Dynamic Factors Influencing

U.S. and Regional Catfish Demand

by

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Abstract

Responses to changes in factors influencing consumption of catfish and competing commodities differ between national, South Atlantic, and Southwest Central markets. A modified state adjustment model for catfish, beef, chicken, and other fish explicitly included age distribution, residence, occupation, education, and race/ethnic variables associated with habit formation. Nationally, per capita expenditures on catfish respond to present and past relative prices, and catfish, chicken, and other fish, but not beef, consumption demonstrates significant habit formation. South Atlantic and Southwest Central habits for catfish consumption persist, and, as the population ages, chicken and fish consumption increase.

Introduction

Catfish consumption has out-paced even the rapid growth in domestic consumption of fish and seafood, which grew by an average 3.5 percent annually over the decade 1974 to 1984 and rose to 15.5 pounds per capita in 1990 (*Aquaculture Situation and Outlook Report*, Sept. 1991). The U.S. catfish industry has grown at an annual average rate of nearly 30 percent since 1980 (*Aquaculture Magazine*, 1989), and farm-raised catfish sold in 1991 increased to 410 million pounds. The inability of domestic commercial fishing to satisfy increasing fishery products demand has led to increased imports, increased prices for wild-caught fish, and incentives for aquaculture expansion.

Increasing prices of wild imported catfish have increased the attractiveness of domestic, farm-raised catfish (Kinnucan et al.). In the Southeastern states, catfish production leads all other species produced by private aquaculturists. Mississippi accounts for approximately 80 percent of total U.S. catfish production. The increasing consumption of catfish, finfish, and seafood in the

United States has been largely income and price related. For example, during the 1980-1988 period, real catfish prices declined from $2.01 to $1.87 per pound, while consumption of catfish increased from 0.12 to 0.61 pounds per capita.

Changing attitudes, lifestyles, and other characteristics of American consumers, however, could be important contributing factors to increasing consumption of catfish and other finfish and seafood. Successful marketing development depends on consumer behavior information. This study examines differences in consumer demand for catfish and related products between the national, South Atlantic, and Southwest Central markets and evaluates dynamic factors influencing growth in domestic catfish marketing.

Related Studies and Theoretical Considerations

Many studies cover different aspects of catfish production; few have analyzed catfish marketing. Most of those marketing analyses have concentrated on the problems of a particular state, not generalizing regionally or nationally. Linking demographic factors affecting seafood demand in Georgia, Cato and Prochaska reported that demand for fresh fish increases with income and with household size except for families with three to five members. Non-white families consume 82 percent more fish on average than do white households. Catholic religious preferences and household size positively influence catfish demand, as does the number of years of residence in Louisiana (Dellenbarger et al.). However, the presence of children in the household negatively influences catfish expenditures, and catfish are considered inferior goods in Louisiana.

Household composition, age, and sex differences within households significantly affect expenditures on both convenience and nonconvenience foods (Capps et al., 1983). Convenience and nonconvenience foods generally are more income- and own-price elastic than cross-price elastic (Capps et al., 1985). Household size plays a more important role in at-home seafood consumption than changes in income level, and southern households spend significantly more than the national average on seafood, as do non-whites (Cheng and Capps). Nationally, strong predictors of fish consumption included consumer attitudes seeking good nutrition, ethnicity, cautious shopping, more children than typical, and targeted advertising (*The American Consumer Fish and Seafood Report*).

Using group profiles of demographic and attitudinal characteristics, McGee et al. analyzed catfish consumers' behavior but did not produce a clear profile. Young, non-Hispanic heads of household with at least a high school education, working in blue-collar occupations, and living in an urban area in one of the two South Central regions were more likely to be catfish consumers. Perceptions of quality, appearance, flavor, packaging, and ease of preparation most distinguished consumers from non-consumers of catfish.

Economic and demographic factors, including expressed consumer tastes and preferences dictate demand for catfish and related products. Economic variables affecting demand include the prices of the product, substitute and complementary goods, and changes in money income. Income and consumer demand are positively related for most food products, but catfish consumption studies have shown inconsistent results. Catfish consumption increased as income rose to the $20,000-$30,000 range and generally fell thereafter, but a slight increase in consumption occurred again as income reached the greater-than-$50,000 level (McGee et al.), belying popular notions of catfish being an inferior good.

Demographics and the Role of Habits

Population increases, especially in major catfish-consuming regions, shift demand outward. Likewise, as the "baby boom generation" (29.3 percent of the U.S. population) matures, attitudes and behavior change with regard to seafood, freshwater finfish, and meat products. Consumers become more conscious about eating lighter meals--fewer calories, less cholesterol. Place of residence, occupation of household head, education, household size, religion, and race (the latter two via cultural habits and restrictions) also influence behavior. In static models, these factors are assumed constant for a given level of demand. As long as tastes and preferences remain unchanged, basic economic relationships between quantities consumed, prices, and income remain unaltered.

Familiarity and previous consumption of a product generally lead to higher consumptive levels in the future than would occur without an affinity for the product; "the consumer is less sensitive to price and income changes when habits have developed" (Johnson et al., p. 138). Dietary habit formation can be expected in U.S. and regional beef and chicken consumption, where eating habits are already well established. Changes in tastes and preferences, such as in the consumption of catfish, other fish, and seafood, may result from consumers developing new habits and be expressed as changes in aggregate demand. A major reason cited for the growth in catfish demand has been a change in preference from red meat to white meat; catfish fills the demand for a white, relatively bland fish with constant quality (*Aquaculture*, 1990, p. 37). Changing consumer demographics also influence demand for the form in which catfish is sold. For example, increasing numbers of working women, married or single, with or without children, alter demand for convenience such as frozen fillets and fish eaten outside the home.

Consumer preferences are difficult to quantify and changes in preferences are sometimes treated as part of changes in income. Common methods of introducing changing tastes into demand relations have included adding an exogenous time trend or assuming the parameters are time dependent. This paper, however, treats aggregate changes in tastes and preferences as being revealed over time through relative changes in key demographic variables, such as age distribution and place of residence.

The State Adjustment Model

Static consumer demand systems, wherein consumers are expected to adjust instantly to changes in income and prices, may be considered overly restrictive, since they ignore adjustments that occur due to habit formation. Consumers generally need some time to change their consumption habits following a price decrease or an income rise, because instant change would entail some immediate disutility. Dynamic systems, conversely, account for habit formation. The state adjustment model (Houthakker and Taylor) assumes that quantities purchased depend on existing physical stocks of goods and/or psychological stocks of habits. While not ideal theoretically, the state adjustment model (SAM) can incorporate habit formation practically into a consumer demand model for an immature industry product, such as catfish, with an extremely small market share.

Two basic equations make up the complete structure of the state adjustment model. The first equation specifies that quantity demanded is determined by prices, income, and the quantity of stocks (of habits). The rate of demand and the rate of decay of habits influence the rate of change in stocks of habits in the second equation. The general expression for the state adjustment model for good i is (following Johnson et al., pp. 80-82):

$$(1) \quad q_i = \Theta_i + \alpha_i s_i + \kappa_i m + \nu_i p_i \,, \text{ and}$$

$$(2) \quad \dot{s}_i = q_i - \delta_i s_i \,,$$

where q_i is the rate of demand for good i at time t, m is the rate of income at time t, p_i is the relative price of good i at time t, s_i is the stock of the commodity i (in this application, the psychological stock of habits[1]) at time t, and Θ, α, κ, and ν are the underlying structural parameters in (1), and where $\dot{s}_i$ is the rate of change in the stock of (habits associated with) commodity i and δ_i is a constant depreciation rate (of habit decay), usually positive, in (2).

Simplifying to include only observable terms (i.e., substituting for stocks of habits), the estimated Houthakker and Taylor model becomes:

$$(3) \quad q_{it} = A_0 + A_1 q_{it-1} + A_2 \Delta m_t + A_3 m_{t-1} + A_4 \Delta p_{it} + A_5 p_{it-1} \,.$$

[For details and derivation of structural parameters, see Johnson et al., pp. 80-83.] Equation (3) must be estimated subject to the constraint $A_2 A_5 = A_3 A_4$ to obtain a unique estimator for δ, the habit decay parameter.

Combining the structure of SAM with an explicit consideration of variables influencing stocks of habits and changes in tastes and preferences, which are generally not observable, a modified SAM (MSAM) provides a framework for further hypothesis testing. Attitudinal characteristics toward catfish consumption often refer to consumer perceptions of catfish compared to other fish or meat. Data for such consumer perceptions over time, excepting prices, are not available. Instead, changes in certain demographic variables can be hypothesized to capture the dynamics of associated attitudinal preferences. How the rates of change of each demographic variable influence changes in catfish, beef, chicken, and other fish consumption can then be tested. Demographic variables to test include population size and distribution by age, place of residence, occupation category, education attained, and race.

To incorporate the demographic variables, let habit formation (stocks of habits) be implicitly described:

$$(4) \quad s_i = f_i\,(AGE, MET, WHT, RAC, HID, AWF)\ ,$$

where AGE refers to the proportion of 18 to 44 year olds in the population, MET is the proportion of metro population, WHT is the proportion of white collar workers in the labor force, RAC is the proportion of races other than Black or White, HID is the proportion of higher education graduates, and AWF is the proportion spent on food away from home. Differentiated with respect to time and expressed linearly:

$$(5) \quad \dot{s}_i = \beta_1\dot{AGE} + \beta_2\dot{MET} + \beta_3\dot{WHT} + \beta_4\dot{RAC} + \beta_5\dot{HID} + \beta_6\dot{AWF}\ ,$$

where ($\dot{}$) represents the rates of change in each of the variables.

Substituting and rearranging the terms algebraically (for details, see Ermita), MSAM can be expressed:

$$(6) \quad q_{it} = A_0 + A_1\dot{AGE}_t + A_2\dot{MET}_t + A_3\dot{WHT}_t + A_4\dot{RAC}_t + A_5\dot{HID}_t + A_6\dot{AWF}_t + A_7m_t + A_8p_{it},$$

where the rates of change in socioeconomic variables represent determinants of habit formation. For example, changes in the proportion of the population in the age group 18 years to 44 years of age, AGE, are hypothesized to link the aging of the population with changes in tastes and preferences, and, consequently, in consumer demand for these meat and fish products.

Empirical Model Formulation

Changes in catfish demand from 1970 to 1988 are estimated in terms of the economic and socio-dynamic factors influencing the Southwest Central and South Atlantic regions and the United States. Similar formulations are developed for beef, chicken, and other fish and presented as a partial demand system. Own and substitute relative prices, income, and aggregate attitudinal characteristics implied by changes in demographic factors are used as explanatory variables. A habit parameter is included in the general (SAM) formulation to depict the time lag in which preferences adjust to a particular commodity's consumption level.

U.S. Catfish Demand

Consumption of each commodity is first specified in the traditional Houthakker and Taylor state adjustment model framework. The general expression used to empirically estimate the dynamic, national-level consumption was specified in equation (3), where q_{it} are per capita expenditures on catfish, beef, chicken, or other fish; q_{it-1} are per capita expenditures lagged one year; Δm_t is the rate of change in income at time t; m_{t-1} is the rate of income in the previous period; Δp_{it} are changes in price relatives; and p_{it-1} are price relatives lagged one year. The modified state adjustment model was specified in equation (6), where the variables are those introduced in the previous section.

Per capita expenditures for each commodity were computed by the constant (1982-84) total expenditures divided by the U.S. population level. Price relatives were calculated as sums of expenditures in current dollars for each of the product groups divided by expenditures in constant dollars on the group (for example, catfish), and then deflated by the Consumer Price Index (Johnson et al., p. 117). The rates of changes in explanatory variables for each model were calculated following the example where the difference in the proportion of population in the 18 to 44 year old age group in one year and the proportion of 18 to 44 year olds in the previous year is compared to the proportion of 18 to 44 year olds in the previous year.

Regional Catfish Consumption

Systems of equations for the South Atlantic and Southwest Central regions differ in specification from the U.S. model in that some demographic variables are not reported at the regional level over a sufficiently long period and are excluded. The empirical models estimated for each region were thus specified:

$$(7) \quad q_{it} = A_0 + A_1\dot{AGE}_t + A_2MET_t + A_3m_t + A_4p_{it},$$

where i = 1 for catfish, 2 for beef, 3 for chicken, and 4 for other fish.

Expenditures for each product group, demographic changes, and income represented South Atlantic or Southwest Central regional data. That is, catfish expenditure per capita measures the constant total expenditures for catfish in the South Atlantic or Southwest Central region divided by the total population per region. Data on the 18 to 44 year old population, as well as metropolitan populations for each region, were divided by the total population for the respective regions; then proportional changes occurring for each demographic variable were calculated. Personal disposable income is specific to each region and is measured by summing the total disposable personal incomes of each state in each region.

Data and Procedures

Consumption figures and price indices for beef, chicken, and pork were obtained from the *Aquaculture Situation and Outlook Reports* and *Food Consumption, Prices, and Expenditures, 1967-1988*. The *Livestock and Poultry Situation Reports* were used for data on beef, chicken, and pork prices. Data on catfish prices, amount processed, sales, imports, and inventories were furnished from the National Agricultural Statistics Service (NASS) of the U.S. Department of Agriculture (USDA) and *Aquaculture Situation and Outlook Reports*. Demographic statistics, such as resident population by age, number of metro and nonmetro population, number of blacks and other races within the population, number of higher education graduates, and money income data, were obtained from *Statistical Abstracts*, 1970-1990. Employment status and the civilian labor force were from *Geographic Profile of Employment and Unemployment*, Bureau of Labor Statistics.

The state adjustment model (SAM) and the modified state adjustment model (MSAM) with demographic information entailed estimation of systems which are nonlinear (or pseudo-linear) in the parameters (Johnson et al., pp. 94-98). Estimates were corrected for autocorrelation, and nonlinear Seemingly Unrelated Regressions (SUR) estimation was used, as contemporaneous correlation was assumed present in the system.

Results and Discussion

State Adjustment Model

Parameter estimates (Table 1) of the state adjustment model for the United States generally conform with *a priori* expectations regarding their signs. As expected, effects of habits on consumption are largely captured by the lagged dependent variables in the Houthakker-Taylor models. Estimated parameters for these are all positive and significant at the one percent level, except for beef, implying that past consumption reinforces present habits for these commodities. Past consumption strongly influences present catfish and other fish consumption, but promotions undertaken by various consumer organizations to

Table 1

Estimated Parameters for the State Adjustment Consumption Model, U.S., 1970 to 1988.

Explanatory Variables	Expenditures			
	Catfish	Beef	Chicken	Fish
CATFISH LEXPEND.	1.11003 *** (24.75)			
BEEF LEXPEND.		.39555 (1.44)		
CHICKEN LEXPEND.			.43547** (2.29)	
OTHER FISH LEXPEND.				.92569*** (25.51)
INCOME (Δm_t)	.00299[a]	-.12970[a]	.47760[a]	14.00610[a]
INCOME (m_{t-1})	.00191 (1.49)	-.09804 (-.56)	.29015* (2.00)	14.6090*** (4.34)
DCATFISH	-4.38E-06** (-2.16)			
LCATFISH	-2.75E-06* (-1.99)			
DBEEF		-5.49391* (-2.09)		
LBEEF		-3.59741* (-1.78)		
DCHICKEN			-2.40093*** (-5.13)	
LCHICKEN			-1.45851*** (-3.07)	
DFISH				-.24606 (-.85)
LFISH				-69.0986 (-.84)

t values are in parentheses. Asterisks indicate parameter estimates significantly different from zero at the 10% (*), 5% (**), and 1%(***) levels.

[a]/ Calculated from equation 3.

encourage reduced beef consumption may have already altered (reduced) habit persistence for beef during this period. The parameter estimate for catfish (1.11003) suggests a degree of instability of prices whereby shocks to the market, such as weather-related supply changes, would unsettle prices and they would tend not to converge to an equilibrium price (that is, they would tend to remain volatile). While somewhat unsettling in the SAM approach, the catfish industry is an immature industry displaying rapid, sometimes uneven, growth during this period. Production disequilibria periodically created volatility in catfish supplies and prices.

Past income levels significantly and positively influence current chicken and other fish demand but do not significantly affect catfish or beef demand. Parameters estimated for the rates of change in income which were not significantly different from zero in the unrestricted model were restricted to zero in the restricted form (that is, the constraint that $A_2A_5 = A_3A_4$ holds in order to estimate δ). Catfish consumption increases at a decreasing rate when relative prices decline, as do expenditures on chicken, beef, and other fish. The price relatives of catfish, beef, and chicken in the previous period significantly influence present consumption for these commodities. If prices in the previous period increased, relatively less is purchased in the present, even if current prices fall.

Estimated structural parameters (Table 2) implied habit formation for catfish, beef, chicken, and other fish (i.e., $\alpha_i > 0$), as was earlier indicated. High depreciation (or habit decay, δ) rates for the four commodities, coupled with their positive α's, reflect a lack of strong habit persistence, especially for fish. The short-run income coefficient, κ_i, is positive for catfish, fish, and chicken, but negative for beef. The short-run price coefficient, ν_i, is negative for all four commodities, consistent with expectations.

Although catfish consumption is positively related to income in the short run, the converse appears true in the long run. Both chicken and other fish have positive income elasticities, and expenditures for chicken and fish are quite income-elastic in the long run, especially in the case of other fish. Short-run income elasticities for the four groups are less than their long-run elasticities, "consistent with Houthakker and Taylor (1970) rationalizations for inventory adjustment and habit formation" (Johnson, et al., p. 123). Price elasticities for all four commodities have their anticipated negative signs, except for the long-run elasticity of catfish. The long-run price elasticity of catfish is positive because the estimated habit formation parameter, α, for catfish is greater than its rate of habit decay, δ. During the study period, growth in the catfish industry has been vigorous and uneven. Farm-raised catfish, a relatively new product, has been introduced during a period of sharp life-style changes. These conditions may have combined to initiate market development that will not be sustained in the future. Long-run price and income elasticities, dependent on the habit parameters demonstrated during this immature industry phase, are not reliable indicators of long-term growth in this industry.

Modified State Adjustment Model

U.S. Demand

Demographic change variables contribute little additional information to the dynamic U.S. consumption model for these four food categories. Parameter estimates and elasticities for the U.S.-level, modified SAM indicate the economic variables to be the major determinants of per capita expenditure (Table 3). Income and the catfish price relative are the primary determinants of catfish consumption. Contrary to previous, static findings (Dellenbarger et al.), increased income is associated with greater catfish consumption in the dynamic model. Rate of changes in the metro population and other demographic variables representing changing attitudinal preferences do not significantly influence U.S. consumption (at the 0.10 level), although directions of implied change appear consistent with expectations.

Only the beef price relative is significant in the beef equation. Income and metro population changes suggest some influence on beef consumption (absolute t values greater than 1), and the positive sign of the metro population variable indicates that beef consumption rises with

Table 2

Estimated Structural Parameters and Elasticities of the State Adjustment Consumption Model, United States, 1970-1988

	Catfish	Beef	Chicken	Fish
Structural Parameter				
Θ	-.1522	99.0230	18.7279	527.3500
α	1.0376	.1130	.0859	2.1028
κ	.0019	-0.1443	.4633	6.9600
ν	-2.80E-06	-5.2957	-2.3287	-32.9199
δ	.9333	.9735	.8725	2.1800
Elasticities				
Price				
Short run	-.1035	-.5208	-.5117	-.0305
Long run	.9206	-.5889	-.5676	-.8616
Income				
Short run	.8081	-.2148	.9962	.6244
Long run	-7.2300	-.2430	1.1050	17.6609

Θ = intercept;
α = psychological stock of habit;
κ = income;
ν = price; and
δ = depreciation rate.

Table 3

Estimated Parameters and Elasticities for the Modified State Adjustment Model, U.S., 1970-1988

Explanatory Variables	Expenditures: Catfish	Beef	Chicken	Fish
CATFINDEX	-1.53E-05** (-2.57) [-0.5657]			
BEFINDEX		-5.8239*** (-13.83) [-0.5727]		
CHKINDEX			-2.2638*** (-7.84) [-0.4975]	
FSHINDEX				-1390.4900 (-1.51) [-1.2800]
DMONYIN	0.0230*** (4.26) [9.6127]	-0.2204 (-1.44) [-0.3280]	0.8038*** (4.70) [1.7284]	46.1569*** (3.31) [4.1412]
CHAGE	-5.0649 (-0.75) [-0.2466]	-101.2800 (-0.53) [-0.0176]	197.3200 (0.91) [0.0495]	-19426.0800 (-1.14) [-0.2032]
CHMET	-2.2351 (-0.83) [-0.0421]	96.5324 (1.41) [0.0065]	5.7948 (0.07) [0.0006]	1869.1500 (0.22) [0.0076]
CHWHI	0.8929 (0.80) [1.6032]	-22.0867 (-0.73) [-0.0058]	3.9177 (0.12) [0.0015]	2247.5200 (0.72) [0.0357]
CHRAC	0.8830 (0.75) [0.2876]	32.3509 (0.98) [0.0376]	-24.9989 (-0.68) [-0.0419]	2966.4300 (0.98) [0.2077]
CHHID	0.4775 (0.48) [0.0755]	25.7192 (0.96) [0.0145]	-24.8090 (-0.83) [-0.0202]	-422.1700 (-0.16) [-0.0143]
CHAWF	-0.1673 (-0.10) [-0.0128]	-36.1559 (-0.80) [-0.0098]	26.9537 (0.53) [0.0106]	1912.4400 (0.43) [3.71E-05]

t values are in parentheses; elasticities are in brackets. Asterisks indicate parameter estimates significantly different from zero at the 10% (*), 5% (**), and 1%(***) levels.

increased urbanization. This supports beef industry findings that a reduction in beef consumption at home would be offset by increased consumption in fast food chains predominantly in metro areas (*National Food Review*, 1989, p. 5).

Economic variables significantly influence chicken demand, and chicken consumption is slightly less price elastic than catfish. Income influences per capita expenditure on other fish positively, with each one percent increase in real income increasing fish consumption by over four percent. Due to relatively higher prices of fish, higher income groups generally consume relatively more fish than those in lower income brackets.

South Atlantic and Southwest Central Regional Demand

Estimates and corresponding elasticities of the modified SAM for the South Atlantic (SA) and Southwest Central (SWC) regions are reported in Table 4. While catfish, beef, and chicken consumption are price inelastic, other fish demand is price elastic in the SA region. The catfish price relative is not significant in the SWC. McGee et al. noted that the SWC has the highest per capita consumption of catfish in the nation, partially explaining its price behavior (i.e., price insensitivity due to habit formation). Beef, chicken, and other fish price relatives are significant and price inelastic in the SWC.

Income influences consumption of all four groups positively in the SA and SWC regions. Chicken consumption is slightly income elastic (1.11) in the SA, and other fish, and especially catfish, are quite income elastic. Slow decay in changing beef consumption habits in the SA region might partially explain the lack of significance of the SA beef income elasticity. Chicken consumption is income elastic (1.36), and both catfish and other fish are quite income elastic in the SWC region. Regional availability and eating habits for chicken and fish (especially shellfish and catfish) may contribute to these responses.

Although not generally significant at the 0.10 level, the demographic variables show a tendency to influence consumption for the four commodities in the SA and SWC. The metro variable is significant in both SA and SWC beef consumption. However, as the proportion of metro residents in the SA grows by one percent, beef consumption rises only 0.02 percent. The metro effect is even smaller in the SWC region. This response generally supports, however, the hypothesis that rising metro populations stimulate fast food beef consumption. Again, as the proportion of 18 to 44 year olds in the SA population contracts (ages), fish consumption increases. The rate of catfish consumption in the SA falls as the region urbanizes. This negative influence may be explained by migration into the metro areas of the SA of individuals from regions where catfish consumption habits are less pronounced.

Age group and metro variables also influence dynamic changes in the SWC region. The coefficients of the proportion of 18 to 44 year olds in the SWC population are negative and significant in the catfish, other fish, and chicken models. That is, as the proportion of population in this age group decreases by one percent (with the aging of the baby-boom bulge), consumption of catfish, chicken, and other fish would rise by 0.73, 0.06, and 0.18 percent, respectively. The proportion of metro residents influences beef demand positively, but marginally, in the SWC. A high and increasing percentage of the regional population lives in metro areas--an estimated 72 percent in metro areas in 1988 (*Statistical Abstract*)--and urbanization likely will continue.

Conclusions

A state adjustment model for the United States and a modified version for U.S. and regional levels were used to evaluate the impacts of habit formation for catfish, beef, chicken, and other fish. Explicit incorporation of observable demographic terms into the habit model specification and estimation of the four commodity groups as a food subsystem differentiate this study from previous works (Dellenbarger et al., Cheng and Capps, McGee et al.). Estimated parameters indicate persistent habit formation for catfish, chicken, and other fish, but habit formation does not appear to be influential in U.S. beef consumption.

Table 4

Estimated Parameters and Elasticities for the Modified State Adjustment Model, South Atlantic and Southwest Central Regions, 1970-1988.

Explanatory	South Atlantic Region Expenditures				Southwest Central Region Expenditures			
Variables	Catfish	Beef	Chicken	Fish	Catfish	Beef	Chicken	Fish
CATFINDEX	-1.52E-05** (-2.79) [-0.5614]				3.70E-06 (0.90) [0.1364]			
BEEFINDEX		-4.6352*** (-13.75) [-0.4558]				-1.75734*** (-2.58) [-0.1725]		
CHIKINDEX			-1.8983*** (-9.35) [-0.4171]				-1.68323*** (-5.70) [-0.3729]	
FISHINDEX				-1700.14*** (-4.84) [-1.5734]				-774.17** (-2.68) [-0.7164]
DMONYIN	0.0191*** (4.95) [9.3649]	0.0129 (0.15) [0.0223]	0.4399*** (4.43) [1.1113]	31.9537*** (5.66) [3.3681]	0.0212*** (4.30) [9.7380]	0.4165* (2.09) [0.6806]	0.5741*** (3.07) [1.3612]	37.8968*** (4.67) [3.7334]
CHAGE	-2.5478 (-0.97) [-0.1010]	22.9211 (0.39) [0.0032]	-47.6287 (-0.70) [-0.0009]	-2573.7800 (-0.61) [-0.0219]	-16.44033*** (-5.64) [-0.7280]	-69.8220 (-0.60) [-0.0109]	-259.94** (-2.60) [-0.0589]	-19183.58*** (-3.58) [-0.1808]
CHMET	-1.2974 (-1.04) [-0.0870]	94.9626*** (3.42) [0.0227]	21.4941 (0.68) [0.0074]	11.7541 (0.01) [0.0002]	-2.14930 (-1.01) [-0.0288]	198.83** (2.33) [0.0001]	3.49107 (0.05) [0.0002]	-528.45 (-0.14) [-0.0015]

t values are in parentheses; elasticities in brackets.

Asterisks indicate parameter estimates significantly different from zero at the 10% (*), 5% (**), and 1%(***) levels.

Per capita expenditure on catfish responds significantly to current and previous period relative prices. U.S. per capita expenditure on other fish, however, shows little or no response to changes in past or present relative prices. Current income significantly influences demand for all commodity groups except beef, and past levels of income significantly affect current chicken and fish consumption. An increase in the proportion of metropolitan residents tends to increase beef consumption, likely because fast food restaurants, more prevalent in metro areas and lifestyles, constitute a major market for beef. Increasing urbanization negatively affects catfish consumption, on the other hand. While McGee et al. found catfish consumers to be located mostly in suburban neighborhoods, their study did not relate dynamic changes.

Catfish expenditures suggest a degree of instability of prices whereby shocks to the market, such as sudden supply changes, unsettle prices. Prices then tend to remain volatile. The catfish industry is an immature industry, displaying rapid, sometimes uneven, growth during this period. Although catfish consumption is positively related to income in the short run, the long run is much less certain, given the evidence during the study period. The long-run price elasticity of catfish appears positive because estimated habit formation during the study period is greater than its rate of decay. Conditions during the 1980s may have combined to initiate market development that will not be sustained in the future. Long-run price and income elasticities, dependent on the habit parameters demonstrated during this immature industry phase, are not likely reliable indicators of the long-term growth potential of this industry.

At the regional level, income and relative prices affect expenditures on each of the four groups significantly. In both the South Atlantic and Southwest Central, expenditures on beef increase as income rises, contrary to findings at the national level. Also, catfish generally is perceived as a normal good rather than an inferior good in these two regions, consumption responding positively to increased income. Changes in the metro populations in both regions significantly influence beef consumption during the study period. In addition, as the proportion of the SWC population in the 18-to-44 year old age group declines through aging and in-migration, catfish and other fish consumption increases.

Catfish enjoys especially high consumer acceptability in the South Atlantic and Southwest Central regions. Future regional marketing thrusts should maintain or increase current high levels of consumption by introducing new product forms. Chicken more readily substitutes for catfish and other fish than does beef. A lower relative price and wider availability in a variety of product forms help to give chicken a consistently higher consumption share than fish. Catfish products could better compete with chicken if more efficient production and processing techniques continued to lower costs.

Notes

[1]Although the state adjustment model explicitly considers current consumptive behavior with respect to past consumption, an underlying theoretical construct rationalizing the introduction of habit formation is less clear (Johnson et al., 1984, p. 80).

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