Factors Affecting the Probability of Consuming Fish and Shellfish in the Away from Home and at Home Markets

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Abstract

Models are developed to measure the effect of socioeconomic factors on the probability of consuming fish and shellfish in both the away from home and at home markets. Factors that significantly affect the likelihood of eating fish and shellfish at home include: urbanization, region, race, ethnicity, age, diet status and income. On the other hand, region, employment, diet status, household size, age and income significantly affect the likelihood of eating fish and shellfish away from home.

Key Words: consumption, fish and shellfish, food at home, food away from home

Introduction

Fish consumption has increased by about 50 percent on a per capita basis in the United States (U.S.) since World War II (National Oceanic and Atmospheric Administration). Fish consumption has also increased since the mid 1960s, except during the latter 1970s to early 1980s (figure 1). Per capita fish consumption peaked in 1987 at 16.2 pounds due to among others, reported healthful attributes of seafood relative to red meats and due to the highly publicized advice to "eat seafood twice a week" (Lees). Per capita fish consumption, however, has been lower since the beginning of 1988. This downward trend coincided with increasing concern among consumers about seafood borne illnesses, numerous incidents of water and beach pollution along the coasts, and the Exxon-Valdez oil spill (Edwards).

A comparison of the annual expenditures of meat products used at home between 1977\78 and 1987\88 is presented in figure 2 using the estimates from Lutz et al.. As shown, annual expenditures for beef, pork, and veal have declined between 1977\78 and 1987\88. Annual expenditure for lamb, mutton, and goat has also decreased during the same time period. Annual expenditure for poultry products, however, has increased from 60.45 in 1977\78 to 71.41 in 1987\88 in 1988 dollars. Fish annual expenditure, on the other hand, has been relatively unchanged between 1977\78 and 1987\88.

The away from home food market represents an important market for fish products. In fact, away from home outlets account for more than half of total seafood consumption (Miller). For example, catfish sandwiches are now being test-marketed in fast food outlets like McDonald's (Harvey). The changing sociodemographic and economic structure of the U.S. population as well as changes in consumer lifestyles have contributed to the increased popularity of food away from home (FAFH) (Nayga and Capps, 1992)[1]. Some factors that come to mind are: a growing number of women in the work force; the increasing importance of

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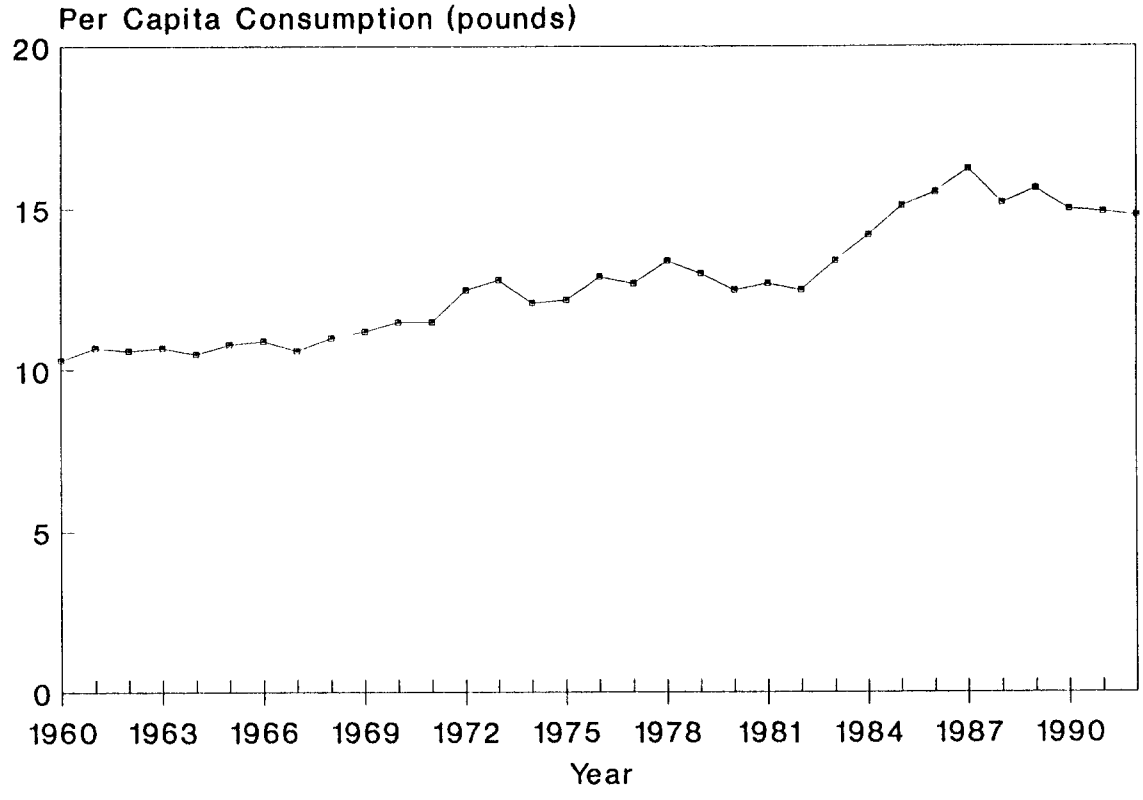
Figure 1. U.S. Annual Per Capita Consumption of Fish and Shellfish, 1960-1992



Source: National Oceanic and Atmospheric Administration

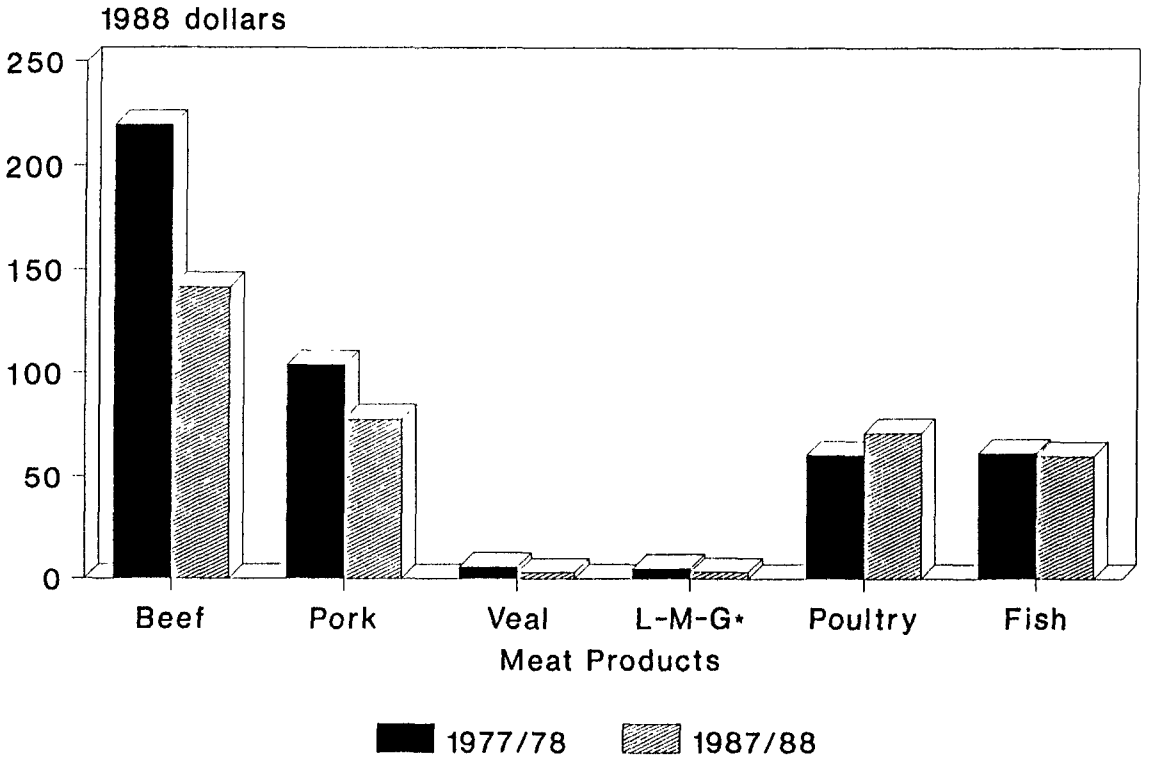
convenience in eating out; more families living on two incomes; and the impact of advertising and promotion by large food service chains (Putnam and Van Dress). Moreover, married couples with children are declining as a share of all households. The one-adult households are growing the most quickly, and are likely to exhibit non-conventional food consumption patterns (i.e. FAFH consumption). It is, therefore, important to know consumption patterns not just in the food at home (FAH) market but in the FAFH market as well.

In recent years, the sociodemographic and economic structure of the U.S. population has changed dramatically. In particular, changes have occurred in the composition and size of the household, the number of households with multiple wage earners, per capita income, age distribution of the population, the location of residence, and social mix of the population (McCracken). These changes in the sociodemographic and economic structure of the U.S. population will continue to have important implications and impacts on the marketing system and on the demand for food products.

A number of studies relating to fish consumption have been conducted in the past (Nash and Bell; Purcell and Raunikar; Capps; Perry; Pippin and Morrison; Keithly; Hu; Dellenbarger et al. 1988, 1992; Cheng and Capps; McGee et al.; Israel et al.). Most of these studies centered their analyses on the effect of socio-demographic factors on the consumption of fish products. With the exception of the study done by Dellenbarger et al. (1992), none of these studies have analyzed consumption of fish and shellfish products in both the away from home and at home markets. In addition, the Dellenberger et al. (1992) study limited their analysis on catfish consumption.

Simply put, little is known about the demographic and socio-economic characteristics of individuals in the U.S. who have eaten fish and shellfish either in the away from home market or

Figure 2. Average Annual Expenditure, per 21-meal equivalent person of Meat Products Used at Home, 1977/78-1987/88



*Lamb, Mutton, and Goat
Source: Lutz et al.

the at home market. This research, therefore, builds on previous work and attempts to identify the socioeconomic characteristics of individuals in the U.S. who have eaten fish and shellfish in either the away from home or at home markets. Pinpointing key socioeconomic determinants of the likelihood of consuming fish in either the away from home or at home market may help producers and marketers target marketing and promotion campaigns. Moreover, by separating the analyses into the away from home and the at home markets, this research may be important to fish producers, processors, food store retailers, and food service retailers.

Model Specification

To investigate the decision to eat fish and shellfish, the analyses rely on the use of qualitative choice models. The linear probability model, the probit model, and the logit model are alternative specifications of qualitative choice models (Pindyck and Rubinfeld). Logit and probit analyses, however, are preferred to the linear probability model when qualitative choice models (e.g. discrete/binary dependent variable) are to be estimated since the latter suffers from a number of deficiencies. The variance of the disturbance term of the model is heteroskedastic and, therefore, the standard errors of the ordinary least squares parameter estimates are biased. Further, the disturbance term is not normally distributed. The classical statistical tests are then not applicable. Another deficiency of the linear probability model is that it allows the predicted values (probabilities) to fall outside the interval between 0 and 1, which is inconsistent with the interpretation of the conditional expectation as a probability.

Logit models are employed in the analyses to circumvent the inadequacies of the linear probability model and because of the dichotomous nature of the dependent variables that are used.

These models are based on the cumulative logistic probability function and are specified as (Pindyck and Rubinfeld):

$$L = f(z) = f(x_i'\beta) = 1/(1+e^{-z}) = 1/(1+e^{-(x_i'\beta)})$$

where z is a theoretical index determined by a set of explanatory variables x; $f(z)$ is the cumulative logistic function; e represents the base of natural logarithms (approximately equal to 2.718); and L is the probability that an individual will make a certain choice, given the knowledge of x_i. The logit model is estimated using a maximum likelihood technique.

Demographic and lifestyle changes are among the factors that have materially affected the structure of food distribution and the demand for food products. Previous studies (i.e. Pippin and Morrison; Hu; Dellenberger et al. 1988, 1992; Cheng and Capps; Keithly; McGee et al; Israel et al.) have focused their analyses on sociodemographic and economic factors affecting seafood consumption. Common sociodemographic factors considered were income, sex, age, household size, urbanization, race, region, education, and employment. Haidacher et al. reported that characteristics such as race, region, seasonality, and urbanization are likely to affect expenditure patterns of red meat, poultry, and seafood. Keithly also found that urbanization, race, household size, and income significantly affect at home consumption of seafood.

Health issues, through changing tastes and preferences, are also considered an important determinant of the changing trends in food consumption. Within the data set, information is available on whether or not an individual is on a special diet and this is used as a proxy for those who consider the "healthiness" of a product in the purchase decisions.

Food preparation accounts for much of the time spent in household production. The purchase of food away from home obviates the need for some of the consumer's labor, time, and culinary skill (Capps). Employment status, sex, and age of the consumer may affect availability and value of time, and are therefore likely to be important considerations in making choices among away from home and at home food products.

Based on the model specifications found in the literature and data availability, the models are specified as follows (Nayga and Capps, 1994; Nayga):

$$P = b_0 + b_1 urban1 + b_2 urban2 + b_3 region1 + b_4 region2 + b_5 region4 + b_6 race2 + b_7 race3 + b_8 race4 + b_9 hisp1 + b_{10} sex1 + b_{11} employ1 + b_{12} fstamp1 + b_{13} diet1 + b_{14} hsize + b_{15} logage + b_{16} logincome + b_{17} weekend + b_{18} quarter1 + b_{19} quarter3 + b_{20} quarter4;$$

where P represents the following dependent variables: (1) equal to 1 if the individual consumed fish and shellfish away from home and 0 otherwise (referred to in the text as the FAFH model); or (2) equal to 1 if the individual consumed fish and shellfish at home and 0 otherwise (referred to in the text as the FAH model). The names and description of the independent variables are shown in table 1.

One classification is eliminated from each group of variables for estimation purposes. The base group or profile corresponds to individuals who satisfy the following description: reside in a nonmetro area (*urban3*); in the South (*region3*); white (*race1*); nonhispanic (*hisp2*); female (*sex2*); not employed (*employ2*); not participating in the food stamp program (*fstamp2*); not on a special diet (*diet2*); and the three-day intake occurred mostly during a weekday (*weekday*). The variable depicting the presence or absence of hispanics (*hisp1*) is separated from the race variables because hispanics as a group are defined by the U.S. Department of Agriculture as an ethnic group rather than a race. Therefore, based on the definition, a hispanic can be white, black, or some other race.

Data Source and Description

The data set used in this study is the Individual Intake phase of the 1987-88 Nationwide Food Consumption Survey (NFCS) from the U.S. Department of Agriculture. This data set is the most recent of the national household food consumption surveys conducted by USDA. Data collection for this data set started in April 1987 and continued through August 1988. The sample was designed using a multi-stage, stratified, area probability sampling method. The stratification plan

Table 1. Names and Description of the Independent Variables

Name	Description
urban1	1 if individual resides in a central city; 0 otherwise.
urban2	1 if individual resides in a suburban area; 0 otherwise;
region1	1 if individual is in the Northeast; 0 otherwise;
region2	1 if individual is in the Midwest. 0 otherwise,
region4	1 if individual is in the West, 0 otherwise;
race2	1 if individual is black; 0 otherwise;
race3	1 if individual is Asian or Pacific Islander; 0 otherwise,
race4	1 if individual is of some other race, 0 otherwise;
hisp1	1 if individual is hispanic; 0 otherwise;
sex1	1 if individual is male, 0 otherwise;
employ1	1 if individual is employed, 0 otherwise;
fstamp1	1 if individual is receiving food stamps; 0 otherwise;
diet1	if individual is on a special diet; 0 otherwise;
hsize	household size,
logage	the logarithm of age,
logincome	the logarithm of income;
weekend	1 if the three-day intake of the individual occurred mostly during a weekend. 0 otherwise,
quarter1	1 if January - March; 0 otherwise
quarter3	1 if July - September; 0 otherwise
quarter4	1 if October - December; 0 otherwise

took into account geographic location, degree of urbanization, and socio-economic considerations.

The original number of respondents in the survey is 11,045. However, many individuals in the sample have incomplete socio-economic and demographic information. Subsequently, after deleting observations with missing individual relevant socio-economic and demographic information, the data set contained 6276 observations.

The descriptive statistics of the independent variables used in the regression analyses are exhibited in table 2. About 21 percent of the sample reside in central city areas; 49 percent in suburban areas; and 30 percent in nonmetro areas. Most of the individuals (35 percent) included in the sample come from the South. Eighty six percent are white; 96 percent are non-Hispanic; 45 percent are male; 58 percent are employed; 95 percent are non-recipients of the food stamp program; 14 percent are on a special diet; and about 16 percent are interviewed mostly on a weekend during the three-day survey period. Moreover, the average age of the individuals is about 43 years while the average household size is approximately three. Average household annual income is close to $30,000.

The distribution of individuals by urbanization, race, origin, sex, food stamp participation, special diet status, and income seems representative of the U.S. population in 1988. However, this sample is probably overrepresentative of individuals located in the South and underrepresentative of individuals located in the Northeast and West. In addition, the sample is not uniformly distributed across seasons. The average age of individuals in the sample and the average household size are above the national average. The sample is also probably underrepresentative of the number of employed individuals.

Empirical Results

The maximum likelihood estimates of the FAFH and FAH models are exhibited in tables 3 and 4. Based on the statistically significant coefficients, the results indicate that individuals residing in central cities and suburban areas have higher probabilities of eating fish and shellfish at home than individuals residing in non-metro areas. In addition, individuals residing in central cities are more likely to eat fish and shellfish away from home than those residing in non-metro areas. This result may be explained by the fact that fish and shellfish products are more likely to be advertised and offered in restaurants in a variety of preparations in urban areas than in non-urban areas.

Table 2. Descriptive Statistics of the Exogenous Variables Used in the Analyses

Variable		Mean	Std. Dev.	Range
Urbanization				
	Central City	0.21	0 4044	0-1
	Suburban Area	0.49	0.5000	0-1
	Non-metro Area[a]	0.30	0 4567	0-1
Region				
	Northeast	0.20	0 3997	0-1
	Midwest	0.27	0.4452	0-1
	South[a]	0.35	0.4762	0-1
	West	0.18	0.3843	0-1
Race				
	White[a]	0.86	0 3380	0-1
	Black	0 10	0.2970	0-1
	Asian/Pacific Islander	0.01	0.0906	0-1
	Other race	0 03	0.1571	0-1
Origin				
	Hispanic	0 04	0 1855	0-1
	Non-Hispanic[a]	0 96	0 1855	0-1
Sex				
	Male	0 45	0 4968	0-1
	Female[a]	0.55	0.4968	0-1
Employment Status				
	Employed	0 58	0 4935	0-1
	Unemployed[a]	0 42	0 4935	0-1
Food Stamp Participation				
	Recipient	0 05	0.2219	0-1
	Non-recipient[a]	0 95	0.2219	0-1
Special Diet				
	Yes	0.14	0.3495	0-1
	No[a]	0 86	0.3495	0-1
Week Variable				
	Weekend	0.16	0.3682	0-1
	Weekday[a]	0.84	0.3682	0-1
Seasons				
	Quarter1	0.29	0.4554	0-1
	Quarter2[a]	0 41	0 4899	0-1
	Quarter3	0.14	0.3508	0-1
	Quarter4	0.16	0 3689	0-1
Age		43.30	18.37	15-99
Household Size		3.03	1.46	1-12
Income		29621.8	23927.8	3-300000

[a]Refers to the omitted category in the analysis.

McGee et al. also found, in the case of catfish, that consumption was more likely in urban areas than non-urban areas.

In terms of regional differences, individuals from the Northeast are more likely to eat fish and shellfish at home than those from the South. However, compared to individuals from the South, individuals from the West are more likely to eat fish and shellfish at home. Keithly indicated the significance of regional variables in his analysis of at home seafood consumption using the 1977-78 NFCS. Previous studies on catfish consumption (i.e. Hu; McGee et al.; Israel et al.; Dellenbarger et al. 1992) have also found that regional location was an important determinant.

The race variables as a group are statistically significant in the FAH but not in the FAFH model. In particular, blacks and Asians/Pacific Islanders are more likely to eat fish and shellfish at home than whites. Dellenbarger, et al. (1992) likewise found, in the case of catfish, that blacks have a higher probability of consuming the product at-home than whites. Results of this study also indicate that Asians/Pacific Islanders are more likely to eat fish and shellfish away from home than whites. This result is not surprising considering the

Table 3. Maximum Likelihood Estimates of the FAFH Model

Variable	Estimate	Std. Error	Changes in Probability[b]
Intercept	-7.186[a]	0.826	-0.520
Urban1	0.271[a]	0.136	0.019
Urban2	0.169	0.117	0.012
Region1	0.033	0.123	0.002
Region2	-0.141	0.121	-0 010
Region4	-0 337[a]	0.139	-0.024
Race2	-0.154	0.185	-0.011
Race3	0.726[a]	0.419	0.052
Race4	-0 046	0.396	-0 003
Hisp1	-0 054	0.312	-0.004
Sex1	0 081	0.091	0.006
Employ1	0 403[a]	0.107	0.029
Fstamp1	-0.326	0.341	-0.023
Diet1	0.216[a]	0 123	0 015
Hsize	-0.192[a]	0.039	-0.014
Logage	0.374[a]	0.123	0.0006[d]
Logincome	0.356[a]	0.068	0.87-06[d]
Weekend	0.327[a]	0.113	0.023
Quarter1	0.122	0.106	0.009
Quarter3	0.008	0.140	0 0006
Quarter4	-0.233[a]	0.141	-0.016
% of Right Predictions		91.1	
R Statistic		0.1740	
Ratio[c]		0.0894	

[a] Indicates statistical significance at the 0.05 level.
[b] Equal to the product of the parameter estimates times the value of the logistic density function [β*f(z)] At the sample means, the value of this density function (f(z)) is 0.0723 while the value of z is -2 4623.
[c] Ratio of nonzero observations to the total number of observations (6276)
[d] Computed as [β*f(z)/age] and [β*f(z)]/income]. Sample means of age and income are used to calculate this change in probability.
Note: The R statistic is similar to the multiple correlation coefficient in the normal setting, after a correction is made to penalize for the number of parameters estimated. See page 183 of the SUGI supplemental guide, 1983 edition of SAS for further details.

fact that fish/shellfish is common in the diets of Asians and Pacific Islanders. Individuals of other races, on the other hand, are less likely to eat fish and shellfish at home than whites.

Seasonal differences are evident in the logit models. For instance, the probability that an individual will eat fish or shellfish at home is lower during the third and fourth quarters of the year than during the second quarter of the year. Moreover, the likelihood that an individual will eat fish or shellfish away from home is lower in the fourth quarter than in the second quarter of the year.

Hispanics are more likely to eat fish and shellfish at home than non-Hispanics. Employed individuals are more likely to eat fish and shellfish away from home than unemployed individuals. This result is expected considering the cost associated with eating fish/shellfish away from home. In accord with prior expectations, individuals who are on a special diet are more likely to eat fish and shellfish in either the away from home or the at home market than those who are not on a special diet. This result may have some important implications about consumers' nutritional perception of fish and shellfish products vis-a-vis red meat products.

Results indicate that household size is negatively related to the likelihood of eating fish and shellfish away from home. This finding indicates a decreasing affinity to eat fish and shellfish away from home as household size increases. Age and income are positively related to the likelihood of eating fish and shellfish either away from home or at home. With the population becoming older, some opportunities might exist to modestly increase sales of fish and shellfish by targeting the products to the elderly[2], especially in

Table 4. Maximum Likelihood Estimates of the FAH Model

Variable	Estimate	Std Error	Changes in Probability[b]
Intercept	-3.777[a]	0.543	-0.595
Urban1	0.264[a]	0 096	0.041
Urban2	0.347[a]	0 081	0.054
Region1	0.244[a]	0.091	0 038
Region2	0 011	0.088	0 002
Region4	0.205[a]	0.094	0.032
Race2	0 339[a]	0 114	0.053
Race3	1.852[a]	0.289	0.292
Race4	-0.940[a]	0 298	-0.148
Hispl	0.335[a]	0.191	0 052
Sex1	-0 042	0.065	-0 007
Employ1	-0.077	0.071	-0.012
Fstampl	0.165	0.156	0 026
Diet1	0 459[a]	0.085	0 072
Hsize	-0.018	0 025	-0 003
Logage	0.328[a]	0 083	0.001[d]
Logincome	0 097[a]	0.044	0.51-06[d]
Weekend	-0.135	0.089	-0.021
Quarter1	-0 106	0.077	-0.016
Quarter3	-0 206[a]	0 099	-0.032
Quarter4	-0.213[a]	0.095	-0 033
% of Right Predictions		79.8	
R Statistic		0 1490	
Ratio[c]		0.2039	

[a] Indicates statistical significance at the 0.05 level

[b] Equal to the product of the parameter estimates times the value of the logistic density function [β*f(z)]. At the sample means, the value of this density function (f(z)) is 0.1576 while the value of z is -1 4108.

[c] Ratio of nonzero observations to the total number of observations (6276)

[d] Computed as [β*f(z)/age] and [β*f(z)]/income]. Sample means of age and income are used to calculate this change in probability.

Note: The R statistic is similar to the multiple correlation coefficient in the normal setting, after a correction is made to penalize for the number of parameters estimated See page 183 of the SUGI supplemental guide, 1983 edition of SAS for further details.

the at home market. The change in probability value of the age variable in the at home market is slightly higher than that in the away from home market. Finally, as expected, individuals who consumed food away from home mostly during a weekend are more likely to eat fish and shellfish than those who consumed food away from home mostly during weekdays.

Results of the likelihood ratio tests, performed to determine the significance of some groups of variables in the model, are exhibited in table 5. As indicated, the regional variables as a group are statistically significant in the FAFH model. In addition, the variables on urbanization, region, and race contribute significantly to the explanatory power of the FAH model. Keithly, using the 1977-78 NFCS, also found that urbanization, race, and region are significant factors affecting at home seafood consumption.

A measure of goodness of fit is the correct classification of individuals as either consuming or not consuming fish and shellfish (away from home or at home) on the basis of the regression results. With a 50-50 classification scheme, approximately 91 percent of the individuals in the sample were correctly classified as either consuming or not consuming fish and shellfish away from home using the logit specification. In addition, roughly 80 percent of the individuals in the sample were correctly classified as either consuming or not consuming fish and shellfish at home.

Concluding Comments

This research constitutes an attempt to determine the effect of various sociodemographic factors on the probability of consuming fish and shellfish products in both the away from home and at home markets. Although the fish industry

Table 5. Results of the Likelihood Ratio Tests (chi-square values)

Variables	Likelihood Ratio Test
Away from Home Model	
Urbanization	4.14
Region	8.20[a]
Race	3.44
Season	6.28
At Home Model	
Urbanization	18.85[a]
Region	10.85[a]
Race	60.45[a]
Season	7.50

[a] Statistically significant at the 0.05 level.

recognizes the new realities of the marketplace, little information exists on the factors affecting the probability of consuming fish and shellfish away from home and at home.

In general, various demographic factors significantly influence the likelihood of consuming fish and shellfish in the away from home and at home markets. The findings of this study generally indicate that urbanization, region, race, ethnicity, age, diet status and income are significant determinants of the probability of fish and shellfish consumption at home. On the other hand, region, employment and diet status, household size, age and income significantly affect the likelihood of eating fish and shellfish away from home. These factors should be given emphasis by fish marketers and processors in the formulation of marketing strategies designed to promote consumption. For example, fish marketers might emphasize their products' positive health and nutrition image in their promotion and advertisement campaigns. Results in both the FAFH and FAH models indicate that individuals on a special diet are more likely to eat fish and shellfish than those not on a special diet.

The information in this study may allow producers, processors, and distributors to anticipate trends and future changes in the retail markets, improve planning of marketing program strategies, and provide better service to consumers. For instance, results of this study can be combined with projections for the relevant explanatory variables to identify the likelihood of consuming fish and shellfish either away from home or at home. However, to provide more definitive results to the fish industry, it is worthwhile to repeat the analyses in this study with the more current Bureau of Labor Statistics' Consumer Expenditure Surveys, especially with the reversal of consumption trend for fish and shellfish in 1988. Additionally, scanner data from supermarkets represent current market conditions and will permit the analyses of the demand for disaggregate fish products. One of the limitations of this research is that price information is not incorporated in the analyses due to data unavailability. With scanner data, daily price, quantity, and even advertising information can be made available from supermarkets. These data sets might also shed more light on the relative importance of either the away from home or the at home market for the fish and shellfish industry.

Results of this study must also be used with care because of the controversy surrounding the validity of the 1987-88 NFCS. For instance, the General Accounting Office (GAO) has publicly criticized these data on two grounds: (1) only 34 percent of the households provided individual intake data and (2) the data collected may not be accurate because of quality control problems (U.S. General Accounting Office).

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Endnotes

1. FAFH is used in this text to distinguish a food away from home model from a food at home (FAH) model.

2. One of the referees pointed out that there is a declining trend of food away from home consumption for people over 65 from recent Continuing Consumer Expenditure Survey of the Bureau of Labor Statistics. Consequently, there is the possibility that the at home market could be more important than the away from home market in terms of sales growth.