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Consumer Preferences for Selected Fresh Produce: A Case Study

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Abstract

A random sample of Knox County, Tennessee, households is used for a cross-section study of consumer perceptions of selected produce available at the retail level. The data were gathered in the early summer of 1985. Commodities examined are apples, broccoli, cabbages, peaches, and tomatoes. Consumer behavioral issues focus on the regularity of purchase, the level of satisfaction, concern over fresh produce origin, and willingness-to-pay for local versus out-of-state produce. The relationships under consideration entail qualitative responses, and these necessitate the use of an amenable statistical model, which in this study is the probit regression technique. Based upon traditional demand analyses, the measures of consumer behavior are hypothesized to be functions of income categories, the age distribution of household members, race, the age of the respondent, occupation, and household size.

Results provide information with respect to the marketing of locally grown fresh produce. Overall consumer fresh produce satisfaction is high, but considerable variation exists among the commodities. Satisfaction, regularity of purchase, and willingness-to-pay for local versus out-of-state produce are affected by the hypothesized variables; however, the pattern of significant variables changes by commodity. Tomatoes, followed by peaches, have the greatest local market potential. Local promotion of other products may be more difficult. A concerted effort would be required to inform households of the advantages of locally grown fresh produce. The prices of locally grown commodities should be less than or equal to those of comparable out-of-state commodities.

Acknowledgments

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CONSUMER PREFERENCES FOR SELECTED FRESH PRODUCE: A CASE STUDY

Introduction and Objectives

Substantial changes in food consumption have occurred in the United States in recent years. The percent of the consumer's disposable income spent on food fell from 17.2 in 1970 to 16.0 in 1981 (U.S. Department of Agriculture, 1985). The percentages of expenditures for food consumed at home are 13.2 in 1970 and 11.8 in 1981 and for food consumed away from home 4.0 and 4.2 for these two years. Furthermore, consumption of specific food items has changed. For example, per capita consumption of red meat declined from 163.6 pounds in 1970 to 155.6 pounds in 1981, whereas the respective amounts for fresh produce increased from 195.4 pounds to 208.3 pounds.

The dynamic nature of food consumption necessitates theoretical and applied demand research to gain a better understanding of consumer behavior so the agricultural sector can be more responsive in the provision of products that consumers want. Recent changes in food consumption have come during a period in which the farm sector has experienced pronounced production and financial problems, thereby exacerbating the need to respond to consumers. Researchers have responded through increased work examining the dynamic nature of food demand (Capps, 1986, and Capps and Senauer, 1986).

Increases in fresh produce consumption have generated a great deal of interest in fruits and vegetables as potential alternative enterprises for financially pressed farmers (Capps, 1986). The present study contributes to the existing knowledge of consumer preferences for fresh produce. Specific attention is directed toward selected commodities that can be grown in all areas of the country and toward consumer preferences for locally grown products versus products grown out of state. Various dimensions of consumer preferences for these products are examined in ways that have not been reported in the literature. The objective is to examine these dimensions as functions of socioeconomic characteristics of households.

Results obtained from this research are relevant for several segments of the agricultural sector. Through an enhanced understanding of consumer preferences, producers can make better decisions about the types of commodities to grow and about the feasibility of direct market outlets. This is especially relevant for smaller growers who do not use brokers or wholesalers. Retail food outlet operators can make better decisions about the types of fresh produce to carry, whether to distinguish between local and out-of-state items, and whom to reach with the provision of relevant advertising. State agencies and other organizations responsible for promoting fresh produce can use the results in ways similar to retail outlet managers. Consumers also can gain through the increased availability of products more in line with their preferences.

Model Development

The research reported here is exploratory in that it centers on consumer perceptions of fresh produce, as opposed to consumer purchases. Demand analyses are restricted to actual purchases that occur, or the data gathered for applied demand research represent intersections of consumer demand and retail supply. The focus of the present research is somewhat different. Rather than being limited to market transactions alone, concern focuses on consumer perceptions of selected local and out-of-state fresh produce. Such an approach is consistent with learning about the feasibility of promoting and marketing locally grown fresh produce.

Four areas of marketplace perceptions are included in the research. These have been identified as key features of consumer purchasing behavior (Vance Research Services, 1985a, 1985b, and 1985c). First is the regularity with which consumers purchase fresh produce. It is included as a consequence of the shorter shelf life of many commodities, especially if locally grown items are left in the field longer. Two aspects of purchase regularity are examined: the overall purchase frequency for all types of fresh produce and the regularity with which selected items are purchased, which can vary by product. Also examined is the level of satisfaction with fresh produce overall and with selected commodities. This is to identify whether there is any potential for improving commodities as well as for distinctions between local and out-of-state products. Third, consumer interest in where the product is grown is analyzed. This is to examine the extent to which promotional campaigns that emphasize locally grown commodities may be effective. Finally, consumer willingness-to-pay for locally grown versus out-of-state commodities is measured. The feasibility of retailing locally grown fresh produce depends on the price that can be charged, so the long-run market potential depends on this variable.

Consumer demand stems from consumers' willingness and abilities to buy goods. Because consumers' marketplace perceptions are derived from consumers' experiences, the determinants of consumer demand should have impacts on perceptions. Thus, the present analyses are based on the economic theory of consumer demand. Capps (1986) provides a summary of cross-section demand models. These have the quantity demanded as functions of socioeconomic characteristics of the household. Specific independent variables used in cross-section studies include those discussed below, along with their expected relationships to each of the dependent variables.

Disposable personal income, either in dollars or income categories, reflects the ability to buy. Buse (1986) has analyzed cross-section data pertaining to consumer demand for specific meat products. His work shows that per person expenditure for goods varies by income category. More importantly, these expenditures do not vary systematically. For example, the expenditure per person per week for poultry in the 1980-81 Consumer Expenditure Survey was considerably lower ($.55) for the fourth income group than for the four other categories among which the amounts were nearly equal ($.61 to $.64). Furthermore, Buse's analysis indicates that the pattern of expenditures by income category varies by product, so one should not expect a uniform direction of causality because specific products can be inferior, normal, or luxury goods. Other analyses by Vance Research Services (1985a, 1985b, and 1985c) of fresh produce consumption suggest that varied impacts of income categories on selected produce occur. These studies lead to the hypothesis that various income categories have effects on marketplace perceptions; but not all categories need to have significantly different effects, the groups that have significantly different effects vary by commodity, and the effects could be positive or negative on each of the measures of market place perceptions.

Consumption of fresh produce is affected by the age distribution of household members (Blaylock and Burbee, 1985; Blaylock and Smallwood, 1986; Smallwood and Blaylock, 1985). Very young persons are unable to eat most fresh produce. As they grow, consumption of fresh produce is expected to increase in general. As preferences for specific commodities emerge, selected fresh produce consumption may be adjusted, so as the proportion of older members increases the level of satisfaction is expected to increase. The popularity of fresh produce among young and middle-aged adults is another factor (Vance Research Services, 1985a, 1985b, and 1985c). Consequently, the hypothesis is that as the proportion of household members in older age groups increases, regularity of purchase, level of satisfaction, origin consciousness, and willingness-to-pay are expected to increase.

Food consumption has been found to be affected by race (Adrian and Daniel, 1976; Blaylock and Smallwood, 1986; Raunikar, Huang, and Purcell, 1985; Smallwood and Blaylock, 1985). In particular, Blaylock and Smallwood (p. 9) find that black households on average have lower dollar expenditures for food at home than nonblack households. Extending this to the present study leads to the expectations that black households purchase fresh produce less frequently, receive a lower level of satisfaction, are less concerned about origin, and are less willing to pay more for local produce.

The age of the head of the household and/or the age of the food shopper have been related to food expenditures in general and fresh produce commodities in particular (Blaylock and Smallwood, 1986; Buse, 1986; Vance Research Services, 1985a, 1985b, and 1985c). Different lifestyles associated with age are considered to be the cause in these studies. The age patterns that are observed vary by product. Consequently the hypothesis is that respondents' ages have differential effects on marketplace perceptions, not all age categories may have unique effects, and the effects could be positive or negative.[1]

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[1]By way of clarification, the proportion of members in an age group is a different household characteristic than the age of the respondent. The former pertains to the distribution of household members, and the latter refers to the age of a specific person.

Educational attainment of the person who is responsible for food shopping affects marketplace behavior (Adrian and Daniel, 1976; Searce and Jensen, 1979). The expectation is that the higher the level of education, the more likely it is that the person is aware of the nutritional content of fresh produce and its relationship to health. Regularity of purchase, level of satisfaction, concern with origin, and willingness-to-pay are expected to increase with the level of education.

Another hypothesized determinant is the occupation of the person responsible for food shopping. Different occupations are expected to be associated with different opportunity costs of food preparation (Capps, 1986). Homemakers and retired persons tend to have lower opportunity costs of time and can spend more time on food-related activities. These persons are hypothesized to shop more regularly, have higher levels of satisfaction with the produce they acquire, be more concerned with origin, and be more willing to pay for local produce. Just the opposite would hold if this person is employed in a professional occupation outside the home.

Finally, household size is expected to be positively related to the regularity of purchase (Sexauer and Mann, 1979). However, there is no reason to expect that larger households have higher or lower levels of satisfaction with fresh produce, are more or less concerned with origin, or are more or less willing to pay more for locally grown produce.

Empirical Model

A particular type of regression analysis is required to estimate the relationships hypothesized above due to the nature of the dependent variables. All dependent variables are qualitative, and two appropriate statistical models are logit and probit regression techniques. The probit formulation is used here because it assumes a dependent variable is a crude ordinal scale of an underlying (unmeasured) variable. Underlying variables are assumed to be functions of observed independent variables. McKelvey and Zavoina (1975) have developed the model used here. The approach is outlined below.

Let Z be the unmeasured dependent variable and X represent a vector of observed independent variables. The relationship between Z and X is shown as equation (1), where ε is a normally distributed error term and β is the vector of coefficients that transforms X into $(Z-\varepsilon)$.

$$(1) \quad Z = X'\beta + \varepsilon .$$

Although Z is not observed, response categories, Y, related to Z can be observed such that as Z increases, higher response categories are observed. Let Z_i^* denote the values of Z that comprise the bounds for the observed categories Y_i. Either the Y_i occur or they do not. The binomial relationship between the Y_i and Z for M categories can be expressed as:

$$Y_1 = 1 \text{ if } Z \leq Z_1^* ;$$

(2) $Y_2 = 2$ if $Z_1^* < Z \leq Z_2^*$;

$Y_M = M$ if $Z_{M-1}^* \leq Z$.

These relationships can be transformed into probabilities (Pr) of $Y_i = i$. Assuming that ε is normally distributed with a mean of 0 and a variance of 1 leads to the Pr(Y=1) having a normal distribution. The log likelihood is shown below.

$$(3) \quad \log(\beta, Z^* \mid Y, X) = \sum_{t=1}^{T} \sum_{i=1}^{M} Y_{ti} \log [\varphi (Z_i^* - X_t' \beta) - \varphi (Z_{i-1}^* - X_t' \beta)],$$

Where T = the number of observations, and φ(a) is the cumulative normal density function.

$$\varphi(a) = \int_{-\infty}^{a} \frac{1}{\sqrt{2\pi}} e^{-\frac{\varepsilon^2}{2}} d\varepsilon .$$

Coefficients obtained from estimating the probit equation (3) then pertain to probabilities of observing successively higher categories of Y and the corresponding unobserved Z.

Maximum likelihood estimation techniques are required. Estimated coefficients are asymptotically unbiased and efficient, and these two properties also seem to hold for samples having at least 100 degrees of freedom (Aldrich and Nelson, 1984, p. 53). Independent variables can be either categorical or continuous, and omitted categories must be employed as in ordinary least squares in order to avoid singularity. Since the relationships are nonlinear, interpretation of the coefficients is less straightforward than with ordinary least squares. The sign of the coefficient is the direction of change, but the magnitude of the effect depends on the levels of the independent variables.

Data

Urban consumers in a medium-sized metropolitan area provided the data used to estimate the relationships. Such consumers are considered to be the major market for fresh produce since they comprise a large group and are less likely than their rural counterparts to have access to homegrown produce. Knox County, Tennessee, which had a forecasted population in 1984 of 329,202 and 175,000 households (Center for Business and Economic Research, 1983) comprised the target population.

A questionnaire was developed, pilot-tested, and revised.[2] Major sections of the survey instrument focused on satisfaction with fresh produce, questions about selected fresh produce commodities of interest in Tennessee, and basic socioeconomic information. Apples, broccoli, cabbages, peaches, and tomatoes are the commodities, and their selection is based on personal in-

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[2]Copies of the questionnaire can be obtained from the authors.

terviews by the authors with local wholesalers, retailers, USDA inspectors, and Extension personnel who indicated these are the major local produce.

Early summer 1985 was the sample interview period. The timing of the survey was to coincide with a period when most of the locally grown products would be available in retail outlets. Training sessions were held for interviewers. After 10 interviews were completed, each interviewer's questionnaires were evaluated to help ensure that consistent, reliable responses were being gathered. This was to check for consistency across related questions within a questionnaire and for tendencies of interviewers to skip some questions systematically. Altogether, 231 completed questionnaires were gathered, and the response rate was 83 percent.

Variables reported in related consumer demand research, as noted above, suggested the data to be gathered. Time constraints on the interview length precluded gathering detailed socioeconomic information, since it was necessary to rely on the voluntary cooperation of respondents. Descriptive analyses of the socioeconomic data gathered indicate that a representative sample of the Knox County area was obtained (Eastwood, Orr, and Brooker, 1986). Thus, the results presented below can be interpreted as a case study for a specific medium-sized metropolitan area.

In addition to presenting the basic models defined by the dependent variables and their measures, Table 1 gives further information. Inspection of the definition column provides a clear indication as to why the probit model is appropriate. Each of the dependent variable measures represents a grouping of observed responses that reflect an unmeasured variable. The number of categories column indicates the number of groups (M) associated with a particular model. Frequencies for each of the categories in the various models are shown in the right-hand columns. For example, the overall purchase regularity model has a binomial probit form, and there are 43 households in category one and 188 in category two.

The questionnaire also asked respondents to indicate the number of times they shopped during the harvest season for the respective item. These responses were grouped into the cells as defined in the table. Therefore, M = 4 for regularity of purchase for each commodity.

For each of the selected commodities, consumers were asked "do you care where (product) is grown?" Yes/no responses were recorded. This yielded a binomial care-where-grown probit model for each commodity.

Willingness-to-pay was measured through a series of responses. The question began with "given your impression of locally grown (product), would you purchase them rather than out-of-state (product) if they were for sale at . . ." Thus, the willingness-to-pay incorporates the consumer's perception of locally grown produce versus produce grown out of state. The question was completed with "at a slightly higher price?" If the respondent said "yes," the interviewer went to the next part of the questionnaire. If the consumer said "no," the interviewer asked "at the same price?" If the respondent said "yes," the interviewer went on to the next part of the questionnaire.

Table 1. Probit Models: Dependent Variable Definitions

Dependent Variable	Definition	Number of Categories		Category Sample Sizes[a] 1	2	3	4
Overall purchase frequency	How frequently the household buys fresh produce (occasionally = 1, regularly = 2).	2		43	188		
Selected produce purchase frequency	The number of times during the harvest season the household purchases the commodity was grouped into four categories (no purchase = 1, 1-6 times = 2, 7-12 times = 3, and over 12 times = 4).	4 per commodity	Apples:	18	70	77	66
			Broccoli:	69	76	61	25
			Cabbages:	54	103	48	26
			Peaches:	51	82	54	44
			Tomatoes:	36	49	50	96
Satisfaction with selected produce	How satisfied the respondent was with purchases of selected produce (unsatisfied = 1, neutral = 2, and satisfied = 3).	3 per commodity	Apples:	24	40	166	
			Broccoli:	16	71	142	
			Cabbages:	9	56	165	
			Peaches:	43	69	117	
			Tomatoes:	70	33	126	
Care-where-grown	Whether the respondent cared if the commodity was grown locally or out of state (no = 1, yes = 2).	2 per commodity	Apples:	163	54		
			Broccoli:	203	21		
			Cabbages:	193	35		
			Peaches:	139	89		
			Tomatoes:	110	119		
Willingness-to-pay	Given the respondent's impression of a commodity, was that person willing to pay a slightly higher price, the same price, or a slightly lower price for the locally grown item (asked by the interviewer in the order presented—lower = 1, same = 2, and higher = 3).	3 per commodity	Apples:	40	108	60	
			Broccoli:	19	100	42	
			Cabbages:	23	108	48	
			Peaches:	27	95	46	
			Tomatoes:	18	77	111	

[a]The sample size totals vary due to different response rates for various questions.

If the respondent said "no," the interviewer said "at a slightly lower price?" This sequence of questioning permitted the measurement of an ordinal ranking of the willingness-to-pay for local produce vis-a-vis out-of-state produce.

The remaining columns of Table 1 present the frequencies for the various categories of the models. Most consumers (188) purchased fresh produce regularly. With respect to the number of times selected commodities are bought, the distributions indicate that apples and tomatoes have the fewest "no purchase" responses, and cabbage purchases are concentrated in category two. Inspection of the satisfaction with selected produce frequencies reveals the majority of consumers are satisfied with each commodity, although a separate analysis indicates that satisfaction levels with peaches and tomatoes were significantly lower than with apples, broccoli, and cabbages (Eastwood, Orr, and Brooker, 1986). Most consumers, with the exception of tomato consumers, do not care where the product is grown. The most frequent choice for the willingness-to-pay question is the same price, except for local tomatoes where most consumers are willing to pay slightly more.

Table 2 presents the independent variables used in the regression analyses. This table indicates how each variable was measured. The omitted categories are noted. Each variable's expected relationships to the dependent variables are indicated. For ease of presentation, a single heading for purchase frequency applies to overall and selected commodity purchase frequencies.

Results

Discussion of the estimates of the probit models are presented in the order they appear in Table 1. The ratio of the estimated coefficient to its estimated asymptotic standard error is used to determine the significance of each coefficient. Several measures of overall fit are used to assess the equations. Two are the log likelihood value and the chi square as conventionally calculated. Another is the R^2-like value suggested by McKelvey and Zavoina (1975). This is an estimate of the ratio of the explained variance in the unobserved variable Z to its total variation. The other is the percent of the sample correctly predicted. It is calculated as follows. For every observation predicted probabilities for belonging to each of the categories is computed. Every observation is assigned to that category for which it has the highest probability of membership. The actual membership is compared to the predicted membership, and the percent correctly predicted is generated. Interpretation of the percent correctly predicted must be within the context of the number of categories of the dependent variable and the number of observations in each category.

An initial probit equation for each of the models depicted in Table 1 was calculated using all the independent variables contained in Table 2. These estimated equations are shown in the Appendix. The hypotheses tested here are somewhat different than more conventional situations. Previous studies, as noted above, have found that income, age, and occupational categories are associated with significantly different consumption of specific food items,

Table 2. Independent Variables Hypothesized to Influence Consumer Behavior

Variable	Measurement	Frequency[a]	Expected Relationship: Selected Produce Purchase Frequency	Satisfaction with Selected Produce	Care Where Grown	Willingness to Pay
	Total household income					
INC1	= 1 if $0-$9,999; = 0 otherwise (omitted category)	53	+	+	+	+
INC2	= 1 if $10,000-$19,999; = 0 otherwise	47	+	+	+	+
INC3	= 1 if $20,000-$29,999; = 0 otherwise	43	+	+	+	+
INC4	= 1 if $30,000-$39,999; = 0 otherwise	22	+	+	+	+
INC5	= 1 if $40,000-$49,999; = 0 otherwise	19	+	+	+	+
INC6	= 1 if $50,000 or more; = 0 otherwise	27				
	Proportion of the household in specific age groups					
PP1	Proportion 10 and under (omitted category)	.08[b]				
PP2	Proportion 11 through 18	.08[b]	+	+	+	+
PP3	Proportion 19 and older	.84[b]	+	+	+	+
BLACK	= 1 if the respondent is a member of the black race; = 0 otherwise	29	–	–	–	–
	Age category of the respondent					
AGE1	= 1 if 15-24; = 0 otherwise (omitted category)	11				
AGE2	= 1 if 25-34; = 0 otherwise	51	+	+	+	+
AGE3	= 1 if 35-44; = 0 otherwise	46	+	+	+	+
AGE4	= 1 if 45-54; = 0 otherwise	36	+	+	+	+
AGE5	= 1 if 55-64; = 0 otherwise	34	+	+	+	+
AGE6	= 1 if 65 or older; = 0 otherwise	53	+	+	+	+
COLL	= 1 if the respondent attended college; = 0 otherwise	115	+	+	+	+
HSW	= 1 if the respondent is a housewife; = 0 otherwise	56	+	+	+	+
RET	= 1 if the respondent is retired; = 0 otherwise	42	+	+	+	+
PROF	= 1 if the respondent is employed in a professional occupation; = 0 otherwise	56	–	–	–	–
SIZE	The number of persons residing in the household	2.5[c]	?	?	?	?

[a]Frequency of 1's for the respective independent variable for the entire sample.
[b]Average value of the proportion, not the frequency.
[c]Average household size.

but not every category is significantly different. Estimates displayed in the Appendix are consistent with these studies. Within each of the three types of independent variables, only subsets of the coefficients have significant asymptotic t-values. Furthermore, nearly all the computed chi square values are less than the critical value. These considerations prompted the construction of a careful procedure to delete variables in subsequent regressions. Results obtained from these initial passes were used to delete variables from subsequent regressions using the criteria outlined below.[3] Variables whose coefficients were small relative to their standard errors were omitted and a new probit equation estimated. Coefficients in the new equation were compared to their initial counterparts to determine whether there were changes in estimated values. If this occurred, multicollinearity was suspected, and the corresponding variable was reintroduced.

In addition, the log likelihood values were compared to those of the full models to ascertain if there were any effects on the overall fits. None occurred. A final statistical test was employed for each model. Once a model was obtained that included all the significant variables, adjusted for multicollinearity as noted above, a nested hypothesis test was performed. The null hypothesis was that the omitted variables have coefficients of zero, and likelihood ratio tests were conducted. In every instance the results were consistent with using the reduced models described below. No elasticities are presented given the predominance of categorical independent variables.

Purchase Regularity

Overall purchase regularity refers to the regularity with which households shop for fresh produce, regardless of the commodity. The first column of Table 3 presents the estimated probit equation. A significant chi square and the R^2-like and percent correctly predicted values suggest the estimated equation represents a significant improvement over an intercept alone model. In this equation all of the included income categories are significant; the other hypothesized determinants are not. The interpretation is that relative to the lowest income group, higher income households have greater probabilities of purchasing fresh produce regularly. None of the other socioeconomic variables is found to have an impact on overall purchase regularity.

A mixed pattern of overall fit and significant variables is shown for the regularity of selected produce purchases, as displayed in the remaining columns of Table 3. Although each equation has a significant chi square, suggesting significant overall relationships, the values are much higher for cabbages and peaches than for the others. The percents correctly predicted

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[3]This may introduce a pretest bias. However, the nature of the hypotheses tested, the statistical checks used in dropping variables (explained in the text), and an effort to learn from the data led to the view that a minimal bias, at most, might be introduced.

Table 3. Regularity of Purchase Probit Regressions (asymptotic t-values in parentheses)

Independent Variables	Overall	Apples	Broccoli	Cabbages	Peaches	Tomatoes
Constant	.509*	.919*	-.734	.777	-.241	.938*
	(2.75)	(4.93)	(1.40)	(1.54)	(.90)	(5.46)
INC2	.533*				-.451*	
	(1.96)				(2.36)	
INC3	.475*				-.376*	-.612*
	(1.72)				(1.89)	(3.19)
INC4	.801*			.436*		-.569*
	(1.96)			(1.73)		(2.30)
INC5	.744*				.469*	
	(1.79)				(1.66)	
INC6	.938*		.383*			
	(2.40)		(1.65)			
PP2						.545
						(1.11)
PP3			.894*	-.934*		
			(2.01)	(2.05)		
BLACK		-.297				
		(1.32)				
AGE3			.620*			
			(3.09)			
AGE4				.724*	.509	
				(3.27)	(2.30)	
AGE5				.437*	.610*	
				(1.86)	(2.65)	
AGE6				.693*	.923*	
				(3.06)	(4.12)	
COLL		.381*	.191		.480*	
		(2.46)	(1.25)		(3.11)	
PROF				-.413*		
				(2.04)		
SIZE		.161*	.108	.194*	.270*	.096*
		(2.88)	(1.48)	(2.58)	(4.10)	(1.57)
Log likelihood	-103.33	-286.32	-292.37	-273.61	-292.66	-292.52
X^2	11.59*	16.60*	19.70*	33.00*	36.51*	16.21*
R^2-like	.10	.08	.09	.16	.17	.08
Percent correctly predicted	82	39	38	49	39	41

*Significant at the .05 level.

display a similar pattern within the context of a four-way dependent variable categorization and differing regularities among the categories.

With respect to the regularity of apple purchases, higher income groups do not purchase apples any more or less regularly than the lowest income group. The age distribution of the household, race, and age of respondent do not have significant effects either. Respondents who attended college have higher probabilities of regular purchases, as do larger households.

The probability of regular fresh broccoli purchases is significantly greater for the highest income group and for households with higher proportions of adults. If the food shopper is between 35 and 44 years old, this household is more prone to regular broccoli purchases. None of the other hypothesized independent variables has a significant coefficient.

Cabbage purchases are affected by several variables. Households with $30,000 incomes are more likely to purchase cabbage than households in the other income categories. As the proportion of adult household members increases, the probability of regular purchases declines. Respondents aged 45 or older are more likely to purchase cabbages regularly. If the respondent has professional employment outside the home, the household is less likely to purchase cabbages regularly. Increases in household size increase the probability of regular cabbage purchases.

Peaches are less likely to be purchased regularly by households with incomes between $10,000 and $30,000 than the lowest income households, whereas households with incomes in the $40,000 range are more likely to purchase them regularly. Age distribution and race do not have an effect on the probability of purchase. Respondents 45 or older are more likely to purchase peaches regularly. Households in which the food shopper attended college and larger households have higher probabilities of regular peach purchases.

The regularity of tomato purchases has the fewest number of significant independent variables. Households with incomes between $20,000 and $40,000 have lower probabilities of purchasing fresh tomatoes regularly than those in the lowest income group. None of the remaining independent variables included in the regression analysis has a significant effect. An inference is that tomatoes are used in consumer diets regardless of socioeconomic group.

Satisfaction with Purchases

Table 4 presents the trinomial probit regressions regarding satisfaction with purchases. Each of the computed chi squares is significant, leading to the inference of significant overall relationships. The R^2-like values, although low, are reasonable for cross-section household level data. The percents correctly predicted are for three-way classifications having unequal frequencies.

Three variables are significant determinants of apple satisfaction. Households in the highest income group have significantly lower probabilities of being satisfied than households with other incomes. Respondents in the 45-54

Table 4. Satisfaction Probit Regressions (asymptotic t-values in parentheses)

Independent Variables	Apples	Broccoli	Cabbages	Peaches	Tomatoes
Constant	1.010*	1.219*	2.496*	1.122*	1.085*
	(7.78)	(7.99)	(4.34)	(7.93)	(6.54)
INC2				-.355*	
				(1.69)	
INC3		.417*		-.324	
		(1.86)		(1.51)	
INC4			.656*		
			(1.66)		
INC5				-.441	
				(1.49)	
INC6	-.511*	.487*	-.641*	-.637*	-.478*
	(1.82)	(1.74)	(2.41)	(2.51)	(1.81)
PP2		-.895*	-1.782*		
		(1.74)	(2.30)		
PP3			-1.269*		
			(2.00)		
BLACK					.840*
					(2.78)
AGE2		.547*			-.483*
		(2.32)			(2.19)
AGE3		.333	.920*		-.534*
		(1.35)	(3.32)		(2.38)
AGE4	.628*		1.411*	.159	
	(2.31)		(4.23)	(.716)	
AGE5			1.179*		-.448*
			(3.72)		(1.83)
AGE6			.838*		
			(3.15)		
COLL	.318*				.535*
	(1.70)				(2.92)
RET		.662*			
		(2.72)			
Log likelihood	-173.31	-183.74	-142.41	-227.34	-201.71
X^2	8.76*	17.77*	34.09*	8.09*	38.53*
R^2-like	.08	.11	.22	.05	.23
Percent correctly predicted	72	62	74	51	62

*Significant at the .05 level.

age group have higher probabilities of being satisfied. Apple purchasers are more likely to be satisfied if they had attended college.

Households with incomes in the $20,000 range or with incomes at least equal to $50,000 have higher probabilities of being satisfied with fresh broccoli than the lowest income group. As the proportion of teenagers in a household increases, the likelihood of being satisfied with broccoli declines. If the respondent is between 25 and 34 years old, the probability of being satisfied is higher. Retired respondents are more likely to be satisfied with fresh broccoli.

Satisfaction with cabbage is affected by several socioeconomic variables. Households with incomes in the $30,000 range are more apt to be satisfied than the lowest income households, whereas households with incomes of $50,000 or more are less likely to be satisfied. Increases in the proportion of teenagers and adults lower the probability of being satisfied. However, respondents 35 and older are more prone to be satisfied than younger respondents.

Only two income categories affect the satisfaction probabilities of peaches. Households with incomes between $10,000 and $20,000 have lower probabilities of satisfaction, as do households in the highest categories. Not one of the other variables is significant. A poor harvest during the summer may have led consumers to be less satisfied with the available peaches relative to previous years.

The highest income group had lower probabilities of being satisfied with tomato purchases vis-a-vis the lowest income group. Black households also have higher satisfaction probabilities. Respondents between the ages of 25 and 44 and between 55 and 64 are less likely to be satisfied. College-educated respondents also have lower probabilities of satisfaction.

Care-Where-Grown

No estimates of apple, broccoli, and cabbage care-where-grown probit regressions are presented because the computer algorithm failed to reach convergence. Without any guide as to further steps to take, no estimates for these three equations are discussed. However, this problem did not arise with the peaches and tomatoes equations. Appendix Table 3 presents the estimated equations for the entire set of variables, and Table 5 presents the reduced set.

The statistical procedures failed to generate results with a significant chi square for a peach equation. Consequently, the discussion here is with this additional caveat. Households in the $30,000 range are less likely to care whether peaches are locally grown than other income households. Blacks are more likely to care about the origin of peaches. Respondents in age categories three, five, and six are more likely to care about the origin of peaches.

Turning to the tomatoes equation, only the age distribution and the oldest respondent age categories have significant coefficients. As the distribution of household members in the older age groups (two and three) increases, the probability of not caring about the origin of tomatoes increases. If the

Table 5. Care-Where-Grown Probit Regressions (asymptotic t-values in parentheses)

Independent Variables	Peaches	Tomatoes
Intercept	-.463*	1.288*
	(3.17)	(2.60)
INC4	-.534	
	(1.64)	
PP2	-.739	-1.416*
	(1.28)	(2.07)
PP3		-1.518*
		(2.76)
BLACK	.486*	
	(1.80)	
AGE3	.432*	
	(1.75)	
AGE5	.418	
	(1.61)	
AGE6	.373*	.661*
	(1.65)	(2.98)
Log likelihood	-145.68	-150.30
Chi square	11.67	13.73*
R^2-like	.08	.09
Percent correctly predicted	63	63

*Significant at the .05 level.

respondent is a member of the oldest age category, this person has a higher probability of caring about tomato origin.

Willingness-to-Pay

Willingness-to-pay for locally grown produce trinomial probit equations for each selected commodity are displayed in Table 6. The overall measures of goodness-of-fit lead to inferences of significant relationships. These measures are relatively high for cross-section household level data. Apples, broccoli, and cabbages have the highest chi square values and R^2-like values.

Several socioeconomic variables are significant in the apples equation. Households with incomes in the $10,000 to $20,000 range are more likely to pay the same or higher prices than the lowest income categories. As the proportion of members under the age of 10 increases, the household is less likely to be willing to pay more for local apples. Blacks are more likely to be willing to pay less. Respondents between the ages of 35 and 54 are more inclined to pay more for local apples than respondents between 15 and 24.

Only two variables are significant in the willingness-to-pay for local broccoli equations. Blacks have significantly lower probabilities to pay for locally grown selected produce vis-a-vis other races. Households in which the respondent was retired also have significantly lower probabilities.

Households with incomes in the $20,000 range are less apt to be willing to pay more for cabbages than other income category households. Black

Table 6. Willingness-to-Pay Probit Regressions (asymptotic t-values in parentheses)

Independent Variables	Apples	Broccoli	Cabbages	Peaches	Tomatoes
Constant	.822* (5.84)	1.647* (7.56)	1.686* (9.54)	1.335* (7.62)	1.419* (3.65)
INC2	.515* (2.56)				
INC3			-.427* (1.87)		
INC6		-.375 (1.39)			
PP2	-1.197* (2.29)				
PP3					-.124 (.31)
BLACK	-.728* (2.92)	-.992* (3.25)	-.563* (2.16)	-.861* (3.21)	-.622* (2.57)
AGE2			-.402* (1.76)		-.148 (.71)
AGE3	.385* (1.71)				
AGE4	.379* (1.66)				
AGE5	.336 (1.39)				
COLL		-.033 (.16)	-.496* (2.75)	-.336* (1.87)	
HSW					.372* (1.72)
RET		-.696* (2.64)		-.049 (.20)	.288 (1.12)
PROF					.425* (1.77)
Log likelihood	-198.93	-135.63	-153.63	-156.81	-181.37
X^2	24.77*	19.02*	22.61*	12.59*	13.79*
R^2-like	.14	.15	.15	.09	.08
Percent correctly predicted	54	62	61	57	61

*Significant at the .05 level.

households are more likely to be willing to pay less. Also, if the respondent is between 25 and 34 years old or if the respondent has attended college, slightly lower willingness-to-pay probabilities are predicted.

Willingness-to-pay for local peaches does not appear to be affected by the various income categories. Household age distribution and age of the respondent are not significant. Black households have significantly lower probabilities, as do households in which the respondent attended college. Employment status of the respondent is not a significant determinant either.

Three variables are significant in the willingness-to-pay for local tomatoes probit regressions. Black households are more likely to be willing to pay less for local tomatoes than other race households. The other two variables are employment status measures. Housewives and professional respondents are more likely to be willing to pay more.

Implications

Is there a market niche in the Knox County area for locally grown fresh produce? Results described above shed light on this question. The inferences that can be drawn provide direction for the promotion of these products. Overall consumer satisfaction with fresh produce is fairly high, but significant variation in the level of satisfaction among the selected commodities has been found (Eastwood, Orr, and Brooker, 1986). Consumer concern with the origin of fresh produce is not high, with the exceptions of tomatoes, for which just over one-half of the respondents indicate caring about origin. Consumers also care about the origin of peaches, but to a lesser extent. There appear to be no strong preferences either for or against locally grown commodities. The mixed pattern of significant variables in the probit regressions also suggests local promotion needs to be conducted carefully on a product-specific basis, as opposed to a blanket approach for all fresh produce.

Marketing implications for apples are as follows. The majority of consumers in the study area purchase apples, but they are not concerned about the origin and indicate that local apples must be competitively priced vis-a-vis out-of-state apples. Larger households and college-educated respondents have higher probabilities of purchasing apples regularly. In addition, because consumers are satisfied, they ought to be reminded of this in specific advertisements. Promotional efforts should be directed at shoppers who are 35 or older.

Broccoli is not purchased as regularly as apples, peaches, or tomatoes. Consumers who are more likely to purchase broccoli regularly are in the higher income group, have higher proportions of adults in the home, and the respondent is between 35 and 44. They are not concerned about broccoli origin, and they are not likely to be in the group that is willing to pay more for locally grown broccoli. Thus, promotion of local broccoli should emphasize satisfaction with purchases and entail the same or lower price than out-of-state broccoli.

Cabbages also are not purchased as regularly as apples, peaches, and tomatoes. Respondents 45 and older and larger families are more likely to be regular purchasers. Consumers in that age category are also more apt to be in the satisfied category. Lack of concern about cabbage origin and responses to willingness-to-pay questions indicate that more than a local label and comparable prices to out-of-state cabbages are needed in the promotion of this commodity.

The potential for marketing local peaches is greater than for apples, broccoli, and cabbage. Peaches are more likely to be purchased by older respondents in larger households. Consumers are less satisfied with these purchases than with apples, broccoli, and cabbages. This may be the result of a poor harvest resulting in lower levels of satisfaction. Respondents are more concerned about peach origin than with apples, broccoli, and cabbages. The results suggest that the promotion of local peaches should be directed at larger households in which the food shopper is 45 or older. However, the peaches must be priced at or below the price of those grown out of state.

Tomatoes have the greatest potential for a market niche. They are the most regularly purchased selected commodity, and consumers are most concerned about tomato origin. Housewives and professional respondents are most likely to be in the group that is willing to pay the same or more for locally grown tomatoes. These results suggest that promotions should be directed at all types of households.

The probit regressions can also be used in another way. The absence of significant relationships or negative relationships represent a challenge. These household types comprise a potential market. The challenge is to develop promotional campaigns directed toward these groups. Other analyses of the data (Eastwood, Orr, and Brooker, 1986) found that most consumers did not know about the attributes of selected locally grown vis-a-vis out-of-state commodities. There is the further suggestion that unless a local product is differentiated (e.g., by longer vine-ripening and the associated need for special handling) there is little reason to pursue local versus out-of-state marketing. Viewed from this perspective the local promotion of apples, broccoli, and cabbages should be informative in terms of emphasizing the advantages of attributes of locally grown products. The initial pricing should be slightly below that of comparable grade out-of-state commodities.

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Table A-1. Regularity of Purchase Probit Regressions for All Variables (asymptotic t-values in parentheses)

Independent Variables	Overall	Apples	Broccoli	Cabbages	Peaches	Tomatoes
Intercept	.504	-1.143	-.786	.717	-.377	.128
	(.46)	(1.53)	(1.04)	(.95)	(.51)	(.17)
INC2	.555*	.140	.078	.132	-.590*	-.124
	(1.81)	(.65)	(.35)	(.60)	(2.67)	(.55)
INC3	.521	-.010	-.090	-.244	-.461*	-.604*
	(1.57)	(.04)	(.38)	(1.01)	(1.94)	(2.50)
INC4	.805*	.045	-.195	.387	-.256	-.565*
	(1.73)	(.15)	(.65)	(1.29)	(.87)	(1.90)
INC5	.465	-.028	.237	.020	-.690*	.281
	(.95)	(.09)	(.74)	(.06)	(2.08)	(.81)
INC6	.875*	.154	.389	-.347	-.133	.444
	(1.80)	(.51)	(1.32)	(1.14)	(.44)	(1.36)
PP2	-.755	-.622	-.534	-.530	-.579	1.21*
	(.89)	(.99)	(.85)	(.85)	(.92)	(1.83)
PP3	.451	-.377	.624	-1.200*	-.243	.834
	(.500)	(.60)	(1.00)	(1.95)	(.39)	(1.27)
BLACK	-.304	-.278	-.093	.192	.004	-.024
	(1.00)	(1.20)	(.40)	(.83)	(.02)	(.10)
AGE2	-.670	-.199	.406	.618	.463	.020
	(1.08)	(.52)	(1.02)	(1.46)	(1.17)	(.05)
AGE3	-.836	.135	1.00*	.831*	.774*	-.146
	(1.29)	(.33)	(2.39)	(1.88)	(1.85)	(.35)
AGE4	-.473	.293	.370	1.44*	1.10*	-.410
	(.72)	(.72)	(.88)	(3.22)	(2.58)	(.99)
AGE5	-.348	.083	.087	1.05*	1.222*	-.120
	(.53)	(.21)	(.21)	(2.41)	(2.94)	(.30)
AGE6	-.087	.102	.380	1.26*	1.713*	-.078
	(.13)	(.24)	(.87)	(2.74)	(3.87)	(.18)
COLL	.152	.486*	.234	-.222	.499	.033
	(.57)	(2.63)	(1.28)	(1.21)	(2.68)*	(.18)
HSW	.026	-.110	.105	-.121	-.099	.065
	(.09)	(.53)	(.51)	(.58)	(.48)	(.31)
RET	-.746*	.119	.077	-.044	-.425	-.076
	(1.82)	(.41)	(.27)	(.15)	(1.45)	(.26)
PROF	.135	.228	-.191	-.354	.133	.283
	(.38)	(1.01)	(.85)	(1.53)	(.59)	(1.21)
SIZE	.118	.179*	.104	.159*	.250*	.135
	(1.02)	(2.16)	(1.26)	(1.92)	(2.98)	(1.56)
Log likelihood	-96.74	-283.00	-288.23	-266.57	-289.07	-287.58
Chi square	24.77	23.14	27.99	47.08*	43.70*	26.08
R^2-like	.21	.11	.13	.22	.20	.13
Percent correctly predicted	81	43	37	48	38	42

*Significant at the .05 level.

Table A-2. Satisfaction Probit Regressions for All Variables (asymptotic t-values in parentheses)

Independent Variables	Apples	Broccoli	Cabbages	Peaches	Tomatoes
Intercept	1.032	.876	2.994*	.833	1.187
	(1.18)	(1.07)	(3.18)	(1.04)	(1.38)
INC2	-.009	-.105	-.099	-.408*	-.180
	(.04)	(.43)	(.35)	(1.70)	(.71)
INC3	.148	.364	-.133	-.388	-.114
	(.52)	(1.35)	(.45)	(1.53)	(.42)
INC4	.310	.246	.561	-.120	.344
	(.83)	(.72)	(1.25)	(.36)	(.98)
INC5	.125	.043	-.416	-.533	-.284
	(.30)	(.12)	(1.03)	(1.52)	(.75)
INC6	-.382	.360	-.729*	-.739*	-.422
	(1.09)	(1.02)	(2.02)	(2.30)	(1.24)
PP2	.461	-.951	-2.09*	.004	.046
	(.59)	(1.33)	(2.56)	(.01)	(.06)
PP3	-.153	-.007	-1.574*	.005	.246
	(.20)	(.01)	(1.98)	(.01)	(.35)
BLACK	.179	-.179	.089	-.240	.878*
	(.61)	(.70)	(.29)	(.94)	(2.79)
AGE2	.149	.059	.157	.354	-.690
	(.34)	(.15)	(.38)	(.88)	(1.50)
AGE3	.237	.558	1.136*	.358	-.738
	(.51)	(1.28)	(2.46)	(.83)	(1.49)
AGE4	.771	.420	1.695*	.542	-.443
	(1.60)	(.96)	(3.41)	(1.24)	(.89)
AGE5	-.196	.064	1.382*	.183	-.760
	(.44)	(.15)	(2.93)	(.43)	(1.57)
AGE6	.366	.129	1.061*	.223	-.174
	(.75)	(.28)	(2.13)	(.49)	(.33)
COLL	.271	.179	-.113	.045	-.551*
	(1.20)	(.85)	(.48)	(.23)	(2.60)
HSW	.204	.112	-.332	-.244	-.050
	(.81)	(.48)	(1.20)	(1.10)	(.21)
RET	-.078	.739*	-.248	.326	-.003
	(.22)	(2.13)	(.62)	(1.00)	(.01)
PROF	-.063	.029	-.144	-.143	-.199
	(.23)	(.11)	(.52)	(.61)	(.79)
SIZE	.098	.087	-.039	-.045	.013
	(.03)	(.93)	(.38)	(.51)	(.14)
Log likelihood	-169.74	-181.37	-140.48	-224.09	-198.45
Chi square	15.89	22.51	37.95*	14.60	45.04*
R^2-like	.11	.13	.25	.08	.26
Percent correctly predicted	72	63	74	52	63

*Significant at the .05 level.

Tabel A-3. Care-Where-Grown Probit Regressions for All Variables (asymptotic t-values in parentheses)

Independent Variables	Peaches	Tomatoes
Intercept	-.584	.732
	(.64)	(.83)
INC2	-.133	.263
	(.50)	(.99)
INC3	-.255	-.325
	(.89)	(1.14)
INC4	-.677*	.090
	(1.78)	(.25)
INC5	.187	.364
	(.47)	(.91)
INC6	.120	-.040
	(.33)	(.11)
PP2	-1.374*	-1.531*
	(1.78)	(1.96)
PP3	-.702	-1.555*
	(.94)	(2.05)
BLACK	.437	-.195
	(1.52)	(.67)
AGE2	.521	-.159
	(.99)	(.35)
AGE3	.757	.167
	(1.38)	(.34)
AGE4	.307	.035
	(.55)	(.07)
AGE5	.932*	.532
	(1.72)	(1.12)
AGE6	.819	.820
	(1.45)	(1.61)
COLL	.138	.173
	(.62)	(.78)
HSW	.273	.312
	(1.09)	(1.25)
RET	.306	.184
	(.88)	(.52)
PROF	.233	.040
	(.86)	(.15)
SIZE	.071	.109
	(.70)	(1.09)
Log likelihood	-140.19	-142.48
Chi square	22.65	29.37*
R^2-like	.16	.19
Percent correctly predicted	64	63

*Significant at the .05 level.

Table A-4. Willingness-to-Pay Probit Regressions for All Variables (asymptotic t-values in parentheses)

Independent Variables	Apples	Broccoli	Cabbages	Peaches	Tomatoes
Intercept	.604	1.214	1.330	1.654*	2.76*
	(.71)	(1.12)	(1.41)	(1.87)	(3.14)
INC2	.397	.007	.056	.196	-.084
	(1.61)	(.02)	(.21)	(.70)	(.34)
INC3	-.227)	-.127	-.413	-.159	-.164
	(.87)	(.39)	(1.44)	(.50)	(.59)
INC4	-.171	-.447	.014	-.165	.152
	(.52)	(1.10)	(.04)	(.46)	(.44)
INC5	.045	-.112	.203	-.307	.012
	(.13)	(.28)	(.53)	(.72)	(.03)
INC6	-.142	-.473	-.142	-.266	.255
	(.44)	(1.30)	(.37)	(.71)	(.73)
PP2	1.13	-.338	-.030	-.401	-.226
	(1.59)	(.39)	(.04)	(.54)	(.32)
PP3	-.026	.117	.309	-.173	-.944
	(.04)	(.14)	(.43)	(.24)	(1.33)
BLACK	-.793*	-1.183*	-.525*	-.897*	-.556*
	(2.98)	(3.45)	(1.91)	(3.08)	(2.17)
AGE2	.545	.514	-.424	-.045	-.291
	(1.25)	(.86)	(.66)	(.09)	(.65)
AGE3	.911*	.033	-.038	-.045	-.223
	(1.97)	(.05)	(.06)	(.08)	(.47)
AGE4	.888	.294	-.191	.289	-.140
	(1.94)*	(.48)	(.29)	(.51)	(.29)
AGE5	.853*	.006	.254	-.045	-.023
	(1.87)	(.01)	(.39)	(.08)	(.05)
AGE6	.618	.455	-.205	-.023	-.175
	(1.30)	(.72)	(.31)	(.04)	(.35)
COLL	-.102	-.009	-.487*	-.226	-.134
	(.50)	(.04)	(2.19)	(.96)	(.63)
HSW	-.227	-.230	.151	-.146	.369
	(.99)	(.86)	(.62)	(.57)	(1.53)
RET	-.123	-.799*	.082	-.115	.231
	(.42)	(2.16)	(.24)	(.31)	(.67)
PROF	.044	.004	.088	-.001	.471*
	(.18)	(.01)	(.32)	(.01)	(1.80)
SIZE	-.018	.094	-.032	-.032	-.161*
	(.19)	(.83)	(.33)	(.32)	(1.71)
Log likelihood	-196.49	-132.15	-151.29	-154.15	178.07
Chi square	29.66*	25.98	27.29	17.91	20.43
R^2-like	.17	.19	.18	.13	.12
Percent correctly predicted	24	65	64	58	61

*Significant at the .05 level.

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Jacqueline O. DeJonge, Textiles, Merchandising and Design

BRANCH STATIONS

Ames Plantation, Grand Junction, James M. Anderson, Superintendent
Dairy Experiment Station, Lewisburg, J. R. Owen, Superintendent
Forestry Experiment Station: Locations at Oak Ridge, Tullahoma, and Wartburg, Richard M. Evans, Superintendent
Highland Rim Experiment Station, Springfield, D. O. Onks, Superintendent
Knoxville Experiment Station, Knoxville, John Hodges III, Superintendent
Martin Experiment Station, Martin, H. A. Henderson, Superintendent
Middle Tennessee Experiment Station, Spring Hill, J. W. High, Jr., Superintendent
Milan Experiment Station, Milan, John F. Bradley, Superintendent
Plateau Experiment Station, Crossville, R. D. Freeland, Superintendent
Tobacco Experiment Station, Greeneville, Philip P. Hunter, Superintendent
West Tennessee Experiment Station, Jackson, James F. Brown, Superintendent