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The Impact of Food Product Characteristics on Consumer Purchasing Behavior: The Case of Frankfurters

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Consumers purchase different foods with differing characteristics. These reasons undoubtedly extend beyond prices to include taste, convenience, and the presence or absence of nutrients. Mandatory food product labeling now provides information on nutrients in food products. However, survey data indicates that consumers value taste more highly than nutrition when they purchase food, at least for some food products. This study employs hedonic price analysis to demonstrate that consumers value taste more than nutrition when they purchase frankfurters.

Consumers purchase different foods with different characteristics for different reasons. These reasons undoubtedly include the taste and the convenience of food products. The presence or absence of particular nutrients is another important factor. This study evaluates consumer preferences for taste, convenience, and nutritional content of frankfurters.

Mandatory nutrition labeling of food products provides consumers with information on levels of particular nutrients. A 1996 Food Marketing Institute study indicates that nearly 60 percent of consumers use food product nutrition labels in their purchasing decisions. The same study also indicates that 60 percent of consumers consider taste more important than nutrition information for these decisions, at least for some food products.

This study tests the hypothesis that consumers place a higher value on the taste of frankfurters than on their nutritional content. Franks and packaged meats usually contain significant quantities of nutrients (i.e., saturated fat) that have been associated with health problems. A better understanding of the influence of these characteristics on consumer purchasing preferences may result in more effective product development and labeling policies. The results of the study suggest consumers place a higher value on the taste of frankfurters than on their nutrient content.

This analysis contrasts with most hedonic studies since the market-based methodology em-

ployed here uses the estimated consumer values of characteristics to make inferences about the taste, nutrition, and convenience of frankfurters. Stanley and Tschirhart (1991) have applied a similar methodology to breakfast cereals.

This study uses supermarket scanner data in concert with published nutrient information to estimate consumers' value of characteristics. The market-based approach incorporates notions of budget constraints and product substitution that are often lacking in consumer surveys. Scanner data provides representative data for all consumers. This approach overcomes the problems of statistical inference from case studies and provides information on individual food items rather than broad food categories. Not only can the market-based methodology be applied to specific food products, but the estimated values of characteristics provide inference to the population of consumers in the marketplace.

Methodology

More than a half century ago, Waugh (1928,1929) estimated implicit prices for product attributes. He estimated the value of product characteristics on the Boston wholesale produce market and concluded that "there is a distinct tendency for market prices of many commodities to vary with certain physical characteristics which the consumer identifies with quality, and the relation of these characteristics to prices may in many cases be fairly accurately determined by statistical analysis."

Court coined the term 'hedonic analysis' in a 1939 study of price-quality changes over time for automobiles. The term hedonic was taken from hedonistic thinking, that is, seeking the greatest happiness for the community as a whole (Berndt, 1991). Court defined hedonic price comparisons as "those which recognize the potential contribution of any commodity, a motor car in this case, to the welfare and happiness of its purchasers and the community."

Lancaster (1966) developed a model of the demand for characteristics. In the model, consumers obtain positive utility from the characteristics contained in goods. Modern hedonic analysis draws heavily on Lancaster's work.

Ladd and Zober (1977) introduced the idea that goods with different characteristics provide consumers with services such as taste, convenience, and nutrition. The various characteristics contained in these products contribute to these services. Ladd and Zober's utility function is a composite function of services, in which services depend on the characteristics of goods. Their model provides an estimate of the implicit price of product characteristics.

Hedonic Model

The model used in this analysis is based on the hedonic price function proposed by Ladd and Zober (1977). Parameters of the price function provide a composite net marginal implicit price of characteristics based on the characteristics' contribution to the various consumption services.

In this analysis, frankfurters provide consumers with a number of services, s , from which they derive utility. They also obtain utility from other goods, X , which is modeled as a single composite commodity. Their utility function may be written as: (s_1, \dots, s_m, X) .

Each service also depends on a vector of n characteristics, $[z_1, \dots, z_n]$. The effect of each characteristic can contribute positively or negatively to individual consumption services. Taste, nutrition, and convenience are assumed to be the relevant consumption services provided by frankfurters.

Maximization of this utility function subject to the consumer's budget constraint yields marginal implicit prices for the characteristics of

frankfurters. Inferences can be made about the composite effects of taste, convenience, and nutrition based on the signs of the parameters in the hedonic price function.

Model Specification

The economic model is expressed as a single hedonic price equation in which the price per serving for frankfurters depends on the summation of the marginal yields of eight characteristics multiplied by their respective marginal implicit prices. The individual products are called marginal money values and the sum of these values equal the product price.

In this study, frankfurters provide consumers with nutrition (N), taste (T), and convenience (C) services. While the interpretation of taste and convenience services are straightforward, the nutrition service requires some explanation. While the nutrition service could be interpreted as the level of nutrient(s) provided, it can also refer to the service of providing nutrients in levels that conform to established dietary guidelines for healthy eating.

In this analysis, eight frankfurter characteristics contribute to the nutrition, taste, and convenience services. The number of servings per package (SERV) contributes to convenience and total fat (FAT) contributes to the nutrition and taste services (Table 1). The remaining characteristics reflect whether the product is: a beef frank (BEEF); a chicken or turkey frank (POUL); a Kosher frank (KOSH); a cheese frank (CHEESE); a jumbo frank (JUMBO); or, a bun-length frank (BLGTH). The eight characteristics chosen in the study reflect the selection of frankfurters on the market today. While consumers derive positive marginal utility from nutrition, taste, and convenience, a given characteristic can contribute positively or negatively to each service.

Three of the eight characteristics included in the model contribute only to the convenience service. The number of servings per package (SERV) is considered to contribute positively to convenience, as are jumbo franks (JUMBO), and bun-length franks (BLGTH). In the model, the SERV, JUMBO, and BLGTH characteristics contribute neither to taste nor to nutrition services.

Table 1. Definitions of Characteristics and Services

Characteristic	Description	Relationship of characteristics to services ¹
SERV	Servings per package	C(+)
FAT	Grams of fat per serving	N(-), T(+)
BEEF	1 if labeled as beef franks	N(-), T(+)
POUL	1 if labeled as chicken or turkey franks	N(+), T(-)
KOSH	1 if labeled as Kosher franks	N(-), T(+), C(+)
CHEESE	1 if labeled as cheese franks	N(-), T(+), C(+)
JUMBO	1 if labeled as jumbo franks	C(+)
BLGTH	1 if labeled as bun length franks	C(+)

¹Services: N = nutrition; T = taste; C = convenience.

Five of the eight characteristics contribute both to taste (T) and to the nutrition (N) services. Table 1 suggests that the higher the fat content of frankfurters, the better they taste. On the other hand, the higher fat content detracts from the nutritional service of frankfurters. Beef type franks (BEEF) contribute positively to taste and negatively to nutrition since beef franks usually contain relatively higher fat content than other types of franks. Poultry franks (POUL) contain slightly lower fat content than other beef and meat franks but are less palatable to consumers. Thus, the poultry characteristic contributes negatively to taste and positively to nutrition. Kosher franks are relatively high in fat, so (KOSH) contributes positively to taste and negatively to nutrition. Also, because the Kosher frank is processed specifically for Jewish consumption, it is expected to contribute positively to convenience. Finally, cheese franks (CHEESE) are expected to taste better than other franks and, because they contain relatively higher levels of fat, are expected to contribute negatively to the nutrition service. The relationship between each of the eight characteristics and the three services are summarized in column 3 of Table 1.

Saturated fat, cholesterol, and sodium were excluded from the model since they are highly correlated with total fat. Like most hedonic studies, near collinear variables are excluded to prevent problems estimating the parameters of the price function. One could also argue that these variables are technically irrelevant since they are measures for the same technical relationship represented by the total fat variable. Vitamin content was also omitted since frankfurters contain small

contributions to recommended daily allowances of primary vitamins. Excluding vitamin content is probably not a serious omission since vitamin content of frankfurters is relatively constant across frankfurter items.

The information on characteristics of frankfurters can be summarized in a hedonic price function. The price function is expressed as a single equation where price is a function of the selected product characteristics. The parameters of the price function are marginal implicit prices of the characteristics. Given an implicit price of each characteristic, and information on the contribution of each characteristic to each service, one can evaluate the importance of each service provided by a given product.

In this study, the price of frankfurters can be expressed as a linear function of the eight characteristics listed in column 1 of Table 1. The linear functional form is based on two assumptions. Characteristics are assumed to be present in frankfurters in constant proportions no matter what quantity is consumed. The second assumption assumes that the subjective marginal rate of substitution of income for a characteristic is constant (Eastwood, et. al., 1986).

Given the information in Table 1 and parameters (implicit prices) for each characteristic, one can interpret the signs on the parameter estimates as an indicator of the combined effect of characteristics and services on utility. For example, Table 1 suggests that FAT contributes positively to taste and negatively to nutrition. A positive sign on fat would indicate that taste dominates nutrition since the positive contribution to the taste service is larger than the negative contri-

bution to nutrition. Other implicit prices are evaluated in a similar manner.

Data and Estimation Procedures

Ordinary least squares (OLS) is used to estimate the parameters of the economic model. The signs on the parameters will indicate the composite effect of the characteristics on services and consumer utility.

The price variable is constructed from supermarket scanner data. Annual average prices are computed using 1994 dollar sales divided by quantity sold during the year. Annual average price eliminates seasonality and gives annual price data representing a universe of transaction prices based on a national sample of supermarkets with greater than \$2 million of sales. Price per serving is computed by dividing the package price by the number of servings per package. Items used in this analysis represent 1994 sales of frankfurters sold in at least 50 percent of stores across the country. Nutrient data is obtained from published sources (Bellerson, 1993; Natow and Heslin, 1995; Netzer, 1994; Chicago Center for Clinical Research, 1996; Ulene, 1995). Nutritional information is based on nutrients per serving.

Results

The parameter values and the signs associated with each characteristic provide useful information with respect to the dominance of the services and consumer preference for the individual characteristics. The coefficients are in cents per serving since the dependent variable is expressed in cents per serving. The parameters can be directly interpreted as marginal implicit prices since the linear functional form is used. Implicit prices (coefficients) and their signs demonstrate consumer preference for the characteristics and the signs on the coefficients reflect the dominance of the services. The sign on FAT will indicate whether consumers value taste more than nutrition when they purchase frankfurters. Insignificant coefficients indicate that consumers either do not have enough information to incorporate the characteristics into their purchasing decision or they place no value on these characteristic when they purchase frankfurters.

Table 2 provides estimated coefficients and their associated standard errors for the specified frankfurter characteristics. The intercept term is significant and gives a price level of 25.1 cents per serving. The coefficient on total fat (FAT) is positive and significant. The positive sign indicates that consumers place a positive value on fat content in frankfurters. The taste component (service) of higher fat franks dominates the nutrition component, where high fat is considered unhealthy. The marginal implicit price is .67 cents per serving. This means that consumers are willing to pay .67 cents for an additional gram of fat in each hot dog. Taste clearly dominates nutrition in this case.

Table 2. Coefficients (implicit prices) and Standard Errors

	Coefficients	Standard Errors
Constant	25.10*	3.68
SERV	-0.63*	0.16
FAT	0.67*	0.18
BEEF	5.79**	3.07
POUL	-6.64**	3.45
KOSH	16.37*	4.27
CHEESE	-0.91	6.86
JUMBO	4.65	6.47
BLGTH	-0.34	3.14
R-Square = .82		

* $p < .05$

** $p < .10$

The coefficient for servings per package (SERV) is negative and significant. The implicit price is .63 cents. This result means that consumers discount each additional serving in a package of frankfurters by .63 cents. This result differs from the hypothesized result. However, consumers pay less for larger package sizes. The economies involved with purchasing larger package sizes apparently outweighs the associated inconvenience of storing larger package sizes.

The beef variable (BEEF) is positive and significant. The results indicate that consumers place a premium of 5.79 cents on a serving of beef frankfurters relative to meat franks. Based on the parameter sign, taste dominates nutrition. Consumers favor the better taste of beef franks compared to meat franks. The coefficient of poultry franks (POUL) was negative and signifi-

cant. Consumers discount poultry franks relative to meat frankfurters. Chicken and turkey franks were grouped into one category since the sample contained too few observations on chicken franks to estimate a variable representing chicken franks alone. The results probably reflect the value of turkey franks. The implicit price indicates that consumers discount poultry franks by 6.64 cents per serving relative to meat franks. The negative sign indicates that nutrition dominates the taste service.

The coefficient for kosher franks (KOSH) was also positive and significant. The marginal implicit price was 16.4 cents per serving. Consumers, including both Jewish consumers and non-Jewish consumers are willing to pay a positive price for the kosher characteristic. The taste and convenience services dominate the nutrition service in this case. The relative magnitudes of the taste and convenience services are indeterminate.

The coefficients on the non-dietary, convenience characteristics including the addition of cheese (CHEESE), jumbo size (JUMBO), and bun length franks (BLGTH) were insignificant. The result suggests that either consumers do not have significant information to evaluate these characteristics or they are not a factor in the consumer purchasing decision. The latter explanation is more plausible since package labeling should provide adequate information on these characteristics.

Conclusions

The theoretical framework presented in this study provides a means of evaluating the effects of services contained in food products on consumer purchasing behavior. The framework also provides a technique for looking at the implicit values of product attributes.

The results suggest that consumers are not being totally guided by nutritional concerns when they purchase a package of frankfurters—at least pertaining to reductions of fat in the diet. However, the 1994 market had fewer low-fat alternatives with taste and textures which could compete with contemporary higher fat meat and beef frankfurters. Chicken franks, using less costly mechanically deboned chicken, were also rela-

tively high in fat plus less tasty than regular frankfurters. However, poultry frankfurters, as defined here, were almost exclusively turkey franks made from turkey meat. Fat-free, red meat franks were introduced in January, 1995. Further research is needed to determine whether consumer perceptions concerning the taste of lower or no-fat products has changed.

The hedonic methodology proved useful as a tool for analyzing price variation for frankfurters and as a mechanism for examining consumer preferences of product attributes. This method could be used in future studies which seek to evaluate the value placed on product attributes and how taste, nutrition, and other services contribute to consumer purchasing behavior.

Similar models could be developed for other food products. Comparison with the findings in this paper would provide information about whether consumers demonstrate consistent consumption behavior across other food products. Pooled cross-section/time series models or structural comparisons of cross-section models taken at different points in time could also be used to analyze changes in the value of characteristics and their demand over time. These results could be used to evaluate whether consumer preferences change over time.

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