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# Incorporating Food Attributes in the Demand for Food: A Cross-Section Study of Oyster Consumption 

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#### Abstract

This study examines the relationship between consumer's product attribute perceptions, especially food safety perceptions, and long-term consumption of oysters. Statistical analysis of consumer survey data shows that attribute perceptions are significantly associated with both market participation and level of consumption decisions. Yet, safety perception had a negligible behavioral impact.


Incorporating Food Attributes in the Demand for Food: A Cross-Section Study of Oyster Consumption

Generally speaking, there are two ways that characteristics of a good such as quality can be incorporated in microeconomic demand analysis. One is the household production approach as exemplified by Lancaster. In this approach, it is assumed that the household obtains utility from some underlying goods, i.e., attributes or characteristics of the market goods. It is also assumed that "the characteristics possessed by a good or a combination of goods are the same for all consumers" (Lancaster, p. 134). An alternative approach, the repackaging model, introduces characteristic parameters into the budget constraint (Houthakker; Theil). The market price of a good becomes a function of the measured or observed characteristics (e.g., quality) of a good.

It is evident from these demand models that product characteristics or attributes are often treated as universal to all consumers. Yet, another body of literature suggests that perceptions of goods are one of the important criteria of purchase decisions and that product attributes may not be identical and homogeneous to different individuals. Bayton points out that perceptions are the intervening variable between stimuli (e.g., the attributes of a good) and behavior and one of the sources of differences in observed individual economic behavior. Assael suggests that perceptions of attributes may directly affect purchases of products which are considered to be relatively unimportant and similar. According to $\mathrm{O}^{\prime}$ Shaughnessy, a consumer does not purchase a good partly because (s)he has no desire for the good. But desire is only a necessary but not sufficient reason for buying. Beliefs and economic considerations also influence the realization of a desire (i.e., actual purchase action).

Psychological research suggests that observed heterogeneity of a risk-related behavior can arise from different perceptions of the risk related to the behavior. Actual or objective risk does not necessarily trigger behavioral responses from an individual if (s)he does not consider or interpret the danger as a significant risk (Cunningham; Slovic et al.).

Thus, the existing literature leads us to the contention that consumer's perceptions of product attributes may have important and systematic influences on consumer demand. Yet perceptions are rarely examined in demand studies. Because consumption is a personal choice decision, it is necessary to incorporate individuals' views of the choice object in the explanation of consumer behavior.

This paper investigates individual long-term oyster consumption behavior with the consideration of individual perceptions of the food's attributes. Previous qualitative studies of shellfish consumption indicate that perceptions of shellfish attributes and purchase behavior toward shellfish vary between
consumers (Sanchez and Konopa; National Fish and Seafood Promotional Council; Food Marketing Institute; Lin et al.). Health risks from eating shellfish, particularly oysters, have been cited as a serious impediment to growth in seafood consumption (Becker; Manges). The U.S. Food and Drug Administration estimates that molluscan shellfish are 83 to 122 times more likely to cause illness than chicken on a pound for pound consumed basis. Given that oysters are not a frequent purchase (Fisheries Council of Canada) and individual consumption level varies widely, attribute perceptions of oysters may help explain the observed individual demand for oysters. The primary hypothesis investigated in this paper is that consumption of oysters is influenced by consumer's perceptions of oysters' attributes. The secondary hypothesis relates to safety perceptions only: consumption of oysters is positively related to perceived safety of the food.

## Theoretical Model

Several assumptions about consumer behavior of an established food product ${ }^{1}$ are made in this paper. First, individual purchase decisions are made in a multiattribute context. Second, many attributes of a food are not fully observable by the buyers. Third, consumer choice of the established product (in contrast to a new product) is mostly a routinized response behavior. Fourth, the product costs a small fraction of the total consumer budget. Most consumers are unlikely to become involved in extensive product information search and processing. Fifth, a consumer's purchase decision of such a product is partially related to the perceptions of product attributes formed prior to purchase. Sixth, preferences for the food are weakly separable from that of all other goods in an individual's feasible consumption set. $r$

An individual's s consumption decision can be considered as a constrained optimization problem: $\operatorname{Max} U=U(x(K), Z)$
x
s. t. $\mathrm{px}=\mathrm{m}$ and $\mathrm{x} \geq 0$,
where $U=$ a well-defined sub-utility function for the food; $x=$ the food examined; $p=$ market price of $x, K$ is a vector of perceived attributes associated with the food, $\left(k_{1}, k_{2}, \ldots, k_{j}, \ldots, k_{\mathrm{a}}\right) ; Z=a$ vector of individual demographic characteristics; and $m=$ income. The relationship between the sub-utility function and perceived attributes is such that $\partial U / \partial k_{j}=(\partial U / \partial x)\left(\partial x / \partial k_{j}\right)>0$; or, by the

[^0]nonsatiation axiom of preferences $(\partial U / \partial x>0), \partial x / \partial k_{j}>0$, for all $j$ 's. The optimal consumption level, $\mathrm{x}^{*}(\mathrm{~K}, \mathrm{~m}, \mathrm{p}, \mathrm{Z})$, is then obtained by solving the constrained maximization problem.

The optimal consumption $x^{*}$ can be put in a behavioral framework (Figure 1) that decouples the observed market participation ( $\mathrm{x}^{*}>0$ or $\mathrm{x}^{*}=0$ ) and level of use (the measured size of $\mathrm{x}^{*}$ ) decisions. An individual does not participate in a product market because 1) (s)he is not disposed to consider using the product; or 2) product perceptions, product availability, price of the product or income inhibits her/him from entering the market though (s)he is inclined to buy the good. For an individual who possesses strong enough disposition and is not inhibited, his/her consumption level is conditional on perceptual and economic factors. If market price of the food is held constant, these considerations can be incorporated in the demand for the product as

$$
\begin{array}{rll}
x^{*}=g(K, m, Z \mid p) & >0 & \text { iff } q>q^{*} \text { and } s>s^{*}  \tag{2}\\
& =0 & \text { if } q \leq q^{*}, \text { or } q>q^{*} \text { and } s \leq s^{*}
\end{array}
$$

where g is a demand function; q is an index that determines a person's potential to consume the product; $q^{*}$ is a threshold of the potential; $s=a n$ index that determines the realization of consumption potential; $\mathrm{s}^{*}=$ threshold of the realization. The $\mathrm{q}, \mathrm{q}^{*}, \mathrm{~s}$, and $\mathrm{s}^{*}$ are unobservable and influenced by K , $m$ and $Z$. But the observed $x^{*}$ reflects the outcomes of whether both of the thresholds ( $\mathrm{q}^{*}$ and $\mathrm{s}^{*}$ ) have been exceeded.

## Data Collection

To empirically examine the relationship between perceptions and behavior based on the empirical model, data from a random digit telephone survey of adults ( 18 years or older) in the Southeastern and Mid-Atlantic states were used. ${ }^{2}$ The states were chosen on the belief that oysters harvested from this region were marketed within the region. The sampling frame was stratified to provide proportional representation for urban and rural population within each state. To obtain insights into the two behavioral decisions, market participation and level of consumption, the sampling frame included both users and nonusers of oysters.

The survey was conducted by a private market research firm in January and between April and June of 1990. The interviews typically lasted $10-15$ minutes. The scope and framing of questions in the survey were based on focus group interviews during the summer and fall of 1989 (Lin et al.) and a series

[^1]of pretests. A total of 1094 completed interviews were obtained. After observations with missing values were dropped, the usable sample size was 616.

The survey identified individual consumption of oysters, perceptions of oysters ' attributes (taste, freshness, nutritional value, cost, and safety), and demographic backgrounds. Consumption was elicited in terms of the average monthly frequency that oysters were eaten in a two-month recall period. ${ }^{3}$ A 1-to-7 rating scale using a semantic differential method provided measures of perceptions. All demographic characteristics were recorded categorically. Descriptive statistics of the usable sample are shown in Table 1. Most ( $68 \%$ ) respondents did not eat any oysters during the recall period. Less than $10 \%$ ate the food more than once a month. The diversity of how respondents perceived oysters is apparent in the frequency distribution of each attribute rating. For example, almost $25 \%$ of the respondents thought oysters had "excellent" taste while $22 \%$ of them gave the attribute the lowest rating ("terrible" taste).

## Empirical Specification and Statistical Method

Empirically, the relationship between an individual's demand for oysters and its determinants was specified as a two-stage process, and represented in the two equations below:

$$
\begin{align*}
& \mathrm{E}\left(\mathrm{Y}_{1}\right)=\mathrm{b}_{10}+\mathrm{b}_{11} \text { TASTE }+\mathrm{b}_{12} \text { NUTRITION }+\mathrm{b}_{13} \text { FRESH }+\mathrm{b}_{14} \text { COST }+\mathrm{b}_{15} \text { SAFE }+  \tag{3}\\
& b_{16} \text { INCOME }+b_{17} \text { EDUCATION }+b_{18} \text { AGE }+b_{19} \text { INLAND }+b_{110} \text { EXPOSURE }+ \\
& b_{111} \text { RELIGION }+b_{112} \text { CHILD }+b_{113} R A C E+b_{114} S E X+b_{115} S M S A \\
& \mathrm{E}\left(\mathrm{Y}_{2}\right)=\mathrm{b}_{20}+\mathrm{b}_{21} \text { TASTE }+\mathrm{b}_{2} \text { NUTRITION }+\mathrm{b}_{2} \text { FRESH }+b_{24} \text { COST }+\mathrm{b}_{25} \text { SAFE }+  \tag{4}\\
& \mathrm{b}_{26} \text { INCOME }+\mathrm{b}_{21} \text { EDUCATION }+\mathrm{b}_{23} \text { AGE }+\mathrm{b}_{29} \text { INLAND }+\mathrm{b}_{210} \text { EXPOSURE }+ \\
& b_{211} \text { RELIGION }+b_{212} \text { CHILD }+b_{213} \text { RACE }+b_{214} \text { SEX }+b_{215} \text { SMSA }
\end{align*}
$$

where

| $\mathrm{Y}_{1}$ | $=$the outcome of the market participation decision <br> recall period, positive if oysters were consumed $)$ |
| :--- | :--- |
| $\mathrm{Y}_{2}$ | $=$ if oysters were not eaten in the |
| TASTE | $=$ perception of taste $(1=$ terrible taste, $7=$ excellent taste $)$ |
| NUTRITION | $=$ perception of nutritional value $(1=$ lowest, $7=$ highest $)$ |
| FRESH | $=$ perception of freshness $(1=$ lowest, $7=$ highest $)$ |
| COST | $=$ perception of cost $(1=$ very inexpensive, $7=$ very expensive $)$ |

[^2]| SAFE | perception of safety ( $1=$ not safe at all, $7=$ perfectly safe) |
| :---: | :---: |
| INCOME |  |
| EDUCATION | education level ( $1=$ grade school, $2=$ some high school, $3=$ high school graduate, $4=$ some college, $5=$ college graduate, $6=$ post graduate) |
| AGE | $=1$ if $18-34$ years, 2 if $35-64$ years, 3 if over 65 years |
| INLAND | $=1$ if residence is more than 100 miles from the nearest coast, 0 otherwise |
| EXPOSURE | $=1$ if someone in the household ate oysters when a consumer was growing up, 0 |
| RELIGION | $=1$ if Jewish, 0 otherwise |
| CHILD | $=1$ if there are children under 12 in the household, 0 otherwise |
| RACE | $=1$ if white, 0 otherwise |
| SEX | $=1$ if male, 0 otherwise |
| SMSA | $=$ population size of the market area in which a consumer lives $(1=$ nonmetropolitan, $2=$ less than $100,000,3=100,000-249,999,4=250,000-499,999$, $5=500,000-999,999,6=1,000,000-2,499,999,7=$ more than $2,500,000$ ). |

Ali perception and demographic factors were assumed to influence both participation and frequency decisions because no information on the decomposition of consumption decision at productspecific level was available. The five product attributes were selected based on previous studies of seafood and shellfish consumption. ${ }^{4}$ Taste and nutritional value have been mentioned in many seafood consumption studies to contribute positively to seafood purchases (Lin et al.; Better Homes and Garden in Otwell; Sanchez and Konopa). In Food Marketing Institute and Lin et al., it was noted that consumers demañed assurances of seafood freshness because seafood was perceived more perishable than other meat products. The perception of cost measures the degree of costliness of oysters in a consumer's mind, rather than the market price of oysters. In Food Marketing Institute's focus group study, some individuals expressed fear and serious concern about food-borne illness from fish and "this has a definite impact on consumer's fish consumption behavior" (p. 13). But, Lin et al. found that safety considerations did not appear to be a widespread inhibitor of oyster consumption, especially for users who had not been ill or heard about safety problems with oysters.

[^3]Income, as a consumption constraining factor, is expected to influence both the likelihood to consume and the frequency of consumption. Past studies do not suggest a definite impact of education (Cheng and Capps; Keithly). Yet product usage may vary between different life styles which are partially related to a person's education (Assael). Sanchez and Konopa found that age is a major determinant that distinguishes regular from irregular users of most shellfish products.

A consumer who lives more than 100 miles from the nearest coast may have less familiarity with and access to seafood. (Note: the distance of 100 miles was chosen out of convenience.) People are less likely to purchase seafood products if they have not been exposed to the products when they were growing up or their religious affiliation such as Judaism discourages shellfish consumption (Food Marketing Institute; Moskowitz; National Fish and Seafood Promotional Council). The presence of young children in a household has been shown to reduce at-home oyster consumption (Cheng and Capps; Fisheries Council of Canada). Consumers of different races have also exhibited different athome seafood purchase patterns with nonwhites eating more oysters (Cheng and Capps). Finally, the larger the market area in which a consumer resides, the more likely oysters are marketed and available in local food outlets.

Given that consumption frequency is a count variable ( $0,1,2, \ldots$ ) and truncated at zero, and considering the behavioral framework, a count hurdle model developed by Mullahy was selected for empirical analysis. This model is similar to Cragg's variant of the Tobit model, in which the relative probabilities of zero and non-zero realizations of the dependent variable can differ. A binomial probability model governs the binary outcome of whether the count variable has a zero or a positive realization. If the realization is positive, the conditional distribution of the positives is governed by a truncated-at-zero count data model. A geometric distribution of counts was deemed an appropriate data generating process. As shown in Mullahy, the model can be estimated by maximizing the likelihood function

$$
\begin{align*}
\mathrm{L}= & \prod_{i \in \Omega_{0}}\left\{1 /\left[1+\exp \left(\mathrm{X}_{11} \prime^{\prime} \beta_{1}\right)\right]\right\} \cdot \prod_{\mathrm{i} \in \Omega_{+}}\left\{\exp \left(\mathrm{X}_{1 i^{\prime}} \beta_{1}\right) /\left[1+\exp \left(\mathrm{X}_{1 \mathrm{i}} \beta_{1}\right)\right]\right\}  \tag{5}\\
& \cdot \prod_{\mathrm{i} \in \Omega_{+}}\left\{\exp \left[\left(\mathrm{y}_{\mathrm{i}}-1\right) \mathrm{X}_{2 \mathrm{i}^{\prime}} \beta_{2}\right] /\left\{\left[1+\exp \left(\mathrm{X}_{2 \mathrm{i}} \cdot \beta_{2}\right)\right]\right\}{ }^{\mathrm{y}_{\mathrm{i}}}\right\}
\end{align*}
$$

where $\Omega_{0}=\{0\}, \Omega_{+}=\{1,2, \ldots\} ; \mathrm{X}_{1 \mathrm{i}}$ and $\mathrm{X}_{2 \mathrm{i}}$ are the vectors of independent variables that determine the probability of observing zero and positive counts for the ith observation, respectively; $\beta_{1}$ and $\beta_{2}$ are the associated parameters; and $y_{i}$ is the frequency count for the ith observation.

Results
The primary hypothesis in this paper is that consumption of oysters is influenced by consumer's perceptions of oysters' attributes. The null hypothesis states that product perceptions are not relevant to the observed consumption of oysters and was constructed by imposing the parameter restrictions that $b_{11}=b_{12}=b_{13}=b_{14}=b_{15}=0$ in Equation 3 and $b_{21}=b_{22}=b_{23}=b_{24}=b_{25}=0$ in Equation 4. The alternative hypothesis is represented by Equations 3 and 4, the unrestricted or full model, where all attribute perceptions are allowed to freely influence observed consumption. A likelihood ratio test between the restricted and unrestricted models yields a test statistic of 122.69 , which is larger than the critical Chi-square value at 10 degrees of freedom and 0.01 level of significance. Therefore, the null hypothesis was rejected. Variations of individual consumer's consumption of oysters were influenced by the subset of perceptual variables representing the five perceived attributes of oysters.

Maximum likelihood estimates using the count data hurdle model are reported in Table 2. The first and second columns of the table show the estimated coefficients for the unrestricted model, associated with the market participation and frequency decisions, respectively. The third and fourth columns show the corresponding estimates for the restricted model. However, the following inferences are based on the unrestricted model only. Estimation results for the market participation decision will be reported first and followed by that of the frequency decision.

## Market Participation

The independent variable that we are interested in is perceived safety - whether there is a positive relationship between the perception of this attribute and consumption behavior. Although the estimate for safety perception is positive, it is only 0.97 times its standard error and not statistically significant. Therefore, the probability of eating oysters was not related to the image of oyster safety in consumers' minds. This result is not surprising since $61 \%$ of the survey respondents gave a neutral rating to this attribute (i.e., 3,4 , and 5 on the $1-7$ scale) and the rating distribution is relatively symmetrical.

Among the other perception variables, taste of oysters had the strongest influence on market participation. The coefficient is positive and statistically significant. This result is consistent with a priori expectations that the better taste consumers perceive in oysters the more likely they consume the product. Coefficients for freshness and cost also exhibit the expected signs. However, their influences are relatively weak in terms of statistical significance. As to nutritional value, the associated coefficient has a negative sign that contradicts observations from qualitative studies.

The remaining variables represent the demographic profile of an individual. As shown in the first column of Table 2, education level exerted the strongest influence on market participation. The positive sign suggests that oyster consumers were more highly educated. The positive income coefficient conforms with the notion that income is a constraint on the likelihood of consuming oysters. However, the effect is not statistically significant. None of the other demographic variables significantly influenced the market participation decision.

## Frequency

Coefficient estimates for the determinants of consumption frequency are listed in the second column of Table 2. Safety perception had a positive effect on the average monthly consumption frequency. Yet, the estimated coefficient is only 1.35 times its standard error. This result suggests that consumption frequency had a rather weak relationship with consumers' perceptions of oyster safety.

All other perceptual variables exerted strong impact on the frequency decision. Estimates for taste and cost parameters have the expected signs and are statistically significant. This finding is consistent with available evidence from qualitative studies of seafood consumption in that better taste and cost images of a product help motivate more regular use of the product. The estimates also indicate that, as expected, consumption frequency and perceptions of oysters' freshness and nutritional value move in the same direction. The better the perceptions of these two attributes, the more often oysters were eaten. Compared to taste and cost, the influences of freshness and nutritional value are less statistically significant.

The only demographic variable that exerted some significant effect on the frequency decision is an individual's gender. The coefficient has a positive sign and is 1.61 times its standard error.

## Conclusion and Implications

In general, the empirical results show that individual's oyster consumption was affected systematically by their perceptions of oysters ' characteristics. Taste, nutritional value, freshness and cost perceptions influenced market participation or frequency of use decision or both. On the other hand, safety perceptions did not appear to be associated with discernible variations in oyster consumption.

The distinctive feature of this study is the explicit incorporation of consumers ' subjective beliefs of food attributes in the analysis of observed demand for the food. The results from the conventional model (the restricted model) and this alternative model (the unrestricted model) are quite different. The former examines only demographic characteristics of consumers while the latter considers both demographic and perceptual factors that may influence consumer demand. A comparison between the
statistical results of the two models indicates many of the demographic variables that were significant in the restricted model lost their behavioral relevance when product attribute perceptions were included in the unrestricted model.

This study suggests that the common practice of assuming attributes of market goods are homogeneous to all consumers is inadequate. It can cause a specification error since relevant behavioral determinants are omitted. If consumption variations are indeed affected by perception differences, then it is necessary to develop a more complete behavioral model. Empirical analyses of such a model will require data on individual consumer's subjective perceptions.

In so far as many marketing decisions are made with inputs from economic analysis, this study also has practical implications. For example, a promotional scheme based on the conventional model would target various demographic segments in the marketplace to increase the frequency of oyster consumption. Yet, demographic differences are hardly relevant to consumption frequency when product images are taken into account. Therefore, the promotion may be more successful if more attention was devoted to improving the images of oyster products.


Figure 1. A Consumer Behavior Framework

Table 1. Characteristics of the Sample

| Variable | No. | \% | Variable | No. | \% |
| :---: | :---: | :---: | :---: | :---: | :---: |
| CONSUMPTION FREQUENCY ${ }^{\text {a }}$ |  |  | INCOME |  |  |
| Nonuser | 419 | 68.0 | $1=<\$ 20,000$ | 115 | 18.7 |
| Once or less a month | 141 | 22.9 | $2=\$ 20,000-\$ 35,000$ | 153 | 24.8 |
| More than once | 56 | 9.1 | $3=\$ 35,000-\$ 50,000$ | 187 | 30.4 |
|  |  |  | $4=>\$ 50,000$ | 161 | 26.1 |
| TASTE 26.1 |  |  |  |  |  |
| 1 = Terrible | 134 | 21.8 | EDUCATION |  |  |
| 2 | 30 | 4.9 | 1 = Grade School | 17 | 2.8 |
| 3 | 47 | 7.6 | $2=$ Some High School | 60 | 9.7 |
| 4 | 64 | 10.4 | 3 = High School Grad | 182 | 29.6 |
| 5 | 116 | 18.8 | 4 = Some College | 165 | 26.8 |
| 6 | 76 | 12.3 | $5=$ College Grad. | 128 | 20.8 |
| 7 = Excellent | 149 | 24.2 | 6 = Post-Graduate . | 64 | 10.4 |
| NUTRITION |  |  | AGE |  |  |
| 1 = Lowest | 44 | 7.1 | $1=18-34$ years | 237 | 38.5 |
| 2 | 50 | 8.1 | $2=35-64$ years | 298 | 48.4 |
| 3 | 79 | 12.8 | 3 = over 65 years | 81 | 13.1 |
| 4 | 102 | 16.6 | 3 over 65 jears |  |  |
| 5 | 167 | 27.1 | INLAND |  |  |
| 6 | 84 | 13.6 | $1=\mathrm{Yes}$ | 390 | 63.3 |
| 7 = Highest | 90 | 14.6 | $0=\mathrm{No}$ | 226 | 36.7 |
| FRESH |  |  | EXPOSURE |  |  |
| 1 = Lowest | 32 | 5.2 | 1 - Yes | 450 | 73.0 |
| 2 | 27 | 4.4 | 0 = No | 166 | 27.0 |
| 3 | 52 | 8.4 |  |  |  |
| 4 | 99 | 16.1 | RELIGION |  |  |
| 5 | 137 | 22.2 | 1 = Jewish | 10 | 1.6 |
| 6 | 100 | 16.2 | 0 - Other groups | 606 | 98.4 |
| 7 = Highest | 169 | 27.4 | O |  |  |
|  |  |  | CHILD |  |  |
| COST |  |  | $1=$ Yes | 207 | 33.6 |
| 1 = Very inexpensive | 6 | 1.0 | $0=\mathrm{No}$ | 409 | 66.4 |
| 2 边 | 5 | 0.9 |  |  |  |
| 3 | 18 | 2.9 | RACE |  |  |
| 4 | 49 | 8.0 | $1=$ White | 495 | 80.4 |
| 5 | 136 | 22.1 | $0=$ Nonwhite | 121 | 19.6 |
| 6 | 151 | 24.5 |  |  |  |
| 7 = Very expensive | 251 | 40.8 | SEX |  |  |
|  |  |  | $1=\mathrm{Male}$ | 256 | 41.6 |
| SAFETY |  |  | $0=$ Female | 360 | 58.4 |
| $1=$ Not safe at all | 49 | 7.8 |  |  |  |
| 2 | 54 | 8.8 | SMSA ${ }^{\text {b }}$ |  |  |
| 3 | 112 | 18.2 | 1 = Non-Metropolitan | 182 | 29.6 |
| 4 | 140 | 22.7 | $2=<100,000$ | 4 | 0.7 |
| 5 | 129 | 20.9 | $3=100,000-249,999$ | 82 | 13.3 |
| 6 | 73 | 11.9 | $4=250,000-499,999$ | 45 | 7.3 |
| 7 = Perfectly safe | 59 | 9.6 | $5=500,000-999,999$ | 82 | 13.3 |
|  |  |  | $6=1 \mathrm{M} .-2.5 \mathrm{M}$. | 87 | 14.1 |
|  |  |  | $7=>2,500,000$ | 134 | 21.8 |

Note:
a - The category "once or less" includes once per month, once or twice every 6 months, once or twice per year, and only once during the recall period. The highest count is 15 times per month (one respondent).
b - SMSA was classified according to the estimated population as of July 1, 1987 and listed in Statistical Abstract of the United States (1989).

Table 2. Maximum Likelihood Estimates of Unrestricted and Restricted Oyster Participation and Frequency Equations ( $\mathrm{N}=616$ )

| Variable | Coefficient |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  | With Perceptions |  | Without Perceptions |  |
|  | Part. | Freq. | Part. | Freq. |
| Intercept | $\begin{aligned} & -2.98 \\ & (0.78)^{a} \end{aligned}$ | $\begin{aligned} & -2.18 \\ & (1.17) \end{aligned}$ | $\begin{aligned} & -2.35 \\ & (0.55) \end{aligned}$ | $\begin{gathered} 0.86 \\ (0.75) \end{gathered}$ |
| TASTE | $\begin{aligned} & 0.39 \star \star \\ & (0.05) \end{aligned}$ | $\begin{gathered} 0.26 \\ (0.12) \end{gathered}$ | (0.55) | (0.75) |
| NUTRITION | $\begin{aligned} & -0.11 \\ & (0.07) \end{aligned}$ | $\begin{gathered} 0.20 \\ (0.11) \end{gathered}$ | - | - |
| FRESH | $\begin{aligned} & 0.11 \\ & (0.06) \end{aligned}$ | $\begin{gathered} 0.22 \\ (0.12) \end{gathered}$ | - | - |
| COST | $\begin{aligned} & -0.10 \\ & (0.08) \end{aligned}$ | $\begin{aligned} & -0.34 \\ & (0.11) \end{aligned}$ | - | - |
| SAFE | $\begin{gathered} 0.06 \\ (0.07) \end{gathered}$ | $\begin{gathered} 0.16 \\ (0.12) \end{gathered}$ | - | $\bigcirc$ |
| INCOME | $\begin{gathered} 0.10 \\ (0.10) \end{gathered}$ | $\begin{aligned} & -0.15 \\ & (0.15) \end{aligned}$ | $\begin{gathered} 0.11 \\ (0.10) \end{gathered}$ | $\begin{gathered} 0.04 \\ (0.15) \end{gathered}$ |
| EDUCATION | $\begin{aligned} & 0.24 \\ & (0.09) \end{aligned}$ | $\begin{aligned} & -0.07 \\ & (0.14) \end{aligned}$ | $\begin{aligned} & 0.23 \\ & (0.08) \end{aligned}$ | $\begin{aligned} & -0.19 \\ & (0.11) \end{aligned}$ |
| AGE | $\begin{aligned} & -0.16 \\ & (0.16) \end{aligned}$ | $\begin{aligned} & -0.28 \\ & (0.25) \end{aligned}$ | $\begin{gathered} 0.11 \\ (0.14) \end{gathered}$ | $\begin{aligned} & -0.25 \\ & (0.20) \end{aligned}$ |
| INLAND | $\begin{aligned} & -0.26 \\ & (0.20) \end{aligned}$ | $\begin{gathered} 0.30 \\ (0.32) \end{gathered}$ | $\begin{aligned} & -0.31 \\ & (0.19) \end{aligned}$ | $\begin{gathered} 0.32 \\ (0.25) \end{gathered}$ |
| EXPOSURE | $\begin{aligned} & -0.02 \\ & (0.23) \end{aligned}$ | $\begin{gathered} 0.19 \\ (0.33) \end{gathered}$ | $\begin{aligned} & 0.36 \\ & (0.21) \end{aligned}$ | $\begin{gathered} 0.14 \\ (0.29) \end{gathered}$ |
| RELIGION | $\begin{aligned} & -0.17 \\ & (0.62) \end{aligned}$ | $\begin{gathered} 0.11 \\ (0.68) \end{gathered}$ | $\begin{gathered} 0.10 \\ (0.21) \end{gathered}$ | $\begin{aligned} & -0.30 \\ & (0.29) \end{aligned}$ |
| CHILD | $\begin{aligned} & -0.32 \\ & (0.22) \end{aligned}$ | $\begin{gathered} 0.33 \\ (0.32) \end{gathered}$ | $\begin{aligned} & -0.31 \\ & (0.20) \end{aligned}$ | $\begin{gathered} 0.21 \\ (0.27) \end{gathered}$ |
| RACE | $\begin{gathered} 0.23 \\ 0.23 \\ (0.27) \end{gathered}$ | $\begin{aligned} & -0.55 \\ & (0.39) \end{aligned}$ | $\begin{gathered} 0.16 \\ (0.24) \end{gathered}$ | $\begin{aligned} & -0.71 \\ & (0.30) \end{aligned}$ |
| SEX | $\begin{gathered} 0.11 \\ (0.20) \end{gathered}$ | $\begin{gathered} 0.51 \\ (0.31) \end{gathered}$ | $\begin{aligned} & 0.31 \\ & (0.18) \end{aligned}$ | $\begin{gathered} 0.48 \\ (0.25) \end{gathered}$ |
| SMSA | $\begin{aligned} & -0.04 \\ & (0.04) \end{aligned}$ | $\begin{gathered} 0.04 \\ (0.07) \end{gathered}$ | $\begin{aligned} & -0.03 \\ & (0.04) \end{aligned}$ | $\begin{gathered} 0.01 \\ (0.05) \end{gathered}$ |
| $\begin{aligned} & -\log L \\ & -\log L \text { (Slopes } \end{aligned}$ |  | $\begin{aligned} & 533.05 \\ & 620.01 \end{aligned}$ |  | $\begin{aligned} & 593.21 \\ & 620.01 \end{aligned}$ |
| McFadden's $\mathrm{R}^{2}$ |  | $0.14{ }^{\text {b }}$ |  | $0.04{ }^{\text {b }}$ |

Note:
a - Number in parentheses is heteroscadesticity-adjusted asymptotic standard error. The adjustment procedure followed White.
b - Calculated as 1 - $\log \mathrm{L} / \log \mathrm{L}($ Slopes $=0)$.
** - The coefficient is significant at the 0.05 level.

*     - The coefficient is significant at the 0.10 level.


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[^0]:    ${ }^{1}$ An established product is loosely defined here as an existing product in the marketplace of which many consumers are likely to have acquired some level of knowledge.

[^1]:    ${ }^{2}$ These states were Delaware, Maryland, Virginia, North and South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas.

[^2]:    ${ }^{3}$ Distinctions in product form (raw, cooked, fresh, frozen, and so on) and where the consumption occurred (at-home or away-from-home) were not considered in the survey because health hazards associated with oysters can take place in all product forms and all places of consumption.

[^3]:    ${ }^{4}$ Most of the a priori expectations about how perceived attributes affect seafood consumption were based on focus group studies. By nature, these studies are not representative of any population and should be taken as suggestive rather than conclusive or statistically significant.

