Consumption of Reduced-Fat Peanut Butter

in Addition to the Consumption of Regular Peanut Butter

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Abstract:

A set of factors has been identified to affect consumption of reduced-fat peanut butter in addition to regular peanut butter. We found that consumption of reduced-fat peanut butter, which is an imperfect substitute for regular peanut butter, may expand total demand for peanut butter. Interestingly, for those who usually buy the same brand of peanut butter, their consumption of reduced-fat peanut butter is more likely in addition to consumption of regular peanut butter, implying promotion of a specific brand of reduced-fat peanut butter tend to increase total demand for the same brand of peanut butter.

Key Words: reduced-fat peanut butter, regular peanut butter.

I. Introduction

Peanut butter, known to be delicious and nutritious, has been a staple food in the United States for a long time. Apart from its intrinsic quality, use convenience also contributes substantially to the popularity of peanut butter. Open the jar and eat several spoonfuls of peanut butter, your hunger will be kept at bay for hours. Apply a spoonful of peanut butter to a piece of bread and you get a peanut butter sandwich, ready for breakfast or a lunch box. Being delicious, nutritious, and convenient to use, peanut butter has become so popular that nine out of ten people in the US consume it (Prepared Foods).

The popularity of peanut butter is likely to gain a significant momentum in the near future for the health benefits it offers. A recent study found that frequent and regular consumption of peanut butter can reduce heart disease and lower the probability of type II diabetics (Jiang et al.) Contrary to popular belief, it helps to reduce and keep off weight (Mcmanus, Antinoro, and Sacks.) Heart disease, diabetics, and obesity are common in developed countries today.

Peanut butter is rich in fat, especially unsaturated fat. Excessive intake of fat is listed among the six highest priority health problems related to food consumption (Joint Nutrition Monitoring Evaluation Committee). Although peanut butter contains mostly unsaturated fat, which is scientifically proven to be beneficial to health (Jiang et al; Mcmanus, Antinoro, and Sacks), some consumers have become so sensitive to fat that they want to avoid fat whenever they can. The tendency of modern consumers in developed countries to avoid fat may negatively affect demand for peanut butter. Recognizing the

effect of the fat-avoiding tendency, producers developed reduced-fat peanut butter to meet consumer demand for low fat food.

Apart from the change in fat level, reduced-fat peanut butter retains most of the nutritional contents such as protein and dietary fibre. However, the change in fat level may result in changes in other product attributes such as taste, which plays a key role in food consumption. This implies that reduced-fat peanut butter is an imperfect substitute for regular peanut butter, and an individual's consumption of reduced-fat peanut butter may or may not substantially affect his demand for regular peanut butter, depending on the level of his sensitivity to changes in fat level and in other product attributes such as taste and appearance. Currently, information lacks on how changes in fat level and the resulting changes in other attributes affects total market demand for peanut butter. This study identifies factors affecting the effect of consumption of reduced-fat peanut butter on market expansion, that is, in addition to the consumption of regular peanut butter. Insights gained from this study may help to better understand and fully exploit the market for peanut butter.

II. Econometric Model

Theoretically, whether a household's consumption of reduced-fat peanut butter is in addition to or in place of regular peanut butter depends on the solution to the household's utility maximization problem regarding consumption of the underlying good. The probability that a household's consumption of reduced-fat peanut butter is in addition to regular peanut butter equals the probability that the utility the household obtains from this consumption alternative is greater than or equal to the utility it attains from the other consumption alternative. Utility is unobservable, what we observe is the respondent's answer to the relevant question indicating whether or not the household's consumption of

reduced-fat peanut butter is in addition to consumption of regular peanut butter. The qualitative nature of the answer warrants the use of a qualitative response model. Further, regarding consumption of reduced-fat peanut butter in addition to consumption of regular peanut butter, the question is a dichotomous choice one because "in place of regular peanut butter" implies "not in addition to it" since only two alternatives were given in the survey. The binary choice nature of the dependant variable entails the use of a binary choice model and a binomial probit regression analysis is applied in this study. The probability that a household's consumption of reduced-fat peanut butter is in addition to its consumption of regular peanut butter can be expressed as:

$$prob(y_i = 1) = \Phi(a + b'x_i) \qquad (1)$$

where y_i is an indicator variable which is assigned a value of one if the ith household's consumption is in addition to regular peanut butter, zero otherwise; $\Phi(.)$ is the cumulative distribution function (cdf) of the standard normal distribution; x is a vector of explanatory variables and b is a vector of parameters to be estimated; a is the coefficient on a constant variable. The probability that the household's consumption is not in addition to regular peanut butter is given by $1 - prob(y_i = 1)$.

The parameters a and b in (1) are frequently estimated using the maximum likelihood method. The log-likelihood function can be expressed as:

$$\ln L = \sum_{i=1}^{N} \{y_i \ln \Phi(a + bx_i) + (1 - y_i) \ln[1 - \Phi(a + bx_i)]\} \qquad (2)$$

where N is the total number of observations of the sample.

III. Data and Empirical Model

The data used in this study are from a nationwide telephone survey, conducted in 1997 by the Gallup Corporation, of US household peanut consumption. The survey was primarily designed to obtain information on consumption of peanuts in three forms, peanut butter, in-shell peanuts, and snack peanuts. The survey instrument was designed by a group of agricultural economists and survey experts. Following a pilot test of the survey instrument, telephone interviews were conducted with 991 respondents regarding peanut butter consumption. The sample was selected using the random digit dialing method.

Information about the effects of consumption of reduced-fat peanut butter on total consumption of peanut butter was obtained using a dichotomous choice question. Respondents were asked, if they were going to purchase reduced-fat peanut butter, whether the purchases were in addition to or in place of consumption of regular peanut butter. In order to reduce the possibility of misunderstanding the question, respondents were requested to repeat the whole sentence of their choice rather than just give either a "yes" or a "no" answer. About 30% of them indicated their purchases would be in addition to regular peanut butter, implying consumption of reduced-fat peanut butter may substantially expend the market for peanut butter.

Consumer perception about the overall quality of a good is known to affect the consumption of the good. Information was obtained on consumer overall perception about reduced-fat peanut butter relative to regular peanut butter. About 62% considered reduced-fat peanut butter to be as good as or better than regular peanut butter, indicating a favorable attitude toward the product.

Consumer concerns about fat intake may affect their food consumption behavior. Two multiple choice questions were included in the survey to obtain information on consumer consideration of fat in food purchase and their perceptions about fat level of regular peanut butter. More than 55% of the respondents usually take fat level into consideration when they purchase food, 61% consider peanut butter to be rich in fat, and more than 38% both usually take fat level into consideration and think peanut butter is rich in fat.

Information was also obtained on purchase behavior regarding product brand. The results show that the majority of consumers are brand loyal in peanut butter consumption. About 64% of the respondents usually buy the same brand when they purchase peanut butter, 22% buy the brand on sale, and only 14% tend to try different brands.

A probit model is specified to explore factors affecting consumption of reduced-fat peanut butter in addition to regular peanut butter. Table 1 presents definitions and means of the explanatory variables. Age is included in the model to capture the possible effect of age on consumer demand for dietary fat in food consumption. Peanut butter is known to be a favorite food of children and a child usually needs more fat than an adult, hence, the presence of children in the household is assumed to be a factor affecting consumption of reduced-fat peanut butter in addition to regular peanut butter. Marriage status is included to account for a spouse's consumption behavior regarding reduced-fat peanut butter. Education level is taken into consideration because it may reflect consumers' knowledge about health effects of fat intake. Level of physical exercise, considered to be a good indicator of a respondent's perception of the importance of health, is assumed to be an important factor affecting food consumption and is included as an explanatory variable. In addition to these demographic factors,

consumer perception about reduced-fat peanut butter relative to regular peanut butter, their purchasing

behavior regarding product brand, and several nutritional factors are also considered to be influencing

factors. A dummy is assigned to those who consider reduced-fat peanut butter to be as good as or

better than regular peanut butter and a dummy is assigned to those who think that regular peanut butter

is better. Respondents who are uncertain about their attitudes are used as a benchmark. Those usually

taking fat level into consideration in food purchase and believing that peanut butter is rich in fat are

assigned a dummy variable. So are those who usually take protein into consideration in food

consumption and think peanut butter is rich in protein. The effect of consumer overall perception of the

nutritional value is accounted for by assigning a dummy to those who consider peanut butter nutritious.

Price is one of the important factors affecting food consumption and the effect of perceived price level

is captured by assigning a dummy variable to those who think peanut butter is expensive relative to

sandwich meats and other spreads. As for purchase behavior regarding product brand, we assign a

dummy to those who usually buy the same brand in peanut butter purchase.

IV. Results

The model was estimated using the maximum likelihood method and the estimation results are

presented in Table 2. Regarding the discussion of the results, one point should be made clear first. In

the survey, respondents were asked whether their purchases of reduced-fat peanut butter would be in

addition to or in place of regular peanut butter if they were going to make such a purchase. The

assumptive nature of the clause in the question implies that this study is not dealing with actual

consumption of reduced-fat peanut butter. However, if an adult member of a household intends to

purchase reduced-fat peanut butter, the purchase is usually intended for the consumption of the

household. Thus, instead of using awkward phrases such as "a respondent's intended purchase" or "a household's intended consumption," we sometimes use the word "consumption," which is not to be confused with actual consumption.

Consistent with our expectation, age is found to be inversely related to the probability that consumption of reduced-fat peanut butter is in addition to regular peanut butter. Generally, as people age, their health conditions decline and they are more likely to suffer from fat-intake related diseases, such as diabetics and coronary heart disease, and they usually become more sensitive to the negative health effects of fat. Hence, their consumption of reduced-fat peanut butter is more likely in place of regular peanut butter so that they can reduce fat intake while keep the intake of other beneficial nutrients from peanut butter. Even their purchases might not be intended for themselves but for their families, they are likely to take their own tastes, preferences, and nutritional needs into consideration when making purchase decisions. Although some recent studies (Jiang et al.) have reported that consumption of peanut butter actually reduce risk of diabetics and heart disease, it is unlikely that the respondents in the survey had such information then because the survey was conducted before these studies.

Education level is also found to be inversely related to the probability that consumption of reduced-fat peanut butter is in addition to consumption of regular peanut butter. We find it difficult to provide a convincing explanation for the education effect. More educated people are generally more knowledgeable about the health effect of various kinds of nutrients. One may argue that more educated people, being more aware of the health risks related to fat, tend to consume reduced-fat peanut butter as a substitute for regular peanut butter to reduce fat intake. However, the fat contained in peanut

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butter is mostly unsaturated fat, which has been proved to be beneficial to health if its intake is not excessive. If consumers' education has a positive effect on their nutrition and health knowledge, more educated consumers should be more likely aware of the fact that the fat in peanut butter is mostly beneficial unsaturated fat.

The results show that the consumption of reduce-fat peanut butter of a household with a non-adult family member is more likely to be in addition to its consumption of regular peanut butter. A non-adult generally needs a higher fat intake than an adult. It could be that when a household with a non-adult member makes food consumption decision, it makes sure that the fat demand of the non-adult member is met, hence, it is less likely that the household's consumption of reduced-fat peanut butter would substantially reduce consumption of regular peanut butter.

It is indicated that, if a consumer usually takes fat into consideration in food purchase and considers peanut butter rich in fat, then, his consumption of reduced-fat peanut butter is less likely in addition to regular peanut butter. It could be that those considering peanut butter rich in fat did not take into account the fact that peanut butter is rich in beneficial unsaturated fat, but not saturated fat. Failing to distinguish between saturated and unsaturated fat, they may tend to think that the rich fat in peanut butter may negatively affect their health. Since reduced-fat peanut butter retains most of the nutrition contents except fat, they may consume it as a substitute for regular peanut butter in order to cut fat intake.

The results indicate that, if a consumer thinks that regular peanut butter is better than reduced-fat peanut butter, then, his purchase of reduced-fat peanut butter is likely to be in addition to regular peanut butter. Regular peanut butter is usually considered to be more tasteful than reduced-fat peanut

butter. It could be that he values highly the good taste of regular peanut butter while recognizes that reduced-fat peanut butter is just as nutritious but less fatty. He may want to keep enjoying the good taste of regular peanut butter while obtaining, through consumption of reduced-fat peanut butter, more nutrition without significantly increasing fat intake. On the other hand, if a consumer considers reduced-fat peanut butter to be as good as or better than regular peanut butter, his consumption is less likely in addition to consumption of regular peanut butter.

It is found that, if a consumer usually buys the same brand when purchasing peanut butter, his purchase of reduced-fat peanut butter is more likely to be in addition to the purchase of regular peanut butter. Brand loyalty usually means consumer satisfaction with a brand. If a consumer is satisfied with a specific brand of regular peanut butter, then, his purchase of reduced-fat peanut butter is less likely as a substitute for the regular one. The effect of brand loyalty implies that, for a specific brand, promotion of reduced-fat peanut butter tend to increase total market demand for the same brand.

If a respondent is married, then his purchase of reduced-fat peanut butter is more likely to be in addition to regular peanut butter. The marriage status effect may be due to a respondent's consideration for his spouse's taste and preference regarding peanut butter consumption. Even if a respondent does not intend to consume reduced-fat peanut butter in addition to his consumption of regular peanut butter, his spouse may do so.

The purchase of those who frequently engage in sports or physical activities are less likely in addition to regular peanut butter. People who do physical exercises regularly and frequently may put greater importance on a good health. It could be that, as food consumers, they tend to pay greater attention to nutrient intake, such as limiting fat intake, to maintain a good health. Hence, when they

purchase reduced-fat peanut butter, it is more likely that their purchases are substitutes for regular peanut butter so that they can reduce fat intake.

As expected, those who consider peanut butter nutritious tend to purchase reduced-fat peanut butter in addition to regular peanut butter. We also expect the purchases of those who usually pay attention to protein content in food purchase and consider peanut butter rich in protein to be more likely in addition to regular peanut butter. But protein consideration is not found to have a statistically significant impact. The results indicate that if a consumer considers peanut butter to be expensive relative to sandwich meats and other spreads, then, his purchase of reduced-fat peanut butter is more likely to be in addition to regular peanut butter.

V. Concluding Remarks

Apart from a lower level of fat and resulting changes in taste and appearance, reduced-fat peanut butter retains most of the nutrition values of regular peanut butter. As an imperfect but close substitute, reduced-fat peanut butter can either be consumed in addition to or in place of regular peanut butter. Given the size of the market for peanut butter in the United States, information on the effect of consumption of reduced-fat peanut butter on total market demand for peanut butter is valuable, especially to peanut butter producers and retailers.

The results of this study indicate that consumption of reduced-fat peanut butter may substantially expand the market for peanut butter. A set of factors is identified to be important determinants of consumption of reduced-fat peanut butter in addition to regular peanut butter, including several demographic factors, consumer perception of the product attributes of the underlying good, and purchasing behavior. Among these factors, consumer fat consideration and brand loyalty are of special

interest. The negative effect of fat consideration implies that the market for peanut butter can be expanded by dispelling consumers' concern about fat in peanut butter through information dissemination, telling them fat in peanut butter is mostly beneficial unsaturated fat. The positive effect of brand loyalty indicates producers of a specific brand of peanut butter can increase its demand by promoting reduced-fat peanut butter of the brand.

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Table 1. Description and means of the explanatory variables.

Variable	Description	Means
Child	= 1 if the household has at least one member 17 years old or younger, 0 otherwise.	0.3683
Married	= 1 if the respondent is married, 0 otherwise.	0.5378
Age	= 1 if the respondent's age is between 17 and 25, = 2 if the respondent's age is between 24 and 35, = 3 if the respondent's age is between 34 and 45, = 4 if the respondent's age is between 44 and 55, = 5 if the respondent's age is between 54 and 65, = 6 if the respondent's age is 65 or older.	3.6599
Midedu	= 1 if the respondent has some college education or vocational training, 0 otherwise.	0.2634
Hiedu	= 1 if the respondent has a college degree or postgraduate degree, 0 otherwise.	0.3189
Sporty	= 1 if the respondent engages in physical exercises four times or more in a week, 0 otherwise.	0.1645
Lowinc	= 1 if the household income is $35,000 or less, 0 otherwise.	0.4419
Highinc	= 1 if the household income is $55,000 or more, 0 otherwise.	0.1958
Fat	= 1 if the respondent frequently takes fat into consideration in food purchase and considers peanut butter rich in fat, 0 otherwise.	0.3835
Protein	= 1 if the respondent frequently takes protein into consideration in food purchase and considers peanut butter rich in protein, 0 otherwise.	0.2462
Expensive	= 1 if the respondent thinks peanut butter is expensive, 0 otherwise.	0.0747
Nutritious	= 1 if the respondent thinks peanut butter is nutritious, 0 otherwise.	0.7694
Asgood	= 1 if the respondent thinks reduced-fat peanut butter is as good as or better than regular peanut butter, 0 otherwise.	0.62
Worse	= 1 if the respondent thinks reduced-fat peanut butter is worse than regular peanut butter, 0 otherwise.	0.34
Samebrand	= 1 if the respondent usually buys the same brand of peanut butter, 0 otherwise.	0.6347

Table 2. Maximum likelihood estimates from a probit model of consumption of reduced-fat peanut butter in addition to regular peanut butter.

Variable	Coefficient	t-value
Constant	-0.5059	-2.24**
Child	0.2814	2.70***
Married	0.2191	2.26**
Age	-0.0526	-1.63
Midedu	-0.2642	-2.37**
Hiedu	-0.4183	-3.66***
Sporty	-0.2618	-2.02**
Lowinc	0.0390	0.37
Highinc	0.1287	1.01
Fat	-0.3583	-3.72***
Protein	0.1252	1.19
Expensive	0.2716	1.69*
Nutritious	0.2231	2.18**
Asgood	-0.3532	-3.38***
Worse	0.4818	4.08***
Samebrand	0.1615	1.74*
McFadden R^2	0.0992	
Observations	991	

Note: * denotes significant at 0.1 level, ** denotes significant at 0.05 level, *** denotes significant at 0.01 level.