Analysis of the Delaware Market For Organically Grown Produce*

by

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Introduction

Recent growth of organic produce sales in California and New Jersey indicate a trend toward increased consumer desire for organically grown produce. In 1987, the California market for organics ranged between $54 -68 million in wholesale prices, and was projected to exceed $300 million by mid-1992 (Franco, 1989). While much smaller, the New Jersey market for organics ranged between $1 - 3 million wholesale in 1988, and "the organic produce market offers a growth area for New Jersey growers" (Morgan and Barbour, 1991).

The fresh produce industry is a small but important aspect of Delaware agriculture. Delaware producers are continuously searching for new opportunities in produce production and marketing, and this recent trend in the growth of organic produce sales may provide an area of growth for Delaware producers. Of importance,

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however, is knowledge of consumer attitudes toward and opinions about organic produce. One topic to be explored is consumer rating of organic versus conventional produce.

Certain information about consumer attitudes and purchasing determinants is available from the study entitled "An Analysis of Consumer Preference between Organically and Conventionally Grown Produce in Delaware" (Groff, unpublished thesis, May, 1993). It was found that the factors of freshness, healthfulness, flavor, safety, nutrition, appearance, and price were largely unanimously important factors in organic purchasing decisions. This importance was not as clear for the factors of brand name and where the produce was grown. Perhaps certain demographic groups feel these factors are important, while others may not. Knowing this information would help in determining the target consumers for organics.

Objectives

The objectives of this study were to 1) determine the overall probabilities and marginal demographic effects for consumer rating of organics versus conventional produce, and 2) determine the importance of various factors in consumer organic produce purchasing decisions.

Data

Data was collected from a consumer mail survey on organic and conventional produce conducted in Delaware during 1990 (Byrne, 1991). A random mailing sample of listed and unlisted telephone subscribers was obtained from Donnelly Marketing (Nevada, Iowa). This random mailing was sent to a total of 6155 households across the state, with 4070 in New Castle county, 1010 in Kent county and 1075 in Sussex county. The response rates were 13.5, 9.8, and 9.8 percent for New Castle, Kent, and Sussex counties, respectively, with a statewide response rate of 12.2 percent.

Procedures

Ordered logit models were utilized to determine the three objectives of this study. The following material on ordered logit analysis is quite standard, and the procedures used are patterned after those set forth in Byrne's unpublished thesis (Byrne, 1991). Ordered logit analysis was used for questions representing dependent variables with contingent valuation measures based on the 1-7 scale. The dependent variables were aggregated into three categories for estimation purposes.

Responses to consumer rating of organics versus conventional produce (RTORG) were aggregated into the following three categories:

0 = organics worse than conventional produce
1 = organics same as conventional produce
2 = organics better than conventional produce

The observed frequency responses were .1009, .2710, and .6280, respectively. Responses to consumer rating of the importance of where the produce was grown (WHER) and brand name (BRAN) in their produce purchasing decisions were aggregated as follows:

0 = unimportant
1 = neutral
2 = important

The observed frequency responses were .3774, .1824, and .4403, respectively for WHER, and .4611, .2305, and .3084, respectively for BRAN.

The regression model used for all ordered logit models in this study is as follows:

$$Y = \beta_0 + \beta_1 AGE + \beta_2 MALE + \beta_3 INCOME + \beta_4 SOME\ COLLEGE + \beta_5 BACHELOR\ DEGREE + \beta_6 GRADUATE\ WORK\ or\ DEGREE + \beta_7 KID + \beta_8 MARRIED$$

where:

RTORG, BRAN, and WHER are substituted for Y depending on the model being run

AGE = respondent age in years

MALE = 1 if male; 0 otherwise

INCOME = total household income

KID = 1 if kids present; 0 otherwise

SOME COLLEGE = 1 if only attended some college; 0 otherwise

BACHELOR DEGREE = 1 if completed bachelor degree; 0 otherwise

GRADUATE WORK or DEGREE = 1 if completed some graduate work; 0 otherwise

MARRIED = 1 if married; 0 otherwise

The base group consisted of single females with a high school diploma or less.

Outcome prediction for individuals is not the reason that these ordered logit models were utilized. The intent of analyzing the demographic effects on the relevant dependent variable may be lost if too much emphasis is placed on improving the predictive ability of these models (Greene). Instead, characterization of the population requires good parameter estimates of the true independent variables. Logit modelling uses maximum likelihood estimators to maximize the combined density of the observed dependent variable, as opposed to the classical regression which chooses estimates to maximize the fitting of the dependent variable prediction and thus maximizing R^2. Additionally, a good fitting of the observed dependent variable and achieving valid coefficient estimates are not necessarily compatible (Greene). Hence, eliminating pseudo-independent variables, such as safety rating, avoids artificial inflation of prediction and reduction of true independent variable effects.

Chi-square values verify each model's significance for these structural analysis models, resulting as a difference of the restricted and unrestricted log likelihood functions. The restricted regression for these models consists of the intercept as the only right-hand-side variable (Maddala). Comparing the observed frequencies and the estimated overall probabilities provides further evidence of significance. The Score Test for the Proportional Odds Assumption confirmed parallelism for the ordered logit models (SAS Institute, Inc.).

Demographic Overview

Demographically, Sussex county residents are older, as 47.6 percent of respondents are 50 years of age or older, whereas 40.1 and 36.1 percent of respondents in New Castle and Kent counties, respectively, are 50 or older (Table 1). New Castle residents are more educated, as 48.7 percent of respondents have at least a bachelors degree, compared to 41.9 and 35.6 percent, respectively, in Kent and Sussex. Income distribution varies by county, as New Castle respondents have higher annual incomes. The percentage of respondents earning over $50,000 annually in New Castle, Sussex and Kent, respectively, are 48.9, 32.7 and 27.3. Sixty and 52.0 percent of Kent and Sussex respondents earn between $30,000 and $50,000 annually, whereas 44.6 percent in New Castle earn between $30,000 and $50,000.

Consumer Rating of Organic Versus Conventional Produce

This model shows that the overall probabilities for rating organics as much worse, the same, or much better than conventional produce were .0882, .2721, and .6397, respectively (Table 2). These probabilities were similar to observed frequencies, and the model has a significant chi-square value.

For every 10 year increase in age above the mean age of approximately 47, a respondent was 5.4 percent less likely to rate organics as much better than conventional produce. Similarly, males were 14.11 percent less likely to rate organics as much better, and 4.97 percent more likely to rate organics as much worse. Education also decreases the likelihood of a much better rating, but only significant for graduate degree holders, who were 16.97 percent less likely than their high school educated counterparts to rate organics as much better than conventional produce. This indicates that a strategy which targets younger female respondents without high education would be aimed at a group that is more likely to feel that organics are much better than conventional produce.

Table 1

Demographic Characteristics of Consumers, by County, Delaware, 1990

Characteristic	Survey area			
	New Castle	Kent	Sussex	State
		percent		
AGE				
18-34 years of age	24.7	21.6	19.4	23.6
35-49	35.2	42.3	33.0	35.8
50-64	23.6	20.6	27.2	23.7
65 or older	16.5	15.5	20.4	16.9
TOTAL	100.0	100.0	100.0	100.0
SEX				
Male	50.2	47.4	45.6	49.2
Female	49.8	52.6	54.4	50.8
TOTAL	100.0	100.0	100.0	100.0
EDUCATION				
Less than high school	4.1	7.1	9.6	5.3
High school graduate	27.1	32.6	29.8	28.2
Some college	20.1	18.4	25.0	20.6
Bachelor degree	24.6	27.6	23.1	24.8
Some graduate work or degree	24.1	14.3	12.5	21.1
TOTAL	100.0	100.0	100.0	100.0
ANNUAL HOUSEHOLD INCOME				
<$10,000	1.6	1.1	2.0	1.6
$10,000-19,999	4.9	11.6	13.3	7.0
$20,000-29,999	10.7	22.1	17.3	13.1
$30,000-39,999	13.2	12.6	21.4	14.3
$40,000-49,999	20.7	25.3	13.3	20.3
$50,000-59,999	14.6	6.3	9.2	12.7
$60,000-69,999	8.3	8.4	9.2	8.4
$70,000 or higher	26.0	12.6	14.3	22.6
TOTAL	100.0	100.0	100.0	100.0

SOURCE: Consumer survey and calculations

Table 2

Ordered Logit Overall Probabilities and Demographic Effects
For Consumer Rating of Organic Produce Versus Conventional Produce, Delaware, 1990

	P_0[1] MUCH WORSE	P_1[2] SAME	P_2[3] MUCH BETTER
OVERALL (chi-squared = 45.0160[a])	0.0882	0.2721	0.6397
MARGINAL EFFECTS			
Age[a] (mean = 46.793)	0.0019[4]	0.0035	-0.0054
Male[a]	0.0497[5]	0.0914	-0.1411
Income (mean = 50.8210)	0.0004[4]	0.0006	-0.0010
Kid	0.0007[5]	0.0014	-0.0021
Married	-0.0007[5]	-0.0013	0.0020
Some college	0.0204[5]	0.0431	-0.0635
Bachelor degree	0.0250[5]	0.0516	-0.0766
Graduate degree[a]	0.0622[5]	0.1075	-0.1697

N = 535

[a]Significant at the .01 level

[b]Significant at the .05 level

[c]Significant at the .10 level

[1]Computed as $P_0 = \frac{e^{-\beta' x}}{1 + e^{-\beta' x}}$ (Greene)

[2]Computed as $P_1 = \frac{e^{M\mu - \beta' x}}{1 + e^{M\mu - \beta' x}} - P_0$ (Greene)

[3]Computed as $P_2 = 1 - (P_0 + P_1)$ (Greene)

[4]Marginal effect (ME) of continuous variables (var) calculated:

$$P_0: \quad -[P_0 * (1 - P_0)] * \beta_{var}$$

$$P_2: \quad [P_2 * (1 - P_2)] * \beta_{var}$$

$$P_1: \quad 0 - (P_0 + P_2)$$

[5]ME of dummy variables calculated: ME = $P_i[x=1] - [x=0]$

SOURCE: Delmarva consumer survey and calculations

Table 3

Consumer Rating of Factor Importance in
Organic Produce Purchasing Decisions by County, Delaware, 1990

FACTORS	Survey area NEW CASTLE		KENT		SUSSEX		STATE	
	mean[a]	s.d.	mean[a]	s.d.	mean[a]	s.d.	mean[a]	s.d.
Freshness	1.46	0.03	1.30	0.06	1.38	0.06	1.43	0.03
Health	1.67	0.05	1.49	0.10	1.49	0.08	1.62	0.04
Flavor	1.70	0.04	1.59	0.09	1.57	0.08	1.67	0.04
Nutrition	1.71	0.05	1.54	0.11	1.57	0.09	1.67	0.04
Safety	1.72	0.05	1.73	0.13	1.55	0.10	1.70	0.04
Appearance	2.13	0.06	2.06	0.12	2.11	0.13	2.12	0.05
Price	2.44	0.07	1.98	0.13	2.15	0.15	2.34	0.06
Envir. effect	2.44	0.07	2.46	0.17	2.29	0.17	2.42	0.06
Certification	2.52	0.08	2.67	0.21	2.57	0.19	2.55	0.07
Where grown	3.83	0.09	3.79	0.22	3.74	0.22	3.81	0.08
Brand name	4.36	0.08	4.29	0.19	4.65	0.19	4.39	0.07

[a]1 = very important and 7 = very unimportant

SOURCE: Consumer mail survey and calculations

Importance of Various Purchasing Determinants

The most important factors affecting consumer organic produce purchasing decisions are freshness, healthfulness, flavor, nutrition, and safety (Table 3). Overall, where the produce was grown and its brand name are of the least concern in consumer purchasing decisions.

Chi-square testing for significance showed that freshness, flavor, nutrition, health, safety, appearance, price, and environmental effects are highly important factors in consumer produce purchasing decisions for all demographic categories. The importance of brand name (BRAN) and where grown (WHER) were not so strongly agreed upon, however. The purpose of the following two models is to determine whether certain demographic groups are more likely to rate WHER and BRAN as important in their purchasing decisions.

Overall probabilities for respondents rating of WHER as important, neutral, or important were .3707, .1911, and .4382, respectively (Table 4). These were similar to the observed frequencies, and the model had a significant chi-square value.

Table 4

Ordered Logit Overall Probabilities and Demographic Effects
On the Importance of Where Produce is Grown (WHER)
As a Purchasing Determinant, Delaware, 1990

	P_0[1] Unimportant	P_1[2] Neutral	P_2[3] Important
Overall (chi-squared = 35.482[a])	0.3707	0.1911	0.4382
Marginal Effects			
Age (mean = 46.313)	-0.0015[4]	-0.0001	0.0016
Male[c]	0.0637[5]	0.0035	-0.0672
Income[a] (mean = 50.767)	0.0024[4]	0.0001	-0.0025
Kid	-0.0437[5]	-0.0039	0.0476
Married	0.0160[5]	0.0010	-0.0170
Some college	0.0283[5]	0.0036	-0.0319
Bachelor degree	0.0707[5]	0.0064	-0.0771
Graduate degree[a]	0.1491[5]	0.0037	-0.1528

N = 636

[a]Significant at the .01 level

[b]Significant at the .05 level

[c]Significant at the .10 level

[1]Computed as $P_0 = \frac{e^{-\beta' x}}{1 + e^{-\beta' x}}$ (Greene)

[2]Computed as $P_1 = \frac{e^{M\mu - \beta' x}}{1 + e^{M\mu - \beta' x}} - P_0$ (Greene)

[3]Computed as $P_2 = 1 - (P_0 + P_1)$ (Greene)

[4]Marginal effect (ME) of continuous variables (var) calculated:

$$P_0: \quad -[P_0 * (1 - P_0)] * \beta_{var}$$

$$P_2: \quad [P_2 * (1 - P_2)] * \beta_{var}$$

$$P_1: \quad 0 - (P_0 + P_2)$$

[5]ME of dummy variables calculated: ME = $P_i[x=1] - [x=0]$

SOURCE: Delmarva consumer survey and calculations

Males were 6.72 percent less likely than females, and graduate degree holders were 15.28 percent less likely than respondents with at most a high school education to rate WHER as important to their organic produce purchasing decisions. Respondents with some college or a bachelor degree also are less likely to feel WHER is important than do their high school educated counterparts, but not significantly.

Similarly, most of the significant effects in the importance of brand name (BRAN) are cases of groups being less likely, no more, to rate it as important. All education beyond high school tended to make BRAN less important, as respondents with some college, a bachelor degree, or a graduate degree, are 9.14, 7.94, and 13.27 percent, respectively, less likely to rate BRAN as important (Table 5). However, for every ten years older than the mean age a respondent is, s/he was 2.0 percent more likely to rate BRAN as important, indicating some benefit to marketing a branded organic item to older individuals.

This model had overall probabilities to rate BRAN as unimportant, neutral, or important of .4572, .2374, and .3054, respectively, and had a significant chi-square value.

Conclusions

(1) This study concludes that younger respondents, female respondents, and those with lower education levels were more likely to feel organics are a better produce than is conventionally grown produce.

(2) Education and being male had negative effects on the likelihood to feel that where the produce was grown is important in organic produce purchasing decisions.

(3) Increasing age raised the likelihood for respondents to feel brand name is important, while higher education lessened the likelihood.

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Table 5

Ordered Logit Overall Probabilities and Demographic Effects
On the Importance of Brand Name (BRAN)
As a Purchasing Determinant, Delaware, 1990

	P_0[1] Unimportant	P_1[2] Neutral	P_2[3] Important
Overall (chi-squared = 23.005[a])	0.4572	0.2374	0.3054
Marginal Effects			
Age[c] (mean = 46.294)	-0.0023[4]	-0.0003	0.0020
Male	0.0232[5]	-0.0034	-0.0198
Income (mean = 50.732)	0.0010[4]	-0.0001	-0.0009
Kid	-0.0380[5]	0.0045	0.0335
Married	0.0623[5]	-0.0074	-0.0549
Some college[b]	0.1014[5]	-0.0102	-0.0914
Bachelor degree[c]	0.0870[5]	-0.0076	-0.0794
Graduate degree[a]	0.1548[5]	-0.0221	-0.1327

N = 636

[a]Significant at the .01 level

[b]Significant at the .05 level

[c]Significant at the .10 level

[1]Computed as $P_0 = \frac{e^{-\beta' x}}{1 + e^{-\beta' x}}$ (Greene)

[2]Computed as $P_1 = \frac{e^{M\mu - \beta' x}}{1 + e^{M\mu - \beta' x}} - P_0$ (Greene)

[3]Computed as $P_2 = 1 - (P_0 + P_1)$ (Greene)

[4]Marginal effect (ME) of continuous variables (var) calculated:

$$P_0: \quad -[P_0 * (1 - P_0)] * \beta_{var}$$

$$P_2: \quad [P_2 * (1 - P_2)] * \beta_{var}$$

$$P_1: \quad 0 - (P_0 + P_2)$$

[5]ME of dummy variables calculated: ME = $P_i[x=1]$ - $[x=0]$

SOURCE: Delmarva consumer survey and calculations