

The Impact of Advertising in Child, Adult, and “All Family” RTE Cereal Markets

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Abstract

This research investigates the impact of advertising on brand choice in the ready-to-eat cereal market, where many brands are heavily advertised. In particular, effects of advertising may depend on consumer demographics; for instance, children are thought to be vulnerable to advertising claims, and this market readily allows comparisons of healthier adult and all-family cereals against less healthy brands aimed at children. Convincing results indicate that households which include children and/or teens respond differently to television advertising than do adult-only households. However, the findings are not exactly what one might anticipate on the basis of previous literature. The impact of children in the home on preference response to advertising for children's cereal is particularly strong in two-adult households. Further, teens act as "switch hitters," responding like children to children's brands in single parent households but like adults to healthier products, particularly in two-adult households.

INTRODUCTION

This research examines the impact of advertising on brand choice, giving particular attention to differences in response based on demographic criteria. Although advertising response has certainly been previously studied, many prior researchers have found weak and/or insignificant effects. For instance, in a meta analysis of the cigarette marketplace, Nelson (2006) finds small and insignificant advertising elasticities. Jedidi, Mela, and Gupta (1999) and Lodish, Abraham, Kalmenson, Livelsberger, Lubetkin, Richardson, and Stevens (1995) also find small (but significant) advertising elasticities. The latter authors subdivide these elasticities into those for established products and those for new products, noting that they are significant only for new products. Finally, Ackerberg (2001) finds small and significant advertising elasticities, but observes that, when consumers are subdivided based on levels of experience with the product category, effects are significant only for inexperienced users.

Chandukala, Dotson, Brazell, and Allenby (2007) offer an explanation for some, but not all, of these findings. They point out that aggregate-level analysis of advertising data obscures advertising effects, and that strong effects can be observed when demographics and other factors are considered. In this spirit, we compiled a unique data set that permits us to test the relationships between demographic characteristics and brand choice, and to observe significant differences. Our findings offer face validity, in that positive outcomes of advertising at the corporate and brand levels can be seen. Further, an incremental impact of advertising focused at certain demographic groups is also discernable: we find, for instance, that households with teenagers respond differently than others and that the number of adults present can influence household advertising response.

Our goal is to investigate how (1) a brand's target market segment, (2) consumer household demographics, and (3) marketing mix, especially television advertising, influence buying behavior in the ready-to-eat (RTE) cereal market. We use data from the cereal market because these products have relatively clear target consumers – cereals tend to be aimed at children, adults, or the entire family (Hitsch 2006; Shum 2004). Also, RTE cereal is a product often mentioned in articles about child obesity and the “nag factor,” which suggest that children ask for food products that are unhealthy (Atkin 1978; Petrecca 2000; Schmuckler 2002; Spake 2003; Thompson 2001). The present research represents a step forward, in part because we utilize scanner data (which includes both household demographics and purchase patterns) in tandem with television advertising reach data (which can be selected for the appropriate geographic area and includes differences in reach due to household demographics). Thus, we directly observe the impact of advertising on brand purchase behavior for various demographic groups.

We begin by reviewing relevant literature and developing hypotheses. We then describe our model and specifics of our cutting edge dataset. Finally, we discuss our results and conclusions. The results show that households with children (ages 0-12) tend to switch brands in children's cereal more frequently than do other households, consistent with a tendency to respond to children's requests for particular brands. Also, single adult households exhibit greater preference response to advertising for cereals for the entire family, while those with two adults show more preference response to advertising for children's cereals. Finally, households with teens and a single adult behave similarly to households with children (0-12), but those with teens and two adults act like households with no children.

CONCEPTUAL FRAMEWORK

We wish to measure the impact of television advertising on consumers' brand choice, considering both the primary target market and household demographics. We make use of the fact that cereal brands may be grouped according to whether they are targeted toward children, adults, or the entire family. Brands aimed at children tend to be advertised alongside child-oriented content, and the advertisements tend to encourage brand switching to follow the advice of licensed cartoon characters offering rapidly changing series of promotions and tie-ins. Advertising of brands aimed at adults tends to be positioned within more mature content and to promote brand loyalty (Bridges and Briesch 2006). By comparing purchase patterns of brands aimed at children, at adults, and at the entire family, in conjunction with relevant advertising data, we can identify where advertising most impacts brand choice.

Some drivers thought to influence brand choice include marketing mix activities of major brands, household composition, and the relationships between these variables, seen in outcomes such as the "nag factor." Here, we briefly review literature describing advertising and its relationship with demographic variables, and develop our hypotheses. In our model, in addition to television advertising, we specifically consider the impact on brand choice of other promotional activities, including in-store displays, feature advertisements, and temporary price cuts, as these have been demonstrated in prior literature to be effective (Bucklin and Gupta 1992; Fader and Lodish 1990; Grover and Srinivasan 1992; Inman and McAlister 1993; Kamakura and Russell 1989; Narasimhan, Neslin, and Sen 1996).

Corporate-Level Advertising Effects

A number of researchers have tried to assess the impact of advertising on purchases of food products, but the majority of published articles do this either indirectly or in controlled

experimental situations, because marketplace data measuring actual purchases along with the requisite advertising data is not readily available. One key exception is an early study by Bolton (1983), which makes use of advertising broadcast reports from local TV stations, television viewing diaries, and food consumption diaries completed by 262 households with children in the 2-11 age group. The results indicate that children alter their consumption of certain food product categories as a result of viewing televised food advertising, receiving less nutritious and more caloric intake. Thus, Bolton finds amount of food commercial exposure to be a successful predictor of food consumption, where the predictor is based on total food advertising viewed, as opposed to product category or brand level advertising. This aggregate-level predictor may have been used due to the difficulty of obtaining more specific advertising data.

Bolton's (1983) results support the idea that advertising for food products influences total food purchases. This leads us to consider the question: do advertisements for a food brand from a given company obtain synergy, leading to greater purchases of other food brands offered by the same firm? There are a few articles in the literature that indicate this might be true. Sheinen and Biehal (1999) and Biehal and Sheinen (2007) observe transfer of corporate-level advertising messages to the firm's brands, suggesting that the corporate image may obtain synergy across its brands. Berens, van Riel, and van Bruggen (2005) also find that the corporate brand image influences perceptions across the firm's brands. Thus, we need to consider how advertising for other brands marketed by a particular firm influences choice of any one of the firm's brands, due to interaction between advertising at the corporate and brand levels. If we define corporate-level advertising as that done by the corporation but not for the target brand, the literature suggests we might observe synergy between the two. Thus, image advertising for the firm and advertising for other firm brands in the product category can both influence brand choice.

H1: Corporate-level advertising reach has a positive impact on cereal brand choice.*Preference and Habit Persistence Effects of Advertising*

In addition to the influence of corporate advertising, the literature demonstrates a specific impact of brand-level advertising on brand sales. Among those finding significant sales response to brand television advertising are Eastlack and Rao (1986), who used an experimental design to build an advertising response model in the V-8 vegetable juice cocktail market, and Tellis, Chandy, MacInnis, and Thaivanich (2005), who identified actual response in a telephone referral service. We are interested in brand-level advertising effects on sales, which may be seen in changes in long-term preference or in short-term switching behavior. Thus, we consider both consumer preferences and their buying habits in developing an understanding of advertising's influence in the RTE cereal market. "Preference" may be defined as apparent liking for brand characteristics, taking into consideration the similarity between brands, as demonstrated over the long term in choice behavior. "Habit persistence" refers to the most recent category purchase: when a habit persists, the same brand is purchased again on the subsequent occasion. As time passes, wearout of habit persistence may occur, increasing the likelihood of switching to a different brand on the next purchase occasion.

To better describe the RTE cereal market, we consider three categories: (1) Adult cereal, (2) Children's cereal, and (3) All Family cereal. This use of categorization is not new – it is justified on the basis of price elasticities, according to Cotterill and Haller (1997) – and Shum (2004) defines three very similar categories. Cotterill and Haller further suggest that the cereal purchase process is hierarchical: consumers first identify a need based on the cereal category they want, and then consider their preferences in making a brand choice within that category.

Consumers reveal their brand preferences in their purchases over time. (This may be less true for Children's cereal than Adult cereal because, while adults tend to have well-formed preferences, children are more likely to be learning their preferences, so choices would naturally be more dynamic.) Consumers also form buying habits that facilitate repurchase of the same brand. In general, we expect these habits to wear out over time, because, as observed by Mehta, Rajiv, and Srinivasan (2004), consumers do not perfectly recall prior product evaluations when making purchase decisions. Thus, habit persistence is thought to naturally decline over time.

Using BehaviorScan data that includes household demographics, consumer panel data, and split cable advertising (which allows experimental testing of advertising in a real purchasing environment), Lodish et al. (1995) find that television advertising is effective in driving brand sales. Estimations, performed for each brand separately, allow brands to be classified as either new or established for purposes of interpreting the results. This is important because the role of advertising is very different for new and established products: new products require more informative, awareness-building advertising. Not surprisingly, advertising is found to have a greater positive impact on sales for new products than for existing ones. Although the impact of advertising is generally positive, when advertising increases are very large, they begin to have a slightly negative effect on sales. However, the authors note that in cases with specific strategic goals, such as increasing penetration or changing the target market, additional advertising spending might pay off.

Consistent with this observation, Hitsch (2006) points out that the RTE cereal industry is characterized by very high product introduction rates, high exit rates, and very uncertain profitability. This suggests both a high need for awareness advertising and an emphasis on children's cereals, where demand is enhanced by an ever-changing marketplace. Due to the

large amount of clutter, it is not surprising that Hitsch observes a gradual decay of advertising impact. Cotterill and Haller (1997) also find that the influence of advertising on brand choice (based on Nielsen GRPs) declines over time, having a decay rate of 30% per week for RTE cereal. The implications of this literature are captured in Hypothesis 2:

H2: Brand-level advertising reach increases long-term brand preference for the advertised brand.

Shum (2004) uses national brand-level advertising data from Leading National Advertisers (LNA) in combination with IRI scanner data and notes that cereals for the entire family are advertised more than cereals aimed exclusively at adults or at children, although they sell for lower prices. His findings indicate that advertising has a marginally negative effect on purchases by loyal households, which suggests that advertising may undermine loyalty. This may occur because consumers believe that, when there is so much advertising, they buy a brand because of the advertising rather than because of any long-term loyalty or preference. Consistent with this idea, Shum finds that a decrease in advertising results in an increase in loyal consumer switching costs – in other words, when there is less advertising, loyal customers find it more difficult or costly to switch to a different brand. However, the net impact of advertising across all consumers is found to be positive, and the research results indicate that it is more cost effective to advertise than to reduce price in order to stimulate demand.

These findings are consistent with those of Akerberg (2001), who theorizes that advertising provides information to consumers with the goal of inducing trial. This makes sense, because households that try a new brand are less likely to repurchase it than are current, loyal households. Therefore,

H3: Brand-level advertising reach reduces household repurchase probability, or habit persistence.

The Influence of Household Demographics

The RTE cereal marketplace is excellent to study for our purposes, because there are products clearly aimed at different demographic groups, and because many brands are heavily advertised to their target groups. A key example of this is provided by the “nag factor,” which suggests that some parents are more likely than others to purchase child-oriented products in response to their children’s requests or demands after viewing advertising for national brands (Bridges and Briesch 2006; John 1999). Specifically, parents who are single and have lower incomes and educational backgrounds are thought to be particularly vulnerable to advertising targeting their children with sugary and unhealthy products, including fast food, candy, and breakfast cereals, which are often promoted using the latest licensed characters (Coakley 2003; Mangleburg, Grewal, and Bristol 1999; Morgan, Schuler, and Stoltman 1995; Pettersson, Olsson, and Fjellström 2004). An implication of this literature is that households respond differently to incremental advertising targeted toward children than to that targeted toward adults. Therefore,

H4: Households respond more favorably to incremental advertising reach among children than that among adults.

Specifically, for households with children, we would expect an increase in purchase of the advertised brand, along with a decrease in *repurchase* of the advertised brand, resulting in overall greater brand choice.

Ages of the children involved can impact household response to advertising: older children experience greater success in obtaining brands they request than do younger children (Atkin 1978), whereas younger children often demonstrate less ability to evaluate claims made in

advertising (Bahn 1986; John and Lakshmi-Ratan 1992; Sanft 1986). This begs the question: which households really are more susceptible to advertising targeted at children? The answer might be those with young children, those with teenagers, those with single parents, or those having some combination of these characteristics. Also, if children are influenced by advertising and make requests, are there differences in how parents respond to their demands?

Children can attempt to influence household purchase decisions through a number of different modes including, but not limited to, asking, pleading, bargaining, persisting, using force, telling, being demonstrative, sugar-coating, threatening, and using pity (Atkin 1978; Isler, Popper, and Ward 1987; McNeal 1992; Williams and Burns 2000). The resulting impact can vary greatly depending on both demographic characteristics of the household and its decision making style. For instance, children's influence on purchases appears to increase with household size; also, the impact of children on brand choice increases with age of the oldest child (Ahuja and Stinson 1993). However, John (1999) observes that older children become more passive in their influence on household purchase decisions as parents learn their children's likes and dislikes and make purchase decisions accordingly. As it is unclear whether observed greater responsiveness to teenagers is due to the "nag factor," we consider teens (13-17) and younger children (12 and under) separately in this research. As teens tend to have greater influence over household purchases than do younger children, we hypothesize an effect in this direction.

H5: Advertising response among teenagers in the household has greater impact on brand purchases than does its response among younger children.

Beatty and Talpade (1994) find that teenagers in dual-income households have more perceived influence on purchases than do teenagers in single-income households. This means that, when there are two adults present, there is a greater likelihood that teenagers will influence

household brand choices. They further suggest that teenagers have greater influence than younger children over purchases in households where the parents believe that, as children age, they should learn to make their own choices. Family decision making styles can be categorized as either: (1) pluralistic / consensual, or (2) protective, depending on their typical internal communication patterns (Foxman, Tansuhaj, and Ekstrom 1989; Shoham, Rose, and Bakir 2004). Children's influence on purchases tends to be greater if parents are pluralistic / consensual, especially for consumer packaged goods like cereal. Mothers are more often viewed as pluralistic / consensual, while fathers are more likely to be seen as protective; thus, children may have greater impact on purchase decisions if they shop with their mothers alone.

Because the literature suggests there may be interactive effects due to the ages of children in the household and other household characteristics, including the number of adults present, we allow for this possibility in our model and data analysis. We do not hypothesize particular effects, as the literature does not provide clear direction. In the next section, we build a model and analyze our data to test the hypotheses. The results provide confidence in our work, because they are generally consistent with theory and prior research. Following this, we are able to make additional observations regarding consumer choice and response to advertising in the RTE cereal market.

RESEARCH APPROACH

In this section, we build an appropriate model to empirically test our hypotheses and address additional research questions. Specifically, we wish to examine whether we find a significant effect of advertising, either at the corporate level on brand choice (H1), at the brand level on preference (H2), and/or at the brand level on habit persistence (H3). For our measure of

advertising, we use “reach,” or the probability that a household has seen a brand’s advertisement. We also test for impact of the “nag factor,” or specifically, advertising of children’s cereal to children that enhances brand choice (H4) and for greater advertising response among teenagers than among younger children (H5). Some of the additional questions we consider involve other relationships between advertising response and the target market (both for the advertising and for the brand). For instance, products may be targeted toward the entire family, but we can observe advertising impact on various demographic groups, such as teens or single adults.

We begin by describing the theoretical model, and follow it with specification of the empirical model and discussion of our estimation approach. Our model considers the outcomes that may result from advertising, specifically, preference for a brand and habit persistence, or continuation of buying behavior. Among other issues, we consider how the presence of children and adolescents in a household impacts brand choice, particularly in a product category targeted toward children. It is important that we use longitudinal data, to observe whether the influence of advertising reaching children lasts over a period of time. We need to distinguish purchase-level effects capturing longitudinal heterogeneity from household-level effects due to cross-sectional heterogeneity, so we test our ideas within a modeling framework that incorporates both types of heterogeneity.

Model Description

We begin with our indirect utility function, which describes a particular household’s apparent utility for a brand of cereal. This includes four components, as seen in equation (1):

$$U_{hbt} = PF_{bt}^h + HP_{bt}^h + MM_{bt}^h + \varepsilon_{hbt} \quad (1)$$

where PF_{bt}^h represents the preference of household h for brand b in period t , HP_{bt}^h represents the habit persistence (or longitudinal heterogeneity) of household h with respect to brand b in period

t , MM_{bt}^h represents household h 's response to brand b 's marketing mix in period t , and ε_{hbt} represents the random component of the utility function.

As noted by Cotterill and Haller (1997), it is important to include price, any promotional activities, and advertising to obtain a complete analysis of demand in RTE cereals. Our definition of household h 's response to a particular mix of marketing activities differs slightly from others in the extant literature, to account for findings of interactions between price and variables representing other promotional activities (Van Heerde, Leeflang, and Wittink 2000; 2001). Thus:

$$MM_{bt}^h = \beta_1^h PR_{bt} + \beta_2^h FA_{bt} + \beta_3^h D_{bt} + \beta_4^h PR_{bt} FA_{bt} + \beta_5^h PR_{bt} D_{bt} \quad (2)$$

where PR_{bt} is the paid price for brand b in period t , FA_{bt} indicates whether brand b was feature advertised in period t , D_{bt} indicates whether brand b was displayed in period t , and ε_{hbt} is an error term. We assume that elements in the vector of response coefficients, β^h , have independent normal distributions with mean β_i and standard deviation σ_i^β .

The impact of advertising, as measured by its reach, may potentially affect both household brand preferences and habit persistence. Therefore, advertising is integrated into both of these components in the model. The habit persistence component of utility is given by equation (3):

$$HP_{bt}^h = S_{hbt} \left(\gamma_{0b}^h + \gamma_1^h L_{ht}^C + \gamma_{2b}^h A_{hbt}^B + \gamma_{3b}^h A_{hbt}^I \right) \quad (3)$$

where S_{hbt} is a binary variable indicating whether or not household h purchased brand b on the previous shopping trip, and L_{ht}^C is the natural logarithm of number of days (plus one) since household h purchased in category C (Adult, All Family or Children's cereal) to which brand b belongs. This formulation allows us to test for change in habit persistence over time.

We set the “base” advertising reach of brand b for household h in period t , A_{hbt}^B , under conditions of no children in the household; thus, this value is determined by the head of household age and ethnic group. The incremental advertising reach, A_{hbt}^I , represents the increase in reach of brand b for household h in period t when children are present in the household. Thus, incremental advertising reach is set based on the actual composition of children in the household, so it is zero when no children are present. Base and incremental advertising reach are given by:

$$\begin{aligned} A_{hbt}^B &= \lambda_1^{hB} BA_{hbt}^B + \lambda_2^{hB} I^b(K)CA_{hbt}^B + \lambda_3^{hB} I^b(Q)CA_{hbt}^B + \lambda_4^{hB} I^b(P)CA_{hbt}^B + \lambda_5^{hB} I^b(GM)CA_{hbt}^B \\ A_{hbt}^I &= \lambda_1^{hI} BA_{hbt}^I + \lambda_2^{hI} I^b(K)CA_{hbt}^I + \lambda_3^{hI} I^b(Q)CA_{hbt}^I + \lambda_4^{hI} I^b(P)CA_{hbt}^I + \lambda_5^{hI} I^b(GM)CA_{hbt}^I \end{aligned} \quad (4)$$

where BA_{hbt}^R is the brand advertising reach and CA_{hbt}^R is the corporate advertising reach (base when $R=B$; incremental when $R=I$) to household h for brand b in period t . The indicator $I^b(\cdot)$ is set to one if the manufacturer of the brand is Kellogg’s, Quaker, Post or General Mills; it allows for different consumer response to different manufacturers’ advertising. The λ parameters are heterogeneous across households, and we assume that they are normally distributed with mean λ_i^R ($R=B$ or I) and standard deviation σ_R^λ . We identify the advertising-related terms by setting λ_1^R to one and constraining the standard deviations to be equal to one. The latter is necessary because the advertising reach variables are multiplied by heterogeneous parameters in equation (3) and result in advertising terms with unit variance.

To address our research questions regarding the impact of advertising (through both the advertising target and the household demographic composition) on habit persistence, we use hierarchical equations for the household’s response to advertising, given by γ_2 and γ_3 in equation (3). We assume that the habit persistence response coefficients (γ) are independent and normally distributed, with mean γ_i and standard deviation σ_i^γ . Thus:

$$\gamma_{ib}^h = \gamma_{0i} + \delta_{1i}CH_b + \delta_{2i}F_b + \delta_{3i}G_h + \delta_{4i}O_h + \delta_{5i}G_hCH_b + \delta_{6i}G_hF_b + \delta_{7i}O_hCH_b + \delta_{8i}O_hF_b + \zeta_{i,\gamma}^h \quad (5)$$

where CH_b is set to one if brand b is targeted toward children, F_b is set to one if brand b is targeted toward the entire family, G_h is set to one if teenagers are present in the household, O_h is set to one if there is a single adult in the household, and $\zeta_{i,\gamma}^h$ is a random component (dependent upon the household and response coefficients), which is assumed to have a normal distribution with mean zero and standard deviation σ_i^γ .

Because state dependence interacts with advertising reach in equation (3), we want to control for any apparent “variety seeking” behavior not due to advertising. In particular, changes in the brand purchased may result from household income, number of people in the household, the interaction between income and people in the household, and product category effects. Therefore, we rewrite the response coefficient for state dependence (γ_{0b}^h) as

$$\gamma_{0b}^h = \gamma_0 + \delta_{10}HS_h + \delta_{20}HI_h + \delta_{30}(HS_h - \overline{HS})(HI_h - \overline{HI}) + \delta_{40}CH_h + \delta_{50}F_b + \zeta_{0,\gamma}^h \quad (6)$$

where HS_h is the number of people in household h , and HI_h is the income of household h , \overline{HS} is the average (over the sample) household size, \overline{HI} is the average household income, and $\zeta_{0,\gamma}^h$ has mean 0 and standard deviation σ_0^γ . We subtract the means from the interaction terms so that the main effects are easier to interpret. With this form, δ_{10} represents the change in state dependence sensitivity due to household size at the average income, and δ_{20} represents the change in state dependence sensitivity due to household income at the average household size.

As mentioned above, we also need to address the form of the preference component of indirect utility in equation (1). To avoid problems in estimating heterogeneity due to the large number of brands involved, we reduce its dimensionality through two-dimensional perceptual

mapping, as recommended by Elrod (1988), Chintagunta (1994), and Erdem (1996), writing the preference component as:

$$PF_{bt}^h = \pi_1^h a_{b1}^h + \pi_2^h a_{b2}^h + \pi_{3b}^h A_{hbt}^B + \pi_{4b}^h A_{hbt}^I \quad (7)$$

where A_{hbt}^B and A_{hbt}^I are the base and incremental advertising reach of brand b for household h in period t as defined in equation (4), and a_{b1}^h and a_{b2}^h are the perceptions of brand b held by household h . We assume that elements of response vector π^h are independent, normally distributed, and have mean π_i and variance σ_i^π . Following the identification conditions in Erdem (1996), we identify our perceptual map by: 1) setting the position of one brand (the outside good) at the origin to initialize, 2) restricting the variance of both dimensions to unity to obtain scale invariance, and 3) setting $\pi_1 = \pi_2 > 0$ for rotational invariance. As noted by Erdem, this last constraint is equivalent to requiring both dimensions to have the same measurement metric, but it does not constrain the values of the perceptual map except through rotational invariance.

To address our research questions regarding whether preferences are influenced by response to advertising reach, considering the target of advertising and demographic composition of the households, we use hierarchical equations for the household's response to advertising reach terms, π_3 and π_4 in equation (7), as:

$$\pi_{ib}^h = \pi_{0i} + \delta_{1i} CH_b + \delta_{2i} F_b + \delta_{3i} G_h + \delta_{4i} O_h + \delta_{5i} G_h CH_b + \delta_{6i} G_h F_b + \delta_{7i} O_h CH_b + \delta_{8i} O_h F_b + \zeta_{i,\pi}^h \quad (8)$$

where the variables are defined following equation (5). We assume that $\zeta_{i,\pi}^h$ is normally distributed with mean zero and standard deviation σ_i^π .

As mentioned above, because there are a large number of shopping occasions involving multiple purchases (see Table 4) we cannot use a standard multinomial logit model. Instead, we

use a multivariate model, which is formed as the product of individual binary logistic models. Let θ represent the parameter vector of the indirect utility equation, Σ represent the covariance matrix of the parameters (i.e., all of the σ 's), and Y^h represent household h 's purchases over time. Then, we can write the likelihood that household h purchases a particular sequence of brand bundles over time as:

$$LL^h(Y^h, \theta, \Sigma) = \int \left(\prod_{t=1}^{T_h^A} \prod_{b \in B^A} (1 + \exp(-U_{hbr}))^{-y_{hbr}} \right) \left(\prod_{t=1}^{T_h^F} \prod_{b \in B^F} (1 + \exp(-U_{hbr}))^{-y_{hbr}} \right) \left(\prod_{t=1}^{T_h^{CH}} \prod_{b \in B^{CH}} (1 + \exp(-U_{hbr}))^{-y_{hbr}} \right) f(\theta, \Sigma) \partial \Sigma \quad (9)$$

where T_h^A , T_h^F and T_h^{CH} represent the purchase time periods for Adult, All Family and Children's cereal, respectively, and B_h^A , B_h^F and B_h^{CH} represent the set of brands in Adult, All Family and Children's cereal, respectively. We use simulated maximum likelihood (Hajivassiliou and Ruud 1994) with Halton sequences to numerically integrate the equation. The total likelihood is then the product of the individual households' likelihoods.

Description of Data

Our data were obtained by combining information from Information Resources, Inc. (IRI) and Simmons. The former provides demographics and longitudinal purchasing behavior by household; the latter provides periodic advertising reach by brand for demographically-defined categories of households. We believe this research is the first to combine these two sources of information to be able to directly characterize advertising response.

Simmons advertising data measure reach (the probability of a particular type of household viewing a brand advertisement) for the top 18 brands in the RTE cereal market, given as an average value over the preceding 12 months, and updated approximately every six months.

Because the Simmons consumer survey collects data on household demographics, we were able to improve upon the reported reach measures by adjusting based on ethnic group (white, African American, other), head of household age group (18-24, 25-34, 35-44, 45-54, 55-64, 65 or older), and age ranges of children (0-11, 12-17, or both) as described in Appendix A. Because the Simmons data break children's age groups into ages 0-11 and 12-17, we use these groups for "children" and "teens," respectively. Table 1 reports the reach values for each of the brands; the "Base Advertising" column represents the simple average over time, ethnic group and head of household age, i.e., the advertising reach before adjusting for the presence and composition of children in the household. The values for children's age ranges are used to find the incremental probability that a particular household sees an advertisement by a particular brand, given the presence or absence of children in each age range in the household.

<Put Table 1 about here>

In addition to brand advertising data, Simmons provided corporate advertising results for each cereal manufacturer; these results represent the probability that a particular household sees an advertisement by any of a company's brands. As with the above, these data can be adjusted by region of the country and household demographics. Table 2 provides descriptive statistics for this corporate advertising.

<Put Table 2 about here>

IRI provided a multi-outlet panel data set from Charlotte, North Carolina covering a 104-week period between September 2002 and September 2004. These data are different from typical panel data because the panelists recorded all packaged and non-packaged goods purchases by UPC using in-home scanning equipment. Thus, purchase records are not limited to a small sample of grocery stores; rather, purchases made in all grocery and non-grocery stores

are captured. This is important, because packaged goods purchases are frequently made in non-grocery retail stores, for example at mass merchandisers.

We categorized the cereal brands depending on whether they are targeted primarily at children (“Children’s”), at adults (“Adult”) or at both (“All Family”) using guidelines provided in previous research (Bridges and Briesch 2006; Cotterill and Haller 1997; Hitsch 2006; Nevo 2001; Shum 2004). For a brand to be included, it had to either have advertising data or be manufactured by a company other than those in Table 2. Additionally, each brand had to have at least 1% share in the category. Private label cereals were also categorized as “Children’s,” “Adult,” or “All Family” products, a procedure which resulted in 44 total brands (14 in Adult cereal, 18 in All Family cereal, and 12 in Children’s cereal). Descriptive statistics for the brands are provided in Table 3.

<Put Table 3 about here>

Following Seetharaman, Ainslie, and Chintagunta (1999), we included households in our sample if they purchased at least twice in any of our three cereal categories (this is required in order to initialize the habit persistence variable) and at least 70 percent of their purchases within a category were of focal brands. This procedure resulted in 697 households that made 29,613 purchases, including purchases of non-focal brands. Descriptive statistics for the households are provided in Table 4. We note that a large proportion of purchase incidences (12% in Adult cereal, 16% in All Family cereal, and 20% in Children’s cereal) include more than one brand per household. This interesting statistic implies that the assumptions of a standard multinomial logit model are violated, and that a model allowing multiple choices on each purchase occasion is required, so we need to use a multivariate model.

<Put Table 4 about here>

Because our focus is on a descriptive rather than a predictive model, all observations excepting the first purchase of each household in each cereal category are used in the estimation. Thus, the estimation includes 17,083 purchases of focal brands on 23,030 purchase occasions.

Model Selection and Fit

We estimate fit statistics for the model (“Full model”) proposed above and compare them against two alternative models (described below) to ascertain whether the proposed model provides the best possible fit to our data. Following model selection, we discuss parameter estimates for the selected model. Finally, we examine advertising elasticities to determine the short-term effect of advertising reach on brand choice.

The first alternative model (“Combined model”) combines the base and incremental advertising reach components, to see whether this obtains better fit than the proposed model that posits separate effects for the base and incremental components. This model is defined by setting $\gamma_2=\gamma_3$ in equation (3), $\pi_3=\pi_4$ in equation (7), and adding six demographic terms representing the presence of children and single adults in each household.

The second alternative model (“Base model”) addresses the question of whether the demographics in equations (5) and (8) add significant descriptive power. This model is defined by constraining δ_{3i} through δ_{8i} to zero. Fit statistics for the Full, Combined, and Base models are provided in Table 5.

<Put Table 5 about here>

Both information criteria (AIC and BIC) recommend selection of the Full model over the two comparison models. Because the Full model offers improved fit over the Base model, including demographics significantly enhances descriptive validity. Comparing the Full model

to the Combined model implies that separating advertising impact into base and incremental components adds significantly to the descriptive ability of the model.

Results

Parameter estimates for the Full model are provided in Table 6, with the exception of detailed results in regard to advertising and demographic effects, which are discussed later in this section. (Positional parameter values are not included, but are available from the authors upon request.) The marketing mix parameter values provide face validity for the model: price carries a significant negative coefficient and use of feature advertising and in-store displays have significant positive coefficients. The interaction between price and feature advertising is also significant, and the parameter is negative, indicating that feature advertising is associated with increased consumer price sensitivity.

<Put Table 6 about here>

The base effect of corporate advertising is significant and positive ($p < 0.05$) for Kellogg's, General Mills, and Quaker, but is insignificant for Post. This implies that there are synergies between brand advertising for three of four major manufacturers, providing support for our first hypothesis (H1). Interestingly, for incremental advertising reach, only one of the corporate advertising parameters is even marginally significant (for General Mills, $p < 0.10$). The implication is that synergies for manufacturers among various brands exist only for baseline and not for incremental advertising.

Similar to the marketing mix parameter values, the results obtained for consumer preference also provide face validity. The coefficient for the baseline effect of advertising reach is positive and significant, which is consistent with the idea that advertising increases brand preference, providing support for our second hypothesis (H2). Although the coefficient for

incremental advertising reach is not significant, it is positive, which is in the correct direction. We would not expect this incremental effect to be significant, because the base case for this coefficient is measured for Adult cereal, and we do not expect the presence of children in the household to influence preferences for adult cereal.

Habit persistence measures the tendency of state dependence to last, or conversely, the tendency of preference to wear out over time: we first examine its main and interaction effects without advertising. We find that consumers' tendency to repurchase the same brand is positive and significant. Further, although there is significant heterogeneity, habit persistence does not tend to deteriorate over time (state dependence * time is not significant). Looking at the state dependence hierarchical equation, we observe a significant negative coefficient for All Family cereal, implying that households are less persistent in this category. Because the magnitude is roughly 10% of that of the main effect for state dependence, there is still substantial persistence. For Children's cereal, on the other hand, the coefficient is not significant ($p > 0.10$), so we find no difference in habit persistence between Adult and Children's cereal. We observe significant effects of income and household size: smaller and higher income households exhibit greater habit persistence. There is also an interesting and significant interaction effect, which implies that higher income households with more children and lower income households with fewer children are less habit persistent than other households.

The baseline effect of advertising appears to reduce habit persistence (coefficient = -2.08; $p < 0.05$), providing support for our third hypothesis (H3). Considering this result in conjunction with the positive impact of advertising on preference, the combination implies that advertising leads to increases in less loyal consumers' probability of purchase. However, because they are less loyal, they are also more likely to switch to a different brand following each purchase. We

examine the magnitudes of these effects below, when we calculate elasticities. Finally, the effect for incremental advertising, while positive, is not significant, indicating that its effect on state dependence for households with children is not significantly different from the baseline effect on households without children, in purchases of Adult cereal.

We now turn the discussion to cereal category and demographic effects on advertising impact, for which results are provided in Table 7. There are three significant ($p < 0.05$) baseline effects on preference: households with teenagers are less responsive to advertising in both Children's and All Family cereal categories and single adult households are less responsive to advertising in the All Family cereal category. There are also three coefficients of note for the impact of incremental advertising reach. First, teens are marginally ($p < 0.10$) less responsive and single adults are significantly ($p < 0.05$) more responsive, in general, to this incremental reach. However, single adults are significantly ($p < 0.05$) less responsive to incremental advertising reach for Children's cereal.

<Put Table 7 about here>

Considering habit persistence, there are two coefficients of note for the effect of baseline advertising reach. Compared to Adult cereal, households exhibit significantly greater ($p < 0.05$) habit persistence for both Children's and All Family cereal. There are also several interesting coefficients for the effect of demographics on household response to incremental advertising reach. First, households with children are less habit persistent and thus, tend to switch more often, in the Children's cereal category. This means that incremental advertising reach obtained due to children in the household is observed to lead to more switching in Children's cereal brand purchases than would be seen otherwise. This is consistent with the "nag factor" theory that children view brand appeals aimed at them and then make requests of their parents for certain

brands because of the advertising, and thus, supports our fourth hypothesis (H4). Second, single adults appear significantly ($p < 0.05$) more likely than other households to switch brands in response to incremental advertising reach. This effect is mitigated in the Children's and All Family cereal categories, where single adults also exhibit significantly ($p < 0.05$) greater habit persistence.

Because the estimated coefficients cannot be summed, due to different scales used for the base and incremental advertising reach constructs, Table 8 provides elasticities for the advertised brands conditioned on cereal categories and demographics. These elasticities represent the marginal response to increased advertising within specific demographic groups. Standard errors, provided in parentheses, were calculated using the delta rule (Gupta, Chintagunta, Kaul, and Wittink 1996).

<Put Table 8 about here>

Before examining the specific elasticities and differences between them, we note that face validity is provided for our method by the fact that all of the elasticities for preference are positive, and all but one are significant ($p < 0.05$). Similarly, all of the elasticities for habit persistence are negative, and all but one are significant ($p < 0.05$). The net short-term effect of advertising, given by the sum of preference and habit persistence elasticities, provides an estimate of the total sales elasticity due to advertising. These values offer face validity in that their magnitudes are consistent with, but slightly greater than, advertising elasticities found in prior literature (e.g. Nelson 2006). Their interpretation is also very interesting, and is addressed in the next few paragraphs.

For households with two adults and no children, the net effect of advertising is positive and significant ($p < 0.05$) for all three cereal categories. That is, the increase in preference due to

advertising dominates the penalty associated with habit persistence. For households with two adults and children (but no teens) present, elasticities for Adult cereal and All Family cereal are positive and significant ($p < 0.05$). However, the net elasticity for Children's cereal, where incremental advertising reach would be expected have an impact in households with children, is positive but not significant. This result is driven by (1) an insignificant increase in preference relative to households without children [$\Delta(\text{Kids, No Kids}) = 0.13$, $\text{S.E.} = 0.11$, $p > 0.10$], combined with (2) a significant increase in switching behavior [$\Delta(\text{Kids, No Kids}) = -0.24$, $\text{S.E.} = 0.06$, $p < 0.05$], leaving the net effect positive but not significant. The increase in switching is consistent with extant literature that suggests advertising to children increases "variety seeking" in Children's cereal. The implication is that advertising targeted toward children, for Children's cereal, is less effective than advertising to either adults, for Adult cereal, or to both children and adults, for All Family Cereal.

The results for two-adult households with teens are similar to those for households without children, even though children (age 0-12) may be present in the household. This result is in contrast to our prediction based on the literature; thus we do not find support for H5. It is, however, consistent with developmental theory, which suggests that children become less responsive to advertising as they get older, entering their teenage years (Bahn 1986; John 1999). Further, it makes sense that teenagers would not wish to exhibit any response to advertising directed at younger children. The results also suggest that the presence of teenagers reduces any impact of the "nag factor" in households with two adults.

Single adult households may or may not include children. For those without children, we observe a positive, but not significant, net effect of advertising for all cereal categories. This suggests that the significant gain we find in preference is offset by a significant loss in habit

persistence. When single adult households include children (0-12), we see a positive, but not significant, net advertising effect for Adult cereal. This results from (1) a significant [$\Delta(\text{Kids, No Kids})=0.23$, S.E.=0.10, $p<0.05$] increase in preference, combined with (2) a significant [$\Delta(\text{Kids, No Kids})=-0.27$, S.E.=0.07, $p<0.05$] decline in habit persistence. We also see a negative, but not significant, net advertising effect for Children's cereal. This results from (1) an insignificant [$\Delta(\text{Kids, No Kids})=0.02$, S.E.=0.19, $p>0.10$] increase in preference, combined with (2) a significant [$\Delta(\text{Kids, No Kids})=-0.30$, S.E.=0.14, $p<0.05$] decline in habit persistence. This increase in switching behavior is consistent with our findings for two-adult households, implying that the "nag factor" exists in both single- and dual-adult households. The net advertising effect for All Family cereal is positive and significant ($p<0.05$). This results from (1) an insignificant [$\Delta(\text{Kids, No Kids})=0.02$, S.E.=0.19, $p>0.10$] increase in preference, combined with (2) a marginally significant [$\Delta(\text{Kids, No Kids})=-0.22$, S.E.=0.13, $p<0.10$] decline in habit persistence.

Our results for single adult households that include teens mirror the results for single adult households with children (0-12). We note that this finding is qualitatively different than what we observed in two-adult households, where the results for teens mirror the results for households without children. This interesting finding begs the question: how does advertising reach response differ for one- and two-adult households with children and teens? Table 9 provides a summary of tests for differences between single- and dual-adult households that include children and teens, for both preference and habit persistence responses to advertising.

<Put Table 9 about here>

Table 9 shows that, for households with children (0-12), those with single adults are significantly less responsive than those with two adults to advertising for Children's cereal in terms of preference. There is no significant difference for habit persistence. Thus, it appears

that, overall, two-adult households are more responsive to advertising for Children's cereal. When we examine All Family cereal, we find that preference response to advertising is significantly greater for single adult households with teenagers than for dual-adult households with teenagers. This suggests that teenagers' preferences drive purchases of All Family cereal in single adult households, consistent with the idea that teens behave more similarly to adults in dual-adult households, but more similarly to children in single adult households. This may indicate that teenagers wield greater influence over purchases of All Family cereal in households managed by a single adult. Finally, in Adult cereal, we note that single adult households exhibit significantly less habit persistence than do two adult households, but they are only significantly more responsive to preference advertising when teenagers are present.

In summary, our key findings with respect to elasticities are: (1) households exhibit inelastic response to advertising in the short term, and (2) households with children ages 0-12 exhibit what appears to be a "nag factor," in that they engage in more switching behavior in Children's cereal than do other households. Further, (3) single adult households respond differently to advertising than do dual-adult households, but this difference is not related to the presence or absence of children. Instead, there is an increase in preference for All Family cereals and a decrease in preference for Children's cereals. Finally, (4) single adult households with teens are found to be similar to households with children, whereas in two adult households, those with teens behave similarly to households without children. This is a thought-provoking result, because it suggests that teens in single adult households develop adult shopping patterns at a later age than do those in households with two adults.

DISCUSSION

We find that corporate- and brand-level advertising have significant effects on both brand preference and habit persistence, depending on household demographic characteristics, in ways consistent with four of our five hypotheses. First, corporate advertising effects are significant for three out of four major national RTE cereal manufacturers, indicating that these companies are able to achieve advertising synergies between their brands. This result is consistent with Hypothesis 1 and with previous research that has shown positive effects of corporate level advertising on brand purchase behavior. Hypothesis 2 suggests that brand advertising increases overall brand preference; the results in Table 6 provide evidence that the baseline effect of brand-level advertising reach is indeed positive and significant. Also in Table 6, we find support for Hypothesis 3, which proposes that brand advertising reduces habit persistence. Thus, consumers' state dependence decreases as advertising reach increases, because advertising at the brand level encourages consumers to switch brands more frequently.

An important benefit of using the both the Simmons and IRI data is our ability to examine the overall influence of advertising reach on household cereal purchases as well as to break these effects down to see the specific impact in three cereal categories (i.e., Adult, All-Family, and Children's) and for different household demographics. The model providing the best fit separates base and incremental advertising, suggesting that certain demographic groups, such as households with children, do respond differently to advertising. Building upon previous research on the effects of advertising to children, and more specifically the impact of the "nag factor," Hypothesis 4 suggests that brand-level advertising specifically targeting children reduces habit persistence in the Children's cereal category. We find evidence for this effect by looking at the impact of incremental advertising reach among children (Table 8): households with children exhibit significantly more switching behavior than do other households. Thus, brand advertising

for Children's cereals, which is typically targeted toward children, persuades households to switch brands more frequently than they do for other categories of cereal, and also more often than do households without children who also buy Children's cereal.

Finally, Hypothesis 5 focuses on how advertising effects may differ for teenagers and younger children. Looking first at the effects of advertising on brand preference (Table 7), our results show that households with teenagers are significantly less responsive to advertising for Children's and All Family cereals than are other households. This finding is also reflected in lower preference elasticities for households with teenagers (Table 8). These results are unexpected and in contrast to the literature, which suggests that older children have more influence on household purchases than do younger children. H5 is not supported, and in fact, we obtain significant findings in the opposite direction. Although our results indicate that households with teenagers have low responsiveness to advertising for two categories of cereal, and this is not in line with our hypothesis, it is consistent with John's (1999) observation that older children become more passive in their influence on household purchase decisions.

Due to a scarcity of previous research on effects of advertising on preference and habit persistence combined with interactions between children's ages and the number of adults in the household, our findings related to such interactions (which follow) should be considered exploratory. However, some significant and very interesting results emerge, providing insight into how demographic characteristics of households interact with effects of advertising.

We have several surprising results where teenagers are involved. One of our most interesting findings relates to the interaction between number of adults and the role of teenagers in the household, regardless of whether the household also includes younger children. Dual-adult households with teenagers react to advertising similarly to households without any children; in

other words, these households are less likely to respond to advertising by switching brands in Children's and All Family cereals. This response among households with teenagers is consistent with theories that propose teenagers are less influenced by advertising than are younger children. What's unexpected is the effect of advertising in single adult households with teenagers. These households have a strong switching response to advertising for All Family cereal, and thus behave like single adult households with younger children. This result appears inconsistent with prior theory, which suggests that teenagers have greater influence in two adult households. Instead, greater switching rates in single adult households with teenagers and/or younger children could be reflective of stronger (more vocal) demands by the younger family members when only one adult is present, and/or a more pluralistic/consensual decision making style within these households.

The magnitudes of the advertising elasticities we obtain (Table 8), are best appreciated when put into context with previous research on advertising response. Most previous work that documents advertising elasticities finds relatively small effect sizes, ranging from 0.08 (Jedidi et al. 1999) to 0.13 (Lodish et al. 1995) to 0.15 (Ackerberg 2001). When significant effects are observed, they tend to be for specific groups (such as new products or inexperienced users) – but most aggregate-level effects are insignificant (Nelson 2006), as are those for established products and experienced users (Ackerberg 2001; Lodish et al. 1995). Although our net effects are similar in magnitude to previous findings, we find much larger (and significant) elasticities within groups based on demographic characteristics, product category, and/or effects on preference versus habit persistence. For instance, we find elasticities of 0.98 and 0.88 for preference for All Family cereal in single adult households with children or with teens, respectively, although our aggregate-level elasticities are only 10% of this size. These findings support the position that

aggregate-level analysis obscures advertising effects, and that effects are larger than previously thought when demographics and other factors are included in the analysis.

CONCLUSION

This research investigates how the interplay of a brand's target market, consumer household demographics, and television advertising influence buying behavior in the ready-to-eat (RTE) cereal market. We find significant differences in the effects of advertising reach on both preference and habit persistence, depending on the primary target market (Adult, Children, or All-Family cereal) and household demographics. Specifically, single adult households show greater preference response to advertising for All-Family cereal, whereas dual-adult households show greater preference response to advertising for Children's cereal. Single adult households with teenagers behave similarly to households with younger children, but two-adult households with teens behave more like households with no children. Importantly, effects of advertising reach on habit persistence for Children's cereal purchases in households with young children (ages 0-12) are consistent with previous work on the "nag factor," which suggests that parents make purchases in response to children's requests for advertised brands.

Although many of our results were hypothesized based on prior research (e.g., expected effects of advertising targeted toward children), some of our results represent new findings that merit additional investigation. For instance, we find interesting and non-obvious effects of advertising in households with teenagers, especially those headed by a single adult. The lack of support for our hypothesis that advertising reach among teenagers has a greater impact than advertising reach among younger children suggests that there is still much work to be done in understanding the influence of teenagers on household purchases. Further research is also

important to determine the cause of a greater switching response to advertising in single adult households; it may be due to stronger demands on a single parent by children and teens, or to a more pluralistic/consensual decision making style, or some combination of the two. It may also be worth investigating why purchasing behavior on behalf of teenagers in single adult households differs from that in dual-adult households. Is this a function of differences in preferences among the two groups of teenagers, or is it a result of differences in parenting style? The interaction between household type and response to advertising reach among teenagers may be more complicated than previously recognized.

Another rich area for further research is to improve understanding of how preferences for RTE cereal evolve over a consumer's lifecycle. Recent work on individuals' earliest and defining memories suggests that childhood experiences with certain brands create long-lasting influences on brand choice (Braun-LaTour, LaTour, and Zinkhan 2007). In particular, a daily consumption ritual like breakfast can create a rich set of memories upon which future brand preferences depend. Preference stability among teenagers and adults may reflect such developed preferences, whereas children, who have yet to form strong memory-based relationships with brands, are more willing to switch brands frequently. Advertising reinforces different brand choices by encouraging switching among children and by encouraging loyalty among adults (possibly even through commercials that reinforce those old memories).

Our findings, while theoretically interesting, also have important implications for marketing decision makers. By observing advertising effects on habit persistence as well as preference, our work goes beyond previous research that has focused primarily on brand preference. This additional analysis allows us to understand not just effects of brand advertising on loyalty but also its effects on switching behavior. The resultant more complete understanding

of both types of effects provides guidance for practicing marketers, assisting in decisions regarding whether to use retention advertising or advertising that encourages trial. By separating observed effects into those that impact preference and habit persistence, we also obtain more accurate measures of advertising elasticities than have been possible in previous research. A seemingly small net advertising effect can mask much larger elasticities that become apparent when effects are decomposed to separately assess demographics, product category, and loyal or switching behavior in brand choice.

In summary, an overall positive effect of corporate-level advertising reach on consumer brand preference supports investment in advertising for companies in the RTE cereal industry. Brand advertising offers a positive effect on consumer preference, and although it appears to have a negative impact on habit persistence (leading to more switching between brands), on the whole it is a net positive for advertisers. For target groups that include teenagers living in dual-adult households, our results support a continued advertising focus on preference and overall loyalty. By contrast, our results imply that advertising for Children's cereal, targeted toward children, leads to increased switching between brands; effective advertising in this category encourages children to try the advertised brand ahead of competitive brands.

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Table 1
BRAND ADVERTISING REACH BY HOUSEHOLD TYPE

Brand	Base	Teens	Kids 0-11	Multiple Ages
KELLOGG'S SPECIAL K	13.1% (0.02)	2.1% (0.06)	2.0% (0.08)	2.0% (0.06)
KELLOGG'S RAISIN BRAN	19.8% (0.02)	5.2% (0.09)	3.8% (0.07)	4.1% (0.06)
KELLOGG'S MINI-WHEATS	13.4% (0.03)	6.0% (0.05)	6.0% (0.06)	5.7% (0.03)
POST SHREDDED WHEAT	9.9% (0.02)	-0.5% (0.03)	2.1% (0.05)	0.9% (0.03)
GENERAL MILLS TOTAL	10.8% (0.02)	2.6% (0.05)	1.2% (0.07)	1.6% (0.04)
POST GRAPENUTS	5.9% (0.01)	0.3% (0.03)	-0.1% (0.03)	0.2% (0.02)
KELLOGG'S CRISPIX	4.8% (0.02)	3.4% (0.04)	3.7% (0.05)	3.2% (0.04)
GENERAL MILLS CHEERIOS	40.9% (0.04)	9.1% (0.07)	10.8% (0.08)	9.7% (0.05)
KELLOGG'S RICE KRISPIES	16.5% (0.04)	6.9% (0.06)	7.9% (0.08)	6.6% (0.06)
KELLOGG'S CORN FLAKES	19.0% (0.05)	5.1% (0.07)	5.3% (0.09)	4.3% (0.06)
GENERAL MILLS WHEATIES	7.8% (0.01)	1.5% (0.03)	1.5% (0.03)	1.1% (0.02)
QUAKER CAP'N CRUNCH	16.3% (0.07)	8.6% (0.05)	8.0% (0.07)	6.2% (0.05)
KELLOGG'S FROOT LOOPS	15.9% (0.07)	10.5% (0.08)	11.3% (0.08)	8.3% (0.05)
QUAKER LIFE	5.0% (0.02)	1.5% (0.02)	1.7% (0.02)	1.4% (0.02)
GENERAL MILLS GOLDEN GRAHAMS	7.6% (0.03)	4.1% (0.04)	2.6% (0.03)	2.5% (0.03)
POST COCOA PEBBLES	10.5% (0.05)	6.6% (0.07)	5.9% (0.05)	4.6% (0.04)
GENERAL MILLS KIX	5.3% (0.02)	2.6% (0.02)	2.9% (0.02)	2.3% (0.02)

Note: Values in parentheses are standard deviations.

Table 2
CORPORATE ADVERTISING REACH BY HOUSEHOLD TYPE

	Base	Teens	Kids 0-11	Multiple Ages
KELLOGG'S	64.2% (0.06)	17.2% (0.09)	15.7% (0.09)	15.2% (0.08)
GENERAL MILLS	61.0% (0.05)	13.9% (0.08)	13.5% (0.06)	13.1% (0.05)
QUAKER	22.2% (0.08)	8.4% (0.05)	7.8% (0.06)	6.0% (0.04)
POST	31.1% (0.02)	6.9% (0.07)	5.7% (0.04)	5.2% (0.04)

Note: Values in parentheses are standard deviations.

Table 3
BRAND DESCRIPTIVE STATISTICS

Category	Brand	Within Category:			Price:	
		Share	Cumulative	Purchases	Mean	Std Dev
ADULT	KELLOGG'S SPECIAL K	16%	16%	1728	3.51	0.72
ADULT	KELLOGG'S RAISIN BRAN	15%	31%	1583	2.03	0.42
ADULT	KELLOGG'S MINI-WHEATS	13%	44%	1379	2.23	0.37
ADULT	POST SHREDDED WHEAT	5%	48%	497	2.42	0.39
ADULT	GENERAL MILLS (GM) TOTAL	4%	53%	465	3.87	0.83
ADULT	PRIVATE LABEL RAISIN BRAN	4%	57%	456	1.71	0.38
ADULT	PRIVATE LABEL MINI-WHEATS	3%	60%	366	1.73	0.32
ADULT	PRIVATE LABEL (PL) BRAN	3%	63%	326	2.06	0.55
ADULT	POST GRAPENUTS	2%	66%	253	1.88	0.27
ADULT	PRIVATE LABEL GRAPENUTS	2%	68%	229	2.34	0.84
ADULT	KELLOGG'S CRISPIX	2%	70%	227	3.58	0.84
ADULT	KASHI HEART TO HEART	2%	72%	218	3.86	0.47
ADULT	PL SHREDDED WHEAT	1%	73%	130	2.08	0.66
ADULT	KASHI PROMISE	1%	74%	66	4.92	1.00
FAMILY	GM CHEERIOS	10%	10%	1711	2.90	0.77
FAMILY	GM HONEY NUT CHEERIOS	9%	19%	1533	2.89	0.61
FAMILY	KELLOGG'S RICE KRISPIES	5%	25%	885	3.21	0.76
FAMILY	KELLOGG'S CORN FLAKES	4%	29%	657	2.45	0.69
FAMILY	PL RICE KRISPIES	4%	32%	603	2.03	0.49
FAMILY	PL CORN FLAKES	3%	35%	509	1.83	0.58
FAMILY	PL CHEERIOS	3%	38%	491	2.07	0.40
FAMILY	GM WHEATIES	3%	41%	469	3.04	0.68
FAMILY	KASHI GO LEAN	3%	44%	446	3.13	0.49
FAMILY	PL FROSTED FLAKES	2%	46%	396	1.70	0.29
FAMILY	PL MISCELLANEOUS	2%	48%	345	2.19	0.24
FAMILY	PL HONEY	2%	50%	328	2.12	0.39
FAMILY	PL HONEY NUT	2%	52%	317	2.31	0.39
FAMILY	MALT-O-MEAL (MOM)	1%	54%	242	1.83	0.39
FAMILY	KASHI GOOD FRIENDS	1%	55%	183	3.38	0.48
FAMILY	PL MULTI-GRAIN CEREAL	1%	55%	121	2.44	0.66
FAMILY	UNCLE SAM'S CEREAL	1%	56%	114	3.66	1.01
FAMILY	KASHI PUFFED CEREAL	1%	57%	93	4.58	0.66
CHILDREN	QUAKER CAP'N CRUNCH	10%	10%	1273	2.56	0.62
CHILDREN	KELLOGG'S FROOT LOOPS	8%	18%	1010	2.80	0.71
CHILDREN	QUAKER LIFE	5%	23%	630	2.39	0.54
CHILDREN	POST FRUITY PEBBLES	4%	27%	487	2.90	0.68
CHILDREN	GM GOLDEN GRAHAMS	4%	30%	466	3.09	0.75
CHILDREN	MOM	3%	33%	417	2.10	0.41
CHILDREN	POST COCOA PEBBLES	2%	36%	301	2.97	0.60
CHILDREN	GM KIX	2%	38%	279	4.33	0.81
CHILDREN	PL FRUIT LOOPS	2%	40%	268	2.01	0.40
CHILDREN	PL LUCKY CHARMS	1%	41%	172	2.28	0.54
CHILDREN	PL CHOCOLATE	1%	43%	171	2.12	0.25
CHILDREN	PL MISCELLANEOUS	1%	44%	123	2.27	0.27

Table 4
HOUSEHOLD AND CEREAL CATEGORY DESCRIPTIVE STATISTICS

	Cereal Category:			
	<i>Adult</i>	<i>All Family</i>	<i>Children's</i>	<i>Total</i>
Number of Households	495	335	132	697
Percentage Making Multiple Purchases per Trip	12.1	16.4	20.2	
Time between Cereal Purchases (Days)	82.4 (83.2)	65.5 (67.8)	82.3 (72.8)	
Brands Purchased	3.01 (1.61)	3.85 (2.07)	2.74(1.85)	
Household Income (\$10,000s)	0.52 (0.25)	0.49 (0.26)	0.53 (0.25)	0.51 (0.25)
Household Size (Mean)	2.84 (1.27)	2.61 (1.20)	2.85 (1.30)	2.77 (1.26)
Head of Household Age (Mean)	48.3 (11.1)	50.8 (10.8)	46.2 (11.4)	48.7 (11.1)
Number of Adults (Mean)	1.81 (0.39)	1.78 (0.41)	1.82 (0.39)	1.80 (0.40)
Percentage of Households with Teens	20.4 (0.40)	14.6 (0.35)	23.5 (0.43)	19.2 (0.39)
Percentage of Households with No Kids	65.1 (0.48)	73.1 (0.44)	62.1 (0.49)	66.1 (0.47)
Percentage of Households with Kids 0-12	24.2 (0.43)	19.4 (0.40)	26.5 (0.44)	23.8 (0.43)
Percentage of Households with Single Parent	2.02 (0.14)	2.69 (0.16)	3.79 (0.19)	2.58 (0.16)

Note: Values in parentheses are standard deviations.

Table 5
MODEL FIT STATISTICS

	<i>Base Model</i>	<i>Combined Model</i>	<i>Full Model</i>
Log-Likelihood	-45985	-45939	-45859
Parameters	134	147	158
AIC	92238	92172	92035
BIC	93276	93311	93259

Table 6
PARAMETER ESTIMATES

	Mean Response		Heterogeneity	
	Value	t-score	Value	t-score
<i>Merchandising Mix</i>				
Price	-0.42	-17.24	0.03	4.23
Display	0.81	4.19	0.43	6.08
Feature	1.97	13.73	0.36	6.82
Price*Display	0.01	0.15	0.02	0.77
Price*Feature	-0.26	-5.05	0.01	0.99
<i>Preference</i>				
Dimension 1	0.27	40.70	0.15	9.19
Dimension 2	0.27 *		0.00	2.31
Base Advertising	1.08	14.57	0.08	3.55
Incremental Adv.	0.59	0.69	0.03	0.11
<i>Habit Persistence</i>				
State Dependence	3.91	34.73	0.93	26.60
State Dep. * Time	-0.02	-0.88	0.11	4.89
Base Advertising	-2.08	-14.46	0.08	1.44
Incremental Adv.	5.46	1.47	0.02	0.08
<i>State Dependence Hierarchical Equation</i>				
Income	0.35	3.02		
Household Size	-0.18	-8.27		
Income*HH Size	-0.25	-3.11		
Children's Cereal	-0.12	-1.59		
All Family Cereal	-0.39	-4.45		
<i>Base Corporate Advertising Factors</i>				
Brand	1 *		1 *	
Kellogg's	0.85	10.37	1 *	
Quaker	0.85	2.19	1 *	
General Mills	0.24	2.42	1 *	
Post	-0.29	-1.35	1 *	
<i>Incremental Corporate Advertising Factors</i>				
Brand	1 *		1 *	
Kellogg's	0.38	1.09	1 *	
Quaker	0.95	1.57	1 *	
General Mills	0.40	1.71	1 *	
Post	0.41	0.64	1 *	

Note: * indicates a parameter constrained for identification.

Table 7
 DEMOGRAPHICS & CATEGORY IMPACT ADVERTISING RESPONSE PARAMETERS

	Preference				Habit Persistence			
	Base		Incremental		Base		Incremental	
	<u>Value</u>	<u>t-score</u>	<u>Value</u>	<u>t-score</u>	<u>Value</u>	<u>t-score</u>	<u>Value</u>	<u>t-score</u>
Main Coefficient	1.08	14.57	0.59	0.69	-2.08	-14.46	5.46	1.47
Children's Cereal	0.02	0.15	-0.02	-0.02	0.97	4.78	-9.60	-2.27
All Family Cereal	-0.02	-0.20	0.76	0.44	0.49	3.22	-6.99	-1.57
Teen Present	0.01	0.05	-1.85	-1.81	0.33	1.25	1.48	0.42
One Adult Present	-0.07	-0.74	4.66	3.41	0.15	0.90	-13.87	-4.87
Teen * Children's Cereal	-0.36	-2.39	1.34	1.07	-0.41	-1.24	4.18	0.94
Teen * All Family Cereal	-0.35	-2.62	0.57	0.35	0.24	0.73	-1.09	-0.26
One Adult*Children'sCereal	-0.23	-1.32	-6.12	-2.77	-0.23	-0.64	11.22	2.23
One Adult*AllFamilyCereal	-0.36	-2.81	2.35	1.50	-0.17	-0.53	12.92	3.98

Notes: Bold indicates significance at $p < 0.05$ (two-tailed).
 Bold and italics indicate significant at $p < 0.10$ (two-tailed).

Table 8
ADVERTISING ELASTICITIES FOR CATEGORY & DEMOGRAPHICS

		Preference			Habit Persistence			Net Effect		
		No Kids	Kids	Teens	No Kids	Kids	Teens	No Kids	Kids	Teens
Two Adults	<i>Adult</i>	0.51 (0.04)	0.56 (0.05)	0.52 (0.07)	-0.39 (0.02)	-0.37 (0.08)	-0.28 (0.06)	0.12 (0.06)	0.19 (0.12)	0.24 (0.13)
	<i>Children's</i>	0.38 (0.04)	0.51 (0.07)	0.28 (0.05)	-0.18 (0.03)	-0.42 (0.05)	-0.13 (0.06)	0.20 (0.06)	0.09 (0.10)	0.15 (0.10)
	<i>All Family</i>	0.62 (0.04)	0.79 (0.09)	0.48 (0.06)	-0.36 (0.02)	-0.53 (0.06)	-0.34 (0.04)	0.25 (0.05)	0.27 (0.14)	0.14 (0.09)
One Adult	<i>Adult</i>	0.47 (0.04)	0.70 (0.07)	0.67 (0.09)	-0.41 (0.03)	-0.67 (0.05)	-0.59 (0.07)	0.07 (0.07)	0.03 (0.10)	0.08 (0.14)
	<i>Children's</i>	0.26 (0.07)	0.28 (0.13)	0.03 (0.12)	-0.16 (0.04)	-0.46 (0.13)	-0.21 (0.21)	0.10 (0.10)	-0.18 (0.22)	-0.19 (0.28)
	<i>All Family</i>	0.36 (0.07)	0.98 (0.11)	0.88 (0.11)	-0.27 (0.02)	-0.49 (0.13)	-0.39 (0.11)	0.10 (0.08)	0.49 (0.21)	0.49 (0.19)

Notes: Standard errors are in parentheses.
 Bold indicates significant at $p < 0.05$ (one-tailed).
 Bold and italics indicate significant at $p < 0.10$ (one-tailed).

Table 9
COMPARISON OF SINGLE- AND DUAL-ADULT HOUSEHOLD ELASTICITIES

	Preference		Habit Persistence	
	Kids	Teens	Kids	Teens
<i>Adult</i>	0.14 (0.10)	0.15 (0.11)	-0.30 (0.11)	-0.31 (0.11)
<i>Children's</i>	-0.23 (0.16)	-0.26 (0.10)	-0.04 (0.09)	-0.08 (0.11)
<i>All Family</i>	0.18 (0.18)	0.40 (0.12)	0.04 (0.10)	-0.05 (0.08)

Notes: Values are differences: Single-Adult Household – Dual-Adult Household elasticities.
 Values in parentheses are standard errors.
 Bold indicates significant at $p < 0.05$ (one tailed).
 Bold and italics indicate significant at $p < 0.10$ (one tailed).

Appendix A: Adjusting the Advertising Reach Values

To calculate the advertising reach at the brand level, we start with national advertising reach in the Simmons data, then adjust for the region, household ethnic group (White, African American, Other), age of the head of household, and composition of children (none, ages 0-11, ages 12-17, or ages 0-17). Therefore, the advertising reach to household h can be written:

$$BA_{hbt} = Base_{bt} Region_{bt} Race_{hbt} Age/Children_{hbt} \quad (A.1)$$

where $Base_{bt}$ is the national reach for the average household for brand b in period t , $Region_{bt}$ is the adjustment in reach for the region (e.g., Charlotte, NC) for brand b in period t , $Race_{hbt}$ is the adjustment in reach for the ethnic group of household h for brand b in period t , and $Age/Children_{hbt}$ is the adjustment in reach for the composition of children and head of household for household h for brand b in period t .

We then define the base advertising for household h in period t for brand b , BA_{hbt}^B , to be the advertising calculated using equation (A.1), but assuming that the household has no children. Finally, the incremental advertising is given by equation (A.2)

$$BA_{hbt}^I = BA_{hbt} - BA_{hbt}^B \quad (A.2)$$

The net effect of these adjustments is that each household has longitudinal changes in advertising, due to different advertising reach values over time. Additionally, the data contain cross-sectional variation in advertising reach based upon household demographics.

Simmons also reports the reach (see Table 2) for each of the four major manufacturers of cereal, independent of each brand. Adjustments to corporate advertising are calculated in a similar manner as are those for brand advertising.