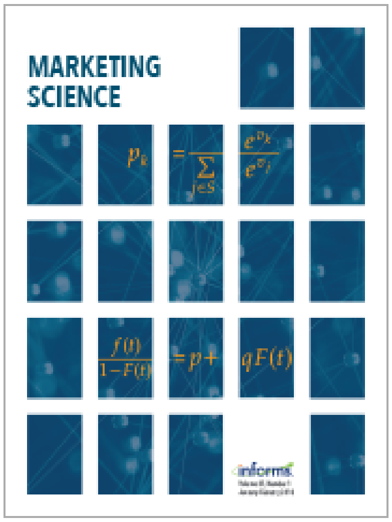

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Wine Online: Search Costs Affect Competition on Price, Quality, and Distribution

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Abstract

A fundamental dilemma confronts retailers with stand-alone sites on the World Wide Web and those attempting to build electronic malls for delivery via the Internet, online services, or interactive television (Alba et al. 1997). For consumers, the main potential advantage of electronic shopping over other channels is a reduction in search costs for products and product-related information. Retailers, however, fear that such lowering of consumers' search costs will intensify competition and lower margins by expanding the scope of competition from local to national and international. Some retailers' electronic offerings have been constructed to thwart comparison shopping and to ward off price competition, dimming the appeal of many initial electronic shopping services. Ceteris paribus, if electronic shopping lowers the cost of acquiring price information, it should increase price sensitivity, just as is the case for price advertising. In a similar vein, though, electronic shopping can lower the cost of search for quality information. Most analyses ignore the offsetting potential of the latter effect to lower price sensitivity in the current period. They also ignore the potential of maximally transparent shopping systems to produce welfare gains that give consumers a long-term reason to give repeat business to electronic merchants (cf. Alba et al. 1997, Bakos 1997).

We test conditions under which lowered search costs should increase or decrease price sensitivity. We conducted an experiment in which we varied independently three different search costs via electronic shopping: search cost for price information, search cost for quality information within a given store, and search cost for comparing across two competing electronic wine stores. Consumers spent their own money purchasing wines from two competing electronic merchants selling some overlapping and some unique wines.

We show four primary empirical results. First, for differentiated products like wines, lowering the cost of search for quality information reduced price sensitivity. Second, price sensitivity for wines common to both stores increased when cross-store comparison was made easy, as many analysts have assumed. However, easy cross-store comparison had no effect on price sensitivity for unique wines. Third, making information environments more transparent by lowering all three search costs produced welfare gains for consumers. They liked the shopping experience more, selected wines they liked more in subsequent tasting, and their retention probability was higher when they were contacted two months later and invited to continue using the electronic shopping service from home. Fourth, we examined the implications of these results for manufacturers and examined how market shares of wines sold by two stores or one were affected by search costs. When store comparison was difficult, results showed that the market share of common wines was proportional to share of distribution; but when store comparison was made easy, the market share returns to distribution decreased significantly. All these results suggest incentives for retailers carrying differentiated goods to make information environments maximally transparent, but to avoid price competition by carrying more unique merchandise.

(*Buyer Behavior*; *Competitive Strategy*; *Internet Marketing*; *Price Sensitivity*; *Retailing*)

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Introduction

Emerging electronic channels create a fundamental dilemma for retailers with stand-alone sites on the World Wide Web and for those attempting to build electronic malls for delivery via the Internet, online services, or interactive television. Alba et al. (1997) present the case that for consumers, the main attraction of interactive electronic retailing is a reduction in search costs for products and product-related information. However, it is precisely this lowering of search costs that retailers fear most. Their concern is that electronic retailing will intensify competition and lower margins by expanding the scope of competition from local to national and international (Anders 1998, 1999; *Economist* 1999; Gove 1999; Kuttner 1998; Quelch and Klein 1996; Reeve 1998; Trudeau 1999).

Established retailers seem to view these emerging channels as inevitable but potentially lethal. They therefore configure their individual electronic stores so that it is difficult to compare their merchandise with that of other stores selling on the same channel. In addition, when third-party agents like Anderson Consulting's Bargain-Finder are created to facilitate cross-store electronic search, merchants attempt to block them from their sites (Bakos 1997, Pazgal and Vulcan 1998, Quick 1998b). When infomediaries invite multiple retailers to participate in electronic markets, the large and established retailers resist, preferring to have their own individual sites (Bounds 1999). Thus, we see three interrelated themes of fear of price competition, fear of comparison shopping, and perceived disincentives for electronic retailers to cooperate in lowering cost of search for information consumers might desire.

Our paper presents an empirical analysis and extension of the ideas suggested by Alba et al. (1997) and Bakos (1997). Alba et al. argued that conventional retailers fixated on the potential for electronic shopping to lower search costs for price information and to heighten competition. This drove them to create defensive, toe-in-the-water interactive offerings with few benefits to consumers, opening the door to new, electronic competitors such as Amazon, e-Toys, etc.[1] Arguably, this response misanalyzed the effects of lowered search costs in the short run (i.e., the consumer's first transaction with an electronic interface) and in the long run, ignoring how lowered search costs might affect the customer's lifetime value.

Consider first how the consumer might be affected by search costs on the first transaction with an electronic merchant. Both Alba et al. (1997) and Bakos (1997) made the point that electronic shopping does not just lower the cost of search for price information. Independently, it can lower the cost of search for quality information, decreasing price sensitivity. Alba et al. argued that consumers also value the potential for electronic shopping to lower search costs by a third route. By supporting comparisons across merchandise sold by competing vendors, electronic shopping increases consumers' ability to choose merchandise that will maximize consumption utility (Häubl and Trifts, this issue). We therefore add to our investigation the impact of interstore comparison on the benefits of interactive shopping systems and consumer price sensitivity. As other analysts have suggested, we expect that making interstore comparisons easier should increase price sensitivity for items carried by multiple comparable stores. We expect to find, however, that this result will not hold for differentiated merchandise sold exclusively by one retailer. Moreover, if the stores differ in the information they offer, in their appearance, or in the benefits they provide, the additional information consumers will derive from interstore comparison may result in decreased price sensitivity.

Alba et al. (1997; see also Quick 1998a,b) noted that third-party efforts to provide cross-shopping services can be hamstrung if retailers refuse to cooperate in providing relevant information. They maintained, though, that in the long run, efforts by electronic merchants to make cross-shopping difficult are doomed to failure, removing much of what makes the electronic venue more appealing than other retail formats. Moreover, if consumers value the benefit of cross-shopping online, some other entrants will offer it (e.g., www.autobytel.com, www.bizrate.com, www.compare.net, www.killerapp.com, www.mysimon.com, www.personallogic.com, www.weddingchannel.com, www.wirelessdimension.com, and www.zdnet.com), and consumers will demand it (Erlich and Fisher 1982). Consumers may choose to patronize those sellers who deliver this benefit, bypassing those who do not.

[1]For anecdotal support, e.g., Krantz (1998, p. 40), Downes and Mui (1988, p. 88), Steinhauer (1998), Wigand and Benjamin (1995).

Our paper attempts to provide empirical evidence about the short-run and long-run consequences of the different lowered search costs, to better understand consumer, retailer, and manufacturer incentives in electronic markets for differentiated products. We have three purposes:

• to examine the conditions under which lowered electronic search costs should increase or decrease consumer price sensitivity (Alba et al. 1997, Bakos 1997) and to make plainer that retailers selling differentiated product categories face a very different scenario for common merchandise than for unique merchandise sold exclusively by them;

• to demonstrate (somewhat obvious) consumer welfare gains from providing increasingly transparent informational environments, highlighting why "defensive" interactive home shopping offerings may be unsustainable; and

• to examine the effects of search costs on market share returns to distribution, thus shedding some light on how lowered electronic search costs affect manufacturer disincentives to grant exclusive distribution—e.g., to sell private label merchandise or branded variants (Alba et al. 1997).

We elaborate each of these in turn in the sections that follow.

Search Costs and Price Sensitivity

The popular business press has fixated on the potential for electronic shopping to increase price sensitivity, but academic scholars have noted circumstances under which electronic shopping might either increase or decrease price sensitivity and/or prices (Alba et al. 1997, Bakos 1997, Degaratu et al. 1998). It is true that electronic shopping may reduce the cost of search in ways that enlarge consumers' consideration sets and that make price comparisons easier. Ceteris paribus, if electronic shopping lowers the cost of acquiring and processing price information, it should increase price sensitivity, just as is the case for price advertising (Popkowski-Leszczyc and Rao 1990, cf. Boulding et al. 1994).

At the same time, a well-constructed electronic shopping site can provide a vehicle for conveying nonprice information related to quality that is superior to the comparable information that can be gleaned from shopping in conventional malls, catalogs, etc. (Hoffman et al. 1995). The consequences of better differentiating information should be like the effects of differentiating advertising (Kaul and Wittink 1995; Mitra and Lynch 1995, 1996). Advertising can convey differentiating information that reduces consumer price sensitivity. So too can these interactive channels. If there *are* real differences among retailers in merchandising, assortment of complementary products, and service, interactive channels could be more effective than existing modes of retailing in conveying those points of differentiation.

Following Alba et al. (1997) and Bakos (1997), we expect that lowering search costs for price information will increase consumer price sensitivity. But insofar as search costs for differentiating, quality information are lowered, consumer price sensitivity will decrease, and the latter effect may outweigh the former. Thus, if a site decreases search costs only for price—either sorting within a single retailer's store or sorting across stores—price sensitivity will increase. However, if a site decreases search costs for both price and quality information, price sensitivity need not increase compared to a case in which both costs are high. The net effect is a matter of the calibration of the size of these two search cost reductions, as well as certain moderator variables. In the present research, we test hypotheses about conditions under which the effects of search cost for quality do or do not outweigh those of search costs for price. Our aim is not to assert the generality of our empirical results but to provide a theoretical perspective for anticipating the economic consequences of shifting the different search costs in different kinds of product markets.

Bakos (1997) pointed to two factors that can affect the degree to which the effects of more transparent quality information will outweigh those of easier price search. The first is the degree of differentiation in the product category and the associated degree to which consumers suffer from "lack of fit" cost for choosing an alternative that is not closest to their ideal. Second, Bakos noted that the relative size of effects of search costs for price and quality information should depend on the number of sellers. With more sellers, the effects of lowered cost of price information become more pronounced.

We wish to demonstrate the rhetorical point that effects of easier quality search may outweigh those of easier price search, so we chose to study a category in which these factors magnify the relative weight of search costs for quality information: selling of fine wines. In the experiment that we report, two competing electronic wine stores each carry some wines exclusively and some wines that are common to both stores. We hypothesize that making cross-store comparison easy will increase price sensitivity when another vendor carries the same product but will have little effect when retailers are carrying differentiated merchandise sold by a single seller. This point has not been considered explicitly in prior academic or popular discussions of the effects of electronic search costs on price sensitivity, but we can deduce it from both behavioral and economic principles. When the same wine is sold at one store for a higher price than at another equivalent store, buying at the more expensive store is dominated. Häubl and Trifts (1998) have shown that electronic comparison aids reduce propensity to choose dominated options. A similar effort to make cross-store comparisons easy should have less effect on sales of unique wines, where a change in price does not create dominating and dominated options.

One can also deduce the hypothesis that comparison should have more effect on common than on exclusively carried wines by reinterpreting Bakos (1997), although his model does not consider highly differentiated product markets in which some alternatives are perfect substitutes. We assert that the user of a price-search engine for a pre-specified SKU is searching for an "undifferentiated" good even if the category as a whole is differentiated. Thus, price sensitivity should be higher for cross-store comparison of common than of unique wines. Under this interpretation, our contrast of the effects of lowered search costs on common versus unique wines allows us to understand the effects of lowered search costs in markets with low versus high differentiation.

Search Costs and Consumer Welfare

Lowering search costs for price and quality information and for comparing merchandise from competing stores does not just affect price sensitivity. More transparent, "full featured" electronic shopping systems may improve consumer welfare in several obvious ways. First, consumers are likely to value reduced shopping effort on all three of these search costs, so they enjoy the shopping experience more. For example, Ariely (1999) demonstrates that electronic environments that allow greater flexibility in search increase consumers' satisfaction with the site. Second, lowered search costs for quality information and easier store comparison should improve decision quality, helping consumers to better match heterogeneous brands to their personal tastes—just as advertising improves the match between consumers with heterogeneous tastes and heterogeneous products (Bakos 1997, Mitra and Lynch 1996, Rosen 1978).

If consumers prefer more transparent informational environments, sellers offering lower search costs should benefit from better retention. We noted earlier that sellers have attempted to thwart such comparisons, and Bakos (1997) has noted seller incentives to do so. However, we argue that such defensive strategies of some Internet retailers contribute to their tepid sales. Consumers may be more likely to reward full-featured, "transparent" electronic merchants with repeat business (cf. Hoffman et al. 1995).

Manufacturer Market Share Returns to Distribution

The experiment to be reported studies only buyer behavior, treating seller behavior as exogenous. However, one might anticipate how retailers and manufacturers might adapt to consumer responses to reduced search costs. We predict that retailers will find that consumers give more business to sellers who provide transparent shopping experiences that lower search costs for price, quality, and store comparison. We have also predicted that retailers will find that providing this transparency will intensify price sensitivity for common but not for unique merchandise. What market pressures will these twin dynamics produce?

Alba et al. (1997) discuss the potential for electronic retailing to threaten (inter)national brands, by shifting the formula for retail success from stocking branded goods that draw customers into the stores to stocking exclusive merchandise. If a customer can buy the same pair of Levis over the Internet from multiple vendors, price competition may erode dealer margins. Retailers may respond by replacing the branded item with a slightly less popular exclusive or private label offering (Faust 1997, King and Bounds 1997, White 1998) or by demanding "branded variants" exclusive to a given retailer (Bergen et al. 1996).

Manufacturers could respond by striking deals with retailers for exclusive distribution, but this would entail a potential penalty of lost sales through stores no longer used as distributors (Reibstein and Farris 1995). The interesting conceptual question is whether making electronic comparison easy will reduce returns to distribution—in essence, lowering the sales penalty for granting exclusivity.

One might predict that easy comparison should increase the share of common brands, because these should be more likely to be found at a low price when cross-shopping is easy. Similarly, common brands might benefit if easy comparison revealed asymmetric dominance (Ariely and Wallsten 1995, Huber et al. 1982). Our prediction, though, is that easy comparison should reduce the share of common brands relative to unique ones. Just as brands draw market share more heavily from more similar alternatives (Meyer and Kahn 1991, Tversky 1972), we anticipate that easy comparison will make more apparent that a bottle of wine sold at two different retailers is, in fact, the same, despite differences in price or format of description. Easy comparison should reveal real differences when they do exist, but should also make plainer real similarity and dominance (Häubl and Trifts, this issue).

We report below an experiment in which consumers shop with their own money at two competing electronic wine merchants carrying partially overlapping inventories. We vary independently three components of search costs in electronic shopping: the ease with which consumers can access price information, quality information, and can make cross-store comparisons. We consider the current "status quo" for most brick and mortar retailers' Internet retailing sites to correspond to our condition in which it is difficult to access price and quality information or to make store comparisons.[2] Our condition where search costs for price and quality are low and where store comparisons are made easy approximates the kind of transparent electronic shopping system that consumers might see as having benefits over competing retail formats.

[2]This characterization is becoming less true as even laggard brick and mortar retailers are confronted with the startling success of new, purely electronic competitors. The most prominent of these do not facilitate store comparison, but make price and quality information easy to access and process.

Experiment

Method

Overview. Seventy-two M.B.A. and Ph.D. students and staff were recruited to participate in a test of an electronic shopping system described as being similar to Virtual Vineyards (now www.wine.com). Respondents were told that wines would be sold at significant discounts relative to prices for the same wines from area merchants, and that the researchers would contribute $5.00 to the M.B.A. Games charity fund-raiser for each participant who bought one or more bottles. Participants first shopped for wine from our two competing electronic wine merchants, Jubilee and Dionysus. A total of 100 wines were available. Each store sold 60 wines, 20 of which overlapped and 40 of which were unique to the store. Consumers went on a series of eight shopping trips, across which the prices of the different wines varied independently. In this way, we could assess price sensitivity at the individual subject level by measuring how the quantity of wine purchased depended on its price level.

We independently varied Price-Usability (High or Low) $\times$ Quality-Usability (High or Low) $\times$ Store-Comparability (High or Low) in a $2\times2\times2$ between-subjects design. Participants were randomly assigned to one of the eight conditions. The primary dependent variables at this stage were price sensitivity for wines (computed by pooling across all wines, and also computed separately for common versus unique wines), market share of the common wines, and liking of the shopping experiences. We also took measures of breadth and depth of search.

After performing the shopping part of the study, participants were asked to taste 10 of the wines to see which they actually preferred. We computed from each participant's ratings a measure of liking for wines chosen earlier and for wines unchosen in the shopping phase.

Two months later, an e-mail announcement was sent to participants in which they were asked if they would like to continue using the same electronic wine-shopping system from their homes for future purchases of wines. This measure of service subscription was taken as an indicator of retention of the service.

Procedure for Electronic Wine-Shopping Task. Respondents reported to the M.B.A. computing lab at prearranged times. They were told that they would go on eight shopping trips, with the prices of the wines varying from trip to trip. On each trip, respondents searched through the wines in either one or both stores and purchased as much or as little wine as they deemed appropriate. Respondents were asked to buy as much wine as they normally might consume in a month. Once they had finished purchasing wine for that "month's" shopping trip, they indicated so and started a new month's shopping trip. This continued until all eight trips were completed.

Respondents expected to use their own money to pay for the wines they selected, and they did in fact pay for their purchases. We were concerned, however, that our price sensitivity measures (Quantity Difference and Price Elasticity) would be less stable if respondents with real budget constraints purchased only a few wines. Therefore, respondents were told that they would take eight shopping trips but that they would actually purchase only the wines they chose on one of the trips, to be randomly determined at the end of the experiment. Because respondents could not know which trip would be chosen, they were told to treat each one as if that would the one selected for the real transaction. As a consequence, we were able to get eight times as many purchases as we would have if respondents were paying for what they selected on each of the eight shopping trips. We also avoided inventory effects. All of the wines sold were on discount on four of the eight trips and were sold at regular price on the remaining four trips, although the discounted wines were not specially noted in any way. Respondents were instructed that they were not obliged to purchase any wines at all—after all, they were spending their own money. However, all participants bought at least three bottles. The shopping task took between 30 and 75 minutes.

At the end of the electronic shopping task, participants were asked to rate how enjoyable the shopping experience had been for them. This response was given on a scale from 0 (not enjoyable at all) to 100 (very enjoyable). In addition, participants answered a battery of questions that were aimed at assessing their knowledge of wine. There were two types of questions: one that related to experience with wine (amount typically consumed, frequency of purchase, prices typically paid, etc.) and one that asked respondents to identify different varieties of wine as being red or white. From participants' answers, we were able to construct a measure of wine expertise that was unidimensional and that exhibited marginally acceptable reliability (Cronbach's $\alpha = 0.65$). We had anticipated that expertise might moderate the effects of Quality-Usability. However, expertise had no effects and will not be discussed further.

Independent Variables. As mentioned earlier, the independent variables were Price-Usability (High or Low), Quality-Usability (High or Low), and Store-Comparability (High or Low). For analyses of price sensitivity, there was a fourth, repeated factor of Wine Block Uniqueness (Unique versus Common). This factor was not relevant to other dependent variables.

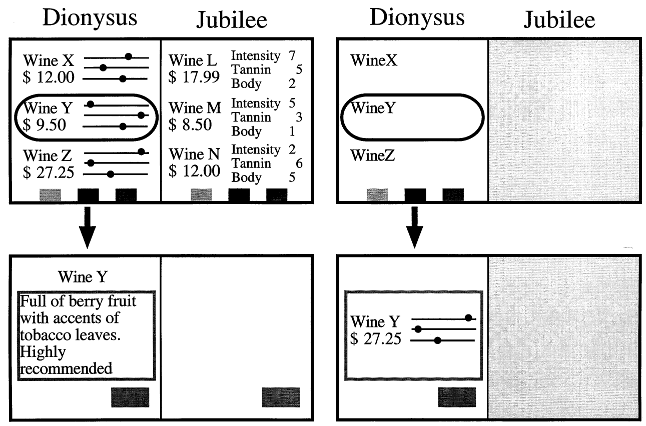
When Price Usability was high, price information was displayed in the first-level list of available wines, with a tool available to permit sorting by price. When Price Usability was low, the initial list of wine names did not show their prices nor was a tool available to sort wines by prices; respondents had to click on a wine name to bring up a screen with its price.

Quality Usability was varied by a parallel manipulation. When Quality Usability was high, the first-level list of wine names displayed descriptions of the wines using differentiating sensory attributes. Wines at Dionysus were described in terms of complexity, acidity, body, and sweetness/dryness, using bar graphs patterned after those used by Virtual Vineyards (www.wine.com). Wines at Jubilee were described in terms of body, sweetness/dryness, intensity, and tannin, with numerical values of 1 to 7 for each dimension. This difference in format was intended to mirror the real world, in which competing vendors are unlikely to make the same information available or to use common display forms. In addition, when Quality Usability was high, respondents could sort the wine by varietal (e.g., Chardonnay, Merlot, etc.). Finally, respondents in this condition could click or "drill down" to see further differentiating comments (e.g., "Fun red wine? Here it is! A very pleasing bardolino with cherry and grape flavors and an easygoing demeanor. It's soft, juicy, and even sports hints of complex flavors such as vanilla and jam. But don't be fooled; it's down-to-earth and fun.") The differentiating comments were provided by the head wine buyer at the top wine store in the area. He augmented his own sensory comments with comments from Wine Spectator magazine. (He also provided the sensory ratings.) When Quality Usability was low, the standardized descriptions on sensory dimensions did not appear on the first screen containing the list of wines. Instead, participants had to click on a wine's name on the first screen to see them and no tool was available to sort wines by varietal. Furthermore, there was no ability to drill down to see a further differentiating comment.

Store Comparability was varied by the nature of the display subjects saw on first-level viewing screens. When Store Comparability was high, the screen was divided in half, with Dionysus on the left and Jubilee on the right. The navigation tools mentioned earlier were provided at the bottom of each store's display, and the respondent could independently view and navigate both stores. The wine list in each half was displayed initially in alphabetical order, but any sorting tool available in one store would simultaneously sort the wines from both stores on the same criterion. When Store Comparability was low, only one store appeared on the screen at a time. If the respondent was shopping at Dionysus, the right-hand side of the screen for Jubilee was blank. If respondents were shopping at one store and then wanted to visit the other, their shopping carts emptied; they had to start again from scratch at the first store if they returned after visiting the second. Moreover, sorting tools used at one store had no effect on the ordering of wines displayed at the other store. Such interfaces again mimic current reality. Most merchants do not let consumers hold on to their unconsummated purchases while they leave the store.

Figure 1 shows a schematic of the first and second screens in two conditions: when Price Usability and Quality Usability were high and Store Comparability was high (on the left), and when Price Usability and Quality Usability were low and Store Comparability was low (on the right). Moving among the different screen levels was done by clicking with a mouse on the tools that appeared at the bottom of the screen. Figure 2 shows the actual first and second screens seen by subjects in the low Price Usability, low Quality Usability, and high Store Comparability condition; and Figure 3 shows the first and second screens seen by subjects in the high Price Usability, high Quality Usability, and high Store Comparability condition.

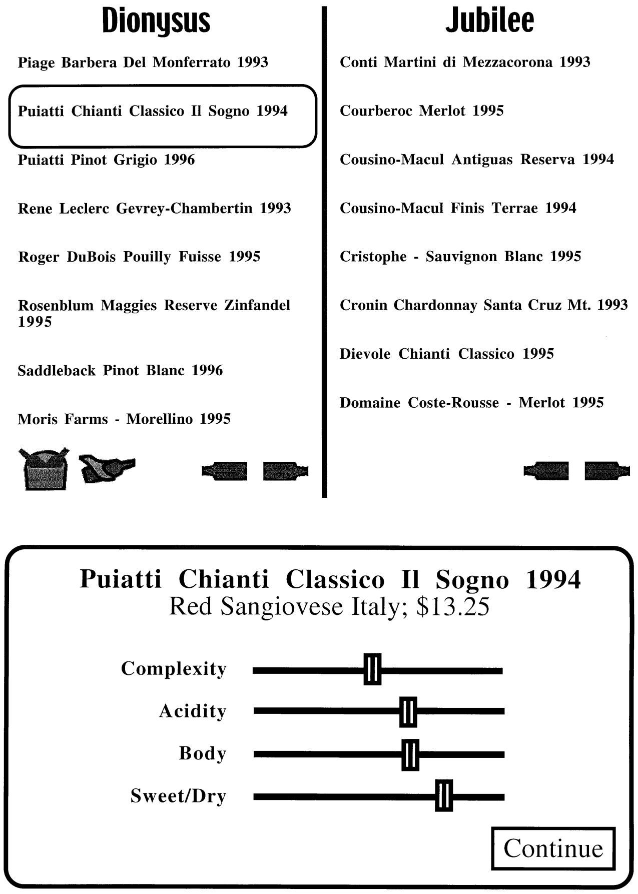
Figure 1 **A Schematic Representation of the Different Electronic Shopping Interfaces**



Note: (Actual screens used were significantly more detailed and are available from the authors.) The left panel shows the condition where Price Usability, and Quality Usability are high, and Store Comparability is high. The right panel shows the condition where Price Usability, and Quality Usability are low, and Store Comparability is low. Within these two panels, the top panel shows the information that was available at the highest level of the interface (without any search cost), and the bottom panel shows the information that was available at the second level of the interface (with search cost). In the "full-featured electronic shopping" (left panel), all the information was presented at the highest level, and additional descriptive information was presented at the second level. In the "impoverished status quo electronic shopping" (right panel), none of the information was presented at the highest level, and participants had to drill down to get information about price, quality, or the other store.

Dependent Measures: Price Sensitivity. The major dependent measures were based on the difference in wine purchasing when the wines were on discount and when they were not. Because we had only eight shopping trips, it was not possible to vary the price of each of the 100 wines independently. We therefore divided the wines up into five "wine blocks," each of

Figure 2 Screens (1) and (2) for Low Price Usability, Low Quality Usability, High Store Comparability



which was a stratified random sample of the universe of 100 wines. Each store had three wine blocks of 20 wines each. Two wine blocks in each store included only wines that were unique to that store and one block included only wines sold in both stores. If we designate the five wine blocks by letters, Dionysus carried wine blocks A, B, and E, and Jubilee carried wine blocks C, D, and E′.

We varied the prices of these wine blocks independently across the eight shopping trips taken by each respondent. Note that the prices of the common block of wines (E) in Dionysus were varied independently of the prices for the same block of wines in Jubilee (E′). We used eight price combinations, orthogonally changing the prices of the six wine blocks A, B, C, D, E, and E′. Each wine block was sold at its regular price on four of the eight trials and at a 15% discount on the other four trials. The order of exposure to the eight price combinations was counterbalanced.

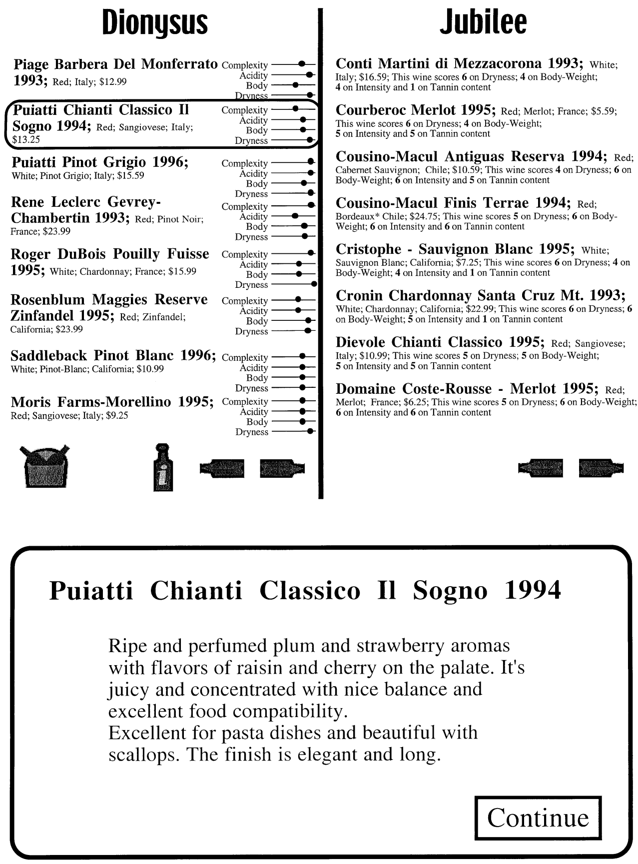
For each participant, we separately calculated price sensitivity collapsed across all six wine blocks pooled across stores. To test hypotheses about how the effects of ease of Store Comparison might interact with the overlapping versus nonoverlapping nature of the merchandise, we separately calculated both measures for (4) unique and for (2) common merchandise blocks.

For each respondent, we calculated two measures of how sensitive a wine block's sales were to changes in its own price: Quantity Difference and Price Elasticity. Quantity Difference is a measure of the slope of an individual's demand curve. It equals the total number of bottles purchased from a wine block in four high-priced trials minus the total purchased in four low-priced trials. For each respondent, we calculated one such measure collapsing across all six blocks, as well as separate measures collapsing across the four unique blocks and across the two common blocks. The overall measure of Quantity Difference is not the unweighted average of the measures for unique and for common blocks, because each store had two unique wine blocks and one common wine block. (The same is true for price elasticity measures.) Each Quantity Difference is divided by the number of wine blocks included in the measure, indicating the per-block difference in total quantity of the block purchased at high versus low prices.

Similarly, we calculated Price Elasticity collapsing across all six wine blocks and separately for the (collapsed) four unique wine blocks and for the two common blocks. The Price Elasticity measure was based on the proportional change in this quantity relative to the proportional price change. Again, negative values correspond to downward-sloping demand.

To calculate Price Elasticity, let Q(R) refer to the quantity of wines sold at regular price, and Q(D) refer to the quantity sold at the discounted price. Let $(R) refer to the regular price of the wines, and $(D) refer to their discounted price. By relating the proportional difference in quantity purchased under the two pricing conditions to the proportional change in price, we get the formula for Price Elasticity shown in Equation (1):

Figure 3 High Price Usability, High Quality Usability, High Store Comparability



$$\frac{\{Q(D) - Q(R)\}}{\{Q(D) + Q(R)\}/2} \Big/ \frac{\{\$(D) - \$(R)\}}{\{\$(D) + \$(R)\}/2}. \tag{1}$$

Note that in our case, because the discount was always fixed at 15%, the price part of the equation (the denominator) is a constant $(0.85 - 1.0)/(0.85 + 1.0)/2 = -0.162162$.

Price Elasticity and Quantity Difference each have advantages and disadvantages. Price elasticity is the normatively relevant measure, but individual-level price elasticity is not preserved by aggregation. That is, price elasticity aggregating quantities across all respondents and then calculating Equation (1) is not identical to calculating Equation (1) separately for each individual and then averaging the individual values. Respondents buying few bottles of wine are weighted equally to those buying many in calculating the average individual-level price elasticity, but those buying many bottles contribute more to the aggregate price elasticity. Quantity difference is preserved by aggregation; the value of Quantity Difference averaging quantities purchased across individuals is equal to the average of the individual quantity differences.

Dependent Measure: Market Share of the Common Wines. For each individual, we calculated Common Wine Market Share = (Total Purchases of Common Wine Blocks) / (Total Purchases Common Wine Blocks + Total Purchases Unique Wine Blocks).

Dependent Measures: Search During Shopping. We also collected various measures of the shopping process for each respondent relating to depth and breadth of search (cf. Novak and Hoffman 1997). We will explore their relationships to price sensitivity.

1. Scroll is the sum of times subjects hit the "Next" and "Previous" Scroll buttons. This is a measure of amount of shallow, broad search.
2. Sort By Price is the number of times the respondent sorted the wines by price. This was possible only in High Price-Usability conditions.
3. Sort By Varietal is the number of times the respondent sorted the wines by varietal (Chardonnay, Merlot, etc.). This was possible only in high Quality Usability conditions.
4. Drill for Wine Comment is the number of times the respondent drilled down to view the differentiating comment (e.g., "Fun red wine? Here it is . . ."). This was possible only in high Quality Usability conditions.
5. Drill for Missing is a measure of the number of times respondents drilled down to a second screen to access "missing" information about either price (in low Price Usability high Quality-Usability conditions) sensory quality ratings (in high Price-Usability–low Quality-Usability conditions), or both (in low Price Usability–low Quality Usability conditions). In high Price Usability–high Quality Usability conditions, this drilling was not possible or necessary.

Dependent Measure: Rated Liking of Purchased Wines. After completing the computer-shopping task, respondents proceeded to the wine-tasting task. The purpose of the task was to get a measure of how successfully consumers chose their wines, as measured by their rated liking for wines purchased and not purchased. The local wine expert mentioned earlier chose the wines to be included in the wine-tasting test. Our goal was to include the most popular wines in the set. We hoped that this approach would maximize the probability that each consumer would have purchased at least some of the wines included in the wine-tasting, thereby permitting the above measures to be calculated.

Before starting the taste test, respondents were given a choice of whether to taste 10 red or 10 white wines taken from the earlier wine-shopping task. We assumed that, given individual preferences for red and white wines, allowing the choice would again increase the probability that a respondent would taste some of the wines he or she had purchased. Each wine was rated on a scale from 0 (poor) to 10 (excellent). Because each respondent had purchased some of the wines and had not purchased others, we could compute his or her mean liking for both wines they had previously chosen and ones they had not.

Procedure for Wine Tasting Task. Within each set, the wines were tasted in an order from light to heavy, as is recommended for wine tasting. Respondents tasted 0.5 fluid ounces of each wine from a plastic cup. Baguettes and water were available to cleanse their palates. Respondents were told by the experimenter pouring the wines not to discuss their perceptions with other participants. The wine tasting was not blind. We were trying to mimic the real world, where, if information from electronic shopping makes people think that they like a product better, this affects their experienced utility. The labels of the wines but not their prices were visible during tasting.

After all 10 wines had been tasted, respondents were thanked and dismissed. They were told that they could pick up their ordered merchandise later that week. To guarantee that all participants benefited from the promised discounted prices, we chose to fulfill orders from a shopping trip when half the wines were on sale. Prior to picking up their wines, participants were notified by e-mail of which wines they had ordered on the selected trial and of the prices of those wines. Participants paid by cash or check.

Dependent Measure: Retention. Two months after the completion of the study, participants were asked if they would like to subscribe to the same electronic-shopping wine service from their homes. They received the following message: "During Term 1, you participated in our study on electronic home shopping for wines. We would like to get your feedback on your experience and to assess your interest in continuing on in another phase of the study in which you would be able to order wines during Terms 3 and 4. Would you be interested in participating in the next phase of the study? If you say yes, we will e-mail you our wine program to install on your computer to use at your convenience. You would pick up your wines and pay for them at the kiosk on the following day. You would have exactly the same interface and merchants as you had in the earlier stage.

________ Yes, please e-mail me the program

________ No, I am not interested in participating"

Results

Price Sensitivity. We had two measures of price sensitivity: Quantity Difference and Price Elasticity. Thus, we have two tests of every key ANOVA effect in a $2 \times 2 \times 2 \times 2$ mixed design with Price Usability $\times$ Quality Usability of Information $\times$ Store Comparability as between-subjects factors and Wine Block Uniqueness as a repeated factor. In the results presented below, we use MANOVA as protection against escalating type 1 errors that would be expected if each measure were analyzed separately.

Eight participants purchased no common wines. This creates division by zero in Equation (1); consequently, we had "missing" values for common wine Price Elasticity for those eight participants. MANOVAs dropped those eight participants. There were no missing values for unique wine Price Elasticity or for unique or common wine Quantity Difference. When follow-up tests could be conducted either on the 64 participants with complete data or on all 72 participants, qualitative results were identical in terms of patterns and statistical significance. We report follow-up tests on the full data set whenever possible below.

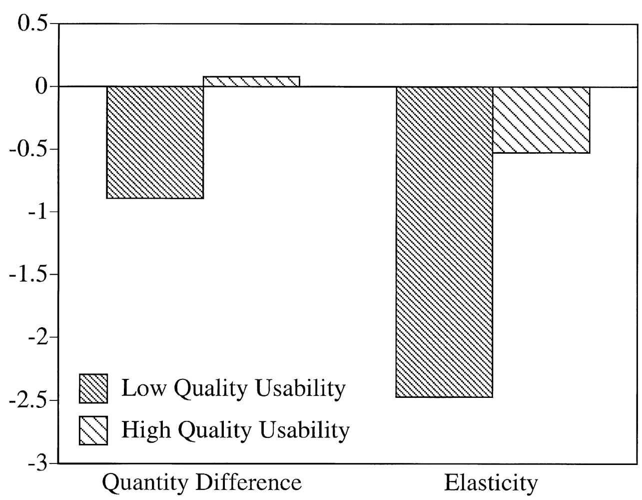
The theoretically critical MANOVA results were that there was a significant multivariate main effect of Quality Usability [$F(2,55) = 6.50$, $p < 0.003$] and a significant multivariate interaction of Store Comparability $\times$ Wine Block Uniqueness [$F(2,55) = 3.87$, $p <$

0.03]. We followed up with univariate tests for Quantity Difference and Price Elasticity below.

For both dependent variables, there was a significant univariate effect of Quality Usability. Quantity Difference showed a more negative slope in the demand curve for low Quality Usability ($M = -0.90$) than for high Quality Usability ($M = +0.13$), [$F(1,56) = 13.08$, $p < 0.01$]. (Interpret -0.90 to mean that for each block of 20 wines, the average respondent in Low Quality-Usability conditions bought 0.90 less bottles in total during the four trips when those wines were at regular price than on the four trips when the same wines were discounted by 15%.) Similarly, respondents showed greater Price Elasticity for low Quality Usability ($M = -2.47$) than for high Quality Usability ($M = -0.52$), [$F(1,56) = 3.88$, $p < 0.054$]. See Figure 4.

When the parallel analysis is done on all 72 respondents—by pooling across all six wine blocks to avoid missing values for the eight participants—the effects described above are strengthened. The greater *n* and the balanced cell sizes increase statistical power. The multivariate main effect of Quality Usability is significant, [$F(2,63) = 6.83$, $p < 0.003$], as are the univariate tests for Quantity Difference [$F(1,64) = 13.67$, $p < 0.001$] and Price Elasticity [$F(1,64) = 7.89$, $p < 0.007$].

Figure 4 Price Sensitivity Measures as a Function of Quality Usability.



Note: Quantity Difference measures (Quantity at Low Price − Quantity at High Price) are on the left and Self Elasticity measures are on the right. For both measures, more negative numbers imply greater price sensitivity.

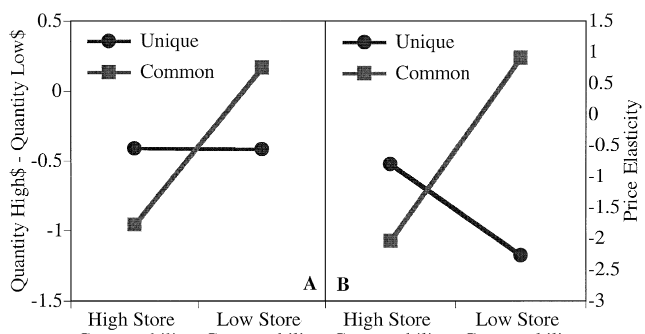
There was a significant univariate interaction of Store Comparability × wine block uniqueness for Quantity Difference [$F(1,64) = 4.84$, $p < 0.04$] and for Price Elasticity [$F(1,56) = 6.89$, $p < 0.02$]. The similar patterns for Quantity Difference and Price Elasticity can be seen in Figure 5.

Simple-effects follow-up tests for Quantity Difference showed that for unique wine blocks, increasing Store Comparability had no effect [$F(1,64) = 0.00$], with $M = -0.41$ for high Store Comparability and $M = -0.42$ for low Store Comparability. For common wines, Quantity Difference was significantly higher for high Store Comparability ($M = -0.96$) than for low Store Comparability ($M = +0.17$), [$F(1,64) = 10.45$, $p < 0.002$].

Parallel simple-effects tests for unique wine Price Elasticity showed that increasing Store Comparability had no effect [$F(1,56) = 2.68$, $p < 0.11$], with directionally lower Price Elasticity when Store Comparability was high ($M = -0.80$) as opposed to low ($M = -2.27$). For common wines, Price Elasticity was significantly higher for high Store Comparability ($M = -2.04$) than for low Store Comparability ($M = +0.91$), [$F(1,56) = 4.57$, $p < 0.04$].

Process Measures and Price Sensitivity. Recall that experimental conditions varied in the opportunity or necessity for various processing operations during search. We correlated measures of Price Elasticity and Quantity Difference (pooling over all six wine blocks)

Figure 5 Price Sensitivity Measures as a Function of Store Comparability and Wine Block Uniqueness



Note: Figure 5A shows the results for Quantity Difference, and Figure 5B shows the results for Price Elasticity.

with various measures of process. For all the correlations, note that a negative correlation implies that more of the processing activity is associated with more negatively sloped demand curves and more Price Elasticity. We make no causal interpretations.

Scroll, a measure of breadth of search, was associated with greater (negative) Quantity Difference ($r = -0.34$, $p < 0.01$, $df = 70$) and more (negative) elasticity ($r = -0.24$, $p < 0.05$, $df = 70$). This is expected, because scrolling increases potential consideration-set size. Moreover, scrolling is associated with a pattern of shallow search focusing on price, not quality. Sort by Price (possible only for respondents in the high Price Usability conditions) also increased with price elasticity ($r = -0.35$, $p < 0.04$, $df = 34$) and marginally increased with Quantity Difference ($r = -0.29$, $p < 0.09$, $df = 34$). Sort by Varietal (possible only for respondents in the high Quality Usability condition) had no reliable effect. Drill for Wine Comment (drilling down for a differentiating wine comment in the high Quality Usability conditions) decreased price elasticity ($r = +0.45$, $p < 0.01$, $df = 34$) and Quantity Difference ($r = +0.48$, $p < 0.01$, $df = 34$). As expected, Drill for Missing—drilling down for information that was missing from the first-level screen—was associated with more Price Elasticity ($r = -0.63$, $p < 0.01$, $df = 16$) and Quantity Difference ($r = -0.60$, $p < 0.01$, $df = 16$) when the information that was missing was only price information (in the high Quality Usability, low Price Usability condition). However, when drilling down revealed either quality information alone (high Price Usability, low Quality Usability) or both quality and price (low Price Usability, low Quality Usability), correlations with Price Elasticity and Quantity Difference did not differ significantly from zero or from each other.

Process Mediation of Effects of Search Costs on Price Sensitivity. In the foregoing zero-order correlation analyses, we treated a given process measure as missing whenever it was structurally zero—e.g., because a price-sorting tool was unavailable to subjects in low Price Usability conditions. In the analyses reported next, we examine whether variations in patterns of search mediate the two key effects of our design variables on price sensitivity: the Quality Usability main effect and the Store Comparability × Unique/Common Wine interaction. For these analyses, we coded the process variables as zero rather than missing when they were structurally unavailable.

As a preliminary step, we analyzed the effects of Price Usability, Quality Usability, and Store Comparability on Scroll, Sort by Price, Sort by Varietal, Drill for Wine Comment, and Drill for Missing. Table 1 shows cell means.

Recall that the primary between-subjects result was a main effect of Quality Usability, such that Price Elasticity and Quantity Difference were less negative when Quality Usability was high rather than low. A MANOVA with Price Elasticity and Quantity Difference calculated across all six wine blocks showed that Drill for Wine Comment had a significant multivariate main effect [$F(2,56) = 6.04$, $p < 0.005$], but that there was no remaining partial effect of Quality Usability with process variables in the model [$F(2,56) = 0.48$].

A separate mediation analysis for the Store Comparability × Wine Uniqueness interaction showed that (Unique–Common) difference scores were not predictable by the process measures and the effect of Store Comparability (i.e., the Store Comparability × Wine Uniqueness interaction) remained highly significant. It is unsurprising that process measures do not mediate the Store Comparability × Wine Uniqueness interaction, because the process measures do not distinguish between search for unique and common wines.

Prices Paid and Quantity Sold. We showed above that high Store Comparability increased price sensitivity for common wines, but not for unique wines. To understand the effect of this heightened price sensitivity on profit, however, requires an analysis of prices paid and quantity sold. We cannot meaningfully calculate profitability without making arbitrary assumptions about marginal costs.

We can, however, report analyses of average price paid per bottle of wine in common and unique blocks analyzed as a function of Price Usability, Quality Usability, and Store Comparability. The eight subjects who bought no common wines were dropped from the analysis. Interestingly, seven of the eight were in high Store Comparability conditions.

Table 1 Effects of Price-Usability, Quality-Usability, and Ease of Store-Comparability on price sensitivity (Price Elasticity and Quantity Difference), number of Scrolls, Sorts by Price, Sorts by Varietal, Drills for Wine Comment, and Drills for Missing Price and/or Quality Information

Price Usability	Quality Usability	Store Comparability	Price Elasticity	Quantity Difference	Scroll	Sort Price	Sort Varietal	Drill Wine Comment	Drill Missing	N
High	High	High	−0.66	0.11	118.9	3.9	2.9	45.4	0.0	9
High	High	Low	−0.23	0.30	119.8	5.3	5.1	41.7	0.0	9
High	Low	High	−3.99	−1.54	147.0	5.2	0.0	0.0	69.4	9
High	Low	Low	−1.68	−0.63	203.2	10.1	0.0	0.0	58.4	9
Low	High	High	−0.94	−0.39	196.6	0.0	6.2	26.7	89.7	9
Low	High	Low	−0.26	0.04	119.6	0.0	9.9	32.0	69.3	9
Low	Low	High	−2.69	−0.56	207.0	0.0	0.0	0.0	83.9	9
Low	Low	Low	−1.52	−0.59	262.1	0.0	0.0	0.0	96.9	9

There were two key results showing that unique wines sold for higher prices than common ones, but only when store comparison was high and when price usability was high. First, a Store Comparability × Wine Block Uniqueness interaction ($F(1,56) = 4.24$, $p < 0.05$) showed that unique wines were sold at higher average prices than common ones in high Store Comparability ($M = \$11.25$ versus \$9.48, $F(1,25) = 10.96$, $p < 0.003$), but not in low Store Comparability conditions ($M = \$10.41$ versus \$10.17, $F(1,31) = 0.21$, $p > 0.64$). Second, a Price Usability × Wine Block Uniqueness interaction ($F(1,56) = 3.85$, $p < 0.055$) showed that unique wines sold at higher average prices than common wines when Price Usability was high ($M = \$11.08$ versus \$9.52, $F(1,29) = 11.23$, $p < 0.002$), but not when Price Usability was low (\$10.48 versus \$10.22, $F(1,27) = 0.26$, $p > 0.61$). Both of these interactions were moderated by a marginally significant three-way interaction of Store Comparability × Price Usability × Common versus Unique wine blocks ($F(1,56) = 2.95$, $p < 0.10$). The locus of the effect was that unique wine blocks commanded higher prices than common ones only under conditions of high Store Comparability and high Price Usability ($M = \$11.79$ versus \$8.74, $F(1,13) = 21.21$, $p < 0.001$). In all other combinations of Store Comparability and Price Usability, the simple comparisons of unique versus common wines were nonsignificant, with all F values < 1. Thus, a pricing advantage for unique wines emerges only in relatively transparent environments.

Next, we analyzed average quantity per block of Common and Unique wines as a function of Price Usability, Quality Usability, and Store Comparability. The results did not support the hypothesis that high Store Comparability increases sales, and the trend was in the opposite direction [$F(1,64) = 3.18$, $p = 0.08$]. This, however, was moderated by a three-way interaction of Quality Usability × Store Comparability × Uniqueness [$F(1,64) = 5.65$, $p < 0.021$]. Follow-up tests showed that the simple interaction of Store Comparability × Uniqueness was present when Quality Usability was high ($F(1,32) = 3.90$, $p < 0.058$). When Quality Usability was high and Store Comparability was low, common wines ($M = 6.9$) outsold unique wines ($M = 5.0$). When Store Comparability was high, though, the reverse was true; unique wines ($M = 3.5$) outsold common ones ($M = 2.6$). Neither simple effect was significant, $F(1,16) = 1.37$ and 2.54, respectively. When Quality Usability was low, the relative advantage of unique wines did not depend on Store Comparability ($F(1,32) = 1.79$, $p > 0.19$), nor was there any significant simple main effect of Uniqueness, ($F(1,32) = 2.07$, $p > 0.15$).

An unexpected Price Usability × Quality Usability interaction arose ($F(1,64) = 4.57$, $p < 0.05$) because shoppers bought less wine when Price Usability and Quality Usability were both low ($M = 3.7$) or both high ($M = 3.5$) than in conditions of Low Quality Usability-High Price Usability ($M = 6.7$) or High Quality Usability-Low Quality Usability ($M = 5.5$). Perhaps equal usability of price and quality information produces more conflict, which leads to deferral of choice (Dhar 1997, Luce 1998).

Measures of Consumer Welfare. Next we report measures of consumer welfare that confirm the obvious point that our shoppers prefer more transparent informational environments. We expected and found that consumers' liking for the shopping experience increased as we lowered all three kinds of search costs, and that they would be more likely to be retained when asked two months later to continue using the same wine-shopping interface to buy wines from home. We expected and found that environments that made wine quality more transparent (by making quality more usable and by allowing store comparison of wines) allowed consumers to choose wines better suited to their personal tastes.

For each of these dependent measures, we report two kinds of analyses. First, we report a 2 × 2 × 2 Price Usability × Quality Usability × Store Comparability ANOVA in which we anticipate that a main effects model should explain all reliable variance among the eight cell means. Second, we report the test of a more parsimonious model nested in the former that constrained the coefficients on relevant main effects to be the same. We regressed each welfare measure on the sum of the dummy variables for the individual main effects—a "transparency" index.

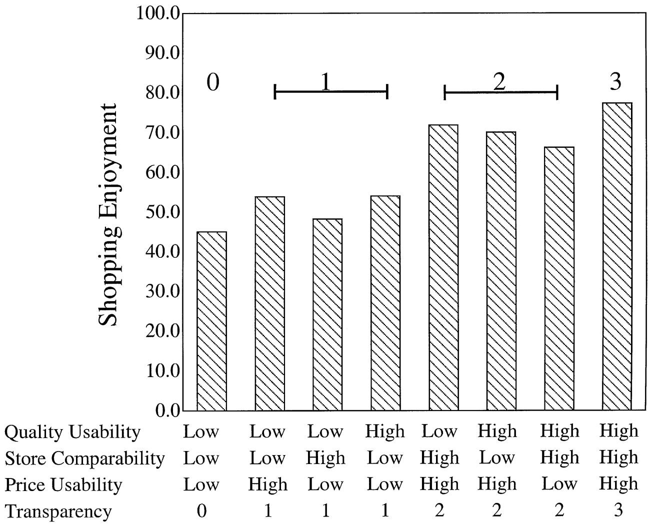
Because we have predictions about the sign and not the magnitude of the different search cost effects on consumer welfare, we know from the literature on unit weighting schemes in decision making (Einhorn and Hogarth 1975) that the constrained models should capture all of the reliable variance in the former. However, the unit weighting model should have more statistical power because we estimate a single parameter rather than separate parameters for each main effect. Four of nine of the individual main effect coefficients are significant in ANOVA analyses below, but the transparency index is highly significant for all three dependent variables, explaining all reliable between-cell variance with no significant residual. The absence of deviations from the equal weight models should not be taken as evidence that the different search costs have exactly equal effects. Because of the "flat maximum" principle, modest deviations from the "true" weights that do not change the sign of the relationship have almost no effect on overall fit (Dawes and Corrigan 1974). These analyses should be interpreted as analogous to a within-study meta-analysis in which we pool the effects for the different search costs and ask the standard meta-analytic questions of whether the effect is significant in aggregate and if there is significant heterogeneity in the effects of the three different search costs.

Shopping evaluation. At the end of the shopping phase of the study, participants were asked to indicate how enjoyable the shopping experience had been for them on a 100-point scale. A 2 × 2 × 2 ANOVA showed only three significant main effects. Each of the three components of increased transparency increased participants' enjoyment. Shopping was more enjoyable when Price Usability was high ($M = 68.3$) rather than low ($M = 53.4$), [$F(1,64) = 10.14$, $p = 0.002$]; when Quality Usability was high ($M = 66.9$) rather than low ($M = 54.8$), [$F(1,64) = 6.78$, $p = 0.011$]; and when Store Comparability was high ($M = 66.9$) rather than low ($M = 54.7$), [$F(1,64) = 4.69$, $p = 0.034$.] No interactions were significant.

We created a summary independent variable, Interface Transparency, by summing the 1-0 dummy variables for Price Usability, Quality Usability, and Store Comparability. Regressing enjoyment on transparency is tantamount to a main-effects-only model with equality constraints on the weights of the 1-0 dummy variables for the three main effects. Transparency was highly significant [$t(71) = 4.73$, $p < 0.0001$]. Each incremental component of transparency added an average of 12.4 units of liking on a 100-point scale, as can be seen in Figure 6. Nested model comparisons showed that the model including only Transparency fit as well ($R^2 = 0.242$) as one estimating separate main effects for the three components of Transparency [$F(2,68) = 0.27$] or a model estimating all main and interaction effects of the components [$F(6,64) = 0.33$]. R^2 values were 0.248 and 0.265 respectively, for the latter two models.

Liking for purchased brands. Consumers tested 10 red or 10 white wines after shopping. For the set of 10, we computed the mean rated liking of the subset that the consumer had purchased earlier on at least one of the eight shopping trials, dropping from the analysis three

Figure 6 **Shopping Enjoyment as a Function of "Interface Transparency" of Shopping Environment**



Note: Interface Transparency is sum of dummy variables for Price Usability, Quality Usability, and Store Comparability.

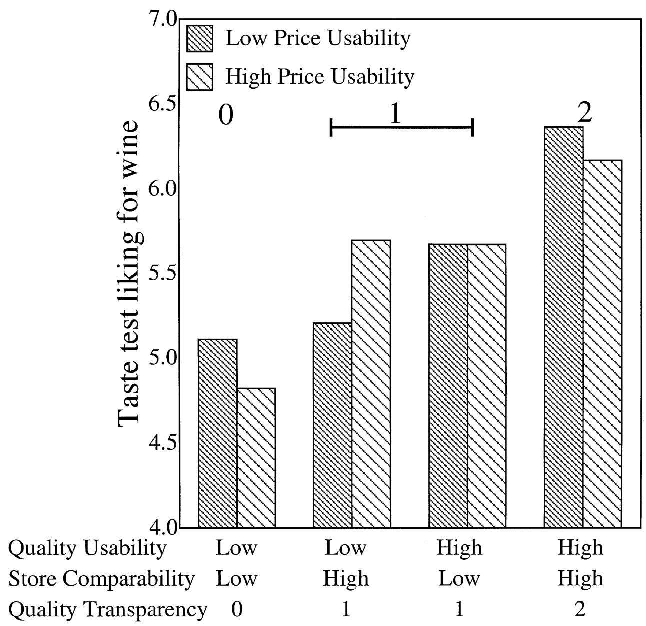
participants who did not purchase any of the 10 wines that they later tasted. We regressed this measure of liking for the purchased brands on the main effects of Price Usability, Quality Usability, and Store Comparability, and the mean liking of wines not purchased. The latter is a covariate that controls for individual differences in scale usage, liking for wine in general, etc. We expected that consumers would make better choices—liking the purchased wines more—when Quality Transparency was high—that is, when Quality Usability and ease of Store Comparability were high.

ANOVA results showed a significant effect of the covariate rating of unpurchased wines [$F(1,64) = 47.7$], a main effect for Quality Usability [$F(1,64) = 6.74$, $p = 0.012$], and a marginal main effect for Store Comparability [$F(1,64) = 2.98$, $p = 0.089$]. As expected, consumers were better able to choose wines they liked when Quality Usability was high ($M = 5.97$) rather than low ($M = 5.21$) and when Store Comparability was high ($M = 5.85$) rather than low ($M = 5.33$). Both of these effects supported the hypothesis that information systems that are more complete and informative will elicit higher ratings. These results support the idea that increasing quality information makes consumers better able to choose merchandise that matches their personal tastes. There was no effect for Price Usability [$F(1,64) = 0.00$].

We replaced the main effects of Quality Usability and Store Comparability dummies in the model with a Quality Transparency index equal to the sum of their dummies—constraining their weights to be equal in magnitude and direction. Model $R^2 = 0.502$ for the constrained model, which does not differ significantly from the $R^2 = 0.513$ of the full ANOVA model [$F(5,60) = 0.27$] or the $R^2 = 0.505$ of main effects model [$F(1,64) = 0.35$). This analysis leads to the conclusion that liking for the chosen wines increases by 0.64 of a scale point on a 10-point scale for each improvement in Quality Transparency [$t(65) = 3.05$, $p < 0.003$], with Price Usability still showing zero effect [$t(65) = 0.02$]. Figure 7 plots the results.[3]

[3]A reviewer argued that the Quality Transparency index should include Price Usability in addition to Quality Usability and Store Comparison. We cannot reject this view. When we replace our Quality Transparency index with the Interface Transparency index that sums the dummies for all three search costs, the model $R^2 = .479$ does not differ significantly from an unconstrained model that estimates each main effect separately [$F(2,64) = 1.66$, $p = 0.20$], and differs only

Figure 7 **Taste Test Liking for Wine as a Function of Quality Transparency (Quality Usability + Store Comparability Dummies) and Price Usability**



Two other findings for this dependent variable bear mention. First, we analyzed the number of bottles from our taste-test sample that participants purchased. Our wine expert had identified these as the wines in our inventory most often purchased by inexperienced consumers. We found a main effect for Store Comparability [$F(1,61) = 6.54$, $p = 0.013$]. Participants in the low Store Comparability condition purchased more of our sample than participants in the high Store Comparability condition. We speculate that in the high Store Comparability condition consumers were better able to choose wines that deviated from the group norms.

Second, we correlated our search variables with the difference in rated liking of chosen and unchosen wines, using only cells for which a search variable was not structurally zero. In the high Price Usability conditions, sorting by price was associated with lower liking for chosen wines relative to unchosen ones ($r = -0.34$, $p < 0.05$).

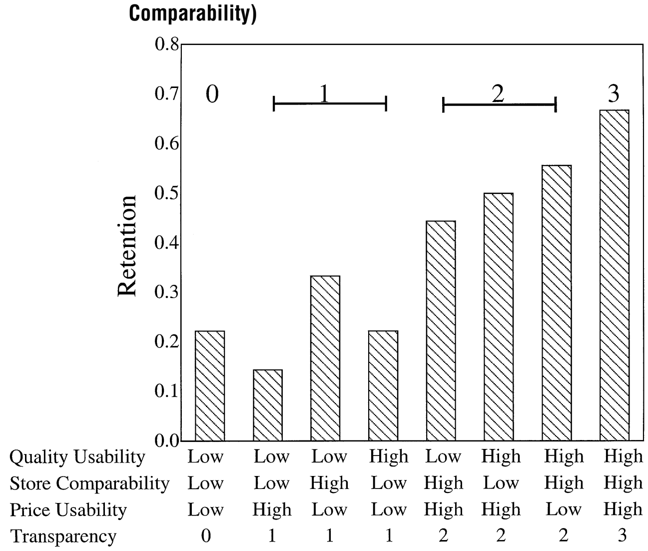
Retention. Two months after the first phase of the study, participants were invited to take part in a second phase in which they would be e-mailed software from the experiment that would allow them to shop from home. Their agreement was our measure of retention. Three participants did not respond. We analyzed the data treating those nonresponses both as missing and as a failure to retain. We present the former results, which prove to yield slightly more conservative conclusions.

Yes/No responses were analyzed by a $2 \times 2 \times 2$ Price Usability $\times$ Quality Usability $\times$ Store Comparability ANOVA. The results showed a marginally significant main effect for Quality Usability [$F(1,61) = 2.91$, $p = 0.093$] and a marginally significant main effect for Store Comparability [$F(1,61) = 3.77$, $p = 0.057$]. Logit and probit regressions including the main effects of Price Usability, Quality Usability, and Store Comparability all led to the same conclusions, albeit with slightly more power. When Quality Usability was low, 29% requested software to use the service further, compared with 49% when Quality Usability was high. When Store Comparability was low, 27% were retained, whereas 50% were retained when Store Comparability was high. The Store Comparability effect becomes significant at conventional levels if missing responses are treated as "No" responses.

Our expectation was that between-cell differences in retention probability would be completely accounted for by a 1 df contrast for Interface Transparency, defined as the sum of the 1-0 dummy variables for Price Usability, Quality Usability, and Store Comparability. This expectation was supported. Retention significantly increased with Transparency [$F(1,61) = 7.11$, $p < 0.01$], and there was no significant residual between-cell variation after subtracting out variance due to Transparency [$F(6,61) = 0.24$]. If Retention is regressed on Transparency alone, Retention probability increases 17.4% for every added element of Transparency, as seen in Figure 8.

Market Share of Common Wines. We suggested in the introduction that retailers may respond to consumer demand for more transparency by coupling increased transparency with a merchandising shift. Increasingly, retailers might seek exclusive distribution

Figure 8 Retention as a Function of Interface Transparency (Sum of Dummies for Price Usability, Quality Usability, and Store Comparability)



marginally from a model that relaxes the constraint that Price Usability must share a common coefficient with Quality Usability and Store Comparability, [$F(1,65) = 3.0$, $p < 0.09$]. The coefficient on the transparency index implies that each search cost reduced improves liking for the chosen wines by 0.42 scale points [$t(66) = 2.48$, $p < 0.02$].

from manufacturers and rely less on common merchandise. We showed above that high Store Comparability increased price sensitivity for common wines. We now address the question of how market share returns to distribution are affected by lowered search costs.

We examined the effects of Price Usability, Quality Usability, and Store Comparability on the per-customer market share of the common wines in our experiment. For each customer, we calculated the share of common wines, (quantity of common wines)/(quantity of unique wines + quantity of common wines). Results showed a main effect for ease of Store Comparability, [$F(1,64) = 4.99$, $p < 0.05$]. The common wines had an average 35.9% market share when Store Comparability was low, and an average 26.2% market share when it was high. The implication is that manufacturer returns to distribution are diminished in electronic environments that make cross-shopping easy rather than hard.

It is instructive to compare each of these market shares to two benchmark null hypotheses. Consider the null hypothesis that the common wines' market share is proportional to their share of distribution—i.e., one-third of the merchandise at each of the two competing stores. Given the 35.9% share in the low Store Comparability condition, one cannot reject that null hypothesis [$t(35) = 0.83$, $p > 0.4$], but the 26.2% common wine share in the high Store Comparability condition is significantly lower than 33.3% [$t(35) = -2.36$, $p < 0.05$].

We noted that even when Store Comparability was high, wines sold in both stores attained disproportionately high market share. We formed Common and Unique wine blocks by dividing our 100 wines into five stratified random samples of 20 wines each, then randomly designating one of the five blocks as the one to be sold in both stores. If the customer realized the identity of the wines sold in both stores, then the market share of those wines would be one-fifth, not one-third, as in similarity effects (Tversky 1972). Common wines had significantly more than 20% market share for both high Store Comparability [$t(35) = 2.08$, $p < 0.05$] and low Store Comparability [$t(35) = 5.33$, $p < .0001$]. Thus, there appear to be positive returns to distribution for electronic merchants even when cross-shopping is easy.

One possible reason for this higher-than-20% share is that common wines are available at low prices in at least one store on six out of eight trials in the experiment. The unique wines are discounted on only four of the eight trials. To control for differences in pricing, we analyzed share of the common wines in the one trial out of eight in which all wines sold at their high price. We report here an aggregate analysis because too many subjects bought no wines on that trial to measure share at the individual level. In aggregate, the common wines had a 23.4% share in the high Store Comparability condition (22 of 94 bottles purchased) and a 35.2% share in the low Store Comparability condition (44 of 125 bottles purchased). These percentages differed marginally from each other [$\chi^2(1) = 3.55$, $p < 0.06$]. The 23.4% share differs significantly from the null hypothesis of 33.3%—i.e., share proportional to distribution—[$\chi^2(1) = 4.17$, $p < 0.05$]. It does not differ significantly from the null hypothesis of 20%—share equal to fraction of all available wines in the common block, [$\chi^2(1) = 0.68$, $p > 0.4$]. The 35.2% share does not differ significantly from the null hypothesis of 33.3%, [$\chi^2(1) = 0.20$, $p > 0.65$], but it does differ from the null hypothesis of 20%, [$\chi^2(1) = 18.1$, $p < 0.0001$].

Discussion

Implications for Retailers

Both academics and popular business-press writers have stressed the potential for electronic retailing to increase competition, owing largely to easier price search. Alba et al. (1997) argued that established retailers' fears of increased price competition have led them to underinvest and to attempt to create electronic venues that minimize exposure to competition. The result, ironically, was that their defensive offerings gave customers little reason to shop electronically, leading to poor sales that they then misinterpreted as an indication that the electronic venue had low potential.

We have argued that the conventional analysis overlooks two important countervailing principles that have received ample documentation in marketing research on the economics of information. First, electronic shopping can also reduce search costs for differentiating quality information (Alba et al. 1997, Bakos 1997). It has been well established that differentiating information can lower price sensitivity (Kaul and Wittink 1995, cf. Mitra and Lynch 1995). Making it easy for consumers to compare across stores need not intensify price competition—at least not if competing stores are selling exclusive (nonoverlapping) merchandise. Consequently, if a retailer cooperates in efforts to lower search costs for price, for quality information, and for comparison across stores, it may well be that consumer price sensitivity will be no greater than it is currently at electronic retailing sites. It is a matter of the relative strength of the three effects.

Our empirical results support this conjecture, but not without boundary conditions noted below. We examined the effects of Price Usability, Quality Usability, and ease of Store Comparability on price sensitivity. We found that increasing Price Usability had no reliable effect, but increasing Quality Usability decreased price sensitivity. Increasing ease of Store Comparability did not increase quantity sold; it increased price sensitivity for Common wines sold by both competing merchants, but not for wines unique to one merchant. In the marketplace, similar effects would create incentives for retailers to carry more unique merchandise. Only low-cost retailers who can expect to undercut rivals on price will benefit from higher Store Comparability for common merchandise.

The second part of our thesis is that offering consumers the benefits of transparency improves consumer welfare. We showed that consumers were better able to choose wines that they liked in taste tests when they used electronic interfaces that maximized the transparency of quality information. Erlich and Fisher (1982) argue that if information has the potential to reduce the full price of a good (purchase price + cost of search + costs from disappointing purchases), consumers will demand it. We therefore predicted that by maximizing the transparency of the information environment for consumers, retailers would earn their repeat business—or, alternatively, that consumers would not be trapped in impoverished, defensive sites of low transparency. Our findings show exactly that. Retention was significantly higher for shoppers in more transparent informational environments when we recontacted them two months after the experiment with the offer to continue the same service.

Collectively, our findings imply that retailers should be open to cooperation with third-party agents allowing cross-store comparison, but should avoid commoditization by increasing the uniqueness of their merchandise. When they cooperate with comparison-shopping engines, it is in their interest to make the informational base include richer differentiating information. Current comparison agents have relatively impoverished criteria, effectively increasing Price Usability and Store Comparability without increasing Quality Usability (*The Economist* 1997, Quick 1998a). See, e.g., http://www.zdnet.com/computershopper/, and contrast this with www.bizrate.com, which attempts to provide better and more easily processed information on retailer quality, thus making it more viable to compete on quality.

Implications for Manufacturers: Effects of Distribution on Market Share

Most of our analysis takes a retailer's perspective on the problem of whether or not to participate in transparent electronic markets that permit easy comparison. Retailers' incentives affect the derived demand for manufacturers' brands. Perhaps our most striking findings are those showing how transparent comparison affects the relative attractiveness to retailers of exclusive brands versus those carried by their competitors. Demand for common brands becomes more price sensitive, and the market share of common brands is reduced.

Considering this finding from the manufacturer's perspective, we see that transparent comparison reduces returns to distribution. We showed that when Store Comparability is low, the market share of common brands was proportional to market share, but when Store Comparability was high, the market share of wines carried in two stores was no higher than the share of unique wines carried by only one store. Our results are consistent with Alba et al.'s (1997) conjecture that easy comparison may militate toward a world in which manufacturers will be more open to selling retailers private label merchandise, branded variants, and partnering with a single powerful retailer to offer outright exclusives. This issue of the influence of search costs on branding and branded merchandise deserves significant future research.

Conclusions and Future Research

The challenge to online merchants is not to fortify their defensive positions. In a competitive environment, the strategy of keeping some search costs high is arguably doomed to fail. Rather, retailers' task is to learn how to provide consumers with useful product-related information that will increase consumer retention by increasing consumers' satisfaction with the merchandise they purchase. Although we studied only the behavior of consumers, our research also highlights the interconnectedness of retailers' merchandising decisions with their decisions about cooperating to lower search costs. Lowered search costs may reduce the profitability to retailers of internationally branded merchandise carried by competing retailers. Taken together, retailers are given incentives to invest in specialization—providing deep information about a (perhaps smaller) inventory of exclusive merchandise. The kinds of price pressures on electronic retailers that have been amply discussed in the business press may translate to unforeseen second-order pressures on manufacturers of branded merchandise.

The net effects of retailer decisions about search costs and merchandising on price sensitivity, consumer welfare, and retailer incentive to carry exclusive merchandise are a matter of calibration of the strength of effects of our three search costs. We chose the product category of wines quite deliberately in an attempt to demonstrate our rhetorical points. Thus, what we expect to generalize is our conceptual point about the tradeoff of these search costs rather than our specific finding that the differentiating effects of quality usability dominate the effects of lowering search costs for price information. Our conceptual framework can be adapted to any specific electronic shopping environment.

Beyond these matters of calibration, there are interesting questions of the external validity of our findings that turn on the interaction of our conceptual search-cost variables with background factors held constant in our experiment (Lynch 1982). Below we consider potential moderators of the effects in our experiment that deserve attention in future research.

First, Bakos (1997) argues that lowering search costs for price should matter less when lack-of-fit costs are higher. Such a pattern should occur in product classes characterized by a high degree of real differentiation, such as wines. In such a market there is great potential for well-done electronic shopping to increase consumers' ability to choose goods that they like better than those they would have chosen in another shopping medium. In commodity-type markets, perhaps the effect of making prices more transparent would prevail. Our findings for common wines are consistent with this conjecture. Arguably, when alternatives are the same, easy comparison is lowering search cost for price. Further empirical and analytical work on seller incentives to disclose parity versus differentiation is needed (cf. Bakos 1997, Shaffer and Zettelmeyer 1998).

Second, Bakos deduces that the search cost for price should matter more when there are more sellers. We had 100 distinct wines, but only two retailers. Perhaps if we had replicated our results with, say, six retailers instead of two, we would have found that the net effect of lowering all three component search costs would have been to increase price sensitivity.

Third, consider the mix of common and unique wines at the two stores. In categories like books, CDs, and travel, the major electronic retailers may have extremely high overlap of merchandise (e.g., Clemons et al. 1999). In categories like clothing and housewares, the overlap is much lower. In our research, each store stocked two thirds unique and one third common wines. What would happen if the overlap of merchandise were higher—e.g., 90% common and 10% unique? One simple answer is that a higher fraction of the merchandise would behave as the common block, leading to high price sensitivity when store comparison is easy. Increasing the share of the common merchandise could also increase consumers' incentive to search to see if another retailer is carrying the same item for a lower price.

Fourth, prices in our study were exogenous. It is an open question how our results would change if pricing were endogenous. Electronic retailing makes it easier to monitor competitors and to respond in a rivalrous manner (Cortese 1998). Gatignon's (1984) research on advertising suggests that such circumstances might tip the balance of the effects of transparency toward greater price sensitivity.

Fifth, Mitra and Lynch (1995) argue that the path from advertising to differentiated preferences is strongest when consumers begin with little knowledge. The same point should hold for differentiation via electronic shopping. If consumers learn about alternatives off-line and only come online to complete the transaction, there would be little differentiation effect to offset the lowered costs of search for price and for comparing sellers of the preselected good.

This same conceptual point suggests interesting avenues for future research on dynamic changes in price sensitivity over time after a cohort of consumers has adopted a full-featured electronic shopping system. Consider highly differentiated markets in which there is little new entry over time, but where prices remain volatile over time due to promotion, etc. A full-featured electronic shopping system might cause shoppers to be less price-sensitive when they first shop electronically than when they shop in brick-and-mortar stores. But after some time, consumers will have learned about whatever product differences exist. Once real product differences are learned, the potential of electronic shopping to achieve further differentiation would diminish while consumers' ability to track and compare volatile prices would remain. Thus, one might expect that with the introduction of full-featured electronic shopping, price sensitivity would first decrease and then increase over time compared with price sensitivity in brick-and-mortar retail environments. In a category such as wine, there is constant turnover in the set of competing alternatives. Here electronic shopping systems may continue to be valuable media for differentiation.

All is not lost even when consumers can learn. As in a brick-and-mortar world, electronic sellers can learn about customers' tastes. They then can use this information to provide better and better tailored advice about which alternatives would maximize customer utility. Retailers can offer customers ancillary services such as Peapod's "Personal Lists" that reduce price sensitivity (Degeratu et al. 1998). They can use customer data to anticipate utility better, using smart agents to build trust (Urban 1998). Research is needed to learn how retailers can use electronic commerce not to compete on price, but to capture the value of differentiation for their customers and themselves.[4]

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