5-25-2000

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Abstract
The authors study the effect that consumers' adopted shopping patterns have on their responsiveness to pricing activity of retailers. Two important dimensions of shopping behavior — inclination to switch stores and preference for a particular retail price format (every day low price (EDLP) or promotional price (HILO)) are hypothesized to systematically affect the responsiveness of in-store expenditure decisions to changes in prices. In particular, store loyal households should be more responsive to changes in prices when deciding how much to buy in a given store. Similarly, the household shopping in a HILO format (where price variability is greater) should be more responsive. These hypotheses are developed and then tested using a joint model of store choice and in-store expenditure which accounts for potential interdependence between these decisions.

The findings attest to the ability of consumers to exploit variation in the environment: When constrained on one dimension (e.g., by shopping in only one store), consumers exhibit flexibility on another (e.g., by adjusting expenditures in response to price changes). If afforded the opportunity to be flexible (e.g., through variable prices at a HILO store), consumers take advantage of this. These aspects of shopping behavior interact in a theoretically interesting, but counter-intuitive way: the expenditure decisions of HILO switching consumers turn out to be the *least* responsive to changes in prices at a *particular* store. These shoppers exploit advertised price differences and move among stores. This responsiveness in the store choice decision means they have less incentive to exhibit flexibility in their expenditure decisions at a given store. The authors present estimates from a series of models calibrated on a scanner panel data set which captures store choices and expenditure receipts, and find all hypotheses to be supported.

Keywords
shopping behavior, store choice, expenditure, selectivity bias

Disciplines
Behavioral Economics | Business | Cognition and Perception | Cognitive Psychology | Experimental Analysis of Behavior | Marketing

Comments
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Consumer Shopping Behaviors
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May 25, 2000

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Key Words: Shopping Behavior; Store Choice; Expenditure; Selectivity Bias

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Consumers engaged in repetitive shopping behavior (e.g., for groceries in a supermarket) regularly encounter the need to make two types of decisions for each shopping trip: where to shop, and once in the store, which products to buy. The initial store choice and subsequent product purchase decisions inside the store may be driven by very different factors (e.g., store location may not affect expenditures in a store while store traffic is unlikely to be generated by in-store displays). Despite the potential differences in causal factors, evidence indicates that the two are related. For example, field work by Park, Iyer and Smith (1989) finds a link between familiarity with the store environment to purchase outcomes in the store. Econometric work by Krishnamurthi and Raj (1988) shows that brand choice and purchase quantity decisions are interdependent. This raises the question of how the store choice and subsequent in-store expenditure decisions may be linked.

Although store traffic and in-store expenditure both drive sales, store choice and total purchases have traditionally been studied separately. Sales, either in volumes or in market shares, have been widely studied at an aggregate (store/chain) level (e.g. Hoch, Dréze and Purk 1994; Montgomery 1997). In addition, Kumar and Leone (1988) and Walters (1991) model brand sales at an aggregate level and demonstrate that pricing activity in one store can have a statistically significant effect on sales in competing stores. While these studies provide insight into sales drivers, it may be difficult to use them to assess the impact of marketing activity on store choice versus in-store expenditure because they do not explicitly model consumers' store choice decisions. Furthermore, in cases where empirical work involves a single category, drawing implications regarding total in-store expenditures is problematic.

At the disaggregate level, store choice — the individual-level equivalent to store traffic — has been the subject of recent work (e.g., Bell and Lattin 1998; Ho, Tang and Bell 1998). Even though these studies do not model expenditure directly, the results lead to some conjectures about the relationship between choice and expenditure. Bell and Lattin (1998) show that the intended size of the market basket is linked to consumer preference for different supermarket price formats: Large basket shoppers prefer the format with lower average basket prices. Ho, Tang and Bell (1998) show that for a rational cost-minimizing consumer, the frequency of store visits and the average quantities purchased per visit are driven by price variability. While these findings allude to a correlation between store choice and in-store expenditures there exists no joint model of the store-choice and in-store expenditure decisions. Moreover, previous econometric work has not provided a detailed analysis of how retail-level marketing variables (e.g. price, feature or display) influence store choice versus in-store expenditure, or of how consumers' shopping behaviors affect their in-store purchase decisions.

Because shopping behavior is repetitive, consumers have multiple opportunities to select stores and purchase products. This creates a potential to (1) learn about product prices at *multiple* stores prior to store visits (via feature advertising) and (2) to become familiar with *particular* store environments through trips to these locations. These two features of the shopping process give consumers the *potential* to exhibit flexibility in their behavior. First, they can use their knowledge of prices at a *particular point in time* to inform their store selection decision. Second, consumers accumulate knowledge about the price distribution at a *particular store* through increased visits. This knowledge allows them to recognize when deals in this store are attractive (or prices are too high) and to adjust their expenditures on that trip accordingly.

The general question of interest to us is how shoppers who have settled into a store choice pattern (to be a store loyal or store switcher) and a price format to shop in (every day low price (EDLP) or promotional price (HILO)) make their purchase decisions once in the store. Our analysis is based on the premise that the propensity to switch stores and preference for a particular store format are not only important dimensions of overall shopping behavior, but that these dimensions are relatively stable over time for a particular consumer.[1] In this paper, we propose that in deciding how to shop in a store on a given trip, consumers take advantage of the flexibility afforded to them by their overall shopping behavior.

Two stylized examples help to illustrate the types of behavior of interest to us. Mr Jones, after a brief period of store switching subsequent to his arrival in a new neighborhood, has now settled into

[1]We provide evidence of the primacy and stability of these dimensions of shopping behavio later in the paper.

a shopping pattern that sees him shop almost exclusively at his favorite store — a HILO store that sometimes offers specials and deep discounts off a variety of its merchandise. Through his habitual shopping in this store, Mr Jones has developed some ability to recognize deals and, as a consequence, his expenditures on a given trip are quite responsive to changes in prices. As a store-loyal shopper, Mr Jones implicitly recognizes that to profit from his loyalty to a promotional pricing store he can adjust his expenditures in response to favorable (or unfavorable) prices. This type of responsiveness has been documented for consumer purchase quantity decisions in single product categories (e.g., Krishnamurthi and Raj 1991; Krishnamurthi, Mazumbdar and Raj 1992). In addition, Bell and Bucklin (1999) find that through the judicious management of product inventory, consumers are able to strategically time product category purchases to coincide with favorable perceptions of category prices.[2]

Mrs Brown, on the other hand, frequents two neighborhood HILO stores. Both stores regularly advertise price specials and, in addition, post unadvertised price specials on many products. On a given shopping trip, her store choice decision is quite sensitive to the advertised information she scans about specials on that day. Once in the store, however, she refrains from increasing expenditures in response to favorable prices, as she knows that the next time she is in need of the product, she has more than one source from which to obtain it.

These shopping scenarios provide an entree into the phenomena that we examine in this paper. In the first case, the consumer is predisposed to shopping primarily in one store. In this setting he adjusts expenditures in the store in response to deals. In the second case, the shopper makes an explicit store choice decision on each visit, yet has a lower need to be as responsive to in-store prices. The logic for this is that, the stores act as substitutes and she therefore does not need to customize her expenditure patterns to best take advantage of any one store.

In addition to the expenditure response differences that may be induced by store loyalty versus store switching, we also expect to see expenditure responsiveness moderated by the price format of the chosen store. In particular, if Mr Jones were to shop only in an EDLP store, instead of a HILO store, we would expect him to be less responsive to price changes. Such behavior would be a rational

[2]This type of "flexibility" is also reported in industry studies by the Point of Purchase Advertising Institute which note that upwards of 50% of product purchases are unplanned.

response to the greater degree of price variation in the HILO store (Ho, Tang and Bell 1998).

The purpose of this paper is to examine the relationship between consumers' store choice and in-store expenditure decisions. We develop and test hypotheses about the outcomes associated with particular shopping behaviors along the two dimensions just discussed: store loyalty versus store switching and choice of HILO versus EDLP price format. Our first objective is to formulate a model to jointly estimate store choice and expenditure decisions and test for interdependence (selectivity bias). For households identified as store-switchers, we estimate this joint model of store choice and expenditure; for the store loyals we simply estimate store-specific expenditure equations.[3] Our first hypothesis is that with respect to the shopping process, the decisions of where to shop and how much to spend will not be independent.

We then use the parameters estimated from these models to test three hypotheses relating to consumers' shopping behaviors. First, following Krishnamurthi and Raj (1991), we expect that store switching households will be responsive to prices in their store choice decisions, but not in their expenditure decisions. Store loyals (by definition) will not be responsive to prices in store choice, however, they are expected to be more responsive than switchers in their expenditure decisions. Second, the literature on disaggregate store choice and preference for price formats (e.g., Bell and Lattin 1998; Ho et al 1998) leads us to expect that HILO-shoppers will be more responsive to in-store prices in their expenditure decisions than their EDLP counterparts. We also hypothesize an interaction between switching and format. While one might expect that the *most* responsive shopper might be the HILO-switching shopper (this shopper is sensitive to prices in store choice and is exposed to the most price variability), we argue that this need not be the case for the in-store expenditure decision.

We report our results using an extensive market basket database which contains information on the store choices of consumers and the expenditures made on each trip. The remainder of the paper is organized as follows. In the next section, we present a conceptual development for the analysis of consumer shopping behaviors. This section forms the basis for four hypotheses and a separate section on the econometric model of the store choice and expenditure decisions of shoppers. Three subsequent sections then describe the data and measures, discuss the results and summarize findings

[3] It is clear from our data that store-switching and store loyalty are enduring characteristics of an individual's shopping behavior. We discuss this in more detail in the Data, Measures and Model Specification section.

and implications.

CONCEPTUAL DEVELOPMENT

A key premise of this paper is that consumers have different shopping behaviors and that they lead logically to different patterns of in-store response to marketing variables. The behavioral foundation for this premise is that the consumer's store choice and expenditure decisions are linked and dependent on each other. As noted earlier, this foundation has a basis in consumer behavior field work (e.g., Park et al 1989), formal econometric analysis (e.g., Krishnamurthi and Raj 1988) and recent work on store choice (e.g., Bell and Lattin 1998). We begin by describing the rationale and mechanism for this joint process and then proceed to outline specific hypotheses regarding how shopping behaviors influence the expenditure outcomes. In particular, we develop arguments for how two dimensions of shopping behavior (inclination to switch stores and preference for store price formats) influence the in-store expenditure behavior of consumers.

Store Choice and Expenditure as Related Decisions

At the level of in-store decision-making the need to decompose the impact of promotional activity on separate consumer decisions has long been acknowledged (Gupta 1988; Chiang 1991).[4] Decomposing the impact of price and promotion into the effects on purchase incidence, brand choice, and purchase quantity allows manufacturers and retailers to better evaluate promotion activity (e.g., brand switching versus purchase acceleration) and gives deeper insights into consumer behavior. Prior research on these in-store decisions has either focused on some subset of the three (e.g., Neslin, Henderson and Quelch 1985; Krishnamurthi and Raj 1988, 1991) or analyzed them simultaneously (e.g. Gupta 1988; Chiang 1991; Chintagunta 1993). While these studies differ in many respects, those that allow the possibility that consumer decisions might depend on each other find support for this idea (e.g., the decision of how much product to buy is affected by which brand is initially chosen).

[4]The term "in-store decision-making" refers to the decisions of purchase incidence, brand choice and purchase quantity, which are *conditional* upon a store choice having been made. These are also decisions for which it is assumed that the consumer has complete access to prices and promotion information prior to making a choice.

In a parallel development to work on in-store decision making, previous literature suggests that store choice and in-store expenditure decisions are not independent, and that clear competitive and consumer purchase patterns arise from the (co-existence of) competition between EDLP and HILO format stores (e.g., Bell and Lattin 1998; Ho et al 1998). Collectively, these findings suggest a joint relationship between store choice (which drives store traffic) and in-store expenditure (conditional sales) and highlight the need to study both simultaneously. In the empirical work in this paper, we will control and test for this potential interdependency, or "selectivity bias" directly. Existing models for in-store decisions from the brand choice literature (e.g., Krishnamurthi and Raj 1988; Tellis 1988; Chiang 1991; Chintagunta 1993) all provide suitable frameworks for the analysis of, and testing for, selectivity bias in those contexts, and will serve as a starting point for our model development.

In summary, prior literature has identified dependence between brand choice and purchase quantity decisions. Recent work on store choice has suggested a similar selectivity bias might exist in the store choice and expenditure decisions, but has not explicitly tested this idea.[5] Our hypotheses and analysis of consumer shopping behaviors are built on the fundamental notion that the store choice and expenditure decisions are linked. We therefore state our first hypothesis as follows:

H_1 Consumer store choice and in-store expenditure decisions are not independent (i.e., the amount that a shopper spends on a given store visit will be a function of the store selected).

To test this hypothesis we estimate a model that explicitly captures the (potential) correlation in these two decisions. We determine support for H_1 on the basis of comparative model fit (with respect to models in which the processes are assumed to be independent).

A Typology of Consumer Shopping Behaviors

We study the shopping behavior of a consumer along two dimensions: inclination to switch stores and preference for a particular retail price format. We choose these two factors as primary dimensions of the shopping behavior space because both have been shown to be relatively enduring characteristics of consumer behavior. Store visit behavior (in terms of number of stores shopped

[5]From a modeling point of view, the store choice and expenditure decisions parallel the brand choice and purchase quantity decisions. Both have a discrete and continuous component and are potentially interdependent.

and shopping frequency) has been shown to be relatively stable within a consumer over time (e.g., Bell et al 1998). In addition, the preference for a store format type is also highly stable (Galata et al 1999). This preference has been shown to be, in part, a rational outcome of self selection based on household characteristics. For example, a large family on a relatively fixed budget shopping infrequently may rationally prefer to patronize a store that is consistently less expensive on average, yet is located further from their residence (see Bell et al 1998 for a detailed discussion). Thus, the domain of shopping behavior that we investigate covers four potential types of shoppers:

	Inclination to Switch	
Format Preference	*Store Loyal*	*Store Switcher*
EDLP	EDLP Loyal	EDLP Switcher
HILO	HILO Loyal	HILO Switcher

A key assumption underlying our typology is that a given consumer's position in a particular cell is a stable outcome resulting from several exogenous factors that have been extensively studied in previous work. Our interest centers on how these dimensions of shopping behavior (individually, and by way of interaction) give rise to differences in expenditure responsiveness. It is important to note here that not only are these two dimensions of shopping behavior relatively enduring and stable, but also that they do in fact generate a meaningful segmentation of consumers. While it is possible that a store-switching household could switch across stores of *both* formats, it is the case that most households who switch stores do so *within* formats rather than across them. We discuss this point in more detail when we present the empirical results.[6]

Our focus is primarily on the behavioral differences in in-store expenditure response that may exist across cells of the matrix (i.e., that result directly from a particular shopping pattern). We treat each cell of the matrix as a natural experimental condition, within which we analyze the responsiveness of consumer expenditure decisions to changes in in-store prices. We classify consumers *a-priori* into the cells and estimate econometric models for each group. In the next section we present a detailed justification of this approach. We also note that the initial classifications (based on historical purchase

[6]We study the behavior of a total of 424 households who are either loyal to a single store, or switch among stores of the same format (i.e., either EDLP or HILO). A further 81 households (the smallest group) switch across both formats. In this paper, we do not analyze the behavior of these households.

patterns) are very robust and do not change over time. (This is to be expected given the results of prior research, and the large number of observations available with which to classify the households.)

Store Loyalty and Store Switching

In the literature on brand choice, a number of empirical regularities have emerged with respect to consumer switching patterns and underlying responsiveness to prices. A key generalization of relevance to our work is that of Krishnamurthi and Raj (1991), who show that brand loyal consumers are relatively insensitive to prices in their brand choice decisions, yet they respond to deals by stocking up on their preferred brands. Brand switchers, on the other hand, act in the opposite manner: they do not stock up on any one brand, but their initial brand choice decisions are highly sensitive to changes in price. Krishamurthi and Raj (1991) give the following rationale:

> "Loyal consumers are expected to be in the market for their particular brand often; in some sense they need the brand. Because of their strong preferences for the brand's attributes, they will choose the brand most of the time regardless of price. However, they are likely to adjust the quantity they purchase to take advantage of prices. This should be reflected in high quantity elasticities."

On the other hand, non-loyal consumers:

> "should be quite sensitive to the price of the brand in the choice decision. Because they have no compelling need to buy this particular brand, they will be persuaded to buy the brand only if the price is low enough. This is reflected in high choice elasticities. However, because this brand is not their favorite brand and they adjust brand choice based on prices, the quantity purchased is not expected to be as sensitive to the brand's price."

By a parallel logic, we expect to find a similar difference in the shopping behavior of consumers who are store loyal versus those who are store switchers. There are, however, some additional observations here. First, the store loyals, by definition, are able to make product selections only within the confines of a single store environment — they do not modify their store selection decisions on the basis of prices and advertisements observed prior to a store visit. The store switchers, on the other hand, shop in multiple store environments and make their store selection decision (in part) on the basis of observed feature advertising. How then would we expect loyals and switchers to differ in terms of responsiveness to prices in their in-store purchase decisions?

The store loyal shopper has no degrees of freedom in store selection and, as such, the only way this type of consumer can benefit from *intertemporal* variation in the pricing environment of the chosen store is to adjust purchase timing and quantities in response to prices on individual visits. Conversely, the store switcher can exploit *cross-sectional* variation in prices across stores *at a particular point in time* and may use this to determine which store to select on a given visit. Using this shopping behavior, the store switcher has less incentive to respond strongly to changes in in-store prices *for any given store*. In sum, the value of a price promotion on a given store visit is implicitly higher for the store loyal shopper because he or she returns to the same store environment on subsequent shopping trips.

Two other empirical regularities further support the expected effect for the store loyal shopper. First, we determined that brand loyalty and store loyalty are positively correlated. Using all our available data, we computed a brand loyalty index for each consumer in 24 product categories. This index was equal to the number of purchases in the category on the maximally-preferred sku divided by the total purchases in the category. We also computed a household-level store Herfindahl Index for each product category (to measure the store loyalty of households buying in the category). Over the 24 categories in our study, these two measures are positively correlated ($r = 0.2250,\ p < 0.0001$). This implies a further enhancement in the value of a deal to a store loyal shopper for the following reason: Krishnamurthi and Raj (1991) show that brand loyal consumers are more elastic than brand switchers when they make purchase quantity decisions (i.e., a brand loyal consumer will stock up on his or her preferred product). Thus, the store loyal shoppers (who also tend to be brand loyal) should respond to prices across many categories and this will show up as variation in their total in-store expenditures.

The second regularity is that stores promote some items simultaneously but also offer additional unique promotions (i.e., deals not offered by the other stores). This means that a store switcher will be exposed to a larger "deal menu" (higher proportion of deals at a given instant for the same product category) than a store loyal. The following exhibit is based on an analysis of 261,253 individual skus carried by two competing stores over a two year period. These skus are common to both stores (i.e., they are nationally branded items). To determine the type of deal menus that a store loyal or store switcher might encounter on any given trip we compute the percentage of times a given item is promoted in a single store, both stores, or not at all.[7]

[Table 1 about here]

In Table 1, categories are rank-ordered according to the frequency of promotion. The data should be interpreted as follows: Each column of the table records mutually-exclusive events and the columns are collectively exhaustive (summing across them gives 100%). In the soap category, a randomly selected item will not be on deal 52% of the time. 18% of the time it will be dealt in store E1 only, 14% of the time in store E2 only, and 16% of the time in both stores simultaneously. In all categories, the number of deals available in a given week at one store is *always* significantly less than the number that are *potentially* available to the store-switching shopper. Finally, it is important to recall that in this analysis we use only those skus which are available in all stores (in order to facilitate direct matches across stores). Thus, our results here are conservative because we omit private labels and other exclusive brands which may also be heavily and frequently dealt. Finally, as noted earlier, store switching and brand switching are also correlated. Thus, a store switcher not only sees larger deal menus, but is more likely to find an acceptable alternative on any given menu of deals.

Prior research and our exploratory analysis suggest the following hypothesized main effect of store loyalty:

$\mathbf{H}_2$ The expenditure decisions of store-loyal consumers will, relative to the expenditure decisions of store-switching consumers, be more responsive to changes in in-store prices.

Thus, the expenditure elasticity of the store loyal should be significantly higher than that of the store switcher: $\eta_L > \eta_S$ (where L and S denote loyals and switchers, respectively). As a corollary to H_2 we expect to see store-switching consumers respond to advertised prices when they select a store

[7] In Table 1 we provide data for the EDLP-switchers because this requires comparison across only two stores (there are only two EDLP stores in our dataset). We also replicated the analysis for the three stores available to the HILO switchers and evaluated promotion matches across all possible combinations of stores for every sku in the dataset. In the interests of space we do not provide the details here except to note that the qualitative pattern of results is identical to that presented. Details are available from the authors upon request.

and can test this by examining the relevant parameter estimate in the store choice model.

Store Formats: EDLP v HILO

The second dimension of shopping behavior — preference for a store price format — also has a theoretically plausible and predictable relationship with the responsiveness of consumer expenditures to changes in a store's prices. The EDLP format (relative to the HILO format), by definition, is a format that offers lower average prices and less variability in prices, both across items and across time. Two important points to note here are that these across-format differences have a basis in theory and in actual retailing practice (as reflected in observed pricing patterns of EDLP and HILO stores). Ho et al (1998) prove the following: If store A (the EDLP store) has a lower average price than store B (the HILO store) for a particular item, it must be the case that this store will also have less variability in prices for this item. The converse relation also holds such that the directional difference in price variability for a given item also predicts the directional difference in the average prices. This is rational behavior on the part of stores if they wish to make a consumer who is otherwise indifferent between them on other dimensions, remain indifferent.

Complementary experimental research by Alba et al (1994; 1999) shows that consumers are indeed able to distinguish between such formats and form stable impressions about them. Combining these ideas from previous work leads to a relatively straightforward prediction regarding the effect of format preference on expenditure elasticities. We expect that HILO shoppers will be more responsive in their expenditure decisions precisely because there is more variance in the environment (e.g. Ho et al 1998) and because increased flexibility in category purchases is a rational response to increased variance (e.g., Bell and Lattin 1998). Transferring this concept to the domain of total in-store expenditures, we hypothesize the main effect for store price format:

H$_3$ The expenditure decisions of HILO shoppers will, relative to the expenditure decisions of EDLP shoppers, be more responsive to changes in in-store prices.

In other words, holding the store switching/store loyalty dimension of shopping behavior constant, we expect the expenditure elasticity of the HILO shopper to be significantly higher than that of the EDLP shopper: $\eta_H > \eta_E$.

Store Loyalty/Store Format Interaction

Our final hypothesis involves an interaction effect for the two dimensions of shopping behavior: inclination to switch stores and preference for a particular store price format. To develop the intuition for the interaction, we refer back to the shopping behavior matrix and examine data on the average number of shopping visits over a one-year period and the average expenditures per visit. (We discuss the nature of our data in more detail in a subsequent section.)

	Inclination to Switch	
Format Preference	*Store Loyal*	*Store Switcher*
EDLP	EDLP Loyal [44, $57]	EDLP Switcher [57, $39]
HILO	HILO Loyal [57, $38]	HILO Switcher [89, $22]

Note that shoppers on the diagonals (EDLP Loyals and HILO Switchers) have very different visit and expenditure behavior. In order to understand the interaction and a key insight into what these shopping behaviors may imply, observe that the off-diagonal groups (EDLP switchers and HILO loyals) are *identical* in terms of the simple descriptive statistics that capture their shopping patterns. Thus, one might be tempted to infer that these two groups would be very similiar in terms of their expenditure elasticities (i.e., the extent to which their expenditures are responsive to prices in a given store). It might also be natural to expect that the group that both switches stores *and* faces the most price variation in the environment (i.e., the HILO switchers) could be the most responsive in terms of changing expenditures in particular stores in response to changes in price. We argue that this need not be the case.

We propose that exposure to price variation moderates the size of the gap in expenditure elasticities that occurs between store loyal and store switching households. In the EDLP environment, there is limited price variation, which should lead to a small gap in the size of the expenditure elasticities for loyals and switchers (i.e., loyals should only be slightly more responsive than switchers). In the HILO environment, the loyal household patronizing only one store should, all else constant, rationally exploit the *intertemporal* variation in prices by adjusting in-store expenditures: The greater variation at the HILO store serves to enhance the responsiveness associated with store loyalty. The HILO switcher, on the other hand, is exposed to the most variation in prices, both cross-sectionally and over time. As noted earlier, the implicit value of a *given* price promotion for a switcher is lower than for a loyal and this will be further lowered in an environment with large price variation: The greater variation in prices at the HILO stores serves to further reduce the value of a given deal for a store switcher. Putting these ideas together, we expect that the size of the gap in expenditure elasticities between store loyals and store switchers will be amplified in a HILO environment.

In addition to these arguments based on price variation, one can also observe some evidence for the interaction in the shopping patterns of the households. The HILO switcher is the most frequent shopper with an average of 89 visits per year and the shopper with the smallest average basket size ($22). These smaller value trips are more likely to contain a higher proportion of items that are necessities (e.g., Kahn and Schmittlein 1989). Necessities typically have low primary demand elasticities (e.g., Narasimhan, Neslin and Sen 1996) and their preponderance in the shopping basket would lead to a small expenditure elasticity. While the *overall* price sensitivity of these households is likely to be high (when the store choice elasticity is taken into account), the in-store expenditure elasticities will be relatively small. This leads to our final hypothesis:

H$_4$ The difference between the expenditure elasticities of loyal and switching households will be magnified in high price variation environments (i.e., HILO stores).

We test this by looking at whether there is evidence of this amplification in the elasticity: i.e., is $[(\eta_L - \eta_S)|H] > [(\eta_L - \eta_S)|E]$? A corollary to H$_4$ is the following. Households with the most *dissimilar* shopping patterns (EDLP loyals and HILO switchers) will both exhibit *similarly* low expenditure elasticities, but for different reasons. EDLP loyals have relatively little exposure to deals, and HILO switchers place less value on any given deal because of prevalent exposure. Conversely, the shoppers with identical shopping patterns (EDLP switchers and HILO loyals) will be very *different* in terms of expenditure elasticities. In particular, the HILO loyals will exhibit the greatest expenditure elasticity because they have strong incentives to respond to individual deals (because they only shop in one store) and greater opportunity (they shop in highly variable pricing environments).

ECONOMETRIC MODEL

In order to test our four hypotheses we need to formulate and estimate an econometric model of the store choice and expenditure decision. Our model formulation draws initially from a well-established base of models for discrete and continuous choices (e.g., Hanemann 1984; Krishnamurthi and Raj 1988), with some changes that capture unique aspects of the store choice and in-store expenditure interaction.

Store Choice and In-Store Expenditures

To decompose the impact of marketing activities into store choice and in-store expenditure effects, we develop a joint model of choice and expenditure decisions. Our proposed methodology for joint estimation is based on a limited dependent variable framework (Krishnamurthi and Raj 1988, 1991). We model the store choice decision with a standard conditional choice model (i.e., logit) and the expenditure decision with a regression model. A switching regression framework provides the link between the two components by allowing selectivity bias through correlated choice and expenditure error terms. If these correlations are significantly different from zero, we reject the hypothesis of independent store and expenditure decisions and find evidence in favor of H_1. Otherwise, one could simply proceed by analyzing both decisions separately (see Gupta 1988 for a model in which brand choice and purchase quantity decisions are independent).

As shown in Hanemann (1984), a model of joint discrete/continuous decisions, based on the actions of a utility-maximizing agent, can be derived as a special case of a more general statistical model of switching regressions. In fact, this framework has been applied in the marketing literature in the domain of category level decision-making (e.g., Chiang 1991; Chintagunta 1993). An important advantage of this approach is that it is derived from explicit structural roots (e.g., the demand equations for the continuous variables can be obtained directly from Roy's Identity). Unfortunately, the approach is not directly applicable when one considers a sequential discrete/continuous decision in which information available to the decision-maker changes across the two decisions. In Hanemann

(1984) the decision-maker must have all the relevant information available for both decisions (e.g., as in the brand selection and purchase quantity decisions) from the start of the decision process. Any new and relevant information for one of the decisions cannot be uncovered from the outcome of the other.

This assumption, implicit in Hanemann's formal derivations, poses important problems for the store choice problem we wish to analyze. When modeling a brand selection/purchase quantity decision it is reasonable to assume that all the prices for each alternative, and all the remaining relevant information for the decision process, is either known or costessly available by simple in-store inspection. For store choice decisions, however, consumers cannot be assumed to know all the relevant variables pertaining to the in-store expenditure decision *prior* to entering the store. In addition, consumers will be faced with particular displays and with an overall store environment that will influence their expenditure decision that are not known, or predictable, before visiting the store destination. To be sure, consumers may build expectations of prices (e.g. using previous price levels), availability, and general store environment, and use these expectations together with other variables (e.g. distance to store) to choose which store to visit. But, once a store is chosen and visited, the consumer will acquire new information relevant to the expenditure decision. It is also important to recognize that the nature of the change in the consumer's information set (once a store is selected) will vary according to the store selected. Finally, Hanemann's approach also imposes severe restrictions on the elasticity structure and the functional form of the expenditure equation (e.g., Chintagunta 1993).

These issues suggest the need for a more flexible model. In particular, a model that (1) can allow for changes in the information set, (2) has store-specific demand functions to accommodate differential sensitivity to marketing activities in each store, and (3) has a flexible elasticity structure. Our proposed model, which is similar to the reduced-form approach of Krishnamurthi and Raj (1988), has all of these features. We build the choice and expenditure components of the model separately. We then link their error structures to account for potential decision inter-dependence based on unobserved preference structures.

Store Choice. We model store choice using the familiar multinomial logit framework. The random utility of household h for store s at time t is

$$U_{st}^h = \overline{U}_{st}^h + \epsilon_{st}^h \tag{1}$$

where the errors ϵ_{st}^h are iid extreme value random variables. The deterministic component is

$$\overline{U}_{st}^h = \mu_s + Q_s^h \lambda' + W_{st}^h \alpha' \tag{2}$$

where μ_s is a store-specific constant, Q_{st}^h is a $(1 \times k_1)$ vector of household, store, and time-specific covariates, and λ the corresponding $(1 \times k_1)$ vector of response parameters. W_s^h is a $(1 \times k_2)$ vector of household and store-specific covariates and α the corresponding $(1 \times k_2)$ vector of parameters. These covariates, representing store and consumer characteristics that are known prior to store selection, will be discussed in the next section. Given this setup, the probability that store s will be chosen on the t^{th} shopping occasion by household h is

$$\Pr(s_t^h) = \frac{\exp(\overline{U}_{st}^h)}{\sum_{i=1}^{S} \exp(\overline{U}_{it}^h)} \tag{3}$$

In-Store Expenditure. In-store expenditures are denominated directly in dollar amounts. Previous studies (e.g., Kahn and Schmittlein 1989, 1992; Bell and Lattin 1998) have examined the empirical distribution of expenditures. Based on this work and our own exploratory analysis, we assume that grocery dollar expenditures across trips, stores and shoppers are log-normally distributed (i.e., the log of basket expenditures is normally distributed). We model log expenditure as a function of store and shopper-specific covariates:

$$\log Y_{st}^h = \upsilon_s + X_{st}^h \beta_s' + Z^h \theta_s' + u_{st}^h \qquad \left[u_{st}^h \overset{iid}{\sim} N(0, \sigma_s^2)\right] \tag{4}$$

where Y_{st}^h represents the total dollar expenditure by household h at store s on trip t. The elements of the $(1 \times k_3)$ vector X_{st}^h include time-varying store and household-specific variables (e.g., prices, etc.). Z^h is a $(1 \times k_4)$ vector of household-specific information (e.g. demographics, etc.) which accounts for observable household heterogeneity. An important feature of the in-store expenditure equation is the specification of store-specific response parameters. In particular, the υ_s parameters capture the fact that base levels of expenditures on a given trip can be different across stores. We expect this given prior work (e.g., Bell and Lattin 1998) showing strong relationships between basket size and type of store. Moreover, through the vectors β_s and θ_s, we allow for differential response across stores to the same covariate. Again, the details of the covariates in equation (4) are given in the next section.

The Joint Store Choice/In-Store Expenditure Model. While equations (2) and (4) specify store choice and expenditure separately, we require a mechanism that allows for a potential linkage between the two decisions. To see how the decisions can be linked, note that the dependent variable $\log Y_{st}^h$ (log expenditure in equation 4) is observed if and only if household h chooses store s at time t. Let δ_{st}^h denote a dichotomous indicator such that $\delta_{st}^h = 1$ if household h visited store s at time t, and $\delta_{st}^h = 0$ otherwise. In addition, let $\widetilde{Y}_t^h$ denote the household's log-expenditure at shopping trip t. Each store has its own expenditure regression (equation 4), and the store choice model will determine which expenditure equation is relevant on a given visit. To capture this, we apply a switching regressions approach to the two decisions, such that for each household at each shopping trip (for $h = 1, \ldots H$ and $t = 1, \ldots T^h$)

$$\begin{aligned} \widetilde{Y}_t^h &= \log Y_{st}^h = \upsilon_s + X_{st}^h \beta_s' + Z^h \theta_s' + u_{st}^h \quad \text{for} \quad \delta_{st}^h = 1, \\ \text{and} \quad \delta_{st}^h &= 1 \quad \text{iif} \quad U_{st}^h = \max\left(U_{1t}^h, U_{2t}^h, \ldots U_{St}^h\right). \end{aligned} \tag{5}$$

Estimation

To estimate the parameters of the model given by (5), we link the extreme value errors ϵ_{st}^h from the choice model in (2) and the normally distributed errors u_{st}^h from the expenditure decision in (4). This can be accomplished using the method developed by Lee (1983) who showed any bivariate distribution with an abritrary correlation can be transformed into an equivalent bivariate standard normal distribution. This is acheived by applying the inverse function of the standard normal distribution, $\Phi(\cdot)^{-1}$, to standardize non-normal variates. In our model, we first define $F(\cdot)$ as the logistic probability from the store choice decision

$$F(\overline{U}_{st}^h) = \frac{\exp(\overline{U}_{st}^h)}{\sum_{s=1}^S \exp(\overline{U}_{st}^h)} \tag{6}$$

and embed this in the full model specified in (5). This leads to the following log-likelihood function:

$$\log L = \sum_{h=1}^{H} \sum_{t=1}^{T^h} \sum_{s=1}^{S} \delta_{st}^{h} \left[\begin{array}{c} \log \Phi \left[\Phi^{-1} \left(F(\overline{U}_{st}^{h}) \right) - \frac{\rho_s}{\sigma_s \sqrt{1-\rho_s^2}} \left(u_{st}^{h} \right) \right] \\ - \log \sqrt{2\pi} - \log \sigma_s - \frac{1}{2\sigma_s^2} \left(u_{st}^{h} \right)^2 \end{array} \right] \tag{7}$$

where, as before, δ_{st}^{h} equals 1 if household h visited store s at time t, and zero otherwise. $\Phi(\cdot)$ and $\Phi(\cdot)^{-1}$ represent the standard normal cumulative distribution function and its inverse, respectively. Note that if the estimated correlation parameters ρ_s are equal to zero, there is no dependence between the store choice and in-store components of the model. In (7), $\left(u_{st}^{h}\right)$ are errors from the $\log$ of basket expenditure regression defined in equation (4). That is

$$u_{st}^{h} = \log Y_{st}^{h} - \upsilon_s - X_{st}^{h} \beta_s' - Z^h \theta_s'. \tag{8}$$

Maximization of (7) provides the parameter estimates for the store choice and expenditure equations, and for the potential correlation between the two decisions.

DATA, MEASURES AND MODEL SPECIFICATION

We estimate our model using a market basket data set provided by Information Resources Inc. The data come from a large midwestern US city and cover the period from June 1991 to June 1993. We selected the first six months for initialization of variables and the following year of data to calibrate our model. The selected data set comprises scanner panel data from 52,023 shopping trips (19,068 and 32,955 trips from initialization and calibration periods respectively), 424 panelists, 24 product categories, and 5 supermarkets.

To conceal the identity of the stores in the data set, we label them as E1, E2, HL, HH1 and HH2. E1 and E2 are from different chains and explicitly advertise as EDLP stores. HL is a HILO store from a third chain; HH1 and HH2 are a higher tier of HILO store and are from the same chain. The HL store has a lower average basket price than the HH1 and HH2 stores and is therefore positioned somewhat between the EDLP and the higher-tier HILO stores.[8]

[8] This is based on a market basket of identical goods. Differences between the average prices in the three tiers are statistically significant. See Bell et al (1998, p. 357) who also used this dataset.

Consumer Types and Shopping Behaviors

We separate out the households into the four groups given in the shopping behavior matrix: EDLP loyals, EDLP switchers, HILO loyals and HILO switchers. Several researchers have separated store loyal and store switching households and estimated separate models for each (see, for example, Grover and Srinivasan 1987, 1989, 1992; Kamakura and Russell 1989; Krishnamurthi and Raj 1991). We estimate the joint store choice and in-store expenditure models for the two groups of switching households (EDLP switchers and HILO switchers). For the HILO and EDLP loyal shoppers we estimate only the in-store expenditure equations.

Definitions. Our definition of a store-loyal household is stringent. To be classified as store-loyal, the household must make all of its visits in one store during the initial six months of the dataset (see Kamakura and Russell 1989). All other households are classified as store-switchers. Given the length of our initialization period (six months), the number of observations per household available to determine the classification is large (on average about 33 visits per household). Recent work also suggests that store choices are relatively stable (Galata, Bucklin and Hanssens 1999). Thus, we are confident that segmenting the households into loyals and switchers based on observed store visits will provide a good approximation of their true segment assignment. Indeed, compared to the case of scanner data sets for brand and category purchases which have few choice observations per household, the numbers here are large. In our data set, households make on average 65 trips per year (more than a trip per week). Delineation of EDLP and HILO shoppers proceeds as for loyals and switchers. The EDLP (HILO) shoppers only ever shop in EDLP (HILO) stores.

[Table 2 about here]

Table 2 provides some basic descriptive statistics on the four types of shopper. It also shows some specific patterns that have a direct bearing on the hypotheses. First, a considerable fraction of households sampled (54%) are 100% store loyal. Second, of the within-format switching households (the other 46%), the largest fraction (26%) switch only among EDLP stores and 20% switch only among HILO stores. To test the robustness of the classification in Table 2, we reclassified the households based on the observed store visits from the entire calibration period. Only 5% of the households were classified into a different *a-priori* segment using the two sample periods. This suggests that our *a-priori* segmentation into the different shopping behavior cells is very stable.

Measures

Household Characteristics. The database includes several household-specific variables (e.g., demographic information and distance to stores, etc.) which are included as covariates in the store choice and expenditure components of the model. These variables are listed below:

Name	Description
INC^h	Total income for household h
$SIZE^h$	Number of family members in household h (1,2,3, ... 6 = 6 or more)
$EDUC^h$	Education level for family head of household h
$MRET^h$	= 1 if household h male spouse is retired, 0 otherwise
$FRET^h$	= 1 if household h female spouse is retired, 0 otherwise
$MWOR^h$	= 1 if household h male spouse is currently employed, 0 otherwise
$FWOR^h$	= 1 if household h female spouse is currently employed, 0 otherwise
$DIST_s^h$	expected travel distance in miles for household h distance to store s

Table 3 presents additional descriptive statistics regarding the behavioral and demographic characteristics of the segments. The segments are distinct in terms of both shopping behavior and demographic characteristics. Many of these differences are also consistent with previous research findings. As suggested by the information on number of trips given in Table 2, loyal consumers tend to visit a store more frequently (the mean trip frequency for loyal consumers is 73 versus 58 trips per year for switching households). This is consistent with Krishnamurthi and Raj's (1991) findings.[9] In addition, within the loyal and switching segments, EDLP shoppers shop less often than HILO shoppers and buy bigger baskets.

[Table 3 about here]

Marketing Variables. Our dataset also contains information on the weekly marketing activity of each store (e.g., feature, display, prices) for all skus in 24 product categories. In order to estimate our models, we require resasonable proxies for store-wide marketing activity. Following previous

[9] According to Krishnamurthi and Raj (1991), "loyal consumers are expected to be in the market for their particular brand often." For the two product categories used in their study they find that loyal consumers buy more than non-loyal consumers.

research (e.g. Dillon and Gupta 1996) we allow the marketing activity (e.g. feature, display and price activity) of the household's favorite products to have more influence on the assessment of the attractiveness of each store. We use this information to create idiosyncratic, household and time-specific variables to capture each store's marketing activity and how it is perceived by the individual consumers.

We follow prior research (e.g., Simester 1995) and assume consumers are aware of the distribution of marketing (e.g., price) information for each product, but do not know the realization until they visit a store. Given this, we can use the idiosyncratic choice information to develop household-specific measures to reflect basket-wide perceptions of marketing activity. This procedure can also be justified through appeal to experimental work by Alba et al (1994) which shows that consumers have quite accurate perceptions of differences in store-level marketing activity. Our three primary measures are P_{sw}^h, $FEAT_{sw}^h$ and $DISP_{sw}^h$ which reflect basket-level price, featuring, and display activity, respectively. To capture any stickiness in basket price perceptions, we also define a lagged basket price variable $\left(LagP_{sw}^h\right)$. Details on the weighting procedures used to obtain the variables are given in Appendix A.

Model Specification

As noted earlier, we specify two model components for the store switchers (store choice and in-store expenditure) and a single expenditure component for store loyal households. The exact specification of equation (2) is determined with reference to available data and prior work (e.g., Huff 1964; Fotheringham 1988; Bell and Lattin 1998; Bell et al 1998). In particular, we make the deterministic component of store choice utility a function of feature advertising, distance and basket price expectations. We take the logarithm of distance to reflect non-linear response (Bell et al 1998) and take the log of past basket prices. This yields

$$\overline{U}_{st}^h = \mu_s + \lambda \log DIST_s^h + \alpha_1 FEAT_{st}^h + \alpha_2 \log LagP_{st}^h. \tag{9}$$

Consistent with both prior work and existing theory we expect $\lambda < 0$, $\alpha_1 > 0$ and $\alpha_2 < 0$.

To complete the joint model, we specify the conditional expenditure equation component. Demographic variables are used as covariates to directly account for potential household heterogeneity. In addition to the demographic covariates, we also include variables that reflect store-wide marketing activity: basket prices and in-store display as defined in the Appendix in equations (16) and (17). The conditional expenditure equation is[10]

$$\log Y^h_{st} = \upsilon_s + \beta_{1s} \log P^h_{st} + \beta_{2s} DISP^h_{st} + Z^h \theta'_s + u^h_{st} \tag{10}$$

where Z^h is a (1×7) vector of the demographic variables given in section 3.3. We expect $\upsilon_s > 0 \; \forall s$ because these parameters indicate the base level of expenditure for a trip in a store. With respect to the other response parameters, β_{1s}, β_{2s} and the elements of θ_s, we do not offer hypotheses as to their signs.

Expenditure Elasticities and Parameter Expectations. Contrary to what one would expect for parameters in a quantity equation of a joint brand choice/purchase quantity model, we do not expect expenditure will necessarily decrease with increased basket prices, nor increase with more displays. If demand is price-elastic $(-\varepsilon_{q,p} > 1$, where $\varepsilon_{q,p}$ is the demand price elasticity$)$, we should indeed expect an expenditure decrease as a result of an increased price. If, however, overall demand for groceries is price-inelastic, an increase in price may lead to an increase in total expenditure (see Appendix B for the derivation of the elasticities). If displayed items are on price promotion, and even if this leads consumers to buy more units, total household expenditure could decrease as a "result" of display activity. Therefore, we leave the sign of these variables as an empirical question. We chose not to include feature activity as an explanatory variable in the conditional expenditure equation (equation 10), although it does appear in the store choice equation (equation 9). We hypothesize that the major impact of feature advertisements (which consumers are exposed to prior to store visits) on unconditional store expenditure will be via their influence on the store choice decisions of the switching segments. We expect to see this influence through $\alpha_2 > 0$ in equation (9).[11]

Similarly, we do not offer hypotheses for the effects of the demographic variables. This is because we are not measuring how different households (i.e. with different family sizes, income, and

[10]For the store loyal segments we only estimate the expenditure model given by (10) as the store choice component of the model is not relevant for this group.

[11]We also estimate all expenditure equations with and without a feature variable and find that the parameter is not significant and that we can exclude feature on the basis of penalized model fit. Full details are available from the authors upon request.

family structure) differ in the total (or, unconditional) amount that they spend. Rather, we evaluate the patterns of expenditures for a particular store, across the five different stores. To see how the effects of demographic variables on conditional (i.e., in a particular store) and unconditional (i.e., in total) expenditures are separate issues, consider the following example. If richer (bigger) families tend to spend more, and if all of the rich (big) families shop at one store while all of the poor (small) families shop at a different store, income (family size) will have little power in explaining *conditional* in-store expenditure (which we model in equation 10). This will be true even though it is highly relevant for the total *unconditional* expenditure. In our model, the effect will show up through the store choice decision and the selectivity bias and in the computation of a total, rather than conditional, expenditure elasticity.

RESULTS

We discuss model fit statistics for our choice models, model coefficients and the implied conditional expenditure elasticities under different shopping behaviors. The order of presentation of the results follows the previous development of the hypotheses.

Hypothesis 1. Hypothesis 1 holds that for the store-switching consumer, the decisions of where to shop and how much to spend on a given shopping trip will not be independent. In order to test this conjecture, we estimate a series of models. We pair a fully-specified store choice model (equation 9) with the expenditure model (equation 10) and estimate this model for the HILO switchers and again for the EDLP switchers.[12] For both store-switching groups, the best-fitting overall model includes all the demographic covariates shown in Table 2 and all marketing variables with the exception of feature advertising. As discussed previously, we anticipate that while feature advertising will affect the decision of which store to select, we do not expect to see any effect of this variable on in-store expenditures and as reported earlier found that we could exclude feature from the expenditure models (the parameter estimates were not significant and including them led to a worse penalized model fit).

Having estimated these models, it is straightforward to determine whether there is evidence that

[12]For the HILO switchers this system has four equations: the store choice equation (equation 9) and three conditional expenditure equations (equation 10) – one for each of the three HILO stores. For the EDLP switchers, the system has a total of three equations because there are only two EDLP stores.

the store choice and expenditure decisions of store switching consumers are linked. Statistically, this is accomplished by first allowing ρ, the parameter measuring correlation between store choice and expenditure (see equation 7), to be free and then setting $\rho = 0$ and re-estimating the models. Following H_1 we expect that these correlations will be significant. Since the two models are nested, we compute χ^2 statistics, based on model fits.[13] For the HILO switchers we find that $\chi^2_3 = 347.6$ ($p < 0.0001$), indicating a signficantly better model fit when ρ is a free parameter. For the EDLP switchers we have $\chi^2_2 = 237.8$ ($p < 0.0001$). Thus, both store-switching groups indicate strong support for H_1 and we conclude that the store choice and expenditure decisions are related.[14]

Model Parameters. Hypotheses H_2-H_4 concern the parameter estimates of the estimated models and in particular, the implied expenditure elasticities under different shopping behaviors. Prior to discussing H_2-H_4 and the associated tests in detail, we first provide an overview of the estimation results. Table 4 provides the store choice model parameters for the HILO and EDLP store-switching households. The first observation is that all response parameters for store choice are in the expected direction and statisically different from zero. For both groups, the effects of household distance from the store (λ), and basket prices (α_2) are negative as expected. Feature advertisements have a positive effect on the store selection decision ($\alpha_1 > 0$).

Some differences between the EDLP and HILO switchers are also apparent. HILO shoppers appear more sensitive to changes in marketing variables when switching among HILO stores, whereas the EDLP shoppers are more sensitive to travel distance.[15] These results make intuitive sense as one would expect switching households to be more attune to marketing activities in environments where this activity is more variable (i.e., HILO stores).

[13]The log likelihood (LL) and Bayesian Information Criterion (BIC) values for the nested models are as follows. For the HILO switchers $LL = -5,338.2$ $(BIC = -5,378.7)$ for the model with ρ_s free and $LL = -5,512.0$ $(BIC = -5,539.8)$ when $\rho_s = 0\ \forall s$. The corresponding values for the EDLP shoppers are $LL = -4,143.8$ $(BIC = -4,185.0)$ and $LL = -4,262.7$ $(BIC = -4,295.4)$.

[14]We also tested H_1 by pooling all of the switching households together into a system with six equations (one store choice equation and five expenditure equations). Again we find strong support for H_1 ($\chi^2_5 = 587.6,\ p < 0.0001$).

[15]Since the scale of the utility functions is arbitrary, this directional statement depends on the assumption that the error variances in the utility functions for the two groups are the same (see Swait and Louviere 1983).

[Table 4 about here]

The parameter estimates from the expenditure models are given in Tables 5 and 6 for the store switching and store loyal households, respectively. We begin by discussing the effect of demographic variables. As noted previously, we do not offer predictions regarding the signs of these coefficients, because while it may be true that the effect of some variables on *unconditional* expenditures may be unambigious (e.g., larger families spending more), this will not necessary hold true when one considers the conditional expenditures in a particular store, which is the dependent variable in our model.

Nevertheless, there are some discernable patterns for the demographic variables. For both loyals and switchers, the effect of family size (θ_1) is positive and significant in all stores with the exception of one of the higher priced stores, HH2. In addition, larger incomes are typically associated with higher expenditures in all stores, with the exception of store E1 where there is no effect for either group and a negative effect in store HH1. In general, the effects of demographic variables are more consistent (i.e., have the same signs across stores) for the loyal shoppers. The effect of having retired females (θ_5), working males (θ_6) and working females (θ_7) is positive for all stores and significant in 14 of 15 cases. The effects of education and retired males vary across both stores and types of shopper (loyal or switcher).

[Tables 5 and 6 about here]

With respect to the two marketing variables — display and in-store prices — the effects are relatively weak for the store switching households. In stores E1 and HH1 displays increase expenditures for switchers, but have no significant effects in other stores. Prices also have little impact, with the exception of store HH1 ($\beta_{24} = 0.38,\ t = 3.10$). In this case, a price increase leads to higher overall expenditures. This outcome is likely when purchases are largely necessities — quantities purchased and consumed stay relatively constant, which coupled with the price increase, leads to greater expenditure. For the store loyal households, displays increase expenditures in store HH1. The most striking comparison between the loyals and switchers is that for the loyals, the price effect is negative and different from zero in all stores (see Table 6). *This suggests that every store's loyal shoppers adjust expenditures in response to price, and are in fact more likely to do so than are each store's switching consumers.* We utilize the standard errors of the elasticities to test this idea formally via H_2.

Hypothesis 2. H_2 holds that the in-store expenditures of store loyal households will be more responsive to prices than will the expenditures of store switchers. In order to test this hypothesis, we utilize the parameter estimates in Tables 4 and 5 and compute their standard errors.[16] In order to compare the loyals and switchers (holding the store format dimension constant) we weight the elasticities by the number of observations in each cell (i.e., the number of trips given in column 4 of Table 2).[17] We find that $\eta_L = -0.124 > \eta_S = -0.008$ and that this difference of -0.116 is in the expected direction. Support for H_2 and the main effect of store loyalty is statistically significant, but not especially strong ($t = -1.698,\ p < 0.045$).[18] We conclude that the expenditure decisions of store loyals are more responsive to changes in a store's prices. Also, as shown in Table 3, the store switchers do respond to both advertised prices and price expectations when *selecting* a store. Thus, it is not that they are insensitive to price overall, rather, as predicted, they exhibit sensitivity on the basis of the store choice decision and not the in-store expenditure decision.

Hypothesis 3. H_3 suggests that the consumers shopping in HILO stores will, relative to EDLP shoppers, be more responsive to changes in prices when making expenditure decisions. Following the approach taken for H_2 we test this idea by computing the weighted elasticity for HILO and EDLP shoppers, holding the dimension of store switching and store loyalty constant. We find $\eta_H = -0.254 > \eta_E = -0.039$. This difference is in the expected direction and is statistically less than zero ($t = -3.291,\ p < 0.001$). Thus, we have strong support for H_3. The expenditure decisions of HILO shoppers, relative to those of EDLP shoppers, are more responsive to changes in prices.

Hypothesis 4. H_4 predicts an interaction among the two dimensions of consumer shopping

[16] Because the expenditure equation is in log form, the elasticity is simply given by the price coefficient β_{2s} in equation (10).

[17] That is, the weights pertain to the number of HILO or EDLP shoppers within the loyal and switcher groups.

[18] Because these elasticities should be negative, a larger negative magnitude indicates "more elastic."

behavior. In particular, in the HILO store environment, the responsiveness gap between store loyals and store switchers will be magnified. In testing H_4 we again utilize weighted elasticities, this time focusing on the difference between loyals and switchers across the different price formats. We find that this difference, $[(\eta_L - \eta_S)|H] - [(\eta_L - \eta_S)|E] = -0.712$ and that the corresponding test statistic is $t = -7.436,\ p < 0.001$. Thus, we have a strong interaction effect and significant support for H_4.

To illustrate the nature of this interaction and to summarize the two main effects tested in H_2 and H_3 we plot the relevant elasticities in Figure 1. The horizontal axis separates the two store format conditions: EDLP and HILO. We plot the four points corresponding to the in-store expenditure elasticities of the four groups: EDLP loyals, EDLP switchers, HILO loyals and HILO switchers. The figure highlights the key findings from our study. First, averaged across formats, store loyals are more responsive than switchers, and averaged across store switching and store-loyalty, consumers shopping in HILO stores are more expenditure elastic. The predicted interaction is illustrated by the increased slope for the line pertaining to the store loyal shoppers, and by the cross-over. The interaction effect is especially interesting because the store switching consumers who are most sensitive to price overall (i.e., in total for both the store choice and expenditure decisions) are in fact the least sensititive to prices in their expenditure decisions in a particular store.

[Figure 1 About Here]

SUMMARY AND DISCUSSION

A mounting body of research indicates significant and systematic relationships between consumer shopping behavior and promotional environments. In particular, recent literature has focused on how consumer expectations about promotional conditions influence the store choice process. In addition, it has been established that the degree of freedom expressed by a decision-maker in the first stage of a sequential choice has an impact on what happens in the second stage. Brand loyal consumers, for example, who restrict their freedom on the dimension of brand choice, exhibit flexibility by adjusting purchase quantities. In this research, we build and expand upon these concepts to examine a new substantive issue: The relationship between store choice and subsequent in-store expenditure decisions.

We began with the idea (based on previous research) that the two consumer decisions of which store to shop in and how much to spend, might be interdependent. This led us to suggest that shopping behavior can be defined along two dimensions: the inclination to switch stores, and preference for a particular price format. The first dimension may be thought of as a stable consumer trait — the tendency to shop in either a single or multiple stores. The second dimension follows a situational condition — whether consumers shop in high (HILO) or low (EDLP) price variation environments. We then developed a conceptual framework to show how the shopping behavior of the consumer would influence his or her response to prices when making in-store expenditure decisions.

To test these ideas, we segmented households according to whether they are loyal to a particular store, or switch among stores and also according to whether they prefer the EDLP or HILO format. We then estimated a series of joint store choice and in-store expenditure models. We found, consistent with work on brand choice and purchase quantity decisions (Krishnamurthi and Raj 1991), that store choice and expenditure are in fact linked. We also tested additional hypotheses relating dimensions of shopping behavior to the expenditure responsiveness of consumers. We found that store loyal households are more responsive than store switchers and that HILO shoppers were more responsive than their EDLP counterparts.

We also found a significant interaction between these two dimensions of shopping behavior. The HILO pricing environment widens the gap between the expenditure elasticities of the store-loyal and store-switching households. This empirical result could not be obtained from simple inspection of consumer shopping patterns which showed that the shoppers with almost identical shopping profiles (and plausibly, similar patterns of response) were in fact the EDLP switchers and HILO loyals. It turns out that the HILO loyal shopper is considerably more responsive than the EDLP switcher and that this is a logical consequence of the adopted shopping behavior. We also explored an apparent paradox to explain why the HILO switcher — a shopper for whom it might be reasonable to assume would be the most price sensitive — does not in fact respond strongly to prices *in a particular store on a particular trip.* The intuition is that this household exploits cross sectional variation in prices on each trip and places lower value on deals on particular items in specific stores. It should be noted, however, that this shopper is the most responsive *overall* when sensitivity to prices in the store choice decision is taken into account.

Implications

We have attempted to establish that models of consumer shopping behavior need to take into account dependencies in joint decisions of where to shop and how much to spend. Moreover, this joint process leads to a typology of shopping behaviors which have different implications for how consumers adjust in-store expenditures in response to changes in prices. We hope that the findings in this research will stimulate other researchers to study how consumer and environment-driven factors interact to develop logical patterns of consumer responsiveness.

Our findings attest to the ability of consumers to exploit variation in the environment: When constrained on one dimension (e.g., by say shopping in only one store), consumers may seek flexibility on another dimension (e.g., by adjusting expenditures in response to price). Similarly, a consumer who exhibits flexibility on the dimension of store choice (i.e., a store switcher) has less need to be responsive to prices in a given store at a given point in time. It is important therefore, to consider how a collection of decisions result in what amounts to an overall behavioral pattern.

Along with new insights into the behavior of consumers, our results also provide implications for retailers and others interested in practical applications of the findings. First, consumer shopping patterns are very stable in our data set and have predictable effects on in-store responsiveness. The majority of consumers who switch among stores do so within formats rather than across them.[19] The insight that store loyal shoppers are likely to be most responsive to changes in the store's pricing and promotional environment gives retailers who can assess the relative mix of loyal and switching shoppers in their stores a basis for forecasting the effectiveness of price changes. Our results also show that the tools needed to appeal to store loyal and switching consumers are different (e.g., displays versus advertised price specials).

[19]As noted earlier, across-format switchers — the smallest group in our dataset — are not analyzed in this paper.

Future Research

The model presented in this paper is an “as if” model of consumer behavior and there are a number of avenues open for future research, via controlled experiments and other methods. Among them is the need for further examination of the consequences and antecedents of loyalty and switching behavior. In particular, it would be of interest to study in detail the drivers of the simple correlations reported in this paper (i.e., that brand and store loyalty are positively related). Further, our work highlights how consumer shopping behaviors lead to different behavioral outcomes in the face of price variation. It would be interesting to examine (experimentally and with secondary data) how overall shopping patterns lead to different outcomes when consumers deal with variable assortments (e.g., product additions, deletions and stock-outs).

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APPENDIX

A: Marketing Variable Definitions

We define three basket-level marketing variables in order to operationalize our models. These variables are for basket prices, feature advertising and display. The basket-level marketing variables are formed by aggregating information from the level of the universal product code (upc) because our dependent variables of interest are store choice and basket expenditure per trip (rather than brand or category choice). Following previous research (e.g. Dillon and Gupta 1996) we allow the marketing activity for favorite products to have more influence on the consumer's assessment of the attractiveness of each store. To reflect this differential influence we build household, store, and time-specific "basket-level" variables using weights computed from the initialization period purchase data (Dillon and Gupta 1996). These weights are

$$\omega_{ks} = \frac{\text{Units of upc } k \text{ sold by store } s}{\text{Total units sold by store } s} \tag{11}$$

$$\omega_j^h = \frac{\text{Units bought by household } h \text{ in category } j}{\text{Total units bought by household } h} \tag{12}$$

$$\omega_{kj}^h = \frac{\text{Units of SKU } k \text{ bought by household } h \text{ in category } j}{\text{Total units bought by household } h \text{ in category } j} \tag{13}$$

$$CR_j^h = \frac{\text{Total units bought by household } h \text{ in category } j}{24} \tag{14}$$

The weights ω_j^h and ω_{kj}^h give a measure of "share of attention" to category j and to upc k in category j, respectively; ω_{ks} is the weight of each upc k over the store s total sales, and CR_j^h gives household h consumption rate of category j through the 24 categories.

Using the raw upc-specific prices we compute weighted average prices for each category in each store at each week (MPC_{jsw}) using as weights the upc sales share for the corresponding store. These average category prices are then used to compute household-specific basket prices at store s and week w (P_{sw}^h) by weighting the category prices (MPC_{jsw}) using the weights for the category-share of attention (ω_j^h)

$$MPC_{jsw} = \sum_{k=1}^{K} \omega_{ks} \cdot UPCPRICE_{kjsw} \tag{15}$$

$$P_{sw}^h = \sum_{j=1}^{24} \omega_j^h \cdot MPC_{jsw} \tag{16}$$

where $UPCPRICE_{kjsw}$ the price of upc k from category j in store s at week w.

To capture any stickiness is basket price perceptions, we also define a lagged basket price variable $(LagP_{sw}^h)$ in the same way as the regular basket price variable, but we use the previous week's prices instead of the current week's prices. The price for the upc in the previous week is always used, even if the household did not visit the store in the previous week, in order to maintain consistency in the lagged price definition across households. It is important to note that these variables are "as if" proxies for consumer expectations, and should capture cross-sectional and time-varying differences across stores and consumers. The basket and store-wide feature and display variables are computed in the same way

$$FEAT^h_{sw} = \sum_{j=1}^{24} CR^h_j \sum_{k=1}^{K} \omega^h_{kj} \cdot F_{kjsw} \tag{17}$$

$$DISP^h_{sw} = \sum_{j=1}^{24} CR^h_j \sum_{k=1}^{K} \omega^h_{kj} \cdot D_{kjsw} \tag{18}$$

D_{kjsw} represents a dummy variable that takes the value 1 when upc k of category j is displayed in store s at week w, and zero otherwise. F_{kjsw} is a dummy variable of value 1 when upc k of category j is featured in store s at week w, and zero otherwise.

B: Elasticities

For the choice elasticity of store s $\left(\varepsilon^c_{s,P}\right)$, since price enters the random utility in log form, we can write:

$$\varepsilon^c_{s,P} = \alpha_2(1 - \Pr(s)) \tag{19}$$

where $\Pr(s)$ is the probability of choosing store s, and α_2 lagged price choice parameter. Instead of simply computing the choice price elasticity at the mean market share, we computed the choice and expenditure elasticities by applying the analytical elasticity expression for each data point and subsequently averaging over the sample.

Price also enters the expenditure equation in log form so the respective parameter is already the conditional expenditure price elasticity $(\varepsilon^{e\,|\,c}_{s,P})$:

$$\varepsilon^{e\,|\,c}_{s,P} = \beta_{1s}. \tag{20}$$

The total expenditure elasticity $(\varepsilon^e_{s,P})$ is given by the sum of the choice price elasticity and the conditional (on choice) expenditure price elasticity

$$\varepsilon^e_{s,P} = \varepsilon^c_{s,P} + \varepsilon^{e\,|\,c}_{s,P} = \alpha_2(1 - \Pr(s)) + \beta_{1s}. \tag{21}$$

Table 1: Deal Menus Available to Store Switchers

	Price Promotions for Common SKUS (% time)			
	Neither Store	Store E1 Only	Store E2 Only	Both Stores
Soap	52	18	14	16
Dryer softeners	57	14	18	10
Detergents	58	11	13	18
Analgesics	59	17	16	8
Cleansers	67	18	11	4
Catfood	67	10	15	7
Salted snacks	70	8	7	15
Coffee	71	6	15	8
Meat sauces	73	10	9	9
Peanut butter	73	13	8	7
Hotdogs	76	3	16	5
Cereal	77	14	6	4
Tissue	78	10	6	6
Sugar	78	5	13	4
Paper towels	79	6	7	8
Cookies	80	7	8	5
Softdrinks	84	5	9	3
Crackers	84	6	5	4
Bacon	84	10	5	1
Yogurt	87	4	4	5
Icecream	89	2	7	2
Pizza	90	3	6	1
Butter	91	3	5	1
Eggs	91	4	4	1

Table 2: A-Priori Segmentation of Households

	Households		Trips*	
	Number	%	Number	%
Loyals	230	54%	16844	64%
EDLP	113	27%	6475	24%
HILO	117	28%	10369	39%
Switchers	194	46%	16111	36%
EDLP	111	26%	4867	18%
HILO	83	20%	4811	18%
Total	424	100%	26522	100%

* Calibration period.

Table 3: Descriptive Statistics for Segments

	Store Loyals		Store Switchers	
	EDLP	HILO	EDLP	HILO
No. of households	113	117	111	83
Mean Expenditure	\$57	\$38	\$39	\$22
Trip Frequency (per year)	44	57	57	89
Income	\$34,734	\$36,361	\$31,969	\$30,679
Education	5.02	5.20	4.86	5.04
Family Size	2.97	1.69	3.08	1.45
Male Retired	0.14	0.10	0.12	0.16
Female Retired	0.15	0.30	0.16	0.41
Male Working	0.60	0.23	0.55	0.19
Female Working	0.55	0.46	0.45	0.32
E1 Share of Trips	49.3%	—	42.4%	—
E2 Share of Trips	50.7%	—	57.6%	—
HL Share of Trips	—	60.3%	—	55.3%
HH1 Share of Trips	—	29.6%	—	20.8%
HH2 Share of Trips	—	10.1%	—	23.9%

Table 4: Store Choice Parameters for Store-Switching Consumers

	Specific Segments			
	EDLP		HILO	
	Param.	t-ratio	Param.	t-ratio
Intercepts (μ_s)				
E1	0.000	0.000	—	—
E2	0.331	6.892	—	—
HI	—	—	0.000	0.0000
HH1	—	—	-0.972	-20.183
HH2	—	—	-0.288	-5.864
Log Distance (λ)	-2.770	-29.910	-1.496	-35.871
Feature (α_1)	0.968	5.062	1.073	4.454
Log Lagged Price (α_2)	-2.201	-5.082	-3.233	-10.553

Table 5: Expenditure Parameter Estimates for Store-Switching Consumers

	Store E1		Store E2		Store HL		Store HH1		Store HH2	
	Par.	t-rat	Par.	t-rat	Par.	t-rat	Par.	t-rat	Par.	t-rat
Intercepts (υ_s)	2.63	25.71	2.38	14.70	3.54	31.67	2.70	11.73	2.26	6.31
Marketing										
Display (β_{1s})	1.21	3.82	0.01	0.06	0.22	1.01	0.59	2.20	0.31	1.60
Log Price (β_{2s})	-0.04	-0.55	-0.20	-1.58	0.02	0.15	0.38	3.10	0.12	0.50
Demographics										
Size (θ_{1s})	0.01	5.27	0.18	12.05	0.04	2.02	0.48	3.28	-0.53	-2.12
Income $>$\$$100k$ (θ_{2s})	0.06	0.42	0.79	6.33	1.81	10.21	-1.13	-5.93	1.01	3.40
Education (θ_{3s})	-0.01	-0.32	0.07	2.98	-0.15	-8.29	0.09	3.96	-0.22	-3.06
Male Retired (θ_{4s})	0.70	11.03	-0.26	-2.75	-0.76	-10.65	1.20	5.26	2.15	7.30
Female Retired (θ_{5s})	-0.44	-7.17	0.53	6.39	0.46	7.88	-0.46	-4.04	1.97	3.06
Male Working (θ_{6s})	0.70	0.16	9.89	2.92	-0.14	-1.72	0.26	0.95	2.84	3.82
Female Working (θ_{7s})	-0.21	-3.59	0.29	6.77	0.10	1.45	0.10	0.87	1.96	2.89
Selectivity Bias										
ρ	-0.45	-23.71	0.33	10.26	0.77	11.31	0.16	2.48	0.27	4.63
σ	0.85	52.56	0.89	69.20	1.10	34.70	0.70	61.22	0.87	44.25

Table 6: Expenditure Parameter Estimates for Store-Loyal Consumers

	Store E1		Store E2		Store HL		Store HH1		Store HH2	
	Par.	t-rat	Par.	t-rat	Par.	t-rat	Par.	t-rat	Par.	t-rat
Intercepts (υ_s)	2.65	31.35	2.55	25.38	1.85	30.98	1.45	15.49	3.70	12.78
Marketing										
Display (β_{1s})	-0.17	-0.91	0.62	1.66	0.04	0.77	0.84	2.31	-0.61	-0.84
Log Price (β_{2s})	-0.12	-2.30	0.14	-2.05	-0.35	-5.51	-0.39	-5.34	-0.62	-2.74
Demographics										
Size (θ_{1s})	0.18	11.16	0.15	10.83	0.05	2.72	-0.01	-0.35	-0.35	-4.23
Income $>$ \$$100k$ (θ_{2s})	0.00	0.02	0.30	2.85	0.26	3.85	1.28	13.99	1.99	13.01
Education (θ_{3s})	-0.09	-4.37	-0.04	-1.98	0.09	9.53	0.03	2.11	-0.25	-6.37
Male Retired (θ_{4s})	-0.13	-1.92	-0.12	-1.85	0.25	7.60	0.18	3.27	0.20	1.54
Female Retired (θ_{5s})	0.38	5.38	0.39	5.83	0.33	10.85	0.62	12.92	0.20	2.24
Male Working (θ_{6s})	0.27	5.38	0.08	1.67	0.13	3.28	0.38	7.79	0.58	5.37
Female Working (θ_{7s})	0.50	11.60	0.17	4.26	0.15	4.90	0.12	2.64	0.37	3.77
σ	0.94		0.98		0.90		0.88		0.88	

Figure 1: The Moderating Effect of Store Format on the In-Store Expenditure Responsiveness of Store Switchers and Store Loyals