The Value to Consumers of Health Labeling Statements on Breakfast Foods and Cereals

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ABSTRACT

Food manufacturers have an incentive to include nutrient content claims, health claims, or other types of labeling statements on foods if they believe that consumers will be willing to pay more for products with specific attributes. We estimated semi-log hedonic price regressions for five breakfast bar and cereal product categories using Nielsen ScanTrack scanner data for 2004 and found that labeling statements for these foods are often associated with substantial increases in consumer willingness to pay. The largest effects were associated with "carb-conscious" carbohydrate labeling (reflecting the time period of the data), followed by fat and sugar content labeling statements.

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INTRODUCTION

Food manufacturers have an incentive to include labeling statements on products if they believe that consumers will be willing to pay more for products with specific nutritional or other types of attributes. These labeling statements may be nutrient content or health claims as defined by FDA, organic labels as defined by USDA, or other types of statements developed by food manufacturers for product characteristics that are outside the regulatory authority of either agency. Labeling statements in general are intended to signal positive nutritional or other benefits that consumers may obtain as a result of consuming a food product. In many cases, the benefits associated with a labeling statement are credence attributes because a consumer is unlikely to be aware of the benefits in the absence of the statement. In other words, the labeling statement converts a credence attribute into a search attribute that a consumer can determine by reading the product label.

The Nutrition Labeling and Education Act (NLEA) of 1990 stimulated a large number of studies investigating the effects of food labeling information on consumer behavior. Although some studies have found little or no effect of labeling information on consumer behavior, others have found substantial positive effects on consumer purchases of healthier foods. Based on results from four studies, Balasubramanian and Cole (2002) concluded that the NLEA has had limited effects on consumers' search for and efficiency in processing information from the Nutrition Facts label located on product packages. They also found that the implementation of the NLEA increased consumers' sensitivity to foods with labeling statements emphasizing the lack of nutrients with negative attributes (e.g., sodium and fat) relative to statements on nutrients with positive attributes (e.g., vitamin C and calcium). Also, in an experimental study, Garretson and Burton (2000) found that health claims about fat and fiber did not affect product evaluations or purchase intentions.

In contrast, several studies have found positive effects of displaying nutrition information on food labels or store shelves. For example, Kim, Nayga, and Capps (2000) quantified the effect of nutrition label information on nutrient intakes by label users and found recognizable benefits associated with nutrition labels. Specifically, use of the nutrition label was estimated to decrease label users' intake of calories from total fat (by 6.9%), saturated fat (by 2.1%), cholesterol (by 67.6 milligrams), and sodium (by 29.6 milligrams). In another paper, Kim, Nayga, and Capps (2001) estimated that different aspects of food labels improve diet quality by four to six points on a 100-point Healthy Eating Index scale. They found that health claims provided the highest level of diet quality improvement compared to nutritional panels, serving sizes, nutrient claims, and lists of ingredients. Furthermore, using a value of information approach, Teisl, Bockstael, and Levy (2001) evaluated the present value of the social benefit of shelf labels that provide nutrition information for selected products at $6.3 billion for milk alone.

Use of nutrition labeling information has been shown to be affected by consumer demographics. For example, using a survey of supermarket shoppers, Nayga, Lipinski, and Savur (1998) found that unemployed individuals and those who place greater importance on nutrition are more likely to use nutritional labels. Also, they found that education level was positively associated with use of nutritional labels. Similarly, in Neuhouser, Kristal, and Patterson (1999), nutrition label use was found to be substantially higher among female respondents, respondents below age 35 years, and respondents with more than a high school education. Survey results from Smith, Taylor, and Stephen (2000) also indicated that female college students are more likely to use nutrition labels than male college students.

In another vein of research using hedonic regression approaches, a number of studies have investigated the effect of food product attributes, including those specified in nutrition labels, and food labeling statements on product prices. For example, Shi and Price (1998) evaluated the effect of consumer demographics on implicit valuations of both nutritional and non-nutritional characteristics of breakfast cereal; they found that demographics are significant determinants of the implicit values of breakfast cereal food characteristics. Also, Huffman and Jensen (2004) found that the implicit values of nutritional enhancement for margarine products are positive.

Thus, many studies have shown that consumers use labeling information to make their food choices, that their use of labeling information typically varies with demographic characteristics, and that they are typically willing to pay more for foods with specific characteristics. The increasing use of labeling claims on foods beyond the information contained in the Nutrition Facts label raises questions regarding how consumers value this information. Therefore, the purpose of our study was to estimate the value to consumers of food product labeling statements that indicate the health or other benefits that may be associated with consumption of specific products. We used detailed recent scanner data to capture information on current food labeling trends and to provide results that are representative of the entire United States rather than limited geographic regions. The methodology is a revealed preference approach in that actual prices paid are used in the analysis rather than stated willingness-to-pay as in surveys of hypothetical purchase decisions. The results are useful for understanding food manufacturer incentives for health labeling statements and the implications for policies related to use of unqualified and qualified health claims.

BACKGROUND ON FOOD LABELING POLICY

The Federal Food, Drug, and Cosmetic Act, as amended by the NLEA of 1990 (Public Law 101-535), together with FDA's implementing regulations (21 CFR 101), established mandatory nutrition labeling for most packaged foods, including the Nutrition Facts label, and provides for regulation of nutrient content claims, health claims, and other labeling statements. The Nutrition Facts label provides information on the nutritional characteristics of a food in a standardized format usually found on the back of food packages. Food manufacturers may voluntarily display nutrient content claims, health claims, and related labeling statements on product packaging to highlight one or more nutritional characteristics of a food; such statements are generally displayed on the front of food packages.

Nutrient content claims are statements that characterize the level of a nutrient found in a food. FDA recognizes two types of nutrient content claims: (1) expressed nutrient content claims and (2) implied nutrient content claims. An expressed nutrient content claim is any direct statement about the level (or range) of a nutrient in a food (e.g., "low sodium" or "contains 100 calories"). An implied nutrient content claim is any claim that either describes a food or its ingredients in a manner that suggests a nutrient is absent or present in a certain amount (e.g., "high in oat bran") or suggests that the food, because of its nutrient content, might be useful in maintaining healthy dietary practices and is made in association with an explicit claim or statement about a nutrient (e.g., "healthy, contains 3 grams of fat") (FDA, 1994). Labeling regulations (21 CFR 101.13 and 101.54–101.69) define the terms that may be used to describe the level of a nutrient in a food and how these terms can be used. Recognized nutrient content claims include "good source," "high," "more," and "high potency;" "light" or "lite;" claims regarding calories, sodium, fat, fatty acids, and cholesterol; and others as specified in the regulations. Labeling regulations specify criteria for displaying these claims on a product. For example, to display the statement "low sodium" the food must contain 140 milligrams or less sodium per serving.

Health claims are food labeling statements that expressly or by implication characterize the relationship between a specific food or a component of a food (e.g., nutrient) *and* a disease or health-related condition. Further, health claims are limited to claims about disease risk reduction and cannot be claims about the diagnosis, cure, mitigation, or treatment of disease. FDA recognizes two types of health claims: (1) authorized health claims and (2) qualified health claims. Labeling regulations (21 CFR 101.14 and 101.70-101.83) identify health claims that are authorized by FDA and the specific requirements foods must meet to display these claims. Authorized health claims require significant scientific agreement (SSA) regarding the relationship between a food substance and a disease or health-related condition (FDA, 1999). An example of a health claim authorized by FDA is: "Diets low in sodium may reduce the risk of high blood pressure, a disease associated with many factors" (21 CFR 101.74). In contrast, qualified health claims, must be accompanied by a disclaimer or qualified in such a way as to not mislead consumers (FDA, 2006). Currently, qualified health claims are rarely used on food products. Food labels may also display other types of statements regarding dietary guidance (e.g., "calcium is good for you" or "diets rich in fruits and vegetables may reduce the risk of some types of cancers") as long as these statements are truthful and not misleading, as determined by FDA (see 403(a) and 201(n) of the NLEA).

In contrast to nutrient content and health claims, organic labeling statements on food products fall under the jurisdiction of USDA. Food products that are labeled as organic must be produced and processed in accordance with the National Organic Program (NOP) standards

(USDA, AMS, 2008b). The standards provide for three types of labeling: "100% organic," "organic" (at least 95% organically produced ingredients with restrictions on the types of products for the remaining 5%), and "made with organic ingredients" (at least 70% organically produced ingredients). Operations that handle or produce foods must be inspected and certified in order to include organic labeling statements on food products (USDA, AMS, 2008a).

STUDY HYPOTHESES

In conducting the analyses for this paper, we sought to test whether consumers are willing to pay more for products with labeling statements regarding the possible benefits associated with consuming the product. These labeling statements may include nutrient content or health claims as defined by FDA, organic labels as defined by USDA, or other types of labeling statements that indicate a positive attribute of the food product. We specifically sought to test the following null and alternative hypotheses:

H_0: Labeling statements have no relationship to food product prices, and

H_A: Labeling statements are positively associated with food product prices.

For example, consumers might place a higher value on products with a labeling statement regarding the salt or sodium content of the food (low or no salt or sodium) because of the association between salt consumption and high blood pressure. However, it is also possible that some consumers would have a lower willingness to pay for these products because they associate low or no salt with less taste. In equilibrium, we would expect a higher price for products with a low or no salt labeling statement, and thus food manufacturers would have an incentive to formulate foods with low or no salt in order to include a labeling statement. In cases where the equilibrium price premium on the low or no salt labeling statement is negative, food manufacturers may still have an incentive to offer foods with low or no salt labeling statements due to the goodwill it may generate with some consumers and the resulting spillover effects on sales of other food products offered by the manufacturer. Similar arguments apply to other types of labeling statements regarding product attributes that indicate a possible benefit to consumption of the food.

METHODS AND DATA

The Hedonic Regression Approach

Suppose an individual food product is composed of n attributes $A_1,...,A_n$. The bundle of attributes defines a unit price $P(A_1,...,A_n)$, which implies the product price can be decomposed into implicit prices for individual attributes. These implicit prices are called hedonic prices. Intrinsic values of the n attributes may be recovered by specifying the hedonic price as a function $f(\cdot)$ of these attributes as follows:

$$P(A_1,...,A_n) = f(A_1,...,A_n).$$

In a competitive market, hedonic prices are a result of the interaction between demand for and supply of these attributes. Hence, the traditional simultaneity of price and quantity in demand estimation extends to the estimation of hedonic price functions. Rosen (1974) suggest that, to obtain unbiased estimates of consumer demand for attributes, demand and supply of these attributes should be simultaneously modeled in empirical analysis. However, many researchers have contended that supply may be considered perfectly inelastic (e.g., Maguire, Owens, and Simon, 2004; Steiner, 2004) or perfectly elastic (e.g., Nerlove, 1995) and have used a single equation approach to recover the implicit prices. In this paper, since we do not attempt to estimate food demand or supply curves, neither perfectly inelastic nor elastic food supply schedules are assumed. Instead, we estimate the effect of labeling statements on the equilibrium prices of food products.

We specify a semi-log regression of food prices on labeling statements and other non-nutritional characteristics of the food. In addition to its simplicity, a semi-log specification of the hedonic price function has two additional desirable properties. First, because the labeling statement variables are all binary indicator variables, the coefficients on these variables can be interpreted as the percentage changes in the price of the food product as a result of these statements. Second, simulation results in Cropper, Deck, and McConnell (1988) suggest that simpler specifications of the price equation such as the semi-log form have superior properties in measuring marginal willingness to pay when product attributes in the statistical analysis are incomplete or proxy measures for the quality of the product.

Store Scanner Data

Several hedonic studies of food nutrients have used datasets from the U.S. Department of Agriculture (USDA), including the Nationwide Food Consumption Survey (Shi and Price 1998) and the Continuing Surveys of Food Intakes by Individuals (CSFII) (Ranney and McNamara 2002). Others have used household-level scanner data such as the Nielsen Company's Homescan (Huffman and Jensen 2004). However, these datasets do not contain labeling statement information and hence are not suitable for the current study. Thus, to evaluate the effect of labeling statements on food prices, we used the Nielsen Company's 2004 ScanTrack store scanner data purchased by FDA to conduct the econometric analysis.

The ScanTrack dataset includes annual total sales information and selected product information identified by individual Universal Product Codes (UPCs). There are 69 broad product categories in the original dataset, with each product category consisting of one or more product modules. Each UPC is assigned a product module number by Nielsen based on its product characteristics. In addition to the UPC description, each UPC is associated with 14 variables that provide information on its annual dollar and volume sales, package type and size, brand, flavor, form, style, manufacturer, and the manufacturer's parent company.

Dollar and volume sales information is reported for three types of retail outlets: food stores with $2 million or more in annual sales excluding Aldi, drug stores with $1 million or more in annual sales, and mass merchandisers excluding Wal-Mart. The sales statistics are national sales projected by Nielsen based on a national sample of retail stores across the United States. We based the statistical analysis on the sales data for food stores primarily because the majority of food purchases occur at food stores, and Nielsen maintains a food store sample that is much larger in the number of stores and geographical coverage than both the drug store sample and the mass merchandiser sample. Furthermore, food stores carry a more complete line of products of the same food type. Packaging, labeling, and pricing strategies are also more consistent than for products sold through the other outlet types. Thus, using only food store sales facilitates identification of consumers' preferences for product attributes presented on the product labels.

In addition to product information on sales and non-nutritional attributes, the dataset also contains labeling information on up to 11 broad labeling statement categories for each UPC. The 11 statement categories and the mutually exclusive labeling statements within each category are summarized in Table 1.

We focused on the breakfast foods category and the cereals category because they both contain a large number of UPCs and have a large degree of variation in labeling statements across UPCs. These two categories are also important in terms of their shares of the food budget. Together, they account for about 4.1% of the total dollar sales of all 69 Nielsen food categories combined. Table 2 presents the product modules associated with the two product categories as well as the number of UPCs within each module. The breakfast foods product module for powdered instant breakfast and the breakfast cereals product modules for hominy grits and wheat germ were excluded from the analysis due to an insufficient number of observations. Additionally, the breakfast foods module for shelf-stable toaster pastries was dropped because few UPCs contained labeling statements.

Using the ScanTrack data, we constructed the following UPC-level variables for the hedonic regression analysis:

- **Price**: dependent variable for the hedonic regression in dollars/ounce for each UPC in logarithmic form (constructed by dividing total dollar sales by total ounces sold).
- **Package Size**: continuous variable measuring product weight (in ounces) per container. This variable is included to represent price discounts associated with large packages.
- **Bulk**: indicator variable for multi-pack products (equals 1 if the UPC consists of more than one container, 0 otherwise). This variable is intended to capture price discount associated with multi-packaging.
- **Store Brand**: indicator variable for store brand products, also known as private label or control brand, (equals 1 if the brand is a store brand, 0 otherwise). This variable is included to account for the fact that private label products are usually priced lower than their branded counterparts.
- **Major Brand**: indicator variable for brands with annual sales greater than $1 million (equals 1 if the brand is a major brand, 0 otherwise). This variable captures any price premium or discount associated with well-known brand names.

- **Labeling Statements**: indicator variables for labeling statements (equals 1 if the UPC has the labeling statement, 0 otherwise).

The average number of labeling statements per product ranged from 0.7 for granola or yogurt bars to 1.9 for granola or natural cereals, with intermediate values of 1.4 for breakfast bars and hot cereals and 1.0 for ready-to-eat cereals. Within each regression model, the number of binary labeling statement variables varied based on the relevancy of the labeling statement to the product type. We included a specific labeling statement in each regression model if 10 or more UPCs had the statement. This cutoff rule was adopted to avoid confusing the true price effect of a labeling statement with idiosyncratic price differences associated with a few UPCs that contain the statement. An interaction variable indicating the presence of both the low fat and whole grain labeling statements was included for ready-to-eat cereals because many UPCs carried both labeling statements.

Prior to estimation, we plotted the UPC-level price and product size distributions to detect potential outliers in the data. We dropped 12 breakfast food products and two cereal products because of extreme prices (either too low or too high). We also dropped 26 breakfast food products and one cereal product because of extreme values for product size. Tables 3 and 4 summarize the mean and standard deviation for the analysis variables in the breakfast foods and cereals product categories after the outliers were removed.

RESULTS

As a first step, we conducted generalized Chow tests (Dufour 1982) to examine whether it is appropriate to estimate the breakfast foods and cereals regressions using data pooled across product modules in their corresponding product categories. The test results rejected the specifications that used pooled data. Hence, the semi-log hedonic price regressions were estimated for the five product modules individually. Tables 5 and 6 report the regression results for breakfast foods and cereals, respectively. The estimated coefficients on the binary variables are interpreted as percentage changes relative to average per-ounce prices of 43.8 cents for breakfast bars, 50.0 cents for granola or yogurt bars, 19.1 cents for hot cereals, 18.8 cents for ready-to-eat cereals, and 23.5 cents for granola or natural cereals. In terms of model fit, the models appear to fit the data fairly well given the cross-sectional nature of the data with the adjusted R^2 values ranging from 0.47 for granola or natural cereals to 0.55 for granola and yogurt bars.

Based on the results, we reject the null hypothesis that labeling statements have no relationship to food product prices. A majority of the estimated coefficients on labeling statements have positive signs and many are statistically significant. Carb-conscious labeling statements have the most significant positive effect on product prices across all five equations. This is likely a reflection of the time period of the data because many individuals were following low-carbohydrate diets for weight loss in 2004. The largest effect is found in the granola or yogurt bars equation, where the estimated coefficient suggests a 69.7% increase in price attributed to the product being labeled Carb-conscious. No sugar added also appears to be an important statement associated with the retail product price. The estimated effect of this statement on product price is 45.7% for granola or yogurt bars, 27.6% for ready-to-eat cereals, and 20.1% for granola or natural cereals.

The effect of an organic labeling statement is not statistically significant for the breakfast foods categories. However, its effect on food prices is statistically significant in the cereals categories. The largest effect is found for hot cereals, where the presence of an organic labeling statement is associated with a 32.5% increase in price.

Calcium labeling statements generally are not found to affect price significantly except calcium presence statements are estimated to increase the price of granola or yogurt bars by 15.9% (statistically significant at the 10% level).

The results concerning fat content statements are mixed. The price effect of a low fat labeling statement is large and statistically significant for hot cereals and ready-to-eat cereals, but its effect is not statistically significant for the other three products. This result may be due to consumer perceptions regarding the effect of lower fat formulations on product taste. Across the five product modules, fat content statements appear to be most important in ready-to-eat cereals. Each of the three fat labeling statements is present on a number of ready-to-eat cereal UPCs, and all three have statistically significant and relatively large effects on prices. Among all fat statements, the largest effect on price is 40.4% for the absence of a specific fat (e.g., trans fats) in ready-to-eat cereals.

The estimated coefficients on ten labeling statement variables had negative signs, although only three were statistically significant at conventional levels. The statistically significant variables include "whole grain" in the granola or yogurt bars equation; "no salt" in the hot cereals equation; and the interaction variable "low fat*whole grain" in the ready-to-eat cereals equation (although the net effect of low fat and whole grain labeling statements on ready-to-eat cereals is positive). These results indicate that for some food products and labeling statements, consumers may view the labeling statement as having a negative effect on the taste or texture of the food.

The coefficient estimates on non-nutritional product characteristics are generally plausible. Larger packages are associated with lower per-ounce product prices. The estimated price discount ranges from 2.1% for granola or natural cereals to 5% for breakfast bars for a

1-ounce increase in package size. For granola or yogurt bars and ready-to-eat cereals that are available in multi-pack forms, price per ounce is lower in multi-packs than in single packs by 36.6% and 17.9%, respectively. Relative to other non-major brands, store brands are sold at substantially discounted prices. The highest degree of price discount for store brands is 61.4% for granola or yogurt bars. Except for ready-to-eat cereals, major brands (based on sales) are sold at lower per-ounce prices than other brands.

DISCUSSION AND CONCLUSIONS

This analysis has shown that labeling statements on food products are often associated with substantial increases in willingness to pay by consumers. In particular, while controlling for other factors that potentially affect unit pricing of foods, we found the largest price effects across all food products included in the analysis were those associated with unregulated carb-conscious labeling statements. This result is a reflection of the time period of the data when there was heightened interest in the marketplace for foods with carbohydrate claims and related statements for apparent perceived health benefits, including weight management. Thus, food manufacturers capitalized on this trend by producing lower carbohydrate foods bearing carbohydrate claims and related labeling statements without necessarily indicating a direct link between low-carbohydrate diets and any health benefits.

Labeling statements with more firmly established links between consumption and health benefits had mixed results across food categories. Sugar content labeling statements (no sugar added, sugar free, and less sugar) had large positive effects on product prices. Fat content labeling statements (fat free, low fat, or absence of a specific fat) had large positive effects on product prices for granola or yogurt bars and ready-to-eat cereals, but no effect for breakfast bars, hot cereals, or granola or natural cereals. Salt content labeling statements (low salt, no salt, and no salt added) had large positive effects on product prices for granola or yogurt bars and ready-to-eat cereals, but large negative effects for hot cereals. Finally, whole grain labeling statements had a positive effect on product prices for ready-to-eat cereals, but a negative effect for granola or yogurt bars. Thus, while consumers appear to place higher values on foods with possible nutritional or other types of benefits, they might perceive some labeling statements as signaling reduced taste or texture for some categories of food products.

Consumer decisions are complex and difficult to analyze thoroughly with scanner data alone. In conducting the analysis presented in this paper, we were restricted to considering the effects of labeling information as contained in the ScanTrack dataset. Consumers also consider other labeling information including the Nutrition Facts label and ingredient list. The nutrient and ingredient information has likely changed since 2004 for many of the food products included in our analysis, and therefore we were unable to include this information using current food labels. A more complete analysis would also include these characteristics to better understand how consumers might weigh labeling statements versus nutrient and ingredient information in making their purchase decisions. However, to make collection of complete nutrient and ingredient information feasible for each product, the number of products included in the analysis would need to be reduced.

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Table 1. Food Product Labeling Statements Related to Health Benefits in the Nielsen Company's ScanTrack Data

Broad Labeling Statement Categories	Specific Labeling Statement Categories
Calcium	Calcium free
	Calcium presence
	Comparative calcium claim
	Excellent source of calcium
	Good source of calcium
Calories	No calories
	Reduced calories
Carb-conscious	Carb-conscious
Fat	Absence of specific fat
	Fat free
	Low fat
	Reduced fat
Flax or hemp	Flax or hemp seed
Grain type	All other grain
	Bran
	Germ
	Sprouted grain
	Whole grain
Lactose	Lactose free
	Lactose reduced
Organic	Organic
Salt or sodium	Low salt or sodium
	No salt or sodium
	No salt or sodium added
Soy	Soy
Sweeteners	Less sugar
	No sugar added
	Sugar free

Table 2. Food Product Categories and Modules Included in the Analysis, 2004

Food Category	Food Product Module	Number of Observations (UPCs)
Breakfast foods	Breakfast bars	1,284
	Granola or yogurt bars	4,041
Total breakfast foods		**5,325**
Breakfast cereals	Hot cereal	3,085
	Ready-to-eat cereals	10,237
	Granola or natural cereals	1,503
Total breakfast cereals		**14,825**

UPCs = universal product codes

Table 3. Means and Standard Deviations of Variables in the Breakfast Foods Models, 2004

Model Variables	Mean (Std. Dev.) Breakfast Bars	Mean (Std. Dev.) Granola or Yogurt Bars
Labeling statements (1 = yes, 0 = no)		
Carb-conscious	0.194	0.135
	(0.396)	(0.342)
Soy	—	0.055
	—	(0.228)
Organic	0.058	0.088
	(0.233)	(0.283)
Absence of specific fat	—	0.024
	—	(0.152)
Fat free	—	0.021
	—	(0.144)
Low fat	0.464	0.110
	(0.500)	(0.313)
Whole grain	0.191	0.093
	(0.394)	(0.290)
No sugar added	—	0.033
	—	(0.177)
Sugar free	—	0.026
	—	(0.160)
Less sugar	0.054	—
	(0.226)	—
Calcium presence	—	0.026
	—	(0.160)
Good source of calcium	0.288	0.080
	(0.454)	(0.272)
Low salt	0.040	0.051
	(0.195)	(0.221)
Other product characteristics		
Package size (ounces)	7.759	6.741
	(4.761)	(5.760)

Model Variables	Mean (Std. Dev.) Breakfast Bars	Granola or Yogurt Bars
Bulk packaging (1 = yes, 0 = no)	—	0.006
	—	(0.079)
Store brand (1 = yes, 0 = no)	0.122	0.099
	(0.328)	(0.299)
Major brand based on sales (1 = yes, 0 = no)	0.673	0.600
	(0.470)	(0.490)

Note: Some specific labeling statements appear on few or no UPCs within a product type. The labeling variable was excluded from the model if 10 or fewer products had the labeling statement.

Table 4. Means and Standard Deviations of Variables in the Breakfast Cereals Models

Model Variables	Mean (Std. Dev.)		
	Hot Cereals	Ready-to-Eat Cereals	Granola or Natural Cereals
Labeling statements (1 = yes, 0 = no)			
Carb-conscious	0.031	0.009	0.038
	(0.174)	(0.092)	(0.192)
Soy	0.035	0.016	—
	(0.183)	(0.126)	—
Organic	0.085	0.081	0.177
	(0.280)	(0.273)	(0.382)
Hemp	0.031	0.005	—
	(0.174)	(0.072)	—
Absence of specific fat	—	0.010	0.048
	—	(0.102)	(0.215)
Fat free	0.044	0.068	—
	(0.206)	(0.252)	—
Low fat	0.161	0.165	0.273
	(0.368)	(0.371)	(0.447)
Bran	0.041	0.061	—
	(0.199)	(0.239)	—
Whole grain	0.765	0.333	0.841
	(0.424)	(0.471)	(0.367)
No sugar added	—	0.016	0.052
	—	(0.124)	(0.222)
Sugar free	0.051	0.008	—
	(0.220)	(0.087)	—
Less sugar	—	0.035	—
	—	(0.183)	—
Calcium presence	—	0.020	—
	—	(0.141)	—
Good source of calcium	0.049	0.082	—
	(0.217)	(0.274)	—
Low salt	0.031	0.031	0.152
	(0.174)	(0.173)	(0.360)

Model Variables	Hot Cereals	Ready-to-Eat Cereals	Granola or Natural Cereals
	Mean (Std. Dev.)		
No salt	0.076	0.015	0.083
	(0.265)	(0.122)	(0.276)
No salt added	—	0.012	—
	—	(0.110)	—
Lactose free	—	0.005	—
	—	(0.068)	—
Low fat & whole grain	0.143	0.081	0.235
	(0.350)	(0.272)	(0.425)
Other product characteristics			
Package size (ounces)	18.810	16.344	17.256
	(13.803)	(8.743)	(10.174)
Bulk packaging (1 = yes, 0 = no)	—	0.013	—
	—	(0.115)	—
Store brand (1 = yes, 0 = no)	0.315	0.386	0.232
	(0.465)	(0.487)	(0.423)
Major brand based on sales (1 = yes, 0 = no)	0.417	0.535	0.433
	(0.494)	(0.499)	(0.496)

Note: Some specific labeling statements appear on few or no UPCs within a product type. The labeling variable was excluded from the model if 10 or fewer products had the labeling statement.

Table 5. Results of Log-Linear Price Regression for the Breakfast Foods Models
Dependent variable: Natural log of cents per ounce

	Breakfast Bars			Granola or Yogurt Bars		
	Parameter Estimate	Standard Error	P Value	Parameter Estimate	Standard Error	P Value
Intercept	3.983	0.080	<.0001	4.097	0.030	<.0001
Labeling statements (1 = yes, 2 = no)						
Carb-conscious	0.599	0.073	<.0001	0.697	0.043	<.0001
Soy	—	—	—	0.117	0.062	0.061
Organic	0.164	0.145	0.260	0.066	0.057	0.245
Absence of specific fat	—	—	—	0.129	0.095	0.174
Fat free	—	—	—	0.261	0.112	0.020
Low fat	−0.053	0.060	0.378	−0.074	0.051	0.145
Whole grain	−0.048	0.071	0.495	−0.104	0.049	0.034
No sugar added	—	—	—	0.457	0.084	<.0001
Sugar free	—	—	—	−0.046	0.091	0.613
Less sugar	0.252	0.113	0.027	—	—	—
Calcium presence	—	—	—	0.159	0.090	0.076
Good source of calcium	0.043	0.063	0.489	0.021	0.055	0.707
Low salt	−0.026	0.183	0.889	0.181	0.077	0.018
Other product characteristics						
Package size (ounces)	−0.050	0.005	<.0001	−0.026	0.003	<.0001
Bulk packaging (1 = yes, 2 = no)	—	—	—	−0.366	0.175	0.037
Store brand (1 = yes, 2 = no)	−0.357	0.096	0.000	−0.614	0.055	<.0001
Major brand based on sales (1 = yes, 2 = no)	−0.068	0.066	0.301	−0.395	0.035	<.0001
N		278			800	
Adjusted R^2		0.490			0.553	

Table 6. Results of Log-Linear Price Regression for the Breakfast Cereals Models
Dependent variable: Natural log of cents per ounce

	Hot Cereals			Ready-to-Eat Cereals			Granola or Natural Cereals		
	Parameter Estimate	Standard Error	P Value	Parameter Estimate	Standard Error	P Value	Parameter Estimate	Standard Error	P Value
Intercept	3.210	0.066	<.0001	3.055	0.030	<.0001	3.409	0.074	<.0001
Labeling statements (1 = yes, 0 = no)									
Carb-conscious	0.496	0.149	0.001	0.605	0.088	<.0001	0.356	0.106	0.001
Soy	0.169	0.116	0.145	0.225	0.063	0.000	—	—	—
Organic	0.325	0.071	<.0001	0.167	0.030	<.0001	0.156	0.052	0.003
Hemp	0.069	0.131	0.597	0.121	0.104	0.247	—	—	—
Absence of specific fat	—	—	—	0.404	0.077	<.0001	0.0003	0.102	0.998
Fat free	0.131	0.103	0.201	0.152	0.031	<.0001	—	—	—
Low fat	0.307	0.054	<.0001	0.108	0.028	0.000	0.037	0.044	0.393
Bran	0.060	0.117	0.608	0.077	0.032	0.015			
Whole grain	0.034	0.057	0.546	0.097	0.020	<.0001	0.100	0.056	0.076
No sugar added	—	—	—	0.276	0.066	<.0001	0.201	0.091	0.029
Sugar free	0.375	0.095	<.0001	0.088	0.095	0.353	—	—	—
Less sugar	—	—	—	0.048	0.042	0.245	—	—	—
Calcium presence	—	—	—	0.043	0.052	0.406	—	—	—
Good source of calcium	0.104	0.095	0.274	0.001	0.028	0.983	—	—	—
Low salt	0.027	0.112	0.807	0.113	0.046	0.015	0.086	0.059	0.151
No salt	−0.378	0.079	<.0001	0.120	0.063	0.058	0.027	0.071	0.709
No salt added	—	—	—	−0.038	0.076	0.619	—	—	—
Lactose free	—	—	—	−0.146	0.108	0.174	—	—	—
Low fat & whole grain	—	—	—	−0.081	0.041	0.046	—	—	—

	Hot Cereals			Ready-to-Eat Cereals			Granola or Natural Cereals		
	Parameter Estimate	**Standard Error**	**P Value**	**Parameter Estimate**	**Standard Error**	**P Value**	**Parameter Estimate**	**Standard Error**	**P Value**
Other product characteristics									
Package size (ounces)	−0.028	0.001	<.0001	−0.027	0.001	<.0001	−0.021	0.002	<.0001
Bulk packaging (1 = yes, 0 = no)	—	—	—	−0.179	0.065	0.006	—	—	—
Store brand (1 = yes, 0 = no)	−0.285	0.054	<.0001	−0.030	0.030	0.317	−0.398	0.053	<.0001
Major brand based on sales (1 = yes, 0 = no)	−0.017	0.049	0.736	0.213	0.029	<.0001	−0.118	0.046	0.011
N		609			2,108			289	
Adjusted R^2		0.521			0.484			0.470	