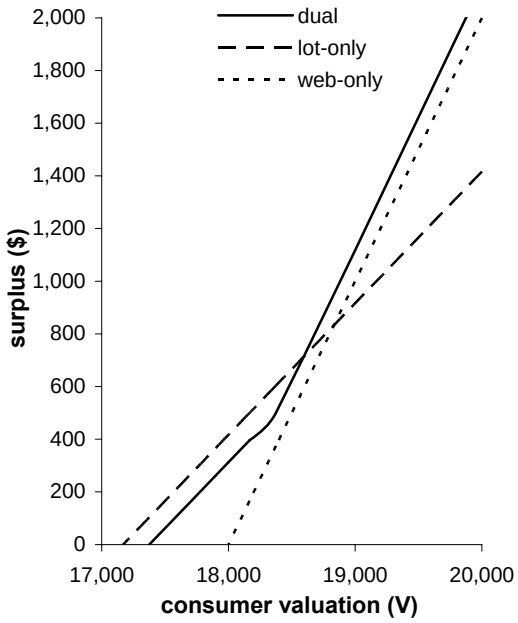


(a) β varies, $hc_h = 0.055, hc_l = 0$

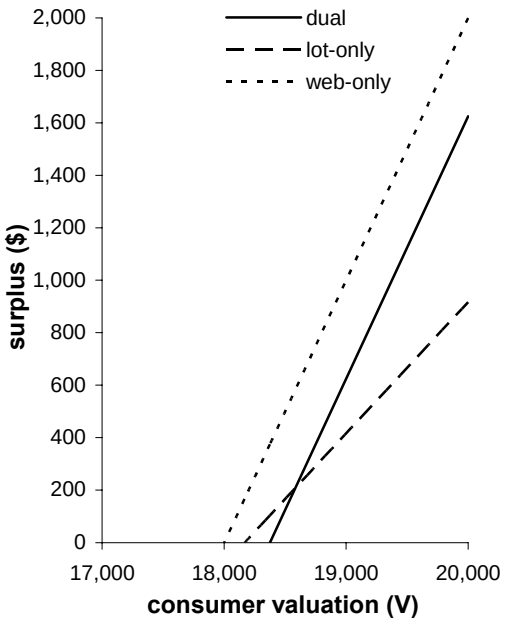


(b) $\beta = 0.5$, both hc_h and hc_l vary while $\left(hc_h + hc_l\right)/2 = 0.035$

Figure 2.3: Consumer Welfare

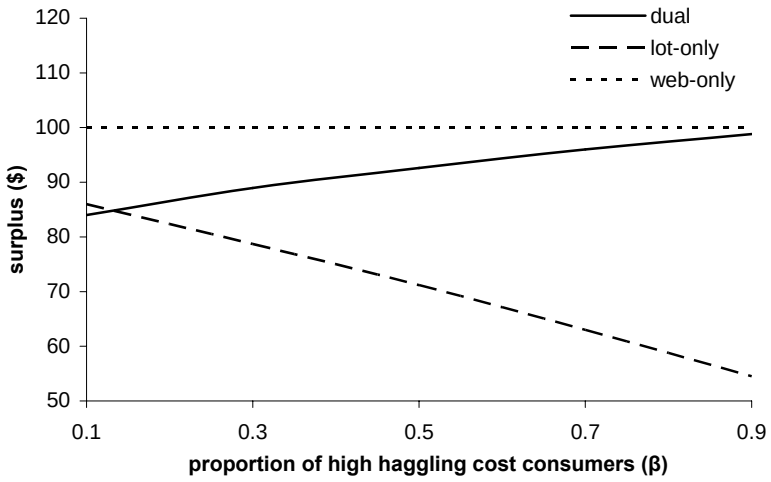


(a) Low Haggling Cost Consumers



(b) High Haggling Cost Consumers

$(\beta = 0.5, hc_h = 0.05, hc_l = 0)$



(c) Total Consumer Welfare

$(hc_h = 0.05, hc_l = 0)$

Table 2.1: Model Notation

Notation	Explanation
p^I	No-haggle Internet price
p^L	Negotiated lot price
M	Minimum acceptable price
B	Salesperson's commission rate, $0 \le B \le 1$
A	Salesperson's fixed salary
C	The dealer's true cost of the vehicle
q^I	Unit sales on the Internet
U_S	Salesperson's outside option, $U_S \ge 0$
α	Salesperson's bargaining power, $\alpha \in (0,1)$
V	Consumer's valuation of the car, $V \sim U(0,1)$
hc	Consumer's haggling cost, $hc \in \{hc_l, hc_h\}$, where $hc_l < hc_h < 1 - C$
β	The proportion of high-haggling-cost consumers, where $0 \le \beta \le 1$
U_C	Consumer's outside option, $U_C \ge 0$

Table 2.2: Market Segmentation for the Three Channel Structures

Dual-channel ($hc_l + M \le p^I \le hc_h + M$)		
Consumer Characteristics $\{V, hc\}$		Choice
$hc = hc_h$	$V \in [p^I + U_C, 1]$	Buy on the Internet
	$V \in [0, p^I + U_C)$	Outside option
$hc = hc_l$	$V \in [hc_l + M + U_C, 1]$	Buy on the lot
	$V \in [0, hc_l + M + U_C)$	Outside option
If $p^I > hc_h + M$, the channel structure becomes a lot-only channel		
Consumer Characteristics $\{V, hc\}$		Choice
$hc = hc_h$	$V \in [hc_h + M + U_C, 1]$	Buy on the lot
	$V \in [0, hc_h + M + U_C)$	Outside option
$hc = hc_l$	$V \in [hc_l + M + U_C, 1]$	Buy on the lot
	$V \in [0, hc_l + M + U_C)$	Outside option
If $p^I < hc_l + M$, the channel structure becomes a web-only channel		
Consumer Characteristics $\{V, hc\}$		Choice
$hc \in \{hc_l, hc_h\}$	$V \in [p^I + U_C, 1]$	Buy on the Internet
	$V \in [0, p^I + U_C)$	Outside option

Table 2.3: Demand Comparison

β		**0.15**	**0.35**	**0.55**	**0.75**
Dual	Q_{dual}	0.114	0.111	0.106	0.102
	Q_{dual} from hc_l consumers	0.105	0.087	0.060	0.033
	Q_{dual} from hc_h consumers	0.009	0.024	0.046	0.069
	M	\$17,529	\$17,333	\$17,333	\$17,333
	p^I	\$18,829	\$18,634	\$18,340	\$18,154
	π_{dual}	\$234	\$219	\$209	\$203
Lot-only	$Q_{lot-only}$	0.127	0.118	0.110	0.100
	$Q_{lot-only}$ from hc_l consumers	0.116	0.092	0.065	0.037
	$Q_{lot-only}$ from hc_h consumers	0.011	0.026	0.045	0.063
	M	\$17,268	\$17,182	\$17,095	\$17,008
	$\pi_{lot-only}$	\$242	\$212	\$183	\$154
Web-only	$Q_{web-only}$	0.100	0.100	0.100	0.100
	p^I	\$18,000	\$18,000	\$18,000	\$18,000
	$\pi_{web-only}$	\$200	\$200	\$200	\$200

(a) β varies, $hc_h = 0.065$

hc_h		**0.02**	**0.035**	**0.05**	**0.065**
Dual	Q_{dual}	0.075	0.102	0.103	0.103
	Q_{dual} from hc_l consumers	0.031	0.032	0.033	0.033
	Q_{dual} from hc_h consumers	0.044	0.070	0.070	0.070
	M	\$17,675	\$17,431	\$17,333	\$17,334
	p^I	\$18,075	\$18,131	\$18,154	\$18,154
	π_{dual}	\$202	\$203	\$203	\$203
Lot-only	$Q_{lot-only}$	0.124	0.116	0.108	0.101
	$Q_{lot-only}$ from hc_l consumers	0.035	0.036	0.036	0.037
	$Q_{lot-only}$ from hc_h consumers	0.089	0.080	0.072	0.064
	M	\$17,233	\$17,158	\$17,083	\$17,008
	$\pi_{lot-only}$	\$227	\$200	\$176	\$154
Web-only	$Q_{web-only}$	0.100	0.100	0.100	0.100
	p^I	\$18,000	\$18,000	\$18,000	\$18,000
	$\pi_{web-only}$	\$200	\$200	\$200	\$200

(b) hc_h varies, $\beta = 0.75$

Table 2.4: Profit Comparison under Different Heterogeneities of Haggling Cost

(a) With high heterogeneity in haggling cost ($hc_h - hc_l = 0.055$)			
	Consumer Valuation	Price	
		Lot-only $\left(M^* = \$17{,}150\right)$	Dual channels $\left(M^* = \$17{,}333,\ p^I = \$18{,}400\right)$
High-haggling-cost consumers	A. V=$19,500	$17,775	$18,400 (web)
	B. V=$18,200	Not buy	$18,400 (web)
Low-haggling-cost consumers	C. V=$19,500	$18,325	$17,867 (lot)
	D. V=$18,200	$17,675	$17,767 (lot)
Total profit		$5,775	$8,433
(b) With low heterogeneity in haggling cost ($hc_h - hc_l = 0.005$)			
	Consumer Valuation	Price	
		Lot-only $\left(M^* = \$17{,}317\right)$	Dual channels $\left(M^* = \$17{,}938,\ p^I = \$18{,}038\right)$
High-haggling-cost consumers	E. V=$19,500	$18,359	$18,038 (web)
	F. V=$18,200	$17,709	$18,038 (web)
Low-haggling-cost consumers	G. V=$19,500	$18,409	$17,988 (lot)
	H. V=$18,200	$17,759	$17,988 (lot)
Total profit		$8,234	$8,052

Table 2.5: Optimal Strategies and Profits: Monopoly vs. Competition

	hc_h	**0.01**	**0.03**	**0.05**	**0.07**	**0.09**
Monopoly dual-channels dealer	A	\$0	\$0	\$0	\$0	\$0
	B	0.40	0.13	0.08	0.07	0.07
	M	\$17,875	\$17,625	\$17,375	\$17,333	\$17,333
	p^I	\$18,075	\$18,225	\$18,375	\$18,400	\$18,400
	average negotiated price	\$17,970	\$17,887	\$17,780	\$17,760	\$17,760
	web demand	0.05	0.04	0.04	0.04	0.04
	lot demand	0.05	0.06	0.07	0.07	0.07
	total demand	0.10	0.10	0.11	0.11	0.11
	web profit	\$100	\$99	\$96	\$96	\$96
	lot profit	\$103	\$110	\$115	\$115	\$115
	total profit	\$203	\$209	\$211	\$211	\$211
	web consumer surplus	\$46	\$39	\$33	\$32	\$32
	lot consumer surplus	\$51	\$55	\$60	\$60	\$60
	total consumer surplus	\$97	\$94	\$93	\$92	\$92
Two competitive dealers	A	\$0	\$0	\$0	\$0	\$0
	B	0.31	0.11	0.10	0.10	0.10
	M	\$17,333	\$17,333	\$17,333	\$17,333	\$17,333
	p^I	\$17,533	\$17,933	\$18,000	\$18,000	\$18,000
	average negotiated price	\$17,429	\$17,600	\$17,625	\$17,625	\$17,625
	web demand	0.06	0.05	0.05	0.05	0.05
	lot demand	0.07	0.07	0.07	0.07	0.07
	total demand	0.13	0.12	0.12	0.12	0.12
	web profit	\$95	\$100	\$100	\$100	\$100
	lot profit	\$93	\$105	\$106	\$106	\$106
	total profit	\$188	\$205	\$206	\$206	\$206
	web consumer surplus	\$76	\$53	\$50	\$50	\$50
	lot consumer surplus	\$82	\$71	\$69	\$69	\$69
	total consumer surplus	\$158	\$124	\$119	\$119	\$119

CHAPTER 3 COMPETITIVE IMPLICATIONS OF A "NO-HAGGLE" PRICE POLICY: THE CASE OF THE ACCESS TOYOTA PROGRAM

3.1 Introduction

In the U.S. and Canada, automobile prices are largely determined through a process of negotiation between the dealer and the consumer. However, some sellers have recently attempted to replace the practice of negotiation with a fixed price policy. For example, some manufacturers, like Saturn, encourage their dealers to sell their vehicles at a "no-haggle" price so that all consumers coming into the dealership pay the same price (Business Week, 2007). A similar policy has also been initiated by a large number of individual dealerships, who provide consumers with the option of buying a vehicle over the Internet at a fixed price and thus avoid the bargaining process.

While the practice of offering a fixed price Internet option alongside the existing bargaining option has become widespread among dealers, our research focuses on the simpler case where a manufacturer exclusively implements a no-haggle pricing policy among its downstream dealerships, while competitors' prices continue to be determined through bargaining. More specifically, our purpose is to understand the competitive consequences of an exclusive no-haggle pricing policy by looking at its impact on a firm's and its competitors' sales and prices.

Our investigation is based on the case of Toyota's fixed price policy, or the "Access Toyota program", in Canada. To date, the policy has been implemented in all the major provinces of Canada except for Ontario. This creates a natural experiment that allows us to explore the effects of a fixed price policy. In analyzing the competitive consequences of the program, we confine our analysis to two manufacturers, Toyota and its closest competitor, Honda. Although Honda shares many similarities to Toyota, it uses a different pricing strategy: it continues to sell cars at negotiable prices even after Toyota introduced a fixed price policy.

In order to answer the question of how the fixed price policy affects the prices and sales performance of both Toyota and Honda, we collect retail price and sales information for both brands across the major provinces of Canada. The empirical results indicate that the prices of both Toyota and Honda vehicles are higher in the areas where the program has been implemented than those in the areas where the program is absent. We also compare the sales performance for both brands before and after the program was introduced and find that, while the program did not affect Toyota's sales, it led to an increase in Honda's sales.

To the best of our knowledge, this is the first empirical study on the competitive consequences of switching to a fixed price policy when other firms allow for negotiation. Previous studies, which are theoretical in nature, have explored a seller's choice between a posted price and a bargaining price in a competitive market. For example, Bester (1993) and Wernerfelt (1994) derive equilibrium conditions under which either bargaining or a posted price is optimal, while Bester (1994) and Desai and Purohit (2004) show that under certain conditions both mechanisms are employed simultaneously in equilibrium. In addition, Desai and Purohit (2004) find two prisoners' dilemma situations in a duopoly market – under some conditions, although both firms would be better off with a haggling policy, each firm's incentives to deviate to a fixed price policy forces both to offer fixed prices; under other conditions, the reverse holds. However, our research does not aim to explain what drives the choice of a particular pricing policy; instead, we focus on comparing firms' performance under each price regime.

Since implementing a fixed price policy implies that manufacturers restrict the prices that their dealers can charge, our research is somewhat related to a large literature on resale price maintenance. This literature is motivated by the policy debate on whether or not resale price maintenance is anticompetitive and hence should be prohibited (See Mathewson & Winter, 1998, for a survey). It is found that maintaining resale prices can either be anticompetitive if it facilitates price collusion (e.g., Jullien & Rey, 2007), or it can be beneficial if it increases retailers' incentive to provide service (Klein & Murphy, 1988; Marvel & McCafferty, 1984) or supports greater inventory among retailers in the presence of demand uncertainty (e.g., Deneckere, Marvel, & Peck, 1997). However, this literature usually assumes that both the focal firm and the competition offer fixed prices.

We therefore contribute to this literature by examining the case where competitors' prices are negotiated.

The remainder of the chapter is organized as follows. In the next section, we provide a description of the Access Toyota program. In section 3.3, we describe our data. We present our analyses of prices and sales in section 3.4 and draw our conclusions in section 3.5.

3.2 Background: Access Toyota Program

According to the Toyota Company, the "Access Toyota" program is an attempt to counter long-standing consumer dislike of negotiation in the car buying process. The decision to introduce the program was based on more than four years (in the late 1990s) of focus groups that found only a minority of car buyers actually like negotiating the price of their cars – an estimated 14% to 20% – while most people strongly dislike it (Marketing Magazine, 2000). Another objective of the program was to increase customer confidence and trust in Toyota dealerships since, although consumers consider Toyota's vehicles among the top in quality, they tend to rate their experience at Toyota's showrooms as negative, at least in North America (The Gazette, 2002).

Under the Access program, Toyota encourages its dealers to sell each of their vehicles at a fixed price or "access price" which is disclosed through the company's website. The program was launched in 2000 in Manitoba, and was then expanded into Saskatchewan, Alberta, British Columbia and Quebec (Musgrove, 2008). By the end of 2002, it was implemented in all provinces in Canada except for Ontario, where it is banned by provincial regulation. **Table 3.1** lists the time of program adoption by Toyota dealerships across the six major provinces in Canada.

The Toyota access prices are set monthly by dealers' poll. Every month, Toyota dealerships in a defined local geographic market (typically this is done province wide) submit a suggested selling price for every model they offer based on the local market conditions. All prices are averaged into one price for each model and this average price becomes the access price (Musgrove, 2008).

Figure 3.1 summarizes the nature of competition in both types of markets. **Figure 3.1**(a) shows the case where all vehicle prices are negotiated, i.e., in Ontario, whereas

Figure 3.1(b) represents the provinces where the Access program was implemented among Toyota dealerships.

3.3 Data

In order to understand the impact of the program, we confine our analysis to Toyota and its closest competitor, Honda. The two brands are widely recognized as close competitors in terms of their market positions and comparability of their products. For example, the following models of Toyota and of Honda are included in the top recommendations of *Consumer Reports* (2007): Toyota Camry and Honda Accord in the family sedan category, Toyota Corolla and Honda Civic in the small car category, Honda CR-V and Toyota RAV4 in the small SUV category, and Honda Odyssey and Toyota Sienna in the minivan category. Furthermore, in Canada, Toyota and Honda have a combined share of over 60% among Japanese automakers, and approximately 18% among all car manufacturers (2006).[18] Because of the large combined share commanded by the two, we are able to capture the major competitive consequences of the program by limiting our focus to these two brands while ignoring the remaining brands in the market.

For our analysis, we require sales and price data for both firms. The sources we use to obtain both types of data are different. We therefore discuss each type of data separately, beginning with a description of the sales data in section 3.3.1., after which we discuss the price data in section 3.3.2.

3.3.1 Sales data

We obtain sales data for both manufacturers from new vehicle registration data collected by R.L. Polk Canada, Inc. The data reports the annual sales of a panel of 131 census metropolitan areas in six major provinces of Canada over a period of 12 years, from 1995 to 2006. The data set contains the registration counts, the make and model of the car, the census metropolitan area, and the year at the time of sale. Among the 131 census areas, 42 belong to the province of Ontario where the program was never introduced but the rest of the areas adopted the program during 2000~2002.

[18] The data for brand sales is obtained from the Japan Automobile Manufacturers Association of Canada. The data for the industry sales is obtained from Statistics Canada.

For our analysis, we begin by only considering models that had over 50,000 units of sales during the period 1995-2006. This yields a total of 12 models, of which 8 models are of Toyota and 4 of Honda. These models are listed in **Table 3.2**. Not all of them are available over the entire time period: some vehicle models were introduced to the market after 1995 while others were dropped before the end of the period. Honda's unit sales during the period (=1,316,939) are lower than that of Toyota's (= 1,524,583), which also has a broader product line. We therefore chose the four largest selling Honda models (which account for 95% of Honda's sales from 1995-2006) and then match them with the models from Toyota which, according to *Consumer Reports*, are their closest competitors. This ensures that we have a sufficient number of observations for each vehicle model. Thus, our analysis studies four pairs of matched models: Toyota Corolla versus Honda Civic (small car category), Toyota Camry versus Honda Accord (family sedan category), Toyota RAV4 versus Honda CR-V (small SUV category), and Toyota Sienna versus Honda Odyssey (minivan category).

3.3.2 Price data

To understand the impact of the program on prices, we use transaction data collected by the Power Information Network (PIN), a division of J.D. Power and Associates. PIN collects daily point-of-sales transaction data from voluntarily participating dealers in the major metropolitan areas in Canada, which are then aggregated to the city-level on a monthly basis. PIN transactions represent approximately 40% of all new vehicle retail transactions in Canada. Our dataset contains observations during the period August 2004 to September 2007 from five major cities in Canada: Vancouver (in British Columbia), Toronto (in Ontario), Calgary and Edmonton (in Alberta) and Montreal (in Quebec), All of these cities, except for Toronto, have implemented the Access program. Unfortunately, this period does not include the time before the program was introduced as PIN only began enrolling dealerships in Canada from 2003. As a result, our analysis can only analyze the impact of prices across *provinces* but not across *time*.

For each observation, we have the average transaction price by city, month and year as well as the make, model and trim level of the vehicle. The average price is computed

based on the price the customer pays for the vehicle plus factory and dealer-installed accessories and options contracted for at the time of sale, less a customer cash rebate, if any. The reported price has also been adjusted by the "trade-in over allowance", which is the difference between the trade-in price the dealer pays to the consumer and the market value of the trade-in vehicle. Since according to Zhu, Chen, and Dasgupta (2008), customers who traded in a used car on average paid more for a new car than buyers who did not have a car to trade in, it is important to adjust the price for the over allowance so that we obtain the true price of the new vehicle: failing to adjust for it implies that the price of the vehicle may be overstated. A description of the price data by model and by program adoption is given in **Table 3.3**.

Compared to the sales data, which we obtained at the model level, prices are at the trim level (e.g., Camry LE, Camry SE). We therefore maintain consistency between the sales and price analysis by performing the price analysis at the model level (e.g., Camry). In order to do so, we consider prices at the model level by computing the share-weighted average of all prices at the trim level. For example, the price of the Toyota Camry in a particular city is given by the average price of all trim levels in that city, weighted by the sales of the individual trims.[19]

3.4 Analyses and Results

As our data sets to investigate the effect of the Toyota Access program on prices and on sales differ, we need to employ different statistical models to analyze each set of data. Since the main purpose of the program was to give customers access to fair prices, we start with an analysis of prices. We follow the price analysis with our sales model.

[19] A potential problem of using the share-weighted average price for each city is that the model price is confounded by the shares of individual trims in each city. For example, Toyota Camry can have a high price either because all its trims have high prices or because a highly priced trim has a large share. We therefore compare the market shares of individual trims for each of the eight models across the different cities and found that these shares are similar across all of them. Thus, the difference in computed prices across cities is not driven by differences in individual trim level shares, but is representative of the actual prices in each city.

3.4.1 Impact of the Program on Prices

Estimation

In order to understand the impact of the program on prices, we estimate a cross-sectional, time-series regression model, correcting for heteroskadasticity and serial correlation of disturbances. We use the log form of price as our dependent variable so that any changes in prices are better understood as a percentage of the vehicle's original price, an approach which has been used in a number of studies of the automobile market (e.g., Sloot, Fok, & Verhoef, 2006; Zettelmeyer et al., 2006). Specifically, the model has the following structure:

$$\ln P_{ijt} = \alpha_0 + \alpha_1^T M_i^T A_j + \alpha_1^H M_i^H A_j + \sum_{i=1}^{I-1} \delta_i^{\text{mod}} Z_i + \sum_{m=1}^{M-1} \delta_m^{\text{modyr}} M\_Year_m + \sum_{n=1}^{N-1} \delta_n^{\text{yr}} Year_n + \sum_{t=1}^{T-1} \delta_t^{\text{mnth}} Month_t + \sum_{r=1}^{R} \beta_r V_r + \phi_j + u_{ijt}, \quad (3.1)$$

where:

$P_{ijt} =$ price of vehicle model i in city j in month t,

M_i^T (or M_i^H) = dummy for manufacturer: = 1 if i = Toyota (or Honda), = 0 otherwise,

A_j = indicator of program adoption: = 1 if program is implemented in city j, = 0 otherwise,

Z_i = dummy for vehicle models, $i = 1$ to I -1, $I = 8$,

M_Year_m = dummy for model year, $m = 1$ to M -1, $M = 4$ (2004 - 2007),

$Year_n$ = dummy for year, $n = 1$ to N -1, $N = 4$,

$Month_t$ = dummy for month, $t = 1$ to T -1, $T = 12$,

V_r = dummy for major model re-design events, $r = 1$ to R, R=5,

ϕ_j = time-invariant city characteristics,

u_{ijt} = stochastic error term, assumed to be heteroskedastic and following a first order autoregressive (AR(1)) process, i.e., $u_{ijt} = \rho u_{ijt-1} + \nu_{ijt}$, where $|\rho| < 1$, and ν_{ijt} is i.i.d.

A_j accounts for the impact of the Access Toyota program. Since it is likely that the program affected the two manufacturers differently, we identify the differential effects of the program by including interactions between the program effect, A_j, and the manufacturer dummy, M_i^H (or M_i^T). We also control for car fixed effects by adding dummy variables for the vehicle model and model year and control for time variation in

prices with month and year specific dummies. It is important to control for such time variation as vehicles are often heavily promoted either when new models are introduced or at the end of the year. This approach is consistent with many previous studies on natural experiment (See Meyer, 1995 for a survey).

We also include dummies for model redesign events in order to control for price changes due to vehicle quality improvements. A redesign is referred to as a new generation for that model and typically involves significant changes to the body, chassis, drive train, and interior. Most models change very little from year to year. Using *Consumer Reports* as our source, for all the eight models, we identify five major changes from August 2004 to September 2007 (see **Table 3.4** for details).[20]

Since we have data over time, we must account for the possibility that the errors are correlated over time. Furthermore, because of the cross-sectional nature of the data, it is quite possible that the disturbance terms in Equation (3.1) are heteroskedastic. Our estimation, therefore corrects for both serial correlation and heteroskedasticity of the disturbance terms: not accounting for them implies that the least squares estimator will be unbiased but no longer best linear unbiased estimator (B.L.U.E.) (Wooldridge, 2002). For example, in the case of negative serial correlation, the estimates of the standard errors will be higher than they should be. This can result in incorrect tests of hypotheses. We use a feasible GLS approach with the Prais-Winsten regression estimator and compute panel-corrected standard errors. This is known in the literature as the *full* FGLS approach. Although the feasible GLS estimator is not BLUE, it is asymptotically more efficient than the OLS estimator when the AR(1) model for serial correlation holds. The Prais-Winsten method is used as it preserves the first observation in the estimation so that it is particularly suitable when the time series are relatively short (Wooldridge, 2002, p. 404).

Since the data does not have observations before the program introduction date (2000~2002), our analyses have certain limitations. Specifically, we are unable to control directly for the existing price differences between two groups of cities that may be due to factors other than the program, e.g., income levels, weather conditions, etc. Using city

[20] The redesign for the 2004 Sienna is not included as our analysis of pricing does not contain observations for the Sienna prior to 2004.

level fixed effects are not feasible as they cannot be identified separately from the program effect.[21]

To address this issue, we collect average market prices of *all* nameplates in each of the five cities. The source of this data is also PIN. Presumably, since Toyota and Honda account for only 18% of the new car market, the impact of the program on average prices in general should be relatively small or negligible. Therefore, comparing the average prices of all nameplates across the same set of cities would allow us to measure any price differences that may be due to factors other than the program. The inherent assumption here is that city specific characteristics that could create such differences remain constant over time. In order to test whether differences exist across cities, we estimate the following specification:

$$\ln AP_{jt} = \gamma_0 + \gamma_1 A_j + \sum_{m=1}^{M-1} \lambda_m^{\text{modyr}} M\_Year_m + \sum_{n=1}^{N-1} \lambda_n^{\text{yr}} Year_n + \sum_{t=1}^{T-1} \lambda_t^{\text{mnth}} Month_t + w_{jt}, \quad (3.2)$$

where:

AP_{jt} = average price of all nameplates in city j in month t,

A_j = indicator of program area: = 1 if city j is in the program area, = 0 otherwise,

M_Year_m = dummy for model year, $m = 1$ to M -1, $M = 6$ (2003 - 2008),

$Year_n$ = dummy for year, $n = 1$ to N -1, $N = 4$,

$Month_t$ = dummy for month, $t = 1$ to T -1, $T = 12$,

w_{jt} = stochastic error term, assumed to be heteroskedastic and following a first order autoregressive (AR(1)) process, i.e., $w_{jt} = \rho_a w_{jt-1} + \xi_{jt}$, where $|\rho_a| < 1$, and ξ_{jt} is i.i.d.

If γ_1 is positive and significant, this indicates that there are inherent differences between the program and non-program areas which result in higher prices in the former.

Discussion of Results

The parameter estimates of our main pricing model, given by Equation (3.1), are listed in **Table 3.5**. α_1^T and α_1^H are the parameters that capture the effect of the program

[21] Econometrically, this implies that there are unobserved city characteristics, ϕ_j, which are correlated with the program adoption areas. Not accounting for them in equation (3.1) implies that using a standard OLS procedure will result in biased estimates of the program coefficients.

on prices for Toyota and Honda respectively: both parameters are positive and significant indicating that the program resulted in higher prices for both manufacturers' vehicles. Specifically, $\alpha_1^T = 0.02$, which implies that the prices of Toyota's vehicles were, on average, 2% higher in areas with the program than those without the program. This suggests, for example, a Toyota vehicle which is sold at $20,000 in areas without the program will be $400 more expensive in areas with the program. While the absolute difference may seem small, it can amount to substantial portion of a dealer's margin (e.g., Zettelmeyer et al., 2006). According to J.D. Power and Associates, the average dealer gross profit margin per vehicle is about 4% of a vehicle price (2006). This means that the program led to an approximate 50% increase in the dealer's gross margin. The program effect parameter is also significant for Honda: prices are 6% higher in the areas that are part of the program.

In order to conclude that the price differential between program and non-program areas is indeed driven by the program, we need to rule out the possibility that the differential may potentially be driven by any differences in existing area characteristics. As discussed above, we use Equation (3.2), which models average prices for the entire new car market as a function of whether or not it is a program area (and other variables) to control for any possible effects of program area on car prices more generally. The result is listed in **Table 3.6**. We find that the coefficient, γ_1, of the program area dummy, A_j, is not significantly different from zero. This suggests that there is no statistically significant difference in the average prices of all nameplates between the areas with the program and the areas without the program.[22] This supports the conclusion that the observed price differential between Toyota and Honda in the two groups of cities is more likely to be due to the Access Toyota program and not any differences in area

[22] It should be noted that here we focus on statistical significance, which is not the same as economic significance (McCloskey & Ziliak, 1996). As the size of the coefficient of the program area is not small (which is -0.04), the price difference might not be negligible in economic sense. If the negative sign of coefficient -0.04 is economic significant, then it further supports the conclusion that the higher prices of the two brands in program areas are not because that new cars are generally more expensive in program areas.

characteristics.[23] In other words, ϕ_j is not correlated with A_j and the standard OLS procedure results in unbiased estimates of α_1^T and α_1^H.

Our findings regarding the program effect on Toyota price are consistent with evidence obtained from two other smaller scale studies. First, in a CBC news investigation in 2003, a comparison of the prices of the Toyota Camry XLE across dealerships in Montreal and Toronto revealed that the average price in Montreal, where the program was in place, was, on average, $500 higher than the average price across Toronto dealerships. This is despite the fact that the Retail Price Index in Toronto is higher which suggests that buying a car in Toronto should usually be more expensive than the same car in Montreal (CBC Disclosure, 2003). In 2005, the Automobile Consumer Coalition of Canada sent a researcher, who acted as a typical consumer, to 53 Toyota and Honda dealerships in Quebec, Ontario, Alberta, and British Columbia to negotiate the prices for two vehicle models, Toyota Camry LE and Honda Accord DX-G. He found that Toyota dealerships asked for higher prices in cities where the program had been introduced than where it had not been introduced (Automobile Consumer Coalition, 2006).

The possible reason for an increase in Toyota's vehicle prices is as follows. The no-haggle pricing policy may have improved consumers' shopping experience. For many consumers, negotiation is costly as it takes time and effort and often consumers are afraid of being taken advantage of by salespeople (The Economist, 2006). The Access program effectively eliminates the consumers' cost of negotiation and so dealers are able to charge a premium, resulting in a higher average price.

A particularly interesting finding is that Honda's prices also increased as a result of the program. Till date, there has been very little research on the impact of the Access program on Toyota's competitors. The only exception is the Automobile Consumer Coalition's study (Automobile Consumer Coalition, 2006),which compared the prices of the Honda Accord DX-G across program and non-program areas and found no price differences. Their results is somewhat surprising, as one would not expect a firm's prices

[23] Another possible factor that may drive the price is that, as some vehicles are built in Toronto, less transportation cost may be charged to the local customers. However, our investigation finds that the same transportation cost is charged throughout Canada, so that it is not a factor that drives the price.

to be unaffected by the price of its closest competitor. However, since our research examines Honda's price response over more years and more models and in a more systematic manner, we believe that our findings are more robust. The higher prices for Honda probably occur because the higher prices charged by dealers that are part of the Access program effectively reduce price competition between the two brands, allowing Honda to increase its prices as well. Furthermore, the dealer environment (haggle versus non-haggle) may also further differentiate the two brands allowing for more price flexibility.

3.4.2 Impact of the Program on Sales

Estimation

Next, we attempt to understand the impact of the program on the sales of both manufacturers. Our model is as follows:

$$\ln Q_{ijt} = \beta_0 + \beta_1^T M_i^T A_{jt} + \beta_1^H M_i^H A_{jt} + \sum_{i=1}^{I-1} \delta_i^{\text{mod}} Z_i + \sum_{i=1}^{I-1} \sum_{t=1995}^{T=2006} \delta_i^{\text{mod t}} Z_i (t-1995) + \sum_{n=1}^{N-1} \delta_n^{\text{yr}} Year_n + \sum_{r=1}^{R} \beta_r V_r + \kappa_j + \varepsilon_{ijt}, \quad (3.3)$$

where :

$Q_{ijt} =$ sales of vehicle model i in area j in year t,

M_i^T (or M_i^H) = dummy for manufacturer: = 1 if i = Toyota (or Honda), = 0 otherwise,

A_{jt} = indicator of program adoption: = 1 if program was implemented in area j in year t, = 0 otherwise,

Z_i = dummy for vehicle models, $i = 1$ to I -1, $I = 8$,

$Year_n$ = dummy for year, $n = 1$ to N -1, $N = 12$,

V_r = dummy for major model re-design events, $r = 1$ *to* R, $R = 14$,

κ_j = unobserved time-invariant characterisitics of area j,

ε_{ijt} = stochastic error term, assumed to be heteroskedastic and following a first order autoregressive (AR(1)) process, i.e., $\varepsilon_{ijt} = \rho_s \varepsilon_{ijt-1} + \eta_{ijt}$, where $|\rho_s| < 1$, and η_{ijt} is i.i.d.

We use the log form of sales as our independent variable such that the model coefficients represent the percentage changes in the annual sales growth rate. Following the pricing model, we identify the separate program effects for Toyota and Honda via an interaction between the program adoption and brand indicator. In addition, we incorporate model dummies to control for model fixed effects and year dummies to control for time

variation. As in the price model, we also include dummies for model redesign events to control for sales changes due to vehicle quality improvements. For all the eight models, we identify fourteen major changes from 1995 to 2006 and code the series redesigns as dummy variables. For example, as the Toyota Corolla 2003 model is a major redesign, we introduce a dummy variable for that car in the sales equation for 2003 and all subsequent years.[24]

As in the pricing model, we are unable to directly control for area specific differences between program and non-program areas which, besides the program, may have an impact on sales: including area specific constants do not allow us to identify the program and area effects separately, resulting in biased estimates of the program coefficients. However, unlike the pricing model, the sales data runs from a period before the program was implemented. By taking first differences of Equation (3.3), we are able to eliminate the area specific effects, κ_j (which we assume remain constant over time), but retain the program effects for the years in which the program was introduced:

$$\Delta \ln Q_{ijt} = \theta_0 + \beta_1^T M_i^T \Delta A_{jt} + \beta_1^H M_i^H \Delta A_{jt} + \sum_{i=1}^{I-1} \delta_i^{\text{mod t}} Z_i + \sum_{n=1}^{N-1} \delta_n^{\text{yr}} \Delta Year_n + \sum_{r=1}^{R} \beta_r \Delta V_r + \Delta \varepsilon_{ijt}, \quad (3.4)$$

where Δ stands for the difference between the two adjacent periods.

In equation (3.4), the program coefficients, β_1^T and β_1^H, now represent a *one time* percentage change in the sales growth rate that may have occurred once the program was implemented. Note that by allowing for an interaction between the model dummies, Z_i, and time, $(t-1995)$, in equation (3.3), we are able to retain the model dummies in equation (3.4) and thus control for any differences in sales growth rate which maybe a function of a particular model type. In order for β_1^T and β_1^H to be unbiased and

[24] As our sales data does not contain model year information, we have to make an assumption for the introduction time. We have also tried equations in which we code major redesigns as occurring one year in advance, e.g., assuming the Corolla 2003 enters the market in 2002. Our results show small changes in the coefficients of the year and model dummies, as expected, and no significant changes in the coefficients of the program effect.

consistent, we assume that ΔA_j and $\Delta \varepsilon_{ijt}$ are independent. This excludes the case where there is any factor, which is coincident with the program, affects the sales.[25]

Discussion of Results

The results of Equation (3.4) are listed in **Table 3.7**. We find that while the program had a significant and positive effect on Honda's sales, there was no effect on the sales of Toyota. Specifically, the introduction of the program resulted in a one-time increase in Honda's annual sales growth rate by 13%. This means that if, for example, the sales of Honda were growing at a rate of 10% per year, after the program introduction, the annual growth rate would have been 11.3%.

Given that we find that both Toyota and Honda's prices increase as a result of the program, the above result may, at first glance, seem surprising as one would expect sales to fall for both manufacturers. However, there are several possible reasons for this. With regard to the overall sales patterns, both brands were generally increasing their sales over time. Possibly buyers still found these two brands attractive, thus limiting the effect of a price increase. With regard to the differential effects for Honda and Toyota, the results depend, in part, upon the preferences of the car buyers. Car buyers who prefer to bargain and feel that the time invested in bargaining leads to a better deal would tend to favor Honda, while those who value the convenience of not bargaining would have a higher chance of choosing Toyota. If the distribution of consumer preferences are is skewed more towards consumers who prefer to bargain, this would explain why Honda experienced an increase in its growth rate. In addition, in areas where the program exists, Honda salespeople may have an advantage over their Toyota counterparts as they are able to use Toyota's access prices as a comparison point during the negotiation process. In areas without the program, on the other hand, Honda dealerships are unable to make such comparisons as Toyota prices are negotiated and their final prices are not transparent to their competitors. Individual level data on consumer's preferences and shopping patterns would help to clarify the reasons underlying results and are worthwhile pursuing.

[25] It may be argued that the advertising levels or content at the time of program introduction could be an example of such a factor. However, as the advertisement should not have a sales effect that lasts for years, it will likely not be confounded with the long-term program effect that our model measures.

Table 3.7 also reports the sales growth rates of all eight models. Within each pair, the growth rates of the two brands are very similar. Across categories, the growth rate of minivans (Toyota Sienna, Honda Odyssey) seems to be slower than other categories, especially smaller cars. Series redesigns also help explain the sales change. Overall, model redesigns have a positive effect on sales. For example, the introduction of the 1999 Odyssey caused sales growth rate to more than double.

3.5 Conclusion

In the automobile market, fixed price policies are becoming increasingly common. However, the implications of introducing a fixed price policy in a market where prices are predominantly negotiated remain largely unexplored. This research is one of the first empirical studies that analyze the competitive consequences of such a strategy. The Access Toyota program implemented in Canada is used as a context since it serves as a natural experiment to explore the question.

The Access program has generated widespread interest in Canada and has been the topic of much discussion. However, the consequences of its introduction remain unclear. According to some reports, the program has been very consumer-friendly and was supported by many automobile consumers.[26] It was expected by some that the Access program would result in lower prices for consumers by making the price information transparent (The Gazette, 2002). According to others, however, the driving force behind the move was to address "dealer profitability" issues and predictions were made that prices would increase (Walsh, 2003). Our study is the first that systematically addresses this issue by analyzing the impact of the program not only on Toyota but also on its competition.

In particular, we focus on the impact of the program on the prices and the sales of Toyota and its closest competitor, Honda. Our results show that, when Toyota introduced its fixed price policy, both Toyota and Honda prices increased. The program did not seem to affect Toyota's sales. Instead, it led to an increase in Honda's sales, perhaps due to some consumers switching away from Toyota due to their perception that a fixed price may not allow them to obtain a fair price.

[26] When the program was introduced in British Columbia and Quebec, surveys show that 70% of Quebecers and 77% of British Columbians were in favor of the program (The Gazette, 2002).

The increase in price resulted from the program may lead to some regulatory concerns. Some alleged that the fixed-price policy amounts to price maintenance, therefore the Competition Bureau examined whether Toyota prohibited dealers affiliated with the program from selling vehicles below the access price.[27] While this was not proven in court, so that Toyota was allowed to continue its program after some revisions, there is probably still some effect on price and we find such effect in our study. While people may applaud for Toyota's attempt to eliminate the hassle of negotiating, our results suggest that such benefit may be discounted by an increase in the car price. As an alternative to help consumers, the government and consumer associations could provide information to assist consumers in negotiating with the sellers. For example, a large number of web sites (e.g., Edmund, KBB, Car Help Canada) have sprung up that educate automotive consumers about how to improve their negotiating skills.

Our research can be generalized to similar situations where competitive firms adopt different pricing formats (bargaining vs. posted price). Such cases exist in markets other than automobiles, such as boats, musical instruments and jewelry. For example, prices of boats are traditionally negotiated but some manufacturers such as Tracker and Nitro are now selling their boats at a fixed price. Such situations can also exist in the online domain – www.priceline.com style haggling or online negotiation enabled by "shop bots" (New York Times, 2000) provide the options for online companies of choosing between bargaining and posted prices. Our findings shed light on the impact of such price decisions on prices and consumer demand.

Some questions remain unanswered. First, our research does not address why firms' choose such strategies. For example, while we were able to understand the impact of the program on both Toyota and Honda, we are unable to address why Honda chose to stay with its existing policy of negotiated prices. According to some theoretical studies, a fixed price policy may serve to reduce consumers' uncertainty about product quality, due to its commitment effect (Riley & Zeckhauser, 1983; Wernerfelt, 1994), or allows a dealer to charge a higher price by saving consumers' haggling cost (Chapter 2). However,

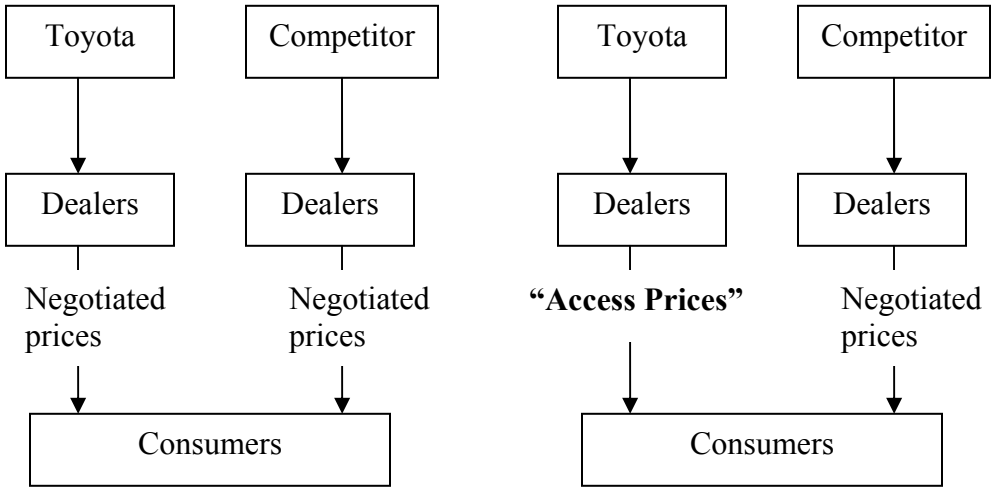
[27] The Competition Bureau's News Release, "Competition Bureau Settles Price Maintenance and Misleading Advertising Case Regarding the Access Toyota Program" (March 28, 2003) and the Prohibition Order and Agreed Statement of Facts in this case are available online at: http://www.competitionbureau.gc.ca/epic/site/cb-bc.nsf/en/00300e.html.

the disadvantage of a fixed price policy is that it limits the dealer's ability to price discriminate among different consumers (Ayres & Siegelman, 1995; Goldberg, 1996). Further, in the Toyota case, the manufacturer's choice of pricing strategy may also depend on the relationship between the manufacturer and the downstream dealerships. We leave this question for future research.

Second, while we have examined the consequences of the program on prices, we do not study the impact on other market performance metrics such as service. From consumers' point of view, both price and service are important. While it may be tempting to conclude that the higher prices resulting from the program leave consumers worse off, such a conclusion may be erroneous as it fails to account for other factors. Anecdotal evidences suggest that some consumers actually praised the program for its offering better service. For example, the program involves re-identifying sales people as product advisors and developing a more flexible customer service process,[28] changing the sales process to reduce the time spent in a dealership and use of the Internet to buy instead of entering an outlet. A Maritz study (2001) shows increased satisfaction among consumers who dealt with Toyota dealers following the introduction of the Access Toyota program. This evidences suggests that, overall, the program may benefit consumers, even if prices are higher. An extension of our research in this direction could shed light on the consequences on consumer welfare and hence provide guidance to the government's regulations on the use of the fixed price policy.

[28] To motivate the salespeople, many dealerships make commissions a lower proportion of total sales force compensation when fixed priced strategies are used (*National Post*, Mar 3, 2000).

Figure 3.1: A Duopoly Model



(a) Without the program (Ontario)

(b) With the program (Other provinces)

Table 3.1: Program Adoption in the Six Largest Provinces in Canada

Province	Access program	Launch Date	Total # of Dealers
Alberta	Yes	Jun, 2001	17
British Columbia	Yes	Jun, 2002	34
Manitoba	Yes	Mar, 2000	7
Ontario	No	--	78
Quebec	Yes	Jan, 2002	68
Saskatchewan	Yes	Jun, 2001	6

Note: The number of dealerships and program availability in each province were obtained from Toyota Canada's website in Nov, 2006. The launch dates are based on news reports from *Canada NewsWire, Marketing Magazine,* and *The Globe and Mail*.

Table 3.2: Total Sales by Models during 1995~2006

Make	Model	Total Sales	Category	Available
HONDA	CIVIC	688,177	Small car	1972 – present
HONDA	ACCORD	289,072	Family car	1976 – present
HONDA	CR-V	157,065	Small SUV	1996 – present
HONDA	ODYSSEY	111,102	Minivan	1995 – present
HONDA	OTHERS	71,523		
HONDA	TOTAL	1,316,939		
TOYOTA	COROLLA	473,913	Small car	1966 – present
TOYOTA	CAMRY	254,626	Family car	1983 – present
TOYOTA	ECHO	157,457	Budget small car	1999 – 2005
TOYOTA	SIENNA	121,486	Minivan	1998 – present
TOYOTA	MATRIX	91,831	Small wagon	2003 – present
TOYOTA	TERCEL	85,422	Small car	1978 – 1999
TOYOTA	RAV4	84,157	Small SUV	1994 – present
TOYOTA	4RUNNER	52,397	Midsized SUV	1984 – present
TOYOTA	OTHERS	203,294		
TOYOTA	TOTAL	1,524,583		

Table 3.3: Description of the Price Data

Model	With the program		Without the program	
	Mean	Standard Deviation	Mean	Standard Deviation
Toyota Corolla	$19,579	$943	$19,192	$272
Toyota Camry	$27,847	$1,668	$26,406	$1,157
Toyota RAV4	$31,093	$2,352	$30,137	$1,782
Toyota Sienna	$34,302	$2,560	$33,326	$2,151
Honda Civic	$21,104	$1,627	$20,335	$1,207
Honda Accord	$29,389	$1,701	$27,267	$2,886
Honda Odyssey	$38,815	$2,607	$36,599	$3,889
Honda CR-V	$32,034	$1,639	$30,150	$2,899

Note: [1] Cities with the program include Calgary/Edmonton in the province of Alberta, Montreal in the province of Quebec, and Vancouver in the province of British Columbia. The city without the program is Toronto in the province of Ontario.

[2] Means and standard deviations are based on the city-level average prices on a monthly basis from August 2004 to September 2007. (It should be noted that, as the prices are the city-level averages from five cities, the fixed-price policy does not predict that the standard deviation of these prices is lower.)

Table 3.4: Model Redesigns during 1995~2007

Make	Series	Model years redesigned
HONDA	CIVIC	2001, 2006
HONDA	ACCORD	1998, 2003
HONDA	CR-V	2002, 2007
HONDA	ODYSSEY	1999, 2005
TOYOTA	COROLLA	1998, 2003
TOYOTA	CAMRY	2002, 2007
TOYOTA	RAV4	2001, 2006
TOYOTA	SIENNA	1998, 2004

Source: from *Consumer Reports* (Oct, 2007)

Table 3.5: Prices of Honda and Toyota in Areas with and without the Program

Dependent Variable = Ln(Price)

Variable	Parameter Estimates	Variable	Parameter Estimates
Intercept	9.75** (.01)	Year2006	-.10** (.01)
Toyota*Program	.02** (.01)	Year2007	-.13** (.02)
Honda*Program	.06** (.01)	Civic 2006	.02** (.01)
Toyota Corolla (as base series)		CR-V 2007	-.03** (.01)
Toyota Camry	.37** (.01)	Odyssey 2005	-.00 (.02)
Toyota Sienna	.57** (.01)	Camry 2007	-.00 (.01)
Toyota RAV4	.47** (.01)	RAV4 2006	.02 (.01)
Honda Civic	.06** (.01)	M_year2004 (as base model year)	
Honda Accord	.40** (.01)	M_year2005	.13** (.01)
Honda Odyssey	.67** (.01)	M_year2006	.20** (.02)
Honda CR-V	.48** (.01)	M_year2007	.27** (.02)
Year2004 (as base year)			
Year2005	-.06** (.01)		
Adjusted R^2	.998		
Observations	1527		

Notes: The above results do not report fixed effects for months. Standard errors are in parentheses. * = p<.05; ** = p<.01.

Table 3.6: Prices of All Nameplates in Areas with and without the Program

Dependent Variable = Ln(Price of All Nameplates)

Variable	Parameter Estimates
Intercept	10.72** (.28)
Provinces with the program	-.04 (.08)
M_year2003 (as base model year)	
M_year2004	.21 (.15)
M_year2005	.22 (.12)
M_year2006	.55** (.16)
M_year2007	.93** (.25)
M_year2008	1.59** (.32)
Year2004 (as base year)	
Year2005	-.30 (.24)
Year2006	-.68* (.26)
Year2007	-1.53** (.37)
Adjusted R^2	.979
Observations	501

Notes: The above results do not report fixed effects for months. Standard errors are in parentheses. * = p<.05; ** = p<.01.

Table 3.7: Changes in Sales of Honda and Toyota in Provinces with and without the Program

Dependent Variable = ΔLn(sales)

Variable	Parameter Estimates	Variable	Parameter Estimates
Intercept	.23** (.07)		
ΔToyota*Program	-.01 (.07)	ΔAccord 1998	-.08 (.13)
ΔHonda*Program	.13* (.06)	ΔAccord 2003	.03 (.12)
Toyota Corolla (as base series)		ΔCivic 2001	.04 (.07)
Toyota Camry	-.01 (.04)	ΔCivic 2006	-.10 (.08)
Toyota Sienna	-.07 (.08)	ΔOdyssey 1999	1.40** (.20)
Toyota RAV4	-.05 (.12)	ΔOdyssey 2005	.45* (.18)
Honda Civic	.01 (.03)	ΔCR-V 2002	.40** (.12)
Honda Accord	-.05* (.02)	ΔYear1997	.17* (.08)
Honda Odyssey	-.12* (.05)	ΔYear1998	-.08 (.08)
Honda CR-V	-.05 (.04)	ΔYear1999	-.26** (.07)
ΔCorolla 1998	-.01 (.11)	ΔYear2000	-.14* (.07)
ΔCorolla 2003	.10 (.08)	ΔYear2001	-.13 (.08)
ΔCamry 2002	.13 (.17)	ΔYear2002	-.05 (.08)
ΔSienna 1998	1.17** (.30)	ΔYear2003	-.13 (.08)
ΔSienna 2004	.31 (.27)	ΔYear2004	-.21** (.07)
ΔRAV4 2001	.37 (.41)	ΔYear2005	-.20** (.07)
ΔRAV4 2006	1.01* (.42)	ΔYear2006	-.12* (.08)
Observations	10114	Adjusted R^2	.234

Notes: Standard errors are in parentheses. * = p<.05; ** = p<.01.

CHAPTER 4 DETERMINANTS OF CAR NEGOTIATED PRICE: INSIGHTS FROM MATCHING VEHICLE SHOPPING SURVEY AND TRANSACTION DATA

4.1 Introduction

For many products such as automobiles and housing, negotiation is a common way in which prices are determined. While it is widely suggested that factors such as an individual's bargaining ability, the information she collects, situational and psychological factors all contribute to the price that a consumer ultimately pays, there is very little research that has established and quantified the impact of these factors on the actual negotiated price.

Our primary interest lies in determining the impact of an individual's bargaining ability, attitude towards negotiation, and the information collected on the final price she is able to negotiate. Using the automobile market as our context, we employ a unique dataset that combines transaction prices with survey data that allows us to directly test the impact of a person's self-reported bargaining ability and enjoyment of negotiating with dealers on the price she pays. Furthermore, a particular feature of this market is that consumers have access to various sources of information, primarily via the Internet as well as other sources, such as newspapers, magazines and television. While the impact of the Internet on prices has been well established (e.g., Zettelmeyer et al., 2006), we contribute to the literature by looking at the impact of other *offline* information sources, such as newspapers, on prices. We further extend our findings by looking at the impact of information *type*, i.e., price versus non-price information, on the price paid. This allows us to better understand the exact manner in which sources such as the Internet help lower prices.

Our major findings are as follows. First, we find that a consumer's negotiation skill and attitude significantly influence the negotiation outcome. Buyers who perceive themselves as better negotiators obtained a lower price than others, as did buyers who enjoy negotiating. Further exploration indicates that consumers that enjoy negotiating

have a greater propensity to search for price information which then allows them to obtain a better deal. Second, our results indicate that, despite the growing popularity of the Internet, certain offline sources are still important for people who pay lower prices. In particular, we find that newspapers are important for people who pay a lower price. In addition, we find that, while consistent with earlier findings, Internet users pay a lower price, the benefits derived from the Internet, i.e., in terms of lower prices, are greater if the information collected is price-related. In contrast, information that is mostly product-related actually is associated with increases in the average negotiated price.

The remainder of the chapter is organized as follows. In section 4.2, we review the literature. In section 4.3 we describe the data and variables. In section 4.4 we list our hypotheses and describe the methodology we use to test them. We then present the results of our analysis in section 4.5 and conclude in section 4.6.

4.2 Literature Review

There have been numerous studies that have attempted to study the behavioral aspects of negotiation. In particular, the social psychology literature has established, either using theoretical frameworks or laboratory experiments, that a skilled negotiator can effectively make use of a wide array of strategies and tactics to move the process, change perceptions and accommodate to differing interests and priorities (Reardon, 2004) and thereby obtain a lower price. Other studies such as De Dreu, Carnevale, Emans, & van de Vliert (1994) found that communication involving gain-loss frame can influence a negotiator's behavior. Bazerman, Curhan, Moore, & Valley (2000) provides a review of research on how communications can change people's mental model of negotiation and hence their decisions.

While these studies establish the fact that being a superior negotiator is an advantage to a consumer, the true impact of bargaining ability on prices is not well documented. While various laboratory studies have used measures of bargaining ability to understand its impact on prices, the assessment remains limited as true prices are not utilized. By combining true prices obtained from transaction data with survey data with self-reported measures of negotiation skills, we are able to overcome this difficulty.

To our knowledge, no empirical study has explicitly examined the consequence of aversion to negotiation, most existing studies being theoretical in nature. The economics literature explores a concept called negotiation cost, which is modeled as a fixed cost that the negotiator incurs each period until an agreement is reached (Kennan & Wilson, 1993; Perry, 1986; Rapoport, Weg, & Felsenthal, 1990). According to these studies, if this cost is known to both parties, the negotiator will obtain a smaller share of the surplus if her negotiation cost is lower. Other researches examine the role of impatience and suggest that more patient consumers obtain a larger share of the surplus as they are able to signal their lower reservation prices through their willingness to wait (Admati & Perry, 1987; Cramton, 1992). Our survey data contains measures of a buyer's aversion to negotiation, a measure which can be considered analogous to the concepts discussed above.

Our research is also related to a large literature on bargaining with private information. Many researchers use game-theoretical models to show that a negotiator obtains a larger share of the surplus if being better informed about one's own outside option (Chatterjee & Lee, 1998) and about the other negotiator's reservation price (Ausubel, Cramton, & Deneckere, 2002; Chatterjee & Samuelson, 1983; Fudenberg, Levine, & Tirole, 1985). This prediction is supported by laboratory experiments (e.g., Croson, Boles, & Murnighan, 2003). While the field test of the theory was difficult earlier, due to the difficulty of measuring private information, the rise of the Internet presents a good opportunity to explore the question, as we elaborate below.

The most relevant literature to our research is a series of papers on the effect of using the Internet on prices (Morton, Zettelmeyer, & Silva-Risso, 2001; Zettelmeyer et al., 2001; Zettelmeyer et al., 2006). Morton et al. (2001) find that people who use the Internet to help them shop for cars obtained a lower price than others. Zettelmeyer et al.(2006) further investigate how the Internet helps lower a price by exploring buyers' online behavior. In particular, they find that consumers get a lower price by getting information on the dealer's invoice/cost and using the referral service of online intermediaries. The focus of this stream of research is to understand the impact of the Internet alone on prices. We extend these studies by trying to understand (i) the effect of a person's bargaining behavior and (ii) the effects of various information sources other than the Internet as well as the type of information on the final price paid.

4.3 Data

Our analysis is based on two dataset. The first dataset is from the transaction data on new car purchases across the United States during February and March in 2006. The second dataset is from a survey conducted by J.D. Power and Associates to a sample of new car purchasers for which transaction data were available. We matched the individuals in the survey data to the transaction data.

Transaction data

The data were collected by the Power Information Network (PIN), an affiliate of J.D. Power and Associates. PIN uses an electronic tracking system to gather daily point-of-sale transaction data from participating dealers. The company supplied transaction data for respondents who completed the survey for cars bought in February and March 2006. Our data set consists of 7761 transactions. For each vehicle transaction, the data available includes vehicle characteristics (e.g., make, model), price, cost, profit, financing, trade-in measures, date of sale, days to turn, and some customer and dealer information.

The price in the data set is the final negotiated price of the vehicle for purchases, which does not include dealer-installed accessories and has been adjusted by *Trade-In Over Allowance*. *Trade-In Over Allowance* is the difference between the trade-in price the dealer pays to the consumer and the market value of the specific trade-in vehicle (Zettelmeyer et al., 2006). Adjusting the price for this amount can account for the possibility that a dealer may offer a consumer a low (or high) price for the new car because the dealer is profiting (or losing money) from the trade-in. The variable "Price" we use as the dependent variable is the price in the data set less "Manufacturer Rebate," if any, given directly to the consumer. In other words, it is the net price paid by the consumer for the car.

We control for vehicle fixed effects based on nameplate and vehicle cost. The vehicle cost in the data set is the dealer's cost of purchasing the vehicle from the manufacturer. Given a specific nameplate, this cost can capture the variation of vehicle characteristics such as model, body type, trim level and transmission. To control for vehicle fixed effects without losing too many degrees of freedom, we keep the number of different nameplates small by choosing the 24 most popular nameplates purchased, which

accounts for 85% of the market share. In addition, we restrict our analyses to the 2006 model, as it accounts for 97% of the transactions in our data set.

Cost data are not available for all transactions. The observations without vehicle cost information are dropped from the analysis, which leads to a loss of 2228 (or 29% of) observations. We do not find any statistically significant difference between the average prices of the vehicles with cost information and those without cost information.

To control for variation in prices due to inventory issues, we include "Days to Turn" into the model, which is the number of days the vehicle has stayed in the dealership before it is sold. In addition, following the practice of Zettelmeyer et al.(2006), we create two dummy variables based on the date of sale. The variable "End of Month" equals 1 if the car was sold in the last five days of the month. This accounts for the possibility that salespeople are more willing to accept a lower price in order to fulfill monthly sales quotas and receive bonuses. The variable "Weekend" equals 1 if the car was purchased on a Saturday or a Sunday, which controls for whether consumers who buy cars on weekends are different from other consumers. Finally, we control for whether the car was sold in a metropolitan city, a small city or a rural area.

Survey data

The data are from a survey conducted by J.D. Power and Associates with consumers who bought a new car in the United States in February and March 2006. The sample was randomly selected on the basis of transaction data recorded by PIN. The survey asked questions about (1) the offline and online sources of information a buyer used, (2) the information the buyer accessed online, (3) personal shopping attitude and behavior, which includes the buyer's assessments of her own negotiation skill and enjoyment of negotiation, (4) demographics, (5) the number of vehicles the buyer considered. Two versions of the questionnaire were used with a different order of response elicitation to check for bias due to respondent fatigue responses.

Specifically, the data reports the buyer's usage of five information sources: the Internet, newspaper advertisement, magazine advertisement, radio advertisement, and TV advertisement. If the buyer used the Internet, she was provided with a list of 15 types of information. Some of these types of information are related to price (e.g., tools to show

how much dealers are discounting the vehicle, rebates and special offers), where others are not related to price (e.g., road tests and reviews, brochure). The list of these information types appears in Appendix X. For each type of information, the buyer indicated whether she found it online and, if so, where she found it (i.e., on independent website, dealership website and/or manufacturer website). Furthermore, the buyer rated in a ten-point scale how important she thought each type of information is for her purchase decision.

Buyers indicated their agreement or disagreement in a five-point scale (1 = "Don't feel that way at all" to 5 = "That's exactly how I feel") to a list of 11 items regarding their general shopping attitude and behavior. These include the buyer's assessment of her own negotiation skill, the extent to which she enjoys negotiation, price sensitivity, shopping effort, enthusiasm towards car shopping and perceptions of sellers. The list of these items is in Appendix XI.

In addition, buyers reported their demographic characteristics such as age, gender, race, education and income, and the number of other vehicle models that they seriously considered but did not purchase at the end. They also indicated their level of experience with the Internet, which may reflect their search cost online.

Basic survey findings. 73% of respondents reported that they used the Internet as part of their purchase process. Among the offline sources, TV advertisement are most often used (52%), followed by newspaper advertisement (49%), magazine advertisement (44%) and radio advertisement (35%). As for the perceived importance of these information sources, the Internet, newspapers and TV were most highly rated. In terms of self-assessment of negotiation skill and enjoyment, 44% of respondents perceived themselves to be a good negotiator but only 22% of consumers actually enjoy the negotiation (above 3 in a five-point scale).

We match the two data sets by individual consumers. The matched data set has 7761 observations. After we drop those observations without cost information and confine the analysis to our chosen nameplates and the 2006 model year, we had 4427 observations. The summary statistics are listed in **Table 4.1**.

4.4 Hypotheses and Methodology

4.4.1 Hypotheses

In this subsection, we list the six hypotheses that we will test with our data. We concentrate on the effects of information and the buyer's negotiation skill and enjoyment of negotiation on the price paid. We believe that information helps a consumer to get a lower price, either by informing her of a better deal or by assisting her to negotiate more effectively with a dealer. Firstly, it is likely that knowing how much dealers are discounting their vehicles leads to the selection of a better deal. Secondly, as predicted by the theoretical literature and laboratory experiments, the negotiator obtains a larger share of the surplus if she is better informed about her own outside options and the opponent's reservation price (e.g., Ausubel et al., 2002; Croson et al., 2003). In the car purchase context, this prediction suggests that consumers will get a lower negotiated price if they know more about the dealer's reservation price and other competitive dealers' prices. Therefore, we predict that those information sources that offer the above price information will help consumers get a lower price. Among the five information sources in our data, the Internet and newspapers contain a considerable amount of price information. As suggested by Zettelmeyer et al. (2006), the Internet lowers the price consumers paid by informing consumers about dealers' invoice prices. Many websites such as KBB and Edmunds inform consumers about the average market prices of individual vehicle models. Newspaper advertisement, which usually focuses on price, provides timely information on discounts, manufacturer rebate, etc. Hence, we hypothesize the following:

H1: Consumers using newspapers as a source of information pay a lower price on average than consumers who do not.
H2: Consumers using the Internet as a source of information pay a lower price on average than consumers who do not.

We next consider the impact of information more explicitly. We classify the information as price information and non-price information. As discussed earlier, price information may help consumers to negotiate a lower price. In contrast, non-price information may result in a higher price. Bakos (1997) uses a theoretical model to show

that lower search cost of quality information can reduce consumers' price sensitivity and therefore the sellers can charge a higher price. Viswanathan, Kuruzovich, Gosain and Agarwal (2007) finds that consumers using product-related online infomediaries pay a higher price on average for the same vehicle than other consumers. Therefore, our predictions regarding the two types of information are as follows:

H3: Consumers who obtain more price related information pay a lower price than other consumers.
H4: Consumers who obtain more non-price related information pay a higher price than other consumers.

Our next two hypotheses are regarding the impact of negotiation skill and enjoyment of negotiation on price:

H5: Consumers who are better negotiators obtain a lower price than other consumers.
H6: Consumers who enjoy negotiation obtain a lower price than consumers who do not.

The underlying logic is as follows. Firstly, negotiation skill is important for getting a lower price. It follows from the social psychology that one can use many negotiation tactics to influence the opponent's negotiation behavior (Bazerman et al., 2000). This is especially important for car purchase, as it involves making tradeoffs of multiple attributes so that negotiation calls for cognitive skills and the ability to steer the other party's thinking. Despite the apparent obviousness of *H5*, there has been no field study that seeks to estimate the magnitude to which negotiation skill affects the negotiated price. Secondly, enjoyment of negotiation may lead to lower price in two ways: one, consumers who enjoy negotiation are willing to endure a longer negotiation process and, as the bargaining theory suggests, being more patient can lead to a lower price (e.g., Perry, 1986); two, consumers with a positive mood may do more information search and also more effectively implement negotiation tactics and strategies (Forgas, 1998).

4.4.2 Methodology

We test our hypotheses through a series of regression models. They can be summarized by the following general framework:

$$\textbf{\textit{Dependent Variable}} = \boldsymbol{X}_i\beta_1 + \boldsymbol{D}_i\beta_2 + \boldsymbol{I}_{1i}\beta_3 + \boldsymbol{I}_{2i}\beta_4 + \boldsymbol{B}_i\beta_5 + \varepsilon_i \qquad (4.1)$$

where the *X* matrix contains transaction details, the *D* matrix contains buyer demographic characteristics, the *B* matrix contains buyers' shopping behavior and attitude, including their negotiation skill and enjoyment of negotiation, and the I_1 matrix represents buyers' usage of information sources and the I_2 matrix represents the information types buyers accessed online. We discuss more details below.

The major dependent variable that we investigate is *Price*, which was defined in the data section. In addition, we investigate another dependent variable, *Gross Margin (GM)*. *GM* is computed by subtracting the cost from the price *before* the manufacturer rebate. It should be noted that these two dependent variables have different implications. While *Price* measures the desirability of the negotiation outcome for consumers, *GM* takes the dealer's cost into account and hence it measures the desirability of the negotiation outcome for dealers.

The *X* matrix and *D* matrix are the basic control variables and we include them in all our regression models. The *X* matrix contains fixed effects of car, month and region; number of days that the car stayed in the dealership; whether the car was purchased at the end of the month or during the weekend; whether the buyer received a manufacturer rebate or traded in a vehicle; and car costs (excluded if dependent variable is *GM*). The *D* matrix contains the buyer's demographic characteristics. Previous research suggests that it is important to control these variables as they may influence the negotiated price (e.g., Ayres & Siegelman, 1995; Morton et al., 2003).

To the above basic specification, the rest of specifications vary for the I_1 matrix, I_2 matrix and *B* matrix, depending on the hypothesis we will test. To test the impact of information sources on price, we first add the I_1 matrix (Model 1). Then, we add the *B* matrix (Model 2) to investigate the effect of consumer shopping attitudes and behaviors. To examine the impact of information types, we expand Model 2 by adding I_2 matrix (Model 3 and Model 4). Across Models 2-4, which all include the *B* matrix, we are able

to check the influence of negotiation skill and enjoyment of negotiation under different model specifications.

4.5 Results and Discussions

For now, we confine our discussion of results to one dependent variable, *Price*. At the end of this section, we comment on the results with the other dependent variables, *GM*.

4.5.1 The Impact of Information Sources

Recall that H1 and H2 consider the impact of using five information sources (i.e., the Internet, newspapers, magazine, radio and TV) on the negotiated car price. Model 1 includes five indicators, each of which corresponds to one information source and equals 1 if a buyer used it while shopping for their new vehicle. In this model and all other models, we control for transaction details and consumer demographic characteristics. The results are listed in Column 1 in **Table 4.3**. We find that buyers using the Internet and newspapers to help them shop for a new car paid a lower price on average than other buyers. Specifically, buyers who reported using the Internet paid $343 less than others, and those using the newspaper advertisement paid $283 less. On the other hand, there were no significant effects of radio, TV, and magazine on the price paid.

Although the above results measure the price difference between users and nonusers of the information sources, it may not account for other consumer differences such as their shopping behavior and attitude. Therefore, we run our second regression model (Model 2) which includes the same set of variables as Model 1 plus additional variables that control for buyers' shopping behavior and attitude. These include the buyer's rating in a five-point scale regarding their negotiation skill and enjoyment of negotiation, price sensitivity, shopping effort, enthusiasm towards car shopping and perceptions of sellers. We believe that including these variables, together with the demographic variables, could better control for the buyers' propensity to search for information and therefore allow us to measure the effect of information sources more accurately. The results are listed in Column 2 in **Table 4.3**. It shows that, after additional consumer characteristics are controlled, the effects of using the Internet and newspapers on price are still significant.

Our results suggest that newspapers is an important information source for getting a lower price even after the rise of the Internet. It is similar to the Internet in the sense that both of them offer price information and usually for multiple vehicle models so that consumers can easily make side-by-side comparisons. In contrast, other information sources such as magazine and TV usually focus more on the product information, and they typically advertise for one vehicle at a time, which makes competing models less salient to consumers.

Note that, after more consumers' differences are controlled, the effect size of newspapers remains almost the same as previously, but the Internet increases its impact on price (from -$342.9 to -$472.2). This suggests that the Internet users are not those who would have obtained a low price even in the absence of the Internet. Rather, they are likely those consumers who do poorly in the negotiation, perhaps because they have a high personal cost to visiting dealer or lower bargaining skill. This result is consistent with the finding by Zettelmeyer et al. (2001), which suggests that people who perform worse in negotiations are more likely to use the Internet.

To conclude this subsection, we confirm our hypotheses H1 and H2. We suggest that people who use newspapers and the Internet pay a lower price. Both the Internet and newspapers are widely used by car buyers. Our data shows that approximately 87% of car buyers use at least one of these two information sources as part of their purchase process, with 37% of buyers used both the sources.

4.5.2 The Impact of Information Types

Price and Non-price Information

While the effects of using the two information sources implicitly suggest that information is important for getting a lower price, it is unclear what kind of information on the Internet matters most to consumers in terms of price paid. In the survey respondents were asked to indicate whether they found each of 15 types of information online and where they found it (i.e., on an independent website, a dealership website and/or a manufacturer website). We created 15 variables corresponding to these types of information, each being the count of a given type of information across the three websites (e.g., if the consumer found one type of information from all the three websites, then we

count it as three). By doing this, we take into consideration both the breadth and depth of information (Bettman, 1979; Lisa & Gary, 2003) that consumers obtained online.[29] Of the 15 types of information, we identify six types to be related to price: (1) the dealer cost/invoice of new vehicle; (2) the list price (or manufacturer suggest retail price) of a vehicle with the options; (3) how much dealers are discounting vehicles (transaction price); (4) information about rebates and special offers; (5) tool to calculate monthly payments at different interest rates; and (6) the trade-in value of the used car. We classify the remaining 9 types of information to be non-price information. We then code each consumer by how many pieces of price and non-price information they obtained.

Recall that H3 and H4 test the effects of price and non-price information. We add to Model 2 the number of pieces of each type of information acquired by the buyer (Model 3). The results are listed in Column 3 in **Table 4.3**. It confirms our prediction that price information and non-price information influence the price paid in opposite directions. On average, for each piece of price information acquired, the consumer paid approximately $75 less for their car, while one piece of non-price information corresponds to consumers paying approximately $47 more.

The above results suggest that, while consumers using the Internet all paid a lower price, the saving varied across consumers depending on the relative amount of price information and non-price information acquired. **Table 4.4** summarizes the expected return across consumers. The majority of consumers saved $400~$500 by using the Internet. Only 0.1% of consumers using the Internet paid more than those not using the Internet.

Individual Types of Information

To investigate the effect of individual types of information, we replace the numbers of pieces of price information and non-price information in Model 3 with the numbers of pieces of the 15 types of information (Model 4). The results are listed in Column 4 in **Table 4.3**. Two specific types of information significantly affect the price, while the rest are not significant but with the right sign as expected. Specifically, the price information

[29] An alternative way is to code each type of information as 1 as long as the consumer finds the information, regardless where she finds it. However, under this coding we do not find the effect of information on price, which may suggest that the amount of information is an important factor to consider.

"Tool to show how much dealers are discounting vehicles (transaction price)" leads to a lower price. This could be due to two reasons. One, this information allows consumers to easily compare across dealerships and find a dealership who charges a lower price. Two, knowing how much a competitive dealer discounts helps the consumer to negotiate more effectively with the focal dealer. The competitor's offering serves as the consumer's outside option, which exerts pressure on the focal dealer as it has to sell at a lower price in order to close the deal. This is consistent with previous theoretical prediction that a negotiator obtains a larger share of the surplus if she is better informed about her own outside option (Chatterjee & Lee, 1998).

On the other hand, the price information "Dealer cost/invoice of new vehicle", which was found important by previous studies (Zettelmeyer et al., 2006) based on data in 2002, does not influence the negotiated price in our study. This is perhaps because that this type of information becomes increasingly common knowledge in 2006 as compared to in 2002 so that it is less likely to be the factor that differentiates the price paid. For example, major independent websites that help consumers search for new cars, e.g., Edmunds, AutobyTel, InvoiceDealers, all supply free information on the invoice/cost of new cars. Even some automakers and dealerships now freely give consumers the dealer's invoice.

The most important non-price information is brochure. People who use the Internet to obtain a brochure paid a higher price (approximately $235) than those who do not. Brochure is an important form of advertisement for car manufacturers. It usually provides detailed information on product characteristics, often with higher-quality and more color pictures, which may more effectively deliver to readers the impression of quality and therefore increase consumers' willingness to pay.[30]

As a summary of this subsection, we confirm our hypotheses H3 and H4. Our result extends the previous literature on the effect of the Internet on price by showing that such effect depends on the relative amount of price information and non-price information that consumers obtained online. Our results are consistent with the conclusions of several

[30] Some people may argue the reverse causal mechanism. That is, consumers who obtained the brochure are likely people who would have paid a higher price even in the absent of the brochure, such as consumers who are enthusiastic about the brand and less sensitive to price. Which causal mechanism holds is beyond the discussion of this research, although it is an interesting question worth pursuing further.

articles. Some find that the Internet allows for easy search of quality information and hence it may decrease the price sensitivity (Bakos, 1997; Lynch & Ariely, 2000). Viswanathan et al. (2007) find that consumers using price-related online infomediaries pay a lower price for the same vehicle, while consumers using product-related online infomediaries pay a higher price. All the above studies suggest that the benefit of using the Internet to a consumer depends on the information she obtains.

Multicollinearity Diagnostics. As Models 2-4 contain multiple seemly related consumer characteristics and information types, there is potentially a multicollinearity problem. To investigate this, we calculate the variance inflation factor (VIF) for each of the regression coefficients. The VIF indicates the extent to which the multiple correlations among independent variables inflate standard errors (which can result in incorrect tests of hypotheses). For Model 2, the VIF ranges from 1.08 to 3.16. For Models 3-4, the VIF ranges from 1.08 to 5.87, where the increase in VIF may be due to the relatively high correlation among the types of information. Nonetheless, all these VIFs are below the cutoff of 10 recommended by the literature (Neter & Kutner, 1990). Thus, we have little concern about multicollinearity biasing the parameter estimates in our models. The pairwise correlation matrix of major variables can be found in **Table 4.9**

4.5.3 The Impact of Negotiation Skill and Attitude

Next we investigate the effects of negotiation skill and enjoyment of negotiation on the car price. In the survey, the respondent indicated her agreement or disagreement in a five-point scale as to whether she is a good negotiator and whether she enjoys negotiation. We use these two ratings as the measure for negotiation skill and enjoyment of negotiation, respectively. Although they may seem closely relate to each other, our data shows that negotiation skill and enjoyment of negotiation represent two distinctive aspects of consumer negotiation behavior. Summary statistics are listed in **Table 4.2**. Nearly half of buyers (42%) rated themselves a good negotiator compared to most people (above 3 in a five-point scale), but fewer buyers (21%) indicated they actually enjoy negotiation (above 3 in a five-point scale). In particular, people who have good negotiation skill don't necessarily enjoy negotiation, e.g., only 38% "good negotiators" indicated that they enjoy negotiation.

The effects of negotiation skill and enjoyment on price are measured by their coefficients across Models 2-4 (Columns 2-4 in **Table 4.3**). A consistent finding is that negotiation skill significantly leads to a lower price. Each point in a five-point scale led to a saving of $119-$122. The results for enjoyment of negotiation are mixed. When the information type is not controlled, people who enjoy negotiation paid a lower price (Model 2), while such effect diminishes once the information is controlled (Models 3-4). This suggests a potential mediation effect of information type. We examine this at the end of this subsection.

Test of Moderation Effects of Negotiation Skill and Attitude

We have already showed that people who used the Internet and newspapers as part of their purchase process paid a lower price, but the benefit of using the Internet varies for consumers who acquired different types of information. Now, we explore a further question as to whether the benefits of using the Internet and newspapers also vary for consumers who have different levels of negotiation skill and enjoyment of negotiation. For example, Zettelmeyer et al.(2006) show that using the Internet benefits more the buyers who have a higher disutility of bargaining.

We conduct a moderation analysis to examine the possibility that negotiation skill and enjoyment of negotiation may moderate the effects of information sources on price. Following the well-established approach proposed by Baron and Kenny (1986), we add four additional variables in Model 2, each of which interacts with one of the two information sources with either negotiation skill, ***NgtSkill***, or enjoyment of negotiation, ***NgtEnjoy***, as illustrated by Equation (4.2):

$$\begin{aligned} \boldsymbol{Price} = {} & \boldsymbol{X}_i\gamma_1 + \boldsymbol{D}_i\gamma_2 + \boldsymbol{I}_{1i}\gamma_3 + \boldsymbol{B}_i\gamma_4 \\ & + \boldsymbol{Internet} \times \boldsymbol{NgtSkill} \cdot \gamma_5 + \boldsymbol{Internet} \times \boldsymbol{NgtEnjoy} \cdot \gamma_6 \\ & + \boldsymbol{Newspaper} \times \boldsymbol{NgtSkill} \cdot \gamma_7 + \boldsymbol{Newspaper} \times \boldsymbol{NgtEnjoy} \cdot \gamma_8 + \varepsilon_i \end{aligned} \tag{4.2}$$

where the *X* matrix contains transaction details, the *D* matrix contains consumer demographic characteristics, the I_1 matrix represents buyers' usage of information sources and the *B* matrix contains buyers' shopping behavior and attitude, including their negotiation skill and enjoyment of negotiation.

The results are listed in **Table 4.5**. As none of the four interaction variables is significant, neither negotiation skill nor enjoyment of negotiation moderates the effect of the Internet or newspapers on price. In other words, each of the two information sources benefits consumers equally regardless whether they have good negotiation skill or they enjoy negotiation. This suggests that, although good negotiation skill and enjoyment did allow the buyer to get a lower price, they cannot substitute the outside information. Our finding that enjoyment of negotiation does not moderate the Internet effect on price is in contrast with the result from Zettelmeyer et al.(2006), which shows using the Internet benefits consumers who have a high bargaining disutility. Note that the bargaining disutility defined in their study is different from the enjoyment of negotiation defined in our study. In their study, the bargaining disutility is measured by the consumer's agreement or disagreement to two questions "I am afraid that I will be taken advantage of by a dealer when negotiating the price of a new car" and "It is hard for me to find time to shop for a car". Therefore, the bargaining disutility reflects both the consumer's perception of her own negotiation ability and her opportunity cost of time. As we showed earlier, enjoyment of negotiation is distinct from the consumer's perception of her negotiation ability and, furthermore, it can be due to the cost other than the opportunity cost of time, such as mental cost of negotiating with the seller.

Test of Mediation Effect of Information

In this subsection, we are interested in whether the information acquired by consumers mediates the effect of enjoyment of negotiation and of negotiating skill on price. From comparing Models 2-4, it is immediately apparent that the information does not mediate the effect of negotiation skill, because the coefficient of negotiation skill stays the same regardless whether or not we control the information acquired. In other words, the information acquired does not explain the effect of negotiation skill on price.

To test whether the information type mediates the effect of enjoyment of negotiation on price, we follow the four steps approach proposed by Baron and Kenny (1986). We use **Figure 4.1** to illustrate our mediation analysis. Specifically, we need to show the following: (1) enjoyment of negotiation affects the price (path c); (2) enjoyment of negotiation is correlated with the information acquired (path a); (3) the information

acquired affects the price (path b), given that enjoyment of negotiation is controlled; (4) the effect of enjoyment of negotiation on price controlling for information acquired should be either zero (called complete mediation) or reduced in absolute size (called partial mediation) (i.e., c' is either zero or |c'|<|c|).

We list the models that test the above relationships below. The unmediated model, which is actually our Model 2, is represented by Equation (4.3):

$$\boldsymbol{Price} = \boldsymbol{X_i}\gamma_1 + \boldsymbol{D_i}\gamma_2 + \boldsymbol{I_{1i}}\gamma_3 + \boldsymbol{B_i}\gamma_4 + \varepsilon_i \tag{4.3}$$

where the *X* matrix contains transaction details, the *D* matrix contains consumer demographic characteristics, the I_1 matrix represents buyers' usage of information sources and the *B* matrix contains buyers' shopping behavior and attitude, including their negotiation skill and enjoyment of negotiation.

To estimate path a, we use Information type as the criterion variable in the regression equation and enjoyment of negotiation as a predictor (Baron & Kenny, 1986). Note that there are two types of information, price and non-price information. We test them separately in Equation (4.4) and (4.5) below:

$$\boldsymbol{Price\ Information} = \boldsymbol{X_i}\gamma_1 + \boldsymbol{D_i}\gamma_2 + \boldsymbol{I_{1i}}\gamma_3 + \boldsymbol{B_i}\gamma_4 + \varepsilon_i \tag{4.4}$$

$$\boldsymbol{Non-price\ Information} = \boldsymbol{X_i}\gamma_1 + \boldsymbol{D_i}\gamma_2 + \boldsymbol{I_{1i}}\gamma_3 + \boldsymbol{B_i}\gamma_4 + \varepsilon_i \tag{4.5}$$

where the *X* matrix, *D* matrix, I_1 matrix and *B* matrix are the same as defined previously.

To estimate path b and path c', we need to have both the information acquired and enjoyment of negotiation in the model. This is actually our Model 3, as represented by Equation (4.6):

$$\boldsymbol{Price} = \boldsymbol{X_i}\gamma_1 + \boldsymbol{D_i}\gamma_2 + \boldsymbol{I_{1i}}\gamma_3 + \boldsymbol{B_i}\gamma_4 + \varepsilon_i \tag{4.6}$$

where the *X* matrix, *D* matrix, I_1 matrix and *B* matrix are the same as defined previously.

Next, we summarize our results. The result from Model 2 (see **Table 4.3**) suggests that people who enjoy negotiation obtained a lower price (i.e., path c is significant). The results from Equation (4.4) and (4.5) (see **Table 4.6**) suggest that enjoyment of negotiation only affects the price information that the consumer acquired but not non-price information (i.e., path a is significant only for price information). The result from Model 3 suggests that both information types affect the price (i.e., path b is significant) and the effect of enjoyment of negotiation diminishes (path |c'| becomes not significant).

In summary, we conclude that the price information (but not non-price information) mediates the effect of enjoyment of negotiation on price.

We discuss how the enjoyment of negotiation affects the consumer's propensity to search for price information below. People do not enjoy negotiation perhaps because of two kinds of cost, i.e., the opportunity cost of time, and the cognitive/emotional cost. Both of them can lead to less search of information. First, as an individual's opportunity cost of time increases, it is more costly to search for information and hence it leads to less search (Ratchford & Srinivasan, 1993). Second, as suggested by the behavioral literature, higher emotional decision costs lead to avoidant behavior (Bettman, Luce, & Payne, 1998). Applied to our context, this suggests that, if consumers do not enjoy the negotiation process, they will engage less in information search, as the aversion may make spending time in searching the price information distasteful.

4.5.4 Results for Gross Margin (GM)

We replicate Models 1-4 for the other dependent variable, *GM*. As we discussed earlier, it represents the profitability of the transaction to the dealer. The results are shown in **Table 4.7**.

Compared to the results of the models on *Price*, most of the findings for *GM* are largely consistent, except for two relatively minor discrepancies. Although the effect of negotiation skill is consistently significant across both dependent variables, enjoyment of negotiation only influences *Price*. Note that *GM* does not account for the consumers' use of manufacturer rebate. As we discussed earlier, people who enjoy negotiation search for more price information, which can include manufacturer rebate, so that they get a lower price perhaps because of using the manufacturer rebate. Therefore, the effect of enjoyment of negotiation can be better reflected through *Price*, which accounts for the use of manufacturer rebate. The second discrepancy concerns the use of information sources. The use of the Internet influences both *GM* and *Price*, while the use of newspapers only influences *Price* but not *GM*. This may be explained by the fact that newspaper ads are generally used to inform consumers about the rebate and make them aware of the terms of the rebate, so that it has an effect on *Price*, which considers the rebate, but not *GM*, which does not consider the rebate.

Who Get a Better Deal. We explore a general question as for what kinds of consumers get a better "deal" in car price negotiation. We use *GM* to measure the negotiation outcome as it controls for the cost of the vehicle. **Table 4.8** reports the profile of car buyers, in terms of their information sources and their shopping behavior and attitude, at different levels of *GM*. A lower *GM* means the consumer obtained a better deal. The data suggests that consumers who get a better deal are on average collecting more information (especially price information), better negotiators, more price sensitive and do more research before purchase.

4.6 Conclusion

In this chapter we explore the determinants of negotiated prices using a rich dataset from the automobile market. Consistent with the literature, we find that information plays an important role in helping consumers get a better price. While previous studies focus on the Internet as a dominant information source, our research suggests that the role of newspapers as a traditional information source cannot be ignored. Particularly, it provides valuable information such as on rebates allowing consumers to identify better deals.

Our research also extends previous finding regarding the effect of the Internet on price. Our results confirm that consumers who use the Internet still pay a lower price but we point out that the saving is larger for consumers who obtain relatively more price information than non-price information. The data we use reveals some recent changes that have occurred in the marketplace: for example, information about how dealers set prices is associated with consumers getting a lower price, while information about the invoice of vehicles, perhaps being increasingly common knowledge, makes less difference in price paid. These results provide important implications to the dealers in strategies of information provision.

Our research examines the impact of bargaining behavior on price. We identify negotiation skill and attitude to be two distinct aspects of bargaining behavior as they influence price in different ways. While negotiation skill represents an innate ability to influence the opponent negotiator's decision, the effect of enjoyment of negotiation is mainly obtained through its influence on consumers' search for price information. People

who enjoy negotiation are more likely engage in searching for more price information and it is this information search behavior that leads to a lower price.

Note that, when we examine the effect of using the Internet on price, we concentrate on the information it offers to buyers. Therefore, we may ignore other factors that could potentially influence the negotiated price. First, the Internet removes important cues that salespeople can use to determine a consumer's willingness to pay (e.g., clothing, body language) and hence some consumers who have characteristics that indicate they are poor bargainers may benefit from purchasing online (Morton et al., 2003). Unfortunately, our data does not provide information that allows us to identify people who buy online. Secondly, the Internet can go beyond of offering information by changing the way of negotiation. As suggested by Zettelmeyer et al.(2006), the online buying services helps consumers obtain lower prices by exerting pressure on dealers.

In addition, some results from our models open new questions. The gross margin for the new car to the dealer seems to be also influenced by trade-in and the availability of manufacturer rebate. If consumers also trade in their used car while purchasing a new car, the dealer seems to charge a higher price on average. This may be because dealers tend to offer a more desirable price to consumers' used car while trying to profit from the new car. Another interesting phenomenon is that dealers charge a lower price when there is manufacturer rebate. This is counterintuitive as consumers are expected to engage in less negotiation if they already receive the rebate. It is possible that high-end cars offering rebate attract the more price sensitive consumers who would have bought low-end cars. We leave these questions to future research.

Figure 4.1: Mediation Analysis

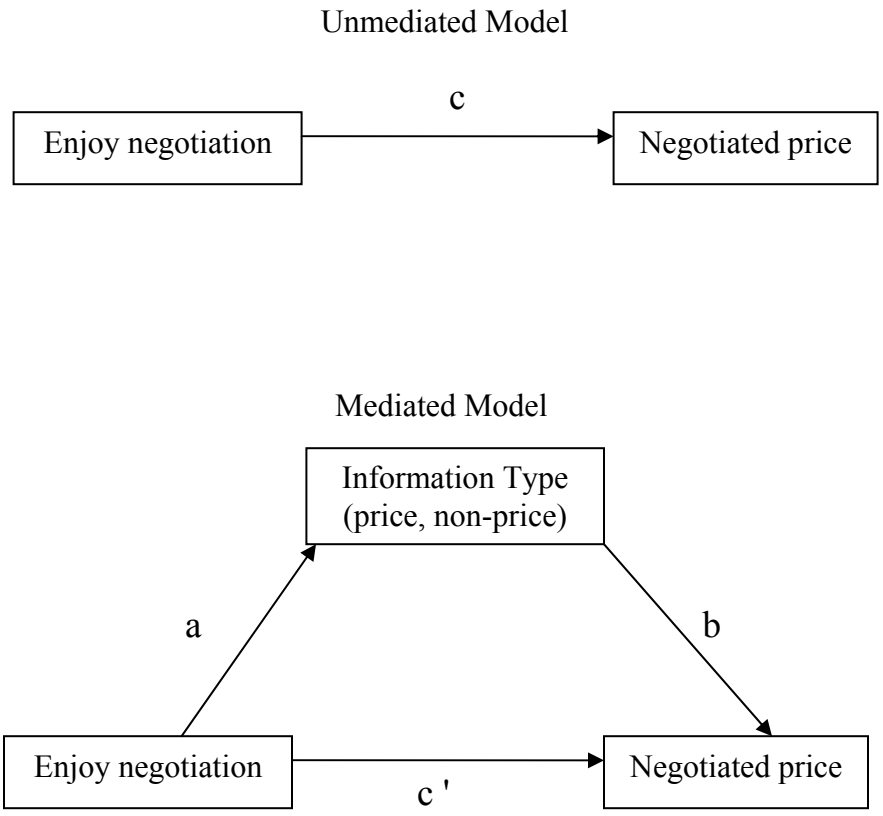


Table 4.1: Summary Statistics

	Observations	Mean	SD	Minimum	Maximum
Usage of Info Sources					
Internet	4176	.73	.44	.00	1.00
Newspapers	3380	.49	.50	.00	1.00
Magazine	3315	.44	.50	.00	1.00
Radio	3219	.35	.48	.00	1.00
TV	3458	.52	.50	.00	1.00
Demographic Variables					
Age	4097	50.64	15.10	17.00	88.00
Female	4299	.41	.49	.00	1.00
Education	4266	5.58	1.71	1.00	8.00
Income	3809	7.94	3.81	1.00	15.00
Nonwhite	4006	.16	.36	.00	1.00
Technical Competence	4042	2.01	.95	.00	3.00
Number of other model considered	4427	.89	.95	.00	3.00
Transaction and car variables					
Price	4427	28,801.51	12,571.34	8,915.81	160,000.00
Cost	4427	28,506.57	11,797.25	8,825.86	154,841.70
Gross Margin	4427	1,236.09	1,506.35	-3,204.35	24,481.35
Manufacturer rebate dummy	4427	.46	.50	.00	1.00
Trade-in dummy	4427	.32	.47	.00	1.00
Days to turn	4291	48.17	55.67	1.00	325.00
End of month	4427	.19	.40	.00	1.00
Weekend	4427	.27	.44	.00	1.00
Small city	4369	.46	.50	.00	1.00
Rural area	4369	.22	.42	.00	1.00

Notes: Education and income represent response categories. There are 8 categories for education: 8th grade or less, some high school, high school graduate, trade/technical school, some college, 4-year college degree, some graduate courses, advanced degree. There are 15 categories for income: under $25,000, $25,000-$29,999, then go in $10,000 increments for $30,000~$99,999, $250,000 increments for $100,000~$199,999, $200,000-$249,999, and $250,000 or more. The 'income' variable used in our analyses take the midpoint income level within each category.

Table 4.2: Negotiation Skill vs. Enjoyment

	Enjoy negotiation	Neutral	Not enjoy	**Total**
Good negotiator	657 (16%)	280 (7%)	811 (19%)	**1748 (42%)**
Neutral	102 (3%)	226 (5%)	576 (14%)	**904 (22%)**
Not good negotiator	98 (2%)	110 (3%)	1200 (30%)	**1408 (35%)**
Total	**857 (21%)**	**616 (15%)**	**2587 (63%)**	**4060 (100%)**

Table 4.3: Effects of Information and Negotiation skill/Enjoyment on Price

Dependent Variable = Price	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Internet	-342.9 (101.7)**	-472.2 (107.3)**	-479.9 (109.4)**	-485.6 (110.1)**
Newspapers	-282.5 (108.4)**	-234.9 (110.9)*	-240.1 (110.9)*	-240.1 (111.1)*
Magazine	25.8 (104.1)	21.2 (106.9)	13.5 (107.0)	39.0 (107.7)
Radio	34.2 (125.1)	47.1 (127.6)	56.9 (127.6)	41.0 (127.9)
TV	54.7 (107.9)	-7.1 (110.4)	-5.7 (110.4)	-17.3 (110.9)
Consumer shopping attitude				
good negotiator		-122.1 (35.0)**	-121.9 (34.9)**	-119.1 (35.1)**
enjoy negotiating with dealers		-68.3 (34.4)*	-65.6 (34.4)	-63.4 (34.5)
lowest price is more important		-62.4 (30.4)*	-61.9 (30.4)*	-58.4 (30.4)*
shop many dealers to get lowest price		9.5 (30.6)	10.3 (30.6)	10.2 (30.7)
spend lots of time shopping for car		13.3 (30.1)	14.2 (30.0)	15.7 (30.1)
researching a lot before visit dealer		53.5 (31.7)	54.1 (31.7)	56.1 (31.9)
Read enthusiast magazine		46.2 (29.8)	45.9 (29.8)	42.9 (29.8)
Enjoy shopping for car		72.6 (32.3)*	71.4 (32.4)*	69.6 (32.5)*
People ask me what car to buy		18.3 (31.7)	23.6 (31.7)	23.5 (31.8)
Dealers try to make customers happy		-13.9 (31.9)	-13.6 (32.1)	-11.3 (32.3)
Most car salespeople are truthful		30.3 (31.2)	29.0 (31.2)	28.0 (31.3)
Type of info on the internet				
Total price info			-74.7 (31.4)*	
How much dealers are discounting				-302.0 (120.0)*
Dealer cost/invoice				-24.0 (95.8)
Trade-in values				-99.5 (124.7)

Table 4.3: Effects of Information and Negotiation skill/Enjoyment on Price

List price with the options				32.1 (114.1)
Rebates and special offers				-91.5 (101.6)
Monthly payments				-50.2 (102.2)
Total non-price info			46.6 (20.0)*	
Brochure				234.7 (113.5)*
Options and features				179.7 (117.9)
Vehicle photographs				-68.3 (110.1)
Road tests and reviews				113.3 (134.2)
Dealer inventories				168.5 (104.5)
Reliability/dependability ratings				-28.7 (135.5)
Safety information				-88.1 (116.9)
Compare vehicles side-by-side				28.4 (115.3)
Information about dealers				-38.1 (102.2)
Consumer demographics				
Age	10.0 (3.4)**	8.9 (3.5)*	8.6 (3.5)*	8.7 (3.5)*
Age (above 65)	-300.4 (142.3)*	-282.4 (145.9)*	-265.7 (145.9)	-256.3 (146.4)
Female	119.3 (74.0)	140.5 (80.2)	145.6 (80.2)	153.8 (80.5)
Education	-22.6 (23.1)	-26.1 (23.9)	-26.1 (23.9)	-25.8 (24.1)
Income	-4.2 (2.2)*	-3.9 (2.2)	-3.8 (2.2)	-4.0 (2.2)
Income^2	.01 (.00)*	.01 (.00)*	.01 (.00)*	.01 (.00)*
Race (nonwhite)	87.7 (101.1)	92.0 (104.4)	91.3 (104.3)	95.5 (104.8)
Technical competence	51.2 (48.9)	65.4 (50.1)	66.1 (50.1)	69.4 (50.3)

Table 4.3: Effects of Information and Negotiation skill/Enjoyment on Price

Number of other vehicles considered	-14.1 (38.5)	-42.6 (40.2)	-44.0 (40.2)	-41.1 (40.3)
Transaction variables				
Cost	1.0 (.00)**	1.0 (.00)**	1.0 (.00)**	1.0 (.00)**
Manufacturer rebate flag	-2150.9 (87.7)**	-2144.3 (89.2)**	-2127.7 (89.4)**	-2131.5 (90.0)**
Trade-in flag	112.4 (75.9)	130.6 (77.6)	127.9 (77.6)	133.4 (77.9)
Days to turn	-1.9 (.7)**	-2.1 (.7)**	-2.2 (.7)**	-2.1 (.7)**
End of month	-138.5 (88.9)	-118.6 (90.2)	-122.2 (90.2)	-122.7 (90.5)
Weekend	120.9 (80.1)	135.5 (81.5)	125.0 (81.5)	108.7 (82.0)
Observations	2269	2183	2183	2183
Adjusted R-square	.983	.983	.983	.983

Note: [1] The above results did not report car and regional fixed effects

[2] * = p<.05; ** = p<.01. Standard errors are shown in parentheses.

Table 4.4: Expected Return of Using the Internet

Number of Buyers (% of Internet users)	Expected Return ($74.7 X # of price-info – $46.6 X # of non-price-info + $479.9)
490 (11.1%)	> $500
3587 (81.0%)	$400 ~ $500
214 (4.8%)	$300 ~ $399
132 (3.0%)	$0 ~ $299
4 (0.1%)	<$0

Table 4.5: Test the Moderation Effects of Negotiation Skill and Attitude

Dependent Variable = Price	**Model 5**
Information Sources	
Internet	-823.9 (230.9)**
Newspapers	-373.6 (215.2)
Magazine	25.8 (106.9)
Radio	50.4 (127.6)
TV	-6.5 (110.6)
Internet use X good negotiator	85.1 (76.3)
Newspapers X good negotiator	28.3 (65.0)
Internet use X enjoy negotiating with dealers	45.5 (70.0)
Newspapers X enjoy negotiating with dealers	20.5 (58.8)
Consumer shopping attitude	
good negotiator	-197.2 (73.9)**
enjoy negotiating with dealers	-113.7 (69.6)
lowest price is more important	-61.9 (30.4)*
shop many dealers to get lowest price	8.7 (30.6)
spend lots of time shopping for car	11.0 (30.1)
researching a lot before visit dealer	57.0 (31.8)
Read enthusiast magazine	46.4 (29.9)
Enjoy shopping for car	75.8 (32.4)*
People ask me what car to buy	17.0 (31.7)
Dealers try to make customers happy	-14.5 (32.0)
Most car salespeople are truthful	29.3 (31.2)

Table 4.5: Test the Moderation Effects of Negotiation Skill and Attitude

Consumer demographics	
Age	8.8 (3.5)*
Age (above 65)	-292.4 (146.0)*
Female	143.6 (80.3)
Education	-24.9 (24.0)
Income	-4.0 (2.2)
Income^2	.01 (.01)*
Race (nonwhite)	96.2 (104.5)
Technical competence	60.1 (50.2)
Number of other vehicles considered	-44.5 (40.3)
Transaction variables	
Cost	1.0 (.0)**
Manufacturer rebate flag	-2142.3 (89.2)**
Trade-in flag	135.2 (77.7)
Days to turn	-2.1 (.7)**
End of month	-112.5 (90.4)
Weekend	136.8 (81.5)
Observations	2183
Adjusted R-square	.983

Note: [1] The above results did not report car and regional fixed effects

[2] * = p<.05; ** = p<.01. Standard errors are shown in parentheses.

Table 4.6: Test the Mediation Effects of Information Types

	Model 6	**Model 7**
Dependent Variable	Price Info	Non-price Info
Internet	1.39 (.16)**	2.40 (.26)**
Newspapers	-.17 (.17)	-.16 (.26)
Magazine	.41 (.16)*	.83 (.25)**
Radio	.33 (.19)	.32 (.30)
TV	-.33 (.17)*	-.56 (.26)*
Consumer shopping attitude		
good negotiator	.02 (.05)	.04 (.08)
enjoy negotiating with dealers	.11 (.05)*	.12 (.08)
lowest price is more important	.05 (.05)	.07 (.07)
shop many dealers to get lowest price	-.05 (.05)	-.10 (.07)
spend lots of time shopping for car	-.00 (.04)	-.02 (.07)
researching a lot before visit dealer	.16 (.05)**	.24 (.08)**
Read enthusiast magazine	.07 (.05)	.11 (.07)
Enjoy shopping for car	-.16 (.05)**	-.23 (.08)**
People ask me what car to buy	.03 (.05)	-.07 (.08)
Dealers try to make customers happy	-.22 (.05)**	-.36 (.08)**
Most car salespeople are truthful	.10 (.05)*	.18 (.07)*
Consumer demographics		
Age	-.02 (.01)**	-.02 (.01)*
Age (above 65)	.30 (.22)	.13 (.35)
Female	.01 (.12)	-.09 (.19)
Education	.06 (.04)	.09 (.06)

Table 4.6: Test the Mediation Effects of Information Types

Income	.00 (.00)	-.00 (.01)
Income^2	-.00 .00	-.00 (.00)
Race (nonwhite)	-.08 (.16)	-.11 (.24)
Technical competence	.20 (.08)**	.31 (.12)*
Number of other vehicles considered	-.01 (.06)	.01 (.10)
Transaction variables		
Cost	.00 (.00)	.00 (.00)
Manufacturer rebate flag	.03 (.14)	-.31 (.21)
Trade-in flag	-.04 (.12)	.00 (.18)
Days to turn	.00 (.00)	.00 (.00)
End of month	-.20 (.14)	-.25 (.21)
Weekend	-.17 (.12)	-.04 (.19)
Observations	2183	2183
Adjusted R-square	.138	.146

Note: [1] The above results did not report car and regional fixed effects

[2] * = p<.05; ** = p<.01. Standard errors are shown in parentheses.

Table 4.7: Effects of Information and Negotiation skill/Enjoyment on Gross Margin

Dependent Variable = Gross Margin	**Model 8**	**Model 9**	**Model 10**	**Model 11**
Internet	-228.6 (87.4)**	-286.1 (92.6)**	-282.3 (94.5)**	-282.8 (95.0)**
Newspapers	-120.1 (93.3)	-56.0 (95.8)	-60.3 (95.8)	-49.4 (95.9)
Magazine	-57.5 (89.5)	-76.5 (92.1)	-78.0 (92.3)	-64.9 (92.8)
Radio	129.0 (107.5)	129.5 (109.9)	136.8 (109.9)	121.5 (110.2)
TV	14.7 (92.7)	-28.5 (95.1)	-29.7 (95.2)	-37.8 (95.5)
Consumer shopping attitude				
good negotiator		-100.2 (30.1)**	-100.0 (30.1)**	-99.3 (30.2)**
enjoy negotiating with dealers		-40.0 (29.6)	-37.9 (29.6)	-34.4 (29.7)
lowest price is more important		-70.5 (26.1)**	-69.9 (26.1)**	-64.6 (26.2)*
shop many dealers to get lowest price		-13.3 (26.4)	-13.1 (26.4)	-16.5 (26.5)
spend lots of time shopping for car		-11.4 (25.9)	-10.8 (25.9)	-7.3 (25.9)
researching a lot before visit dealer		47.0 (27.3)	48.3 (27.4)	47.2 (27.4)
Read enthusiast magazine		30.6 (25.6)	30.8 (25.6)	27.8 (25.7)
Enjoy shopping for car		78.9 (27.9)**	77.3 (27.9)**	75.6 (28.0)**
People ask me what car to buy		31.2 (27.3)	34.3 (27.4)	35.6 (27.4)
Dealers try to make customers happy		-25.5 (27.5)	-26.6 (27.7)	-28.3 (27.8)
Most car salespeople are truthful		51.4 (26.9)	51.2 (26.9)	49.7 (26.9)
Type of info on the internet				
Total price info			-47.4 (27.1)	
How much dealers are discounting				-184.7 (103.4)
Dealer cost/invoice				-40.9 (82.5)
Trade-in values				-125.3 (107.3)

Table 4.7: Effects of Information and Negotiation skill/Enjoyment on Gross Margin

List price with the options				19.6 (98.2)
Rebates and special offers				-89.0 (87.4)
Monthly payments				53.4 (88.1)
Total non-price info			25.8 (17.3)	
Brochure				277.8 (97.7)**
Options and features				116.4 (101.4)
Vehicle photographs				-83.7 (94.8)
Road tests and reviews				23.5 (115.6)
Dealer inventories				70.0 (89.9)
Reliability/dependability ratings				140.0 (116.8)
Safety information				-211.8 (100.7)*
Compare vehicles side-by-side				86.8 (99.2)
Information about dealers				-35.6 (88.0)
Consumer demographics				
Age	8.1 (2.9)**	7.5 (3.0)*	7.2 (3.0)*	7.4 (3.0)*
Age (above 65)	-123.8 (122.2)	-135.5 (125.6)	-124.6 (125.7)	-116.9 (126.0)
Female	39.8 (63.6)	66.0 (69.1)	69.0 (69.1)	73.2 (69.4)
Education	-35.4 (19.9)	-39.8 (20.6)*	-39.4 (20.6)*	-36.7 (20.7)
Income	-1.4 (1.9)	-1.6 (1.9)	-1.5 (1.9)	-1.8 (1.9)
Income^2	.01 (.01)*	.01 (.01)*	.01 (.01)*	.02 (.01)*
Race (nonwhite)	23.8 (86.9)	44.8 (89.9)	44.0 (89.9)	41.9 (90.2)
Technical competence	50.1 (42.0)	52.7 (43.2)	54.3 (43.2)	59.5 (43.3)

Table 4.7: Effects of Information and Negotiation skill/Enjoyment on Gross Margin

Number of other vehicles considered	-34.5 (33.1)	-50.8 (34.6)	-51.7 (34.6)	-46.9 (34.7)
Transaction variables				
Manufacturer rebate	-.03 (.03)	-.02 (.04)	-.02 (.04)	-.02 (.04)
Manufacturer rebate flag	-266.0 (98.9)**	-275.4 (100.8)**	-269.8 (100.8)**	-271.8 (101.0)**
Trade-in flag	186.3 (65.3)**	194.1 (66.9)**	192.2 (66.9)**	201.6 (67.1)**
Days to turn	-1.1 (.6)*	-1.3 (.6)*	-1.3 (.6)*	-1.3 (.6)*
End of month	-92.4 (76.5)	-72.9 (77.7)	-76.2 (77.7)	-74.1 (77.9)
Weekend	59.2 (68.8)	73.1 (70.2)	66.4 (70.3)	49.2 (70.6)
Observations	2269	2183	2183	2183
Adjusted R-square	.100	.114	.115	.117

Note: [1] The above results did not report car and regional fixed effects

[2] * = p<.05; ** = p<.01. Standard errors are shown in parentheses.

[3] Multicollinearity Analysis: VIF ranges from 1.09 to 5.90, which suggests multicollinearity is not a concern.

Table 4.8: Buyer Profile at Different Profitability Levels of Negotiation Outcome

	Gross Margin			
	< 25% Quantile	**25%~50% Quantile**	**50%~75% Quantile**	**> 75% Quantile**
Information Variables				
price information	1.28	1.21	1.12	0.96
non-price information	2.03	2.01	1.91	1.71
Shopping Variables				
good negotiator	3.22	3.11	3.05	2.93
enjoy negotiating with dealers	2.29	2.17	2.17	2.22
lowest price is more important	2.96	2.86	2.67	2.55
shop many dealers to get lowest price	3.01	2.84	2.66	2.52
spend lots of time shopping for car	3.46	3.33	3.36	3.24
researching a lot before visit dealer	3.31	3.23	3.25	3.10
Read enthusiast magazine	2.19	2.07	2.19	2.27
Enjoy shopping for car	2.33	2.27	2.36	2.45
People ask me what car to buy	2.59	2.49	2.51	2.56
Dealers try to make customers happy	3.11	3.15	3.19	3.24
Most car salespeople are truthful	2.55	2.65	2.62	2.77

Note: All shopping variables are in a 5-point scale: 1 = Don't feel that way at all, 5 = That's exactly how I feel.

Table 4.9: Pairwise Correlation Matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1.Internet																			
2.Newspapers	.02																		
3.Magazine	.05	.63																	
4.Radio	.05	.74	.70																
5.TV	.04	.67	.66	.73															
6.Good negotiator	.06	.04	.03	.03	.02														
7.Enjoy negotiating with dealers	-.03	.06	.05	.03	.06	.44													
8.Lowest price is more important	.04	.04	.02	.01	.01	.25	.11												
9.Shop many dealers to get lowest price	.11	.09	.07	.06	.08	.27	.17	.38											
10.Spend lots of time shopping for car	.27	.06	.07	.05	.05	.12	.09	.02	.24										
11.Researching a lot before visit dealer	.39	.08	.12	.08	.10	.19	.11	.11	.27	.45									
12.Read enthusiast magazine	.09	.06	.18	.06	.08	.21	.23	.08	.11	.14	.23								
13.Enjoy shopping for car	.01	.03	.06	.03	.06	.26	.51	.02	.10	.10	.13	.30							
14.People ask me what car to buy	.10	.03	.09	.05	.06	.36	.36	.09	.16	.15	.23	.40	.29						
15.Dealers try to make customers happy	-.10	.00	-.02	-.03	.02	.06	.20	-.07	-.05	-.09	-.05	.03	.27	.04					
16.Most car salespeople are truthful	-.13	-.03	-.05	-.06	-.08	-.00	.07	-.20	-.25	-.11	-.22	-.05	.09	-.10	.29				
17.Price information (online)	.31	.03	.08	.08	.02	.07	.02	.04	.07	.14	.22	.07	-.03	.09	-.14	-.07			
18.Non-price information (online)	.32	.04	.09	.08	.02	.06	-.00	.03	.05	.14	.22	.07	-.04	.07	-.15	-.07	.90		
19.Price	.05	-.06	-.00	-.04	-.05	.07	.07	-.11	-.09	.03	.03	.11	.06	.10	.01	.07	.00	-.00	
20.Gross Margin	-.05	-.05	-.00	-.02	-.02	-.08	-.01	-.12	-.12	-.04	-.03	.05	.04	.02	.02	.05	-.04	-.02	.44

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APPENDIX

I. Proof of Lemma 1:

For a lot channel to have positive sales, at least one consumer should reach an agreement in negotiation with the salesperson, which requires, according to the Nash bargaining model, a nonnegative gain for both negotiators. Formally, it requires that there exist a pair $\{V, hc\}$, where $V \in [0,1]$ and $hc \in \{hc_l, hc_h\}$, such that $V - p^L - hc - D_C \geq 0$ and $B\left(p^L - M\right) \geq 0$. Substituting Equation (2.5) to p^L, the following must hold: (1) there exists a hc, where $hc \in \{hc_l, hc_h\}$, such that $p^I - hc - M \geq 0$, or (2) there exists a pair $\{V, hc\}$, where $V \in \left[hc + U_C, p^I + U_C\right)$ and $hc \in \{hc_l, hc_h\}$, such that $V - hc - U_C - M \geq 0$. Simplifying the above, it requires that there exists a hc, where $hc \in \{hc_l, hc_h\}$, such that $p^I - M \geq hc$. In this case, consumers with sufficiently high valuation, $V \in [hc + U_C + M, 1]$, will buy on the lot, other consumers will choose the outside option. However, no one buys on the Internet.

Then, for the Internet channel to have positive sales, there should be a hc such that $p^I \leq hc + M$. In this case, consumers with sufficiently high valuation, $V \in \left[p^I + U_C, 1\right]$, will buy on the Internet, others will choose the outside option and no one reaches an agreement on the lot.

In summary, receiving positive sales on the lot requires $p^I - M \geq hc$ and on the Internet requires $p^I \leq hc + M$. Obviously they can't hold together if hc is homogeneous. Therefore, it requires $0 < \beta < 1$ so that $hc \in \{hc_l, hc_h\}$. The prices should satisfy the following condition, $hc_l \leq p^I - M \leq hc_h$. In this case, the lot channel gets some low haggling-cost consumers and the web channel gets some high haggling-cost consumers.

II. Optimization Problems and Solutions under the Three Channel Structures

We derive below the optimization problems and solutions under the three channel structures. All the notations are the same as we define in the main body of the text.

Without the loss of generality, we assume that $U_C = 0, hc_l = 0$. In addition, we assume that $hc_h < 1 - C$, to ensure that, when the vehicle is sold at the lowest possible negotiated price (i.e., $p^L = C$), at least some high haggling cost consumers will buy on the lot.

(1) The Lot-only Channel

Consumers can either buy a car on the lot, at a negotiated price, or use an outside option, with the utility function defined as below:

$$U = \begin{cases} V - p^L - hc & \text{if the car is bought at the negotiated price; } hc \in \{0, hc_h\} \\ 0 & \text{if the outside option is exercised} \end{cases} \quad (2.A1)$$

where p^L maximizes the following expression, according to the Nash axiomatic approach

$$\underset{p^L}{Max}[V - p^L - hc - D_C]^{1-\alpha} \times [B(p^L - M) - D_S]^{\alpha} \quad (2.A2)$$

where $D_C = 0$, $D_S = 0$. This leads to

$$p^L = M + \alpha(V - hc - M) \quad (2.A3)$$

The salesperson receives a payment based on the same linear form as we define in the dual-channel case (Equation (2.2)):

$$\pi^S = A + B \cdot \alpha \left[\beta \int_{V=hc_h+M}^{V=1} (V - hc_h - M) dV + (1-\beta) \int_{V=U_C+M}^{V=1} (V - M) dV \right] \quad (2.A4)$$

The objective problem for the dealer is to maximize the profit from the lot, while ensuring the salesperson to receive a minimum payoff, U_S, from the job.

$$\underset{(A,B,M)}{Max}\ \pi = \int_{V \in F_V} [p^L - C - B(p^L - M)] - A \quad (2.A5)$$

Subject to

$$\pi^S \geq U_S \quad (2.A6)$$

Let λ be the Lagrange multiplier corresponding to (2.A6). The Lagrangean L for the problem (2.A5)-(2.A6) is:

$$L(A, B, M, \lambda) = \pi + \lambda(-U_S + \pi^S) \quad (2.A7)$$

In searching for the optimal contract structure, we focus on the case where the fixed salary component, A, is non-negative and the commission rate $B \in (0,1]$. We consider a compensation plan consisting of $\{B, M\}$ and $A=0$ (see the comparison of this plan and

alternative plan in Appendix III). This is because, when a salesperson is risk neutral, the fixed salary component, *A*, is not required and can be set to zero (e.g., Basu et al., 1985; Lazear & Rosen, 1981). As there is complete information, the dealer shall extract all the economic rent from the salesperson, which suggests that $\pi^S = U_S$.

Solving the first order condition $\partial L / \partial M = 0$ gives

$$M^* = \frac{1}{2-\alpha}\left[C + (1-\alpha)(1-\beta hc_h)\right] \tag{2.A8}$$

Then, the optimal quantity and profit are

$$Q^* = \frac{1}{2-\alpha}\left[1 - C - \beta hc_h\right] \tag{2.A9}$$

$$\pi^* = \frac{1}{2(2-\alpha)}\left[\begin{array}{l}(1-C)^2 - 2\beta hc_h(1-C) \\ +\beta hc_h^2\left(2\alpha(1-\beta) - \alpha^2(1-\beta) + \beta\right)\end{array}\right] - U_S \tag{2.A10}$$

The consumer surplus can be written as follows

$$\begin{aligned} W^* &= \beta\int_{hc_h+M^*}^{1}(1-\alpha)\left(V - M^* - hc_h\right)dV + (1-\beta)\int_{M^*}^{1}(1-\alpha)\left(V - M^*\right)dV \\ &= \frac{1-\alpha}{2(2-\alpha)^2}\left[(1-C)^2 - 2(1-C)\beta hc_h + \beta hc_h^2\left(4 - \alpha(1-\beta)(4-\alpha) - 3\beta\right)\right] \end{aligned} \tag{2.A11}$$

(2) The Dual-channel

Following the model description in the text, we rewrite the maximization problem for the dealer. Note that the price constraints in Lemma 1 need to be satisfied:

$$\underset{(p^I, A, B, M)}{Max}\ \pi = (p^I - C)q^I + \int_{V \in F_V}[p^L - C - B(p^L - M)] - A \tag{2.A12}$$

Subject to

$$\pi^S \geq U_S \tag{2.A13}$$

$$0 \leq p^I - M \tag{2.A14}$$

$$p^I - M \leq hc_h \tag{2.A15}$$

Let $\lambda_1, \lambda_2, \lambda_3$ be the Lagrange multipliers corresponding to (2.A13)-(2.A15), respectively. The Lagrangean *L* for the problem (2.A12)-(2.A15) is:

$$\begin{aligned} L(p^I, A, B, M, \lambda_1, \lambda_2, \lambda_3) = \pi^D &+ \lambda_1\left(-U_S + \pi^S\right) + \lambda_2\left(p^I - M\right) \\ &+ \lambda_3\left(hc_h - p^I + M\right) \end{aligned} \tag{2.A16}$$

Again, we confine our analysis to the case where $B \in (0,1]$. Also, complete information assumption suggests $\pi^S = U_S$. The Lagrangean L can be rewritten as

$$L'(p^I, M, \lambda_2, \lambda_3) = \pi^D + \lambda_2\left(p^I - M\right) + \lambda_3\left(hc_h - p^I + M\right) \tag{2.A17}$$

The first order conditions are

$$\partial L / \partial p^I = 0 \Rightarrow p^I = \frac{\alpha + (1-\alpha)\beta + \beta C + \lambda_2 - \lambda_3}{\alpha(1-\beta) + 2\beta} \tag{2.A18}$$

$$\partial L / \partial M = 0 \Rightarrow M = \frac{(1-\alpha+C)(1-\beta) - \lambda_2 + \lambda_3}{(1-\beta)(2-\alpha)} \tag{2.A19}$$

$$p^I - M \geq 0, \quad \lambda_2 \geq 0, \quad \textit{with complementary slackness} \tag{2.A20}$$

$$hc_h - p^I + M \geq 0, \quad \lambda_3 \geq 0, \quad \textit{with complementary slackness} \tag{2.A21}$$

The above conditions suggest four possible patterns of equations and inequalities. First, we can immediately eliminate the combination that $p^I - M = 0$ and $hc_h - p^I + M = 0$, as $hc_h > 0$.

Second, we consider $p^I - M = 0, \lambda_2 > 0, hc_h - p^I + M > 0, \lambda_3 = 0$. However, this is also ruled out as $p^I - M = \frac{\alpha(1-C)(1-\beta) + 2\lambda_2}{(2-\alpha)(1-\beta)\left[\alpha(1-\beta) + 2\beta\right]} \neq 0$.

Third, we consider $p^I - M > 0, \lambda_2 = 0, hc_h - p^I + M > 0, \lambda_3 = 0$. It gives the solutions below

$$p^{I*} = \frac{\alpha + \beta - \alpha\beta + \beta C}{\alpha(1-\beta) + 2\beta} \tag{2.A22}$$

$$M^* = \frac{1-\alpha+C}{2-\alpha} \tag{2.A23}$$

$$Q^* = \frac{(1-C)\left(2\beta + \alpha(1-2\beta)\right)}{(2-\alpha)\left(\alpha(1-\beta) + 2\beta\right)} \tag{2.A24}$$

$$\pi^* = \frac{(1-C)^2(\alpha - 2\alpha\beta + 2\beta)}{2(2-\alpha)(\alpha - \alpha\beta + 2\beta)} - U_S \tag{2.A25}$$

Note that, $hc_h - p^I + M > 0$ suggests that $hc_h > \frac{\alpha(1-C)}{(2-\alpha)\left(\alpha(1-\beta) + 2\beta\right)}$.

The consumer surplus in this case is

$$W^* = (1-\beta)\left(\int_{p^{I*}}^{1} \left(V - \alpha p^{I*} - (1-\alpha) M^*\right) dV + \int_{M^*}^{p^{I*}} (1-\alpha)\left(V - M^*\right) dV \right) + \beta \int_{p^{I*}}^{1} \left(V - p^{I*}\right) dV \quad \text{(2.A26)}$$

$$= \frac{(1-C)^2 \left[4\beta^2 + 4\alpha\beta(1-2\beta) + \alpha^2 \left(1 - 7\beta + 7\beta^2\right) - \alpha^3 (1-2\beta)(1-\beta) \right]}{2(2-\alpha)^2 \left(\alpha(1-\beta) + 2\beta\right)^2}$$

Last, we consider $p^I - M > 0, \lambda_2 = 0, hc_h - p^I + M = 0, \lambda_3 > 0$. It gives the solutions below

$$p^{I*} = \frac{1}{2}\left[1 + C - (\alpha - 2)(1-\beta) hc_h\right] \quad \text{(2.A27)}$$

$$M^* = \frac{1}{2}\left[1 + C - (\alpha + 2\beta - \alpha\beta) hc_h\right] \quad \text{(2.A28)}$$

$$Q^* = \frac{1}{2}\left(1 - C + \alpha(1-\beta) hc_h\right) \quad \text{(2.A29)}$$

$$\pi^* = \frac{1}{4}\left[(1-C)^2 + 2\alpha(1-C)(1-\beta) hc_h - (2-\alpha)(\alpha - \alpha\beta + 2\beta)(1-\beta) hc_h^2 \right] - U_S \quad \text{(2.A30)}$$

Note that, in this case $hc_h \le \dfrac{\alpha(1-C)}{(2-\alpha)(\alpha(1-\beta)+2\beta)}$.

The consumer surplus in this case is

$$W^* = (1-\beta)\left(\int_{p^{I*}}^{1} \left(V - \alpha p^{I*} - (1-\alpha) M^*\right) dV + \int_{M^*}^{p^{I*}} (1-\alpha)\left(V - M^*\right) dV \right) + \beta \int_{p^{I*}}^{1} \left(V - p^{I*}\right) dV \quad \text{(2.A31)}$$

$$= \frac{1}{8}\left[(1-C)^2 - 2(1-C)\alpha(1-\beta) hc_h + (1-\beta)\left(4\alpha(1-2\beta) - 3\alpha^2(1-\beta) + 4\beta\right) hc_h^2 \right]$$

(3) The Web-only Channel

Consumers can either buy a car on the Internet or use an outside option, with the utility function defined as below:

$$U = \begin{cases} V - p^I & \text{if the car is bought at the no-haggle Internet price} \\ 0 & \text{if the outside option is exercised} \end{cases} \quad \text{(2.A32)}$$

Consumers with sufficiently high valuation, i.e., $V \in [p^I, 1]$, will buy the car on the Internet, otherwise choose the outside option. Note that consumers' haggling cost is irrelevant in this case, since buying on the Internet incurs no haggling cost.

The objective problem for the dealer is

$$\underset{p^I}{Max}\, \pi = \left(p^I - C\right)\left(1 - p^I\right) \tag{2.A33}$$

which yields the optimal price, quantity and profit as follows:

$$p^{I*} = (1+C)/2 \tag{2.A34}$$

$$Q^* = (1-C)/2 \tag{2.A35}$$

$$\pi = (1-C)^2/4 \tag{2.A36}$$

The consumer surplus is

$$W^* = \int_{p^I}^{1} \left(V - p^I\right) dV = \frac{1}{8}(1-C)^2 \tag{2.A37}$$

III. Comparison of Two Compensation Plans:

We compare two contracts: (i) a compensation plan consisting of $\{A, B\}$ and $M=C$; and (ii) a compensation plan consisting of $\{B, M\}$ and $A=0$. The following results are regarding the dual-channel. Same conclusion can be found in the lot-only channel.

(i) Let $M=C$, optimize $\{A, B\}$. Given $\partial\pi / \partial B < 0$, $B \in [0,1]$, then $A = U_S$, $B = 0$, and $p^I_{dual} = \dfrac{\alpha(1-\beta) + \beta(1+C)}{\alpha(1-\beta) + 2\beta}$. Then, $\pi_{\{A,B\}} = \dfrac{(1-C)^2(\alpha+\beta-\alpha\beta)^2 - 2\left(\alpha(1-\beta)+2\beta\right)U_S}{2\alpha(1-\beta)+4\beta}$.

(ii) Let $A = 0$, optimize $\{B, M\}$. The solutions are listed in Appendix II. When $hc_h > \dfrac{\alpha(1-C)}{(2-\alpha)\left(\alpha(1-\beta)+2\beta\right)}$, $\pi_{\{B,M\}} = \dfrac{(1-C)^2(\alpha - 2\alpha\beta + 2\beta)}{2(2-\alpha)(\alpha - \alpha\beta + 2\beta)} - U_S$. Compare the two profits: $\pi_{\{A,B\}} - \pi_{\{B,M\}} = -\dfrac{(1-C)^2(1-\alpha)^2(1-\beta)}{2(2-\alpha)} < 0$. When $hc_h \le \dfrac{\alpha(1-C)}{(2-\alpha)\left(\alpha(1-\beta)+2\beta\right)}$, $\pi_{\{B,M\}} = \dfrac{1}{4}\left[(1-C)^2 + 2\alpha(1-C)(1-\beta)hc_h - (2-\alpha)(\alpha-\alpha\beta+2\beta)(1-\beta)hc_h^2\right] - U_S$.

As $\pi_{\{A,B\}} - \pi_{\{B,M\}} \le -\frac{(1-C)^2(1-\alpha)^2(1-\beta)}{2(2-\alpha)} < 0$, the second contract is more profitable.

IV. Proof of Proposition 1:

Proof of Proposition 1(a). The optimal minimum acceptable prices in the dual-channel and lot-only channel are listed in Appendix II. We compare them with the dealer's cost.

In the lot-only channel, $M_{lot-only} - C = \frac{(1-\alpha)(1-C-hc_h)}{2-\alpha} > 0$. In the dual-channel, when $hc_h > \frac{\alpha(1-C)}{(2-\alpha)(\alpha(1-\beta)+2\beta)}$, $M_{dual} - C = \frac{(1-\alpha)(1-C)}{2-\alpha} > 0$; otherwise $M_{dual} - C = \frac{1}{2}\left[1-C-(\alpha-\alpha\beta+2\beta)hc_h\right] \ge \frac{(1-\alpha)(1-C)}{2-\alpha} > 0$.

In both cases, we have $\frac{\partial(M-C)}{\partial\alpha} \propto \frac{\partial((1-\alpha)/(2-\alpha))}{\partial\alpha} = -\frac{1}{(2-\alpha)^2}$.

Proof of Proposition 1(b). When $hc_h > \frac{\alpha(1-C)}{(2-\alpha)(\alpha(1-\beta)+2\beta)}$,

$M_{dual} - M_{lot-only} = \frac{(1-\alpha)\beta hc_h}{2-\alpha} > 0$. Otherwise,

$M_{dual} - M_{lot-only} = \frac{(1-\alpha)(1-C)\alpha\beta}{(2-\alpha)^2(\alpha-\alpha\beta+2\beta)} > 0$.

V. Proof of Proposition 3:

Under the dual-channel, consumers who buy on the lot all have low haggling cost and their valuation is in the range $V \in [M_{dual}, 1]$ (see **Table 2.2**). Given that the negotiated price is a non-decreasing function with respect to V (Equation (2.5)), the dispersion of negotiated prices $Disp_{dual} = \alpha\left(p^I{}_{dual} - M_{dual}\right)$. Under the lot-only channel, consumers who buy on the lot include both the high-haggling-cost consumers,

with $V \in \left[hc_h + M_{lot-only}, 1 \right]$, and the low-haggling-cost consumers, with $V \in \left[M_{lot-only}, 1 \right]$. Given that the negotiated price is a non-decreasing function in V (Equation (2.A3)), the dispersion of negotiated prices $Disp_{lot-only} = \alpha\left(1 - M_{lot-only}\right)$. We then compare the dispersions under the two channel structures,

$$\Delta Disp = Disp_{dual} - Disp_{lot-only} = \alpha\left(p^I{}_{dual} - M_{dual} - 1 + M_{lot-only} \right) \qquad (2.A38)$$

Consider two situations: (1) when $hc_h > \dfrac{\alpha(1-C)}{(2-\alpha)\left(\alpha(1-\beta)+2\beta\right)}$, Equations (2.A8), (2.A22) and (2.A23) give

$$\Delta Disp = \frac{-\alpha\beta\left[(1-C)(2-\alpha)+(1-\alpha)\left(\alpha(1-\beta)+2\beta\right)hc_h\right]}{(2-\alpha)\left(\alpha(1-\beta)+2\beta\right)} < 0, \qquad (2.A39)$$

(2) when $hc_h < \dfrac{\alpha(1-C)}{(2-\alpha)\left(\alpha(1-\beta)+2\beta\right)}$, Equations (2.A8), (2.A27) and (2.A28) give

$$\Delta Disp = \frac{\alpha}{(2-\alpha)}\left[-(1-C)+\left(2-\alpha-\beta+\alpha\beta\right)hc_h\right] \qquad (2.A40)$$

The range of hc_h suggests that $-(1-C)+\left(2-\alpha-\beta+\alpha\beta\right)hc_h < 0$, or $\Delta Disp < 0$.

VI. Proof of Proposition 4:

When $hc_h > \dfrac{\alpha(1-C)}{(2-\alpha)\left(\alpha(1-\beta)+2\beta\right)}$, Equations (2.A22) and (2.A34) give that

$\Delta p^I = p^I_{dual} - p^I_{web-only} = \dfrac{\alpha(1-C)(1-\beta)}{2\alpha(1-\beta)+4\beta} > 0$. Also, $\partial \Delta p^I / \partial \beta < 0$.

When $hc_h \le \dfrac{\alpha(1-C)}{(2-\alpha)\left(\alpha(1-\beta)+2\beta\right)}$, Equations (2.A27) and (2.A34) give that

$\Delta p^I = p^I_{dual} - p^I_{web-only} = \dfrac{1}{2}(1-\beta)(2-\alpha)hc_h > 0$. Also, $\partial \Delta p^I / \partial \beta < 0$.

VII. Demand Comparison:

The demand under the three channel structures are listed in Appendix II.

Dual channel vs. lot-only channel (M>C). (1) When $hc_h > \frac{\alpha(1-C)}{(2-\alpha)(\alpha(1-\beta)+2\beta)}$, $Q_{lot-only} - Q_{dual} = \frac{\beta\left[\alpha(1-C)-(\alpha(1-\beta)+2\beta)hc_h\right]}{(2-\alpha)(\alpha(1-\beta)+2\beta)}$. Therefore, $Q_{dual} < Q_{lot-only}$ if $hc_h < \frac{\alpha(1-C)}{\alpha(1-\beta)+2\beta}$. (2) When $hc_h \le \frac{\alpha(1-C)}{(2-\alpha)(\alpha(1-\beta)+2\beta)}$, $Q_{lot-only} - Q_{dual} = \frac{\alpha(1-C)-\left[\alpha(1-\beta)(2-\alpha)+2\beta\right]hc_h}{(2-\alpha)(\alpha(1-\beta)+2\beta)}$. Suppose $Q_{dual} \ge Q_{lot-only}$, then $hc_h \ge \frac{\alpha(1-C)}{\alpha(1-\beta)(2-\alpha)+2\beta}$. However, this is impossible given the range of hc_h. Therefore, $Q_{dual} < Q_{lot-only}$ must hold. In summary, the demand in the dual-channel is lower than that in the lot-only channel if $hc_h < \frac{\alpha(1-C)}{\alpha(1-\beta)+2\beta}$.

Dual channel vs. lot-only channel (M=C). $Q_{lot-only} = 1-C-\beta hc_h$, $Q_{dual} = 1-C-\beta\left(p^I_{dual}+C\right)$. Recall Lemma 1, $p^I_{dual} \le hc_h + M = hc_h + C$. Therefore, $Q_{lot-only} \le Q_{dual}$. In other words, when *M*=*C*, the total demand in the dual-channel is never lower than that in the lot-only channel.

Dual channel vs. web-only channel. $Q_{web-only} - Q_{dual} = -\frac{(1-C)\alpha^2(1-\beta)}{2(2-\alpha)(\alpha(1-\beta)+2\beta)} < 0$.

In other word, the demand in the dual-channel is always higher than that in the web-only channel.

VIII. Introducing competition

This appendix describes the competition model in section 2.4.1. We assume the consumer market remains the same as in our main model. Consumers have three choices with the utility function specified in Equation (2.1). The lot dealer's optimization problem is

$$\underset{(A,B,M)}{Max}\ \pi = \int_{V\in F_V} [p^L - C - B(p^L - M)] - A \qquad (2.A41)$$

Subject to

$$\pi^S \geq U_S \tag{2.A42}$$

Let λ be the Lagrange multiplier corresponding to (2.A42). The Lagrangean L for the problem (2.A41)-(2.A42) is:

$$L(A,B,M,\lambda) = \pi + \lambda\left(-U_S + \pi^S\right) \tag{2.A43}$$

Again, we confine our analysis to the case where $B \in (0,1]$, and we know that $\pi^S = U_S$. Solving the first order condition $\partial L / \partial M = 0$ gives

$$M^* = \frac{1+C-\alpha}{2-\alpha} \tag{2.A44}$$

Next, we examine the web dealer's pricing decision. First, we can immediately eliminate the case $p^I > M + hc_h$, as the web dealer will have zero demand and hence he has an incentive to lower the Internet price such that $C \leq p^I \leq hc_h + M$ to get at least some high haggling cost consumers to buy. Therefore, it must hold that $p^I \leq hc_h + M$. The web dealer's optimization problem is

$$\underset{p^I}{Max}\, \pi_{web-only} = \left(p^I - C\right)\left(1 - p^I - U_C\right) \tag{2.A45}$$

Solving it yields the optimal price

$$p^I* = \begin{cases} (1+C)/2 & if \quad (1+C)/2 < hc_h + M \\ hc_h + M & if \quad (1+C)/2 \geq hc_h + M \end{cases} \tag{2.A46}$$

Applying (2.A44) to (2.A46) yields

$$p^I* = \begin{cases} (1+C)/2 & if \quad hc_h > \dfrac{\alpha(1-C)}{2(2-\alpha)} \\ hc_h + \dfrac{1+C-\alpha}{2-\alpha} & if \quad hc_h \leq \dfrac{\alpha(1-C)}{2(2-\alpha)} \end{cases} \tag{2.A47}$$

Then, when $hc_h > \dfrac{\alpha(1-C)}{2(2-\alpha)}$, the optimal quantity, profit and surplus are

$$Q^*_{web} = \frac{1}{2}(1-C)\beta \tag{2.A48}$$

$$Q^*_{lot} = \frac{(1-C)(1-\beta)}{2-\alpha} \tag{2.A49}$$

$$\pi_{web}^{*} = \frac{1}{4}(1-C)^2 \beta \tag{2.A50}$$

$$\pi_{lot}^{*} = \frac{1}{8(2-\alpha)}(1-C)^2\left(4-2\alpha+\alpha^2\right)(1-\beta)-U_S \tag{2.A51}$$

$$W^{*} = \frac{1}{8(2-\alpha)^2}(1-C)^2\left(4-\alpha^2(4-5\beta)+\alpha^3(1-\beta)-4\alpha\beta\right) \tag{2.A52}$$

When $hc_h \le \frac{\alpha(1-C)}{2(2-\alpha)}$, the optimal quantity, profit and surplus are

$$Q_{web}^{*} = \frac{\beta}{2-\alpha}\left[1-C-(2-\alpha)hc_h\right] \tag{2.A53}$$

$$Q_{lot}^{*} = \frac{1}{2-\alpha}(1-C)(1-\beta) \tag{2.A54}$$

$$\pi_{web}^{*} = \frac{1}{(2-\alpha)^2}\beta\left[(1-C)(1-\alpha)+(2-\alpha)hc_h\right]\left[1-C-(2-\alpha)hc_h\right] \tag{2.A55}$$

$$\pi_{lot}^{*} = \frac{1}{2(2-\alpha)^2}\begin{bmatrix} 2(1-C)(2-\alpha)\alpha(1-\beta)hc_h-(2-\alpha)^2\alpha(1-\beta)hc_h^2 \\ +2\left((1-C)^2(1-\alpha)(1-\beta)-(2-\alpha)^2U_S\right)\end{bmatrix} \tag{2.A56}$$

$$W^{*} = \frac{1}{2(2-\alpha)^2}\begin{bmatrix} (1-C)^2-2(1-C)(2-\alpha)\left(\alpha(1-\beta)+\beta\right)hc_h \\ +(2-\alpha)^2\left(\alpha(1-\beta)+\beta\right)hc_h^2\end{bmatrix} \tag{2.A57}$$

IX. Results for the model considering the salesperson's effort choice

The determination of the salesperson's effort level. Given the salesperson's objective function (Equation (2.2)) and the relationship between e and α as specified in section 2.4.2, the salesperson will choose high effort e_h over low effort e_l for a consumer with characteristics $\{V, hc\}$ only if

$$
\begin{aligned}
&A+B\left(E\left[\,p^L(V,e_h)\right]-M\right)-c(e_h) > A+B\left(E\left[\,p^L(V,e_l)\right]-M\right)-c(e_l)\\
&\Leftrightarrow \gamma_h B(p^L_{\alpha=\alpha_h}-M)+(1-\gamma_h)B(p^L_{\alpha=\alpha_l}-M)-e_h > \gamma_l B(p^L_{\alpha=\alpha_h}-M)+(1-\gamma_l)B(p^L_{\alpha=\alpha_l}-M)-e_l\\
&\Leftrightarrow \begin{cases}(\gamma_h-\gamma_l)B(\alpha_h-\alpha_l)(p^I-hc-M)-e_h+e_l>0 & \text{if } V \ge p^I+U_C\\ (\gamma_h-\gamma_l)B(\alpha_h-\alpha_l)(V-hc-U_C-M)-e_h+e_l>0 & \text{if } p^I+U_C \ge V \ge hc+U_C+M\end{cases} \qquad (2.A58)\\
&\Leftrightarrow \begin{cases}p^I \ge \dfrac{e_h-e_l}{B(\gamma_h-\gamma_l)(\alpha_h-\alpha_l)}+hc_l+M \equiv \widetilde{p^I} & \text{if } V \ge p^I+U_C\\ V \ge \dfrac{e_h-e_l}{B(\gamma_h-\gamma_l)(\alpha_h-\alpha_l)}+hc_l+U_C+M \equiv \widetilde{V} & \text{if } p^I+U_C \ge V \ge hc+U_C+M\end{cases}
\end{aligned}
$$

Simplifying the above shows that the salesperson spends high effort only if the following two conditions are satisfied: (a) $p^I \ge \widetilde{p^I}$ and (b) $V \ge \widetilde{V}$.

Below, we re-examine the propositions derived from the main model. For clarify, we add a prefix 'A' to denote the propositions for the model considering the salesperson's effort choice, e.g., Proposition A1, Proposition A2, etc. We start by deriving the optimal contract structure. Then, we present a set of results related to the dealer's pricing strategy. This is followed by the results for demand, channel profitability, and consumer welfare.

For the propositions that follow, we can prove some propositions on pricing and demand (Proposition A2, A3 &A5), but other results are not analytically tractable and therefore we employ a numerical procedure using the following parameter values: $\alpha_h = 1, \alpha_l = 0.5, \gamma_h = 0.9, \gamma_l = 0.1,\quad e_h = 0.002, e_l = 0,\ C = 0.9,\ U_C = 0, U_S = 0.0001$. We vary the values of β, hc_h and hc_l, therefore we focus our investigation on variations in the consumer market.

Optimal Compensation Plan. Same as in the main model, we restrict the fixed salary component, *A*, to be non-negative and allow the commission rate, *B*, to vary from 0 to 1. We present a numerical example in **Table 2.A1**. We focus on the component *M*. We summarize the results as follows:

Proposition A1(a). *Under both the lot-only channel and the dual-channel, it is optimal for the dealer to specify a minimum acceptable price that is greater than the marginal cost, i.e., M > C.*

Proposition A1(b). *The minimum acceptable price in a dual channel is higher than that in a lot-only channel.*

Proposition A1(a) and (b) are consistent with Proposition 1(a) and (b). However, when the salesperson's effort choice is considered, *M* has an additional effect: a higher *M* suppresses the salesperson's incentive to increase his effort level by potentially lowering the margin on which the commission is based. This can be found in **Table 2.A1**. $\widetilde{V_{hc\_l}}$ ($\widetilde{V_{hc\_h}}$) represents the valuation cut-off point of low-haggling (high-haggling) consumers at which point the salesperson switches from low to high effort. The marginal cost of the vehicle is set at \$18,000 and *M* is fixed either to be equal to *C* or allowed to be higher. We find that if $M > C$ then the consumer valuation cutoff points (e.g., V_{hc_l}=0.94 and $V_{hc\_h} = 0.99$) are higher than if $M = C$ (e.g., V_{hc_l}=0.92 and $V_{hc\_h} = 0.97$). This suggests that setting $M > C$ has an indirect negative impact on the bargaining price. However, in the range of parameter values we investigate, this negative impact is not large enough to offset the positive effect of forcing the salesperson to commit to a higher price due to the higher price floor (Proposition 1(a)).

The full numerical analysis yields **Figure 2.A1**. It indicates that the optimal $M>C$ as it leads to higher profits than that if $M=C$, in both the lot-only channel and the dual-channel.

Prices. We begin by asking whether prices on the web are higher or lower than those in the lot. We answer this with the following proposition

Proposition A2. *Under the dual-channel dealership, the no-haggle Internet price is higher than the price negotiated on the lot.*

Again, the proof can be directly derived from consumers' utilities (Equation (2.1)).

Next, we compare the dispersion of negotiated prices under the dual-channel and the lot-only channel. We find that:

Proposition A3. *The dispersion of prices in the lot for a dual-channel is lower than that in a lot-only channel.*

The proof is similar to Appendix V. As showed by Equation (2.A38), the difference of price dispersions is $\Delta Disp = Disp_{dual} - Disp_{lot-only} = \alpha\left(p^{I}{}_{dual} - M_{dual} - 1 + M_{lot-only} \right)$, which is negative given that $M_{dual} < M_{lot-only}$ (Proposition A1(b)).

Finally, we compare the Internet price in a dual-channel with that in a web-only channel. We present the following proposition:

Proposition A4. *The Internet price in the dual-channel is higher than that in a web-only channel.*

To see why this is the case, consider equation (2.5) and the relationship between e and α as specified in section 2.4.2. By differentiating equation (2.5) with respect to p^I, we obtain the following expression:

$$\frac{dp^L}{dp^I} = \alpha + p^I \frac{\delta \alpha}{\delta e} \frac{\delta e}{\delta p^I}. \tag{2.A59}$$

The first expression in equation (2.A59), α, captures the direct effect of an increase in p^I: as p^I goes up, the outside opportunity for certain consumers becomes less attractive, making them more dependent on the negotiated outcome. The salesperson can therefore take advantage of this and increase the negotiated price. The second expression in equation (2.A59), $p^I \frac{\delta \alpha}{\delta e} \frac{\delta e}{\delta p^I}$, captures the fact that a higher Internet price also induces a higher level of effort from the salesperson: as the possibility of charging a higher price on the lot increases with a higher p^I, the salesperson has an incentive to put in a greater level of effort in order to increase his surplus.

Demand. Next, we compare the optimal demand under the three channel structures. We present the following proposition:

Proposition A5. *The dual-channel does not necessarily generate higher demand than the single channel structure, when each operates optimally.*

We prove this by a numerical example which is showed in **Table 2.A2**. When $hc_h = 0.05$ (column 5 in **Table 2.A2**), we find that the total demand in the lot channel (0.62) is greater than that in the dual channel (0.60). This is also true for values of less $hc_h < 0.05$. However, if hc_h is not too low, i.e., $hc_h = 0.05$ in this example, then despite the lower demand, the higher web price and the resulting higher lot prices lead to higher profits in the dual channel.

In **Table 2.A2** the demand in the dual-channel is higher than that in the web-only channel, although the difference is smaller as hc_h goes down.

The full numerical analysis yields **Figure 2.A2**, which, consistent with the numerical example, indicates that even though initially both demand and profits are lower in the dual-channel, they eventually exceed those in the lot-only channel.

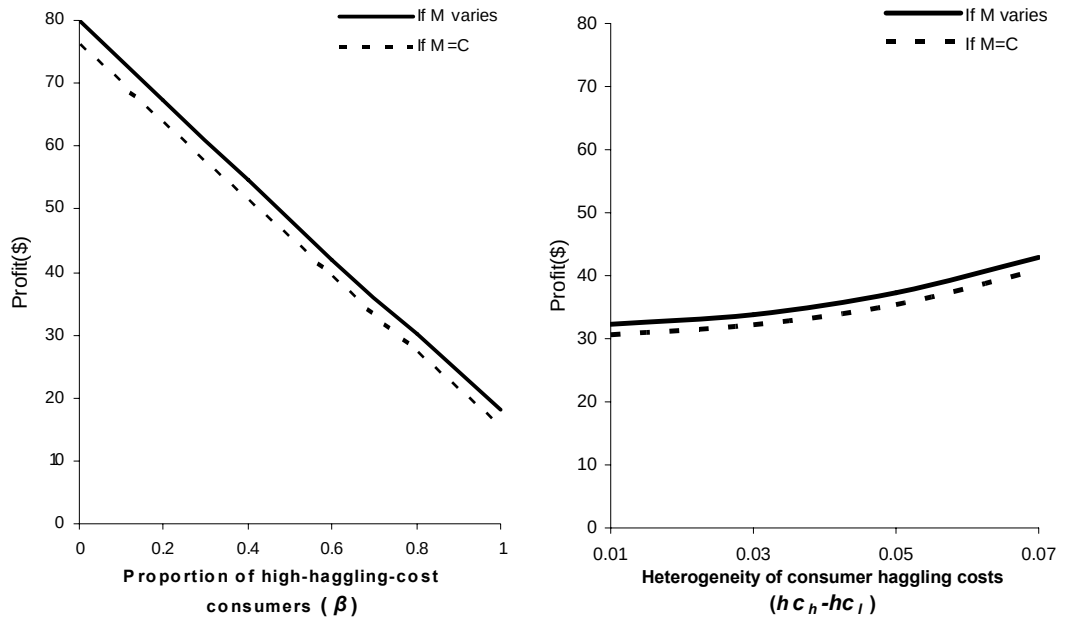
Profitability. Based on our numerical analysis we plot profit levels in each channel structure. **Figure 2.A3**(a) plots profits when the heterogeneity of haggling costs is given ($hc_h - hc_l = 0.05$) but the proportion of high haggling cost consumers, β, varies, while **Figure 2.A3**(b) shows profits with a fixed β (=0.5) and a varying $hc_h - hc_l$. The results from the numerical analysis lead to Proposition A6:

Proposition A6. *The dual channel is the most profitable structure when (a) there are enough high haggling-cost consumers but not too many and (b) when the difference in haggling costs between the two types of consumers is sufficiently high.*

Figure 2.A3(a) and (b) indicates that the dual channel is optimal when the range of the proportion of high haggling cost consumers ranges from 24-83%, and when there is sufficient heterogeneity in haggling costs between the two types of consumers, $hc_h - hc_l \geq 0.034$.

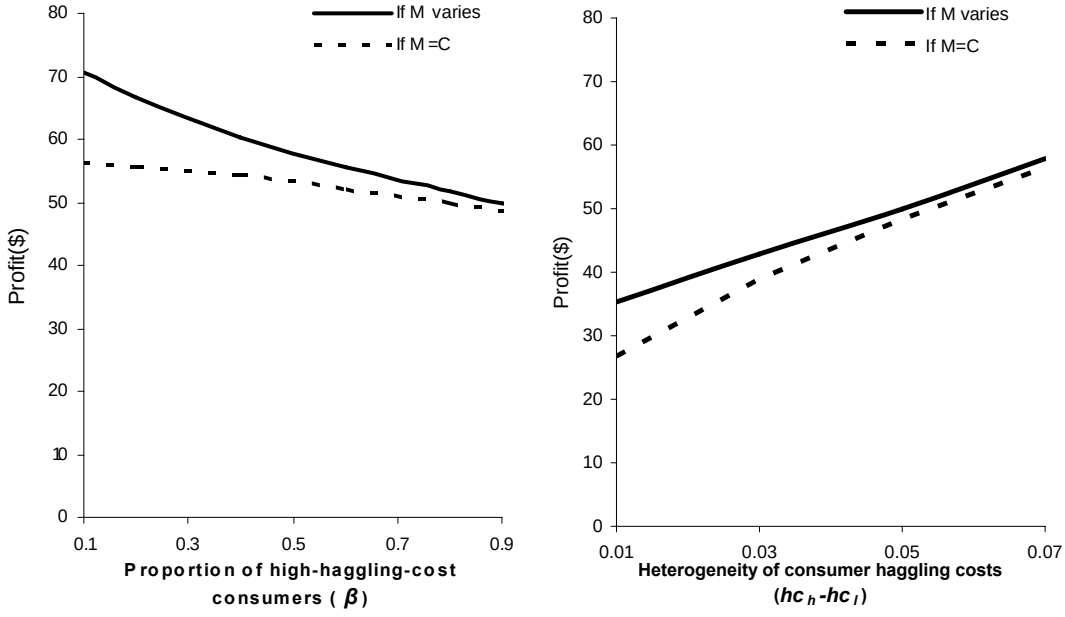
Consumer welfare. Finally, we examine consumer welfare under the three channel structures. From our numerical analysis, we obtain **Figure 2.A4**(a) and (b), which describes how consumer surplus is distributed among different consumers. Consistent with our finding in the main model, no one channel structure generates the highest level of consumer surplus for all consumers. Specifically, for low haggling-cost consumers with relatively low valuations (ranging from \$18,280 to \$18,850 in **Figure 2.A4**(a)), the lot-only channel generates the highest consumer welfare. For high valuation consumers, regardless of their haggling cost, the web-only channel generates the highest welfare (**Figure 2.A4**(b)). **Figure 2.A4**(c) summarizes the overall welfare from the three channels. Overall, the web-only channel generates the highest consumer welfare, the lot-only channel, while most commonly used in practice, generates the lowest and the dual channel stands in between.

Figure 2.A1: Profit Comparison – Variable vs. Fixed *M*



β varies, $hc_l = 0, hc_h = 0.05$ $\beta = 0.5$, hc_h and hc_l vary, $\frac{(hc_h + hc_l)}{2} = 0.035$

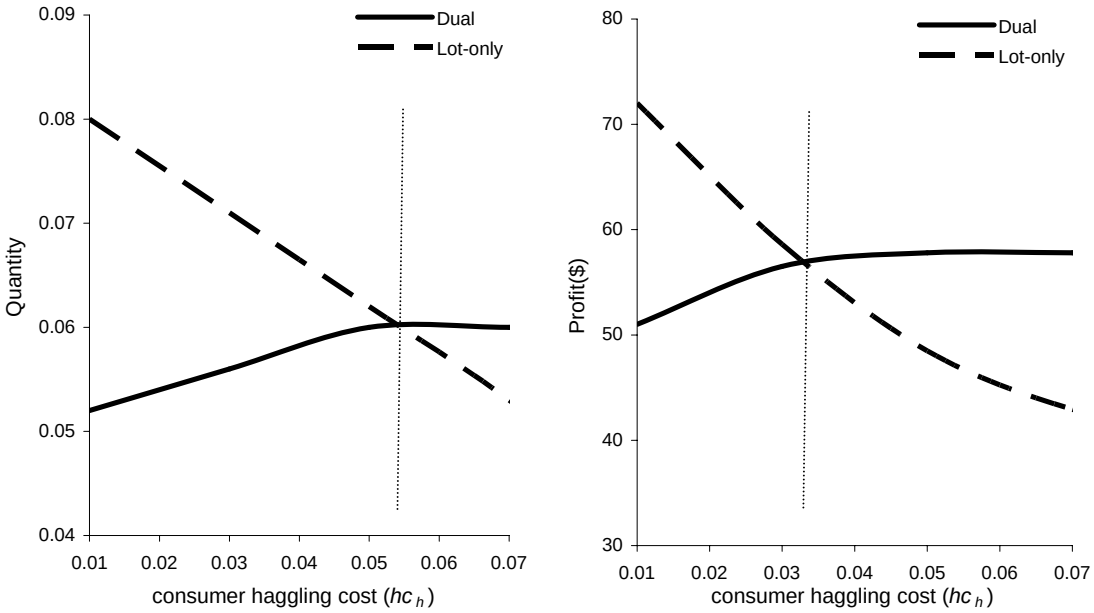
(a) Lot-only channel



β varies, $hc_l = 0, hc_h = 0.05$ $\beta = 0.5$, hc_h and hc_l vary, $\frac{(hc_h + hc_l)}{2} = 0.035$

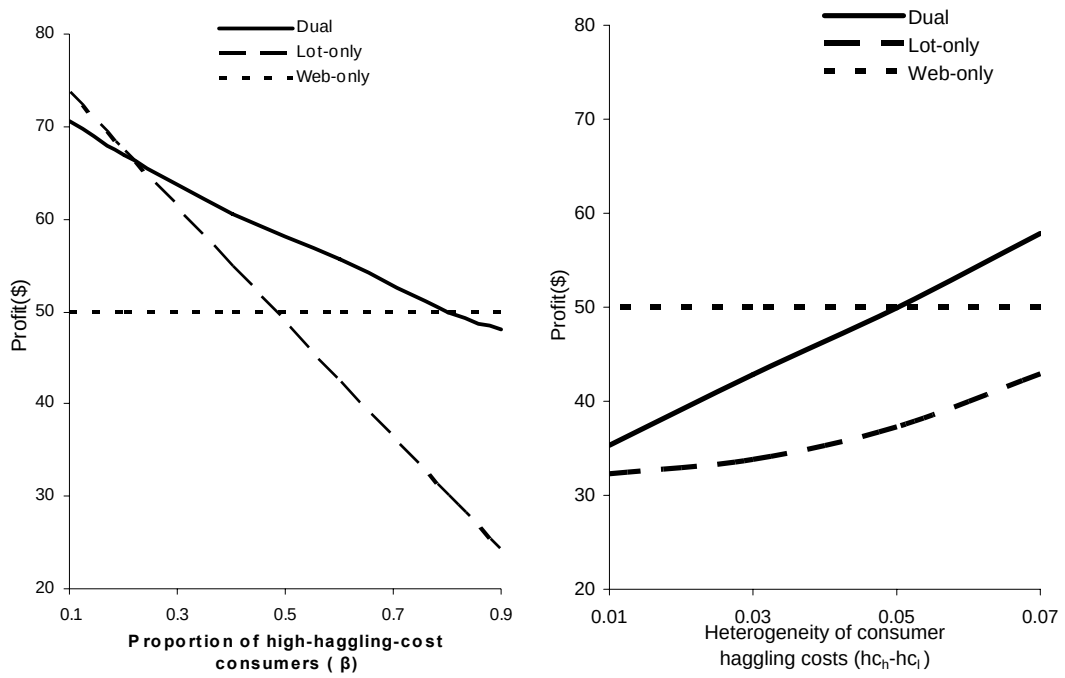
(b) Dual-channel

Figure 2.A2: Demand and Profit under Different Haggling Cost, hc_h



$(\beta = 0.5, hc_l = 0)$

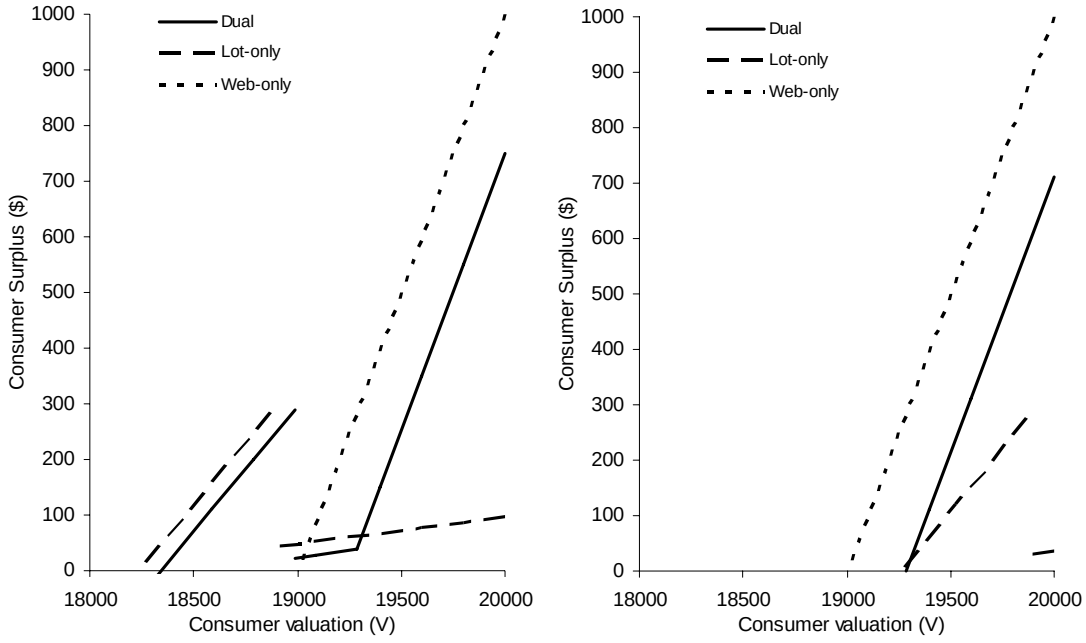
Figure 2.A3: **Profit Comparison across Three Channels**



(a) β varies, $hc_l = 0, hc_h = 0.05$

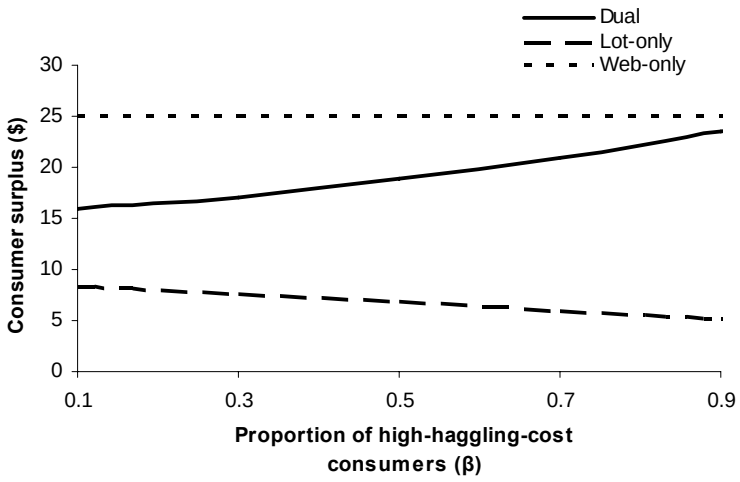
(b) $\beta = 0.5$, hc_h and hc_l vary, $(hc_h + hc_l)/2 = 0.035$

Figure 2.A4: Consumer Welfare



(a) Low Haggling Cost Consumers **(b) High Haggling Cost Consumers**

$(\beta = 0.5, hc_h = 0.05, hc_l = 0)$



-

(c): Total Consumer Welfare

$(hc_h = 0.05, hc_l = 0)$

Table 2.A1: The Impact of a Variable *M*

	Lot-only		**Dual channels**	
	Variable *M*	*M=C*	Variable *M*	*M=C*
A	\$0	\$0	\$0	\$0
B	0.16	0.14	0.15	0.13
M	\$18,255	\$18,000	\$18,323	\$18,000
Web price	--	--	\$19,288	\$19,000
$\widetilde{V_{hc\_l}}$	0.94	0.92	0.95	0.94
$\widetilde{V_{hc\_h}}$	0.99	0.97	--	--
Average negotiated price	\$18,881	\$18,729	\$19,032	\$18,773
Profit	\$49	\$46	\$58	\$53

($\beta = 0.5, hc_h = 0.05, hc_l = 0$)

Table 2.A2: Demand and Profit under Different Heterogeneities of Haggling Cost

	hc_h	**0.01**	**0.03**	**0.05**	**0.07**
Dual	Q_{dual}	0.052	0.056	0.060	0.060
	Q_{dual} from hc_l consumers	0.024	0.020	0.018	0.018
	Q_{dual} from hc_h consumers	0.028	0.036	0.042	0.042
	M	\$18,863	\$18,580	\$18,323	\$18,323
	p^I	\$19,063	\$19,180	\$19,288	\$19,288
	π_{dual}	\$51	\$56	\$58	\$58
Lot-only	$Q_{lot-only}$	0.080	0.071	0.062	0.053
	$Q_{lot-only}$ from hc_l consumers	0.037	0.028	0.019	0.009
	$Q_{lot-only}$ from hc_h consumers	0.043	0.043	0.043	0.044
	M	\$18,300	\$18,279	\$18,255	\$18,249
	$\pi_{lot-only}$	\$72	\$59	\$49	\$43
Web-only	$Q_{web-only}$	0.050	0.050	0.050	0.050
	p^I	\$19,000	\$19,000	\$19,000	\$19,000
	$\pi_{web-only}$	\$50	\$50	\$50	\$50

($hc_l = 0, \beta = 0.5$)

X. The List of Information Types

(1) Price-related information

- Dealer cost/invoice of new vehicle
- Trade-in values
- Tool to show how much dealers are discounting vehicles (transaction price)
- Tool to calculate the list price (MSRP) of a vehicle with the options you want
- Information about rebates and special offers
- Tool to calculate monthly payments at different interest rates

(2) Non-price information

- Options and features information (descriptions, gas mileage, etc)
- Vehicle photographs (exterior, interior, etc)
- Road tests and reviews about vehicles
- Search dealer inventories to find vehicles in stock
- Reliability/dependability ratings of vehicles
- Safety information (crash test results, etc)
- Compare vehicles side-by-side (standard equipment, prices, etc)[31]
- Information about dealers in your area (directions, hours, etc)
- Request or print brochure

Note: For each type of information, buyers indicated whether or not they found it online and, if so, where they found it (i.e., independent/dealership/manufacturer website).

XI. The List of Shopping Attitude and Behavior Items

- Compared to most people, I'm a very good negotiator
- I actually enjoy negotiating with dealers
- Getting the lowest price is more important to me than finding a dealer that provides friendly customer service
- I will shop as many dealers as it takes to get the absolute lowest price
- I spend very little time shopping for a vehicle

[31] Although this item is also related to price information, we think it less relevant as most tools online that allow for side-by-side comparison compare the prices of different models within one dealer rather than prices of the same model across dealers. Nonetheless, we check the model if we classify this information as price information and we found that the results are similar and do not change our conclusions.

- I spend many hours researching before I visit dealers
- I enjoy reading enthusiast magazines about cars and trucks
- I always enjoy shopping for a vehicle
- People often ask me for advice about what car to buy
- Most dealers try very hard to make sure their customers are happy
- Most car salespeople will lie to make a sale

Note: For each item, buyers indicate their agreement using a five-point scale that ranged from 1 = Don't feel that way at all to 5 = That's exactly how I feel.