The Importance of Nutrition Labeling and Health Claim Regulation on Product Choice: An Analysis of the Cooking Oils Market

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The Nutrition Labeling and Education Act (NLEA) prohibits health claims for foods containing more than a certain amount of fat per serving. This disqualifier level eliminates health claims for cooking oils since these products have approximately 14 grams of fat per serving, above the acceptable threshold. However, a number of scientific studies indicate that, from a heart-health perspective, cooking oils lower in saturated fat and higher in monounsaturated fats are superior to other oils. Prior to the NLEA, firms actively competed on this basis, with manufacturers of cooking oils making explicit heart-health claims in print advertising and labeling. This study utilizes supermarket scanner data from twenty stores to examine the type of cooking oil chosen by consumers. The results indicate that after implementation of the NLEA, consumers shifted purchases toward cooking oils higher in saturated fat and lower in monounsaturated fat. This study does not address whether consumers changed their total consumption of cooking oil after implementation of the NLEA.

The flow of information about products is of central importance to consumers in the marketplace. This is especially relevant with respect to food products because of the long-term health impacts of food choice. For example, five of the top ten causes of death in the United States have been linked to diet (U.S. Surgeon General 1988). The role of advertising and labeling in providing reliable product information has been at the center of much debate, culminating in the passage of the Nutritional Labeling and Education Act (NLEA) in 1990.[1] One of the primary purposes of the NLEA is to regulate the types of health claims that can be used on labels and the types of food products that can use these approved diet-disease claims. FDA's final regulations (a) identify several diet-disease relationships where health claims are allowed in some form; (b) delineate nutrient-content requirements that must be met by the food before a health claim is made; and (c) establish disqualifying nutrient levels for total fat, saturated fat, cholesterol, and sodium. If a food product exceeds the disqualifying level for any of these nutrients, no health claim relating to any diet-disease issue can appear on the label.

These disqualifying levels have significant implications for the cooking oil market. In particular, because cooking oils are comprised exclusively of fat, all products contain 14 grams of fat per serving, well above the disqualifying fat level for health claims. As a consequence, manufacturers of cooking oils cannot use explicit health claims to distinguish why one type of cooking oil is superior to others on the market. In the eight years prior to implementation of the NLEA, firms were permitted to use health claims subject to the usual regulation of advertising and labeling. Firms actively used these claims to promote the relative heart-healthiness of certain types of cooking oils. In particular, in response to established and emerging scientific research, firms promoted the relative heart-healthiness of cooking oils high in monounsaturated fat and low in saturated fat. Opponents of these types of claims believe that, because cooking oils have 14 grams of fat per serving, they should not, in any way, be permitted to mention heart-healthiness. This type of concern was the basis for the disqualifying level regulation.

This study utilizes supermarket scanner data and nutrition label data that span the pre- and post-

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NLEA period to address the consequences of eliminating explicit health claims for cooking oils. The advantage of supermarket scanner data is that observations are based on purchase behavior in the natural shopping environment. Moreover, the examination of consumer choices in the same supermarkets over time, during identical weeks within the year, with almost the identical set of available products, allows for a quasi-experimental design. Finally, rather than providing an investigator-induced change, this study takes advantage of a relatively exogenous and real change in the information environment.[2]

This paper investigates three issues. First, the paper analyzes whether educated consumers purchased cooking oils with higher levels of monounsaturated fat and lower levels of saturated fat prior to the NLEA. Second, the paper assesses whether cooking oils with higher levels of monounsaturated fat or lower levels of saturated fat experienced a significant change in market share after the health claim provisions of the NLEA took effect. Third, the paper examines whether these post-NLEA changes in the fat composition of cooking oils vary across supermarkets with different education profiles. Scanner data from supermarkets from the same chain are useful for studying the distributional consequences of changes in the information environment since different types of consumers are faced with almost identical product choices in similar shopping environments.

This paper does not investigate whether the elimination of health claims changed per-capita consumption of cooking oil. Proponents of the elimination of health claims for this food category argued that heart-health comparison claims could lead consumers to consume too much cooking oil. Consequently, the evidence presented in this study can only partially address whether the elimination of health claims for cooking oils had adverse effects on consumers in these supermarkets.

A Brief Review of the Science

There is widespread and convincing evidence that saturated fat consumption contributes to increased levels of serum cholesterol, which in turn leads to increased risk of coronary heart disease. The Framingham study of coronary heart disease risk factors established that a 1% reduction in serum cholesterol led to approximately a 2% reduction in the risk of heart disease (Dawber, Moore, and Mann 1957). Following the Framingham study, Keys, Anderson, and Grande (1957) and Hegstead et al. (1965) established a strong empirical link between the consumption of fats and serum cholesterol. These studies suggested that saturated fat in the diet is especially linked to higher serum cholesterol. Since these studies, much scientific research has focused on the relationship between the consumption of different types of fat and heart disease and cancer risk.

A large body of research suggests that replacing saturated fat with alternative types of fat can help reduce the risk of heart disease. Since the early 1990s there has been increasing scientific evidence and communication to the public that substituting monounsaturated fats for saturated fats is particularly useful in reducing the risk of heart disease and other disease.[3] The research continues to find positive health effects of monounsaturated fats (Edwards 1995; Grundy 1997; Lipworth et al. 1997; Morgan et al. 1997; Nydahl et al. 1995; Willett 1997). Some of these studies suggest that, not only substituting, but adding monounsaturated fats to the diet can reduce the risks of heart disease and certain types of cancer.

In summary, there is convincing scientific evidence that replacing saturated fat with other types of fat, especially monounsaturated fat, helps reduce the risk of coronary disease. There is evidence, although not a consensus, that adding monounsaturated fats (not just substituting them for saturated fat) to the diet can help reduce the risk of disease.

Information Dissemination Policies

Food producers have been shown to be an important source of nutrition information for consumers (Ippolito and Mathios, 1990, 1993, 1995). However, since the 1950s, producers have had different levels of freedom to disseminate information relating to the type of fat and disease risk. After producers reformulated margarine and cooking oil products to reduce saturated fat levels and began promoting their products' heart-related characteristics in the late 1950s, the FDA prohibited any label claims regarding cholesterol or fat content by type.[4] During the early 1970s enforcement of the ban on labeling these characteristics appears to have ended, and by 1973 the labeling policy was explicitly changed to allow fat composition disclosures and nutrient content claims about these characteristics on labels. Despite this policy change, there was still a policy that banned the linking of a nutrient with a disease.

This ban on health claims was effectively relaxed in 1985 following the introduction of Kellogg's highly publicized All-Bran advertising

and labeling campaign explicitly using the National Cancer Institute's statements on the potential relationship between fiber and cancer to promote its high-fiber cereal. These claims, which were in direct violation of the prohibition on health claims, were not challenged. In 1987 FDA published a proposed rule to govern health claims on labels under a general deception standard, but agency officials had publicly supported a change in policy earlier and had announced that well-founded claims would not be prosecuted in the interim.[5]

Firms now faced considerably less regulatory risk and began to promote the relationship between type of fat and heart disease explicitly. Advertisements for Puritan 100% canola oil were introduced in 1986 and developed into a major campaign focused on the relationship between its low saturated fat content and heart-health. The campaign cited a recommendation from the American College of Nutrition and noted that "saturated fat raises blood cholesterol more than anything else you eat. So it's important to lower saturated fat in the diet. Oils with less saturated fat are a better choice for a heart healthy diet" (*Newsweek*, October 9, 1989). This type of campaign lasted for many years. A 1991 advertisement, headlined "Facts for Life," discusses the relationship between saturated fat and heart disease. The advertisement emphasizes that canola oil has less than half the saturated fat of other oils. Wesson ran a series of similar advertisements in major magazines. In an analysis of the sales of oils high in monounsaturated fat, Fitch (1992) concludes that the positive promotion of the health aspects of olive oil is responsible for increased sales in the U.S. market. Olive oil producers used health claims in promoting their products, though the Federal Trade Commission accused some firms of engaging in false and/or deceptive advertising.[6]

As health claims in the market increased during the late 1980s, there was an increased concern that these advertising and labeling campaigns were deceptive and/or misleading. The debate surrounding the role of producer health claims in marketing foods culminated in the passage of the NLEA. On November 8, 1990, the president signed into law the NLEA, which authorized the FDA to regulate health claims on food labels. Section 403 (r) (1)(3) of the act indicates that a product is misbranded if it bears a claim that characterizes the relationship of a nutrient to a disease or health-related condition, unless the claim is made in compliance with the provisions articulated by the FDA.

On January 6, 1993, the FDA adopted the final rule that implemented the health claims provisions of the NLEA act.[7] The rule provides for the conditions under which a food product is eligible to have a health claim. The rule established the procedures the FDA uses to authorize a diet-disease claim, and provides rules for which products can utilize authorized claims. Under the FDA implementation of the NLEA, the relationship between saturated fat and heart disease is an authorized diet-disease claim. However, even if a firm has low enough saturated fat to use the claim (i.e., it meets the low definition), products that exceed a certain amount of total fat are disqualified from making a health claim. It is this part of the FDA health claims regulation that prohibits cooking oils from using labels that contain information linking low levels of saturated fat with reduced risks of disease. The FDA health claims regulation dictated in the January 3, 1993 final rule took effect May 8, 1993. After this date, these regulations prohibit all diet-disease claims on labels for cooking oils. The Federal Trade Commission (FTC), which regulates the advertising of health claims (as opposed to the labeling of health claims), announced its intention to harmonize advertising and labeling regulations, though the agency makes some allowance for differences in the treatment of health claims.[8] However, preliminary evidence from an ongoing study that is examining the content of food advertisements during this period indicates that advertising claims linking type of fat to disease largely disappeared for cooking oils after 1993.[9]

In summary, the relationship between type of fat and disease risk was heavily promoted by producers of canola oil, and there is evidence that health promotion for olive oil was active as well. These claims focused on the link between saturated fat and heart disease, with additional focus on the benefit of monounsaturated fat. These claims continued into the early 1990s. After mid 1993, firms were no longer permitted to make these explicit health claims (though they could continue to use nutrient-content claims) on labels and faced significant regulatory risk in advertising.

Nutrition Labeling Studies

The effect of nutrition labeling regulation has received much attention by regulators and academics. Evaluation of the impact of labeling and advertising regulation on consumer choice has largely focused on consumer use/search for nutrition information (Brucks, Mitchell, and Staelin 1984; Cole and Balasubramanian 1993; Cole and Gaeth 1990; Heimback and Stokes 1982; Lenahan et al. 1973), consumer interpretation of health claims (Ford et al. 1996), and change in consumer

and producer behavior surrounding the lifting of the ban on health claims (Ippolito and Mathios 1990, 1993, 1995). Recent work has begun to focus on evaluation of the impact of the NLEA directly (Moorman 1996), though there has been little work focusing directly on the specific elements of the NLEA examined in this paper.

Data

Supermarket Data

Data are obtained from a relatively upscale supermarket chain located in New York State. The chain owns and operates approximately fifty stores, mostly in the upstate region of New York State. The supermarket chain provided two sources of data for this study: demographic data and product movement data.

Demographic Information from Shopper Club Membership. The supermarket chain provided demographic information for twenty supermarkets. These data are obtained from Shopper Club (SC) application forms, which include questions regarding the shopper's education, household income, age, family size, and sex. The data are provided at the aggregate store level (e.g., the percentage of club members at a particular store who have a college education). The stores were chosen to achieve a large variation in education; in fact, the percentage of shoppers that have a college degree at a particular store ranges from 14% to 66%.

Scanner Purchase Data. Product movement data are provided beginning in October 1992 and ending in October 1994. Every four months during this period, a product movement report details the number of units of each cooking oil sold during the previous week, the average retail price of each product during that week, the UPC code of the product, the size of the product, whether there was a general price promotion for the product, and whether there was a SC promotion for that product. This study utilizes data from the last week in October 1992, February 1993, June 1993, October 1993, February 1994, June 1994, and October 1994. The health claim provisions of the NLEA were adopted on May 8, 1993. Consequently, there are two cross-sections of data from the pre-NLEA period and five from the post-NLEA period.

This study focuses on cooking oils for several reasons. First, the cooking oil product category presents an interesting consumer information issue. These products are very high in fat, yet there are important health distinctions between products based on the type of fat in the cooking oil. Second, prior to the NLEA, virtually all of the cooking oils contained a nutrition label so that the impact of mandatory labeling did not change whether a product had or did not have a nutrition label. Third, most cooking oils are sold in similar-size bottles, making it a relatively homogenous product to consider for analysis. Fourth, cooking oils are a reasonably well defined product market, simplifying the decision of which products to include in the analysis.

Information from Nutrition Labels

Data were collected from nutrition labels to ascertain the fat composition of each cooking oil. Information collected include the saturated fat content, monounsaturated fat content, and polyunsaturated fat content of each product.

Merging the scanner purchase data with the nutrition label data provides a data set in which purchase data is linked with type of fat information. For standardization purposes, the analysis is limited to cooking oils and does not consider cooking sprays, shortening, or margarines and butter. While there are variations in which cooking oils are sold in which stores, most are available in every store during each of the time periods included in the analysis.

The Econometric Model

Econometric Specification

The econometric specification is derived from a differentiated product demand model based on McFadden (1974) and the discussion of this model by Maddala (1983). Consider an individual who faces a choice among cooking oils. Let Y_i^* represent the indirect utility associated with the ith cooking oil. The observed choices represent the maximum of the indirect utilities associated with each item. In other words:

$$(1) \qquad Y_i = 1 \text{ if} Y_i^* = \text{Max}\,(Y_1^*, Y_2^*, \ldots Y_j^*).$$

$$Y_i = 0 \text{ otherwise.}$$

Let

$$(2) \qquad Y_i^* = F_i(\mathbf{X}_i) + \epsilon_i\,.$$

If the residuals are assumed to be i.i.d (identically, independently distributed) and have a logistic distribution then:

$$(3) \qquad P(Y_i = 1|\mathbf{X}) = \epsilon^{\beta \mathbf{X}_i}/\Sigma\, e^{\beta \mathbf{X}_i}\,.$$

Equation (1) implies that $\epsilon_i + \beta \mathbf{X}_i > \epsilon_j + \beta \mathbf{X}_j$ for all $j \neq i$.

If there is a sample of individuals choosing among the cooking oils, then

(4) Y_{ij}^* = the level of indirect utility for the jth individual making the ith choice.
Y_{ij} = 1 if the jth individual chooses the ith choice.
= 0 otherwise.

Assuming that

$$Y_{ij}^* = \mathbf{X}_i\beta + \mathbf{Z}_j\alpha + \epsilon_{ij}, \quad (5)$$

where the vector $\mathbf{Z}$ reflects a vector of characteristics of the individuals (which in this case are characteristics of supermarkets) and the vector $\mathbf{X}$ reflects a vector of characteristics of the individual cooking oils. In this case:

$$P(Y_{ij} = 1) = e^{\mathbf{X}_i\beta + \mathbf{Z}_j\alpha} / \Sigma\, e^{\mathbf{X}_i\beta + \mathbf{Z}_j\alpha}. \quad (6)$$

Converting the units sold of each cooking oil at a supermarket during a particular week into the products' market share provides the measurement for the left-hand side of equation (6). After taking the log of the market share, equation (6) is now a linear function of both the characteristics of the supermarket and the characteristics of the cooking oil. This is the basis for the specifications used in the empirical analysis.

To assess the impact of the NLEA on the choice of cooking oils, we specify the log of the market share of each cooking oil within each supermarket as a function of characteristics of the cooking oil and characteristics of the supermarket. The estimation of equation (1) uses data that vary by product (different cooking oils), store (twenty stores) and time (seven weeks of scanner data).

(7)

$$\begin{aligned} \ln(MKTSHARE_{ijt}) = {} & \alpha_1 + \alpha_2\, PRPER_{ijt} + \alpha_3\, MF_i \\ & + \alpha_4 SF_i + \alpha_6\, Educ{*}SF_{ij} \\ & + \alpha_7\, EDUC{*}MF_{ij} \\ & + \alpha_5\, POST{*}MF_{it} \\ & + \alpha_6\, POST{*}SF_{it} \\ & + \alpha_7\, EDUC{*}POST{*}MF_{ijt} \\ & + \alpha_8 EDUC{*}POST{*}SF_{ijt} \\ & + \alpha_9\, SALE1_{ijt} + \alpha_{10} SALE2_{ijt} \\ & + \alpha_{11} SMALL_i + \alpha_{12} LARGE_i \\ & + \alpha_{13}\, \mathbf{STOREDUM}_j + e_{ijt}, \end{aligned}$$

where:

$\ln MKTSHARE_{ijt}$ = the log of the market share of oil i in store j during week t.

$PRPER_{ijt}$ = the average retail price per ounce for cooking oil i in store j during week t.

MF_i = the number of grams of monounsaturated fat in a serving of cooking oil i.

SF_i = the number of grams of saturated fat in a serving of cooking oil i.

$POST_t$ = 1 if scanner data are from after implementation of health claims provision of the NLEA.
= 0 otherwise.

$EDUC_j$ = the percentage of shopper club members at store j who are college graduates.

$SALE1_{ijt}$ = 1 if cooking oil i in store j during week t is on sale to all shoppers.
= 0 otherwise.

$SALE2_{ijt}$ = 1 if cooking oil i in store j during week t is on sale to shopper club members.
= 0 otherwise.

$SMALL_i$ = 1 if cooking oil i is less than or equal to 16 ounces.
= 0 otherwise.

$LARGE_i$ = 1 if cooking oil i is greater than or equal to 32 ounces.
= 0 otherwise.

$\mathbf{STOREDUM}_j$ = a set of 19 dummy store indicator variables.

In order to examine the impact of the health claim provisions of the NLEA, we focus on the coefficients on *POST*MF* and the coefficient on *POST*SF*. A negative coefficient on *POST*MF* would indicate that consumers are shifting to oils that are lower in monounsaturated fats after implementation of the NLEA. A positive coefficient on *POST*SF* would indicate that consumers are shifting to oils that are higher in saturated fats after implementation of the NLEA. The coefficients on the three-way interaction terms (*EDUC*POST*SF* and *EDUC*POST*MF*) will indicate whether the change in product choice in the post-NLEA period varies by the education level of the supermarket. The coefficients on the two-way interaction terms (*EDUC*MF* and *EDUC*SF*) indicate whether educated shoppers made different cooking oil choices prior to implementation of the NLEA. Finally, the model includes store fixed effects (19 dummy variables) so that unobserved differences in product

choice across stores are accounted for in the analysis, though these coefficients are not reported in the text. Finally, separate regressions for each supermarket are presented.

Results

Descriptive Statistics. Table 1 provides the market-share-weighted saturated fat and monounsaturated fat content for each supermarket in both the pre- and post-NLEA periods.[10] There are several interesting features of table 1. First, there appears to be a relationship between the percentage of shoppers at a supermarket who have a college degree and the market-share-weighted monounsaturated fat level of cooking oils. The monounsaturated fat content in the highest-educated supermarket equals 7.36 grams per serving in the pre-NLEA period and only 5.54 grams per serving for the lowest-educated supermarket for the same period. The results for saturated fat are less dramatic but display similar features: the two lowest-educated supermarkets have the highest saturated fat contents, 1.56 and 1.59 grams per serving of cooking oil.

The second important feature of table 1 is the change in the market-share-weighted levels of saturated fat and monounsaturated fat from the pre- to the post-NLEA period. For every supermarket there was an increase in the market-share-weighted saturated fat content of cooking oils. Since all cooking oils in the sample ranged from 1 to 2 grams of saturated fat per serving, the increases in the post-NLEA period are quite substantial. Concurrent with the increase in the saturated fat content of purchased cooking oils was a decrease in the monounsaturated fat content of these oils. In seventeen of the twenty supermarkets there was a decrease in the market-share-weighted monounsaturated fat content of purchased cooking oils. Interestingly, the three supermarkets where there was an increase in monounsaturated fat were the fifth most educated, the third most educated, and the most educated supermarkets in the sample.

These cross-tabulations suggest changes in fat composition of cooking oil purchases between the pre- and the post-NLEA periods but do not account for a variety of other important determinants of cooking oil sales, most important of which are sale promotions and price. Sale promotions and price are likely to be extremely important in determining the market share of different products, especially since there are buy-one/get-one-free promotions and other dramatic price reductions for selected products in this sample. Consequently, we turn to multivariate results which account for these price and sale promotions.

Table 2 provides the means, standard deviations, minimums, and maximums for each variable used in the regression analysis. This table is self-

Table 1. Market-Share-Weighted Fat Content of Cooking Oils

Store[a]	Percentage College Graduates	Mono Fat Content (Pre-NLEA)	Saturated Fat Content (Pre-NLEA)	Mono Fat Content (Post-NLEA)	Saturated Fat Content (Post-NLEA)
18	14	5.54	1.56	5.17	1.71
20	18	6.12	1.59	5.81	1.69
7	21	6.28	1.53	6.14	1.66
4	23	6.67	1.43	6.17	1.63
19	23	6.41	1.51	6.05	1.61
16	25	6.95	1.31	6.36	1.55
11	26	6.99	1.43	6.48	1.63
3	27	6.80	1.52	6.66	1.62
10	29	7.02	1.46	6.53	1.62
15	29	6.50	1.50	6.38	1.61
12	34	6.72	1.41	6.16	1.62
1	35	7.47	1.31	6.91	1.63
14	36	6.63	1.50	6.35	1.63
8	40	6.54	1.53	6.51	1.67
2	44	6.74	1.52	6.82	1.65
9	47	6.93	1.45	6.69	1.65
6	53	7.34	1.44	7.06	1.61
17	57	7.28	1.41	7.31	1.65
13	59	7.26	1.52	7.06	1.65
5	66	7.36	1.50	7.45	1.67

NOTE: Data are from scanner data and Shopper Club card application forms.
[a]Stores are listed in order of education level.

Table 2. Descriptive Statistics

Variable	Mean	Std. Dev.	Minimum	Maximum
SOLD	18.56	40.10	1	600
MKTSHARE	0.027	0.048	0.0005	0.49
ln(MKTSHARE)	−4.33	1.15	−7.46	−0.71
PRPER	0.11	0.07	0.02	0.47
MF	7.33	3.37	2	11
SF	1.74	0.44	1	2
POST	0.75	.50	0	1
EDUC	35.83	14.56	14	66
SALE1	0.10	0.31	0	1
SALE2	0.07	0.26	0	1
SMALL	0.16	0.37	0	1
LARGE	0.50	0.50	0	1

NOTE: Data are based on supermarket scanner data, nutrition label data, and SC application forms.
Variables used for regression equation—number of obs. = 5,116.

explanatory, though a few variables are discussed in further detail. The number of observations used for the regression analysis equals 5,116. There are, on average, 37.4 different cooking oil products to choose from within a supermarket in each time period. The standard deviation for this variable is relatively small (4.46), indicating that the product choices across supermarkets or over time are quite similar. The average units sold of each product during a week equals 18.58, and there is a large standard deviation for this variable (40.10). This variation stems from the large impact that price promotions have on cooking oil sales. This emphasizes the importance of controlling for price and special sales in the regression analysis. Approximately 10% of cooking oil products are on a shopping-club-card-only sale (SALE1), and an additional 7% of products are on sale to all shoppers. The average monounsaturated fat level of cooking oils equals 7.33, while the average saturated fat content of cooking oils in the sample is 1.74.

Table 3 presents the regression results for the entire sample. The coefficients on the two key variables (*POST*MF* and *POST*SF*) are both statistically significant. The coefficient on *POST*MF* is negative and significant, indicating that the market share of products high in monounsaturated fat is lower in the post-NLEA period than in the pre-NLEA period. The coefficient on *POST*SF* is positive and significant, indicating that the market share of products that have higher amounts of saturated fat gained market share in the post-NLEA period compared with the pre-NLEA period. These results are consistent with the cross-tabulations presented in table 1.

There are other interesting results in table 3. The coefficient on *EDUC*MF* is positive and significant, indicating that high monounsaturated fat cooking oils have higher market shares in highly educated supermarkets. This effect does not vary based on the pre- and post-NLEA distinction (the coefficient on *POST*EDUC*MF* is not significant), so that the decline in monounsaturated fats after implementation of the NLEA appears to be relatively constant across supermarkets. This result will be examined in more detail when the regression results are presented for each supermarket separately. The market shares of cooking oils high in saturated fat are relatively constant across supermarkets with different levels of education. However, there is some suggestive evidence presented later in the paper that the increase in the market share of cooking oils high in saturated fat after the NLEA was concentrated in the least-educated supermarkets.

The coefficients on the other control variables are generally consistent with what one would expect. If a product is on sale to all Shopper Club cardholders, there is a dramatic increase in the market share of these products. This is not suprising given that some of these sales include buy-one-get-one-free promotions. If a product is on sale to all shoppers, the product also has significantly higher market share. The higher the price per ounce of the cooking oil, the lower the market share of that product, even after controlling for the size of the product. Cooking oils sold in large bottles have significantly lower market shares than do medium and small products. Market share is measured, however, in units sold, not in quantity of oil sold.

Table 4 presents the regressions separately for each supermarket. Since there is no variation in education within a supermarket, these regressions

Table 3. Regression Results for Cooking Oils

Variable	Coefficient	T-Value
INTERCEPT	−2.115	−19.58
PRPER	−5.362	−17.17*
MF	−0.079	−4.24*
SF	−0.701	−7.34*
EDUC*MF	0.0016	3.40*
EDUC*SF	0.0007	0.30
POST*MF	−0.0403	−1.99*
POST*SF	0.2331	2.73*
EDUC*POST*MF	0.0002	0.44
EDUC*POST*SF	−0.0014	−0.65
SALE1	1.8688	46.71*
SALE2	0.5816	12.12*
SMALL	0.0680	1.67
LARGE	−0.5464	−17.17*

NOTE: Mean of dependent variable ln(MKTSHARE) = −4.332.
* Indicates significance at the 90% level or greater.

Table 4. Regression for Cooking Oils by Store

Variable	Store 1 N = 174	Store 2 N = 252	Store 3 N = 266	Store 4 N = 220	Store 5 N = 278	Store 6 N = 270	Store 7 N = 266	Store 8 N = 273	Store 9 N = 269	Store 10 N = 261
INTER	−2.89	−2.44	−2.39	−2.61	−2.75	−2.39	−2.43	−2.21	−2.22	−2.78
	−7.14*	−8.40*	−7.39*	−7.50*	−10.1*	−7.91*	7.30*	−7.65*	−7.39*	−8.18*
PRPER	−4.18	−2.70	−6.62	−5.48	−3.42	−3.54	−6.20	−5.55	−4.29	−5.45
	−2.03*	−2.08*	−4.55*	−3.24*	−3.05*	−2.50*	−4.01*	−4.85*	−3.56*	−3.92*
MF	−0.03	−0.02	0.01	−0.01	0.15	0.01	−0.08	−0.03	−0.06	0.00
	−0.34	−0.79	0.17	−0.38	0.53	0.30	−2.03*	−1.04	−1.94*	0.05
SF	−0.68	−0.71	−0.72	−0.75	−0.65	−0.86	−0.54	−0.61	−0.69	−0.73
	−2.82*	−4.51*	−4.06*	−4.04	−4.33	−5.07	−2.94*	−3.82*	−4.19*	−3.88*
POST*	0.01	−0.01	−0.05	−0.06	−.03	−0.04	0.00	−0.04	0.00	−0.04
MF	0.12	−.26	−1.52	−1.62	−0.92	−1.26	0.09	−1.15	0.09	−1.04
POST*	0.159	0.02	0.24	0.35	0.18	0.15	0.05	0.18	0.09	0.25
SF	0.81	0.15	1.65*	2.34*	1.40	1.11	0.29	1.35	0.63	1.63
SMALL	−0.00	−0.20	0.11	0.34	−0.14	−0.16	0.25	0.06	−0.08	0.02
	−0.16	−1.24	0.66	1.76*	−0.92	−0.98	1.32	−0.36	−0.49	0.11
LARGE	−0.47	−0.47	−0.65	−0.38	−0.53	−0.50	−0.61	−0.68	−0.58	−0.34
	−2.74*	−3.64*	−4.55*	−2.49*	−4.45*	−3.75*	−4.05*	−5.50	−4.46*	−2.30*
SALE1	2.24	1.79	2.06	2.05	1.81	1.87	2.22	1.75	1.98	2.19
	10.11*	11.16*	11.58*	10.86*	11.60*	10.98*	11.73*	10.74*	11.89*	11.76*
SALE2	0.93	0.81	0.52	0.39	0.53	0.36	0.80	0.69	0.64	0.62
	3.99*	3.85*	2.46*	1.94*	2.94*	1.91*	3.43*	3.58*	3.17*	2.68*
R-square	.49	.47	.50	.49	.44	.45	.50	.50	.51	.48
F-value	17.6*	24.1*	28.1*	22.8*	23.7*	23.6*	28.2*	29.7*	29.8**	26.0*

*Indicates significance at the 90% level or greater.

do not include any of the education variables. The results in table 4 indicate that in each and every supermarket, the coefficient on *POST*SF* is positive, indicating an increase in the market share of cooking oils high in saturated fat after the NLEA. The sample sizes for each supermarket are approximately 5% of the sample size in the overall regression, so that in many cases the effects for a particular supermarket are not statistically significant. Nevertheless, in six of the twenty supermarkets the coefficient on *POST*SF* is statistically significant. Moreover, the six significant coefficients tend to be in the lower-education supermarkets. For example, the six significant coefficients occur for the second, fourth, sixth, seventh, eighth and eleventh lowest-educated supermarkets.

The results for monounsaturated fat are somewhat more mixed. The coefficient on *POST*MF* is negative in seventeen of the twenty supermarkets and is statistically significant in two of the supermarkets. There does not appear to be a pattern in the coefficients on this variable based on the education level of the supermarket.

Discussion and Conclusion

This study presents some evidence that the elimination of health claims for cooking oils changed the type of cooking oil purchased. After implementation of the NLEA, cooking oils with higher saturated fat content and lower monounsaturated fat content gained market share in a sample of supermarkets in New York. However, there are clear limitations to this analysis. First, the sample consists of only twenty supermarkets in one area of the United States, limiting the ability to extrapolate these results to the population at large. Second, even if consumers did switch to higher saturated fat cooking oils, it is unknown whether total consumption of saturated fat from cooking oils fell. This is one of the key issues in evaluating the benefits of comparative heart-health claims for cooking oils. Another limitation of the analysis in this paper is the limited pre-NLEA data that were available. There were only two waves of data in the pre-NLEA period, and in each wave several cooking oils were on sale. While the regression analysis controls for the impact of this limitation on market share, it is difficult to assess the sensitivity of the results to this issue with limited pre-NLEA data. This is an important limitation.

Despite these limitations, evidence suggests that elimination of health claims for cooking oils may have stifled the flow of useful information to consumers, especially less-educated consumers. Further research is necessary to examine whether the trends found in these supermarkets reflect the trends in nationally representative data. For example, production (or disappearance) data for these various oils can be evaluated for similar shifts in

Table 4. Regression for Cooking Oils by Store (continued)

Store 11 N = 263	Store 12 N = 264	Store 13 N = 274	Store 14 N = 268	Store 15 N = 257	Store 16 N = 247	Store 17 N = 273	Store 18 N = 210	Store 19 N = 239	Store 20 N = 292
−2.20	−1.95	−2.67	−2.88	−2.31	−2.90	−1.82	−2.57	−2.16	−2.48
7.20*	−5.89*	−8.66*	−8.39*	−6.75*	−7.58	5.93*	−6.73*	−6.41*	−8.49*
−4.59	−4.56	−3.91	−7.72	−7.53	−8.10	−1.83	−4.59	−8.02	−7.85
−3.24*	−2.80*	−3.47*	−5.45*	−3.05*	−5.28*	−1.27	−2.46*	−5.51*	−5.99*
−0.02	−0.07	0.02	0.01	0.15	0.00	−0.05	−0.10	0.01	−0.01
−0.72	−1.99*	0.73	0.33	0.53	0.10	−1.61	−2.38*	0.30	−0.45
−0.89	−0.81	−0.59	−0.46	−0.65	−0.62	−0.98	−0.30	−0.73	−0.44
−5.22*	−4.38*	−3.51*	−2.45*	−4.33*	−3.04	−5.66*	−1.55	−4.11*	−2.66*
−0.06	−0.03	−0.05	−0.04	−0.03	−0.04	−.06	−0.03	−0.03	−0.07
1.76*	−0.98	−1.60	−0.95	−0.92	−0.96	−0.64	−0.68	−0.85	−2.22*
0.32	0.28	0.12	0.18	0.18	0.30	0.20	0.09	0.12	0.31
2.28*	1.84*	0.83	1.17	1.40	1.88*	1.41	0.64	0.84	2.35*
−0.05	0.14	−0.32	0.22	−0.14	0.53	−0.55	0.48	0.21	0.37
−0.27	0.75	−1.89*	1.15	−0.92	2.61*	−3.16*	2.27*	1.13	2.30*
−0.57	−0.64	−0.37	−0.40	−0.53	−0.36	−0.81	−0.46	−0.69	−0.52
−4.12*	−4.32*	−2.78*	−2.64*	−4.45*	−2.25*	−5.87*	−2.75*	−4.75*	−4.15*
2.02	1.79	1.54	1.84	1.81	2.07	1.71	1.78	1.91	1.28
11.74*	9.60*	8.88*	9.61*	11.60*	10.48*	9.65*	9.22*	10.92*	8.52*
0.91	0.38	0.40	0.42	0.53	0.48	0.39	1.25	0.28	0.67
4.16*	1.68*	1.97*	1.95*	2.94*	1.96*	1.86*	4.64*	1.27	3.62*
.52	.45	.41	.43	.44	.47	.44	.47	.52	.47
30.2*	23.4*	20.3*	21.4*	23.7*	23.6*	22.6*	19.7*	27.2*	27.7*

trends after implementation of the health claim provisions of the NLEA.

The effect of these disqualifying nutrient levels on consumer information is an important issue. Evidence that monounsaturated fat might help reduce the risk of certain types of cancer continues to grow (Lipworth et al. 1997, Willett 1997). The disqualifying levels do not permit firms from disseminating this information to consumers. If health claims for food products are an important source of information to consumers, then consumer welfare can be significantly reduced by ex-ante rules that must apply to all food categories. A case-by-case approach, which can evaluate each claim based on its net benefits to consumers, would appear to be a superior method of maximizing the flow of truthful and beneficial information to consumers. Moreover, the cooking oil market is just one example of a product category where the FDA disqualifier levels eliminate potentially truthful and valuable information. When disqualifier levels prevent broad food categories from competing on important health dimensions, consumer welfare may be diminished. More research is needed to determine whether the benefits of the FDA disqualifier regulations are outweighed by the costs.

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Notes

1. The act required the Food and Drug Administration (FDA) to implement the provisions of the act by 1994 (21 U.S.C. 301).
2. A number of studies focus on investigator-induced changes in the amount of nutrition information available to consumers. See, for example, Russo et al. (1986), Muller (1985), Schucker et al. (1992), and Patterson et al. (1992).
3. The research suggesting the potential positive health effects of monounsaturated fats was widely covered in the media as well. Some of the newspaper articles appearing in the early 1990s include "Indulging in Olive Oils: New Studies Laud the Benefits of this Friendlier Fat," *Washington Post*, July 13, 1993; "Fruit, Vegetables, and Olive Oil: Cut Heart Disease Risk," *Guardian*, August 21, 1991; "Nutritionists Think They've Struck Oil with Monounsaturated Fat Found in Olives," *Atlanta Constitution*, October 31, 1991; "Olive Oil Boom Has Brought Variety to Stores and Homes," *Chicago Tribune*, March 19, 1992.
4. See "Vegetable Oils Are Enjoying a Boom," *New York Times*, March 4, 1962; "Oil Food Labels Held Misleading: Government Against Use of Polyunsaturated Label," *New York Times*, May 28, 1964.
5. See statement by the FDA general council reported in "Health Claims on Food Put FDA in a Corner," *New York Times*, February 19, 1986.
6. See, for example, *Bertolli Inc.*, FTC Docket no. C-3396, August 17, 1992 (consent decree). The basis for this case was the level of scientific evidence required to substantiate claims regarding the impact of edible oils on any risk factor for disease or any other health benefit.
7. See 58 Federal Register 2478.
8. See Enforcement Policy Statement on Food Advertising, May 1994, Federal Trade Commission.
9. Conversation with Pauline Ippolito, co-author (with Janis Pappalardo) of study, June 1998.
10. The market-share-weighted saturated fat content for each supermarket is computed by Σ $\text{sold}_j * SF / \Sigma$ sold_j.