HEALTH CLAIMS IN ADVERTISING AND LABELING

A Study of the Cereal Market

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FEDERAL TRADE COMMISSION

AUGUST 1989

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BUREAU OF ECONOMICS STAFF REPORT
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EXECUTIVE SUMMARY

This study examines the ready-to-eat cereal market in an attempt to understand the effectiveness of producer advertising and labeling in communicating the link between diet and health to the public. The role that producers should play in providing health information to the public has been the basis for a vigorous and continuing debate on the most beneficial way to regulate advertising and labeling that uses any type of health claim. While this study does not provide any conclusions about the most appropriate policy towards producer health claims for food products, the study does provide clear evidence that in the cereal market producer advertising and labeling added significant amounts of information to the market and reached groups that were not reached well by government and general information sources.

I. A Study of the Cereal Market

Recent developments in the ready-to-eat cereals market provide a unique opportunity to examine the effectiveness of different sources of health information in communicating the link between diet and health. In the mid 1970s, nutrition and health research suggested a link between the consumption of insoluble dietary fiber and the incidence of colon cancer. In October 1984, the Kellogg Company began an advertising and labeling campaign that cited the National Cancer Institute's statements on the link between fiber and cancer, and stressed that their cereal, All-Bran, was high in fiber. The labeling portion of this campaign was in direct violation of long-standing Food and Drug Administration (FDA) policy in the area, which essentially created a ban on health claims for food products.[1] After the Kellogg's

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[1] The FDA has direct regulatory authority for labeling and technically their ban on health claims only applied to labels. However, claims made in advertising may have implications for FDA's interpretation of any statements made

promotions, other cereal producers followed with their own health claims. The timing of these events provides a period when only government and general nutrition sources provided health information to the public (pre-advertising period) and a period when private advertising added to this initial flow of information (advertising period).

Our study of the cereal market is conducted at two levels. First, we examine changes in *aggregate market performance* by using brand level market share data from 1978 to 1987, together with brand level nutrition information, to measure whether there was movement towards higher fiber cereals during the period when only government and general sources provided information on the potential fiber/cancer link and to compare it to the period when health claim advertising on this issue began. In this analysis we also examine two "bad" nutritional characteristics of cereals, sodium and fat, to assess whether advertising of the fiber/cancer link led consumers to worsen other health aspects of cereal consumption. We also examine whether competitive pressures induced cereal manufacturers to voluntarily disclose the fiber content of their cereals.

Once we establish whether government/general information and advertising had effects on fiber cereal consumption at the aggregate level, our focus shifts to *individual consumption behavior* in an attempt to understand more about who responded to the government and general information and whether advertising reached the same types of individuals. For this section of the study, we use two USDA surveys of food consumption behavior for women aged 19-50 years, the first from the spring of 1985, early in the health claim advertising period, and the second from the spring of 1986, more than a year into the health advertising period. Using these data, we also examine a number of economic theories that deal with potential reasons for expecting differential effectiveness of government and general

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on the labels. For this reason, we will not distinguish between claims made in labeling versus advertising in discussing the ban on health claims.

information compared to advertising. We also examine changes in the bread market, where there appears to have been little direct health claim advertising during this period, to explore any "spillover" effect of the cereal advertising and to examine whether the specificity of the advertising is important.

II. Results For Aggregate Market Performance

Fiber Content of Cereals

Analysis of brand level market share data demonstrates that despite growing evidence on the link between reduced cancer rates and high fiber diets during the years 1978-1984, a period before producer health claim advertising, there was no shift towards high fiber cereals.[2] However, as soon as producer advertising began in late 1984 there was a significant increase in the market-share-weighted fiber content of cereals. During the health claim advertising years of 1985-1987, this weighted fiber content of cereals increased 7%. Thus, on the basis of broad market averages for fiber consumption from cereals, the evidence suggests that producer advertising was a significant source of information on the potential benefits of fiber, in contrast to the government and general information sources during 1978-1984. Under reasonable assumptions we estimate that the 7% increase in the fiber content of cereals implies that advertising caused approximately 2 million more households to consume high fiber cereals.

New Product Development

Cereal manufacturers, in response to the growing demand for high fiber cereals and knowing that they could advertise the health benefits of fiber, responded by developing new high fiber cereals. An analysis of new product introductions indicates that, while bran and whole wheat cereals were a

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[2] This study does not analyze the cereal market for years prior to 1978. The trade press, however, indicates that there was a rise in fiber cereal consumption in the mid 1970s.

part of new product development throughout the years 1978-1987, the number and proportion of new cereals of this type increased considerably during the health claim advertising period. Cereals introduced between 1985 and 1987 averaged 2.59 grams of fiber per ounce of cereal compared to cereals on the market in 1984, which averaged only 1.56 grams per ounce.

Voluntary Disclosure of Fiber

This study also examines voluntary disclosure of fiber content. Economic theory predicts that, under certain market conditions, competitive pressures alone are sufficient to generate labeling of all but the minimum quality products. Data from the cereal market in 1988 indicate that 23 of the 58 cereals examined did not voluntarily disclose fiber. However, 21 of the 23 unlabeled cereals contained no significant fiber.[3] Thus, virtually all cereals that contained anything above a trace of fiber voluntarily labeled that fact in 1988. Our data do not allow us to examine the role that producer advertising played in providing the competitive pressure required to induce firms with more than the minimum level to voluntarily disclose fiber content.

The Effect of Advertising on Sodium and Fat Consumption

While the evidence on the fiber content of cereals and on new product development gives clear support to the premise that health claim advertising was an important source of fiber information for consumers, it does not address the hypothesis that allowing firms to advertise the positive nutritional features of their products will lead to higher consumption of the "bad" nutritional features of such products, such as sodium and fat in cereals. We examine this issue and find that the sodium content of low fiber cereals was relatively stable throughout the period 1978-1987 at 234

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[3] The two exceptions were a Swiss import cereal, which provided no nutrition information of any type on the label, and a granola cereal that had 1 gram of fiber per serving.

milligrams per ounce. In contrast, the sodium content of high fiber cereals showed a marked downward trend which continued throughout the advertising period (from 184 milligrams per ounce in 1978 to 164 in 1987). Advertising may have played a direct role in producing this downward trend; during the health claim advertising period, sodium became a focus of advertising in the competition among high fiber cereals. In addition, due to a drop in the fat content of high fiber cereals during the period under analysis, switching from a low to a high fiber cereal would have increased fat consumption by only .1 grams per ounce in 1987, compared to .4 grams in 1978.

Thus, the evidence on the changes in sodium and fat consumption indicates that the focus on the health benefits of fiber did not significantly worsen the consumption of sodium and fat from cereals. Further, during the entire period under analysis, there was clear pressure towards reduced levels of the "bad" nutritional features of high fiber cereals, and the addition of health claim advertising did nothing to change this trend. Low fiber cereals showed little change in either sodium or fat consumption during the period of analysis, suggesting that those who responded to the fiber information were also the consumers creating market pressure for improvements in the other health dimensions. This raises questions about who is receiving diet/health information and acting on it.

III. Results For Individual Consumption Behavior of Women

This section of the study utilizes detailed consumer survey data on food consumption in spring 1985 to document differences in fiber cereal consumption across various demographic groups at that point in time. Early in 1985, the choice of cereal reflected the cumulative effect of all of the information provided on the health benefits of fiber *prior* to

the health claim advertising.[4] Differences in fiber cereal consumption across groups at this point in time will, in part, reflect differences in the assimilation of the health information on fiber provided by government and general information sources.

We also examine consumer survey data from spring 1986, more than a year into the health advertising period. This analysis allows us to examine whether the aggregate changes that occurred after the advertising began were the result of all demographic groups eating more fiber cereal or whether the increases were concentrated among portions of the population. Once we establish that government and advertising were more effective in changing fiber cereal consumption for some demographic groups than for others, we attempt to decipher why these differences occurred.

Effectiveness of Government and General Information

During the period prior to health claim advertising, the evidence indicates that there were statistically significant differences in fiber cereal consumption across demographic groups. For example, crosstabulations of fiber cereal consumption across demographic groups in 1985 indicated that, among other differences:

- **Women who did not smoke chose different types of cereal than women who smoked.** For instance, 7% of nonsmokers ate cereal with more than 2 grams of fiber per ounce compared to 3% for smokers.

- **Women with high levels of education chose different types of cereal than women with lower levels of education.** For instance, approximately 8% of college graduates ate cereal with more than 2 grams of fiber

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[4] The health claim advertising began in October, 1984. To the extent that advertising had an effect before the spring of 1985, we underestimate the incremental effects of the advertising and overestimate the effects of the government/general health information.

per ounce, compared to 0% for those with less than 9 years of education.

- **Women who live in households with a male head chose different types of cereal than women in households without a male head.** For example, approximately 6% of women in households with a male head ate cereal with more than 2 grams of fiber per ounce, compared to just over 3% of women in households without a male head.

- **Women of different races chose different types of cereal.** For instance, 6% of whites ate cereal with more than 2 grams of fiber per ounce compared to less than 1% of nonwhites.

Having established that there were statistically significant differences in fiber cereal choices for various subgroups within the population in 1985, we use multiple regression analysis to examine which characteristics of these groups led to the differences in fiber cereal choices. We focus on individual characteristics that are likely to be indicators of information processing skills, differential access to information from government sources, differences in how much individuals value health, as well as other cultural and demographic factors that could reflect "taste" differences as well as differences in access to information. The regression results indicate that:

- **Variables used to proxy health valuation are significantly related to fiber cereal consumption.** Even after controlling for other factors likely to affect fiber cereal consumption, nonsmokers and women who took vitamin supplements ate higher fiber cereals in 1985.

- **The primary variable used to proxy efficiency in processing information was significantly related to fiber cereal consumption.** Other things equal, women with higher levels of education ate higher fiber cereals. In contrast, other things equal, income was

not significantly related to fiber cereal consumption in 1985.

- **Some of the variables used to proxy potential differences in access to information were significantly related to fiber cereal consumption.** Other things equal, women in households with a male head ate higher fiber cereals in 1985. Also, other things equal, whites ate higher fiber cereals than nonwhites.

In summary, prior to the health claim advertising, there were statistically significant differences in the fiber cereal choices across demographic groups, and these differences were associated, in part, with the variables we use to measure information processing skills and differential access to information. These results indicate that government and general information sources were not effective in informing all segments of the population equally about the health effects of fiber consumption. We now turn to the analysis of behavior in 1986, more than one year after the introduction of health claim advertising for cereals, to examine whether and how advertising changed this distribution of fiber information.

Effectiveness of Producer Advertising

Comparisons of 1986 crosstabulations with those from 1985 indicate that statistically significant shifts in fiber cereal choices were concentrated among the groups that ate lower fiber cereals in 1985. Because these groups shifted towards higher fiber cereals, producer advertising appears to have reduced the differences that existed in 1985. For instance, the data show that after producer advertising:

- **Smokers showed a statistically significant shift in their fiber cereal choices; nonsmokers did not.** For example, the percent of smokers eating cereals with more than 2 grams of fiber increased from 3.20 to 5.42 percent between 1985 and 1986. For nonsmokers, this proportion fell trivially from 7.15 to 7.07 percent.

- **Women in households without a male head showed a statistically significant shift in their fiber cereal choices, while those in households with a male head did not.** For example, the percentage of women eating cereal with more than 2 grams of fiber increased from 3.12 to 4.57 percent for women in households without a male head, but there was a smaller change from 6.56 to 7.31 percent for women in households with a male head.

- **Nonwhites showed a statistically significant shift in cereal choices, but whites did not.** For example, the percent of nonwhites eating cereals with more than 2 grams of fiber increased from 0.65 in 1985 to 4.36 in 1986. For whites the increase was much smaller, from 6.74 to 6.91 percent.

- **Cereal choices across education groups showed a less systematic pattern.** Changes were largest for the lowest education group and for those with some college, while changes for the mid-level groups were not significant.

Why Did Producer Advertising and Government/General Information Have Different Effects?

Having established that advertising tended to affect significantly the groups that ate lower fiber cereals during the government information period, we then compare the multiple regression analyses for the 1985 and 1986 data in an attempt to identify the reasons for these different effects. In particular, we attempt to distinguish between two explanations for advertising's differential effects: was advertising more successful than government in exposing certain types of individuals to the fiber cereal information, or given exposure to the information, was the information provided in advertising easier to assimilate and incorporate into cereal choices.

To distinguish these theories, we examine whether the characteristics that might reflect differential exposure to government information in 1985 remain strong determinants

of fiber cereal choices after one year of health claim advertising. Likewise, we examine whether the characteristics associated with information processing skills continue to play as large a role in fiber cereal consumption after the advertising as they had in 1985.

The results of this analysis are generally not statistically significant but they provide some tentative indication of the reasons for advertising's effects. In particular:

- **The evidence does not indicate that advertising reduced differences across groups by reducing the importance of information processing skills.** The variables that measure information processing were as important in determining fiber consumption in 1986 as they were in 1985.

- **The analysis provides suggestive, but inconclusive, evidence that advertising reduced differences across groups, because it was more effective at exposing consumers who had limited access to government information to the fiber information.** Though not statistically significant, the changes in the coefficients on the variables that measure access to information indicate that the cereal choices of those with limited access to government information became more like the choices of informed individuals.

- **The analysis also suggests that advertising reduced differences across groups, because it was more effective at reaching consumers who were less willing to spend resources seeking out health information.** The coefficients on the variables that measure health valuation declined (one of these changes was statistically significant), indicating that health valuation differences were less important in explaining fiber cereal choices in 1986.

Overall, our analysis of women's cereal choices indicates that between 1985 and 1986 advertising caused statistically significant shifts in cereal choices for various groups within

the population, in particular, for groups that had been less successfully informed by government and other sources of health information. Our evidence also suggests, though much more tentatively, that the reason for these differential effects is not that producer advertising reduced the role of information processing advantages, but rather that it made information more accessible to disadvantaged groups and reached those less willing to spend resources acquiring health information.

In considering potential reasons why advertising had differential effects on various groups, several major differences between the information distribution methods used by government and private advertisers are worthy of mention. Government and general information is usually disseminated in generic form ("increased fiber consumption may reduce some cancer risks") and this information is concentrated in news and print media reports about the latest scientific studies on diet and health. In contrast, most cereal advertising is distributed through television, with a smaller portion in print media. Moreover, health claim advertising is usually product-specific so that advertising not only indicates the relationship between food characteristics and health, but also prominently features a product that contains these characteristics.

Spillover Effects Into the Bread Market

Our analysis of crosstabulations of bread consumption during the same period suggests that there was spillover of the cereal advertising to the bread market; fiber bread choices changed significantly for some groups within the population. However, there were important differences in the pattern of changes in bread consumption that are suggestive of the reasons for advertising's differential effectiveness relative to nonadvertising sources of information.

In contrast with changes in the cereal market, increased fiber bread consumption was concentrated among highly educated women. Also, there was no increase in fiber bread consumption by nonwhites, despite evidence that nonwhites reacted to the cereal advertising by increasing their fiber

cereal consumption. Together, these results suggest that the specificity and brand-level nature of the direct health claim advertising may be important determinants of advertising's effectiveness in reaching more segments of the population.

IV. Conclusion

While this report does not provide any conclusions about the most appropriate policy towards producer advertising of health claims, the study does document that the potential benefits of permitting this type of advertising may be substantial. Legal restrictions on manufacturers' ability to communicate the health effects of fiber cereals appear to have limited the public's knowledge of the fiber/cancer issue and restricted the information's spread to certain groups within the population. Our evidence suggests that had producer advertising never occurred, fewer individuals would be eating cereal, and those eating cereal would be eating lower fiber cereals. This effect would be most pronounced for nonwhites, smokers and women who lived in female-headed households.

Our evidence shows that, in the cereals market, concern that manufacturers will only highlight the positive aspects of their product, and not disclose in advertising that cereals also contain sodium and fat, did not have adverse effects on consumption of these characteristics from cereals. In part, this reflects the fact that higher fiber cereals became healthier on these other dimensions as well throughout the health claim advertising period.

This report focuses on a particular health issue in a particular market. More research is clearly needed to establish the importance of various characteristics of the fiber cereal case, especially since the fiber claims were consistent with advice from the National Cancer Institute. It is not clear how much smaller the effects would have been if the claims had not been able to cite such an authoritative source. However, the evidence from the cereal market makes it clear that a prohibition of producers' use of health claims in advertising and labeling will act to limit the flow of some types of information to consumers, especially to the types of

consumers that are not as well reached by government and general sources of health information. While there is certainly the potential for deception in producer health claims, the evidence here documents that there is also the potential for significant consumer benefits.

CHAPTER I

INTRODUCTION

1. BACKGROUND

This study examines the ready-to-eat cereal market in an effort to understand more about the effectiveness of producer advertising versus government and general information sources in communicating the link between diet and health to consumers.[1] Whether producers of food products should be allowed to use health claims in their promotional efforts has been at the center of a vigorous and continuing debate about the best means of getting nutrition information to the public. Concern about the use of health claims by producers has focused on the potential distortions that advertisers could create as they pursue sales of their products. Yet adoption of a policy discouraging such producer health claims eliminates a potentially large source of information about diet and health for the public.

This study does not attempt to resolve this policy debate. Rather it provides a detailed examination of the effects of a stringent policy towards health claims in one market, the ready-to-eat cereals market. In this case, the evidence clearly supports the view that adoption of a less stringent policy towards producer health claims had substantial benefits for consumers. Producer advertising and labeling added significant amounts of information to the cereal market and reached groups that were not reached well by government and general information sources.

In theory, it is clear that both sources of information (government and producer advertising) have advantages and disadvantages. Government can be an important source of health information because of its credibility and its potential to be a more unbiased and complete source of health information. However, limiting information dissemination to government raises a number of potential problems.

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[1] Throughout this study, we will use the term producer advertising to include all types of promotional activity, including claims made on labels.

Government may be subject to a variety of special interest influences that can affect information policies in ways that are contrary to the public interest. Moreover, government information dissemination typically involves non-product-specific information, usually through the news and print media. This may limit the information to those portions of the population best reached by these media and most adept at processing general information.

In contrast, producers have incentives to disseminate only information that is favorable to their products, leaving it to competitive forces or government and general information sources to attempt to correct any bias this creates. Moreover, firms have incentives to provide deceptive information, if the market or government does not adequately punish such activity. However, producer-provided information is likely to be more product-specific, and producers have strong incentives to use all available media to reach potential consumers who would act on the information if they had it. These features may make it more likely that privately-provided nutrition information will reach the broad population.

The debate about the most appropriate policy towards health claims by food producers is essentially a debate about the magnitudes of these types of competing effects. Unfortunately, there is very little systematic evidence on which to base judgments about these issues, and until recently, the virtual ban on the use of health claims by producers made it impossible to collect such evidence.

2. DEVELOPMENTS IN THE CEREAL MARKET

Recent developments in the ready-to-eat cereals market provide a unique opportunity to collect empirical evidence on the effectiveness of different sources of health information in communicating the link between diet and health. In the mid 1970s research suggested a link between the consumption of insoluble dietary fiber and the incidence of colon cancer. Research on the topic continued through the 1970s and 1980s, providing growing evidence of fiber's

potential cancer prevention effect.[2] In 1979, the Surgeon General recommended an increase in fiber consumption as "prudent," despite the lack of conclusive evidence on the fiber/cancer link at that time.[3] Since some cereals are a rich source of insoluble fiber, effective communication of the growing evidence on the potential link between fiber and colon cancer should have led to increased consumption of fiber cereals beginning in the mid 1970s.

In October 1984, the Kellogg Company, with the cooperation of the National Cancer Institute (NCI), began an advertising campaign to highlight the link between fiber and cancer, and stressed that their cereal, All-Bran, was high in fiber.[4] This campaign was in direct violation of long-standing Food and Drug Administration (FDA) policy in the area, which essentially held that a food manufacturer could describe the nutritional characteristics of its product, but the use of any health claim for the product on the label would subject the firm to the full scope of FDA drug regulation. This amounted to a ban on health claims for food products.[5] The Kellogg's campaign thus became the stimulus for an ongoing debate concerning appropriate policy towards health claims in food advertising. In the interim, FDA chose not to prosecute.[6] Soon, other producers followed suit and began promoting their cereals as healthful sources of varying amounts of fiber.

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[2] Of the 24 correlation studies on the topic reviewed in the recent *Surgeon General's Report on Nutrition and Health* (Surgeon General (1988)), 21 indicate that an increase in dietary fiber consumption is related to a decrease in colon cancer.

[3] The most recent NCI guidelines recommend that Americans increase their fiber consumption to 20-30 grams per day to diminish the risks of colon cancers.

[4] Examples of the Kellogg's advertisements and labeling are included in Appendix B.

[5] See Hutt (1986) for a detailed discussion of FDA's policy towards health claims for food products.

[6] See, for instance, Snyder (1986).

The timing of these events presents a unique opportunity to examine the market's performance when only government and general sources provided health information to the public, and to compare it to a period when private advertising added to this initial flow of information.[7] Moreover, the cereal experience is a particularly fertile one for study because of the availability of unusually rich data at the brand level for aggregate market performance and for individual behavior across the population.

Our study of the cereal market will be conducted at two levels. First, we will examine changes in *aggregate market performance* by using brand-level market share data from 1978 to 1987 together with brand-level nutrition information. More specifically, we will measure whether there was movement towards higher fiber cereals during the period when only government and general sources provided information on the potential fiber/cancer link, and then compare these shifts to those occurring after health claims for cereals began. In this analysis we will also examine two "bad" nutritional characteristics of cereals, sodium and fat, to assess whether the advertising of the fiber/cancer link led consumers to worsen other health aspects of cereal consumption. We will also examine new product development before and after the advertising period to determine whether advertising was important to the development of higher fiber cereals.

Once we establish whether government/general information and advertising had effects on fiber cereal consumption at the aggregate level, our focus will shift to *individual consumption behavior* in an attempt to understand more about who responded to the government and general information

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[7] It is important to recognize that, because they were the first claims made in defiance of existing policy, the cereal claims are likely to be particularly well-documented claims and may not be typical of the range of claims that would be made under a more relaxed regulatory policy. Thus, we expect the impact of the ads may be larger because Kellogg was able to cite authoritative health institutions as recommending increased fiber consumption.

and whether advertising reached the same types of individuals. For this section of the study, we use two USDA surveys of food consumption behavior for women aged 19-50 years, the first from the spring of 1985, early in the health claim advertising period, and the second from the spring of 1986, more than a year into the health advertising period. Using these data, we also examine a number of economic theories that deal with potential reasons for expecting differential effectiveness of government and general information compared to advertising. This analysis will help us to understand why the two sources of information have different effects on various groups within the population. We also examine changes in the bread market, where there appears to have been little direct health advertising during this period, to explore any "spillover" effect of the cereal advertising and to learn more about the importance of specific advertising.

Finally, we will also examine fiber labeling in the cereal market. Since there are no regulatory requirements to label fiber content, this analysis will allow us to examine whether and to what extent competitive pressure can induce voluntary labeling.

3. IMPORTANCE OF EVENTS IN THE CEREAL MARKET

In a study of this type, it is important to document that a substantial change in market conditions occurred at a time when no other major independent event took place. Under these conditions, one can reasonably attribute changes in market behavior to the event under study.

A number of indicators support the view that the introduction of health claims was a major event in the cereal market. First, the marketing and business trade press generally concludes that the relaxation of the ban on health claims for food products had an invigorating and substantial effect on the cereal market.[8] By the end of 1985, Kellogg

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[8] "Cereals geared to adults have become very big business. Most students of the field date the real emergence of the trend to Kellogg Co. and its highly controversial,

had extended the NCI health claim advertising to a number of its other high fiber brands, including Bran Buds, Fruitful Bran, All-Bran Extra Fiber, All-Bran Fruit & Almonds, and Bran Flakes.[9] Other producers also entered the competition with direct health claims,[10] and with indirect health claims

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ground breaking campaign for All-Bran in 1984." (*Marketing & Media Decisions*, 4/87, page 93). "...industry watchers credit Kellogg's high-powered advertising with boosting sales growth for all cereal companies, attracting health-and-convenience-conscious adults ... ." (*Business Week*, 3/30/87, page 52). "In 1984, Kellogg's kicked off the competition among high fiber cereals with their ad campaign relating bran cereal to cancer prevention. Kellogg's share of the bran cereal market increased 30 percent in the 48 months [weeks - Ed.] following the start of the campaign. With other companies following Kellogg's advertising lead, bran and wheat germ cereals accounted for 15% of ready-to-eat cereals in 1984 -- up from 12% in 1983." (*Milling & Baking News*, October 11, 1986). *Consumer Reports* noted in 1986 that "All-Bran sales have soared 41 percent, and the Institute [NCI] has received some 70,000 public inquires as a result of the Kellogg ad campaign." (*Consumer Reports*, October 1986, page 638.)

[9] See Levy and Stokes (1987), *Advertising Age*, June 16, 1986, and *Marketing and Media Decisions*, April 1987.

[10] General Mills' has used the National Cancer Institute's recommendations extensively on boxes and in advertising for its Fiber One cereal (Joanne Levine, "Adults At Breakfast," *Incentive Marketing*, September 1987, page 102, and Paula Schnorbus, "Brantastic," *Marketing & Media Decisions*, April 1987, page 93). *Consumers' Reports* noted in 1986 that General Mills and the Quaker Co. had "likewise played up the NCI's suggestions in their ads and packages." ("The Fiber Furor," October 1986, page 640). In 1987 Quaker Oatmeal television and magazine ads were including direct cholesterol-reducing claims. Also see examples of advertisements from the period in Appendix B.

that focused on the fiber theme.[11] The trade literature suggests that this new competition led to new high fiber cereals, increased market shares for the "adult" cereals, and growth in the cereal market as a whole.

Moreover, the Kellogg advertising and labeling was widely regarded as a major event by the Federal and State law enforcement officials responsible for the regulation of food labeling and advertising. This action triggered a formal review of the entire area of food labeling and advertising regulation[12] and increased activity by the State Attorneys

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[11] Once the competition among fiber cereals was established, some of the firms did not make direct health claims, but appeared to be "free-riding" on the Kellogg (and later Quaker) advertisements. For instance, Post labeled boxes of Natural Bran Flakes with "fiber for health" (*Consumer Reports*, October 1986, page 628) and used the theme "high fiber flakes -- so good you forget the fiber" for its Fruit & Fiber cereals. Ralston labeled its Bran Chex "High Fiber -- Part of a Healthy Diet," (*Marketing & Media Decisions*, April 1987, Page 109) and pointed out in advertising for its High Fiber Hot Cereal that the average American gets only 50% of daily fiber needs (*Food Engineering*, September 1986, page 27). Nabisco's 1986 television ads for its Shredded Wheat 'n Bran began with the line "Hey, you're eating bran cereal because it's good for you, right? Well guess what's in it besides bran. ..."

In commenting on the results of the Kellogg advertising campaign, Bonnie Liebman, Director of Nutrition at the Center for Science in the Public Interest, notes that by 1986 other cereal companies were "piggybacking" on the Kellogg ads. "All a company has to say is 'We have a lot of fiber,' and [consumers] think of Kellogg" (*Marketing & Media Decisions*, April 1987, page 96).

[12] To date this review has resulted in a formal proposal to change FDA labeling policy (52 *Federal Register* 28843) and a public comment period. No final regulation has been promulgated. See also U.S. House, Committee on Government Operations (1988).

General.[13] There was considerable popular press coverage of the health claim policy debate[14], and William Lamothe, Chairman of the Kellogg Company, was awarded the *Saturday Evening Post*'s Benjamin Franklin Award for "the courageous stand he has taken in providing cancer health information from the National Cancer Institute on the backs of cereal boxes" (*Saturday Evening Post*, October 1985, page 106).

There is also one empirical study of the Kellogg advertising initiative. Using weekly sales data from a Washington, D.C. grocery chain for a 48 week period that began 14 weeks prior to the Kellogg campaign, Levy and Stokes (1987) found substantial effects on cereal sales following the start of the advertising. The size, distribution and timing of the sales increases for the Kellogg fiber cereals relative to other firms' cereals supported the conclusion that the introduction of fiber/cancer advertising into the cereal market had a clear and substantial effect in shifting consumer purchases towards high fiber cereals.

Finally, consumer surveys conducted by the FDA also point to changes in consumer knowledge of the possible fiber/cancer link coincident with the addition of the health claim advertising (Heimbach (1986)). In 1984 only 9 percent of those surveyed mentioned fiber, bran or whole grains when asked "What things that people eat or drink might help to prevent cancer?" By 1986 that number had more than

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[13] In June 1988, ten states were reported to be examining health claim issues for prosecution under state deception statutes and the National Association of Attorneys General (NAAG) adopted a resolution urging the FDA to withdraw its health claim proposal and to return to its former practice of prohibiting all health claims on food labels (*Consumer Protection Report*, NAAG, June/July 1988).

[14] See, for instance, "Health Claims on Food Put FDA in a Corner," *New York Times*, 2/19/86, "Sorting Facts in Food Ads," *New York Times*, 3/18/88, "FDA Studies Advertising For Kellogg's All-Bran," *Washington Post*, 11/6/84, "Political Skirmish Over FDA Proposals," *Washington Post*, 2/17/88, and "Health or Hype?" *Newsweek*, 2/22/88.

tripled to 32 percent. When then asked (in 1986) what were good sources of fiber, 69 percent named breakfast cereals, compared to 40 percent for whole wheat/grain breads and 35 percent for vegetables.

Taken as a whole, this evidence indicates that the suspension of the ban against health claims was a substantial change in the cereal market.[15] Moreover, our search of the professional, trade and popular press did not yield any other major events that should have had important effects on the cereal market coincident with the ban removal. Certainly, there was growth in the scientific evidence on the fiber/cancer hypothesis, but this growth seems to have been relatively steady from the early 1970s (Block and Lanza (1987), Greenwald et al. (1987), and Surgeon General (1988)). Information flowing to the public seems to have paralleled these developments.[16] In mid 1985, then-President Reagan

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[15] Freimuth et al. (1988) also review much of the available evidence on the effects of the Kellogg's campaign and conclude that it "had a significant impact on consumers' knowledge, attitudes, and practices regarding the consumption of fiber."

[16] After the early findings in the 1970s, for instance, there were attempts to market food products containing fiber. In 1976, ITT Continental made fiber/health claims on the label for its Fresh Horizon bread. Kellogg distributed "fiber fact sheets" with its bran cereals and its advertising for All Bran focused on the health benefits of fiber (*National Geographic*, August 1976). These initiatives were terminated by the FDA as violations of the health claim ban (Committee on Government Operations (1988) and Hutt (1986)). Nonetheless the market share of fiber cereals grew noticeably in the mid 1970s before leveling out in 1978 (*Advertising Age*, March 29, 1976 and November 27, 1978), suggesting that the early scientific evidence had reached at least some portions of the population. In 1977 a National Institutes of Health workshop entitled "The Role of Dietary Fiber in Health" was convened, in part, because of the "highly publicized interest in the role of dietary fiber in health" (*American Journal of Clinical Nutrition*, 31, October 1978,

was diagnosed as having colon cancer, creating a short burst of publicity that may have had some effect on the fiber cereal market. However, given the temporary nature of this publicity, it seems unlikely to us that it would be responsible for a substantial change in the cereal market.[17] Taken together, these developments lead us to believe that examination of the years surrounding the removal of the health claims ban should be sufficient to allow us to reliably identify the effects of the general flow of fiber information on cereal consumption as distinct from any incremental effect of the change in policy towards health claims in late 1984.

4. OUTLINE OF THE REPORT

Chapter II of the report outlines a theoretical economic framework to describe how fiber consumption from cereals should change in response to general nutrition information and to producer advertising of the link between fiber and cancer. Chapter III provides an empirical analysis of the aggregate response to government and general nutrition information on fiber compared to the effects of producer advertising in the cereals market. Chapter IV provides an empirical analysis of which demographic groups had received the pre-advertising information on the cereal-fiber-health link and which changed their cereal consumption in response to the advertising. This chapter also analyzes why producer advertising had differential effects on various demographic groups. Chapter V presents an examination of the voluntary disclosure of fiber content in cereals. Conclusions are presented in Chapter VI.

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page S1).

[17] To the extent that the Reagan cancer had lasting effects on cereal consumption, our estimates will overstate the effects of the advertising.

CHAPTER II

INFORMATION THEORIES AND INDIVIDUALS' CEREAL CHOICES

1. A MODEL OF INDIVIDUAL CEREAL CHOICE

In this section we describe a model of the individual's choice of the type of cereal to consume, if any. Since our primary concern in this study is the effect of information about the health benefits of fiber, we focus on the major factors that determine fiber cereal consumption. Readers who are not interested in the formal basis of our analysis can proceed directly to Section 2 with little loss of continuity.

Consider first the situation in which the individual has no information about the health effects of fiber. For the sake of simplicity, we assume that each individual will choose to consume a single type of cereal (rather than a mix of various types). However, in order to examine this choice, we assume that each individual has an underlying family of demand curves, one curve for each type of cereal available, that describes how much the individual would purchase if he chose that type of cereal. We assume further that the individual has a distaste for fiber[18] that increases with the level of fiber in the cereal. The individual will then choose the type and quantity of cereal to consume, based on these underlying demand curves.

In this no-information case, a simple model of the individual's willingness to pay for cereal of fiber type F can be written as

$$(2\text{-}1) \qquad P = a - b(F) - cQ$$

Taste for cereal; Distaste for fiber F

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[18] This assumption can be relaxed without altering most conclusions of our analysis.

where P is the willingness to pay for cereal, Q is the quantity of cereal, F is the cereal fiber type, that is, the amount of fiber in a given amount of the cereal under consideration, a is a parameter reflecting the individual's taste for cereal, b(F) is a parameter reflecting the individual's distaste for cereal of fiber type F, $b_F(F)$ is the first derivative of b(F), and c is a parameter reflecting the slope of the demand curve. We are assuming that a, b(F), $b_F(F)$ and c are all positive. Figure 2-1 illustrates such demand curves for cereal with no fiber and levels F_1 and F_2 of fiber ($F_1 < F_2$). These demand curves are labeled D^o_o, D^o_{F1} and D^o_{F2}, respectively.

Our assumption that individuals have a distaste for fiber induces the ordered ranking of the demand curves shown in Figure 2-1. If we assume further that the market price of cereal P_c does not vary with the fiber content of the cereal, the consumer surplus for the zero fiber cereal (reflected by the area under the curve D^o_o) is clearly larger than the consumer surplus associated with the consumption of any fiber cereal (the area under the demand curve D^o_F). Thus, in the no information case individuals will either consume cereal with no fiber content (when $a > P_c$) or they will not consume cereal (when $a \leq P_c$). Intuitively, this is because in this case the individual has a distaste for fiber and no knowledge of the offsetting health benefits.

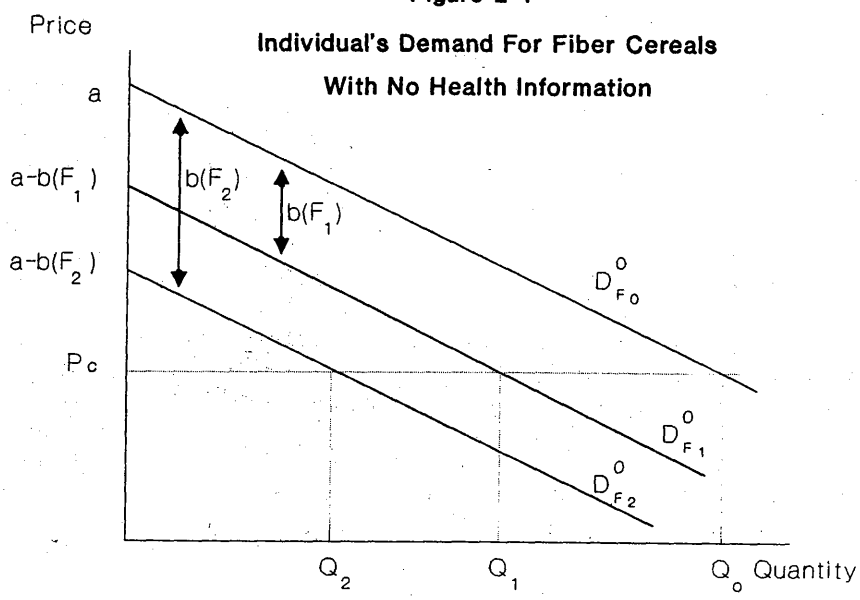
Now suppose that the individual learns that there is a positive health effect from the consumption of fiber. His underlying demand for each type of fiber cereal will increase to reflect his valuation of these perceived health effects. In our model, we let H(F,Q;B(I)) denote the individual's valuation of the fiber health benefits of consuming the Qth unit of type F cereal, given his beliefs B about the health effects of consuming fiber based on the information I he has received. We can then rewrite the individual's willingness to pay for type F cereal as

$$(2\text{-}2) \qquad P = a - b(F) - cQ + H(F,Q;B(I)).$$

Taste for cereal	Distaste for fiber F	Perceived value of health benefit

Figure 2-1

Individual's Demand For Fiber Cereals With No Health Information



We assume that the value of the perceived health benefits of F-type cereals increases with B(I) and that there is no perceived fiber benefit from zero fiber cereals, that is, $H_B(F,Q;B) > 0$, where $F > 0$ and H_B denotes the partial derivative with respect to B, and $H(0,Q;B) = 0$. Further, we assume that individuals differ in their underlying valuation of health, that is, that the function H itself varies for individuals. Thus, individuals who have the same information and beliefs about the health effects of fiber may value those effects differently. Finally, we allow individuals to differ in their cost of getting access to information and in their information processing abilities. That is, we assume that the information I and function B(.) can vary across individuals, because individuals receive different information and some are more efficient in understanding available information I and turning it into beliefs B(I) about the health effects of fiber.[19]

Figure 2-2 illustrates an individual's underlying demand curves for no-fiber cereal and for cereal with fiber content F, with and without (positive) beliefs about the health effects of fiber.[20] Note that because there are no fiber benefits to zero fiber cereals ($H(0,Q;B) = 0$), the underlying demand for zero-fiber cereal does not change with the addition of information. Thus, in the figure, the underlying demand without information D_o^o is equal to the underlying demand with information D_o^B in this case. In contrast, the demand for F-type cereal increases for a range of quantity levels if the information leads the individual to now perceive a health benefit from fiber consumption. The no-information demand curve D_F^o is lower than the informed demand curve

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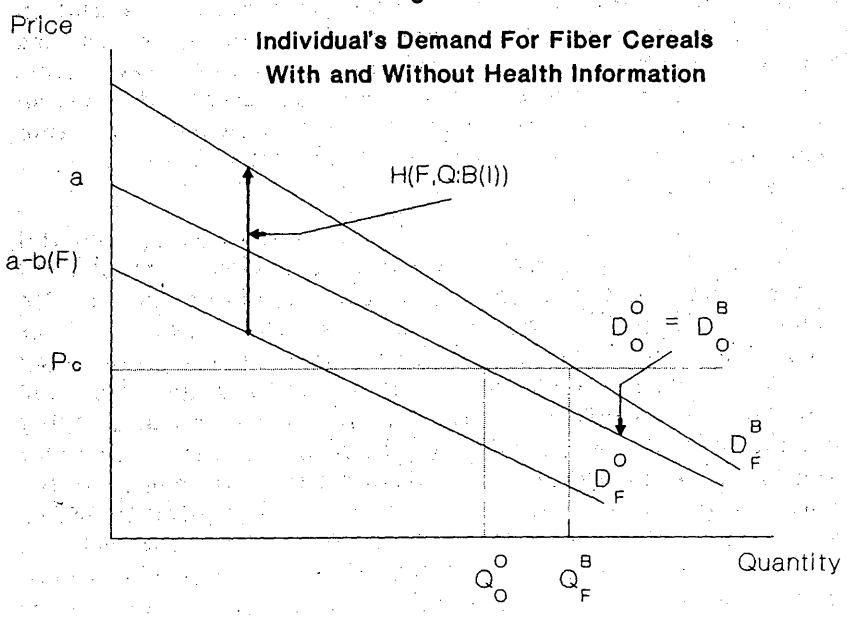
[19] For instance, individuals with more education may be better trained to process information. Similarly, individuals with greater inherent ability may be more efficient in understanding the relevance of nutrition information for their health.

[20] Recall that these underlying demand curves are the demand curves the individual would use <u>if</u> he chose the particular type of cereal represented.

Figure 2-2

Individual's Demand For Fiber Cereals With and Without Health Information



D_F^B over some range of quantity levels[21] and the difference between the two curves, H(F,Q;B), is the value of the perceived health benefit of the marginal quantity of cereal.

Since there is no money price to fiber consumption in this model (recall that we assume that the market price of cereal P_c does not vary with the fiber type), it is straightforward to show that the individual's choice of cereal involves balancing the marginal distaste for fiber, derived from b(F), with the marginal value of the perceived health benefit of consuming a higher fiber cereal, derived from H(F,Q;B). Even without the technical computation, however, it is clear from Figure 2-2 that information about the health benefits of fiber consumption could lead individuals to consume fiber cereals if the perceived health benefit is large enough. In the example in Figure 2-2, the consumer surplus from the high fiber cereal (the area under the demand curve D_F^B and above the line $P = P_c$) clearly exceeds that for no-fiber cereal (the area under D_o^B and above the line $P = P_c$), making it preferable for the individual to switch to the high fiber cereal, once he has the fiber/health beliefs B(I).

This simple model has several implications for our empirical analysis below. First, if the individual has a low enough taste for cereal (specifically, if $a \leq P_c$), he will not eat cereal of any type unless he perceives a large enough health effect from fiber consumption. This implies that as new health information is introduced into the market, we might expect more switching among types of cereals than from no cereal to fiber cereals. Also, even if fully informed, some consumers may not eat cereal, because the health benefit from fiber is not large enough to overcome their distaste for cereal.

Second, the introduction of additional health information into the market will presumably alter the beliefs of some individuals more than others. Beliefs can change only to the extent that information is absorbed by the individual and represents new information for him. Thus, differences in the

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[21] It is possible that high levels of fiber consumption could have adverse health consequences.

exposure to new information, in the efficiency of processing information, and in the amount of information previously obtained will lead to differences in the reactions to new information about fiber.

Third, to the extent that individuals value health differently, as reflected by their different health valuation functions H, these differences should persist despite new information about fiber. Similarly, underlying taste differences (reflected in parameters a and b(F) in equation (2-1)) should not be affected by any new information. Thus, new sources of fiber information could eliminate some types of differences in cereal consumption (those due to differences in beliefs about the effects of fiber) but they should not affect other differences (those due to differences in the valuation of health or in the taste for cereal).

Finally, in this discussion we have abstracted from differences in the information itself. In our model, information can affect behavior only if individuals have access to it (as reflected in I) and effectively process it into meaningful beliefs B(I). For this reason, the nature of the information and the way it is disseminated will be important in determining differences in behavior. For example, information about the health benefits of fiber that is published in obscure scientific journals is unlikely to affect the behavior of many individuals, because it is unlikely to reach them and because it will be difficult to understand for most people. In contrast, widely disseminated summaries of the information in easily understood language have the potential for more widespread effects.

The role of the type of information and how it is disseminated is important for the empirical model that is developed in Chapter IV. Many of the hypotheses we examine concern the differential effects of information provided by government and by health claim advertising. We expect these two sources to differ both in the ease with which the information can be processed and in how well it reaches different types of individuals. Throughout the report, we will refer to the first type of difference as an *efficiency* difference and the second type as an *access* difference.

2. INFORMATION AND THE ROLE OF ADVERTISING

A. Background

In our model, information that individuals acquire about the health effects of their choices is fundamental to their decisionmaking. Yet the process by which information spreads in the market and the role played by various sources of information is not well understood. In this section, we discuss some of the economic theories of information and advertising that apply to the spread of nutrition information. This discussion allows us to formulate several information hypotheses, which we test with data available for the cereal market.

From an economic perspective, information is unlike most goods, because it has public good properties that make it difficult for private firms to develop and sell information as a separate commodity.[22] Once a firm sells information, the buyer can benefit from the information without losing the ability to give or sell the information to many others. This makes it difficult for the original firm to collect the full value of the information, thus undermining the incentives to develop and distribute information. Moreover, information has the property that the consumer cannot usually assess its "quality" without seeing it. But having seen it, the consumer has no incentive to pay for acquiring it. These are the primary economic characteristics of information that can cause the market to provide too little information and that sometimes justify a role for government in the development and dissemination of information.

Despite problems in selling information as a separate commodity, firms can provide information to consumers, often by combining it with the sale of other goods. For instance, newspapers, magazines and other mass media can profitably disseminate information by selling space to advertisers who want to reach the particular audience served by the publication. Similarly, manufacturers often have an incentive to bundle information that is advantageous to their

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[22] See Ippolito (1986) or (1988) for reviews of these and other related issues in the economics of information.

products with the sale of the product or with advertising for the product. In the next sections, we consider the advantages and disadvantages of government and private information sources as they relate to health information.

B. Government As a Source of Diet/Health Information

Government has some advantages as a source of diet and health information. As with all public goods, government is in a unique position to tax the population in order to fund the development and dissemination of information and thus avoid the complexities introduced by attempting to price the information. Moreover, if the public interest theory of government (in which the government is assumed to maximize social welfare) is reasonably accurate in this arena, government would be an unbiased and credible source of information.

However, there are potential disadvantages to government provision of information, especially if private sources of information are legally prohibited. For instance, if government is the sole or major source of such information, great power is concentrated in one body. This can be a significant problem if the process is susceptible to errors or if any of the other theories of government behavior apply. For instance, if the "capture" or "special interest" theories of government explain government behavior (Stigler (1971) and Peltzman (1976)), special interest groups might have undue influence on the types of information developed and disseminated. Similarly, if bureaucratic incentives influence government actions, these decisions may be excessively risk averse or otherwise unresponsive to changes in science and the marketplace.

Finally, the nature of government and the pressures to which it responds influence the way the information is likely to be dispensed. In the nutrition area, for instance, information is usually disseminated through the release of government studies or scientific panel recommendations. These releases are initially limited to one-time reports in the news media, though there is a second round dissemination through the popular press that reports nutrition

information.[23] This information is highly concentrated to the news and print media and therefore, likely to be absorbed disproportionately by those reached by these information channels and those most efficient at processing information (as reflected by B(I) in equation (2-2)).[24] Moreover, the information is generally released in generic form (e.g., "Increased fiber is likely to reduce the risks of colon cancer.") and not in product-specific form (*e.g.* "Product X is a good source of fiber, which may reduce the risks of colon cancer."). Generic information requires that consumers have other sources of information and greater understanding of the issue to turn the information into behavior, again creating a potential bias towards those most efficient in processing information and those with better access to health information.

On the basis of these theoretical considerations and our model of consumer behavior, we can formulate several hypotheses about the cereal consumption effects of government and related general sources of information about the health effects of fiber consumption. First, we hypothesize that the government/general nutrition information had some effect on fiber cereal consumption as the scientific evidence increased on the potential role of fiber in reducing cancer risks. Second, because of the various constraints on the types of information released and the mechanisms used, we expect these effects to have been concentrated among individuals best reached by print and news media and those most efficient at processing information. Third, because of the expected limited spread of the information, we hypothesize that the government information will have

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[23] A number of studies have found that the effects of information that is not repeated frequently can be short-lived. See Russo et al. (1984), for instance, for such a finding on the effects of nutrition information in supermarkets.

[24] Feick et al. (1986), for instance, find that more educated consumers are significantly more likely to acquire nutrition information from print media than their less educated counterparts.

spurred some cereal product development in the health dimension, but that these effects will be limited.

C. Producers As a Source of Diet/Health Information

Producers of food products are another potentially important source of diet/health information. Certain food products have desirable nutritional characteristics that are not well understood by potential consumers. If these potential consumers can be informed about these product features at a low enough cost, their demand for the product will increase enough to create profit opportunities for producers. This mechanism creates an incentive for producers to attempt to provide the missing nutrition information to these potential consumers.[25]

Producers have several advantages as providers of diet/health information. First, they should be willing to devote substantial resources to information provision, if there are significant deficiencies in public knowledge and if there are products that can be sold profitably. Thus, producers are capable of adding large amounts of some types of diet/health information to the market, if it is needed. Second, producers' incentives are to provide nutrition information in product-specific form. Thus, as compared with government information, producer-provided nutrition information is more directly tied to potential behavioral changes, making it easier to act upon. Finally, producers have strong incentives to

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[25] There are a host of issues related to producer provision of information that are beyond the scope of this paper but that are important to understanding these incentives and to designing policy in the area. For example, if the information is provided in generic form (*e.g.* "Fiber cereals reduce your risk of colon cancer.") other producers of similar products will simply "free-ride" on the information and reduce the benefits to the original producer. Thus, producers are unlikely to provide health information unless they can tie it directly to their particular product (*e.g.*, "Kellogg's All Bran reduces your risk of colon cancer.") See Calfee and Pappalardo (1989) and Ippolito (1986) and (1988), for instance, for discussions of these general issues.

find the best methods to reach and communicate the information to those who do not have it and would use it if they had it.[26] Moreover, producers already have substantial experience in communicating information to the public. These considerations should improve consumer access to the information and reduce the information processing requirements necessary to turn the information into meaningful beliefs (B(I) in equation (2-2)).

However, there are also potential disadvantages with producer-provided diet/health information. One important issue is credibility. Since consumers cannot usually verify relationships between diet and health directly (especially for long term effects), there is the potential for deception. Unless the market or government has mechanisms to punish firms that lie, or consumers can verify the information in some way, consumers would be expected to be skeptical of producer-provided information, and thus, we would expect such claims to be of limited value to food producers.

A second issue is the inherent bias of producer-provided information. Assuming they can be credible when they make claims, producers have strong incentives to provide nutrition information that is positive about their product, but they have no incentive to provide negative information. Despite this inherent bias at the individual producer level, economic theory suggests that in certain cases competition among producers can eliminate this bias in the market-provided information (Grossman (1981)).

For instance, this theory would predict that if some firms advertise fiber benefits and are successful in increasing demand for their products, and if consumers are skeptical of firms who say nothing about fiber, the producers of the highest fiber cereals among those not disclosing fiber would have an incentive to advertise their fiber content in order to distinguish themselves from their lower fiber counterparts.

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[26] There is a large literature demonstrating that the format of information is important to consumers' success in incorporating it into behavior. For recent discussions for health and risk issues, see, Viscusi et al. (1988) and Slovic (1986), for instance.

Again, if consumers value the new information, the process would repeat itself, until all but the lowest fiber cereals advertise their fiber content.

Similarly, if some high fiber cereals are gaining sales by omitting information on other dimensions, such as the cereal's high sodium content, other firms with cereals that are high in fiber and low in sodium have incentives to advertise this fact. This "unfolding" theory suggests that despite firms' initial reluctance to highlight "bad" nutritional characteristics in their products, competition will often induce all but the worst firms to disclose the features, if the market values the information. As long as consumers are skeptical of products that do not disclose, they would then be able to rank cereals on the various nutritional dimensions.

Finally, the primary effects of producer advertising will occur in the market for the particular product being advertised. However, we would also expect some "spillover" effects to other product markets. Advertising the health benefits of fiber in cereals, for instance, would be expected to spillover to other food products containing fiber. Because greater understanding and background knowledge is required to carry the health claim from the cereal advertising over to another market, we would expect the spillover effect to be more concentrated among those with better access to nutrition information and among those most efficient at processing information (compared to the direct effects in the cereal market).

These theoretical arguments and our model of consumer behavior suggest several effects from allowing producers to advertise the diet/health effects of fiber cereal consumption. First, we hypothesize that fiber advertising will add significantly to the stock of information about fiber and health, leading some individuals to change their beliefs B(I) and to increase their fiber cereal consumption, as well as their consumption of other products containing fiber. Second, because advertisers have strong incentives to be effective in reaching and conveying the information to the public, we expect the fiber/health information provided by advertising to reach a broader cross-section of the population compared with that provided by the government/general nutrition sources. Third, we expect advertising to affect

cereal product development significantly if advertising spreads the fiber information more broadly. Fourth, we hypothesize that despite the absence of a legal requirement to disclose fiber, competitive pressures will induce all but the lowest fiber cereals to disclose fiber content as described by the "unfolding" theory.

Finally, we hypothesize that the same type of competitive pressure will not allow the focus on fiber to worsen the consumption of other "bad" nutritional features of cereals, such as sodium or fat. This is a strong form of the unfolding hypothesis for multiple dimensions. Consumers might rationally choose to increase the level of one "bad", such as sodium, in order to get more of another "good," such as fiber. Sodium and fat are added to cereals to improve taste, and thus we might expect them to be added to compensate for the distaste of fiber. However, for empirical purposes, we will test the strong form of the unfolding theory, because we have no way to determine the optimal tradeoff with available data. If the evidence supports the strong form of the hypothesis, we can be very confident of the result. If the evidence does not support the hypothesis, we cannot distinguish between the hypothesis that consumers are being mislead into consuming more sodium or fat than they would if informed, and the hypothesis that consumers are rationally trading sodium or fat for higher fiber consumption.

With these hypotheses developed, we now turn to our analysis of the aggregate market share data. These data allow us to examine the hypotheses concerning the broad effects of the fiber/health advertising in the cereal market as well as the effects of the government and general fiber information. We also examine our hypotheses concerning sodium and fat in cereals and the effects of the alternative information sources on new product introductions. In Chapter IV the cross-section hypotheses are examined using individual consumption data. Chapter V directly addresses the "unfolding" theory for voluntary fiber disclosure.

CHAPTER III

AGGREGATE CONSUMPTION ANALYSIS

1. INTRODUCTION

In this chapter, we focus on the aggregate effects of government and general information about fiber and health in the cereal market and whether health claim advertising caused additional changes in the market. As discussed in Chapter II, the flow of government and general information about fiber and health during the 1970s and 1980s should have led to a steady increase in the consumption of fiber cereals throughout this period. Similarly, consumption of fiber cereals should have increased further once advertising of the fiber/health issue began in late 1984, if this advertising was effective in communicating additional information about fiber and health. To test for these effects, we focus primarily on changes over time in the market-share-weighted fiber content of cereals. We also examine whether the development and introduction of new cereals followed similar trends towards increased fiber content.

In addition, we analyze two other nutritional features of cereals, namely, sodium and fat content. This analysis will allow us to examine whether giving advertisers the freedom to focus on positive health characteristics of their products leads to increased consumption of negative nutritional characteristics of cereals, or whether the strong form of the "unfolding" theory described in Chapter II creates sufficient competition among cereals on the other dimensions to prevent increased consumption of the other nutritional "bads."

Section 2 describes the nutrition and market share data, our analytical methods, and the results of our basic analysis of the fiber, sodium and fat characteristics of the cereal market. Section 3 presents evidence on new cereal product introductions for the years 1979 through 1987. Section 4 contains a brief summary of the aggregate results.

2. AGGREGATE CONSUMPTION OF CEREAL

A. Data

The analysis of changes in the aggregate consumption of fiber and other nutrients from cereals during the years 1978-1987 requires data on the market shares of different cereals along with the nutritional makeup of these cereals. Market share and sales data for the years 1978-1987 are available from annual issues of *Advertising Age* in which market shares of most major brands of cereals are reported by John Maxwell (hereafter referred to as the Maxwell data).

Data on the nutritional makeup of these cereals, including information on fiber, sodium, etc., was obtained from the USDA's 1985 Continuing Survey of Food Intakes by Individuals (CSFII) for Women, Ages 19 - 50.[27] This is the most complete data on nutrition for cereals available at the brand level.[28] A limitation of using the USDA nutrition data is that it is data from 1985. Within-brand changes in nutritional composition are thus not reflected in our data.[29] Brands that were dropped from the market prior to 1985 are not likely to be included in the USDA data. Brands added after 1985 are also not in the USDA data. If the brand survived to 1988, we used label nutrition data from Spring 1988 to supplement the USDA data in these cases.

The resulting data set for which we have both brand-level market share data and nutrition information accounts for approximately 80 percent of sales in the cereal market in

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[27] For a description of the USDA data see Chapter IV, Section 2.

[28] We checked the USDA fiber data against label data collected by FTC staff in the spring of 1988 and found a correlation of approximately .9.

[29] Our belief is that this biases the analysis against our hypotheses, since changes in information that cause shifts in market share should exert the same type of pressure on within brand changes. As discussed in Chapter V, available evidence from Consumer's Union and label nutrition data in 1988 suggests that any bias is likely to be small, however.

1978 and rises to nearly 86 percent of sales in 1987. In addition, information on major new product introductions for the years 1979-1987 was collected through a systematic search of *Advertising Age* and other trade literature.

B. Methodology

Changes in the consumption of fiber cereals are examined by focusing on the fiber content of cereals weighted by the market share of the cereal for the years 1978-1987.

This weighting scheme is given by

$$(3\text{-}1)\quad WFIBER_t = \sum_{i=1}^{N} MKTSHARE_{it} * FIBER_i$$

for t = 1978,...,1987, where

$MKTSHARE_{it}$ = cereal i's share of total dollar sales in year t,[30]

$FIBER_i$ = the fiber content of cereal i (in grams per ounce of cereal).[31,32]

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[30] All market shares are measured relative to the total sales covered by our data, which includes approximately 80 to 86% of sales in each year, as described above.

[31] In some instances, the Maxwell market share data are at a more aggregate level than the fiber information. For instance, Maxwell reports the market share for Kellogg's Bran Products rather than for each type of bran cereal. In order to match the market share data with nutrition information, we used the fiber content of a "typical" bran cereal in the category. For Kellogg's bran cereals, we used as our fiber measure the fiber content of Kellogg's 40% Bran cereal. Similarly, the Maxwell data has a market share for Monster cereals, instead of the disaggregate brand data for Count Chocula, Frankenberry etc. Consequently, we use the fiber content of one of the monster cereals as our measure of fiber to be matched with the respective market share (there is very little variation in this category). Maxwell reports data for items like Fruit n' Fiber without specifying

For the analysis of other nutrients, we use the same type of weighted average. For example, in our analysis of sodium, we calculate for t = 1978,...,1987,

$$(3\text{-}2)\quad WSODIUM_t = \sum_{i=1}^{N} MKTSHARE_{it} * SODIUM_i$$

where $SODIUM_i$ is measured in milligrams per ounce of cereal.

To analyze changes in the weighted fiber content of cereals, we use a simple trend model[33] to determine whether WFIBER was affected by the introduction of health claim advertising, that is, we estimate

$$(3\text{-}3)\quad WFIBER_t = a_0 + a_1\, YEAR + a_2\, ADV + e_t$$

where

$WFIBER_t$ = the weighted fiber content of cereals in t,
YEAR = the year t, for t = 1978,...,1987,
ADV = 1 during the post-advertising period, that is, for t=1985-1987,
= 0, otherwise,[34]

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the various versions (with nuts, with raisins, etc.) of Fruit n' Fiber (again the variation in these cases is typically minimal).

[32] Most cereals list a serving size of one ounce on the label; the remainder have a serving size of 1.2 to 1.4 ounces.

[33] A model in which the trend and the intercept were both allowed to change gave essentially the same results as this simpler specification.

[34] The Kellogg Company began its health claim advertising in late 1984. Since the data are on an annual basis and most of 1984 was prior to the start of the advertising campaign, we treat 1985 as the start of the advertising period for this aggregate analysis. This introduces a small bias against the hypothesis that advertising increased fiber consumption and in favor of the

a_0, a_1, a_2 = coefficients to be estimated, and
e_t = a normally distributed error term for year t.

We include the variable YEAR to model any time trend for the dependent variable that might reflect the effects of an on-going flow of information on fiber and health. The evidence is consistent with our hypothesis that government/general health information had an ongoing effect on cereal consumption, independent of the advertising, if the coefficient a_1 is positive and significant. The coefficient a_2 on ADV reflects the change in the average fiber content of cereals beyond that due to the time trend. Our hypothesis that advertising had a significant incremental effect on the cereal market implies that this coefficient should be positive and significant.[35]

For the analysis of sodium and fat in fiber cereals, we use the same regression structure as in equation (3-3). The evidence would be consistent with the strong form of our unfolding hypothesis if the coefficient on advertising a_2 in these regressions is not significantly different from zero, reflecting no change in the trend of fat and sodium consumption in cereals during the fiber/health advertising period.

C. Results

Table 3-1 reports the weighted averages for fiber, sodium and fat in cereals for the years 1978 through 1987, and Figure 3-1 depicts these weighted averages as a percent of their value in 1978. The table and figure show that the

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hypothesis that government and general health information increased it during the pre-advertising period.

[35] As in all tests of this type, we are assuming that if the health claim advertising of fiber had not begun, consumption changes would have continued along the trend reflected in (3-3). One event potentially confounding this assumption was the discovery and treatment of colon cancer in then-President Ronald Reagan in early 1985. This event created a brief increase in popular press coverage of the relationship between fiber and cancer.

TABLE 3-1

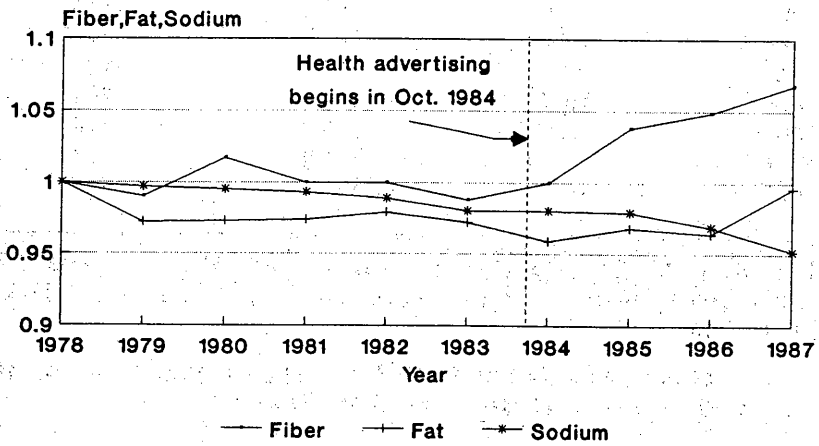
Average Fiber, Sodium and Fat From Cereals, 1978-1987

	WFIBER[1] (Grams/ounce)	WSODIUM (Mg/ounce)	WFAT (Grams/ounce)
1978	1.64	219.7	.738
1979	1.62	218.9	.717
1980	1.66	218.7	.718
1981	1.64	218.1	.718
1982	1.64	217.3	.722
1983	1.62	215.2	.717
1984	1.64	215.3	.707
1985	1.70	215.2	.714
1986	1.72	212.8	.711
1987	1.75	209.1	.735

DATA. USDA Continuing Survey of Food Intakes By Individuals, Women 19-50 Years, 1985, and Maxwell Market Share Data.

[1] See equations (3-1) and (3-2) for the formulations of the weighted averages WFIBER, WSODIUM and WFAT.

Figure 3-1
Average Fiber, Fat and Sodium
For All Cereals



Numbers are in percent of 1978 values.
Averages are weighted as described
in text.

average fiber in cereals increased noticeably in the health claim advertising years.[36] For example, in 1984 WFIBER was equal to 1.64 grams of fiber per ounce of cereal, by 1987 it equaled 1.75 grams. These figures are consistent with the hypothesis that advertising played an important role in informing the public about the health benefits of fiber in cereals.[37] This evidence is also consistent with the findings of Levy and Stokes (1987), who used weekly data for a 48 week period around the start of the Kellogg campaign to conclude that the health claim advertising had a substantial effect on fiber cereal consumption. Below we will examine whether new product introductions contributed to this increase.

In our analysis, changes in fiber consumption prior to 1985 are presumed to reflect the consumer reaction to fiber and health information provided by government and general nutrition sources during this period. Contrary to our hypothesis that the government and general nutrition information steadily increased fiber cereal consumption in the period, these data show that with the exception of 1980, average fiber consumption from cereal during the pre-advertising period was relatively steady. Closer examination

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[36] Note that health claim advertising began in October 1984, so that the 1984 data reflects the changes that occurred between October and December of that year.

[37] It is important to note that the sales of cereals grew throughout the period of our analysis, thus, ruling out the possibility that growth in WFIBER is the result of a reduction in the sales of low fiber cereals. Real sales of high fiber cereals grew throughout the period, as did sales of low fiber cereals.

To test the possibility that changes in the proportion of "children's" cereals determined the pattern of average fiber consumption, this aggregate analysis was also done excluding the children's cereals in the sample. The average fiber level was higher when children's cereals were excluded, but the changes in fiber consumption followed the same pattern: average fiber consumption increased in 1980 but declined afterward until the significant increase in 1985.

of the underlying brand data indicates that there was an increase in purchases of fiber cereals in 1980, but that this increase faded quickly.

Thus, on the basis of broad market averages for fiber consumption from cereals, the evidence supports the hypothesis that advertising was a significant source of information on the benefits of fiber. This broad market evidence does not support the hypothesis that government and general nutrition information increased the consumption of fiber cereals during the pre-advertising period beginning in 1978.[38]

To illustrate the magnitude of the change in behavior necessary to raise the weighted fiber measure from 1.64 to 1.75 gms/oz, consider the following simplified version of the cereal market: Our data indicates that cereals with less than 2 grams of fiber had approximately 68 percent market share prior to the advertising. The average fiber/ounce is 0.7 gm for this group of "low fiber" cereals, and the average fiber/ounce is 3.65 grams for the remaining "high fiber" cereals. In this case, our weighted fiber measure equals the pre-advertising figure, that is, .68 x 0.7 + .32 x 3.65 = 1.64 gms/oz. It would take a shift of about 3.6 percentage points from the low fiber market share to cause the change observed in weighted fiber in 1987, since .644 x 0.7 + .356 x 3.65 = 1.75 gms/oz. A 3.6 percentage point increase in market share for high fiber cereals reflects an increase of $280 million above projected high fiber cereal sales in 1987.[39]

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[38] As discussed in Chapter I, there is some evidence from the trade press indicating that fiber cereals increased their market share during the mid-1970s, prior to the period covered by our data.

[39] A linear projection of the trend during the pre-advertising period indicates that total cereal sales would have been approximately $4.99 billion in 1987, and the share of high fiber cereals would have been approximately 0.32. Actual sales were $5.30 billion. Thus, the increase in high fiber sales attributable to advertising was .356 x $5.30 billion - .32 x $4.99 billion = $.28 billion.

If the typical household consumes a box of cereal per week, and a box of cereal costs $2.50, each household spends approximately $130 per year on cereal. Under these assumptions, the observed change in weighted fiber consumption implies an increase of approximately 2 million households eating high fiber cereals due to the advertising. Thus, this simple calculation demonstrates the relatively large changes in behavior necessary to cause the observed changes in the average fiber content of cereals.

Table 3-2 reports the regression results for equation (3-3). These results give statistical support to the conclusions about fiber consumption drawn from the data in Table 3-1. In particular, the results demonstrate that there was a statistically significant increase in the average fiber content of cereals during the advertising period.[40] The coefficient on the advertising variable is .082, indicating that, after controlling for the general trend in WFIBER over time, the average fiber consumed in cereals rose approximately 5% during the advertising period.[41] The coefficient on the time trend is positive but small, and it is insignificantly different from zero, indicating that the government and general nutrition information on fiber and health did not significantly increase fiber cereal consumption between 1978 and 1987.

While this evidence gives support to the premise that health claim advertising was an important source of fiber information, it does not address the hypothesis that allowing firms to advertise the positive nutritional features of their products will lead to higher consumption of the "bad" nutritional features of such products. To examine this issue, we consider changes in the sodium and fat consumption from all cereals, as well as the changes for high and low fiber

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[40] Results are similar if we allow both the trend and intercept to change with the advertising.

[41] Without health claim advertising, the average fiber content of cereals was projected to be 1.67 grams per ounce in 1987; with the advertising, it was 1.75 grams, an increase of 4.9 percent (1.75/1.67 = 1.049).

TABLE 3-2

Effect of Advertising on Fiber Consumption From Cereals

Variable	Dependent Variable WFIBER	
Constant	0.077	(0.01)
YEAR	0.0008	(0.22)
ADV	0.082	(3.65)**
R^2	0.85	
Mean of Dependent Variable	1.66	

DATA. USDA Continuing Survey of Food Intakes By Individuals, Women 19-50 Years, 1985, and Maxwell market share data for 1978-1987.

NOTES. t-statistics are in parentheses. ** indicates significance at the 99.5 percent level.

cereals.[42] In particular, we test whether switching from a low to a high fiber cereal increases sodium and fat consumption. Moreover, we examine whether high fiber cereals themselves showed any trend towards lower sodium and fat levels and whether the advertising focus on the health effects of fiber slowed these trends.[43]

As shown in Table 3-1 and Figure 3-1, the average sodium in cereals exhibited a downward trend throughout the period, presumably reflecting the effects of a continuing flow of general information about the health effects of sodium consumption. The introduction of health claim advertising about fiber did not adversely affect that trend.[44] The average fat content of cereals also exhibited a downward trend throughout the period until 1987 when it increased.[45]

These results are based on market averages and could be masking a different pattern of changes for high fiber cereals. Figure 3-2 depicts the weighted average for sodium in higher fiber cereals versus that for low fiber cereals, where we define higher fiber cereals as those in the top third of our sample and low fiber cereals as the remaining two-thirds of

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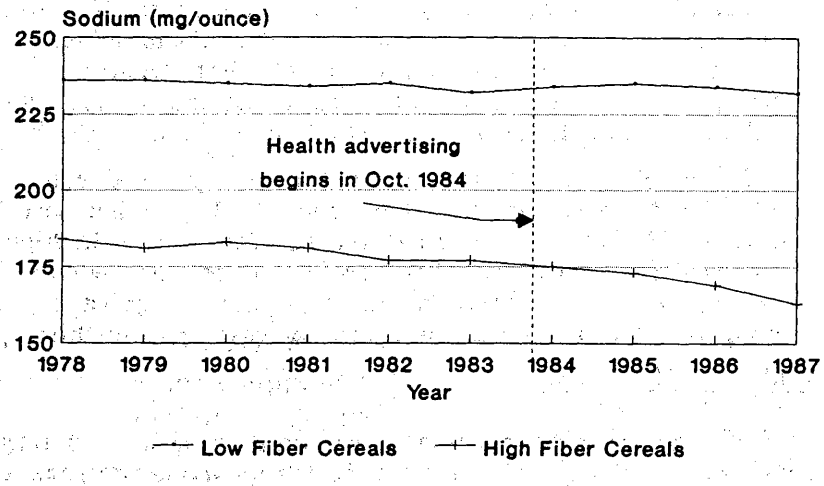
[42] We classify sodium and fat as "bad" nutritional features based on major public health recommendations for the U. S., which advise individuals to reduce their sodium and fat consumption.

[43] An analysis of the implications of advertising for those who switched from other types of breakfast foods is beyond the scope of this study.

[44] Regression results for WSODIUM with the specification in equation (3.3) show that the downward trend was statistically significant and that advertising had a negative, but insignificant, effect on sodium consumption.

[45] Regression results for WFAT based on the specification in (3.3) indicate that neither of these effects is statistically significant.

Figure 3-2
Average Sodium of Higher Fiber Cereals
Compared to Low Fiber Cereals



Averages are weighted as described in text.

the sample.[46] Cereals with approximately 2 grams of fiber per ounce of cereal or more are in the higher fiber group; the mean fiber content for these cereals is 3.65 grams.

There are several important findings illustrated in Figure 3-2. First, higher fiber cereals are lower in sodium than low fiber cereals (176 mg versus 234 mg), so that if a consumer switched from a low to a high fiber cereal, sodium consumption would fall on average.[47] Second, the sodium content of low fiber cereals was relatively stable throughout the period. In contrast, the sodium content of higher fiber cereals shows a marked downward trend, which continued throughout the advertising period. Table 3-3 provides regression results that demonstrate that the negative trend in the sodium content of higher fiber cereals was statistically significant. The coefficient on advertising was also negative, indicating an additional, though insignificant, drop in sodium levels during the advertising period.[48] Thus, switching from a low to a high fiber cereal implied an even larger reduction in sodium consumption by 1987.

Figure 3-3 gives the weighted average fat content of high and low fiber cereals for the years 1978 through 1987. First, this figure illustrates that the fat content of high fiber cereals trended downward throughout the period. The regression results in Table 3-3 demonstrate that this trend is statistically significant and that the advertising had no significant effect on it. However, despite this trend towards

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[46] Thus, of our total of 65 cereals, the 22 cereals with the highest fiber contents are in this "high fiber" group and the remaining 43 cereals are in the "low fiber" group.

[47] Note that we do not analyze the change in sodium consumption implicit in switching from other breakfast foods to high fiber cereals.

[48] There is evidence that some high fiber cereals advertised their lower sodium levels, once the fiber/health advertising had begun; for example, General Mill's Fiber One and Nabisco's Shredded Wheat Products used this as a major theme in their advertising in the last two years. Also see the advertisements in Appendix B.

TABLE 3-3

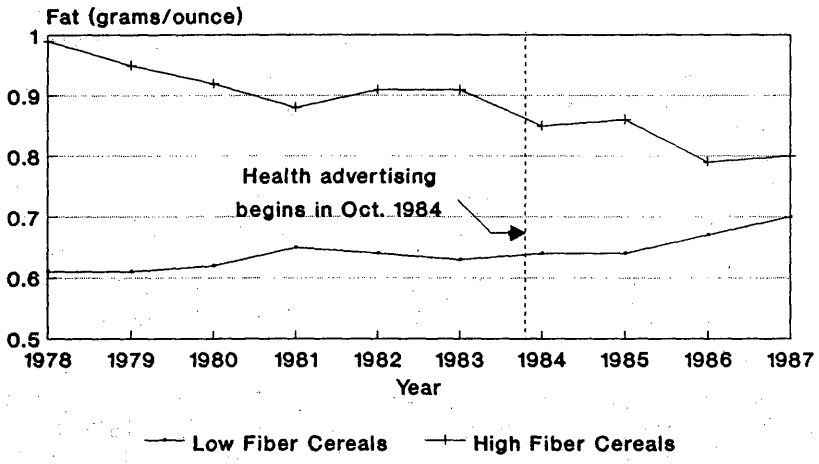
Effect of Advertising on Sodium and Fat Consumption From High Fiber Cereals

Variable	Dependent Variable: WSODIUM (Mg/ounce)	Dependent Variable: WFAT (Grams/ounce)
Constant	3793.96 (5.12)**	38.44 (4.19)**
YEAR	-1.82 (-4.88)**	-.02 (-4.09)**
ADV	-1.79 (-.77)	-.01 (-.21)
R^2	0.92	0.88
Mean of Dependent Variable	176.3	0.88

DATA. USDA Continuing Survey of Food Intakes By Individuals, Women 19-50 Years, 1985, and Maxwell market share data for 1978-1987.

NOTES. t-statistics are in parentheses. ** indicates significance at the 5 percent level.

Figure 3-3
Average Fat of Higher Fiber Cereals Compared to Low Fiber Cereals



Averages are weighted as described in text.

lower fat content, high fiber cereals contained more fat per ounce than low fiber cereals throughout the period. Thus, if a consumer switched from a low to a high fiber cereal, fat consumption would be increased. However, this effect became smaller over time, so that by the advertising period there was only a 0.1 gram difference in the fat content of high and low fiber cereals. Finally, as with the changes in sodium consumption from cereals, Figure 3.3 illustrates that changes in the fat content of cereals seems to have been concentrated among high fiber products.[49] In fact, consumers of low fiber cereals actually increased fat consumption slightly over time.

Overall then, if advertising caused individuals to switch from a low to a high fiber cereal, this change did not have significant adverse effects on either sodium or fat consumption. Moreover, the evidence on sodium and fat in cereals follows a pattern in which the reduction in these nutritional "bads" in cereals is limited to high fiber cereals. This evidence suggests that the 30 percent of the market that ate higher fiber cereals was also the portion of the market exerting the greatest pressure to improve the other nutritional characteristics of cereals, since similar changes were not occurring for low fiber cereals.

This segmented reaction to health information is an important finding that is consistent with two distinct possibilities: health information may be disseminated in ways that reach only a minority of the population; or individuals may differ in the value they place on good health, and only those who value health highly enough will react to new health information of any type. In either case, individuals who respond on one health dimension (fiber in this case) would also respond on other health dimensions (sodium and fat). Chapter 4 explores the issues of who receives health information and who responds to it in much more detail.

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[49] Again, there was direct advertising of the low fat content of cereals later in the health claim advertising period; both Kellogg and Nabisco are currently using low fat themes for their cereals.

3. NEW CEREAL PRODUCTS

Finally, we present evidence on new product development in the pre- and post-advertising periods. Table 3-4 lists all new product introductions by major ready-to-eat cereal producers reported in *Advertising Age* during 1979-1987. It is clear from the table that bran and whole grain cereals have been a part of new product development throughout the period but that the number and proportion of new cereals of this type increased during the health advertising period.

Nutrition data from the 1985 USDA data and from labels collected in 1988 is available for 31 of the 36 cereals introduced between 1985 and 1987. As shown in Table 3-5, for these new cereals, the average fiber content was 2.59 grams per ounce of cereal.[50] The average for all cereals in the Maxwell data base in 1984 was 1.56 grams per ounce. New cereals introduced in the advertising period were clearly higher in fiber than the average cereal available prior to the advertising period. This difference in means is statistically significant at nearly the 5 percent level ($t = 1.62$). When children's cereals are excluded from both the Maxwell data for 1984 and the new cereal data for 1985-1987, the average fiber content of new cereals increased to 3.59 grams per ounce compared to 2.05 grams for the 1984 cereals. Thus, even when restricting the analysis to "all family" and "adult" cereals, new cereals were significantly higher in fiber ($t = 1.95$) than existing brands.

We also considered the average fiber content of new cereals introduced between 1979 and 1984. We have nutrition data for only half of this earlier sample, because our nutrition data is from 1985 and 1988 and many of the new cereals from this period did not survive to these years. In

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[50] Note that these averages are simple averages, unweighted by market share. Thus they represent averages for the typical brand in the category rather than average consumption by cereal consumers. The large differences between the unweighted average fiber here (1.23 gms/oz) and the weighted average in Table 3-1 (1.64 gms/oz) indicates that the market share per brand is larger on average for higher fiber cereals than for low fiber cereals.

TABLE 3-4

New Product Introductions By Year[1]

1979
*Halfsies(Q)
*Graham Crackos(K)[2]
Crispy Wheat 'n Raisins(GM)
Honey Nut Cheerios(GM)
Most(K)[2]
Corn Bran(Q)
Honey Bran(R)[2]

1980
*Blueberry Waffelos(R)[2]
Wheat & Raisin Chex(R)[2]
Honey & Nut Corn Flakes(K)
Raisins, Rice & Rye(K)[2]

1981
*Donutz(GM)[2]
*Dinky Donuts(R)[2]
*Banana Frosted Flakes(K)[2]
*Apple Frosted Mini Wheats(K)
Nutri-Grain(K)

1982
*Fruity Marshmallow Krispies(K)
*Strawberry Shortcake(GM)[2]
Honey Nut Crunch(GF)[2]
Fruit & Fiber(GF)
Raisin Grape Nuts(GF)

1983
*Smurfberry Crunch(GF)
*Donkey Kong(R)[2]
*Strawberry Krispies(K)[2]
*Sugar-free Alpha Bits(GF)[2]
*Strawberry Honeycombs(GF)[2]
*Pacman(GM)
Crispix(K)
Cracklin' Oat Bran(K)
Oat Bran(Q)

1984
*Mr. T(Q)[2]
*ET(GM)[2]
*Choco Cap'n Crunch(Q)[2]
*Gremlins(R)[2]
*Orange Blossom(GM)[2]
*C-3PO(K)[2]
*Cracker Jack's(R)[2]
Raisin Life(Q)
Apple Raisin Crisp(K)
Cinnamon Toast Crunch(GM)
Fruitful Bran(K)

Table continued on next page.

TABLE 3-4 -- Continued

1985	1986
*Rainbow Brite(R)	*Ghostbusters(R)[2]
*S'Mores Crunch(GM)	*Ice Cream Cones(GM)
*OJ's(K)	*Circus Fun(GM)
*Cabbage Patch(R)	*Rocky Road(GM)[2]
Raisin Squares(K)	*New Nerds(R)[2]
Almond Delite(R)	Raisin Nut Bran(GM)
Oh's(Q)	Apple Cinnamon Squares(K)
Fiber One(GM)	All Bran Fruit & Almonds(K)[2]
Horizon Trail Mix(GF)	
Fruit & Fiber/Mt. Trail(GF)	1987
Fruit & Fiber/Harv. Wheat(GF)	*Fruit Islands(R)
Bran Muffin Crisp(GM)	*Freakies(R)
Just Right/Nugget & Flake(K)	*Crispy Critters(GF)
All Bran w/Extra Fiber(K)	Strawberry Squares(K)
	Sun Flakes(R)
	Oat Squares(Q)[2]
	Pro Grain(K)
	Oatmeal Raisin Crisp(GM)
	Clusters(GM)
	Mueslix(K)
	Nutri-Grain Nuggets(K)
	Nutrific(K)
	Fruit Wheats(N)
	Fruit & Fiber w/Peaches(GF)

SOURCE. *Advertising Age*, various issues, 1979 - 1987.

NOTES. [1] K = Kellogg, GM = General Mills, GF = General Foods, Q = Quaker, R = Ralston, N = Nabisco. Cereals with an asterisk (*) are generally considered to be "children's" cereals by the industry. Other cereals are "all-family" and "adult" cereals.

[2] We do not have nutrition data for this new cereal.

TABLE 3-5

Average Nutritional Characteristics of New Cereals[1]

	Fiber (Gms/oz)	Sodium (Mg/oz)	Fat (Gms/oz)	n/N[3]
New Cereals 1985-1987	2.59	149.0	1.01	31/36
Average Cereal 1984	1.56*	196.0**	0.79	49/57
New Cereals 1979-1984	1.70*	169.6	1.12	19/41
Averages Excluding Children's Cereals[2]				
New Cereals 1985-1987	3.59	142.7	1.02	22/24
Average Cereal 1984	2.05**	209.8**	0.83	34/39
New Cereals 1979-1984	1.99**	178.6*	1.07	14/19

NOTES. * indicates that the difference between new cereals introduced 1985-87 and the type of cereal at issue is significant at the 10 percent level. ** indicates significant differences at the 5 percent level.

[1] Simple averages (unweighed by market share) are given in the table and thus represent the characteristics of the average new cereal and not the nutrition received by the average consumer of new cereals.

[2] These averages exclude brands characterized as "children's" cereals by the trade press. For new products, these cereals are marked with an asterisk in Table 3-4.

[3] Indicates the number of brands n of the total N for which nutrition data are available. The excluded cereals presumably did not survive to 1985 or 1988, the years of our nutrition data.

particular, as shown in Table 3-4, low fiber cereals appear to be systematically excluded from the early sample of new products for which we have nutrition data. This should cause our estimate of the average fiber content of new cereals introduced in 1979-1984 to be higher than the true average for these cereals. Despite this selection problem, we find that the average fiber content of the 1979-1984 new cereals is significantly lower than that for new cereals introduced during the health claim advertising period. When we exclude children's cereals, the difference is significant at the 95 percent level.

New cereals also differed from existing cereals in both sodium and fat content. Whether measured for the entire sample of cereals or for the sample that excludes children's cereals, the sodium content of the average new cereal was less than that of the average cereal on the market prior to the health advertising period. Again this difference is statistically significant at the 5 percent level. New cereals introduced between 1985 and 1987 averaged 149.0 mg of sodium per ounce of cereal compared to 196.0 mg for existing cereals in 1984; when children's cereals are excluded, the sodium levels increase to 142.7 mg for new cereals compared to 209.8 mg for existing cereals. This evidence suggests that new cereals were an integral part of the continuing trend towards reducing sodium consumption from cereals reflected in Figure 3-1. As shown by the levels for new cereals introduced in 1979-1984, this trend began before the health claim advertising period, but the level increased slightly during the period.

The evidence on fat from new cereals mirrors the aggregate fat evidence illustrated in Figure 3-3. As shown in Table 3-5, the fat content of new products is higher on average than that of existing products, but this difference is not statistically significant at conventional levels ($t = 0.98$). For the entire sample, the average new product has 1.01 grams of fat per serving compared to 0.79 grams for existing cereals in 1984. These differences are approximately the same if children's cereals are excluded. If broken down by year, the picture is a changing one: new products introduced in 1985 averaged 1.04 grams of fat per serving, but those introduced in 1987 averaged 0.89 grams. Also, as

shown in Table 3-5, new products introduced during the advertising period contained less fat than new products introduced during 1979-84, suggesting that the higher fat levels in new products was occurring for reasons not associated with health claim advertising.

4. SUMMARY

During the years 1985 through 1987, a period when there was considerable advertising of the link between cereals, fiber and health, there was a statistically significant increase in the average fiber consumption from cereals. New cereal products introduced during the advertising period were also higher in fiber than products on the market earlier. Prior to the advertising period, fiber consumption from cereals had been stable since 1978, the year in which our data begin. Taken together, these results provide evidence that the introduction of advertising about the health benefits of fiber cereals played a significant role in informing consumers about the health effects of fiber consumption and in changing their cereal choices. Moreover, contrary to our expectations, the results also suggest that other sources of health information about fiber were not successful in spreading the fiber information as it developed after 1978.

The evidence on the average sodium and fat consumed in cereals during this period suggests that the health focus on fiber in advertising did not create significant offsetting health effects from other aspects of cereal consumption. The evidence is clearest for sodium. High fiber cereals contained less sodium at the start of our data, and this difference grew throughout the period of study, so that switching from low to high fiber cereals reduced sodium consumption on average. Advertising had no adverse effect on these trends, and while not significant, may have even contributed to the sodium improvements.

The evidence on fat consumption in cereals indicates that there was some health cost to switching to high fiber cereals, though by the time advertising was introduced these costs were small. In 1978, at the start of our data, high fiber cereals contained 0.4 grams more fat per serving than low fiber cereals. However, this difference fell throughout the period of study, including the advertising period, so that

by 1987 high fiber cereals contained only 0.1 grams more fat than low fiber cereals on average.

Finally, the evidence suggests that the information about the three health characteristics analyzed -- fiber, sodium and fat -- was received and utilized by a minority of the population of cereal consumers. The low fiber cereal market showed little change in either sodium or fat consumption during the period of analysis, suggesting that those who responded to the fiber information were also the consumers creating market pressure for improvements in the other health dimensions. Thus, while the evidence clearly indicates that the health claim advertising for cereals increased fiber consumption and that these increases did not come at the expense of the other health characteristics we examined, the evidence does raise questions about who is receiving diet/health information and acting on it.

CHAPTER IV

INDIVIDUAL CONSUMPTION ANALYSIS

1. INTRODUCTION

In Chapter III our analysis of the aggregate market share data for cereals indicates that there was a significant increase in average fiber consumption from cereals when advertising about the health benefits of fiber was introduced to the market. Moreover, that analysis shows that during the years prior to the advertising, despite continuing development of evidence on the link between fiber and health, consumption of fiber cereals remained stable from at least 1978.

In this chapter, we will use detailed consumer survey data on food consumption in spring 1985 to document differences in fiber cereal consumption across various demographic groups at that point in time. In 1985, the choice of cereal reflected the cumulative effect of all of the information provided on the health benefits of fiber prior to the health claim advertising. Consequently, any differences in fiber cereal consumption among demographic groups should reflect, among other things, differences in the assimilation of the health information provided by government and general information sources.

We also examine consumer survey data for spring 1986 to determine whether the aggregate changes in cereal consumption that occurred after the advertising began (those documented in Chapter III) were the result of all demographic groups eating more fiber cereal or whether the increases were concentrated among portions of the population. In particular, we will examine whether health claim advertising changed the behavior of the groups that ate less fiber cereal in 1985.

We also attempt to decipher whether changes in fiber cereal consumption during the advertising period occurred because individuals had poor access to government information or because they were better able to process the information provided by the advertising. By attempting to disentangle these effects, we can explore a number of

hypotheses about the effectiveness of government and general health information prior to 1985, and that of the health claim advertising between 1985 and 1986.

The Pre-Advertising Analysis

The first part of this analysis focuses on differences in fiber cereal consumption for various subgroups of the population in spring 1985, early in the health claim advertising period. Once we have established that there were significant differences in fiber cereal consumption for various subgroups within the population in 1985, we use multiple regression analysis to examine the reasons for these differences.[51] As described in detail below, we focus on individual characteristics that are likely to be indicators of information processing skills, differential access to information from government and general sources, differences in how much individuals value health, as well as other cultural and demographic factors that could determine cereal choices.

The Advertising Analysis

The second part of our analysis begins by examining whether the differences in group behavior that existed in spring 1985 had changed by spring 1986, one year into the health claim advertising period. While an admittedly short period of time to measure the effects of a new information source, this second analysis should give us some indication of whether advertising's effects are concentrated among the same demographic groups as the effects of the government and other nonadvertising sources of nutrition information.

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[51] This more detailed analysis is similar in approach to a number of cross-section studies that have found a significant relationship between demographic characteristics and other nutritional aspects of diet. For instance, see Adrian and Daniel (1976), Eastwood et al. (1986), Hama and Chern (1988), and the studies reviewed in Davis (1982). Of particular importance for our study, there is evidence from past work to indicate that fiber intake, and fiber cereal intake, may vary by race, sex and age (Lanza et al. (1987) and Block and Lanza (1987)).

Again, once we establish that advertising had a larger effect on some groups than on others, we will use multiple regression analysis with the 1986 data to attempt to identify the reasons why advertising produced these different effects.[52] In particular, we will compare the importance of key characteristics in determining fiber cereal consumption in 1986 with their importance in 1985 in an attempt to isolate the basis for advertising's effects. For example, we will examine whether the characteristics associated with information processing continue to play as large a role in determining fiber cereal consumption after the advertising as they had in 1985. Likewise we will examine whether the characteristics that might reflect differential access to government information in 1985 remain strong determinants of fiber cereal choices in 1986 after one year of health claim advertising.

Spillover of Advertising to the Bread Market

In this chapter we will also examine whether the health claim advertising in the cereal market had a "spillover" effect on the consumption of fiber from bread and whether the qualitative nature of the spillover effect was different than that of the direct effect. To do this we use a regression model to examine which individual characteristics were associated with differences in fiber bread consumption in 1985 and how they changed in 1986. As in the cereal analysis, we will examine whether information processing ability and access to information are as important in determining bread consumption in 1986 as they were in 1985.

Related Literature

There has been little empirical research that examines the role of information in consumer markets, primarily because of problems in identifying and measuring information changes in these settings. Moreover, few economic studies have attempted to measure the effects of information on the

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[52] None of the cited studies that examine the relationship between demographic characteristics and diet explore changes over time or consider the role of information in determining this relationship.

behavior of different types of individuals. Finally, because of the difficulty of finding opportunities to compare markets with and without advertising, there has been little empirical research that examines the economic theories of advertising's effects.

Previous research that does focus on these questions generally falls into three categories: first, information experiments, in which information is provided in a controlled setting prior to assessing individuals' knowledge of the relevant issue (or in a few cases, prior to measuring behavior); second, consumer surveys, which attempt to measure knowledge about health issues directly or to examine differences in information acquisition activities; and third, event studies, which attempt to measure the reaction to new information in a market setting, as done here.

Experiments and consumer surveys that attempt to measure consumer knowledge or information acquisition behavior have the advantage of focusing on the information issue directly. The studies of chemical product labels by Viscusi et al. (1988), in-store nutrition information by Russo et al. (1984), and radon information booklets by Smith and Johnson (1988) are recent examples of information experiments that find that consumer beliefs about health hazards are influenced by new information and that changes in beliefs may vary by individuals' characteristics that are economically important.

Consumer surveys also indicate that demographic characteristics are often associated with differences in consumer knowledge of basic nutrition and health issues. The FDA-sponsored nutrition information surveys (Baumgardner et al. (1980), for instance) and various National Institutes of Health knowledge surveys (Schucker et al. (1983), for example) provide good examples of these kinds of survey results. As described above, there is consumer survey evidence that knowledge of the fiber/cancer link, and of cereals as a source of fiber, grew significantly during the 1984-1986 period (Heimbach (1986)). Additionally, surveys show that consumer characteristics are important determinants of how individuals acquire information. A recent example is Feick et al. (1986), which finds that

different types of consumers use different sources of health information.

There are a few event studies that examine responses to new information by different types of individuals. For instance, Ippolito, Murphy and Sant (1979) find that college graduates were more likely to quit smoking cigarettes following the *Surgeon General's Report on Smoking* in 1964, and Schucker et al. (1983) find a greater reaction among high education groups to the 1978 government-mandated saccharin warning on soft drinks.

Finally, there are a few empirical studies that examine the role of advertising in markets. The most relevant studies for the issues here are the studies of the effects of state laws prohibiting advertising for certain types of professional services.[53] The primary finding of this body of research is that in consumer markets, such as those for eyeglasses and legal services, the prohibition of advertising leads to higher average prices.

Thus, past research provides some evidence that information changes consumer behavior in the aggregate and that these effects may differ for different types of individuals. Moreover, there is some evidence to suggest that these differences in behavior may result from differences in the way individuals acquire information and differences in their ability to understand its implications for behavior. There is also direct evidence that advertising improves price information in professional service markets. However, available research does not address how market behavior changes when consumers must rely on government and other nonadvertising sources for nutrition information compared to when advertising is allowed. This question is the central focus of this study.

Outline of the Chapter

The chapter begins in Section 2 with a description of the USDA consumption data used in the analysis. Section 3 details our econometric methodology and the particular

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[53] See, for example, Benham and Benham (1975) and Bond et al. (1980).

methods used to compare the effectiveness of government and general sources of information with that of advertising. Detailed results and various sensitivity tests are described in Section 4, followed by a summary of our overall results in Section 5.

2. DESCRIPTION OF THE DATA

A. Basic Description

This portion of the study uses the 1985 and 1986 Continuing Survey of Food Intakes by Individuals (hereafter referred to as the CSFII data) for women between the ages of 19 and 50.[54] The datasets provide detailed 24-hour food intake data for independent nationwide samples of women in spring 1985 and in spring 1986.[55] Detailed demographic data on the women were also collected by personal interview.

These samples give us two independent samples of individual consumption data for study. The first, which we will refer to as the 1985 sample, was collected over three months in the spring of 1985, a point in time by which only the early Kellogg fiber/cancer advertisements had been aired. For our analysis, we will treat this sample as a reflection of the behavior *prior* to the introduction of health

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[54] For a detailed description of the survey design, interview instructions, etc. see the CSFII documentation (USDA (1985) and (1986)). We provide only a short summary of this description.

[55] The surveys actually collected up to 6 days of data for each woman (at approximately 2 month intervals). However, dropout behavior in the sample was significant and our analysis of the dropout behavior suggests that it is related to characteristics of interest for our study. Modeling the dropout behavior to correct for dropout bias would greatly increase the complexity of the statistical methodology. Similarly, accounting for the panel nature of the data introduces additional econometric problems. Such corrections are beyond the scope of this study, but they merit serious treatment in any analysis that uses the subsequent waves of data in these samples.

claim advertising, and thus, a reflection of the cumulative effects of the government and general health information about fiber disseminated prior to 1985.[56] The second sample, which we will call the 1986 sample, was collected over three months in the spring of 1986, more than a year into the health claim advertising period. Changes in fiber cereal consumption between 1985 and 1986 are assumed to reflect the incremental effects of the health claim advertising about fiber.

A year is not a long enough period of time to assess the full impact of a new type of advertising, but the 1986 sample provides the most recent data available. On theoretical grounds we expect this short time period to lead us to underestimate the long term effects of health claim advertising for cereals. The aggregate results reported in the previous chapter are consistent with this expectation.

B. Data and Sample Design

Eligible households were those containing at least one woman 19 to 50 years of age. Household characteristic data collected include the previous year's household income, participation in welfare programs, and the sex and age of each household member. Food intake data include information on all food eaten within a 24-hour period either at home or away and the amount of each item consumed. Each woman who supplied food intake data also provided information, such as, her age, race, physiological status (pregnancy and lactation), employment, education, and use of vitamin and mineral supplements.

In the 1985 sample, 1,341 households participated and provided useful data. A total of 1,459 women provided complete food intake data. In the 1986 sample, 1,352 households participated, resulting in food intake data for 1,451 women. For our regression analysis we deleted any observation with a missing value or a "don't know" answer to

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[56] If the advertising had an effect before the spring of 1985, we will underestimate the advertising effects and overestimate the effects of the government/general health information.

a question that we included in our analysis. After deleting those observations, we were left with 1,366 women who provided complete food intake data for 1985, and 1,241 women for 1986.

The CSFII samples were designed to provide a multistage stratified sample representative of the 48 mainland states. The stratification plan took into account geographic location, degree of urbanization, and socioeconomic considerations. That is, the number of eligible households in each cell in the sample was designed to reflect the proportion of the respective number of households in each cell in the population. However, adjustments to the sample are required, because not all eligible households agreed to participate, not all eligible women in eligible households agreed to participate and not all interviews yielded complete dietary information. Included in the CSFII data are weights to correct for missing observations. All of the nonregression analysis in this report uses these weights to adjust the data; regressions are based on unweighted data.[57]

C. Food Intake Nutrition Data

The CSFII data set links each type of food ingested with its nutritional value. The data on nutritional value were developed by the Human Nutrition Information Service (HNIS) for use with the CSFII data. The data base contains representative nutrient values for approximately 4,600 food items. The data include information on the fiber, sodium, fat and other nutrients contained in each of the 4,600 food items. The USDA has subjected the data to computer assisted cleaning and checking.

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[57] For a detailed description of how these weights were determined see the CSFII documentation (USDA (1985) and (1986)). Weighted data were used for the nonregression analyses, because failure to weight the data in these cases could distort resulting statistics. Regression techniques do not require the use of weighted data. Nevertheless, our tests indicate that the results and conclusions of this report are generally not sensitive to whether weighted or unweighted data are used for either type of analysis.

For cereals, nutrition data are generally provided at the brand level. Comparisons of the USDA fiber data with corresponding label data collected by the FTC staff in the spring of 1988 show a correlation in excess of .90. In light of within-brand changes in cereal composition between 1985 and 1988 and rounding in the label data, this suggests a high degree of accuracy in the USDA fiber data for cereals.

3. ECONOMETRIC METHODOLOGY

A. Evaluation of Behavior in 1985

In spring 1985 health claim advertising for cereals had just begun. Thus, differences in individual cereal consumption at this point in time were presumably the result of differences in the taste for cereals, in consumers' valuation of health, and in the effectiveness of government and general sources of nutrition information in reaching various subgroups of the population.

Our analysis of fiber cereal consumption differences among demographic groups in 1985 begins with an examination of crosstabulations, that is, the proportions of key groups that eat low, medium and high fiber cereals. This analysis will document that in 1985 there were significant differences in fiber cereal consumption across various demographic subgroups within the population.

To explore the basis for these differences, we will then estimate a regression model of fiber cereal consumption, which is designed to identify whether the differences in consumption arise from information processing advantages, differences in access to information, differences in the value individuals place on health, or from other sources. This analysis is based on the recursive system of equations specifying the determinants of fiber cereal choice, given by

$$
\begin{aligned}
(4\text{-}1)\quad FIBER^*_i = {} & a_0 + a_1 INCOME + a_2 GRADE_i + a_3 WHITE_i \\
& + a_4 WORK_i + a_5 NOTPREG_i + a_6 MHEAD_i \\
& + a_7 HEALTH_i + a_8 CHILD_i + a_9 WELFARE_i \\
& + a_{10} AGE_i + a_{11} NOSMOKE_i + a_{12} CITY_i \\
& + a_{13} SUBURB_i + a_{14} NE_i + a_{15} MW_i \\
& + a_{16} SOUTH_i + a_{17} VITSUP_i + a_{18} SVALUE_i \\
& + a_{19} NOGRAINS_i + a_{20} MOUT_i + a_{21} MEALS_i \\
& + a_{22} WEEKEND_i + e_i
\end{aligned}
$$

and

$$
\begin{aligned}
(4\text{-}2)\quad MEALS_i = {} & b_0 + b_1 INCOME + b_2 GRADE_i + b_3 WHITE_i \\
& + b_4 WORK_i + b_5 NOTPREG_i + b_6 MHEAD_i \\
& + b_7 HEALTH_i + b_8 CHILD_i + b_9 WELFARE_i \\
& + b_{10} AGE_i + b_{11} NOSMOKE_i + b_{12} CITY_i \\
& + b_{13} SUBURB_i + b_{14} NE_i + b_{15} MW_i \\
& + b_{16} SOUTH_i + b_{17} VITSUP_i + b_{18} SVALUE_i \\
& + b_{19} MOUT + e_i^m
\end{aligned}
$$

where the subscript i denotes the particular individual, a_0 through a_{22} and b_0 through b_{19} are coefficients to be estimated, and e_i and e_i^m are independent, normally distributed error terms.[58] Definitions and means for all variables in equation (4-1) are given in Table 4-1 and are discussed below.

The independent variables in (4-1) are included to capture differences in individuals' information processing abilities, access to information, valuation of health, and other demographic characteristics that might affect fiber cereal consumption. Since most cereal is eaten at breakfast, we would also like to control for the fact that some individuals

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[58] We also present results based on equation (4-1) without considering equation (4-2).

TABLE 4-1

Variables Used in the Regression Analyses

Variable	Definition	1985 Mean[1]	1986 Mean[1]
FIBER*	Amount of fiber (in grams per 10 grams of cereal) = 0 if did not eat cereal	0.118	0.129
INCOME	Household income (in $1000)	25.793	28.341
GRADE	Education of the respondent (in years)	12.717	12.844
WHITE	= 1 if white = 0 otherwise	0.872	0.865
WORK	= 1 if part or full-time = 0 otherwise	0.625	0.603
NOTPREG	= 2 if not pregnant = 1 otherwise	1.958	1.962
MHEAD	= 1 if household has male head = 0 otherwise	0.746	0.766
HEALTH	= 1 if self-reported health is excellent or good = 0 if bad or poor	0.902	0.916
CHILD	= 1 if there is at least one child in household = 0 otherwise	0.663	0.678

Table continued on next page.

TABLE 4-1 -- Continued

Variable	Definition	1985 Mean	1986 Mean
WELFARE	= 1 if receive WIC, Food Stamps or AFDC = 0 otherwise	0.135	0.100
AGE	Age of the respondent	33.372	34.055
NOSMOKE	= 2 if does not smoke = 1 otherwise	1.657	1.678
CITY	= 1 if live in city = 0 otherwise	0.260	0.249
SUBURB	= 1 if live in suburb = 0 otherwise	0.514	0.508
NE	= 1 if live in Northeast = 0 otherwise	0.220	0.197
MW	= 1 if live in Midwest = 0 otherwise	0.272	0.265
SOUTH	= 1 if live in South = 0 otherwise	0.335	0.324
VITSUP	= 1 if take vitamin or mineral supplement[2] = 0 otherwise	0.174	0.189

Table continued on next page.

TABLE 4-1 -- Continued

Variable	Definition	1985 Mean	1986 Mean
SVALUE	Value of food stamps per month	13.230	8.189
NOGRAINS	= 1 if avoids grains = 0 otherwise	0.028	0.024
MOUT	Number of meals eaten out per week	3.384	3.320
MEALS	Number of meals per week	18.295	18.336
WEEKEND	= 1 if weekend = 0 otherwise	0.212	0.223

NOTES. [1] Reported means are the unweighted means for the data used in the regression analyses, which excludes observations with incomplete data for any of the listed variables.

[2] This definition does not include the use of multivitamins.

do not eat breakfast for reasons that are independent of their information about fiber or their valuation of health. To do this, we assume that breakfast is the meal most often excluded by those who eat fewer meals per week and use the variable MEALS as a proxy to control for this difference.

However, the decision to eat breakfast, and hence MEALS, is determined in part by these same information and health valuation variables that determine cereal consumption. The specification of the MEALS equation (4-2) is thus designed to allow us to separate these information and health valuation effects from this independent role of MEALS. Substituting (4-2) into (4-1) yields our primary equation for estimation, namely,

$$
\begin{aligned}
(4\text{-}3)\quad FIBER^*_i = {} & c_0 + c_1 INCOME_i + c_2 GRADE_i + c_3 WHITE_i \\
& + c_4 WORK_i + c_5 NOTPREG_i + c_6 MHEAD_i \\
& + c_7 HEALTH_i + c_8 CHILD_i + c_9 WELFARE_i \\
& + c_{10} AGE_i + c_{11} NOSMOKE_i + c_{12} CITY_i \\
& + c_{13} SUBURB_i + c_{14} NE_i + c_{15} MW_i \\
& + c_{16} SOUTH_i + c_{17} VITSUP_i + c_{18} SVALUE_i \\
& + c_{19} NOGRAINS_i + c_{20} MOUT_i \\
& + c_{21} RMEALS_i + c_{22} WEEKEND_i + e_i
\end{aligned}
$$

where $c_i = a_i + a_{21}b_i$, for $i = 0,\ldots,18$, $c_{20} = a_{20} + a_{21}b_{19}$, $c_i = a_i$, for $i = 19$, 21, and 22, and $RMEALS_i = MEALS_i - MEALS_i'$, where $MEALS_i'$ is the estimate of $MEALS_i$ from equation (4-2), and (4-2) is estimated using the ordinary least squares regression technique.

1. The Dependent Variable

The dependent variable (FIBER*) is the amount of fiber in the type of cereal consumed by individual i, if the individual consumes cereal. More specifically, the variable measures the amount of fiber in grams per 10 grams of the

cereal consumed.[59] If the individual did not eat cereal, the value of FIBER* for that individual is set at zero. The nature of fiber cereal consumption, as reflected in FIBER*, requires that we use a censored regression technique for estimation of the model. This is discussed in detail in Section D below.

2. The Independent Variables

The independent variables include factors that measure i) two distinct types of information differences: those related to the individual's *efficiency* in processing information, and those reflecting differences in the individual's *access* to information, ii) the individual's underlying valuation of health, and iii) other cultural, behavioral and demographic factors that may affect the cereals individuals consume (including whether to eat cereal or not). While we classify these variables into three groups, some variables may fit into more than one group. Our classification is based on what we consider to be the primary effect on an *a priori* basis, but we will discuss secondary effects as we review each variable. We focus initially on the variables' roles in the 1985 estimate.

Information Variables

We use two variables to capture the individual's *efficiency* in processing information. First, the education of the individual (GRADE) is included to reflect the individual's ability to process new information and to incorporate it into dietary decisionmaking (Schultz (1975)). Besides this

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[59] As shown in Table 4-1, the 1985 mean for FIBER is 0.12 grams per 10 grams of cereal, or 0.34 grams per ounce of cereal. Since 17.1 percent of the sample ate cereal in the 1985 sample, these individuals consumed 1.99 grams of fiber per ounce of cereal on average. This compares to 1.70 grams per ounce derived from the aggregate data for 1985. Since the aggregate data includes consumption by children and the individual consumption data are restricted to adults, this difference is reasonable. The differences are approximately the same for 1986.

efficiency effect, however, more educated individuals may be more likely to read print media, such as newspapers and magazines, and may be more likely to be exposed to news sources. To the extent that nutrition information was concentrated in these media prior to advertising, more educated individuals would have had access advantages in getting fiber information. Consequently, because of efficiency advantages, and to a lesser extent because of possible access advantages, we would expect those with more education to be more likely to eat cereal and more likely to eat higher fiber cereals in 1985, other things constant.

The household's income (INCOME) is also included to capture efficiency in processing information. Income may indicate human capital beyond that given by formal education, and greater human capital should reflect greater efficiency in processing information. For this reason, we would expect a positive relationship between income and fiber cereal consumption after accounting for education and other variables. However, depending on its price relative to other breakfast foods, cereal may be a preferred option for particular income groups (independent of health considerations). If this effect is important, the sign on the income coefficient is more difficult to predict.

The presence of a male head in the household (MHEAD) is used to capture information *access* advantages at the household level. Viewing the household as a productive unit (Becker (1976)), two adults in the household doubles the access to information for the family. Each adult has sources of information and can contribute to family knowledge, and thus jointly the family is more likely to learn about the health benefits of fiber. Moreover, other things equal, the value of time will be lower for women in two-adult households compared with their single-adult counterparts. This lowers their cost of acquiring information, again leading to access advantages for women in households with a male

head. Thus, the sign on this coefficient is expected to be positive.[60]

Valuation of Health Variables

Since individuals may value "good health" differently, we attempt to control for this heterogeneity. Those who place a higher valuation on health are more likely, *ceteris paribus*, to eat high fiber cereals. We include two variables as measures of the value individuals place on health. The first (NOSMOKE) indicates whether the individual smokes cigarettes or not. We expect that individuals who do not smoke cigarettes place more value on good health and are therefore more likely to eat fiber cereals.[61] Similarly, we include a variable that indicates whether the individual takes a vitamin or mineral supplement (VITSUP) other than a multivitamin.[62] We expect individuals who take vitamins to place greater value on health and therefore to consume more high fiber cereals than those who do not take vitamins.

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[60] If men have different tastes for cereal than women, the presence of a male in the household might affect a woman's cereal choices. The limited evidence available suggests that men may be less likely to eat fiber cereals than women (Block and Lanza (1987)). This would reduce the coefficient on MHEAD.

[61] There is considerable evidence that smokers are more likely to engage in other unhealthy behaviors. See, for instance, Schoenborn and Benson (1988) and the papers cited there.

[62] We did not include the use of multivitamins in the definition of VITSUP, because of our concern that for many women multivitamins may be used to compensate for a poor diet rather than simply reflecting a higher valuation of health. Our examination of this issue showed, for instance, that women who ate fewer meals were more likely to take multivitamins, a result that is inconsistent with the use of multivitamins as a proxy for a higher value of health. Nonetheless, our results are not sensitive to the use of the more inclusive definition, with the exception of the coefficient on VITSUP itself, which loses significance.

While both NOSMOKE and VITSUP reflect consumers' underlying health valuation, we should note that those who value health highly should be willing to spend more to acquire health information. For this reason, these variables may also reflect higher levels of health information about fiber, which itself leads to additional fiber cereal consumption. As discussed below, changes in the role of these variables over time will help us to distinguish between these two effects.

We also include the self-reported health status of the individual (HEALTH). Those who report themselves in good health may be those who put a higher valuation on health or who have better information on health issues. As discussed above, these types would be more likely to eat fiber cereals. However, those in poor health may have a higher valuation on changes in health which would lead them to eat more fiber. After controlling for the variables discussed above, we have no prior expectation on the coefficient on HEALTH.

Other Variables

Since demographic subgroups may have varied ways of getting information, and different "tastes," we account for differences among geographic regions, cultural groups, and population density. We include variables indicating whether the individual is from the Northeast (NE), Midwest (MW), and South (SOUTH).[63] Additionally, we include the age (AGE) and race (WHITE) of the individual, as well as whether the individual lives in the city (CITY) or suburbs (SUBURB).[64] To the extent that these variables measure differential access to nutrition information, the coefficients will indicate which groups were most successfully reached by the government and general nutrition sources of information prior to the health claim advertising. For instance, if these sources of nutrition

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[63] These groups are compared to individuals from the West (the excluded category). Regression techniques require that one category be omitted from the analysis.

[64] City dwellers and suburbanites are compared to those living in rural areas (the excluded category).

information are more successful in reaching women in urban markets, we would expect a positive coefficient on CITY. If the variables capture underlying taste differences between groups, these differences will also be reflected in the 1985 coefficients. We will not be able to distinguish between these two potential explanations for the role of these variables until we examine changes induced by the new source of information in 1986, as discussed below.

We also include a variable indicating whether the woman is pregnant, because this may influence her diet (NOTPREG). Included is a variable for whether there are any children in the household (CHILD), because the presence of children may change the mix of cereals purchased, increase the benefits of health information for the household, and increase the value of time for the woman, making information more costly to collect. Also included is a variable indicating whether the individual does not eat grain products (NOGRAIN), because this is likely to affect cereal consumption.

We have included a variable for whether the woman works or not (WORK). Since income and education are already accounted for, the work variable should reflect a higher value of time, which could affect the type of breakfast eaten (because of preparation time) and the cost of gathering information for the household (Becker (1965)). If WORK primarily reflects the higher cost of gathering information, we would expect it to be negatively associated with fiber cereal consumption. If it primarily reflects preparation time, we have no prediction on the sign of the coefficient.

Included in the analysis is a variable that indicates whether the individual receives any type of government assistance (WELFARE). After accounting for differences in income, those involved in a government support program may have better access to other government information than those who are not. On the other hand, the fact that a woman receives welfare may reflect underlying disadvantages in acquiring and processing information not captured by our other variables. Finally, we include the value of the food stamps the household receives (SVALUE) (if any). Those receiving food stamps, after accounting for other income, have more money to spend on food. Therefore, they may be

more likely to spend this money on a more nutritious diet (Basiotis et al. (1983), Eastwood et al. (1986) and Davis (1982)) and thus to consume more fiber cereal. Conversely, as with the general welfare index, the level of food stamp payment may reflect disadvantages in information access and processing ability and therefore would be inversely related to fiber cereal consumption.

We have also included variables for the number of meals eaten out during the week (MOUT) and whether the individual's consumption was on a weekend (WEEKEND). We expect these variables to reduce fiber cereal consumption.

Finally, as discussed in the specification of the model, we include a variable $RMEALS_i$, the residual from the MEALS equation (4-2), to control for the effect of the number of meals eaten per week that is independent of the information and health valuation determinants of MEALS. Because we expect those who eat more meals to be more likely to eat breakfast, and because most cereal is consumed at breakfast, we expect the coefficient on this variable to be positive.

B. Evaluation of Changes In Behavior Between 1985 and 1986

To evaluate changes in behavior that occurred between spring 1985 and spring 1986, we first examine how the proportion of various demographic groups eating low, medium and high fiber cereals changed between 1985 and 1986. This will allow us to determine whether the effects of the advertising were concentrated among the same demographic groups as the effects of the government and general sources of nutrition information.

How producer advertising generated these changes in behavior for various subgroups is examined by estimating the model described in equation (4-3) in 1986 and comparing the results to those obtained in 1985. This allows us to examine changes in the role of the variables that capture differences in information processing ability, access to information, health valuation, as well as other characteristics, and to compare how projected behavior in the 1985 and 1986 models varies with key characteristics. We now discuss how the

coefficients should change if advertising has particular effects.[65]

Changes Related to Information Processing and Access Advantages

For our discussion of changes in the information processing variables, we first focus on the education variable GRADE, used as our primary measure of efficiency in processing information. The analysis of changes for the other information efficiency coefficient (INCOME) is similar.

Changes in the education coefficient in 1986 will depend on two primary factors: the ease with which the advertising information can be absorbed and the distribution of the existing stock of fiber information. First, consider the effect of whether the fiber information in advertising is significantly easier for consumers to process and incorporate into behavior, compared with previously provided information. If the advertising is not significantly easier to understand, other things equal, the advantages to education that determined differences in fiber consumption in 1985 would continue in 1986. In this case, the fiber information in the advertising would be disproportionately absorbed by highly educated consumers as in 1985, causing their fiber consumption to increase more than that of their less educated counterparts. Other things equal, this would cause the coefficient on GRADE to increase or remain unchanged in 1986.

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[65] In our discussion of the impact of adding information to the market, we will focus on the direct effects caused by changing individual's beliefs about the health benefits of fiber. The information may also have indirect effects if the increase in informed buyers causes an increase in the availability of fiber cereals. If there is any randomness in consumer purchase decisions, the uninformed may also benefit from the information, because the larger market share of fiber cereals may increase their likelihood of buying fiber cereals. The empirical estimates below do not distinguish between direct and indirect information effects.

On the other hand, if the advertising is much easier to incorporate into behavior, the advantage that more educated consumers had in 1985 could diminish. More of the less educated consumers would also be able to absorb the fiber information and thus would increase their fiber consumption. If this effect is large enough, consumption by lower educated women would become more like that of highly educated women.[66] In this case, the coefficient on GRADE could be smaller in 1986 than in 1985.

The second factor that determines changes in the education coefficient is the extent to which the health information in the advertising is not known from previous sources, that is, the extent to which it is "new" information. Since past knowledge was determined by consumers' abilities to process information, the highly educated may understand more about fiber cereals prior to the advertising and thus may learn less from it than less educated individuals. In this case, highly educated consumers would increase their fiber consumption by less on average than less educated consumers. If large, this "past information effect" should reduce the 1986 coefficient on GRADE relative to 1985.

Thus, on theoretical grounds, the coefficient on GRADE could either increase, remain stable or decrease in 1986. If the advertising information is not sufficiently easier for consumers to process than the previously provided information, the processing advantages can dominate the past information effect, causing the coefficient to increase or remain stable. On the other hand, the coefficient on GRADE could decrease in 1986 if the advertising information is sufficiently easier to understand or if the past information effect is large enough. The analysis of changes in the coefficients for the other information-efficiency variable is similar.

For variables that are included to reflect potential advantages in access to health information (such as MHEAD),

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[66] In the extreme, if the fiber information was understood by the entire population, there would be no remaining differences in consumption due to information processing advantages.

the analysis is relatively straightforward. If the advertising is more effective in reaching the types of individuals who were not successfully reached by the government and general sources of health information, the differences in cereal consumption will be reduced and the coefficients on these variables will be smaller in magnitude in 1986 than in 1985. If the advertising is not more successful in reaching the disadvantaged groups, the coefficients will increase or remain the same.

Changes Related to Health Valuation Differences

In our analysis, individuals are assumed to make different cereal consumption decisions, in part, because they differ in their underlying valuations of health. New information about fiber should not change these underlying health valuations, and as a result, should increase differences in fiber cereal consumption that reflect health valuation. Thus, if variables such as NOSMOKE and VITSUP reflect only differences in consumers' valuations of health, we would expect their coefficients to be stable or to increase between 1985 and 1986 as new information is added to the market.

However, as described above, consumers with a higher valuation of health should be willing to spend more to acquire health information of all types. For this reason, those who value health highly may know more about fiber cereals prior to the advertising, and thus, may learn less from the advertising and react less to it. This "past information effect" would cause the coefficients on the health valuation variables to decrease in 1986 as the new information is absorbed by those who were not willing to spend as much to seek it out previously.

In summary, in 1986 the coefficients on the health valuation variables (such as NOSMOKE and VITSUP) should be the same or increase if the past information effects reflected in these variables is small. The coefficients should decrease in magnitude if these past information differences are large enough.[67]

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[67] Note, however, that the coefficient should not fall to zero if there are differences in how consumers value health.

Changes in Other Variables

The other variables in our regressions are used to capture two main types of differences, differences in access to information about diet and health and differences in "tastes." The health claim advertising could affect the coefficients on these variables if the advertising is more successful at reaching some groups relative to others. For instance, if the advertising is more successful in reaching women in urban markets, the coefficient on CITY would increase. To the extent that the coefficients on these variables capture only taste differences, however, they should not change with the new source of information. Thus, changes in the coefficients on these variables will help us to determine whether differences in 1985 primarily reflected "taste" differences or differences in the effectiveness of government and general sources of information in reaching certain types of individuals.

Changes in Projected Fiber Consumption

Finally, to illustrate the model's implications for various types of individuals, we will use projections from the regression model. Specifically, we will vary key demographic characteristics used to capture information processing and access differences to examine how these factors affect behavior in 1985, before the health claim advertising, and how their role changed in 1986, after one year of the advertising.

C. Fiber From Bread: The Spillover Effect

A potential secondary effect of advertising is its "spillover" effect to other foods. When cereal firms advertise the health benefits of fiber from cereal consumption, part of that message (that there are health benefits from fiber consumption) may also affect the consumption of other food products containing fiber.

To examine this spillover effect, we use essentially the same model as in (4-3) to estimate the determinants of fiber consumption from bread, though with slightly different econometric techniques (described in Section D below). This analysis uses nonbreakfast consumption of sliced bread as

characterized in the USDA data.[68] To our knowledge, there had been very little advertising of the health benefits of bread as a fiber source during the period of our data, though breads are one of the major sources of fiber in the American diet.[69] As with cereals, we estimate equation (4-3) for 1985 and for 1986, with the dependent variable equal to the amount of fiber in grams per 10 grams of the sliced bread consumed for those who ate bread. If the individual ate more than one type of bread during the day, we averaged over types.

For those who eat bread, the choice of type of bread involves the same issues as the choice of cereal. Thus in the 1985 model for the choice of bread type, we have the same expectations about the role of the information processing, information access and health valuation variables as described for cereal choices.

The decision whether to eat bread, however, may differ from that for cereal. In the cereal analysis, we implicitly assume that switching to cereal consumption is an improvement in diet on average and is thus determined by the same health and information processing considerations as the choice of the type of cereal. However, for breads this assumption may not be reasonable. Breads are usually eaten with other foods and substitute for a wide variety of foods, which may be better or worse than bread and the foods it is often used with. For this reason, we estimate the model for the decision to eat bread separately from the model of the choice of bread type for those who eat bread. We do not have predictions about the coefficients in the 1985 model of the decision to eat bread.

In 1986, the estimates should reflect any spillover effects of the advertising, if they exist. Since the spillover information for breads is not as specific as the direct

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[68] We have also experimented with a broader class of breads rather than focusing on only sliced bread. The results are robust to our different classifications of bread.

[69] See Block and Lanza (1987) for evidence on major sources of fiber in the American diet in 1980.

advertising information for cereals, we would not necessarily expect a reduction in the differences based on information processing advantages. In fact, the greater understanding and access to background information required to convert the health claim for cereals into behavior regarding breads suggests that this spillover effect may be greatest for those with the information advantages. Changes in the coefficients for the health valuation variables should follow the same pattern as in cereals.

D. Econometric Techniques

1. Regression Techniques with Censored Data - The Cereal Model

In the cereal model described in equations (4-1) and (4-2), FIBER* is the amount of fiber in grams per 10 grams of the cereal consumed. If the individual did not eat cereal, the value of the dependent variable for that individual is taken to be zero. In the CSFII data we find that most women do not eat cereal, so that the statistical implications of these zero observations is potentially serious if not adequately addressed. For this reason, the ordinary least squares technique is not the most appropriate method for obtaining estimates of c_0 through c_{22} in equation (4-3).

Tobin (1958) analyzed this type of problem by formulating a regression model that accommodates such "censored" data. His approach, usually referred to as "tobit" analysis, uses a maximum likelihood regression technique to simultaneously estimate the probability of having nonzero observations and the determinants of their level, if nonzero.

Thus, to analyze the determinants of fiber cereal consumption, we use this tobit technique to estimate equation (4-3) independently for 1985 and 1986. This allows us to get unbiased estimates of the determinants of fiber cereal consumption in each year. Because the samples are independent, we can use simple tests to determine whether changes in the coefficients from 1985 and 1986 are statistically significant.

2. Regression Techniques with Censored Data - The Bread Model

As with cereal, many women do not eat bread on a given day, so that regression techniques that accommodate such "censored" data are the most appropriate method. As discussed above, however, the decision to eat bread may be motivated by different factors than the choice of the type of bread, given that the individual is eating bread. For this reason, we estimate these two components of fiber bread consumption *separately* rather than simultaneously as in the cereal model.

To do this, we use the probit regression technique (see Maddala (1983), for instance) to estimate the determinants of the decision to eat bread. In this regression technique, the dependent variable is equal to 1 if the individual eats bread and 0 if she does not. For those who eat bread, we use the standard ordinary least squares regression technique to estimate the determinants of the choice of bread type.

4. RESULTS

A. Demographic Group Differences in 1985 Cereal Consumption

Table 4-2 contains frequency statistics that describe the consumption of fiber cereals by selected demographic groups in 1985. Specifically, statistics are reported by education level, the presence of a male head of household, smoking and race. These crosstabulation results[70] provide strong support for the hypothesis that at the start of the advertising period, fiber consumption from cereals differed significantly across subgroups within the population.

For instance, these frequency statistics indicate that the consumption of cereal and of fiber cereal is higher for women with more education and for women in households that also have a male head. Only 2.5 percent of women who with some high school consumed cereals with more than 2

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[70] We will use the terms frequency statistics and crosstabulations interchangeably throughout the report.

TABLE 4-2

Frequency Tables for Cereal Fiber Consumption By Selected Demographic Variables, 1985 (Percent)

Fiber (gms/oz cereal)	Education Level (Years)				
	< 9	9-11	12	13-15	16+
No cereal	94.11	85.88	83.34	82.79	78.91
0 < Fiber ≤ 1	5.89	7.65	7.08	7.51	7.60
1 < Fiber ≤ 2	0.00	3.95	3.44	3.70	5.31
2 < Fiber ≤ 4	0.00	0.87	3.10	4.02	2.13
4 < Fiber	0.00	1.65	3.03	1.97	6.05
N (Weighted)	56	178	646	337	281
Chi-square	45.32*				

	Male Head of Household	
	Yes	No
No Cereal	81.11	90.36
0 < Fiber ≤ 1	8.15	4.15
1 < Fiber ≤ 2	4.17	2.37
2 < Fiber ≤ 4	3.25	.91
4 < Fiber	3.31	2.21
N (Weighted)	1173	329
Chi-square	16.0*	

Table continued on next page.

TABLE 4-2 -- Continued

Fiber (gms/oz cereal)	Smoke	
	Yes	No
No Cereal	89.35	79.94
0 < Fiber ≤ 1	5.64	8.12
1 < Fiber ≤ 2	1.80	4.79
2 < Fiber ≤ 4	.38	3.95
4 < Fiber	2.82	3.20
N (Weighted)	509	992
Chi-square	30.2*	

	Race	
	White	Nonwhite
No Cereal	81.22	93.95
0 < Fiber ≤ 1	7.93	3.90
1 < Fiber ≤ 2	4.10	1.50
2 < Fiber ≤ 4	3.12	0.65
4 < Fiber	3.62	0.00
N (Weighted)	1274	211
Chi-square	24.2*	

DATA. USDA Continuing Survey of Food Intakes By Individuals, Women 19-50 Years, 1985.

NOTES. * indicates significance at the 99.5 percent level of confidence.

grams of fiber per ounce of cereal, compared to 8.2 percent of college graduates. Similarly, only 3.1 percent of women in households without male heads consumed such cereals, compared with 6.6 percent of women in households with a male head. A chi-square test of independence leads to a strong rejection of the hypotheses that cereal consumption is independent of either education or the presence of a male head.[71]

Smoking is also strongly and negatively related to cereal consumption and to fiber cereal consumption. Only 3.2 percent of smokers ate cereals with more than 2 grams of fiber in 1985, compared to 7.2 percent of nonsmokers. Similarly, only 10.6 percent of smokers ate any type of cereal, compared to 20.0 percent of nonsmokers. The hypothesis that smoking is unrelated to cereal consumption can be rejected with a 99.5 percent level of confidence.

The evidence also allows us to strongly reject the hypothesis that race is unrelated to fiber cereal consumption. Only 6.0 percent of nonwhites ate any cereal in 1985, compared to 18.8 percent of whites, and only 0.6 percent ate cereal with more than 2 grams of fiber, compared to 6.7 percent of whites.

Together with similar results for other variables including income, welfare support and pregnancy status, the evidence from the frequency statistics is quite strong in supporting the hypothesis that there were statistically significant differences in cereal consumption across demographic groups at the start of the advertising period.

B. Determinants of 1985 Differences in Fiber Cereal Consumption

Regression analysis of the determinants of cereal consumption at the start of the advertising period support the hypothesis that cereal consumption is associated with our

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[71] This statistical test is based on a comparison of the observed frequency in each cell with the expected frequency if choices were independent of the variable in question (Freund and Walpole (1980)).

measures of information and health valuation differences. Table 4-3 reports the coefficient estimates from the tobit regression for 1985 fiber cereal consumption corresponding to equation (4-3).[72]

Of particular interest are the coefficients for the information-related variables. As expected, education significantly increases fiber cereal consumption. The coefficient on male head of household is also positive and significant, as expected. This evidence is consistent with the hypotheses that individuals with information advantages had disproportionately reacted to the fiber information in 1985. Having controlled for education and other factors, household income does not appear to be an independent explanation for fiber cereal consumption in 1985.

Race also exhibits a very significant relationship to fiber cereal consumption in the multivariate analysis: whites eat higher fiber cereals than nonwhites, even when income, education and other differences are controlled. This evidence is consistent with the hypothesis that government and general nutrition information sources are more effective in reaching some subgroups of the population (whites in this case) than others. The evidence is also consistent with the hypothesis that there are culturally based taste differences in cereal consumption that are independent of information issues.

The proxies for individuals' underlying valuations of health (SMOKE and VITSUP) are both positively and significantly related to fiber cereal consumption, as expected. Nonsmokers and women taking vitamin supplements are more likely to eat fiber cereals than smokers and those not taking vitamins. Similarly, as hypothesized, pregnant women are significantly more likely to get fiber from cereals. Consumption of fiber cereals is lower on weekends and for

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[72] The likelihood ratio test allows us to reject strongly the hypothesis that the model is equivalent to the restricted model where all of the coefficients are assumed to be zero. The chi-squared test statistic is 2 x (779.42-712.60) = 133.64, which is significant at the 99.5 percent level in our case.

TABLE 4-3

Regression Results for Fiber From Cereal in 1985

	Dependent Variable: Fiber(gm)/Cereal(10 gm)	
Variable[1]	1985	
Constant	-2.005	(-2.66)**
Income	-.001	(-.20)
Grade	.052	(1.75)*
White	.666	(3.01)**
Work	-.122	(-.94)
Not Pregnant	-.606	(-2.52)**
Male Head	.344	(2.07)**
Health	-.142	(-.66)
Children	-.100	(-.84)
Welfare	-.057	(-.18)
Age	-.003	(-.36)
Nonsmoker	.531	(3.95)**
Vitamin Supplements	.381	(2.88)**
Stamp Value	-.000	(-.05)
Meals Out	-.061	(-3.18)**
Meals Residual	.077	(4.39)**
Weekend	-.226	(-1.52)
N	1364	
Log-Likelihood	-710.06	
Restricted Log-Likelihood	-779.42	

DATA. USDA Continuing Survey of Food Intakes By Individuals, Women 19-50 Years, 1985 and 1986.

NOTES. t-statistics are in parentheses. * indicates significance at the 10 percent level. ** indicates significance at the 5 percent level.

[1] Tobit regression specification also controlled for region (Northeast, Midwest, South and West), urbanization (City, Suburb and Rural), and whether the individual avoided grains in her diet, as described in equation (4-3). None of these variables were significant at the 10 percent level.

those who eat out frequently, as hypothesized, though this result is statistically significant only for the latter variable.

The MEALS residual coefficient is positive and highly significant. Those who eat fewer meals (controlling for the information and other determinants of the number of meals) eat less fiber cereal.[73] The estimated relationship between MEALS and the key variables in the cereal fiber equation is reported in Appendix Table A-1. Briefly, these results indicate that there is a strong relationship between our key variables and the number of meals eaten per week. Moreover, this relationship generally parallels the cereal equation with one important exception: race is not a significant determinant of the number of meals eaten. This suggests that the difference in fiber cereal consumption between whites and nonwhites reported above is more likely the result of what is eaten at breakfast, rather than of differences in the likelihood of eating breakfast.

Finally, the coefficients on work, self-reported health status, welfare, food stamp value, age, and the presence of children in the household are all insignificant in the estimate of equation (4-3).

Overall, the crosstabulation results support the hypothesis that in 1985, at the start of the advertising period, there were strong and statistically significant differences in the consumption of fiber cereals by various demographic groups. Moreover, the regression results indicate that these group differences are due, in part, to information and health valuation differences. For example, education and the presence of a male in the household (included as measures of information efficiency and access advantages), and smoking and the use of vitamin supplements (included as proxies for those who value health more highly), appear to be important determinants of consumption. Race is also strongly related to fiber cereal consumption in 1985,

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[73] Appendix Table A-2 reports the estimated coefficients when MEALS is not treated recursively, as in equation (4-1). This specification gives very similar results, though the coefficients and significance levels on MHEAD and GRADE drop somewhat.

with whites consuming much more fiber cereal than nonwhites, perhaps reflecting either information access differences or taste differences.

These results indicate that the government and general sources of nutrition information were not uniformily effective in reaching various types of women, and in particular, that they disproportionately reached those with advantages in acquiring and processing information. We turn now to the analysis of behavior in 1986, one year after the introduction of health claim advertising for cereals, to examine whether and how advertising changed this distribution of fiber information.

C. Effects of Advertising on Fiber Cereal Choices

Table 4-4 contains frequency statistics that describe the fiber cereal consumption choices of women in spring 1986 for the demographic groups examined in Table 4-2. The 1985 statistics are repeated in Table 4-4 to facilitate our analysis of the changes that occurred during the first year of health claim advertising.

First, when categorized by education levels, cereal consumption increased in 1986 for all groups except for the group of women with some high school education. This effect is largest for the lowest education group, where the percent eating cereal increased from 5.9 percent in 1985 to 16.1 percent in 1986 (significant at the 85 percent level).[74] The two highest education groups also increased their probabilities of eating cereal in 1986, by 2.8 percentage

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[74] The chi-square statistics reported in Table 4-4 test for independence of the 1985 and 1986 frequency distributions. Rejection of this hypothesis implies that the distribution of women across the fiber categories has changed significantly between 1985 and 1986. If the test indicates a significant change, it is important to note that this does not indicate the nature of the change (e. g., whether the distribution shifted towards higher fiber cereals or not). This must be determined directly from the reported frequencies for the two years.

TABLE 4-4

Frequency Tables for Fiber Cereal Consumption By Selected Demographic Variables, 1985 Versus 1986 (Percent)

Fiber (gms/oz cereal)	Education Level (Years)					
	Less than 9		9-11		12	
	1985	1986	1985	1986	1985	1986
No cereal	94.11	83.91	85.88	89.87	83.34	83.82
0 < Fiber ≤ 1	5.89	4.58	7.65	4.21	7.08	8.23
1 < Fiber ≤ 2	0.00	5.22	3.95	1.65	3.44	3.15
2 < Fiber ≤ 4	0.00	3.29	.87	1.87	3.10	2.23
4 < Fiber	0.00	3.00	1.65	2.40	3.03	2.57
N (Weighted)	56	59	178	156	646	617
Chi-square	2.07[1]		3.99[2]		1.77	

	Education Level (Years)			
	13-15		16 or More	
	1985	1986	1985	1986
No cereal	82.79	78.85	78.91	76.15
0 < Fiber ≤ 1	7.51	6.89	7.60	8.04
1 < Fiber ≤ 2	3.70	5.44	5.31	7.21
2 < Fiber ≤ 4	4.02	3.09	2.13	4.35
4 < Fiber	1.97	5.72	6.05	4.25
N (Weighted)	337	376	281	296
Chi-square	8.35*		3.82	

Table continued on next page.

TABLE 4-4 -- Continued

Fiber (gms/oz cereal)	Male Head of Household			
	Yes		No	
	1985	1986	1985	1986
No Cereal	81.11	80.38	90.36	84.32
0 < Fiber ≤ 1	8.15	7.54	4.15	7.16
1 < Fiber ≤ 2	4.17	4.77	2.37	3.95
2 < Fiber ≤ 4	3.25	3.15	.91	2.12
4 < Fiber	3.31	4.16	2.21	2.45
N (Weighted)	1173	1081	329	429
Chi-square	1.88		6.85	

	Smoke			
	Yes		No	
	1985	1986	1985	1986
No Cereal	89.35	84.59	79.94	80.17
0 < Fiber ≤ 1	5.64	6.58	8.12	7.85
1 < Fiber ≤ 2	1.80	3.41	4.79	4.92
2 < Fiber ≤ 4	.38	2.34	3.95	3.11
4 < Fiber	2.82	3.08	3.20	3.96
N (Weighted)	509	475	992	1031
Chi-square	10.69**		1.92	

Table continued on next page.

TABLE 4-4 -- Continued

Fiber (gms/oz cereal)	Race			
	White		Nonwhite	
	1985	1986	1985	1986
No Cereal	81.22	80.60	93.95	89.89
0 < Fiber ≤ 1	7.93	7.54	3.90	4.54
1 < Fiber ≤ 2	4.10	4.95	1.50	1.22
2 < Fiber ≤ 4	3.12	2.99	0.65	1.74
4 < Fiber	3.62	3.92	0.00	2.62
N (Weighted)	1274	1252	211	212
Chi-square	1.35		6.10**[2]	

DATA. USDA Continuing Survey of Food Intakes By Individuals, Women 19-50 Years, 1985 and 1986.

NOTES. * indicates significance at the 90 percent level of confidence. ** indicates significance at the 95 percent level.

[1] Because there were fewer than 5 observations expected in each of the fiber cereal cells, the chi-square test was done with all of the cereal cells combined (Freund and Walpole (1980)). The Yates correction for continuity was also applied, because the standard chi-square test is inappropriate when there is only one degree of freedom (Walpole (1968)).

[2] Because there were fewer than 5 observations expected in some of the fiber cereal cells, the categories 0-1 gram and 1-2 grams, and the categories 2-4 grams and more than 4 grams were combined for this chi-square test (Freund and Walpole (1980)).

points for college graduates and by 3.9 percentage points for women with 13-15 years of education.

Moreover, with the exception of the group of high school graduates, the proportion of those eating cereal with more than 2 grams of fiber increased in each education group. The largest changes of this type occurred in the lowest education group. In 1985, none of these women ate cereal with more than 2 grams of fiber; by 1986, 6.3 percent of the women ate such cereals. The chi-square test indicates that the proportion changes between 1985 and 1986 are significant at the 90 percent level for those with some post-high-school education and at the 85 percent level for the lowest education group, but the significance level is much lower for the other education groups. Thus, fiber cereal consumption increased for women at various educational levels, but there is no clear pattern to these changes.

For the other three demographic characteristics we presented (presence of a male head of household, smoking and race), the changes in cereal consumption between 1985 and 1986 follow a consistent pattern. In each case, the group that had responded least to the government and general sources of information responded more to the advertising. Moreover, while the gap in behavior was not eliminated, substantial increases in fiber cereal consumption brought these low consumption groups closer to their counterparts.

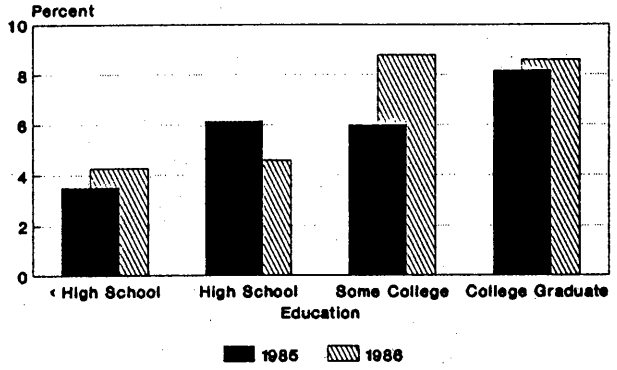
In 1985, 18.9 percent of women in households with a male head ate cereal compared to 9.6 percent of women in a household with no male head. By 1986 these percentages had increased trivially in the first case and dramatically in the second: 19.6 percent of women in households with a male head ate cereal in 1986, compared to 15.7 percent of those in households without a male head. The percentage of women eating cereal with more than 2 grams of fiber increased from 3.1 to 4.6 percent for women in households without a male head, but there was a smaller change from 6.6 to 7.3 percent for women in households with a male head. Overall, the changes in the proportion of women in the various fiber categories are significant at the 85 percent level for women in households without a male head and are highly insignificant in the other case.

In 1985, nonsmokers were much more likely to eat cereal than smokers (20 percent versus 10.6 percent), but by 1986 this difference had been substantially reduced. Nonsmokers still had a 19.8 percent probability of consuming cereal, but smokers had increased their probability to 15.4 percent. The percent of smokers eating cereals with more than 2 grams of fiber increased from 3.2 to 5.4 percent between 1985 and 1986. For nonsmokers, this proportion fell trivially from 7.2 to 7.1. The changes in the proportions across the fiber categories are significant at the 97 percent level for smokers and are highly insignificant for nonsmokers.

Finally, the same pattern of behavior is exhibited in the frequency statistics for race. In 1985, there was a large difference in the probability of eating cereal between whites and nonwhites; 18.8 percent of whites ate cereal versus 6.0 percent of nonwhites. By 1986, this difference had narrowed, because whites had increased their probability of eating cereal only slightly to 19.4 percent, while nonwhites had increased their probability 4.1 percentage points to 10.1 percent. Moreover, for nonwhites the percent eating cereals with more than 2 grams of fiber/serving increased from 0.65 in 1985 to 4.4 in 1986. For whites the increase was much smaller, from 6.7 to 6.9 percent. These changes in proportions are significant at the 95 percent level for nonwhites and are highly insignificant for whites.

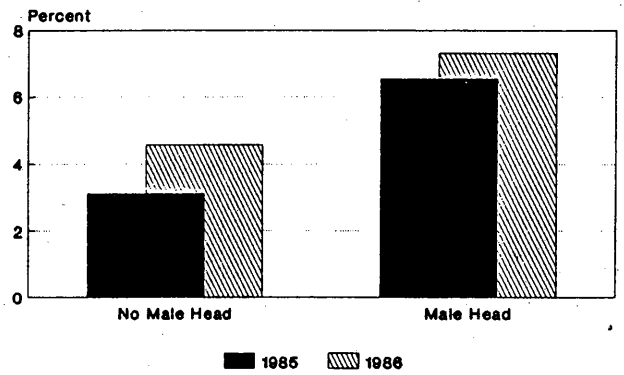
Figures 4-1 through 4-4 illustrate the pattern of these results by focusing on the percentage of each group eating cereals with more than 2 grams of fiber per ounce of cereal. Overall, these crosstabulation results indicate that, with the exception of education, there is a consistent pattern of change from the 1985 statistics: advertising caused statistically significant changes in fiber cereal consumption among the groups that had reacted less to the government and general information provided prior to the advertising. In particular, nonwhites, smokers, and women in households without a male head increased their fiber consumption disproportionately, leading these women to behave more like their counterparts. Consumption increased across most education groups, but showed less of a systematic pattern of change.

Figure 4-1
Percent Eating Higher Fiber Cereals,
By Education*



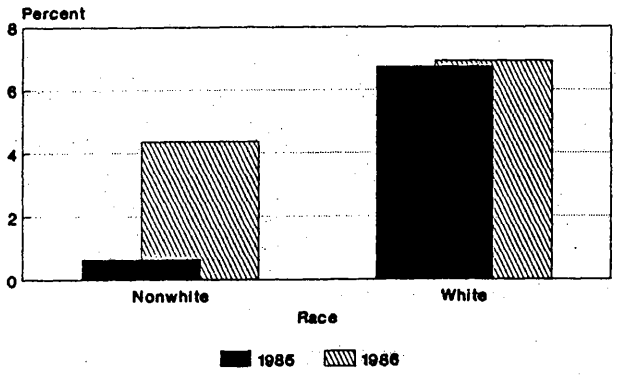
*Cereals with at least 2 gms fiber/oz.

Figure 4-2
Percent Eating Fiber Cereals, For Women
in Households With and Without Male Head



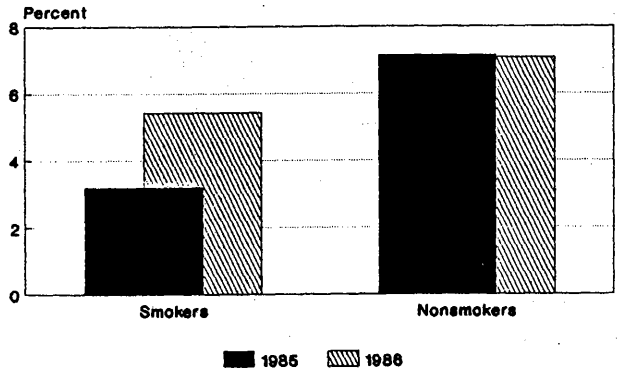
*Cereals with at least 2 gms fiber/oz.

Figure 4-3
Percent Eating Higher Fiber Cereals,
By Race*



*Cereals with at least 2 gms fiber/oz.

Figure 4-4
Percent Eating Higher Fiber Cereals,
By Smoking*



* Cereals with at least 2 gms fiber/oz.

Differences in frequency statistics for groups based on welfare receipt, income and pregnancy, which showed significant differences in 1985, were not significant in 1986. Thus, overall, with the exception of education, there is a general pattern towards reduced differences in fiber cereal choices among groups by 1986.

D. Why Did Advertising Have Differential Effects?

We now turn to our regression analysis for 1986 in an attempt to disentangle how advertising produced these differential changes in cereal consumption for the various demographic groups. In particular, we are interested in examining whether the changes in group behavior occurred because of advertising's ability to reduce the importance of individuals' efficiency in processing information or its ability to increase access to health information for various types of individuals.

Table 4-5 contains the estimate of the tobit equation for 1986. Overall, these results indicate that after one year of health claim advertising, there were still strong cross-sectional differences in fiber cereal consumption, including differences associated with our information and health valuation proxies.[75] To explore how the role of these variables changed during the first year of health claim advertising, we compare the coefficients on our key variables in 1985 and 1986.

The results that follow are much more tentative than the crosstabulation results that establish that advertising had significant effects on some groups but not on others. While there are sizeable changes in many of the key coefficients, only one of these changes is statistically significant, indicating that we cannot be confident that the observed changes in coefficients are real and not the result of noise in the data. Nonetheless, these changes follow a consistent

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[75] Again, using a likelihood ratio test (2 x (735.35-688.96) = 92.74), we can strongly reject the hypothesis that the restricted model in which all variable coefficients are assumed to be zero is equivalent to the model outlined in equation (4-3).

TABLE 4-5

Regression Results for Fiber From Cereal

1985 Versus 1986

	Dependent Variable: Fiber(gm)/Cereal(10 gm)				
Variable[1]	1985		1986		Change
Constant	-2.005	(-2.66)**	-1.741	(-2.03)**	(-.23)
Income	-.001	(-.20)	.002	(0.56)	(0.54)
Grade	.052	(1.75)*	.066	(2.05)**	(0.47)
White	.666	(3.01)**	.404	(1.98)**	(-.87)
Work	-.122	(-.94)	-.266	(-1.88)*	(-.75)
Not Pregnant	-.606	(-2.52)**	-.573	(-1.77)*	(-.08)
Male Head	.344	(2.07)**	.170	(0.94)	(-.71)
Health	-.142	(-.66)	-.084	(-.34)	(0.18)
Children	-.100	(-.84)	-.081	(-.56)	(0.11)
Welfare	-.057	(-.18)	-.011	(-.03)	(-.14)
Age	-.003	(-.36)	.002	(0.29)	(0.46)
Nonsmoker	.531	(3.95)**	.297	(2.04)**	(-1.18)
Vitamin Sup.	.381	(2.88)**	.035	(0.22)	(-1.67)*
Stamp Value	-.000	(-.05)	.001	(0.31)	(0.31)
Meals Out	-.061	(-3.18)**	-.041	(-1.95)**	(0.70)
Meals Residual	.077	(4.39)**	.104	(4.81)**	(0.97)
Weekend	-.226	(-1.52)	-.322	(-2.04)**	(-.44)
N	1364		1241		
Log-Likelihood	-710.06		-688.96		
Restricted Log-Likelihood	-779.42		-735.35		

DATA. USDA Continuing Survey of Food Intakes By Individuals, Women 19-50 Years, 1985 and 1986.

NOTES. t-statistics are in parentheses. * indicates significance at the 10 percent level. ** indicates significance at the 5 percent level.

[1] Tobit regression specification also controlled for region (Northeast, Midwest, South and West), urbanization (City, Suburb and Rural), and whether the individual avoided grains in her diet as described in equation (4-3). None of these variables were significant at the 10 percent level.

pattern that is more supportive of one of our hypotheses about the way advertising worked than the other. For this reason, we will briefly review the changes in the key coefficients.

Of primary interest are the coefficients for the two main information processing variables, GRADE and INCOME. If advertising reduced the importance of information processing ability in determining fiber cereal choices, we would expect the coefficients on these variables to fall in 1986. Contrary to this hypothesis, the coefficients actually increase in both cases between 1985 and 1986. The GRADE coefficient increased from .052 to .066 with an insignificant t-statistic for the change of 0.47. Similarly, the INCOME coefficient increased from -.001 to .002 (t-statistic of 0.49). Thus, our evidence provides no support for the hypothesis that advertising reduced the advantages enjoyed by those who are more efficient in processing information.[76] In fact, if anything, these advantages may have increased slightly with the advertising.

Our second set of information variables reflect potential differences in individuals' access to or cost of accumulating information. If advertising is more successful at reaching women who had less access to pre-advertising sources of information, or if it reduces the cost of acquiring information, we would expect the coefficients on these variables to fall in magnitude between 1985 and 1986. Included in this set of variables are MHEAD and the cultural/regional variables, which could reflect differential access to information.

The estimated coefficient on MHEAD is considerably smaller in 1986 than in 1985 (.170 versus .344) and it is no longer significant. Similarly, the coefficient on WHITE, the only cultural/regional variable that was significant in 1985, fell from a highly significant .666 to a still significant, but considerably smaller, .404 (with a t-statistic for the change

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[76] We also tested whether the coefficients on these two variables, taken together, changed significantly in 1986. As with the individual coefficients, they did not.

of -0.87).[77] For this reason, we will categorize WHITE, together with MHEAD, as our information access variables in our summary analyses below.[78] Thus, the coefficient on the two information access variables that were significant in 1985 fell in 1986, though these changes were not significant.

The health valuation variables (NOSMOKE and VITSUP) may also capture differential accumulation of fiber information, because those who value health more highly should have spent more in the past to acquire the information. If advertising reduces the cost of getting the fiber information, it could reduce these information differences, leading the coefficients on the health valuation variables to fall in magnitude. The coefficient on NOSMOKE fell in 1986 from a highly significant .531 to a still significant, but smaller, .297 (with a t-statistic for the change of -1.18). The coefficient on VITSUP follows the same pattern, falling significantly in 1986 from a significant .381 to an insignificant .035.[79]

In summary, the evidence does not support the hypothesis that advertising changed consumption differentially through a reduction in information processing advantages; the coefficients on GRADE and INCOME did not fall between 1985 and 1986. Though not significant, the pattern of changes in the information access and health valuation coefficients indicates that a more likely explanation for advertising's effect is advertising's superior ability to reach various types of individuals; in particular, the coefficients on WHITE, MHEAD, NOSMOKE, and VITSUP all fell,

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[77] Recall that if a coefficient reflects only taste differences, it would not be expected to change with the introduction of new health information. Thus, a change in the coefficient on a cultural/regional variable reflects a differential reaction to information.

[78] As with the individual coefficient tests, the test of the effect of the coefficients, taken together, also showed no significant change.

[79] The change in the role of the health variables was also insignificant when the variables were tested as a group.

indicating that advertising removed information differences reflected in these variables.[80]

The qualitative difference between the change in the role of the information efficiency variables and that of the information access variables is illustrated by the projections given in Table 4-6 and Figures 4-5 and 4-6. These projections illustrate the marginal impact of the information efficiency advantages discussed above[81] on the behavior of individuals who are one standard deviation above and below the mean on the two information efficiency variables (GRADE

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[80] With the exception of the coefficient on WORK (which doubled in size and became significant in 1986 where it was not in 1985), the other coefficients generally give the same pattern of results as in 1985.

The WORK result indicates that women who work outside the home reacted less to the information than their nonworking counterparts, a difference that is consistent with their facing a higher cost of making changes in their choice of breakfast food.

[81] As described in Maddala (1983), these projections are calculated from the Tobit estimates as follows: the probability that an individual with characteristics **x** will eat cereal is given by P(**bx**), the average fiber for cereal eaters with characteristics x is given by **bx** + sigma p(**bx**)/P(**bx**), and the average fiber for all individuals with characteristics **x** is given by P(**bx**)**bx** + sigma p(**bx**), where **b** is the vector of estimated coefficients, sigma is the estimated standard deviation of the residuals, p is the standard normal density function, and P is the cumulative normal distribution function. For 1985, sigma is estimated to be 1.27, and for 1986 it is 1.38.

In this section we do not analyze whether differences in projections are statistically significant, because the nonlinearity of the model makes this very difficult. However, the projections are based on the regression model, and as a result, we do not expect the differences between the 1985 and 1986 projections to be significant, since the corresponding coefficient changes were generally not significant when examined individually or in these groupings.

TABLE 4-6

Fiber Cereal Predictions

By Information Characteristics

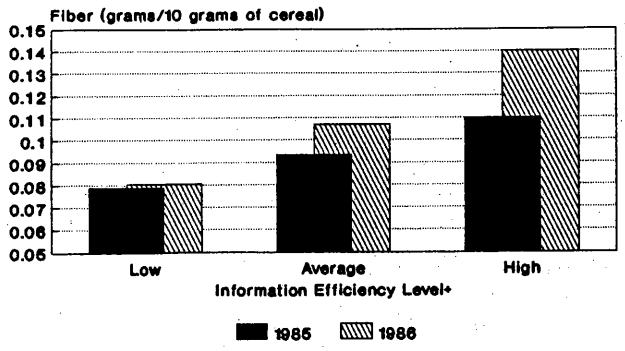
Individual Characteristics[1]	Probability of Eating Cereal		Average Fiber If Cereal Eater (Grams/10 grams cereal)		Average Fiber	
	1985	1986	1985	1986	1985	1986
INFORMATION EFFICIENCY[2]						
Low	.125	.119	.632	.678	.079	.081
Average	.143	.150	.652	.715	.093	.107
High	.163	.185	.674	.755	.110	.140
INFORMATION ACCESS[3]						
Low	.114	.134	.619	.696	.070	.093
Average	.143	.150	.652	.715	.093	.107
High	.177	.167	.688	.735	.122	.123

NOTES. [1] The relevant characteristics are evaluated at one standard deviation above and below the 1986 means. For the categorical variables this was not always possible within the range of the data; in these cases, the largest symmetric interval was used. All other characteristics are evaluated at the mean.

[2] Information efficiency characteristics are education and income.

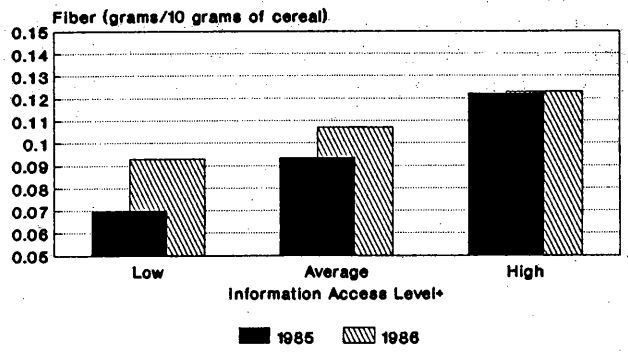
[3] Information access variables are presence of a male head of household and race.

Figure 4-5
Information Efficiency Effects
Fiber Content of Cereal•



• Projections from models in text.
• Defined at means, except at standard deviation from mean on EDUC and INCOME.

Figure 4-6
Information Access Effects
Fiber Content of Cereals•



• Projections from models in text.
• Defined as mean except on RACE and MHEAD (see text).

and INCOME),[82] when all other characteristics are evaluated at the mean. The projections for the *marginal* impact of the two major information access variables (MHEAD and WHITE) are computed similarly.[83]

These results illustrate the overall pattern of our findings. First, the advertising did not reduce the advantages enjoyed by those most efficient at processing information. In fact, other things equal, women with advantages in processing information may have changed their fiber cereal consumption by more than others in reaction to the health claim advertising about fiber.

This larger reaction by individuals with "high" efficiency characteristics contrasts with the distribution of changes in the information access dimension. In this case, the greatest increases are concentrated at the "low" end of the spectrum. These results suggest that, other things equal, advertising may be more successful in reaching the segments of the population that were not reached by the pre-advertising information, namely, nonwhites and women in households with no male head.

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[82] An individual with "low information efficiency characteristics" has 10.52 years of schooling and an income of $9400. An individual with "high information efficiency characteristics" has 15.3 years of schooling and an income of $47,920.

[83] For the dummy variables, we were not able to vary the levels by a full standard deviation without going beyond the limits of the variable. For these cases, we used the largest symmetric interval around the mean that did not exceed the limiting values; this was approximately one half of the standard deviation in each case.

An individual with "low information access characteristics" has a .28 probability of being nonwhite and a .50 probability of living in a household with a male head. An individual with "high information access characteristics" is white and lives in a household with a male head. All other characteristics are evaluated at the mean.

E. Results for Sliced Bread Consumption

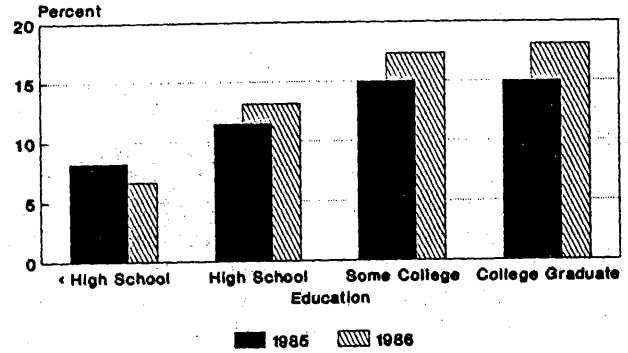
Recall that our rationale for analyzing sliced bread consumption is to explore whether there is evidence of spillover effects from the cereal advertising into the bread market and to examine how these spillover effects differ from the direct effects of the advertising. Because of this focus, we mainly concentrate on the information variables in this section.

An analysis of frequency statistics for key groups within the population confirms that, as with cereals, there were strong differences in fiber bread consumption across groups in 1985 and that some of these differences faded by 1986. In the interests of brevity, we do not report these results in detail. However, there are three notable differences between the frequency statistic results for breads and those for cereals. First, when 1985 differences in bread consumption across demographic groups were reduced in 1986, these reductions were generally smaller in percentage terms than they were for cereals. Second, changes in fiber bread consumption across education groups were more concentrated among the highest education groups than they were for cereals. Finally, between 1985 and 1986 there was no reduction in the differences in fiber bread consumption between whites and nonwhites, in sharp contrast with the cereal results. Figures 4-7 and 4-8 illustrate these differences by presenting the changes in the consumption of bread with more than 1 gram fiber per ounce of bread for different education and racial groups, together with the comparable results for cereals.

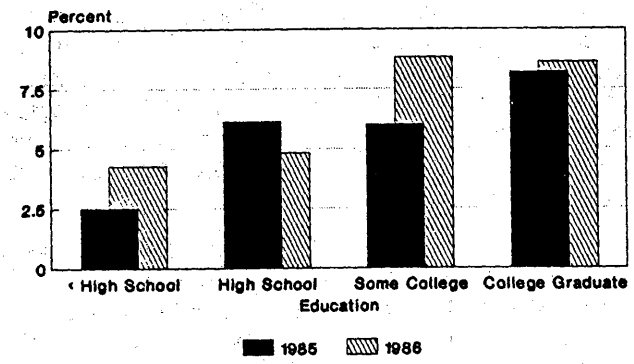
Thus, the frequency statistics for bread consumption indicate that as with cereals, there were sizeable differences in fiber bread consumption across groups in 1985. However, the spillover effects of the cereal advertising into the bread market did not parallel the cereal results in important ways. These findings will be discussed in more detail in the context of the regression estimates to which we now turn.

Tables 4-7 and 4-8 report the regression results for the consumption of sliced bread based on essentially the same model as that used to analyze fiber cereal consumption (see

Figure 4-7
Fiber Choices, by Education
*Percent Eating Higher Fiber Breads**

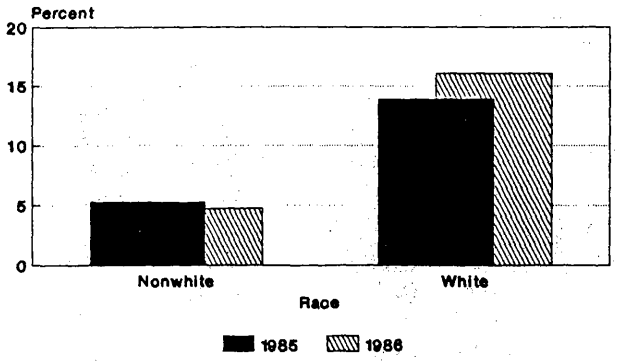


*Percent Eating Higher Fiber Cereals**

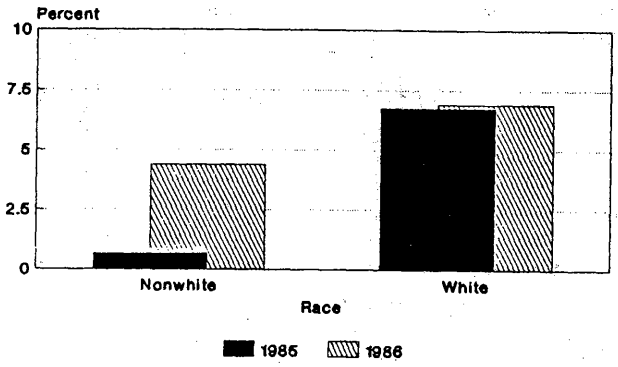


*Breads with at least 1gm fiber/oz.
and cereals with at least 2gms fiber/oz.

Figure 4-8
Fiber Choices, by Race
*Percent Eating Higher Fiber Breads**



*Percent Eating Higher Fiber Cereals**



*Breads with at least 1gm fiber/oz.
and cereals with at least 2gms fiber/oz.

TABLE 4-7

Regression Results for Choice of Bread Type

1985 Versus 1986

	Dependent Variable: Fiber(gm)/Bread(10 gm)				
Variable[1]	1985		1986		Change
Constant	-.300	(-1.41)	.062	(0.24)	(1.08)
Income	.002	(1.43)	.002	(1.46)	(0.04)
Grade	.014	(1.63)	.017	(1.79)*	(0.23)
White	.119	(1.94)*	.175	(2.75)**	(0.64)
Work	.017	(0.44)	-.041	(-.93)	(-.99)
Not Pregnant	.050	(0.68)	.004	(0.05)	(-.42)
Male Head	-.027	(-.58)	-.003	(-.05)	(0.32)
Health	.008	(0.13)	-.090	(-1.16)	(-.99)
Children	.027	(0.69)	-.023	(-.52)	(-.85)
Welfare	-.018	(-.24)	.002	(0.02)	(0.16)
Age	.001	(0.39)	.003	(1.10)	(0.07)
Nonsmoker	.132	(3.50)**	-.013	(-.30)	(-2.52)**
Vitamin Sup.	.027	(0.59)	.030	(0.61)	(0.04)
Stamp Value	-.000	(-.80)	-.001	(-.83)	(-.83)
Meals Out	-.004	(-.74)	.001	(0.20)	(0.68)
Weekend	-.033	(-.76)	-.060	(-1.22)	(-.41)
N	530		488		
R^2	.106		.077		
F	3.03**		1.95**		

DATA. USDA Continuing Survey of Food Intakes By Individuals, Women 19-50 Years, 1985 and 1986.

NOTES. t-statistics are in parentheses. * indicates significance at the 10 percent level. ** indicates significance at the 5 percent level.

[1] Ordinary least squares regression specification also controlled for region (Northeast, Midwest, South and West) and urbanization (City, Suburb and Rural) as described in equation (4-3). The coefficients on these variables were all insignificant except for NE in 1986 and SUBURB in 1985.

TABLE 4-8

Regression Results for Probability of Eating Bread

1985 Versus 1986

	Dependent Variable: Fiber(gm)/Bread(10 gm)				
Variable[1]	1985		1986		Change
Constant	.610	(1.26)	-.912	(-1.75)*	(-2.14)**
Income	-.002	(-.69)	-.005	(-2.17)**	(-.95)
Grade	-.024	(-1.37)	.029	(1.57)	(2.08)**
White	.318	(2.66)**	.319	(2.70)**	(0.01)
Work	.018	(0.22)	-.072	(-.84)	(-.75)
Not Pregnant	-.343	(-1.95)**	-.293	(-1.52)	(0.19)
Male Head	.149	(1.55)	-.044	(-.44)	(-1.39)
Health	.021	(0.16)	.298	(2.07)**	(1.43)
Children	-.013	(-.17)	.157	(1.86)*	(0.02)
Welfare	.051	(0.32)	.073	(0.40)	(0.09)
Age	-.006	(-1.32)	.011	(2.34)**	(2.60)**
Nonsmoker	.006	(0.08)	.042	(0.51)	(0.32)
Vitamin Sup.	-.002	(-.03)	.048	(0.50)	(0.43)
Stamp Value	-.000	(-.05)	-.002	(-1.05)	(1.05)
Meals Out	-.046	(-4.02)**	-.033	(-2.90)**	(0.81)
Meals Residual	.029	(3.17)**	.049	(4.82)**	(1.46)
Weekend	-.089	(-1.02)	-.264	(-2.85)**	(-1.38)
N	1364		1241		
Log-Likelihood	-869.34		-784.49		
Restricted Log-Likelihood	-911.29		-831.68		

DATA. USDA Continuing Survey of Food Intakes By Individuals, Women 19-50 Years, 1985 and 1986.

NOTES. t-statistics are in parentheses. * indicates significance at the 10 percent level. ** indicates significance at the 5 percent level.

[1] Probit regression specification also controlled for region (Northeast, Midwest, South and West), urbanization (City, Suburb and Rural), and whether the individual avoided grains in her diet as described in equation (4-3). The coefficients on NE and NOGRAINS were significant in both years and on MW in 1985.

equation 4-3).[84] These results parallel the frequency statistic findings. In particular, the regression results also indicate that there was spillover to the bread market. For example, projections from the model[85] indicate that an average woman in the sample increased her bread fiber type from .156 grams/10 grams of bread in 1985 to .169 in 1986, an 8.3 percent increase. This compares to a 15.1 percent increase in cereal fiber type over the same period.

Table 4-7 contains the results for the choice of bread model. As expected, the 1985 relationship between bread choice and individual information and health valuation variables is similar to that in cereals. The coefficients on race and smoking are significant, and those on education and income are close to significant, indicating that the same types of disparities existed in the bread market in 1985 as in the cereal market.

The more important issue for our purposes is the change between 1985 and 1986. The coefficients on our two main information processing variables, education and income, remain essentially unchanged in 1986. The coefficients on the two main information access variables, MHEAD and WHITE, increase somewhat, though neither change is significant. Finally, the evidence on the health valuation variables is mixed. The smoking coefficient falls significantly, but the coefficient on VITSUP does not change.

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[84] Recall that we analyze the choice of bread type separately from the probability of eating bread, because the bread decision is more complex nutritionally than the cereal decision. (See Section 3.C in this chapter). The variable RMEALS is not included in the type of bread equation, since the number of meals should not affect this choice.

[85] The projections are calculated as follows: the average fiber choice for bread eater with characteristics **x** is **bx** and the probability of eating bread is P(**cx**), where **b** is the vector of coefficients from the OLS estimate, **c** is the vector of coefficients from the probit estimate, and P is the standard normal distribution function.

Table 4-8 contains the results of the model for the probability of eating bread. We had no predictions for the 1985 coefficients but expected the change in these coefficients to follow the same pattern as in the choice of bread model. Education, our primary proxy for information processing efficiency, increased significantly, but income, our other efficiency proxy, fell insignificantly. The results are similarly mixed on our information access variables; the coefficient on MHEAD fell nontrivially, but the coefficient on race did not change. Both health valuation variables increased, but these changes are insignificant.

Overall, the education results suggest that the spillover of advertising to the bread market is more skewed to the higher education groups than the direct results in the cereal market. If this result is indicative of a more general advertising result, it suggests that it may take more processing ability to carry the information over to another market, or that the advantages that the more efficient had in processing government and general sources of information imply that they were more likely to have the background knowledge (that certain breads contain fiber) necessary to translate the cereal advertising to the bread market.

The race results suggest that the nonwhite population did not carry the cereal advertising over to bread consumption, despite the fact that nonwhites clearly responded disproportionately in cereals. This suggests that nonwhites may not have had access to the background information (that bread is a source of fiber) necessary to make the transfer of the cereal health information to the bread market.[86] Since the pre-advertising sources of information are the primary vehicles for this background knowledge, the failure to carry over the information is thus more evidence suggesting that these pre-advertising sources are less effective in reaching nonwhites.

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[86] While we do not have survey evidence on knowledge broken down by race, by 1986 FDA surveys indicate that nearly 70 percent of consumers listed breakfast cereals as a good source of fiber, while only 40 percent listed whole wheat/grain breads (Heimbach (1986)).

Finally, as we did for cereals, we examined the marginal effects of the information efficiency and access variables. The summary measures indicate that efficiency advantages in processing information were important in explaining consumption for both breads and cereals in 1985, and they remained important in 1986. For the information access predictions from the models, however, the results are qualitatively different. In the cereal case, advertising had a disproportionate effect on those who were not reached by the traditional health information sources. For breads, the spillover effect of the advertising does not reduce the access advantages that existed in 1985.

F. Summary of Results

Our analysis of individual cereal consumption data for women aged 19 to 50 indicates that in 1985, prior to the introduction of health advertising about fiber for cereals, there were significant differences in fiber cereal consumption across various demographic groups. In particular, women with advantages in processing information (as reflected by higher levels of education), women in households with a male head, those who valued health more highly (as reflected by smoking behavior and the use of vitamin supplements) and white women consumed more fiber cereals than others in the pre-advertising period.

In Chapter III, our analysis of aggregate market share data indicated that there were significant changes in the composition of the cereal market once health claim advertising was introduced; in particular, there was a shift towards greater consumption of high fiber cereals. Our analysis of individual consumption data in this chapter shows that this movement was not distributed evenly across the population. Key groups that consumed less fiber cereal in 1985 increased their consumption disproportionately, once the advertising was introduced. In particular, women in households without a male head, nonwhites and women who smoked and did not take vitamin supplements increased their fiber cereal consumption significantly to become more like their presumably more informed counterparts.

Regression analysis designed to examine potential reasons for these differential reactions was less conclusive than the frequency analysis of group behavior, but it provided a pattern of results that is more supportive of one theory than another. This evidence suggests that advertising affected the cereal choices of disadvantaged groups more than others, not because it reduced the importance of information efficiency advantages (the coefficients on education and income increased from 1985 to 1986), but rather because it made information more accessible to disadvantaged groups and reached those less willing to spend resources acquiring health information (the coefficients on MHEAD, WHITE, NOSMOKE AND VITSUP fell from the 1985 levels).

An analysis of bread consumption during this same period suggests that there was spillover of the cereal advertising to the bread market, which increased fiber bread consumption for some groups within the population. However, there were important differences in the pattern of changes in bread consumption that are suggestive of the reasons for advertising's differential effectiveness. In contrast with changes in the cereal market, increased fiber bread consumption was more concentrated among highly educated women, suggesting that education may be more important in using general health information than it is for specific information. Also there was no increase in fiber bread consumption by nonwhites, despite the evidence that nonwhites reacted more to the direct information in the cereal advertising by changing their cereal consumption. Together these results suggest that the specificity and brand-level nature of the direct health claim advertising may be important determinants of advertising's effectiveness.

CHAPTER V

THE UNFOLDING PRINCIPLE: THE VOLUNTARY DISCLOSURE OF FIBER

1. BACKGROUND

According to economic theory, one of the major effects of information in markets is to enhance competitive pressures on producers to provide products that are valuable to consumers. The unfolding theory of voluntary disclosure (Grossman (1981)) discussed in Chapter II is one example of this type of theory. The theory asserts that if enough consumers know the value of a product characteristic, if producers have a credible method of "labeling" their products, and if consumers are skeptical of firms that do not label their products, there is no need to require labeling of hidden product characteristics. Competitive pressures alone are sufficient to generate labeling in this case, since these pressures will induce firms to label the best products voluntarily, which in turn will induce mid-level firms to label their products, and so on, until only the worst products are left unlabeled.

The cereal market provides a good opportunity to test this voluntary disclosure theory. There are no regulatory requirements to label fiber on food products even when other nutritional labeling is required.[87] Moreover, if fiber is labeled voluntarily, this labeling is subject to FDA truth-in-labeling requirements. If fiber content is advertised, it is subject to FTC deceptive advertising requirements. Since nutrition labeling is quite familiar to consumers and known to be federally regulated, it is reasonable to assume that consumers view these types of disclosures as quite credible.

Under the conditions described above, if the fiber/cancer issue is sufficiently important to, and understood by, consumers in the cereal market, and if consumers are

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[87] The disclosure of fiber may not be totally voluntary in the sense that FDA's scrutiny in the area may encourage some fiber labeling that is not legally required.

sufficiently skeptical of firms that do not disclose fiber content, the voluntary disclosure theory predicts that the resulting competitive pressure would induce broad voluntary disclosure of fiber. In the extreme, the theory predicts that all cereals that have *any* significant fiber will be voluntarily labeled, leaving only the cereals with a trace of fiber (the minimum level) unlabeled.

To test the unfolding theory, data are required on the actual fiber content and on the voluntary labeling of fiber for a sample of cereals. The data would support the unfolding theory if they showed extensive labeling for cereals with fiber but no labeling for cereals with only a trace of fiber. To test the theory that health claim advertising was an important catalyst to this unfolding, if it exists, we would also need data on labeling before or early in the advertising period. If the unfolding was substantially more limited at this earlier point, the evidence would be consistent with the theory that advertising was important in increasing competitive pressures to label.

2. DATA

In October of 1986 Consumer's Union (CU) published a review of ready-to-eat cereals (Consumer Reports, October 1986). For this article, CU evaluated the nutritional characteristics of a sample of 59 cereals. At the time the cereals were purchased in the Spring of 1986,[88] CU found that few cereals listed their fiber content on the labels. For this reason, CU did an independent analysis of the fiber content of all 59 brands in their sample.[89] This analysis provides us with fiber data for a sample of cereals that is

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[88] Letter from Edward Groth III of Consumers Union, July 22, 1988.

[89] The sample includes virtually all the major brands of cereals at the time and thus accounts for a majority of cereal sales.

independent of whether the brand currently
or labeled it at the time CU made its measurem

We collected label nutrition data for
spring of 1988.[91] Fifty eight of the 59 cere
sample were still on the market in 1988. If
the fiber content of the brands measured b
change between 1986 and 1988, a comparison o
data with the labeled fiber information in
direct test of the unfolding principle.

3. RESULTS

As shown in Table 5-1, 23 of the 58 cereal
fiber in 1988. However, 21 of the 23 unl
contained no significant fiber according
measurements. The two exceptions were a
cereal, which provided no nutrition informatic
on the label, and a granola cereal that had 1
per serving according to the CU measurement
these two exceptions, all cereals that conta
above a trace of fiber voluntarily labeled that f

There is evidence in Table 5-1 to indic
cereals changed their fiber content between 1

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[90] We used this CU sample from 1986 r
USDA data from 1985, because the CU mea
more recent and thus closer in time to our 1988 label data.
The results are essentially unchanged if the USDA fiber
measurements are used for this sample, except that a few
newer cereals are not included in the USDA dataset, and the
USDA measurements show that the unlabeled brands Crispy
Wheat N' Raisins, Honey Nut Cheerios, Golden Grahams and
Lucky Charms have 1 gram of fiber. See also footnotes 4
and 5 in Table 5-1.

[91] For this analysis we are assuming that the label
information is accurate. CU reported that it spot checked
the label information and found it to be accurate. We also
compared the label information with the nutrition data in the
USDA CSFII database and found a very high correlation
between the two.

TABLE 5-1

Comparison of Cereal Fiber Content With Voluntary Labels, By Brand

Brand	1986 Measured Fiber[1] (Grams/Serving)	1988 Labeled Fiber[2] (Grams/Serving)
Special K	Trace	No Label[3]
Frosted Flakes	Trace	No Label
Crispy Wheats 'N Raisins	Trace	No Label
Trix	Trace	No Label
Cocoa Krispies	Trace	No Label
Crispix	Trace	No Label
Honey Nut Cheerios	Trace	No Label
Golden Grahams	Trace	No Label
Rice Chex	Trace	No Label
Fruity Pebbles	Trace	No Label
Cocoa Pebbles	Trace	No Label
Super Golden Crisp	Trace	No Label
Honey-Comb	Trace	No Label
Apple Jacks	Trace	No Label
Cocoa Puffs	Trace	No Label
Corn Pops	Trace	No Label
Lucky Charms	Trace	No Label
SunFlakes Crispy Wheat & Rice	Trace	No Label
Cap'n Crunch	Trace	No Label
Corn Chex	Trace	No Label
Rice Krispies	Trace	No Label
Sun Country Granola w/Raisins	1	No Label
Genuine Swiss Muesli	3	No Label
Life	1	0.4
Corn Flakes[4]	Trace	1
Honey Smacks[4]	Trace	1
Fruit Loops[4]	Trace	1
Product 19[4]	Trace	1

Table continued on next page.

TABLE 5-1 -- Continued

Brand	1986 Measured Fiber (Grams/Serving)	1988 Labeled Fiber (Grams/Serving)
Almond Delight	1	1
100% Natural[4]	Trace	2
Total	2	2
Grape-Nuts	2	2
Wheaties	2	2
Cheerios	2	2
Wheat Chex	2	2
Grape-Nut Flakes	2	2
100% Natural Raisin & Date[4]	Trace	3
NutriGrain Wheat & Raisins[4]	1	3
NutriGrain Corn	2	3
NutriGrain Wheat[4]	2	3
Shredded Wheat	3	3
Spoon Size Shredded Wheat	3	3
Frosted Mini-Wheats	3	3
Bran Flakes	4	4
Swiss Birchermuesli	4	4
Shredded Wheat & Bran	4	4
Fruit & Fiber Harvest Medley	4	4
Fruit & Fiber Mountain Trail	4	4
Fruit & Fiber Tropical Fruit	4	4
Raisin Bran[4]	4	5
Natural Raisin Bran[4]	4	5
Cracklin' Oat Bran[4]	4	5
Fruitful Bran[4]	4	5
Natural Bran Flakes	5	5
Bran Chex	5	5
Corn Bran	5	5
All-Bran[5]	9	10
Fiber One[5]	12	13

Table continued on next page.

TABLE 5-1 -- Continued

NOTES [1] Measurement of fiber content by Consumers Union in 1986 for a sample of 59 major brands of cereals, 58 of which were still on the market in 1988. Serving size is 1 ounce for most brands. Reformulations and measurement error seem to account for the small discrepancies observed between the 1986 and 1988 measures. See footnotes 4 and 5.

[2] Label fiber information collected in Spring 1988 by FTC staff.

[3] With the exception of Genuine Swiss Muesli, all brands had a nutrition label, but those marked "No Label" do not report fiber content.

[4] USDA 1985 data for fiber in the CSFII dataset for these brands are: Corn Flakes (.51), Honey Smacks (.40), Fruit Loops (.61), Product 19 (.48), 100% Natural (2.41), 100% Natural Raisin & Date (1.87), NutriGrain Wheat & Raisin (2.00), NutriGrain Wheat (1.79), Raisin Bran (4.45), Natural Raisin Bran (4.45), Cracklin' Oat Bran (4.73), and Fruitful Bran (4.34). These measures suggest that most of the discrepancies are due to measurement error and rounding. However, the USDA measurements indicate that the 100% Natural cereals may have been reformulated.

[5] All-Bran and Fiber One were reformulated to increase fiber content (*Advertising Age*, March 18, 1985 and July 22, 1985).

Virtually all of these changes were increases in fiber per serving. However, most of these increases were modest; only 3 cereals increased their fiber amounts by more than 1 gram per serving. On average, the 35 labeled cereals in this sample contained 2.9 grams of fiber per serving in 1986 and 3.3 grams in 1988. These modest increases do not appear to have the potential to undermine the validity of the unfolding result: virtually all cereals that have more than a trace of fiber in 1988 voluntarily label their fiber content. Conversely, with rare exceptions, those cereals that do not label fiber in 1988 can be assumed to have essentially no fiber content.

To test the significance of the health claims advertising in this unfolding process is more problematic. We found no way to get systematic label information prior to the start of the health claim advertising. Thus, the only evidence we have on this point is suggestive. In their review article, CU reported that few cereals in their sample labeled fiber content in 1986 (hence the need for their direct testing). We know from trade sources that the cereals that were adopting a fiber theme through direct advertising[92] or through their names (Fruit & Fiber and Cracklin' Oat Bran, for instance) were publicizing their fiber content prior to 1985 (Advertising Age, various issues). A smaller sample of cereal labels collected in the spring of 1985 by Levy and Stokes (1987) also suggests that the highest fiber cereals were virtually all labeling fiber content by 1985 as were many of the moderate fiber cereals. Thus, this fragmentary evidence suggests that the unfolding of fiber labeling had begun before the health claim advertising but that the health claim advertising may have served to increase competitive pressure enough to induce virtually all the remaining mid- and low-level fiber cereals to voluntarily disclose their fiber content and thus to complete the unfolding process.

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[92] It should be noted that firms were able to advertise the presence of fiber prior to the Kellogg's campaign as long as they did not directly allude to any health benefits from consumption of fiber.

CHAPTER VI

CONCLUSION

This study examined the ready-to-eat cereal market during a period in which the longtime ban against health claims for food products was suspended. This event provided a natural experiment in which government and general sources of information about diet and health were augmented by producer advertising. In particular, in the cereal market, advertising was introduced that linked the consumption of fiber from cereals to a reduction of the risks of some types of cancer. Prior to the advertising, government and general sources had been providing this information for at least ten years.

Our examination of aggregate market movements and individual consumption behavior supports the view that the health claim advertising for cereals was a substantial source of fiber information for consumers. This additional information is reflected in a significant increase in the consumption of fiber cereals and in the development of new types of fiber cereals. Prior to the advertising, fiber consumption from cereals had been stable since 1978, when our data begins, despite growing scientific evidence on the potential health benefits of fiber consumption.

Moreover, our analysis of individual consumption behavior indicates that prior to the health advertising, there were significant differences in the types of cereal chosen across various demographic groups. For instance, during the government information period, women who had less education, were nonwhite, lived in households with no male head, or who smoked, all chose lower fiber cereals than their respective counterparts. After the advertising, these groups shifted their consumption towards higher fiber cereals. With the exception of education, these increases were larger for groups that had consumed less prior to the advertising, so that differences between the groups were reduced by the advertising. Women in different education groups generally consumed fiber cereals more frequently in response to the advertising, but these increases were not consistently larger for the lower education groups.

Taken together, these results suggest that government information may be successful in reaching only particular segments of the population and that producer advertising may provide a broader distribution of knowledge to the public. Why is this the case? While the findings in this portion of the study are less conclusive than our other results, the evidence provides some insight into potential reasons for the different effectiveness of the two sources.

The study examined the reasons for the differences by focusing on characteristics of individuals who obtained government information prior to the advertising and how the role of these characteristics changed after the addition of advertising. This analysis indicates that government information had its greatest effects among individuals who have characteristics that we associate with advantages in processing information, better access to the government information, and higher valuations of health. These results are not surprising. Those who can understand information at lower cost, those who have more exposure to information, and those who place a higher value on the information would be expected to search out and respond to the fiber/health information. After the advertising was added, the role of the variables that measured better access and higher health valuation showed some reduction in their importance in explaining fiber cereal consumption. Though these changes were not statistically significant, they provide some tentative evidence that advertising provided a broader distribution of knowledge not because it made information easier to understand (so that more who were exposed to it could respond), but rather because advertising increased consumer exposure to the information.

In considering potential reasons for advertising's broader reach, several major differences between the distribution methods use by government and advertisers are worthy of mention. Government and general information is usually disseminated in generic form ("increased fiber consumption may reduce some cancer risks") and this information is concentrated in news and print media reports about the latest scientific studies on diet and health. In contrast, most cereal advertising is distributed through television, with a smaller portion in print media. Moreover, health claim

advertising is usually product-specific and requires little additional information to make behavioral changes ("eat Brand X because it has fiber that may reduce cancer risks"). Our evidence also suggests that there were "spillover" effects of the fiber cereal advertising to other fiber product markets: advertising that highlighted the health benefits of fiber consumption in cereals appeared to increase the choice of higher fiber breads. In contrast to the cereal results, however, the spillover effect of the advertising increased the importance of the information processing characteristics in explaining fiber choices; it also did not reduce the role of the health valuation and access variables as much as in the cereal choices. The fact that the spillover of the advertising did not have as broad an effect on bread consumption as it had for cereals suggests that the product-specific nature of the advertising may play an important role in disseminating health information.

Overall, the evidence from this study on advertising's ability to add information to the market is important for the current debate on the desirability of allowing health claims in food advertising. While this study does not provide any definitive conclusions about the most appropriate policy towards producer advertising of health claims, the study does document that the potential benefits of permitting this type of advertising may be substantial. Restrictions on manufacturers' ability to communicate the health effects of fiber cereals appear to have limited the public's knowledge of the fiber/cancer issue and restricted the information's spread to certain groups within the population. Our evidence suggests that had producer advertising never occurred, fewer individuals would be eating cereal and other fiber products, and those eating cereal would be eating lower fiber cereals. This effect would be most pronounced for nonwhites, smokers and women who live in female-headed households.

One concern about health claims in advertising is based on the presumption that, because manufacturers will only highlight favorable aspects of their products, consumers' purchase decisions will be made worse by advertising that is not required to disclose unfavorable nutrition characteristics. However, the evidence from the cereal market suggests that in some cases competitive forces may correct for this type of

individual producer bias. For instance, all producers whose cereals contained all but the lowest levels of fiber were induced to label fiber content voluntarily. Moreover, despite the focus on the health benefits of fiber, cereals became "healthier" on other dimensions as well during the fiber/health advertising period. The average levels of sodium and fat in high fiber cereals continued their downward trends throughout the advertising period, and these and other health dimensions became the focus of advertising in the competition among high fiber cereals.

This study examined a particular health issue in a particular market. More research is clearly needed to establish the importance of various characteristics of the fiber cereal case. For example, we expect the credibility of the health claim to be important. The Kellogg advertising cited dietary recommendations by the National Cancer Institute. It is not clear how much smaller the effects would have been if Kellogg had not been able to cite such an authoritative source.

The cereal market has several firms of varying sizes that produce most of the output. We do not know what role this market structure played in producing the movement towards healthier products in the cereals market or how these results would carry over to other markets with different structures. For instance, we expect that the pressure to compete on nutritional characteristics will be less in markets where firms do not have individual brands, as for most of fresh fruit and vegetables, or where firms are allowed to coordinate advertising at the industry level, as with some agricultural products.

These and other unresolved issues indicate the need for further research on the effects of producer-provided health claims and make it clear that this study alone cannot provide definitive guidance on the health claims policy debate. Certainly, there is the potential for deception in producer health claims, and this study does not address how different advertising policies would balance the costs of potential deception against the benefits of added information. However, the study does make it clear that a policy that sharply limits advertising's role in bringing evolving health information to consumers may come at a high information cost, whatever its other effects.

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APPENDIX A

SUPPLEMENTARY REGRESSION RESULTS

TABLE A-1

Regression Results for MEALS Equation

	Dependent Variable: Meals Per Week			
Variable[1]	1985		1986	
Constant	13.318	(9.18)**	15.554	(10.30)**
Income	-.003	(-.39)	-.003	(-.36)
Grade	.116	(2.21)**	.140	(2.68)**
White	-.310	(-.90)	-.031	(-.09)
Work	-.682	(-2.80)**	-.156	(-.62)
Not Pregnant	-1.039	(-1.94)*	-1.547	(-2.70)**
Male Head	1.243	(4.38)**	.643	(2.20)**
Health	.980	(2.58)**	.215	(0.52)
Children	.392	(1.66)*	.705	(2.90)**
Welfare	-.158	(-.33)	-.843	(-1.57)
Age	.035	(2.69)**	.004	(0.33)
Nonsmoker	1.533	(6.60)**	1.457	(6.03)**
Vitamin Sup.	.328	(1.15)	.254	(0.91)
Stamp Value	.004	(1.10)	.007	(1.64)*
Meals Out	.099	(3.00)**	.102	(3.18)**
N	1364		1241	
R^2	.09		.09	
F	7.07**		6.13**	

DATA. USDA Continuing Survey of Food Intakes By Individuals, Women 19-50 Years, 1985 and 1986.

NOTES. t-statistics are in parentheses. * indicates significance at the 10 percent level. ** indicates significance at the 5 percent level. None of the coefficients on these variables are significant.

[1] Regression specification also controlled for region (Northeast, Midwest, South and West), and urbanization (City, Suburb and Rural) as described in equation (4-2). The coefficients on these variables were not significant.

TABLE A-2

Regression Results for Fiber From Cereal
(Simple MEALS Specification)

	Dependent Variable: Fiber(gm)/Cereal(10 gm)			
Variable[1]	1985		1986	
Constant	-3.031	(-3.77)**	-3.364	(-3.64)**
Income	-.001	(-.14)	.002	(0.63)
Grade	.043	(1.47)	.051	(1.58)
White	.690	(3.12)**	.407	(1.99)**
Work	-.070	(-0.54)	-.249	(-1.77)*
Not Pregnant	-.525	(-2.18)**	-.411	(-1.27)
Male Head	.249	(1.47)	.103	(0.57)
Health	-.217	(-1.00)	-.107	(-.43)
Children	-.130	(-1.10)	-.154	(-1.06)
Welfare	-.044	(0.14)	.077	(0.24)
Age	-.005	(-.73)	.002	(0.23)
Nonsmoker	.413	(3.04)**	.144	(0.99)
Vitamin Sup.	.356	(2.67)**	.008	(0.05)
Stamp Value	-.000	(-.17)	.000	(0.01)
Meals Out	-.069	(-3.59)**	-.051	(-2.45)**
Meals	.077	(4.39)**	.104	(4.81)**
Weekend	-.226	(-1.52)	-.322	(-2.04)**
N	1364		1241	
Log-Likelihood	-710.06		-688.96	
Restricted Log-Likelihood	-779.42		-735.35	

DATA. USDA Continuing Survey of Food Intakes By Individuals, Women 19-50 Years, 1985 and 1986.

NOTES. t-statistics are in parentheses. * indicates significance at the 10 percent level. ** indicates significance at the 5 percent level.

[1] Tobit regression specification also controlled for region (Northeast, Midwest, South and West), urbanization (City, Suburb and Rural), and whether the individual avoided grains in her diet. The coefficients on these variables were not significant.

APPENDIX B

EXAMPLES OF ADVERTISEMENTS

This appendix contains a few examples of advertisements for fiber cereals, which appeared after the Kellogg's fiber/cancer campaign that began in October 1984.[1] The panel from the Kellogg's All Bran package with the original National Cancer Institute information is presented on page B-1. The other advertisements illustrate direct health claims (B-1 through B-4 and B-8), indirect health claims (B-5 through B-7, B-9 and B-10), comparative sodium claims (B-5, B-9, B-10 and B-11), comparative sugar claims (B-3, B-4, B-5, B-9 through B-11), taste claims (B-2, B-3, B-4, B-6 and B-7), comparative fiber claims (B-2, B-3, B-4, B-6, B-10 and B-11), no preservatives claims (B-6) and comparative fat and protein claims (B-11).

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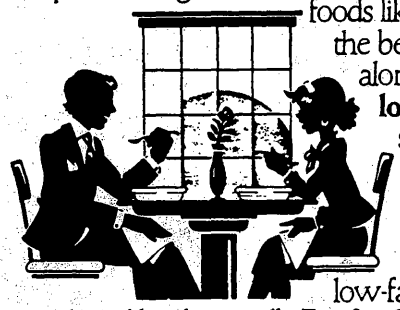
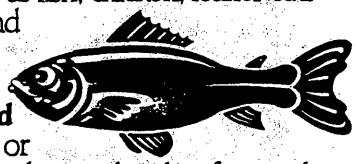
[1] For the Quaker advertisement on B-2, we retyped the National Cancer Institute message in the advertisement to allow for photocopying.

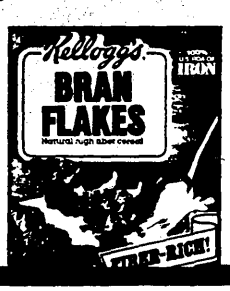
To your Health

PREVENTATIVE HEALTH TIPS FROM THE NATIONAL CANCER INSTITUTE

The National Cancer Institute believes eating the right foods may reduce your risk of some kinds of cancer. Here are their recommendations: **Eat high fiber foods.** A growing body of evidence says high fiber foods are important to good health. That's why a healthy diet includes high fiber foods like bran cereals. Bran cereals are one of the best sources of fiber, and can be served alone or mixed with other foods. **Eat foods low in fat.** Numerous studies associate some types of cancers to the high consumption of fats. Try to eat foods low in fat such as fish, chicken, leaner cuts of meat and use more low-fat dairy products like skim milk. **Eat fresh fruits and vegetables.** Especially good are dark green or yellow vegetables like broccoli, carrots and spinach. Also, fruits rich in Vitamin C, carotene or fiber such as oranges, cantaloupe and apples. **Eat a well-balanced diet and avoid being over or under weight.** For more healthy tips, write for the free "Cancer Prevention" booklet. Send a postcard to: The National Cancer Institute, P.O. Box K, Bethesda, Maryland 20814. Or dial 1-800-4-CANCER.







Fiber-Rich Bran Flakes

Kellogg's All Bran Box Panel --- 1985

Source: **FDA Consumer**, November 1987, page 23.

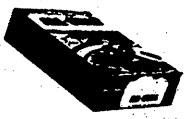
Quaker Corn Bran Ad --- Citing National Cancer Institute.

Source: **Reader's Digest**, November 1985

Fiber One® has more fiber than any other cereal.* Ounce for ounce we have 33% more fiber than even Kellogg's All-Bran. All that fiber's important because according to the National Cancer Institute, a diet high in fiber, low in fat, may reduce the risk of some kinds of cancer.

We made room for all that fiber by putting in less sugar. But the great taste is still there. So move over All-Bran. Only one has the most.

SORRY ALL-BRAN.



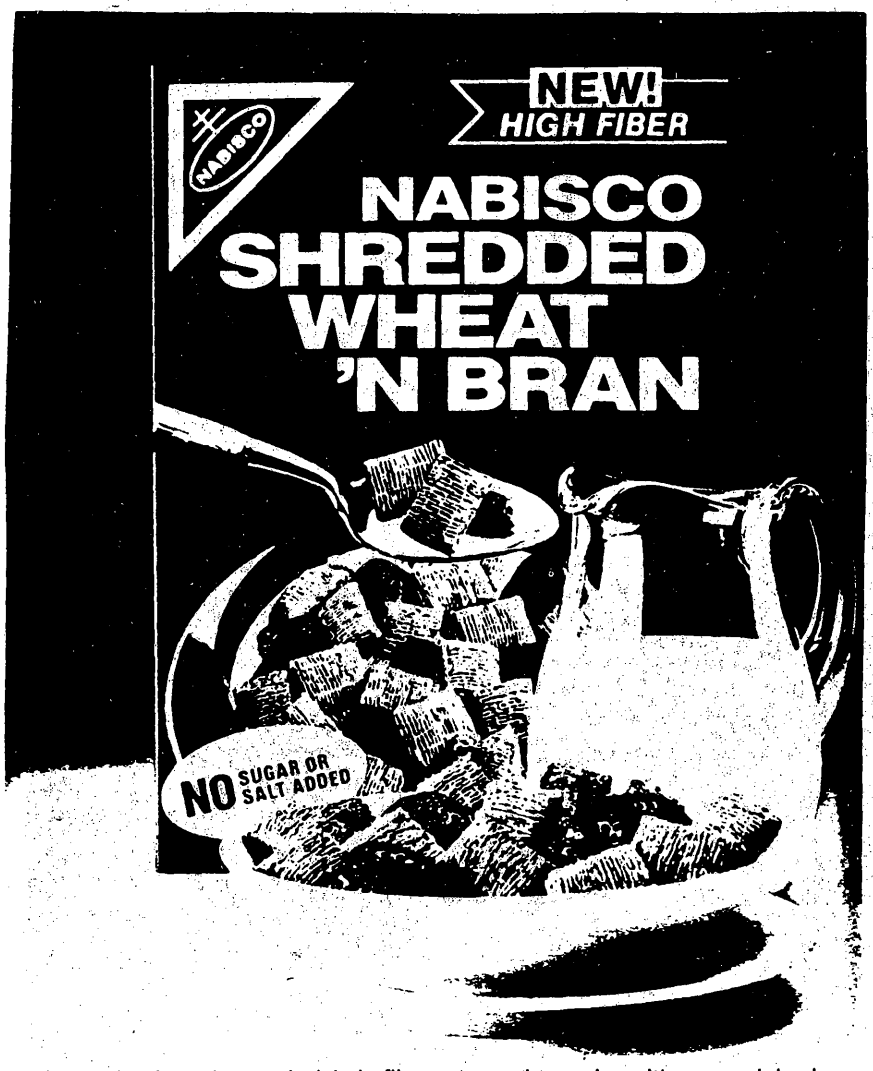
*National brands. Mills, Inc.

One Ad --- Citing National Cancer Institute and making comparative sugar claim.

Reader's Digest, December 1985

Fiber One Ad --- Health claim citing National Cancer Institute, with comparative sugar and fiber claims.

Source: **Reader's Digest**, August 1985



Introducing the only high fiber cereal made with no added sugar or salt. Just 100% crunchy whole wheat and bran.
If you're eating bran because it's good for you, why add sugar or salt?

Nabisco Shredded Wheat 'N Bran Ad --- "Good for you" fiber claim with comparative sugar and salt claims.

Source: **Reader's Digest, June 1986**

The best tasting bran flake has done more than just change its name.

Now it's highest in fiber and natural too. Introducing Post® Natural Bran Flakes.

Being the best tasting bran flake didn't stop us from trying to give you more.

Like more fiber. So now you can enjoy the highest fiber bran flake.

Plus more crunch. Because when we bake this whole grain goodness into every flake, our bran flakes are the crispiest.*

And since we add no preservatives, we wanted you to know we're natural just by looking at our box.

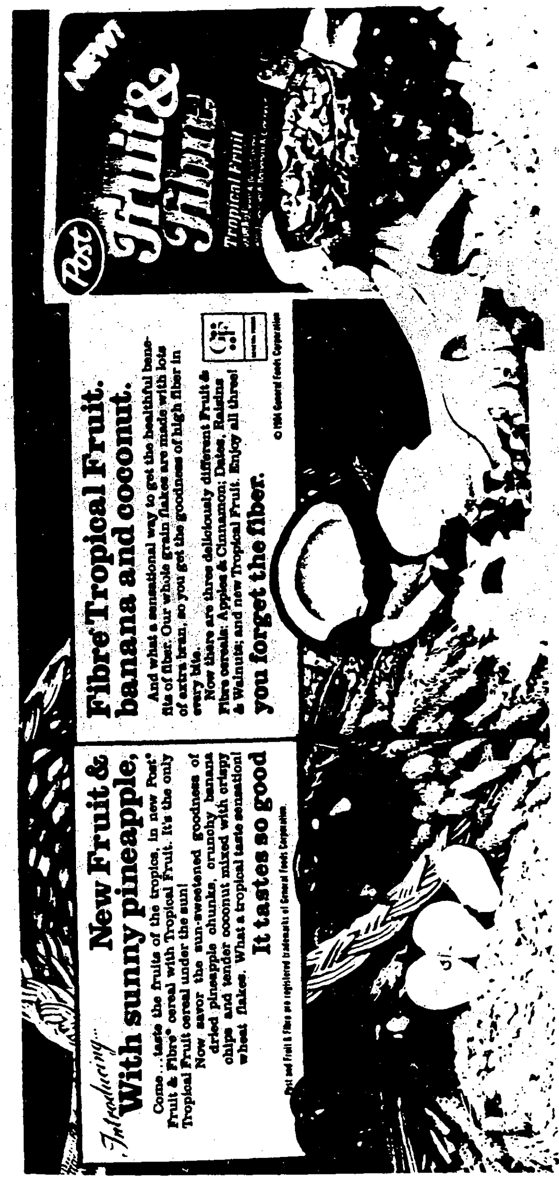
New Post® Natural Bran Flakes— now we're the best tasting, highest fiber bran flake.

GENERAL FOODS

*Tested against a leading brand.

Post Natural Bran Flake Ad --- "fiber for health" claim with comparative taste and preservative claims.

Source: **Reader's Digest**, October 1985



Post Fruit & Fiber Ad --- "healthful benefits of fiber" claim with focus on taste.

Source: **Reader's Digest**, March 1985

THIRTY PERCENT OF AMERICANS WILL DEVELOP SOME FORM OF CANCER IN THEIR LIFETIME.

Most people think cancer happens to "other people" but one look at the odds, and you'll know nobody can consider themselves immune. Cancer is the second leading cause of death in the U.S., and there's certainly no disease more feared. If we don't want to lose the war against cancer, we should start using an important weapon: diet.

ONE-THIRD OF ALL CANCER DEATHS MAY BE RELATED TO DIET.

If there's a link between some kinds of cancer and diet, then maybe it's time for a change. A healthy diet that may lower your risk of certain kinds of cancer is one that's low in fats and includes fiber from a number of sources, including a variety of fruits and vegetables, and whole-grain and bran cereal. Citrus fruits and vegetables from the cabbage family, such as broccoli and cauliflower, are thought to be particularly good. One very accessible source of fiber is whole-grain and bran cereal, an inexpensive and convenient way to fit fiber into your diet on a daily basis.

SIMPLE DIETARY GUIDELINES FROM THE NATIONAL CANCER INSTITUTE TO REDUCE YOUR RISK:

1. Reduce your intake of fats. Americans normally consume about 40% of their calories from fat. The recommended fat intake is 30% or less.

2. Include fruits, vegetables, whole-grain breads and cereals in your diet on a daily basis. Not only are they high in fiber, but consumption of foods that are high in vitamin C (found in citrus fruits), and vitamin A (in dark green and yellow vegetables) has been correlated with lower risk of some kinds of cancer.

3. If you drink alcoholic beverages, do so only in moderation. Excessive drinking has been linked to increased risk of cancer of the upper gastrointestinal tract.

START YOUR DAY WITH A HEALTHY BREAKFAST.

A low-fat, high-fiber breakfast like whole-grain or bran cereal, fruit, whole wheat toast and skim milk is a healthy start to your day, and may help remind you to eat right all day long. Besides, there's hardly any breakfast easier to fix, even on your busiest morning. When it comes to something as serious as reducing your risk of cancer, how can you say no to something as simple as eating a healthy diet starting with a good breakfast?

This message brought to you by Kellogg's, where a healthy breakfast starts.

For more information on diet and cancer prevention, including a special brochure on fiber and coupons for Kellogg's® cereals, write to: Kellogg's Healthy Life, P.O. Box 1989, Battle Creek, MI 49016-1989. And for more information, call the National Cancer Institute toll-free at 1-800-4-CANCER. (Please allow 60 days for delivery.)

Kellogg's

GET A TASTE FOR THE HEALTHY LIFE.

Kellogg's "Cancer" Ad, 1989 --- Health message with low fat and high fiber recommendations by the National Cancer Institute.

Source: New York Times Magazine, April 16, 1989

Script for 30 Second Nabisco TV advertisement

Voice Over: Hey, you're eating bran cereal because it's good for you, right? Well guess what's in it besides bran.

Sugar

Up to 22 added teaspoons a box.

Over a period of time, that can really add up.

And up.

But Nabisco Shredded Wheat 'n Bran is different.

It's the only leading high fiber cereal without ...

a grain of added sugar in it.

Or even salt.

Nabisco Shredded Wheat 'n Bran.

If you're eating bran because it's good for you, why add sugar and salt.

Nabisco Shredded Wheat 'n Bran TV Advertisement, September, 1986 --- Fiber "good for you" claim with comparative sugar and salt claims.

Script for 30 second "Lazy Susan" TV Ad

Audio: *These competitors' cereals have a lot of fiber. Fiber's good for you. But unfortunately, they also have added sugar and they're not low in sodium.*

Fiber One, however, is now low in sodium and has absolutely no added sugar. And no cereal has more fiber.

All of which makes Fiber One very good for you.

Fiber One. Get more of the fiber your body needs and less of the stuff it doesn't.

General Mills' Fiber One TV Ad, January 1988 --- Fiber "good for you" claim with comparative sugar and sodium claims.

Script for 30 second "59 Cereals" Ad

Voice Over:	*If you heard the report on 59 cold cereals by a leading consumer magazine you'd fall through the floor.*
MAN:	*Mine's high in calcium.*
V. O:	*And salt.*
MAN:	*Salt!*
3 PEOPLE (One speaks):	*High in fiber.*
V. O.:	*And sugar.*
3 PEOPLE:	*Sugar!*
4 People (One speaks):	*Lots of protein.*
V. O.:	*And added fat.*
GROUP:	*FAT!!!*
V. O.:	*Nabisco Shredded Wheat was rated tops in nutrition.*
	(SUPER: BASED ON FIBER, SODIUM, SUGAR, FAT AND PROTEIN CONTENT.)
V. O.:	*For no added sugar and salt. Low fat, plenty of fiber and protein. Nabisco Shredded Wheat -- nobody else.*
SINGERS:	*Nabisco.*

Nabisco Shredded Wheat TV Ad, April 1988 --- High fiber claim with comparative sodium, fat, sugar and protein claims.