Impacts of Advertising and Promotion on the Demand for Scanned Purchases of Vidalia Onions

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This study evaluates the promotion and advertising impacts on the demand for scanned purchases of Vidalia onions and estimates returns to promotion expenditures. The analysis uses supermarket scanner data collected from scanned purchases of Vidalia onions and promotion expenditures generated by the Vidalia Onion Marketing Order. An error-components model is estimated to determine the impacts of promotion expenditures for scanned purchases of Vidalia onions, own price, prices of substitutes and complements, demographics, and seasonal variables for 10 different markets over a 260-week period from 1996 to 2001.

The production and marketing of sweet Vidalia onions comprises an $82-million industry with an economic impact of more than $270 million annually in 18 south-Georgia counties (Georgia Agricultural Statistics Service). The industry has grown steadily over the years but seems to have peaked in 1997 (Figure 1). In 1999 approximately 2,000 acres of onions were abandoned due to perceived marketing problems. In 2000, planted acres were reduced from 16,000 to 15,000 in an effort to restore profitable prices. Of 15,000 acres planted in 2001, only 12,400 acres were harvested. Thus there is substantial concern about the apparent decline in demand and the reasons behind it.

The Vidalia Onion Marketing Order was started in 1989 primarily to more effectively market Vidalia onions and is currently administered by the Vidalia Onion Committee (U. S. Dept. of Agriculture, 2001b). Under the marketing order authorization, the Vidalia Onion Committee is responsible for production research, marketing research and development, and marketing-promotion programs including paid advertising.

The advertising and promotion of Vidalia onions conducted by the Vidalia Onion Committee has consisted of television, radio, magazine, and newspaper ads including interviews and special shows. Advertising has been mostly at the national level through newspapers and magazines. Some emphasis has been placed on major metropolitan areas with special television and radio shows and interviews. Figure 2 shows the funds allocated for marketing and promotion by the Vidalia Committee. Such funds have increased considerably since the establishment of the Vidalia Marketing Order in 1989 and differ from the funds allocated by the National Onion Association for generic onion promotion (National Onion Association).

Promotion expenditures by the Vidalia Committee represent approximately 80 percent of all marketing expenditures by the Vidalia Committee and are directly related to the consumption of Vidalia onions. Specifically, nearly $440,000 was spent on regional and national Vidalia onion advertising via television, radio, and print between 1996 and 2000. However, in 1997 marketing and promotion expenditures were cut drastically, and by 1998 these expenditures were barely half the 1996 peak (Figure 2).

Is branded promotion a viable method for increasing the demand for agricultural products? Or have Vidalia onions become just another onion? While many studies have been conducted to determine the benefits of generic promotion (*e.g.*, Ward and Myers; Thompson and Eiler; Kinnucan and Forker; Ward and Dixon; Onunkwo and Epperson), only a few have estimated the viability of branded promotion for agricultural goods (*e.g.*, Jones and Choi, 1992; Lee and Brown, 1992).

The use of panel data in promotion-evaluation studies has been commonplace in the literature. Studies have combined the use of different regions and time frames for analyzing returns to expenditures for marketing and promotion of fluid milk, orange juice, cheese, and other agricultural products (Ward and Dixon, 1989). However, error-components models have not been used at the retail level

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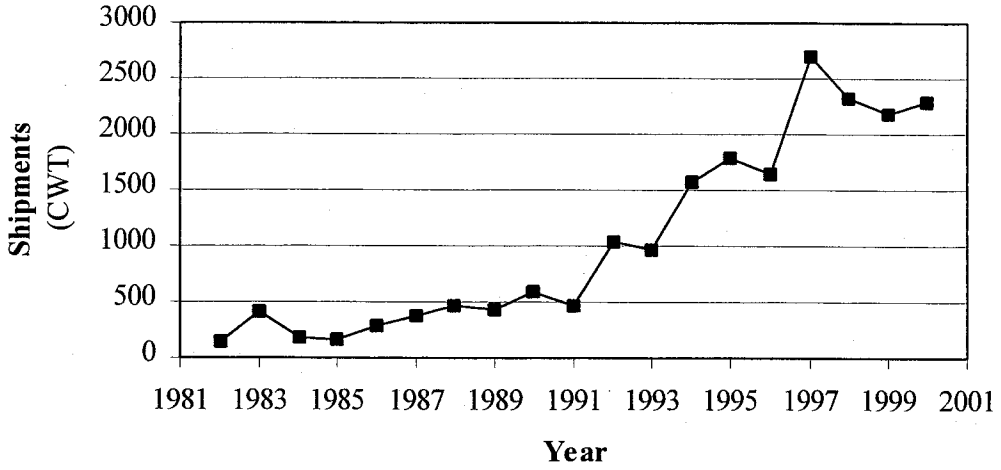

Figure 1. Vidalia Onion Shipments (Dry Onions).
Source: U. S. Dept. of Agriculture.

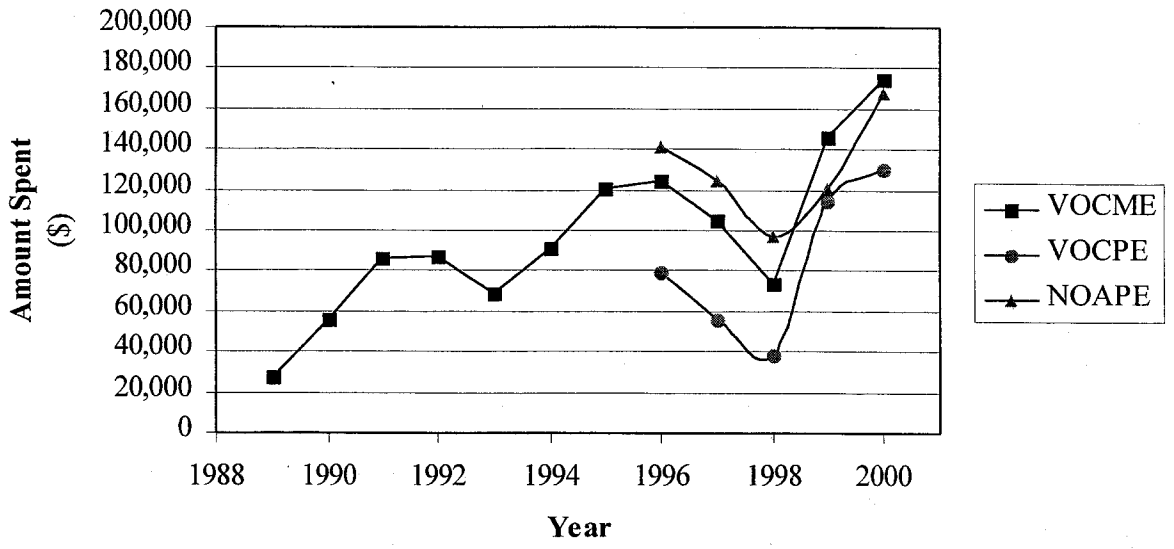

Figure 2. Vidalia Marketing Order Marketing Expenditures (VOCME), Promotion Expenditures (VOCPE), and National Onion Association Promotion Expenditures (NOAPE).

or with weekly observations to estimate the effects of branded promotion expenditures for agricultural products.

The objectives of the study were to ascertain and measure the influence of the important factors that determine the market demand by geographic region in the United States for Vidalia onions, to measure the impact of market-promotion expenditures on sales of Vidalia onions, and to estimate the dollar return on promotion expenditures for Vidalia onions.

data and Methodology

All onion data in this analysis are for scanned purchases of onions—that is, bagged onions rather than bulk purchases, which do not have UPC codes. Scanned purchases of Vidalia onions account for approximately half of all fresh Vidalia onion purchases in the United States (Center for Agribusiness and Economic Development). Sales, price, and purchase data for fresh onions were obtained for 10 U.S. markets where Vidalia onions are sold (AC Nielsen). The 10 markets are Atlanta, Boston, Chicago, Dallas-Fort Worth, Jacksonville, New York, San Francisco, Seattle, St. Louis, and Tampa. The sample period spans March 1996 through February 2001. The onion data were recorded by UPC code at food stores at time of purchase by consumers in each market. The weekly data include date of purchase, UPC code, total expenditures, quantity purchased, and any in-store advertising involved. In-store advertising includes ads and/or displays which differ from the promotion program efforts conducted by the Vidalia Onion Marketing Order. Vidalia onion sales accounted for 10 percent of all scanned onion sales for the year 2000 (Figure 3). Yellow onion sales accounted for 80 percent of all onion sales, representing a direct competitor to Vidalia onions. Other sweet onions, including branded onions such as Maui and Walla-Walla, accounted for approximately 3 percent of the total onion market. The Consumer Price Indices (CPI) for vegetables and meat were used as proxies for vegetable and meat prices (U.S. Dept. of Labor, Bureau of Labor Statistics). Demographic information was collected for the 10 markets being studied. The data were obtained from Demographics USA (Demographics USA - County Edition), which represents the Designated Market Areas (DMAs) supplied by the Nielsen Media Research.

The model developed in this study estimates the impact of promotion expenditures on the demand for Vidalia onions among different markets and is based on demand models developed in the literature. Random effects of variables such as the price of Vidalia onions, competing sweet onion prices, per-capita income, seasonality of Vidalia onion sales, and promotion expenditures are separated by market and time and estimated as a pooled system. After analyzing the impact of promotion on sales and distribution, the corresponding return on each dollar spent on promotion for Vidalia onions is also estimated.

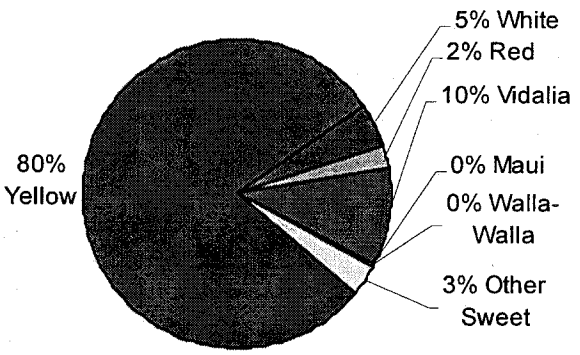

Figure 3. Total Demand for 10 U.S. Markets for Selected Bagged Onions, 2000.

Advertising Model Development

In this study the dependent variable is average weekly pounds of Vidalia onions consumed per capita in each market (*VIDQ*). *VIDQ* is hypothesized to be a function of deflated per-capita income (*PINC*); deflated retail price per pound of Vidalia onions that were not advertised in grocery stores (*VIDP*); deflated retail sales of other sweet onions per pound (*SWES*); deflated retail sales with display and no causal (no display) of yellow onions per pound (*YELS* and *YELDS*, respectively); deflated retail sales of Maui sweet onions per pound (*MAUS*); deflated retail sales of Walla-Walla sweet onions per pound (*WALS*); deflated retail sales of red onions per pound (*REDS*); deflated retail sales of white onions per pound (*WHIS*)[1]; CPI for vegetables as a proxy for vegetables prices (*VEGP*); CPI for meat as a proxy for meat prices (*MEAP*); television, radio, and printed per-capita deflated advertising expenditures for Vidalia onions (*VADV*); national television, radio, and printed per-capita non-branded deflated advertising expenditures of onions (*OADV*); and five variables reflecting demographic differences among the ten markets. The five demographic variables are (a) proportion of a market's population that is eighteen years of age or older (*ADUL*), (b) proportion of a market's population that is black (*BLCK*), (c) proportion of a market's population that is Hispanic (*HISP*), (d) proportion of a market's population that is female (*FEML*), and (e) number of persons per household (*PPHH*). The model also includes monthly dummy variables to indicate seasonality of Vidalia onion consumption, ranging from January (*JAN*) to December (*DEC*). *JAN* is included in the intercept.

Vidalia Onion Advertising Model

The advertising model is specified in Equation 1. The coefficients are denoted with βs:

$$(1)\ VIDQ_{it} = \beta_0 + \beta_1 VIDP_{it} + \beta_2 SWES_{it} + \beta_3 YELS_{it} + \beta_4 YELDS_{it} + \beta_5 MAUS_{it} + \beta_6 WALS_{it} + \beta_7 WHIS_{it} + \beta_8 REDS_{it} + \beta_9 VEGP_{it} + \beta_{10} MEAP_{it} + \beta_{11} PINC_{it} + \beta_{12} VADV_{it} + \beta_{13} OADV_{it} + \beta_{14} ADUL_{it} + \beta_{15} BLCK_{it} + \beta_{16} HISP_{it} + \beta_{17} FEML_{it} + \beta_{18} PPHH_{it} + \beta_{19} FEB_{it} + \beta_{20} MAR_{it} + \beta_{21} APR_{it} + \beta_{22} MAY_{it} + \beta_{23} JUN_{it} + \beta_{24} JUL_{it} + \beta_{25} AUG_{it} + \beta_{26} SEP_{it} + \beta_{27} OCT_{it} + \beta_{28} NOV_{it} + \beta_{29} DEC_{it} + u_{it}$$

Equation 1 is a cross-sectional time-series model. In other words, the model is assumed to have disturbances that vary by cross-section (subscript *i*) and time (subscript *t*) which need to be separated from the unobserved disturbances. Thus, the error-term disturbance is decomposed into three terms:

$$(2)\ u_{it} = v_i + e_t + \epsilon_{it},$$

where v_i, e_t, and ϵ_{it} are independently distributed with zero means and positive variances σ^2_v, σ^2_e, and σ^2_ϵ.

The coefficient for the price of Vidalia onions (*VIDP*) is expected to have a negative sign according to economic theory, meaning that fewer Vidalia onions are demanded when the price of Vidalia onions increases. All coefficients for sales of substitute goods are expected to have negative signs, since a rise in the sales of substitute onions causes a decrease in demand for Vidalia onions. Coefficients for prices of complementary goods such as vegetables and meat (*VEGP* and *MEAP*, respectively) are expected to have negative signs, meaning that increases in the prices of vegetables and meat will cause downward pressure on the consumption of Vidalia onions. The coefficient for per-capita income (*PINC*) is expected to have a positive sign, indicating a normal good—that is, higher income increases consumption of Vidalia onions. The coefficient for Vidalia promotion expenditures (*VADV*) is expected to have positive value, indicating the benefits of Vidalia promotion expenditures. Expenditures by the National Onion Association are expected to have some or no effect on the consumption of Vidalia onions. The coefficient for percentage of adults (*ADUL*) in each market is expected to have a positive sign because of advertising focus. The coefficient for number of persons in the household (*PPHH*) is expected to have positive sign because more people will eat more onions. Coefficients for proportion of blacks (Afri-

[1] Sales rather than prices of yellow, Maui sweet, Walla-Walla sweet, other sweet, white, and red onions were used because the missing observations are too numerous and unbalanced, making the estimation procedure infeasible.

can-Americans, *BLCK*) , Hispanics (*HISP*), and female (*FEML*) are indeterminate in sign. Seasonality is expected to affect consumption of Vidalia onions during the months when Vidalia onions are being harvested—specifically, May through July. The dummy-variable coefficients for these months are expected to have positive signs, meaning that higher consumption is observed during the Vidalia onion season.

Results

Interpretation of Coefficient Estimates

The impacts of the promotion program and in-store advertising are separate in the study. Demand is estimated for markets with promotion generated by the Vidalia marketing order and the National Onion Association. Estimation of the Vidalia onion demand function allows measurement of the promotion programs and specific advertising impacts on the demand for Vidalia onions. Inclusion of population demographics helps to provide an indication of the population characteristics in markets with increasing demand for Vidalia onions. The outcome of this research includes estimated returns to promotion expenditures for Vidalia onions as well as promotion impacts on sales of Vidalia onions.

Descriptions and simple statistics for core variables included in the model are presented in Table 1. Coefficient estimates for the linear model are presented in Table 2. The goodness-of-fit measure for the model is relatively good for pooled data. An R^2 of 0.4558 indicates that approximately 46 percent of the variation in demand for Vidalia onions is explained by the model. The Hausman test for random effects in the error term led to rejection of the null hypothesis of fixed effects, indicating that the error-components model with random effects is the correct estimation procedure in this case (Gujarati).

The coefficient for the price of Vidalia onions is significantly different from zero and negative indicating that higher prices of Vidalia onions decrease consumption. However, this responsiveness to price is considerably inelastic (Table 3). This indicates that Vidalia onions are highly differentiated from other sweet onions and from onions in general. With the apparent level of success in product differentiation for Vidalia onions, and given the average levels of promotion over the study period, total revenue to Vidalia onion producers as a whole can be increased by carefully controlling the week-to-week supply of Vidalia onions over the marketing period.

The estimates for sales of yellow onions with displays and no causal (no displays), other sweet onions, and red onions are significantly different from zero and negative. These results indicate that an increase in sales of competing onions generates a decrease in demand for Vidalia onions, as expected. Unexpectedly, sales of Maui sweet onions are an exception. According to the positive sign of the coefficient observed for sales of Maui sweet onions, an increase in sales of Maui sweet onions is positively associated with the demand for Vidalia onions. Apparently, an increase in sales of Maui sweet onions carries an increase in demand for the less-expensive Vidalia onions. The coefficient for vegetables price is significantly different from zero and negative, indicating that other vegetables are complementary to Vidalia onions. Indeed, the complementary relationship is strong as reflected by the cross-price elasticity estimate in Table 3. The coefficient for per-capita income is significantly different from zero and positive, indicating that consumption of Vidalia onions is higher for individuals with higher income. In fact, the income effect is strong as reflected by the income-elasticity estimate in Table 3.

The estimated coefficient that determines the impact of Vidalia onion promotion expenditures is significantly different from zero and positive, indicating that the promotion efforts undertaken by the Vidalia Committee have generated increased demand for Vidalia onions. The relative impact is reflected in the elasticity estimate presented in Table 3. The coefficient for generic advertising by the National Onion Association was significantly different from zero and negative, indicating that generic advertising has a negative impact on sales of Vidalia onions, a branded product (Table 2).

The coefficients for Hispanics, females, and number of persons per household are significantly different from zero (Table 2). The negative coefficient for Hispanics indicates that markets with relatively lower demand for Vidalia onions tend to have higher proportions of Hispanics in the population. The negative coefficient for females indicates that

Table 1. Description and Simple Statistics for Variables Included in the Vidalia Promotion Expenditures Evaluation Model, 1996.3-2001.2.

Variable	Description	Mean	Standard Deviation	Minimum	Maximum
VIDQ	Per capita quantity of Vidalia onions purchased (lb)	0.0041	0.0102	0.0000	0.0921
VIDP	Deflated[a] retail price of Vidalia onions ($/lb)	1.3906	1.5992	0.1049	7.7793
SWES	Deflated per-capita retail sales of sweet onions	0.0002	0.0008	0.0000	0.0084
YELS	Deflated per-capita retail sales of yellow onions	0.0069	0.0045	0.0000	0.0266
YELDS	Deflated per-capita retail sales of yellow onions with displays	0.0001	0.0002	0.0000	0.0018
MAUS	Deflated per-capita retail sales of Maui onions	0.0001	0.0002	0.0000	0.0019
WALS	Deflated per-capita retail sales of Walla-Walla onions	6.1E-9	0.0001	0.0000	0.0014
WHIS	Deflated per-capita retail sales of white onions	0.0005	0.0006	0.0000	0.0078
REDS	Deflated per-capita retail sales of red onions	0.0001	0.0002	0.0000	0.0016
VEGP	CPI of vegetables[b]	207.2542	14.8984	175.1000	240.6000
MEAP	CPI of meat	144.3638	4.5068	136.4000	156.5000
PINC	Per-capita deflated income ($1,000)	11.7529	1.2003	9.5491	14.5516
VADV	Deflated per-capita Vidalia onion advertising expenditures ($)	0.000016	0.000046	6.0E-7	0.000043
OADV	Deflated per-capita generic onion advertising expenditures ($)	0.000066	0.000091	0.000006	0.000392
ADUL	Proportion of adults in a household (%)	75.2147	2.3480	70.0084	80.6843
BLCK	Proportion of blacks (African-Americans) in the population (%)	14.51066.6722	4.2000	24.5000	
HISP	Proportion of Hispanics in the population (%)	9.2745	6.3907	1.2000	19.6000
FEML	Proportion of females in the population (%)	51.1442	0.6526	50.1656	52.1127
PPHH	Proportion of households with female head (%)	2.5914	0.1020	2.3200	2.7400

[a] All deflated variables used the general CPI with 1982-84 as the base year.
[b] CPIs for vegetables and meat used 1982-84 as the base year.

Table 2. Pooled Cross-Sectional and Time-Series Estimates for the Vidalia Onion Model with Dependent Variable *VIDQ*.

Variables	Parameters	Standard Errors
Intercept	-0.0847	0.3533
VIDP	-0.0004*	0.0002
SWES	-14169.9000***	2679.5000
YELS	-19557.3000***	913.8000
YELDS	-23856.6000**	11845.1000
MAUS	77396.1400***	17839.8000
WALS	1250.2380	29015.9000
WHIS	-1617.5700	6465.1000
REDS	-33643.2000*	19847.9000
VEGP	-0.0001*	0.0001
MEAP	0.0001	0.0001
PINC	0.0001***	1.2E-6
VADV	132.4502***	43.6072
OADV	-41.1895***	10.4859
ADUL	-0.0004	0.0004
BLCK	-0.0006	0.0009
HISP	-0.0071***	0.0008
FEML	-0.0161***	0.0061
PPHH	0.3195***	0.0473
FEB	-0.0034**	0.0016
MAR	-0.0032**	0.0016
APR	-0.0017	0.0016
MAY	0.0098***	0.0017
JUN	0.0092***	0.0017
JUL	0.0035**	0.0017
AUG	0.0027	0.0017
SEP	0.0034*	0.0018
OCT	0.0010	0.0018
NOV	0.0049***	0.0018
DEC	0.0027*	0.0016
$R^2 = 0.4558$	No. of *CS* = 10	
MSE = 0.0000	No. of *TS* = 260	
RMSE = 0.066	Total no. obs. = 1542	
Hausman Test for Random Effects:		
m Value = 49.84***		

*, **, and *** indicate statistical significance at the 10-percent-, 5-percent-, and 1-percent-level, respectively.

markets with relatively higher demand for Vidalia onions tend to have higher proportions of males. Similarly, the positive coefficient for number of persons per household indicates that markets with relatively higher demand for Vidalia onions tend to have relatively a higher number of family members in a household. Cause-and-effect regarding the demand for Vidalia onions with respect to the demographic variables cannot be ascertained given the nature of the demographic data available for this study.

Finally, the seasonality of Vidalia onions is observed in the significance of the intercept shifters for the months of February and March, May through July, September, and November and December. The intercept shifters for February and March have negative coefficients, indicating decreased consumption in the early stages of harvest preparations. The intercept shifters for the months of May through July have positive signs, indicating seasonal demand in May, June, and July for Vidalia onions. The intercept shifters for the months of September, November, and December have positive signs, indicating seasonal demand for stored Vidalia onions.

Impact of Vidalia Onion Advertising and Marginal Advertising Gains

Based on the promotion elasticities shown in Table3, promotion impacts on Vidalia onion demand are calculated for the 10 markets studied as a whole and are presented in Table 4. The returns per dollar of promotion expenditure by the Vidalia

Table 3. Elasticity Estimates for Vidalia Onion Demand in the United States.

Variable	ε_j (Elasticity of Variable j)
Price	
VIDP	-0.14
VEGP	-29.96
Income	
PINC	45.31
Promotion Expenditure	
VADV	0.05

Note: Elasticity estimates obtained by $\beta_j * \frac{\overline{X}_j}{\overline{Y}}$, where β_j is the coefficient for independent variable j, $\overline{X}_j$ is the mean of the independent variable, $\overline{Y}$ and is the mean of the dependent variable (Gujarati, 1995).

Table 4. Estimated Weekly Impacts of Promotion Expenditures on Vidalia Onion Demand for Ten Markets in the United States, 1996.3-2001.2.

Promotion	Deflated Average Vidalia Onion Sales ($)	Deflated Per-Capita Average Promotion Expenditures ($)	Marginal Return per Dollar Promotion Expenditure ($)
VADV	6,756	0.00000161	52.68

Note: Marginal return per dollar of promotion expenditure obtained by $\frac{\overline{N} * e}{\overline{E}}$, where $\overline{N}$ = deflated mean Vidalia onion sales, $\overline{E}$ = deflated mean Vidalia onion promotion expenditures, and appropriate promotion elasticity. (Richards, Van Ispelen, and Kagan, 1997).

Onion Committee are $52.68. Such return to promotion suggests that the expenditures on Vidalia onions have been extremely effective and have been allocated in the appropriate weeks of the year. Further, such high returns are consistent with a product in the early stage of a product life cycle as reflected in Figure 1. Greater promotion efforts should lead to much greater increases in demand for Vidalia onions especially with promotion expenditures at such low levels relative to the size of the Vidalia onion market. Though the returns to promotion were found to be high in this study, other studies concerning other products and commodities have shown even higher returns to promotion (see among others Alston; Williams).

Conclusion

The analysis of promotion expenditure impacts on Vidalia onion consumption and the determination of a demand profile for Vidalia onions by region, season, demographic characteristics, and other aspects serve as instruments for future promotion-expenditure decisions and for more target-oriented advertising. The evaluation of Vidalia onion promotion expenditures should help determine more specifically what promotion-expenditure levels should be implemented in which markets and with which types of consumers.

Results indicate that promotion and advertising expenditures have substantially influenced the demand for Vidalia onions over the study period, though consumption has remained higher in the eastern United States relative to the western region. The sales of competing onions—mainly yellow onions—represent a factor in determining the demand for Vidalia onions. The presence of other sweet onions in the market does not seem to represent significant competition to Vidalia onions. The complementarity of vegetables to Vidalia onions is a surprising result that indicates that perhaps more promotion efforts should be allocated to Vidalia onions in conjunction with certain vegetables. Given the seasonality of Vidalia onions, additional promotional efforts should be used to increase the consumption of Vidalia onions in other months of the year, especially since Vidalia onions can be stored throughout the year with controlled-atmosphere storage. The demographic component of the analysis suggests that promotion efforts should be aimed at middle- and upper-income families.

Future research should involve a complete data set—one encompassing observations that include not only prices, quantities, and promotion expenditures but also a full complement of demographic characteristics. Unfortunately, such data were not available for this study. Future research should also involve the determination of optimal levels of Vidalia onion shipments with respect to alternative levels of promotion expenditures. Continuous efforts to ascertain better forms and targets of Vidalia onion promotion are also of paramount importance.

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