NE-165

PRIVATE STRATEGIES, PUBLIC POLICIES & FOOD SYSTEM PERFORMANCE

ANALYSIS OF CONSUMER'S WILLINGNESS TO PAY FOR NEW FRIED FOOD PREPARED FROM COWPEA FLOUR

by

Stanley M. Fletcher, Kay H. McWatters
and
Anna V. A. Resurreccion

WP-18 May 1990

WORKING PAPER SERIES

A Joint USDA Land Grant University Research Project

ANALYSIS OF CONSUMER'S WILLINGNESS TO PAY FOR NEW FRIED FOOD PREPARED FROM COWPEA FLOUR

by

Stanley M. Fletcher, Kay H. McWatters
and
Anna V. A. Resurreccion

WP-18 May 1990

The results reported are based upon the Georgia Experiment Station project (H-1396) concerned with the functioning of the Food Marketing System. The paper has been written specifically as a contribution to the NE-165 project.

The authors are, respectively, Associate Professor, Department of Agricultural Economics, and Research Scientist and Associate Professor, Department of Food Science and Technology, College of Agriculture, University of Georgia, Griffin, Georgia 30223-1797.

ANALYSIS OF CONSUMER'S WILLINGNESS TO PAY FOR NEW FRIED FOOD PREPARED FROM COWPEA FLOUR

Abstract

Consumers' willingness to pay for cowpea products was analyzed by a multi-ordered response model. The analysis indicated that socio-demographic factors are weakly linked to consumers' willingness to pay while product characteristics are strongly linked. Marketing promotion is possible. Thus, akara products, made from cowpea paste, have potential for extending the utilization of cowpeas.

ANALYSIS OF CONSUMER'S WILLINGNESS TO PAY FOR NEW FRIED FOOD PREPARED FROM COWPEA FLOUR

Cowpeas were once an important agronomic crop, but at the present it only has limited agronomic use (Fery). Currently the cowpea is utilized as a vegetable and a dry bean. The vegetable industry is located mainly in the Southeast while the dry bean industry is located mainly in California and Texas. Cowpeas are an excellent source of protein and B-vitamins. However, cowpea usage is limited in the United States because of its inconvenience. If the appropriate product form for cowpeas could be found, the demand could be promising owing to the increased nutrition consciousness of the consumer.

Akara is a popular breakfast snack food in many West African countries. This product is made from whipped cowpea paste and is bread-like resembling the corn meal hush puppy. However, it has a lighter and spongier texture than hush puppies. An earlier study by Osei-Yaw and Powers found an acceptance based on sensory evaluations by Washington state consumers. Thus, akara made from cowpea paste has the potential to extend the use of cowpeas in the United States which would benefit United States farmers who are seeking alternative agricultural markets.

In order to assess this potential, consumers' perceptions and attitudes toward akara must be analyzed. Consumer's perceptions and attitudes toward food products are crucial information to a successful introduction of new food products. Without such information marketing or promotional programs cannot be specific, which results in costly and unpredictable results. New product introductions are at an all time high with most new products failing to survive. For example, approximately 1,191 new consumer food products

were introduced in 1988 with high rates of failure common (Supermarket News). To avoid such ineffectiveness of product promotional programs, an investigation of consumer's preference toward products as well as identification of the targeted consumer are necessary.

The purpose of this study is to provide information on consumer's willingness to pay for various value-added akara product forms prepared from the cowpea flour. For this purpose, a survey on eliciting consumer's responses was conducted during 1988. A multi-ordered response model was employed to identify the determinant factors.

Research Design

A consumer sensory panel composed of 450 consumers was randomly selected in the Metro-Atlanta area. Only 356 consumers were used in the analysis, due to the incompleteness of the data by some of the participants. The participants answered socio-demographic questions, tasted the akara and then responded to specific questions concerning the product.

The akara was prepared by technologists in the Food Science department at The University of Georgia and frozen prior to the survey. Akara packages were removed from frozen storage on the day of the survey. Two balls of akara (approximately nugget size) per participant were heated in a microwave oven to an internal temperature of ~70°C prior to being evaluated. The participants were asked to rank the two product characteristics, appearance and flavor, on a five point differential scale ranging from 'dislike very much' to 'like very much'.

After the sensory evaluation, the participants were asked to indicate how much they were willing to pay for four akara product forms. The products are as follows: (1) one

pound dry mix that would make 90 pieces, (2) half pound bag of 22 partially cooked, frozen pieces to be finished fried at home, (3) half pound bag of 22 fully cooked pieces to be reheated at home in microwave or conventional oven, and (4) a six piece serving at a fast food restaurant. Five price categories were selected apriori based on a prescreening test and discussion with food scientists. The price categories ranged from less than 70¢ to over $2.00. The response frequency by product and price category is shown in table 1. As more marketing services were imbedded in the product, the price ranges shifted higher which is as one would expect when substituting marketing services for one's own time. The mean responses from the participants fell between the second and third price range for each product.

Participants and Product Relevant Characteristics

A participant profile was characterized by socio-demographic characteristics such as age, martial status, household with children, education, income, race, sex, employment status, cooking responsibility and number of times fried food is eaten per month. In order to capture the household production and the value of time, employment status and cooking responsibility were combined into a set of dummy variables. In total, these characteristics were expected to be important factors in explaining consumers' attitudes toward willingness to pay for the various akara product forms. Means and frequencies for each characteristic are shown in table 2.

The mean value of the age of the participants was at middle age, 45.5 years old. More than two-thirds of the participants had at least some college. Approximately 75% of the participants were white, 68% of the participants were female, 68% were married and 47%

Table 1. Consumer Willingness to Pay for Various Product Forms of Food Prepared from Cowpea Flour

Product form	Percent frequency
One pound of dry mix that makes 90 pieces:	
Less than $0.70	24.7
$0.70 - $0.79	23.0
$0.80 - $0.89	13.2
$0.90 - $0.99	10.7
$1.00 or more	28.4
Half pound bag of 22 partially cooked, frozen pieces to be finished, fried at home:	
Less than $1.00	28.7
$1.00 - $1.24	26.7
$1.25 - $1.49	26.1
$1.50 - $1.74	12.9
$1.75 or more	5.6
Half pound bag of 22 fully cooked pieces to be reheated at home in microwave or conventional oven:	
Less than $1.25	24.2
$1.25 - $1.49	24.7
$1.50 - $1.74	22.2
$1.75 - $1.99	20.2
$2.00 or more	8.7
Six piece serving at a fast food restaurant:	
Less than $0.70	35.7
$0.70 - $0.79	26.7
$0.80 - $0.89	9.5
$0.90 - $0.99	12.9
$1.00 or more	15.2

Table 2. Socio-Demographic and Product Relevant Characteristics of Respondents[a]

Characteristic	Mean	Percent frequency
Marital status:		
Never married, separated, divorced, widowed		32.3
Married		67.7
Educational level:		
None, less than H.S., some H.S., high school graduate		32.9
Some college		35.1
College graduate, post graduate		32.0
Race:		
White		75.7
Black		24.3
Employment status and cooking:		
Employed full-time & cooks most of time		29.8
Employed full-time & cooks seldom		12.4
Employed part-time or other & cooks most of time		49.4
Employed part-time or other & cooks seldom		8.4
Sex:		
Male		32.0
Female		68.0
Households with children less than 19 years old		47.5
Age (years)	45.5	
Approximate yearly income for household before taxes	$38,501.00	
Product appearance[b]	3.8	
Product flavor[b]	3.3	
Fried foods (times eaten)[c]	3.4	

a. Number of respondents is 356.
b. Based on a 5 point scale ranging from 'dislike very much' (scale=1) to 'like very much' (scale=5).
c. Based on a six point scale ranging from 'once a month' (scale = 1) to 'more than once a day (scale = 6).

of the households had children. Approximately 30% of the participants were employed full-timed and still managed to prepare most of the food for at-home consumption. The mean household income of the participants was $38,501.

With regard to the product relevant characteristics, mean responses associated with appearance and flavor were positive (table 2). The mean values were between 'like' and 'neither like or dislike.' The appearance had a slightly higher mean value. The participants were asked later for suggestions in improving the product. This information is being utilized in reformulating the akara paste.

Econometric Model

Given that the dependent variable of willingness to pay for the various product forms was a discrete qualitative variable, the use of ordinary least squares would result in biased and inefficient estimates (Judge et al.). The application of qualitative dependent variable models to explain agricultural decision making has become more common (Carley and Fletcher; Fletcher and Terza; Hill and Kau; and Rahm and Huffman).

Since the dependent variable was defined as categorical price ranges, a multi-ordered response model, as discussed in Amemiya and Maddala, was used for estimation. This model is appropriate to use when the dependent variable has more than two outcomes and the outcomes can be ranked. A brief explanation follows to aid the reader in understanding the basic concept of the model.

The continuous willingness to pay by the t^{th} consumer is denoted Y_t and is assumed to be linearly related to a vector of observed consumer and product characteristics. This can be represented mathematically as:

(1) $Y_t = X_t\beta + e_t \quad (t = 1,2, ..., n)$

where X_t is a vector of consumer and product specific variables, β denotes the parameters to be estimated and e_t is the error term and is assumed to be normally distributed. Since Y_t is not observable, a vector of binary variables indicating which category of willingness to pay the t^{th} consumer has chosen is denoted $D_t=[d_{1t},...,d_{jt},...,d_{mt}]$ where

(2) $$d_{jt} = \begin{cases} 1 \text{ if and only if } \mu_{j-1} < Y_t \leq \mu_j \\ 0 \text{ if otherwise.} \end{cases}$$

Therefore, the likelihood of the t^{th} consumer selecting the j^{th} willingness to pay price category is:

(3) $$\Pr\{d_{jt} = 1\} = \Pr\{\mu_{j-1} < Y_t \leq \mu_j\}$$
$$= \Phi(\mu_j - \beta'X_t) - \Phi(\mu_{j-1} - \beta'X_t)$$

where Φ is the cumulative standard normal distribution function and the μ's are known constants such that $\mu_1 = -\infty$, $\mu_m = +\infty$ and $\mu_1 < \mu_2 < ... < \mu_m$. Thus, the log-likelihood function for the model is:

(4) $$\log L(\beta) = \sum_{t=1}^{n} \sum_{j=1}^{m} d_{jt} \log[\Phi(\mu_j - \beta'X_t) - \Phi(\mu_{j-1} - \beta'X_t)].^1$$

---

[1]The reader will note the similarity of this model to the ordered probit model. The basic difference in the two models lie with the threshold values (μ's). In the ordered probit model, the thresholds are unknown. Thus, with known thresholds, there is additional information on the scale of Y in the data which is incorporated in the estimation. In this study, the thresholds are the endpoints of the price ranges, e.g., \$0.70, \$0.79, ... , \$1.00.

The ß vector that would maximize the log likelihood function (equation 4) was solved using maximum likelihood procedure employing the Davidon-Fletcher-Powell numerical optimization algorithm.[2]

Results

The coefficient estimates and t-statistics of the multi-ordered response analysis with known thresholds of the willingness to pay by the participants for the four product forms of food made from cowpea flour are shown in table 3. The four models were statistically significant based on the chi-square test statistic.

Product relevant characteristics, appearance and flavor, were found to be important in explaining the participants' willingness to pay. This implies consumers who have a higher satisfaction of product taste and appearance will have a higher tendency to pay more for the product. Given that akara is a fried food, it was surprising that the number of times a person eats fried food (i.e., the fried foods variable) was not significant in all the equations, except in the partially cooked and the fully cooked product groups. This may be attributable to the point that akara was identified as being composed of vegetable protein to the participants prior to the sensory evaluation. Thus, akara may be viewed as a health food in spite of being fried.

The socio-demographic characteristics, except for age, were weak in explaining consumer's willingness to pay. Furthermore, marital status, race and college graduate education had no significant influence. In contrast, older consumers have a lower willingness to pay for all products relative to younger consumers. Given that the population is aging,

---

[2]The microcomputer software program, LIMDEP, by Econometric Software, Inc. was used for the estimation.

Table 3. Coefficients from the Multi-Ordered Response Model With Known Threshold for Willingness to Pay for Various Product Forms of Food Prepared from Cowpea Flour

Variable	Dry mix	Partially cooked	Fully cooked & reheat	Restaurant & fast food
Intercept	.533	.989	1.406	.790
	(5.01)[a]	(7.44)	(9.90)	(7.92)
Fried foods	.013	.024	.022	.002
	(1.30)	(2.08)	(1.70)	(.25)
Appearance	.028	.062	.061	.016
	(1.70)	(3.27)	(2.69)	(.89)
Flavor	.063	.066	.087	.041
	(4.71)	(4.46)	(5.11)	(3.17)
Age	-.002	-.005	-.008	-.004
	(-1.68)	(-4.39)	(-5.76)	(-4.14)
Sex	.027	-.069	-.099	-.020
	(.83)	(-1.85)	(-2.35)	(-.67)
Not married	-.012	-.057	-.034	-.040
	(-.35)	(-1.57)	(-.83)	(-1.24)
Race	.002	-.038	-.039	-.034
	(.06)	(-.90)	(-.83)	(-.83)
Some college	-.056	-.049	-.028	-.004
	(-1.63)	(-1.26)	(-.65)	(-.11)
College graduate	-.006	-.038	.002	-.004
	(-.17)	(-.87)	(.05)	(-.10)
Income	.12E-3	-.002	-.93E-3	-.23E-3
	(.18)	(-2.03)	(-1.10)	(-.29)
Household with children	-.037	-.078	-.071	-.013
	(-1.17)	(-2.07)	(-1.79)	(-.41)
Employ & cook[b]	.057	.182	.016	.055
	(.97)	(2.92)	(.22)	(1.02)
Employ & not cook[c]	.067	.154	.119	.047
	(1.04)	(2.25)	(1.50)	(.74)
Not employ & cook[d]	.070	.088	-.001	.037
	(1.21)	(1.49)	(-.02)	(.76)
Chi-square (14df)	49.34*	81.26*	87.12*	65.25*
Pseudo R^2	.135	.215	.227	.176

* Statistically significant at the 1 percent level.

a. T-ratios are in parentheses.

b. Employed full time and prepares most of the food for at home consumption.

c. Employed full time and does not prepare most of the food for at home consumption.

d. Not employed full time and prepares most of the food for at home consumption.

any marketing promotion will need to stress the health aspect of akara so that it may appeal to older consumers. Females are willing to pay a higher price for akara especially if it was fully cooked and just needed to be reheated. The level of education had minor influence on a participant's willingness to pay as did income and the presence of children in a household. The negative coefficient for income in the partially cooked equation implies that akara may be viewed as an inferior good. This implies that a marketing promotion program needs to emphasize the health aspect of the product in order to try to shift the image of the product. Finally, the last variables in the model attempted to capture the household food production and employment status interaction. The results for these latter variables imply that this interaction has no effect on the willingness to pay for the product for away from home consumption but does have a significant positive effect on the willingness to pay for some of the products for at-home consumption.

Conclusions and Implications

Consumer's attitudes on preference and buying intentions toward new food products are crucial information for successfully introducing and marketing such products. In this study, consumer's willingness to pay for four product forms prepared from cowpea flour were extensively analyzed. Factors explaining consumer responses such as socio-demographic factors and product characteristics were investigated. Due to the qualitative ranking of consumer responses, the multi-ordered response model was employed for the analysis.

Socio-demographic characteristics as represented by education, sex, income and employment status were significant in explaining participants' willingness to pay for at least one of the products. Since such significance occurred in selected products, the link between

socio-demographic characteristics and consumers' attitudes tend to be weak which supports similar findings in Menkhaus et al's study. In contrast, product characteristics (appearance and flavor) were strongly linked to consumer attitudes toward the akara products.

The methodology used in this analysis along with the results can aid marketing people in setting prices and segmenting the market for the various products. After the various segmented markets for each product is determined, the consumer profile and product characteristic can be determined for each market and product. These values can be put into the model to calculate the probability of accepting the product at various prices.[3] This will enable marketing executives to determine if the product is feasible at any price, and to set the optimum price for the firm's chosen introduction strategy.

Dry cowpeas are an excellent source of protein and B-vitamins, and hence marketing promotions should emphasize the health aspects of the processed products. Thus, new value-added forms and uses of the cowpea could be utilized which would extend the utilization of cowpeas in the United States and aid farmers in search of alternative agricultural markets.

---

[3]In other words, the consumer profile and product characteristics are the X values in equation (3) while the endpoints of the price range are substituted for the μ's. Then equation (3) can be solved for the probability of accepting the product in the selected price range. This process can be repeated for various price ranges as well as consumer profile and product characteristics.

References

Amemiya, T. "Qualitative Response Models: A Survey." *J. Econ. Lit.* 14(1981):1483-536.

Carley, D. H. and S. M. Fletcher. "An Evaluation of Management Practices Used by Southern Dairy Farmers." *J. Dairy Science* 69(1986):2458-464.

Fery, R. L. "Cowpea Production in the United States." *Hortscience* 16(1982):474.

Fletcher, S. M. and J. V. Terza. "Analyzing Farmers' Selection of Available Marketing Alternatives Using the Multivariate Probit Model." *Canadian J. Agr. Econ.* 34(1986):243-252.

Hill, L. and P. Kau. "Application of Multivariate Probit to a Threshold Model of Grain Drying Purchasing Decisions." *Am. J. Agric. Econ.* 55(1973):19-27.

Judge, G. G., R. C. Hill, W. E. Griffiths, H. Lutkepohl, and T. C. Lee. *Introduction to the Theory and Practice of Econometrics.* New York; John Wiley & Sons, Inc., 1982.

LIMDEP, (c) Econometric Software, Inc., William H. Greene, New York, NY, 1989.

Maddala, G. S. *Limited-Dependent and Qualitative Variables in Econometrics.* New York; Cambridge University Press, 1983.

Menkhaus, Dale J., Glen D. Whipple, Steven J. Torok, and Ray A. Field, "Developing a Marketing Strategy for Branded, Low Fat, Fresh Beef," *Agribusiness: An Internat. J.* 4(1988):91-103.

Osei-Yaw, A. and J. R. Powers. "Batter Properties of Yellow Pea Flour With Respect to Akla Preparation." *Cereal Chemistry* 63(1986): 506-511.

Rahm, M. R. and W. E. Huffman. "The Adoption of Reduced Tillage: the Role of Human Capital and Other Variables." *Am. J. Agric. Econ.* 66(1984):405-413.

Supermarket News. "Product Introductions Dip 5.6%: Researcher," January 16, 1989.

NE-165

PRIVATE STRATEGIES, PUBLIC POLICIES & FOOD SYSTEM PERFORMANCE

Working Paper Series

Purpose: The NE-165 Working Paper Series provides access to and facilitates research on food and agricultural marketing questions. It is intended to be a publication vehicle for interim and completed research efforts of high quality. A working paper can take many forms. It may be a paper that was delivered at a conference or symposium but not published. It may be a research report that ultimately appears in full or abbreviated form as a journal article or chapter in a book. Using the working paper series enables a researcher to distribute the report more quickly and in more extensive detail to key research users. A working paper may also be an end product in itself, for example, papers that collate data, report descriptive results, explore new research methodologies, or stimulate thought on research questions.

Procedures: Working papers may address any issues in the food and agricultural marketing area as described in the NE-165: Private Strategies, Public Policy and Food System Performance, project statement. This research agenda is available from Professor Ronald Cotterill, Chair of NE-165 at the address given below. A prospective working paper should be forwarded to the Chair who will coordinate a review of the paper by two research peers. Alternatively authors may submit two independent peer reviews with their paper. Based upon independent reviewer comments the Chair may accept, accept with revisions, or reject the submission. If accepted the Chair will issue working paper covers, and a mailing list to the author who shall have responsibility for preparing and distributing copies to all persons and organizations on the mailing list. Additional copies of working papers are available from the author or from the Food Marketing Policy Center at The University of Connecticut.

Professor Ronald W. Cotterill, Food Marketing Policy Center.
Department of Agricultural Economics and Rural Sociology
Box U-21
The University of Connecticut
Storrs, Connecticut 06269-4021
Tel. No. (203) 486-4394