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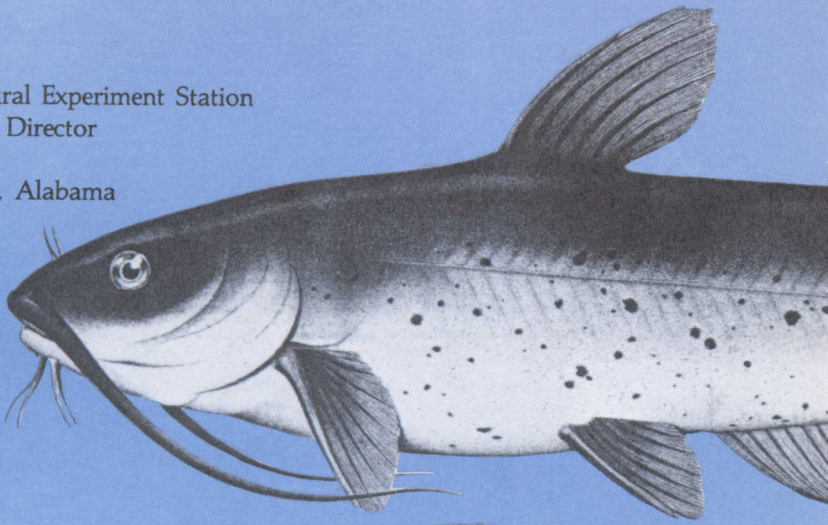

Effects of Catfish Advertising on Consumers' Attitudes, Purchase Frequency, and Farmers' Incomes

CONTENTS

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Effects of Catfish Advertising on Consumers' Attitudes, Purchase Frequency, and Farmers' Incomes[1]

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INTRODUCTION

GENERIC ADVERTISING of farm commodities has increased significantly in recent years, propelled in large part by national legislation authorizing mandatory check-off programs for such major commodities as dairy products, beef, and pork. Despite the large sums being spent on these and related programs — some $530 million in 1986 *(2)* — little is known about the effects of generic advertising on consumers and producers. A purpose of this bulletin is to fill part of this knowledge void by examining in detail an isolated case, the generic advertising of catfish.

The catfish advertising program is singled out for special attention for several reasons. First, because farm-raised catfish is a relatively new commodity, the information-dissemination role of advertising assumes greater importance, increasing the potential effectiveness of the generic campaign. Second, because of the relatively small budget for promotion (about $1 million per year compared to $200 million for dairy, $80 million for beef, and $30 million for pork), catfish offers an interesting case study in which to address the issue of whether a limited budget can be used effectively for

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demand expansion purposes. The issue of whether a small program can be effective is important because there are some 312 federal- and state- legislated programs covering over 80 farm commodities, most of which have limited budgets *(2)*. Finally, a rich and detailed consumer data base exists for catfish containing information not only on consumption of catfish and related aquacultural products but also on consumer attitudes toward catfish, awareness of advertising, and related factors affecting consumption behavior. These data permit testing a variety of hypotheses that will shed light on the role of generic advertising in increasing demand and improving farmers' incomes.

This analysis has five parts. In the introductory section, a brief review of the catfish advertising program is presented along with specific research objectives and how they differ from past research. The second section contains a discussion of the theoretical and empirical models used to estimate producer and consumer impacts of the advertising program. Sources and characteristics of the data are discussed in the third section. Estimation results for an eight-equation empirical model based on the survey data are presented in the fourth section, followed by a discussion of the estimated impacts of advertising on catfish producers' incomes. The final section briefly summarizes the findings and presents recommendations for efficient use of advertising funds.

The Catfish Advertising Program

Media advertising of catfish in recent years has been conducted by three groups: processors, a fast-food chain, and producers through a $6 per ton voluntary contribution on feed. Advertising by processors is of the branded type, is directed chiefly at buyers and brokers in the food service industry, and is modest in scope. In addition, a significant amount of television advertising took place in 1985 when a national fast-food chain added catfish to its product line. However, the effort proved short-lived as the chain dropped catfish from its menu a year later.

The producer-funded ad campaign, which began in April 1987, represents the most sustained effort[3]. The general objective of the program was to efface the image of catfish as a "common fish that is almost always fried" *(31)*. Print advertisements (the only medium

[3]Because advertising funds are obtained from a voluntary check-off on feed, one might logically argue that feed mills share the cost. Still, most of the cost is passed on to producers via higher feed prices. It is accurate, therefore, to term the ad program "producer-funded."

used because of the limited budget) stressed three attributes: no fishy odor; mild, delicate flavor; and nutrition *(31)*. To differentiate farm-raised catfish from the "wild" river-caught counterpart, the advertisements contained a narrative and pictures describing the production process, touting the "natural grain" diet of the farm-raised fish and the pure water of ponds.

The advertisements were placed in regional editions of 10 nationally circulated magazines: *Time, Newsweek, People, Reader's Digest, Better Homes and Gardens, Sunset, Southern Living, Family Circle, Good Housekeeping,* and *Woman's Day.* The target audience was adults aged 25-49 (with a 65 percent emphasis on females), characterized as achievers, experimental, socially conscious, and located in the "Heartland" (Oklahoma, Texas, Louisiana, Arkansas, Tennessee, Mississippi, Alabama, Illinois, and Missouri). The advertisements were expected to reach at least 65 percent of the target audience in 1988 *(31)*.

Research Objectives

The purpose of the research reported in this bulletin is to determine the effectiveness of the catfish ad program described above. Determination of effectiveness has two dimensions. One dimension involves determining the impact of the advertising on the demand for catfish: Has the demand curve been shifted and, if so, what factors influenced the shift? In exploring this dimension, special emphasis was placed on the role of information in altering consumers' attitudes toward a product and the consequent effect on purchase behavior.

The second dimension of the effectiveness question involves determining the impact of the advertising on producers' incomes. Even if it can be determined that the advertising campaign has increased demand, from the producer's perspective the program is not worthwhile unless the shift in demand is large enough to compensate for costs. Because the program is conducted at the industry level (as opposed to, for example, the firm level), an economic measure of profit called "producer's surplus" was used in developing a measure of producer returns from advertising. The producer's surplus measure, in addition to indicating the aggregate impact of the advertising on collective "profit" of catfish producers, has the added advantage of conveniently indicating how supply response and alternative assumptions about the magnitude of the demand shift would affect the profitability of the advertising investment.

Previous research on generic advertising focuses primarily on the relationship between sales and advertising expenditures *(25,20,19,18,17,35,9,33,29)*[4]. Most of these reports describe studies based on aggregate time series data. The research reported here differs from the traditional approach by using disaggegrated cross-section data to focus on consumer beliefs and the role of advertising in altering those beliefs to enhance product image and increase sales.

METHODOLOGY

An Economic Model for Determining Producer Returns

The purpose of generic advertising is to increase industry-wide demand. Unlike brand advertising, the aim of generic advertising is not to increase the market share of a particular firm but rather to increase the size of the total market so that all firms in the industry can enjoy larger sales. As such, an appropriate procedure for evaluating the economic impact of generic advertising is to consider the impacts at the industry level. For this purpose, a partial equilibrium market model is used. The model permits identification of both the short-run and long-run impacts of advertising on prices, quantity, industry revenues, and profits or quasi-rent.

The basic model is illustrated in figure 1. Suppose prior to the advertising program the industry demand and (short-run) supply schedules are the curves labelled D and S in Panel (A). Equilibrium price and quantity corresponding to these curves are P* and Q*. At P* and Q*, the total revenue received by producers is represented by the rectangle OP*iQ*. Total variable costs are represented by the area OjiQ*. The difference between industry total revenue and total variable costs is a measure of the "profits" that exist in the industry at any particular time period. These "profits" (called producer's surplus or quasi-rent) represent returns to inputs in temporarily fixed supply (e.g., ponds, farm machinery, feed bins, spawning sheds). In the diagram, producers' profits consistent with the pre-advertising level of demand and supply are indicated by the area P*ij.

Now suppose implementation of the advertising program results in an outward shift of the industry demand schedule to D'. The short-run effects of the increased demand are indicated in Panel (A). Price increases to P' and quantity increases to Q'. Producers receive added revenues equal to the difference between rectangles

[4]Some noteworthy exceptions include Jensen and Kesavan *(13)*, Ghura and Schrimper *(8)*, Hoover et al. *(12)*, and Ward and Davis *(36)*.

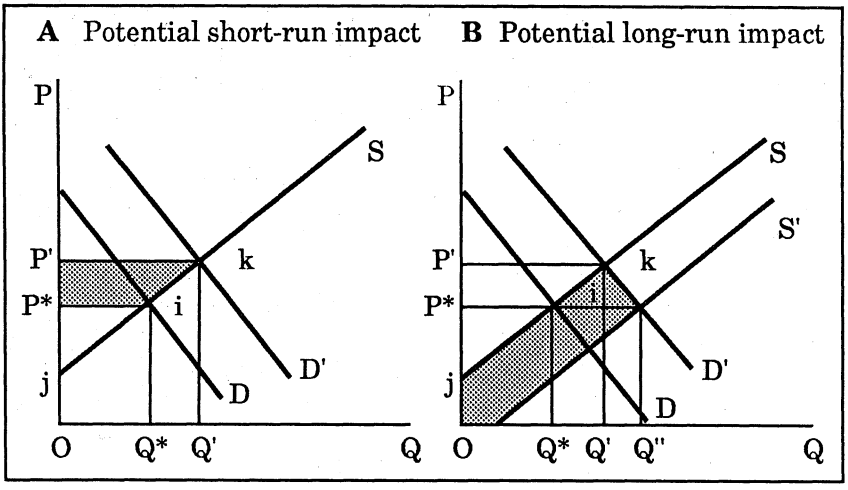

FIG. 1. Producer welfare effects of an advertising-induced increase in demand.

OP'kQ' and OP*iQ*, but spend an additional sum for variable inputs equal to the area Q*ikQ'. Gross profit (i.e., industry profit before subtracting the cost of the advertising program) resulting from the demand shift, obtained by subtracting the added revenues from the added variable costs, is represented by the shaded area P*P'ki in Panel (A).

The foregoing analysis is incomplete because it does not consider the long-run impacts of the price increase on industry supply. The added supply to accommodate the ad-induced demand shift in Panel (A) was assumed to come strictly from the existing firms. In addition, it was assumed these firms can expand production by increasing variable inputs only (e.g., feed or labor). The fixed inputs available to the firm had to remain at pre-advertising levels.

If existing firms are permitted to expand production facilities and new firms are allowed to enter the industry in response to the price increase, the ultimate effect of the demand shift on price will be less than that indicated in Panel (A). The price effect is diminished because the outward shift in the demand curve causes an eventual outward shift in the supply schedule, reflecting increased productive capacity and new firm entry. The exact extent to which prices will be affected in the long run depends on how input prices respond to increases in industry demand.

An interesting and not atypical case to consider is the case in which input costs remain constant (the so-called "constant-cost" industry

assumption). This might occur, for example, if the inputs in question (say catfish feed or aerators) are produced under conditions of constant returns to scale. In this case, the shift in the (short-run) supply schedule caused by the demand shift is such that advertising has no effect on price in the long run [see figure 1, Panel (B)]. The short- and long-run supply responses to the initial price increase (to P'), taken together, force price to return to the initial equilibrium level of P*.

Because demand shifts offer no long-term price enhancement for producers in constant-cost industries, it is tempting to conclude that producers in these industries do not benefit from advertising. Further analysis of figure 1, Panel (B), reveals why this conclusion in general is unwarranted. Even though, after all adjustments are complete, the price is the same whether demand is D or D', the volume of product produced and sold by the industry is larger with D', i.e., Q''. The larger volume implies greater total industry profit. The additional profit, compared to the pre-advertising level, is indicated by the shaded area in Panel (B). To the extent that some of this profit accrues to existing producers (as it must because only a portion of the supply increase, i.e., at most Q'' - Q', represents production by new entrants), producers funding the ad campaign will experience increased gross profits (quasi-rent). If this increased gross profit exceeds the cost of the advertising campaign, producers benefit, even though the price has not changed.

Returning our attention to short-run impacts, it is apparent from Panel (A) of figure 1 that the profitability of any advertising effort at the industry level will depend on three critical factors: the initial size of the industry, the slope of the supply schedule, and the magnitude of the shift in the demand curve. An expression quantifying the relationship among these factors, derived in Appendix A, is as follows:

$$(1)\ \text{PROFIT} = (P^*Q^*\tau\ (2 + \tau) - 2\ \varepsilon\ A) / 2\varepsilon$$

where PROFIT is the net gain in producers' surplus attributable to advertising, P* and Q* are initial (before advertising) equilibrium price and quantity, τ is the magnitude of the ad-induced increase in demand, ε is the price elasticity of supply, and A is the advertising expenditure. By taking derivatives of this equation with respect to τ and ε, it can be shown that profit is higher, ceteris paribus: (1) the larger the demand shift, and (2) the smaller the supply elasticity. Equation (1) is a general expression that can be used to approximate short-run returns to advertising in any industry given information about the magnitudes of P*, Q*, A, ε, and τ. The approx-

proximation will be better for smaller values of τ. The theoretical framework and procedures for estimating τ specific to the catfish industry are major elements of the research effort to be presented later in this publication.

A Theoretical Model of Consumers' Responses to Advertising

Although the aim of advertising is to increase sales, the means by which this is accomplished is not well understood. Theory of buyer behavior from the marketing literature suggests that advertising affects sales indirectly through its effect on consumer attitudes, which in turn are determined by consumers' beliefs about relevant product attributes *(1,6,7,11)*. Advertising can be used to modify consumers' beliefs or, what is more difficult, to modify the set of product attributes deemed relevant by the consumer. The modified beliefs or evaluative criteria lead to improved attitudes toward the product which, in turn, affect purchase intentions, culminating in a choice about whether to purchase the product.

The four elements of the purchase decision — evaluative criteria, beliefs, attitudes, and intentions — are linked in a recursive chain to the advertising stimulus as illustrated in figure 2. Because the elements are critical to understanding how advertising is hypothesized to affect choice, each deserves careful definition.

Evaluative Criteria. Evaluative criteria are the "desired outcomes from choice, expressed in the form of attributes or specifications used to compare various alternatives" *(5)*. Examples of evaluative criteria for a food item like catfish include nutritional value, ease of preparation, cost, flavor, and freshness. Because evaluative criteria are formed from stored information, experience, and consumer motives, they are resistant to change and therefore in general are not susceptible to ad influences *(5)*. But evaluative criteria are pivotal to understanding the nature and functioning of attitudes.

Beliefs. Beliefs represent information that "... links a given alternative to a specified evaluative criteria, specifying the extent to which the alternative possesses the desired attribute" *(5)*. For example, the statement "catfish is highly nutritious" links an alternative, i.e., catfish, to the evaluative criterion nutrition. The adjective "highly" quantifies the linkage in a relative sense. The overall statement expresses a belief about the relative nutritional benefit of consuming catfish. Beliefs are a component of attitude broadly conceived, representing the cognitive element *(5)* because they express a per-

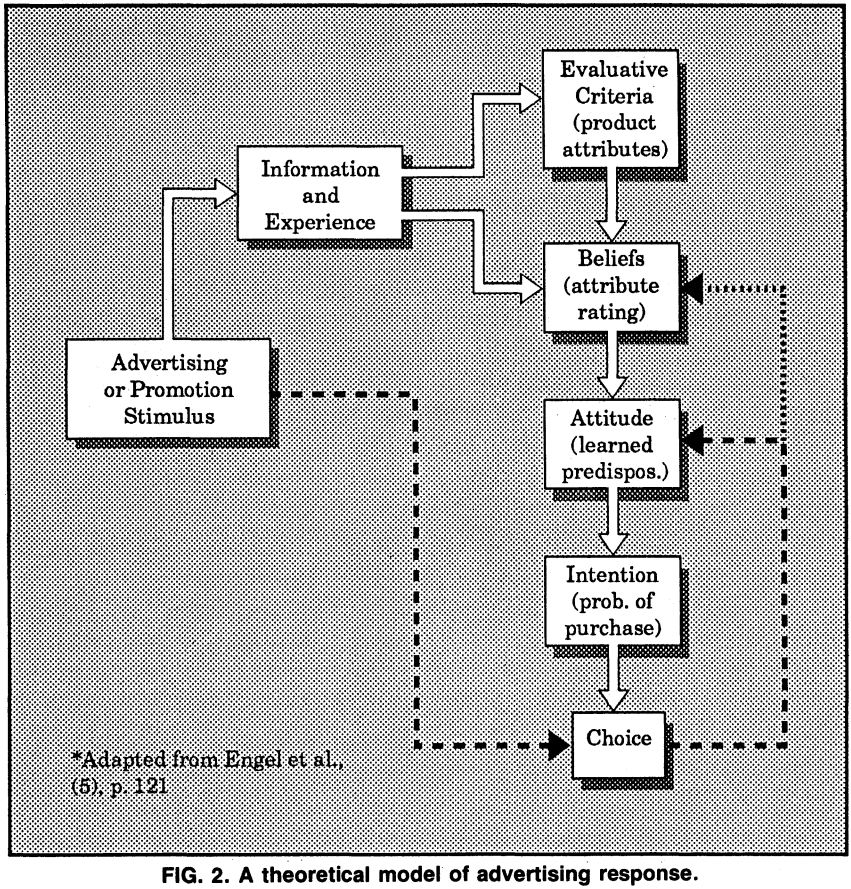

FIG. 2. A theoretical model of advertising response.

son's conviction about the extent to which a certain product contains the desirable (or lacks the undesirable) attribute.

Attitude. The term "attitude" for marketers has a precise meaning. It is defined as a "...learned predisposition to respond in a favorable or unfavorable manner with respect to a given alternative..." *(5)*. "I like catfish" expresses an attitude so defined. The narrowly defined term represents the affective element of the more broadly conceived notion of attitude. That is, it represents a person's like or dislike for a particular alternative. Attitudes are held in varying degrees of intensity depending upon their relationship to an individual's definition of self. Attitudes reflecting core beliefs stemming from religious or cultural influences are more strongly held than attitudes reflecting beliefs of a tangential nature. The latter type, which probably represents attitudes toward most consumer

products and brands, is more amenable to change through influences such as advertising. For advertising to change attitudes, however, the message must maintain consistency with prior beliefs *(32)*.

Intention. Intention is defined as the subjective probability that beliefs and attitudes will be acted upon. It represents the third and final element of the broad definition of attitude — the behavioral component — and as such is the most important element from a marketing perspective. Intention acts as a wedge between attitude change and the consequent effect on purchase behavior or consumption. Advertising and other promotional activities may be successful in changing attitudes but unsuccessful in changing intentions. Thus, a change in attitudes does not necessarily result in a change in intentions or sales.

The foregoing description implies a hierarchy of response in which exposure to the advertisement causes a change in beliefs, which then causes a change in attitudes leading ultimately to an increase in sales of the advertised product. The "attitude-before-behavior" paradigm, to use Krugman's *(24)* terminology, appears applicable to expensive, highly differentiated, infrequently purchased items whose characteristics can be accurately assessed prior to purchase. Research suggests, however, that a different order of responses may occur depending upon the nature of the product and the consumer's involvement in the purchase process *(30)*. In particular, for frequently purchased, low-priced, undifferentiated products, whose characteristics are not readily ascertained by pre-purchase study (e.g., catfish), low involvement is the norm. In such cases, consumers may react to the advertisement by purchasing the product on an experimental basis. Depending on the experience with the product, beliefs (and presumably attitudes) are then affected either favorably or unfavorably. If beliefs or attitudes improve as a result of the ad-induced purchase, purchases will increase.

The alternative path of influence of advertising for the low-involvement/undifferentiated product case is indicated by dashed lines in figure 2. The alternative path describes a "behavior-before-attitude" response to advertising *(24)*. In such cases, the attribute-specific information in the ad may be less important than the information conveyed by the mere presence of the ad. In particular, as argued by Nelson *(28)*, all advertising (even strictly "persuasive" advertising) is informative in the sense that it reminds consumers of the product's existence. Also, the very fact that advertising is being undertaken may signal to the consumer that the product is of good quality (otherwise how could the firm afford the expense?).

The reminder and signaling functions of advertising imply an alternative path of influence in which advertising affects consumption directly, as indicated by the dashed lines in figure 2. This direct path of influence is most relevant for describing the behavior of repeat purchasers already knowledgeable about the product's characteristics. But it can also describe the response of new consumers, or consumers whose beliefs and attitudes toward the product are not well formed. For these consumers, to the extent that low-involvement goods evoke a "behavior-before-attitude" response *(24)*, the advertising increases purchases by encouraging further experimentation with the product.

The distinction between "search" goods and "experience" goods proposed by Nelson has relevance for the hierarchy of influences postulated by the model. Search goods are defined as those goods for which attributes can be readily evaluated by the consumer prior to purchase. For such goods, the attribute-specific information in the ad is likely to be heeded by the consumer because its veracity can be determined by inspection. The flow-of-effects for search goods, therefore, is hypothesized to follow the indirect path indicated by the solid arrows in figure 2.

Experience goods have attributes which cannot be adequately evaluated until after purchase. Because food items must be consumed before such key attributes as taste or flavor can be determined, food products are generally regarded as (nondurable) experience goods. The inability to assess product attributes prior to purchase means that advertisements of experience goods will influence the consumer primarily through the indirect information conveyed by the ad, i.e., by "signaling" the product's existence and quality. As discussed above, signaling implies a "behavior-before-attitude" response, which means that for experience goods the primary mode of action is through the consumption function. That is, attitude is changed not as a result of a cognitive ad-induced change in beliefs, but as a result of an affective reaction to the experience of consuming the product. The interplay between attitude change and consumption implied by the hypothesized response of consumers to advertisements for experience goods has important implications for the specification and estimation of the empirical model.

The Empirical Model

The empirical model consists of four components describing the postulated hierarchy-of-effects of advertising. The equations within each component are specified to permit testing the chain of causation implied by the theoretical model. The chain links exposure to

information from advertising to changes in beliefs about relevant product attributes, which in turn is linked to changes in attitude. The attitude change, if favorable, is hypothesized to induce increased purchases of the advertised product. Because catfish is an "experience" good, a link is added to the chain showing the feedback of consumption to attitude as hypothesized for this type of good. Advertising is posited to affect sales both directly via "signaling" and indirectly through the effect of the advertisement on the consumer's belief structure.

The eight equations representing the four components of the model are:[5]

1. *Awareness equations:*

(2) $SEENAD = f_1(Z_1, e_1)$

(3) $AWARCAT = f_2(SEENAD, Z_1, e_2)$

where SEENAD is self-described awareness of catfish advertisements (0-1 binary variable); AWARCAT is self-described awareness of farm-raised catfish (0-1 binary variable); Z_1 is a vector of socioeconomic characteristics defining the target audience; and e_1 and e_2 are random error terms. Equations (2) and (3) are recursively linked through the ad awareness variable.

2. *Belief equations:*

(4) $NUTR = f_3(AWARCAT, Z_1, e_3)$

(5) $FLAV = f_4(AWARCAT, Z_1, e_4)$

(6) $NOODOR = f_5(AWARCAT, Z_1, e_5)$

where NUTR, FLAV, and NOODOR are the rankings of catfish for nutritional value, flavor, and absence of undesirable fishy odor (1 to 10 scale); Z_1 is as defined previously; and e_3, e_4, and e_5 are stochastic error terms. The three belief equations contain (recursive) backward linkages to the awareness equations via the AWARCAT variable.

3. *Attitude equation:*

(7) $ATT = f_6(NUTR, FLAV, NOODOR, ATHOME, REST, e_6)$

where ATT is consumer's ranking of catfish relative to other fish and seafood (1 to 10 scale); ATHOME and REST are the number of purchases per month (0 to 4) of catfish for at-home and restaurant

[5]For a slightly different specification of the empirical model and further elaboration of the underlying theory, see Kinnucan and Venkateswaran *(16)*. An abbreviated version of this report with emphasis on implications for advertising policy is presented in Kinnucan and Venkateswaran *(17)*.

consumption.[6] These two variables indicate the feedback of consumption onto attitude; e_6 is a random error term. The remaining variables carry over recursively from the belief equations.

4. *Purchase equations:*

(8) ATHOME = f_7(SEENAD, ATT, Z_2, e_7)

(9) REST = f_8(SEENAD, ATT, Z_3, e_8)

Z_2 and Z_3 are sets of exogenous variables affecting purchase behavior and e_7 and e_8 are random error terms. The SEENAD and ATT variables are carried over from the awareness and attitude equations to test the direct influence of these variables on purchase frequency.

DATA

A nationwide telephone survey commissioned by a consortium of universities under a contract with the Southern Regional Aquacultural Center was conducted in spring 1988 by a private research firm to obtain baseline data about consumers' purchase behaviors and attitudes toward catfish and crawfish. A quota sampling procedure was used in which a random sample of 400 consumers in each of the nine U.S. census regions was drawn to yield 3,600 completed interviews. The questionnaire, requiring about 12 minutes to complete, had five sections. The first section contained questions relating to fish in general. The next two focused on catfish and crawfish. The fourth and fifth sections related to the recreational fishing habits and socio-demographic characteristics of households.

A purpose of the questionnaire was to obtain data for evaluating the industry ad campaign. Ad awareness was determined by the question "Have you seen, read, or heard of any advertising for catfish?" If the answer was "yes" the question was posed: "Where did you see, hear, or read it?" Because generic advertising was restricted to magazines, the latter question helped to determine whether the source of the ad information was from the industry-funded effort or elsewhere. The respondent was then asked to indicate the level of agreement with 10 belief statements about catfish. A scale of 1 to 10 was used where 1 = strong disagreement and 10 = strong agreement. Three of the belief statements related directly to the stated objectives of the ad campaign, namely "catfish has no fishy

[6]The coding of the ATHOME and REST variables is based on purchase frequency as follows: 0 - zero purchaser; 1 - less than once a month; 2 - one to two times per month; 3 - three to four times per month; and 4 - more often than four times per month.

odor," "catfish has a mild, delicate flavor," and "catfish is of high nutritional value." Respondents were asked if they had heard of farm-raised catfish and, if so, whether they perceived farm-raised catfish as being different from other catfish. Attitude was assessed by posing the question: "On a 10 point scale where 1 means catfish is worst and 10 means catfish is best, how would you compare catfish to other fish and seafood?"

Although the study covered 3,600 interviewees, the eight-equation model was estimated using only the data from respondents answering "yes" to the question "Have you ever eaten catfish?" Nonconsumers had to be excluded because information on advertising awareness was obtained only for catfish consumers. There were 2,172 such respondents. Such self selection of samples, i.e., using only a subsample of data for those individuals who have eaten catfish, may lead to biased estimates of the model parameters *(10)*. The parameters may be biased because deleting observations may result in a subsample that is no longer random. Potential selectivity bias, therefore, was tested using Heckman's *(10)* two-stage procedure. The results, summarized in Appendix B, indicated that for this particular study, deletion of nonconsumers did not bias parameter estimates.

Variables included in the study and their notations and descriptive statistics are presented in table 1. Means of the binary variables are the proportions of the sample that assume the particular qualitative attribute. For instance, 35 percent of the survey households have an annual income ranging between $20,000 and $40,000 and 36 percent are professionals or administrators.

The concept of a "reference household" is useful in interpreting the coefficients to be estimated by probit analysis *(4)*. The reference household is defined as the household whose characteristics are described when all dummy variables in the model are zero. The reference household for equation (2) is one with an annual income below $20,000, residing in an urban or suburban area in the South Atlantic census subdivision[7] with a male head under 24 years or over 50 years old, with less than high school education, and either unemployed or holding a position other than as a professional, administrator, sales person, clerk, blue collar laborer, or full-time agricultural worker. The reference household for equation (3) is defined as one that has not seen catfish advertisements and has all other characteristics defined for the reference group for equation (2).

[7]The South Atlantic census subdivision includes Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia.

TABLE 1. DESCRIPTIVE STATISTICS OF THE VARIABLES USED IN THE STUDY, 1988, SURVEY DATA, U.S.

Variable name	Description	Sample			
		All observations (N = 3600)		Catfish consumers only (N = 2172)	
		Mean	Std.deviation	Mean	Std.deviation
EATNCFSH	1 if household consumes catfish; 0 otherwise.	0.6033	0.4893	1.0000	0.0000
INC2040	1 if annual household income is between $20,000 and $40,000; 0 otherwise.	.3478	.4763	.3481	.4765
INC4050	1 if annual household income is between $40,000 and $50,000; 0 otherwise.	.0928	.2902	.0981	.2975
INCGT50	1 if annual household income is greater than $50,000; 0 otherwise.	.1306	.3370	.1312	.3377
INCDK	1 if household does not report income; 0 otherwise.	.1742	.3793	.1579	.3648
BLACK	1 if race of household is black; 0 otherwise.	.0725	.2594	.0866	.2813
OTHNW	1 if race of household is Hispanic, Asian, or others; 0 otherwise.	.0833	.2764	.0695	.2544
PROFAD	1 if household head is a professional or administrator; 0 otherwise	.3633	.4810	.3600	.4801
CLERIC	1 if household head is a clerk or in sales profession; 0 otherwise.	.0872	.2822	.0820	.2744
BCLABOR	1 if household head is a blue collar laborer; 0 otherwise	.2172	.4124	.2265	.4187
AGWORKR	1 if household head is a full time agricultural worker; 0 otherwise.	.0372	.1893	.0373	.1895
HSCHSOMC	1 if household head has high school/some college education; 0 otherwise.	.5606	.4964	.5456	.4980
COLED	1 if household head has a college degree; 0 otherwise.	.3194	.4663	.3232	.4678
FEMWORK	1 if female head of household works away from home; 0 otherwise.	.5050	.5000	.5028	.5001
EAST	1 if household belongs to New England/Middle Atlantic census subdivisions; 0 otherwise.	.2222	.4158	.1234	.3290
HEART	1 if household belongs to East North Central/West North Central/East South Central/West South Central census subdivisions.	.4444	.4970	.5631	.4961
WEST	1 if household belongs to the Mountain/Pacific census subdivisions; 0 otherwise.	.2222	.4158	.2044	.4034
HHSIZE	Household size.	2.9053	1.5023	2.9236	1.5099
NKIDS	Number of kids (age below 10 years) in the household.	.4844	.8765	.4802	.8708
NTEENS	Number of teens (age 11-20 years) in the household.	.4869	.8557	.4931	.8501
RURAL	1 if household resides in rural area; 0 otherwise.	.3136	.4640	.3347	.4720
CATHLIC	1 if the household's religious preference is Catholicism; 0 otherwise.	.2422	.4285	.1920	.3940
OTHCHRST	1 if household's religious preference is non-Catholicism; 0 otherwise.	.5850	.4928	.6321	.4823
SEENAD	1 if the household head is aware of catfish advertisements; 0 otherwise.	-	-	.3849	.4867
AGE	1 if the household head is between 25 and 49 years of age; 0 otherwise.	.5136	.4999	.5170	.4998
FEMALE	1 if the respondent is female; 0 otherwise.	.5000	.5001	.4618	.4987
NOODOR	Respondent's rating of absence of fishy odor in catfish. (Scale: 1-10).	5.4511	2.3866	5.8706	2.6770
FLAV	Respondent's rating of catfish flavor (Scale: 1-10).	6.1878	2.4594	6.9899	2.5700
NUTR	Respondent's rating of nutritive value of catfish. (Scale: 1-10).	6.9336	2.5245	7.7215	2.4149
AWARCAT	1 if respondent is aware of farm-rasied catfish; 0 otherwise.	.5256	.4994	.6943	.4608

Continued

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MAGAD	1 if respondent became aware of catfish through magazine advertisements; 0 otherwise.	-	-	.0631	.2432
ATT	Respondent's rating of catfish compared to other fish and seafood. (Scale: 1-10).	-	-	6.5032	2.6223
ATHOME	Frequency of catfish purchases for home consumption.	-	-	.8223	1.0456
REST	Frequency of catfish purchases at restaurants.	-	-	.8762	.9525
IMRSNAD	Inverse Mill's ratio of the SEENAD variable.	-	-	-.8660D-5	.7790

RESULTS

Econometric Estimates of the Empirical Model

The eight-equation model represents a partially recursive system. The one-way direction of causality among awareness, beliefs, and attitudes indicated by theory suggests equations (2) through (6) are block recursive and can be estimated by ordinary least squares (OLS) regression. However, due to the presence of binary dependent variables, equations (2) and (3) are estimated sequentially using a two-stage probit procedure. In the first stage, the maximum likelihood probit estimates of equation (2) are obtained. Using the resulting estimates, an inverse Mill's ratio *(10)* of SEENAD, i.e., SEENAD*, is computed. In the second stage, the SEENAD variable in equation (3) is replaced by SEENAD* and the equation estimated by probit. Because the probit model is estimated using a maximum likelihood procedure, the estimated coefficients are consistent and asymptotically normally distributed *(4)*.

Theory indicates attitudes and consumption may be jointly determined in the case of experience goods. The equations representing attitude and consumption, equations (7) through (9), therefore, must be estimated simultaneously to obtain unbiased estimates of the parameters. The equations are over-identified, lending themselves to estimation by two-stage least squares (2SLS). Error terms across the equations, however, are likely to be correlated. Equations (7) through (9), therefore, were estimated as a total system using three-stage least squares (3SLS). The 3SLS estimates are consistent and asymptotically more efficient than the 2SLS estimates, because 3SLS takes into account the cross-equation correlation of the error terms *(14)*.

Estimation was conducted on a mainframe computer using the econometric software package SHAZAM version 4.5 developed by White et al. *(37)*. Because the inverse Mill's ratio (IMR) option is not available in SHAZAM version 4.5, the IMR values were computed using SAS.

Awareness Equations

The maximum likelihood estimates (MLE) of the two awareness equations, i.e., equations (2) and (3), are presented in table 2. The probability that the reference household in equation (2) would have

TABLE 2. MAXIMUM LIKELIHOOD PROBIT ESTIMATES (MLE) OF AWARENESS EQUATIONS USING HECKMAN'S TWO-STAGE PROCEDURE, 1988, SURVEY DATA, U.S.

Variable	Awareness of catfish ads (SEENAD)		Awareness of farm-raised catfish (AWARCAT)	
	MLE of the parameter	Change in probability[1]	MLE of the parameter	Change in probability[2]
INTERCEPT	-0.3153[3]	-0.1203	0.2996[4]	0.1026
	(.1224)[5]		(.1270)	
INC2040	.1084	.0414	.0561	.0192
	(.0761)		(.0796)	
LINC4050	.0583	.0222	.2648[4]	.0906
	(.1106)		(.1207)	
INCGT50	.0592	.0226	.1224	.0419
	(.1042)		(.1111)	
INCDK	-.1949[4]	-.0744	.1308	.0448
	(.0907)		(.0936)	
PROFAD	-.0190	-.0007	.1440	.0493
	(.0820)		(.0874)	
CLERIC	-.0043	-.0002	-.0676	-.0231
	(.1140)		(.1192)	
BCLABOR	-.1012	-.0386	-.0428	-.0147
	(.0848)		(.0889)	
AGWORKR	-.0290	-.0111	-.1120	-.0383
	(.1554)		(.1637)	
HSCHSOMC	.1426	.0544	.1806[4]	.0618
	(.0890)		(.0920)	
COLED	.1724	.0658	.1948	.0667
	(.1016)		(.1062)	
EAST	-.1819	-.0694	-.2963[4]	-.1014
	(.1157)		(.1184)	
HEART	.1086	.0414	.3229[4]	.1105
	(.0912)		(.0960)	
WEST	-.2203[4]	-.0840	-.2323[4]	-.0795
	(.1041)		(.1060)	
RURAL	.1093	.0417	.1552[4]	.0531
	(.0597)		(.0642)	
AGE	-.0681	-.0260	-.0498	-.0170
	(.0616)		(.0654)	
FEMALE	-.2205[3]	-.0841	-.3165[3]	-.1083
	(.0562)		(.0595)	
IMRSNAD	-	-	.3430[3]	.1174
			(.0387)	

[1]The SEENAD variable evaluated at sample means, using the probit estimates is -0.2993. The standard normal density evaluated at this value is 0.3815. The product of each parameter estimate and the fixed value of the standard normal density (i.e., 0.3815) gives the change in probability.

[2]The AWARCAT variable evaluated at sample means, using the probit estimates is 0.5535. The standard normal density evaluated at this value is 0.3423. The product of each parameter estimate and the fixed value of the standard normal density (i.e., 0.3423) gives the change in probability.

[3]Significant at 1 percent level.

[4]Significant at 5 percent level.

[5]Figures in the parentheses are standard errors of the estimates.

seen catfish ads is 0.375. Households not reporting their incomes (i.e., INCDK = 1, all other income variables = 0), have a significantly lower probability (0.31) of having seen catfish advertisements than households with annual incomes below $20,000 (the reference income group). However, the probabilities of the remaining income groups having seen catfish advertisements are not significantly different from those of the reference income group.

The probability of households in the East or the Heartland region of the United States having seen the catfish ad is similar to that of the reference household (i.e., 0.37). However, households in the West have a significantly lower probability (0.30) of having seen catfish advertisements. Similarly, female respondents have a significantly lower probability (0.30) of having seen the catfish advertisements, compared to male respondents. Age, educational level, and occupation of the household head do not appear to be important in explaining the probability of having seen the catfish advertisements.

The probability of the reference household in equation (3) being aware of farm-raised catfish is 0.62. Households with an annual income ranging between $40,000 and $50,000 have a significantly higher probability (0.71) of being aware of farm-raised catfish than households with an annual income below $20,000 (the reference income group). The probability of being aware of farm-raised catfish is the same for the reference income group as for the other income groups considered in the study.

Household heads with high school or some college education, but without a college degree, have a significantly higher probability (0.68) of being aware of farm-raised catfish, compared to household heads who have less than high school education or who have college degrees and other advanced degrees. Geographic location appears to be an important variable in explaining awareness of farm-raised catfish. Although the Heartland, the East, and South Atlantic regions have the same probability of having seen catfish ads, consumers in the Heartland region have a higher probability (0.73) of being aware of farm-raised catfish compared to consumers in the other regions. This makes sense because consumers in the Heartland, by virtue of their proximity to catfish farms, are exposed to more publicity about the farm-raised product.

Rural households have a significantly higher probability (0.68) of being aware of farm-raised catfish than the urban or suburban households (0.62). Female respondents have a lower probability

(0.49) of being aware of farm-raised catfish, indicating that the industry ad campaign has not been very successful in reaching one of their target groups, namely, the female homemakers.[8] Household heads who had seen or heard catfish advertisements have a significantly higher probability (0.74) of being aware of farm-raised catfish than household heads who had not seen catfish advertisements.

The socio-economic profile of individuals with higher probability of being aware of farm-raised catfish can therefore be characterized as male respondents in the Heartland region, with annual household incomes between $40,000 and $50,000, with the head of household having high school or some college education, residing in rural areas, and being aware of catfish advertisements. Age and occupation of household heads are not important in explaining the probability of households being aware of farm-raised catfish.

The results for the awareness equations, taken together, suggest that although the industry ad campaign has not been successful in reaching its target audience of 25- to 50-year-old female homemakers, it has increased the overall awareness of the farm-raised product.

Belief Equations

The OLS estimates for the three belief equations are presented in table 3. HEART and AWARCAT are positively related to NUTR, while INCGT50 is negatively related. This can be interpreted as follows: if the proportion of households in the sample with INCGT50 (income greater than $50,000) increases by one percentage point, the rating for the nutrition attribute (consumers' evaluations of whether catfish is of "high nutritional value") of catfish will decrease by 0.5 point. Similarly, if the number of households in the Heartland region increases by 1 percent, ceteris paribus, the rating for catfish nutrition will increase by 0.4 point. Finally, if the number of sample household heads who are aware of catfish ads increases by one percentage point, rating for the catfish nutrition variable will increase by 0.78 point. None of the other socio-economic variables have a significant influence on the rating of NUTR variable.

In the case of the FLAV variable, the three significant socio-

[8]Because a number of the magazines containing the ads are women's magazines, the lower level of awareness among female respondents is surprising. Several interpretations are apparent. One is that the ads are less appealing to females than to males. Alternatively, the women's magazines may be a less effective vehicle for advertising a food product than the gender-neutral magazines. In any case, the results suggest the ads failed to reach a primary segment of the target audience.

economic variables affecting the rating for catfish flavor variable are BCLABOR (blue collar laborer), HSCHSOMC (high school/some college education), and COLED (college degree). The effect is negative in all three cases, indicating that individuals having these characteristics rate the flavor of catfish lower than does the reference group. PROFAD (professional or administrator), CLERIC (clerical or sales), and BCLABOR are the three significant variables in the case of the NOODOR variable. The coefficients are negative, indicating these groups have less agreement with the "no fishy odor" statement than do others.

TABLE 3. OLS ESTIMATES OF THE BELIEF EQUATIONS, 1988, SURVEY DATA, U.S.

Variable	OLS estimated coefficients of		
	Nutrition	Flavor	No fishy odor
INTERCEPT	7.2638[1]	6.9934[1]	5.9046[1]
	(.2361)[2]	(.2515)	(.2651)
INC2040	-.0457	.0140	.0656
	(.1404)	(.1495)	(.1577)
INC4050	.0637	-.0765	.4382
	(.2046)	(.2180)	(.2298)
INCGT50	-.5002[1]	-.3975	.0687
	(.1923)	(.2049)	(.2160)
INCDK	-.1914	-.0296	-.0544
	(.1641)	(.1748)	(.1843)
PROFAD	-.1635	-.2185	-.3559[3]
	(.1513)	(.1611)	(.1699)
CLERIC	-.0985	-.3183	-.5154[3]
	(.2106)	(.2243)	(.2365)
BCLABOR	-.2172	-.3586[3]	-.5083[1]
	(.1559)	(.1661)	(.1751)
AGWORKR	-.1073	-.3612	-.0097
	(.2870)	(.3057)	(.3223)
HSCHSOMC	-.1446	-.3749[3]	-.0757
	(.1630)	(.1736)	(.1831)
COLED	-.2823	-.5862[1]	-.0833
	(.1866)	(.1988)	(.2096)
EAST	-.2124	-.1298	.0294
	(.2128)	(.2267)	(.2391)
HEART	.3963[3]	.2463	-.1347
	(.1695)	(.1806)	(.1904)
WEST	-.0330	-.2777	-.1883
	(.1910)	(.2035)	(.2145)
RURAL	-.0411	.0327	.1198
	(.1103)	(.1175)	(.1239)
AGE	.1242	.0037	-.0971
	(.1135)	(.1209)	(.1275)
FEMALE	.1652	.0634	-.1197
	(.1041)	(.1109)	(.1170)
AWARCAT	.7727[1]	.7797[1]	.6193[1]
	(.1135)	(.1210)	(.1275)
R^2	.0475	.0456	.0222
Adjusted R^2	.0400	.0381	.0145

[1]Significant at 1 percent level.
[2]Figures in the parentheses are standard errors of the estimates.
[3]Significant at 5 percent level.

Awareness of farm-raised catfish is the single most important variable in all the three belief equations. The coefficient of this variable is positive and significant at the 1 percent level across all the three equations, table 3. This implies that consumers who are aware of the farm-raised product rate catfish higher on each of the three dimensions of nutrition, flavor, and no fishy odor. Note that advertising, by increasing awareness of the farm-raised product, is indirectly responsible for the improved belief ratings.

Attitude Equation

The 3SLS estimates of the attitude, at-home, and restaurant equations are presented in tables 4 and 5. The relationship between the three belief variables and attitude is significant, with flavor being the most important variable (as indicated by the large parameter estimate), followed by nutrition and no fishy odor. The large coefficient of the flavor variable highlights the importance of this single factor in determining consumers' attitudes: consumers must like the taste if they are to be favorably predisposed towards catfish. The paramount importance of flavor has important implications for the off-flavor problem afflicting the industry *(21)*.

The positive and significant coefficient of the at-home consumption variable indicates consumers' experiences with catfish are associated with a positive predisposition towards the product. Restaurant consumption of catfish, however, does not appear to be important in determining consumers' attitudes towards the product. The belief, at-home, and restaurant consumption variables included in the equation "explain" 25 percent of the variation in the attitude variable.

TABLE 4. 3SLS ESTIMATES OF THE ATTITUDE EQUATION, 1988, SURVEY DATA, U.S.

Variable	Estimated coefficient	Elasticity at the mean
INTERCEPT	2.6795[1]	-
	(.1912)[2]	
NUTR	.1059[1]	.1257
	(.0226)	
FLAV	.3144[1]	.3379
	(.0274)	
NOODOR	.0594[1]	.0536
	(.0188)	
ATHOME	.7665[1]	.0969
	(.2021)	
REST	-.1941	-
	(.2588)	
R^2	.2507	-
Adjusted R^2	.2490	-

[1]Significant at 1 percent level.
[2]Figures in the parentheses are the asymptotic standard errors of the estimates.

TABLE 5. 3SLS ESTIMATES OF THE CATFISH CONSUMPTION EQUATIONS, 1988, SURVEY DATA, U.S.

Variable	Estimated coefficients of	
	At home consumption	Restaurant consumption
INTERCEPT	-.7743[1]	-.3749[1]
	(.1447)[2]	(.1428)
INC2040	.0313	-.0190
	(.0489)	(.0531)
INC4050	.0370	-.0338
	(.0715)	(.0778)
INCGT50	.0093	.0921
	(.0678)	(.0736)
INCDK	.0206	-.0487
	(.0575)	(.0623)
BLACK	.6176[1]	-.0224
	(.0725)	(.0705)
OTHNW	.1523[3]	-.0127
	(.0716)	(.0773)
PROFAD	-.0132	.0728
	(.0520)	(.0575)
CLERIC	.0310	.1265
	(.0728)	(.0802)
BCLABOR	.0173	-.0588
	(.0528)	(.0588)
AGWORKR	.0918	.2006
	(.0992)	(.1076)
HSCHSOMC	-.0251	.2398[1]
	(.0586)	(.0620)
COLED	-.0402	.2670[1]
	(.0673)	(.0714)
EAST	-.0351	-.0894
	(.0741)	(.0805)
HEART	.3018[1]	.2222[1]
	(.0621)	(.0651)
WEST	.0186	-.1694[3]
	(.0673)	(.0724)
HHSIZE	.0114	.0268
	(.0206)	(.0224)
NKIDS	-.0254	-.0406
	(.0284)	(.0308)
NTEENS	.0136	-.0288
	(.0291)	(.0315)
IMRSNAD	.0624[1]	.0744[1]
	(.0230)	(.0247)
ATT	.2057[1]	.1350[1]
	(.0176)	(.0164)
FEMWORK	-	.0192
		(.0401)
R^2	.1320	.0937
Adjusted R^2	.1240	.0849

[1]Significant at 1 percent level.
[2]Figures in parentheses are asymptotic standard errors.
[3]Significant at 5 percent level.

Purchase Equations

The 3SLS estimates of the purchase equations suggest important differences in the at-home and restaurant markets for catfish, (table 5). According to the at-home equation, the socio-demographic variables determining this market are race (blacks and other non-whites consume more catfish at home than whites) and region (Heartland consumers purchase more catfish for home use than consumers in other regions). For the restaurant market, by contrast, race is not significant. Region is still significant, with consumers in the Heartland consuming catfish more frequently in restaurants and those in the West consuming less frequently in restaurants than consumers in the East or South Atlantic. Education is also an important determinant of restaurant consumption, with more-educated consumers having a greater purchase frequency than the less well educated. Income, race, occupation, household size and composition, and working female head appear to have no effect on restaurant consumption.

Attitude is significant at the 1 percent level in both equations, table 5. The positive coefficient in each equation implies that improved perceptions about catfish translate into greater purchase frequency in both the at-home and restaurant markets. The elasticities for attitude, evaluated at mean data points, are 1.63 for home consumption and 1.00 for restaurant consumption. These elasticities, being greater than or equal to 1, highlight the importance of attitude as a determinant of catfish consumption. For example, the attitude elasticity for the at-home equation means that a 10 percent improvement in consumers' attitudes toward catfish would be associated with an increase in purchase frequency of 16.3 percent. Because advertising affects attitude indirectly via beliefs, advertising is an important (indirect) factor influencing catfish consumption in both the at-home and restaurant markets.

The inverse Mill's ratio[9] is significant at the 1 percent level in both equations. The standard interpretation of this result is that selectivity bias would be affecting the estimated parameters if information about SEENAD had been excluded from the consumption equations *(10)*. Alternatively, the results could be interpreted

[9]The inverse Mill's ratio is computed using the formula $\lambda = \phi(Z) / \Phi(Z)$ if $Y = 1$; and $\lambda = \phi(Z) / [1 - \Phi(Z)]$ if $Y = 0$ where Y is the value of the dependent variable from the probit model and $\phi(Z)$ and $\Phi(Z)$ are the normal probability density function and the cumulative density function, respectively, for the response rule. Note λ is positive whenever $Y = 1$ and negative when $Y = 0$. The simple correlation between SEENAD and SEENAD* is .98.

as indicating the direct effect of advertising on consumption *(13)*.[10] In either case, the significance of the inverse Mill's ratio indicates the industry ad program must be explicitly considered in specifying the catfish consumption function.

Model Simulation

To evaluate the effect of advertising on beliefs, attitude, and consumption, the model was simulated under two scenarios: (1) consumers are not aware of catfish ads (SEENAD = 0, and all other variables held constant at mean values); and (2) consumers are aware of catfish ads (SEENAD = 1, ceteris paribus). Values of the endogenous variables obtained from the two simulations indicate the extent to which advertising (as measured by recall) has accomplished its goal of improving consumers' perceptions of catfish and increasing sales. Because advertising exerts its primary influence in an indirect manner via improved consumer awareness of the distinction between the farm-raised and the "wild" product, an advantage of the simulation exercise is that it makes these indirect effects explicit.

The simulations were accomplished in two steps to accommodate the partially recursive nature of the model. In the first step, equations pertaining to the recursive portion of the model, equations (2) through (6), were solved sequentially to obtain the desired values of the respective endogenous variables. In the second step, the simultaneous portion of the model, equations (7) through (9), was solved for the reduced form from which the desired values of the remaining three endogenous variables were computed (see Appendix C for details). The simulation results are presented in table 6.

Assuming an average consumer is unaware of catfish ads, the probability of this consumer being aware of farm-raised catfish is

[10]Although strictly speaking, the coefficient of the inverse Mill's ratio of SEENAD cannot be used to quantify the impact of advertising recall on consumption, the paper by Maddala and Lee *(26)* suggests a situation in which it might be possible to do so. In particular, if consumption and ad recall are simultaneously determined (rather than recursive by determined as assumed in this study), then a correlation would exist between SEENAD and the error terms in the consumption functions, implying biased estimates of the effect of ad recall on consumption. The simultaneous equation bias could be eliminated by replacing SEENAD with an instrumental variable. Because of the high correlation between SEENAD and its inverse Mill's ratio (SEENAD*) (r = .98) and the fact that SEENAD* is uncorrelated with equation error terms suggests to use SEENAD* as the instrument. In this case, the coefficient of SEENAD* could be interpreted as a consistent estimate of the effect of ad recall on consumption. Alternatively, one might wish to use an instrument for SEENAD to deal with measurement error common in recall data. Krugman *(24)* asserts that recall data understate awareness by as much as 50 percent. Bagozzi (*3* p.131) states that all data relating to consumer perceptions "...invariably contain moderate to high amounts of measurement error." Here again the instrumental variable estimator yields a consistent estimate of the advertising effect *(23)*.

0.71, table 6. Such an individual assigns (on a 10-point scale) 7.6, 6.9, and 5.8 points, respectively, for the nutrition, flavor, and no-fishy odor attributes of catfish. Although nutrition receives a higher rating than flavor, flavor is more important as a determinant of attitude. This consumer's rating of catfish compared to other fish and seafood (attitude) is approximately 6.4.

TABLE 6. IMPACT OF CATFISH ADVERTISING ON AWARENESS, BELIEFS, ATTITUDE, AND PURCHASE FREQUENCY, 1988, U.S.

Variable	Estimated value when: SEENAD = 0	SEENAD = 1	% change
Probability of being aware of farm-raised catfish (AWARCAT)	0.71	0.81	15.11
Rating of catfish nutrition (NUTR)	7.61	7.88	3.48
Rating of catfish flavor (FLAV)	6.88	7.15	3.89
Rating of catfish odor (NOODOR)	5.78	5.99	3.67
Rating of catfish compared to other fish and seafood (ATT)	6.44	6.63	2.83
Frequency of purchase for home consumption (# of times per month) (ATHOME)	.81	.91	12.33
Frequency of purchase from restaurants (# of times per month) (REST)	.87	.97	11.40

For the consumer who is aware of catfish ads, the probability of being aware of farm-raised catfish is 0.82, or 15 percent higher than the corresponding figure for the consumer who is unaware of ads. Apparently, because of the ability to distinguish the farm-raised from the "wild" product, the aware consumer assigns a higher rating to the nutrition, flavor, and no fishy odor attributes of catfish, with the flavor attribute being dominant. In percentage terms, the increases range from 3.48 for nutrition to 3.89 for flavor. These results suggest advertising has improved belief ratings for the targeted attributes by about 3 to 4 percent.

The attitude measure (consumer's rating of catfish compared to other fish and seafood) increases from 6.4 for the consumer unaware of advertising to 6.6 for the aware consumer, an increase of 2.8 percent. This increase, while modest, was shown to have a significant impact on consumption.

The monthly purchase frequency for home consumption and the frequency of purchase from restaurants are higher by 12.3 and 11.4

percent, respectively, for the consumers who have seen catfish ads. These results are consistent with the elasticities for the attitude variable presented earlier, showing the at-home market to be more responsive to improved attitudes than the restaurant market. Apparently the at-home market's slightly larger response to advertising is attributable both to its being more sensitive to attitude and to the fact that at-home consumption affects attitude, whereas restaurant consumption does not, see table 4.

The foregoing measures of purchase frequency can be used to calculate the effect of advertising on market demand given certain assumptions. These are: (1) that, on average, the quantity of catfish purchased on each grocery shopping or restaurant occasion is about the same so that a percentage increase in purchase frequency is equivalent to a percentage increase in quantity; (2) recall data accurately measure advertising impact, at least in terms of information conveyed; and (3) at-home and restaurant consumption account for 33 and 67 percent, respectively, of all catfish consumed *(27)*. Based on these assumptions and the foregoing simulation results, we estimate the industry ad campaign to have increased the overall demand for catfish 11.7 percent in its first 12 months.[11]

Producer Returns from Advertising

The foregoing analysis suggests advertising has increased the demand for catfish. But for advertising to be effective, the demand shift must be large enough to compensate for the costs of the program. Because the catfish advertising program is financed by producers, it is appropriate to focus on farm-level impacts when measuring costs and benefits. The returns formula discussed previously, equation (1), can be used for this purpose provided some assumptions are accepted. The assumptions are: (1) percent increases in the retail demand translate into equivalent percentage increases in demand at the farm level; (2) the farm level supply elasticity (ε) for catfish is 3.00; (3) industry equilibrium revenue (P* Q*) in the year preceding the advertising program (i.e., April 1986 through March 1987) is $143.62 million; (4) the amount spent on advertising (A) during the study year (i.e., April 1987 through March 1988)

[11]It is important to note that no effort was made in the study to identify the source of the ad, i.e., whether the ad is generic (paid for by catfish producers) or branded (paid for by a specific processor, retail grocery, or restaurant). Thus, to the extent that branded advertising was taking place, results based on recall of all catfish ads will bias upwards the estimated effect of the industry ad campaign. But because the industry ad campaign represents the largest and most sustained effort during the year preceding the survey, the bias, if present, is likely to be small.

is $1.48 million; (5) advertising increased the farm level demand by 11.7 percent ( ) during the study period; and (6) producers bear the full burden of the feed check-off.

Assumptions (1) and (6) are made for convenience and are not necessarily accepted as facts. Assumption (1) is valid only if processors follow a constant percentage markup rule. If assumption (6) does not hold (as is likely because feed suppliers will absorb a portion of the tax as long as feed demand is not perfectly inelastic), the estimated returns will be understated. Assumption (2) is based on previously published estimates of supply response in the catfish industry *(22)*. Assumptions (3) and (4) are based on data published by the USDA and records kept by The Catfish Institute. Assumption (5) is based on the results presented in table 6 of this publication and the added assumption that the market shares for home and restaurant consumption of catfish are, respectively, 33 and 67 percent *(27)*. Because of the importance of the supply elasticity and the demand shift parameter in determining producer returns, and the fact that the assumed numbers are merely estimates of the true values, sensitivity analysis is performed relative to these parameters.

The estimates of producer returns based on the foregoing assumptions and equation (1) are presented in table 7. Estimated returns

TABLE 7. INCREASES IN NET PRODUCERS' SURPLUSES FROM ADVERTISING-INDUCED SHIFTS IN CATFISH DEMAND FOR ALTERNATIVE VALUES OF THE SUPPLY ELASTICITY, 1988, U.S.

Demand shift (τ)	Supply elasticity (ε)	Producers' surpluses	
		Total	Per media $ invested
0.1171	3.00	4.45	3.01
.1171	1.86	8.09	5.47
.1171	8.10	.72	.48
.2342	3.00	11.04	7.46
.0586	3.00	1.41	.95

for the baseline assumptions of $\varepsilon = 3.00$ and $\tau = .1171$ indicate a total net return of $4.45 million. The corresponding return per media dollar invested is $3.01. By way of comparison, Kinnucan *(18)* estimates an average net producer return of $6.07 for the generic fluid milk advertising program in New York City. Increasing and decreasing the supply response parameters to the extreme values given in Kinnucan and Sullivan *(22)* and doubling and halving the demand shift parameters result in different estimates of total net returns ranging from $0.72 million to $11.04 million, but in all cases the estimates remain positive, table 7. Thus, it appears that the generic catfish advertising program has improved the profitability

of catfish farming as measured by a net increase in producer surplus or quasi-rent.

CONCLUSIONS

The eight-equation econometric model linking ad recall to beliefs, attitudes, and consumption yields insight into the workings of the nascent industry ad campaign for catfish. The relevant findings in terms of advertising policy and management are:

1. The attitude toward catfish held by the consumer is one of the most important factors affecting both at-home and restaurant purchase frequency. Attitude (the consumer's self-described preference for catfish relative to other fish and seafood) is most strongly influenced by perceptions of the flavor of catfish; nutrition and absence of fishy odor are relevant but of lesser importance. Perceptions of flavor, in turn, are determined largely by whether the consumer is aware of the farm-raised product. Thus, advertising copy should stress two themes: flavor attributes and pond culture.

2. Female respondents and those residing in the East and West census regions had the greatest probability of being unaware of farm-raised catfish. Ads designed to distinguish the farm-raised product from "wild" catfish should be targeted toward a female audience and, if the budget permits, placed in media that will give exposure to markets in the East and the West.

3. Blue collar laborers and the more educated ranked catfish lower on the flavor dimension than individuals in other categories. Ads stressing the flavor attributes of catfish designed to appeal to these (somewhat diverse) groups would enhance attitude.

4. The at-home market is still largely regional and concentrated among minority groupings. Ads aimed at upscale white households in regions outside the Heartland would appear to be an appropriate strategy for expanding the at-home market.

5. The restaurant market, accounting for over one-half of all sales of commercially processed fish, is less well developed in the West than elsewhere. Promotional or information programs tailored to the needs of restaurant managers and consumers in the West, perhaps encouraging the use of catfish as a menu item, could expand this segment of the market.

6. Estimated net producer returns of $0.48 — $7.46 per media dollar expended suggest the industry ad effort is a profitable ac-

tivity for catfish producers. A mandatory program requiring all producers (through their feed mills) to share in the cost of the marketing program may be justified because all producers benefit from the program, yet it is not possible to withhold benefits from noncontributing members. In addition to making the program more equitable, the elimination of "free riders" would make the program more effective by providing a more adequate budget for attacking the marketing challenges facing the industry.

Despite its small budget, the research represented in this report suggests the catfish advertising program has been successful, both in terms of increasing consumer demand for catfish and in improving the income of catfish producers. The results suggest commodity promotion programs do not have to be big to be effective — even limited budget programs can be beneficial to producers. But whatever the size of the program, funds must be carefully allocated to assure that producers are receiving the maximum return possible. Because markets are dynamic, subject to rapid change due to changes in relative prices, income, consumer preferences, new products, and other factors, ongoing market research is the *sine qua non* of effective program management.

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APPENDIX A

Producer Returns Function

Derivation of the expression to represent gain in producers' surpluses associated with an advertising-induced demand shift can be facilitated by the use of the following appendix figure:

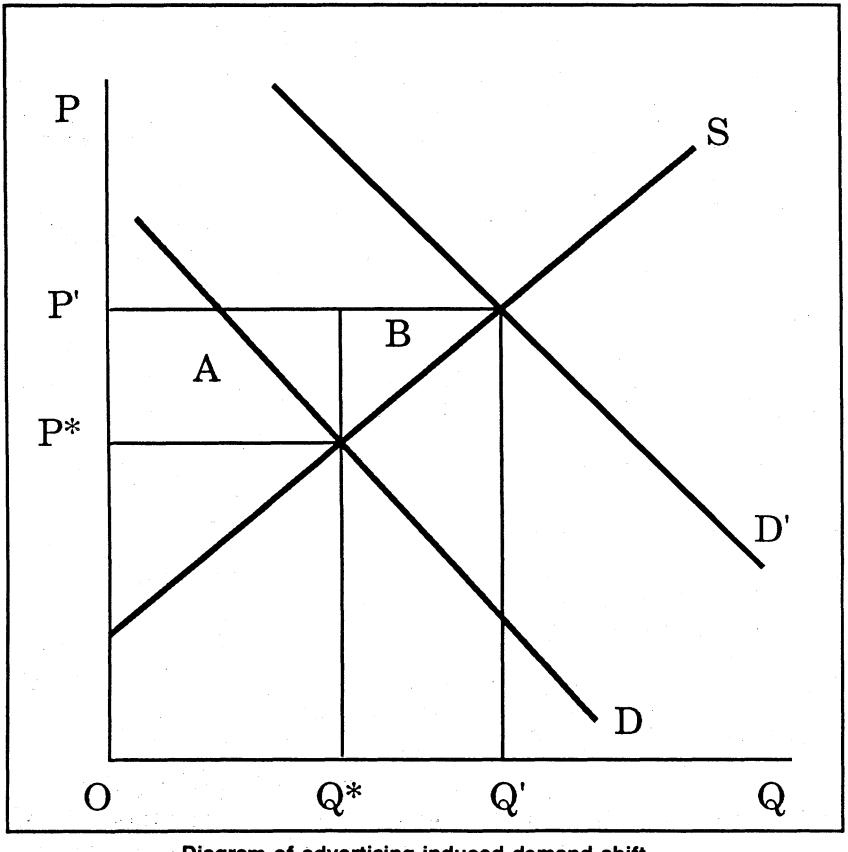


Diagram of advertising-induced demand shift.

In the diagram, the gain in producers' surpluses (GPS) is represented by the sum of the areas of rectangle A and triangle B, i.e.,

(A.1) GPS = area A + area B.

The area of rectangle A is

(A.2) area A = $\Delta P\ Q^*$

where ΔP is the increase in price from the pre-advertising competitive equilibrium level P* (i.e., P' - P*) associated with the shift in the demand curve and Q* is the pre-advertising competitive

equilibrium quantity.

The area of triangle B is

(A.3) area B = 0.5 ΔP ΔQ

where ΔQ is the increase in quantity from Q* associated with the shift in the demand curve (i.e., Q' - Q*).

Substituting equations (A.2) and (A.3) into (A.1) and simplifying yields

(A.4) GPS = ΔP (Q* + 0.5 ΔQ).

Letting τ represent the proportional (not percentage) increase in quantity from the pre-advertising quantity, the increased quantity, ΔQ, can be written as

(A.5) $\Delta Q = \Delta Q^*$.

The increase in price attributable to advertising can be approximated from the supply elasticity:

(A.6) $\varepsilon = (\Delta Q / \Delta P)\ (P^*/Q^*)$.

Hence,

(A.7) $\Delta P = \Delta Q\ P^*/\ \varepsilon\ Q^*$.

Substituting equation (A.5) into expression (A.7) yields

(A.8) $\Delta P = \tau P^*/ \varepsilon$.

Substituting (A.5) and (A.8) into (A.4) and simplifying yields an expression for the gain in producers' surpluses

(A.9) GPS = $(P^*\ Q^*\ \tau\ (2 + \tau))/2\ \varepsilon$.

Defining the net gain in producers' surpluses attributable to advertising (PROFIT) as

(A.10) PROFIT = GPS - A where A is the advertising expenditure, and substituting (A.9) into (A.10) yields an expression which approximates the net profit to the industry:

(A.11) PROFIT = $(P^*\ Q^*\ \tau\ (2 + \tau) - 2\ \varepsilon\ A)/2\ \varepsilon$.

A caveat in applying (A.11) is that it is an approximation formula, the accuracy of which depends on the magnitude of the equilibrium displacement. The approximation becomes more accurate as the shift in the demand schedule (τ) becomes smaller. A precise formula to measure the gain involves the use of integrals but this requires complete specification of the supply equation. Because of difficulties associated with attempting to specify equations completely, Wallace argues that approximation formulas such as (A.11) may do no worse than the integral approach. Moreover, if the supply equation is linear and an arc elasticity is used to represent ε , expression (A.11) is exact.

APPENDIX B

The Two-Stage Test for Sample Selection Bias

The following probit model was fitted using the entire sample (3,600 observations):

(B.1) EATNCFSH = g(Z, e)

where EATNCFSH is a binary variable describing whether the household eats catfish (EATNCFSH = 1 if the household eats catfish and 0 otherwise). Z is a vector of socio-demographic variables that determine whether the selected household eats catfish, and e is a random error term. The maximum likelihood probit estimates of EATNCFSH are presented in table B.1.

The reference household chosen to evaluate the probabilities of catfish consumption is a non-Christian white household, residing in an urban/semi-urban area of the South Atlantic census subdivision, with annual income below $20,000, where the household head has less than high school education and is either unemployed or holds a position other than as a professional, administrator, sales person, cleric, blue collar laborer, or full time agricultural worker, and the female head of household does not work away from home. The average size of the reference household is three individuals, including a child and a teenager.

Results indicate that households not reporting their incomes, black households, Catholic households, and households in the Eastern United States and in the Heartland region are important variables determining whether a selected household eats catfish. The probability that the reference household eats catfish is 0.50. The intercept is non-significant at 5 percent level, hence is treated as 0; all other explanatory variables are also set equal to 0. Hence, $Z_i = XB = 0$. The standard normal cumulative probability of $Z_i = 0$ is 0.50. Households not reporting their incomes, households in the East, and Catholic households have significantly lower probabilities of consuming catfish; whereas, black households and households in the Heartland have significantly higher probabilities, ceteris paribus.

The above maximum likelihood probit estimates are used to compute the inverse Mill's ratio of EATNCFSH (IMRETNCF) for each household. Using the inverse Mill's ratio of EATNCFSH variable of only those households that eat catfish (i.e., 2,172 observations) as an additional regressor, an OLS regression is fitted to equation (1). The OLS estimates are shown below: As noted, the estimated

coefficient of IMRETNCF is not significantly different from zero, eliminating the possibility of sample selection bias in the study. The IMRETNCF variable is therefore eliminated from the rest of the study.

TABLE B.1. MAXIMUM LIKELIHOOD PROBIT ESTIMATES OF CATFISH CONSUMPTION, 1988, SURVEY DATA, U.S.

Variable	MLE of the parameter	Change in probability
INTERCEPT	0.2226	0.0885
	(.1207)[1]	
INC2040	.0423	.0168
	(.0620)	
INC4050	.1453	.0577
	(.0918)	
INCGT50	.0910	.0362
	(.0853)	
INCDK	-.1698[2]	-.0675
	(.0702)	
BLACK	.2696[3]	.1071
	(.0922)	
OTHNW	-.1566	-.0622
	(.0820)	
PROFAD	.0317	.0126
	(.0658)	
CLERIC	-.0268	-.0107
	(.0892)	
BCLABOR	.1197	.0476
	(.0686)	
AGWORKR	-.1344	-.0534
	(.1249)	
HSCHSOMC	-.1232	-.0490
	(.0739)	
COLED	-.0199	-.0079
	(.0842)	
FEMWORK	-.0218	-.0087
	(.0477)	
EAST	-.6090[3]	-.2420
	(.0804)	
HEART	.5128[3]	.2038
	(.0734)	
WEST	-.0504	-.0200
	(.0787)	
HHSIZE	.0468	.0186
	(.0262)	
NKIDS	-.0632	-.0251
	(.0354)	
NTEENS	-.0232	-.0092
	(.0364)	
RURAL	.0902	.0358
	(.0493)	
CATHLIC	-.3210[3]	-.1276
	(.0707)	
OTHCHRST	-.0374	-.0149
	(.0625)	

[1]Figures in the parentheses are standard errors of the estimates.
[2]Significant at 5 percent level.
[3]Significant at 1 percent level.

TABLE B.2. OLS ESTIMATES OF CATFISH ADVERTISING AWARENESS, 1988, SURVEY DATA, U.S.

Variable	Estimated coefficient	Standard errors
INTCPT	0.4470[1]	0.0906
INC2040	.0388	.0286
INC4050	.0149	.0422
INCGT50	.0173	.0394
INCDK	- .0601	.0356
PROFAD	- .0103	.0309
CLERIC	.0015	.0430
BCLABOR	- .0469	.0330
AGWORKR	- .0033	.0589
HSCHSOMC	.0619	.0342
COLED	.0683	.0380
EAST	- .0210	.0670
HEART	.0137	.0463
WEST	- .0749	.0393
RURAL	.0371	.0231
AGE	- .0241	.0231
FEMALE	- .0839[1]	.0211
IMRETNCF	- .1104	.1222

[1]Significant at 1 percent level.

APPENDIX C

Simulation Procedure

Consumer awareness, beliefs, and consumption of farm raised catfish are simulated for two different scenarios, namely, with and without catfish ad awareness. The variables are indexed either 1 or 0 to denote the two scenarios, respectively. The awareness and beliefs variables are evaluated sequentially, while the attitude and consumption variables are evaluated simultaneously.

Using the maximum likelihood probit estimates of equation (2), AWARCAT is expressed as a function of SEENAD, evaluating all other explanatory variables at their means and combining with the intercept. This results in the following equation:

(C.1) AWARCAT = 0.5536 + 0.3430 SEENAD.

AWARCAT(0) AND AWARCAT(1) can be obtained from the above equation by setting SEENAD = 0 or 1 as the case may be. The probability of the consumers being aware of the farm-raised product under the two scenarios can then be obtained by reading the value of the standard normal cumulative probability associated with AWARCAT(0) and AWARCAT(1). These probabilities are found to be 0.7088 and 0.8159 respectively.

The belief equations (i.e., equations 3 through 5) are similarly expressed as functions of AWARCAT, using the OLS estimates and evaluating all other explanatory variables at their means and combining them with the intercept term. This results in the following three equations:

(C.2) NUTR = 7.1850 + 0.7727 AWARCAT
(C.3) FLAV = 6.4485 + 0.7797 AWARCAT
(C.4) NOODOR = 5.4407 + 0.6193 AWARCAT

The values of the belief variables under each of the two scenarios can be obtained by using the value of AWARCAT associated with that scenario.

Following similar procedure but using the 3SLS estimates, the attitude and consumption equations are obtained as:

(C.5) ATT = 2.6795 + 0.0594 NOODOR + 0.3144 FLAV + 0.1059 NUTR + 0.7665 ATHOME - 0.1941 REST
(C.6) ATHOME = -0.5155 + 0.0624 SEENAD + 0.2057 ATT
(C.7) REST = -0.0016 + 0.0744 SEENAD + 0.1350 ATT

Since attitude and consumption are determined simultaneously, equations C.5 through C.7 are rearranged so that the three endogenous variables, namely, ATT, ATHOME, and REST, appear on the left hand side of the equations and all predetermined or exogenous variables appear on the right hand side. Using matrix notation, this can be written as

$$(C.8)\quad AY = BX$$

where

$$(C.9)\quad A = \begin{bmatrix} 1.000 & -0.7665 & 0.1961 \\ -0.2057 & 1.0000 & 0.0000 \\ -0.1350 & 0.0000 & 1.0000 \end{bmatrix}$$

is a matrix of the coefficients of the endogenous variables in the system;

$$(C.10)\quad Y = \begin{bmatrix} ATT \\ ATHOME \\ REST \end{bmatrix}$$

is a column vector of the three endogenous variables;

$$C.11)\quad B = \begin{bmatrix} 2.6795 & 0.0594 & 0.3144 & 0.1059 & 0 \\ -0.5155 & 0 & 0 & 0 & 0.0624 \\ -0.0016 & 0 & 0 & 0 & 0.0744 \end{bmatrix}$$

is a matrix of coefficients of the predetermined or exogenous variables, and

$$(C.12)\quad X = \begin{bmatrix} 1 \\ NOODOR \\ FLAV \\ NUTR \\ SEENAD \end{bmatrix}$$

is a column vector of the relevant predetermined or exogenous variables in the system.

The reduced form of the system is found by solving the structural equation C.8, for the endogenous variables. Using matrix algebra, the solution of the endogenous variables is obtained as

$$(C.13)\quad Y = A^{-1} B X$$

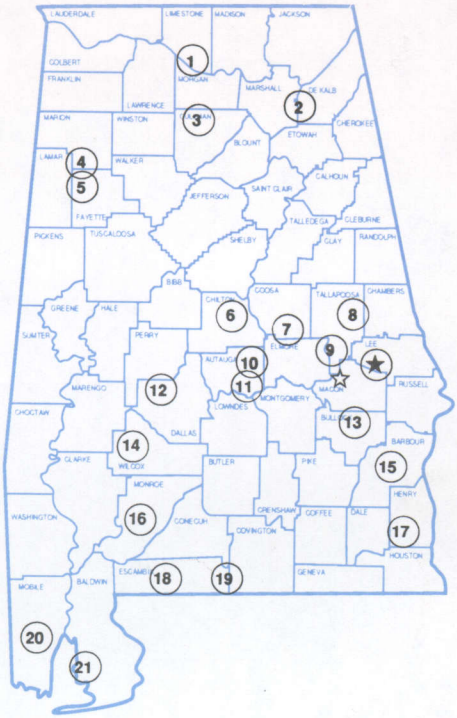
where

$$(C.14)\quad A^{-1} B = \begin{bmatrix} 2.6305 & 0.0684 & 0.3620 & 0.1219 & 0.0384 \\ 0.0256 & 0.0141 & 0.0745 & 0.0251 & 0.0703 \\ 0.3535 & 0.0092 & 0.0489 & 0.0165 & 0.0796 \end{bmatrix}$$

The values of the attitude and consumption variables associated with SEENAD = 0 and SEENAD = 1 are then obtained using equation C.13 and the values of the predetermined or exogenous variables corresponding to that scenario. The simulation results are presented in table 6 of the text.

Alabama's Agricultural Experiment Station System
AUBURN UNIVERSITY

With an agricultural research unit in every major soil area, Auburn University serves the needs of field crop, livestock, forestry, and horticultural producers in each region in Alabama. Every citizen of the State has a stake in this research program, since any advantage from new and more economical ways of producing and handling farm products directly benefits the consuming public.



Research Unit Identification

★ Main Agricultural Experiment Station, Auburn.
☆ E. V. Smith Research Center, Shorter.

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman.
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Chilton Area Horticulture Substation, Clanton.
7. Forestry Unit, Coosa County.
8. Piedmont Substation, Camp Hill.
9. Plant Breeding Unit, Tallassee.
10. Forestry Unit, Autauga County.
11. Prattville Experiment Field, Prattville.
12. Black Belt Substation, Marion Junction.
13. The Turnipseed-Ikenberry Place, Union Springs.
14. Lower Coastal Plain Substation, Camden.
15. Forestry Unit, Barbour County.
16. Monroeville Experiment Field, Monroeville.
17. Wiregrass Substation, Headland.
18. Brewton Experiment Field, Brewton.
19. Solon Dixon Forestry Education Center, Covington and Escambia counties.
20. Ornamental Horticulture Substation, Spring Hill.
21. Gulf Coast Substation, Fairhope.