The Florida Tomato Committee's Education & Promotion Program 2011 - 2016: An Evaluation

John J. VanSickle and Fangyi Zhang

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Food and Resource Economics Department,
Institute of Food and Animal Sciences,
University of Florida

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1 Introduction

This study evaluates the economic impacts of education and promotion expenditures of the Florida Tomato Committee. Federal Marketing Order No. 966 was authorized by the Agricultural Marketing Act of 1937 and became active by vote in 1955. Originally, the marketing order was intended to regulate and standardize the size and net weight of tomatoes that were packed in containers and to have the containers marked by their corresponding weight and size.

Prior to 1987, education and promotion activities were not included in the Marketing Order and had to be conducted under Marketing Agreement No. 125. The agreement funded these activities between 1984 and 1986 with average expenditures valued at $520,000. After 1987, the Marketing Order took over responsibility for education and promotion and increased average expenditures to $1,004,055 between 1987 and 2000. This average dropped slightly between 2001 and 2005, averaging only $501,873, but increased between 2006 and 2010 to an average of $854,072. Marketing and promotion expenditures continued to decline between 2011 and 2015 averaging only $592,930 and they were lowered again in 2016 to $295,429.

The Marketing Order also began Market Access Promotion (MAP) activities in the 1997/1998 season with partial funding by the U.S. Department of Agriculture. The purpose of MAP programs was to increase Florida fresh tomato exports to Canada and Asia and to increase foreign market consumption. Average annual MAP expenditures were $171,000 between the 1997/1998 and 2001/2002 seasons, $184,000 between the 2002/2003 and 2005/2006 seasons, and $195,000 between the 2006/2007 and 2009/2010 seasons. MAP expenditures increased at an average rate of 1.25% per year between the time of its inception and the 2009/2010 season.

The primary focus of this study is to determine whether education and promotion programs led by the Florida Tomato Committee have effectively increased demand for tomatoes in the United States. Much attention is given to evaluating the returns to producers from these expenditures following the mandate that collective funds be spent on promotion and education activities to benefit the members of the Marketing Order.

Beginning with an overview of previous evaluations and model estimations, this study goes on to estimate the effect of education and promotion program expenditures on demand for Florida tomatoes by analyzing data for crop years 1972-2016. The analysis also measures the effects of food safety incidents on consumption using data which shows the annual number of illnesses caused by salmonella outbreaks that were tied to U.S. tomato consumption from 1990 to 2016. The methodology which we call scenario 1 is based on the paper by VanSickle and Einsohn (2012). Previous analyses conducted on education and promotion programs for the Florida Tomato industry have suggested that increases in these programs resulted in increased demand. This evaluation will test this result with additional data.

In addition, we apply a vector auto-regression to analyze what we call scenario 2, in which we focus more on the effect of historical data has on Florida tomato industry. In this framework, we use only a series of key equations to calculate the potential and historical average benefit/cost ratio (ABC).

DEVELOPMENTS IN FOOD SAFETY

Historically, food safety has been under the auspice of the USDA. Currently however, the responsibilities for supervision and regulatory enforcement are divided into two groups from the Department of Health and Human Services, three groups under the Department of Agriculture, and one group under the Environmental Protection Agency. Currently there are no mandates in place for the implementation of national quality control practices such as “Best Management Practices (BMP) or “Good Agricultural Practices (GAP), however the Florida Tomato Committee has been practicing “Tomato Best Management Practices” (T-BMT) and the “Tomato Good Agricultural Practices” (T-GAP) for the past several years (Ferro 2010). The adoption of these practices allowed the Florida tomato industry to distance itself from accusations that their tomatoes caused reported outbreaks. Despite the Committee’s recent lack of involvement, prices for Florida tomatoes have been affected by food safety incidences involving tomatoes from other areas. Since 1998, there have been 51 outbreaks of salmonella in the United States that have been directly tied to the consumption of tomatoes causing 4,635 illnesses (CDC, 2018).

Given these food safety outbreaks it is informative to test the effects that these outbreaks have had on the consumption of Florida tomatoes. Evaluations prior to VanSickle and Einsohn (2012) had yet to consider food safety as a determinant of consumption. They concluded that food safety had a significant impact on returns to promotion and education. This study again tests the hypothesis that there has been a significant decrease in the consumption of tomatoes as a result of food safety incidents. This will be tested by including the annual number of salmonella illnesses associated with tomato consumption as a variable in the estimation of a consumer demand model. With this result we will be able to further determine whether the mandatory spending on education and promotion has acted as a significant hedge against the anticipated negative influence of food safety incidents.

FLORIDA EDUCATION AND PROMOTION

The Florida tomato industry has been using promotion as means of increasing consumption of their products for several years with programs focusing on category market participation. For example, in the retail market, efforts were focused on building the market's relationship with their retail community. In the area of public relations, the industry has published press releases in newspapers and magazines in order to educate consumers on the proper handling and serving of tomatoes. Efforts were also made in the form of trade advertising for those who purchase their tomatoes directly through Florida shippers. During the 2006 season, the Committee launched their first television campaign in an attempt to brand Florida tomatoes as "America's Favorite." The ads ran on a variety of channels including the Food Network, HGTV, DIY, Discovery Home, and Discovery Health. Handling and serving educational information were also included in the commercials. MAP promotion activities were conducted to increase exports to Canada and Asia with a large portion of program funding coming from the USDA.

2 Related Literature

Several independent studies have been performed in the last 30 years for the purpose of evaluating the effectiveness of promotion of agricultural commodities. Some of the most prominent early research was performed by Degner (1985), Forker and Ward (1991, 1993), and Sexton and Crespi (1999, 2003). Each of these studies came to the same conclusion, which is that commodity promotion programs do in fact yield a significant positive benefit to producers. Simply stated, spending on promotion activities increases the demand for commodities. At the same time, in order for promotion programs to be worthwhile, their returns must be greater than their costs (Crespi and Sexton, p.2), i.e., an effective promotion program offers positive net returns to the growers.

Benefit/Cost ratios have been used in previous studies to determine a program's effectiveness at generating these returns to producers. The average benefit/cost ratio (ABC) can be used to calculate producer returns resulting from the dollars spent on promotion. This is calculated by first estimating the effects of various inputs, such as promotion, on the quantity consumed. The marginal benefit/cost ratio can be used to determine returns on promotion at the margin and can be used further to calculate profits to producers resulting from additional dollars spent on promotion. Previous studies for the Florida Tomato Committee show an ABC value of 27.15 (VanSickle and Evans, 2001). This means that each dollar spent on tomato promotion returned $27.15 in additional revenue to the growers.

The three most recent evaluations on Florida promotion programs for tomatoes were conducted by VanSickle and Evans in 2001, VanSickle and Ranjan in 2006, and VanSickle and Einsohn in 2012. These evaluations were conducted with models used as the foundation of this study; however, these models have been further developed in this evaluation.

3 Econometric Framework

3.1 Linear Model: Scenario 1

VanSickle and Evans (2001), VanSickle and Ranjan (2006) and VanSickle and Einsohn (2012) developed their procedures for the evaluation of promotion activates using a model first introduced by Crespi and Sexton (1999). The following model will continue to act as the basis for this evaluation.

$$(1)\ \mathrm{Q} = \mathrm{f}(\mathrm{rP},\ \mathrm{rINC},\ \mathrm{rPromo},\ \mathrm{Trend})$$

Q represents annual per capita consumption in the United States, rP is the price of the commodity adjusted for inflation, rPromo is the inflation adjusted value for education and promotion expenditures, rINC is the inflation adjusted annual per capita U.S. income, and Trend is a linear variable which accounts for the annual stochastic variability in the market that is not captured by the other stated variables.

VanSickle and Evans (2001) altered the model to provide a more realistic depiction of the U.S. tomato market. Consumers are typically unable to discern Florida tomatoes from those of another source so it was expected that the Florida Tomato Committee's education and promotion programs would influence demand for U.S. fresh market tomatoes both in and outside of Florida, and for imported tomatoes.

Three new equations result from the above assumption. The first is as follows:

$$(2)\ \mathrm{USQ} = \mathrm{f}\,(\mathrm{rUSGP}, \mathrm{rINC}, \mathrm{rPromo}, \mathrm{Trend})$$

where USQ represents the annual U.S. per capita consumption of all fresh tomatoes, rUSGP represents the inflation adjusted U.S. average annual price for fresh tomatoes, rINC represents the same variable expressed in model (1), rPromo represents the inflation adjusted annual dollars spent to promote Florida tomatoes, and Trend represents the same variable defined in model (1).

The second model is

$$(3)\ \mathrm{FLQ} = \mathrm{f}\ (\mathrm{rFLP}, \mathrm{rINC}, \mathrm{rPromo}, \mathrm{Trend}, \mathrm{USIMP}),$$

where FLQ represents the annual U.S. per capita consumption of Florida fresh tomatoes (measured as total annual production in the marketing order area divided by the respective annual population), rFLP represents the inflation adjusted average annual grower price for tomatoes received by Florida producers. rINC rPromo and Trend represent the same variable expressed in model (1), and USIMP represents the per capita consumption of imported fresh market tomatoes in the U.S. The USIMP variable was added to the model in order to show the impact of imports on demand for Florida tomatoes. It was not included in model (2) because the USQ variable already contains imports as part of total U.S. fresh tomato consumption without regard for its source. The third model is

$$(4)\ \mathrm{USIMP} = \mathrm{f}\ (\mathrm{rUSGP}, \mathrm{rINC}, \mathrm{rPromo}, \mathrm{Trend})$$

where USIMP represents the annual per capita consumption of imported tomatoes and the other variables are as previously defined. These three models showed the impact of promotion on total U.S. tomato consumption, on U.S. consumption of Florida tomatoes and on U.S. consumption of imported tomatoes. The results provide estimates of the benefits from promotion on the consumption of Florida fresh tomatoes as well as the spillover effects received by U.S. producers outside of Florida and imported tomatoes.

It was also concluded that the trend variable found in the models could not be included in this analysis because trend and income are highly correlated. A correlation of rINC and Trend revealed a 0.989 correlation coefficient between the two variables, making it difficult to separate the effects of both variables in the same model. As a result, Trend is no longer considered as a separate variable in this analysis, but rather being considered as part of the rINC. Tables 6 and 7 show a correlation matrix for all variables included in this evaluation where trend values are the years 1972-2016.

As mentioned before, food safety has become increasingly more important in the estimation of demand models. As a result a new food safety variable was included in the estimation of both U.S. and Florida fresh tomato consumption by VanSickle and Einsohn (2012). The adjusted models used in that evaluation were specified as

$$(5)\ \mathrm{USQ} = \mathrm{f}\ (\mathrm{rUSGP}, \mathrm{rINC}, \mathrm{rPromo}, \mathrm{ILL})$$

$$(6)\ \mathrm{FLQ} = \mathrm{f}\ (\mathrm{rFLP}, \mathrm{rINC}, \mathrm{rPromo}, \mathrm{USIMP}, \mathrm{ILL})$$

$$(7)\ \mathrm{USIMP} = \mathrm{f}\ (\mathrm{rUSGP}, \mathrm{rINC}, \mathrm{rPromo}, \mathrm{ILL})$$

where ILL is the annual number of illnesses caused by salmonella outbreaks in the U.S. that have been tied to the consumption of tomatoes regardless of origin. The inclusion of this variable allows for the measurement of food safety's influence on both the total demand for U.S fresh tomatoes in model (5), the demand for Florida fresh tomatoes in model (6) and the U.S. demand for imported fresh tomatoes in model (7).

The data for the analysis were taken from various sources. Income, population, and Gross Domestic Product (GDP) data were collected from the Economic Research Service's (ERS) international trade briefing room[1], while U.S. tomato prices, per capita U.S. consumption, and U.S. imports were provided by the ERS Vegetable and Melon Yearbook (USDA, 2018). Florida tomato prices, Florida consumption, U.S. education and promotion expenditures, and Market Access Promotion expenditures were all collected from the Florida Tomato Committee's annual reports for seasons 1971/1972 to 2011/2016. All price data were adjusted for inflation by converting all values into 2010 dollars using the ERS reported GDP deflator. Florida consumption was calculated as total Florida production divided by U.S. population. All data used in the analysis are shown in their pre-adjusted forms in Tables 1 and 2.

3.2 Vector Auto-Regression: Scenario 2

We apply a vector auto-regression model to analyze what we call scenario 2, in which food safety index ILL is removed and dedicated to a local model which excludes variables USGP and USQ. In this scenario, we assume that a lag effect exists on the promotion expenditure that current quantity change is a function of past per capita income, past prices, past quantities and past promotion. Accordingly, the vector of variables of interest is

$$y_t \equiv \begin{bmatrix} \mathrm{rINC}_t \\ \mathrm{rPromo}_t \\ \mathrm{rFLP}_t \\ \mathrm{FLQ}_t \end{bmatrix}$$

A generic vector auto-regression has the following structure:

$$(8)\ y_t = A_1 y_{t-1} + \cdots + A_p y_{t-p} + u_t,$$

With A_i are (4×4) coefficient matrices and u_t is a 4-dimentional white noise process with $E(u_t) = \mathbf{0}$.

[1] http://www.ers.usda.gov/Data/Macroeconomics/

One vital characteristic for VAR model is its stability, which should generate time invariant means, variances and covariance structures. Thus, a Johansen test is conducted to test the stationarity and results are showed in Table 9, which proves that our data does not contain any cointegration at 10% level. We focus on the case of one lag (p=1), which we find is preferred by all four information criteria we use. Table 10 provides critical values for number of lags based on different information criteria (we set the maximum lag order to 5). It is important to note that we have excluded constant and trend in our scenarios.

Following scenario 1, our estimation for variables INC, Promo and FLP are all in log form, which assumes constant elasticities.

4 Estimation Results and Model Evaluations for Scenario 1

Equations (5), (6) and (7) were estimated using the double-log form with the ordinary least squares (OLS) method of regression. By using the double-log form of the model, the results show constant elasticities for each variable, i.e., the percentage change in demand caused by a one percent change in each of the explanatory variables. The results of the regressions are shown in Table 3. Standard linear forms of each model were also estimated but the results were found to be inconsistent. The results of the double-log models are mostly consistent with a priori expectations and describe most of the variation in the annual consumption of Florida and U.S. imported fresh tomatoes. The USQ model (equation 5) yielded an adjusted R^2 of .93 while the FLQ model (equation 6) yielded an adjusted R^2 of .78 and the USIMP model yielded an adjusted R^2 of .87. Most parameters, in all three models yield expected signs and most are all statistically significant at the 90% confidence level.

Food Safety: Parameter estimates for food safety (ILL) were negative in all models, indicating that higher numbers of illnesses per year resulted in lower consumption of U.S. and Florida tomatoes. The coefficient in the USQ model indicates that the food safety elasticity is -.0335, i.e., relatively inelastic where a change in the number of illnesses per year will result in relatively minor changes in the quantity of tomatoes consumed. The FLQ model coefficient for food safety is -0.124, indicating a slightly higher and more elastic degree of demand responsiveness to changes in the number of illnesses per year. The highest impact is seen on US Imported tomatoes with a coefficient of -0.1294. These results suggest that Florida experienced a significant portion of the U.S. decline in fresh market tomato consumption due to food safety issues in the U.S. tomato market. This may be due to the fact that Florida is the primary supplier of fresh market tomatoes to the U.S. during the winter months when their major competitor has been Mexico. Mexico has been identified with many of the food borne illnesses associated with tomatoes and our results suggest Florida may be suffering spillover impacts from that cause.

Imports: The estimate for U.S. imports (USIMP) in the Florida model also yielded negative results with a coefficient of -0.746, indicating a moderate to high level of elasticity with regard to demand for Florida tomatoes. A slight change in the number of U.S. imports will result in a relatively large change in the quantity of Florida tomatoes consumed. Some consumers will continue to consume Florida tomatoes either as a result of loyalty to Florida tomatoes or because there is another variable such as purchasing habits which lead to a lag in consumer response to change in suppliers.

Promotion & Income: Parameter estimates for promotion and income (rPromo and rINC) were positive and significant in both models. The coefficients for promotion were 0.027 in the FLQ model and .00263 in the USQ model, indicating inelasticity in both markets, however less elastic in the U.S. model. The coefficient for promotion in the U.S. imports model (USIMP) was -0.03217 indicating that increases in Florida expenditures on promotion were increasing the consumption of Florida tomatoes at the expense of imported tomatoes, i.e., Florida promotion and education was buying market share from imported tomatoes. The coefficients for income were exceptionally similar to one another at 0.7398 in the FLQ model and 0.7366 in the USQ model. Each also showed an extremely high level of statistical significance. The income coefficient for the USIMP model was higher at 2.76, indicating that most of the growth in US imports consumption has been driven by higher incomes in the U.S. These results suggest that income is a critical variable in determining consumption in all models. Effectively, a small change in consumer income will result in a relatively large change in U.S. tomato consumption in U.S. grown, Florida grown and imported tomatoes in the U.S. market.

Price: The price parameters for rUSGP and rFLP in the USQ and FLQ models, respectively, were negative but the elasticity for Florida grown tomatoes was relatively inelastic. The U.S. model stated that price had a negative but small effect on demand for U.S. tomatoes with a low level of statistical significance. Nevertheless, the FLQ model did follow a priori expectations with a negative and statistically significant effect on consumption with a price elasticity of -0.275. The coefficient for price in the imported tomatoes model was insignificant, indicating that imported tomatoes do not respond to price because of the perishable nature of fresh market tomatoes. This result may be due to the fact that foreign producers commit to the U.S. market when production decisions are made and have few alternatives for their product when it matures.

5 Results and Model Evaluations for Scenario 2

Table 11 shows the estimation for coefficient matrix A_1 of scenario 2, a log-formed vector auto-regression. By using this format, we can maintain constant elasticities for variables.

Our interest of this scenario is mostly on the third and fourth column of the coefficient matrix, according to an analysis of causality.

Promotion & Income: Parameter estimate for promotion on Florida tomato price is positive (0.025) and significant (P-value to be 0.003), while promotion has yielded a negative (0.008) but insignificant (P-value to be 0.138) effect on the per capita Florida tomato consumed. Additionally, based on the model, parameter estimates for income on both price and consumption are positive: the coefficient for income in rFLP equation is estimated to be 0.007, and similarly in FLQ equation to be 0.007 but both at an insignificant level (P-value being 0.645 for rFLP equation and 0.329 for FLQ equation).

6 Benefits from Education & Promotion Efforts

As mentioned previously, benefit/cost ratios can be used to determine the effectives of most investments including education and promotion programs. The average ratio (ABC) is calculated using the results of the OLS regression in the previous section. To accomplish this the rPromo coefficient is first used to calculate the precise change in per capita consumption resulting from a change in promotion expenditures and is calculated as

$$(8)\ \frac{\partial\ \text{Quantity}}{\partial\ \text{Promo}} = (\beta_{\text{Promo}}) * \frac{\text{Quantity}}{\text{Promo}}\ .$$

This value is calculated for each year that promotion expenditures are present and is used to further calculate marginal benefits for promotion (MB) as

$$(9)\ \ \text{MB} = \frac{\partial\ \text{Quantity}}{\partial\ \text{Promo}} * (\text{Pop}) * (\text{Price} - \text{Cost}) + \frac{\partial\ \text{Price}}{\partial\ \text{Promo}} * (\text{Pop}) * \text{Quantity}$$

Marginal Benefit[2] is equal to the change in gross margins resulting from the change in quantity consumed as a result of promotion. It is calculated as the change in per capita consumption (equation 8) multiplied by the corresponding year's population and gross margin (per pound price minus the per pound cost of production). In this analysis, cost was assumed to be $.30/LB for each year. Note that the numbers used to calculate should be deflated. This marginal benefit result is also known as the gross benefit realized from

[2] We previously assume that price of Florida tomato is uncorrelated with the promotion expenditure (VanSickle and Einsohn, 2012), as correlation coefficients obtained from the data, variable FLP corresponds to USGP. Interestingly, from results of scenario 2, we observe that price is significantly affected by the promotion expenditure (P-value to be 0.27%), while promotion only accounts for an insignificant decrease of per capita consumption (P-value to be 32.87%).

advertising and can be used to further calculate a benefit/cost ratio known as the marginal gross margin benefit/cost ratio (MGMBC). This gives the additional profit to producers gained after recouping the expense of that year's promotion activities. Tables 4, 5 and 6 show the marginal and average benefits to producers for years 2011-2016. Note that we do not have to differentiate nominal marginal benefit with deflated one, and so do other indexes.

The average gross benefit (AGB) from promotion was calculated as

$$(10)\mathrm{AGB} = \beta_{\mathrm{Promo}} * \frac{\mathrm{Promo}_t - \mathrm{Promo}_{t-1}}{\mathrm{Promo}_t} * \mathrm{Quantity}_t * \mathrm{Pop}_t * \mathrm{Price}_t,$$

while in scenario 2 where $\frac{\partial \mathrm{Price}}{\partial \mathrm{Promo}}$ is observable, the average gross benefit can be expressed as:

$$(11) AGB = (\widehat{a_{32}} + \widehat{a_{42}}) * \frac{\mathrm{Promo}_{t-1} - \mathrm{Promo}_{t-2}}{\mathrm{Promo}_{t-1}} * \mathrm{Quantity}_t * \mathrm{Pop}_t * \mathrm{Price}_t.$$

This value was calculated for each year in which promotion took place and was used to further calculate the average benefit/cost ratio (ABC):

$$(12)\ \mathrm{ABC} = \frac{\mathrm{AGB}}{\mathrm{Promo}}.$$

The results of Florida's average benefit/cost analysis for years 2011-2016 show a range of -$28.39 to $4.78, averaging -$6.77 for scenario 1, and ranging from -$6.94 to $4.86, averaging -$1.08 for scenario 2. Florida's marginal benefits to gross margin ranged from $7.79 to $27.57 for scenario 1, averaging $16.3 while ranging from $7.04 to $16.83 for scenario 2. On average, the six years from 2011 to 2016 show that every dollar spent on promotion of Florida tomatoes yielded just above a negative return after breaking even, i.e., $1.00 spent on promotion created an average of -$6.77 in additional loss to the growers based on scenario 1, or an average loss of -$1.08 for scenario 2. It's important to note that the marginal benefit for both scenarios is relatively high compared with the average benefit/cost ratio, and it can be explained by the constant decrease of education & promotion expenditure since this decrease has eliminated a great proportion of expenditure that can be potentially profitable.

The results for the B/C analysis for U.S. grown tomatoes suggests the returns are slightly lower with an average B/C of -$5.04 for scenario 1 and -$4.20 for scenario 2. However, because scenario 2 has included potential loss from both price and quantity decrease, having a higher estimated average loss is reasonable. These results suggest that the promotion ended up having -$5.04 in additional loss for all U.S. growers for each dollar spent on promotion by Florida growers if calculation is based on scenario 1, and -$4.20 for scenario 2 on average from 2011-2016, i.e. The imported tomatoes equation (USIMP) indicates that promotion dollars are allowing U.S. producers to take market share from imported tomatoes given the negative sign on promotion in that equation (-0.03217). As Florida growers increase their expenditures on promotion foreign producers lose market share in the U.S. market. The estimated average marginal benefit suggests that imported tomatoes lose -$80.14 in value for every additional dollar spent on promotion by Florida growers.

The results from both scenario 1 and 2 can be used to forecast the marginal benefit and average benefit/cost ratio for the coming year, but remember that for the historical estimation of marginal benefit and average B/C ratio, two scenario shows only few differences. Table 12 shows estimated marginal benefit and average benefit/cost ratio of scenario 1 and 2.

7 Conclusion

This study provides an evaluation of the returns on investment from education and promotion expenditures in the Florida tomato market. The study used an econometric model originally created for other commodities which was designed to evaluate the effectiveness of education and promotion expenditures by the Florida Tomato Committee. That model has been modified to represent the U.S. tomato market. The results show that education and promotion expenditures have resulted in increases in demand for tomatoes. Average sales revenue to Florida growers increased by $7.52 for each dollar spent on these programs during years 2011-2016. Accordingly, it appears the promotion and education program has added value to producers of Florida fresh market tomatoes. It is noteworthy that other U.S. producers also gain from this program with spillover effects increasing the value of all U.S. grown tomatoes by $0.69 for each dollar spent on promotion by Florida growers. These increases in returns come from an increase in overall demand generated by promotion spending and from market share taken from imported tomatoes.

These results are conclusive that current education and promotion activities do yield positive returns to the Florida tomato industry. Producers in Florida realize significant benefits from dollars spent on promotion efforts and other U.S. producers' benefit from spillover effects they get from Florida promotional activities. The results suggest that much of those benefits come from shifting demand away from imported tomatoes to U.S. grown tomatoes.

BIBLIOGRAPHY

Alston, J.M., H.F. Carman, J.A. Chalfant, J.M. Crespi, R.J. Sexton, and R.J Venner. The California Prune Board's Promotion Program: An Evaluation. Giannini Foundation Research Report no. 344, March 1998.

Alston, J.M., J.A. Chalfant, J.E. Christian, E. Meng, and N.E. Piggot. The California Table Grape-Commission's Promotion Program: An Evaluation. Giannini Foundation Monograph no. 43, November 1997.

B.C. French and C.F. Nuckton, (1991): "An Empirical Analysis of Economic Performance under the Marketing Order for Raisins", American Journal of Agricultural Economics, Vol. 73, No. 3: 581-593. Available at http://www.jstor.org/stable/1242811

Carman, H.F., and R.K. Craft. "An Economic Evaluation of California's Avocado Industry Marketing Programs, 1961-1995." Department of Agricultural and Resource Economics, University of California, Davis, February 4, 1997.

Center of Disease Control National Outbreak Reporting System (NORS). all years, all states, tomato, salmonella. Available at https://wwwn.cdc.gov/norsdashboard/ Accessed 6/30/2018.

Center of Disease Control Outbreak Net Surveillance Data: Historical Data (1990-1997). Available at http://www.cdc.gov/outbreaknet/surveillance_data.html

Crespi, J.M., (2003): "Generic Advertising Controversy: How Did We Get Here and Where Are We Going?" Review of Agricultural Economics, Vol. 25, No.2: 294–315. Available at http://aepp.oxfordjournals.org.lp.hscl.ufl.edu/content/25/2/294.full.pdf+html

Crespi, J.M, and R.J. Sexton. "The Almond Board at California's Promotion Program: An Evaluation." Unpublished manuscript. Department of Agricultural Economics University of California, Davis, 1999.

Davis, G.C., O. Capps Jr., D.A. Bessler, J.H. Leigh, J.P. Nichols and E. Goddard (2000): An Economic Evaluation of the Pork Checkoff Program, College Station Texas, A&M University.

Ding L. and H.W. Kinnucan (1996): Market Allocation Rules for Non-Price Promotion with Farm Programs: US Cotton, Journal of Agricultural and Resource Economics, 21, 351:367.

Florida Tomato Committee. "Annual Report." Annual Issues, 1972-2010.

Goddard, E.W. and A.K. Amuah. “Demand for Canadian Fats and Oils: A Case Study of Advertising Effectiveness.” American Journal of Agricultural Economics. 71 (1989) : 741-749.

Hausman, C., Auffhammer, M., & Berck, P. (2012). Farm acreage shocks and crop prices: an SVAR approach to understanding the impacts of biofuels. Environmental and Resource Economics, 53(1), 117-136.

Johansen, S. (1988). Statistical analysis of cointegration vectors. Journal of economic dynamics and control, 12(2-3), 231-254.

Kaiser, H.M., D.J., Liu, T. Consignado (2003): An Economic Analysis of California Rasin Export Promotion, Agribusiness, Vol. 19(2), 189-201.

Kaiser, H.M., and C. Chung (2002): Impact of Generic Milk Advertising on New York State Markets, 1986-2000, Dept. of Applied Economics and Management, College of Agriculture and Life Sciences, Cornell University.

Kinnucan H.W. and Y. Zheng (2001): National Cost Benefit Estimates for Dairy, Beef , Pork and Cotton Promotion Programs.

Murray, B.C., R.C. Beach, W.J. White, C. Viator, N., Piggott, and M. Wohlgenant (2001): An Economic Analysis of Cotton Research and Promotion Programs, Research Triangle Park, NC.

Pfaff, B. (2008). VAR, SVAR and SVEC models: Implementation within R package vars. Journal of Statistical Software, 27(4), 1-32.

Piggot, N.E. (1997): The Benefit and Costs of Generic Advertising of Agricultural Commodities, PhD Dissertation, University of California, Davis.

U.S. Dept. Agr. (USDA), Economic Research Service (2011): “International Macroeconomic Data Set.” Available online at http://www.ers.usda.gov/Data/Macroeconomics/

U.S. Dept Agr. (USDA). (2010): “Vegetables and Specialties Situation and Outlook Yearbook.” VGS-2016. Economic Research Service, USDA.

VanSickle, J.J., and S. Einsohn. (2012): “The Florida Tomato Committee’s Education & Promotion Program 2006-2011.” Food & Resource Economics Dept., University of Florida.

VanSickle, J.J, and E. Evans. (2001): “The Florida Tomato Committee’s Education and Promotion Program: An Evaluation” Food & Resource Economics Dept., University of Florida.

VanSickle, J.J., and R. Ranjan, (2006): “The Florida Tomato Committee’s Education and Promotion Program 2001-2005: An Evaluation” Food & Resource Economics Dept., University of Florida.

Ward, R.W., and O.D. Forker. “Washington Apple Advertising” An Economic Model of Its Impact.” Washington Apple Comission, WAC 91:1, University of Florida, Gainesville, 1991.

Weiss, K.R., R.D. Green, and A.M. Havenner. “Walnuts in Japan: A Case Study of Generic Promotion Under the USDA’s Market Promotion Program.” In Agricultural Commodity Promotion Policies and Programs in the Global Agri-Food System, Proceedings of NEC63 Conference, NICPRE. Cornell University, May 1996: 47-80.

Ward R.W. (1996): Beef Checkoff Impact on US Beef Demand, UF NCA 1996 No.1.

Ward, R.W. (2001): Beef Demand and Its Response to the Beef Checkoff, NCA 2001, No.1.

Williams, G.W. “Returns to U.S. Soybean Export Market Development.” Agribusiness 1 (1985): 243-261.

Table 1. Data set for regression analysis of FLQ, USQ, FLP and USGP equations

YEAR	FLQ	FLP	USQ	USGP	IMP	Promo	ILL	INC
1972	2.9	0.15	12.1	0.148	2.79	0	-	24,747
1973	3.0	0.16	12.5	0.16	3.55	0	-	25,897
1974	3.0	0.18	11.8	0.173	2.78	0	-	25,523
1975	3.4	0.19	12	0.187	2.62	0	-	25,236
1976	3.6	0.18	12.6	0.191	2.99	0	-	26,352
1977	2.9	0.22	12.4	0.206	3.59	0	-	27,315
1978	3.3	0.22	12.9	0.197	3.66	0	-	28,447
1979	4.0	0.22	12.4	0.225	3.17	0	-	29,089
1980	4.5	0.22	12.8	0.207	2.85	0	-	28,734
1981	4.4	0.23	12.3	0.214	2.28	0	-	29,192
1982	4.8	0.23	12.9	0.225	2.55	0	-	28,362
1983	4.9	0.30	16.5	0.242	3.15	0	-	29,406
1984	4.8	0.27	14.2	0.256	3.49	622,000	-	31,268
1985	5.5	0.24	14.9	0.242	3.57	627,000	-	32,306
1986	5.4	0.31	15.8	0.251	4.07	311,000	-	33,133
1987	5.8	0.29	15.8	0.259	3.78	353,627	-	33,975
1988	6.6	0.29	16.8	0.271	3.33	389,717	-	35,083
1989	6.6	0.37	16.8	0.332	3.51	739,331	-	36,033
1990	5.3	0.29	15.5	0.274	3.18	1,089,444	102	36,231
1991	5.5	0.37	15.4	0.317	3.14	1,329,151	600	35,726
1992	7.0	0.36	15.4	0.358	1.68	1,630,623	34	36,508
1993	6.0	0.36	16.3	0.317	3.54	1,996,700	143	37,026
1994	5.6	0.29	16.2	0.274	3.31	2,004,043	339	38,057
1995	5.2	0.28	16.8	0.255	5.12	1,379,214	36	38,632
1996	4.4	0.31	17.4	0.281	6.01	1,222,985	48	39,634
1997	4.4	0.32	17.3	0.317	5.99	461,353	34	40,920
1998	4.3	0.36	18.5	0.352	6.76	544,778	86	41,133
1999	5.1	0.30	19.1	0.258	5.85	749,976	0	41,826
2000	5.1	0.28	19	0.307	5.70	649,178	86	42,518
2001	4.7	0.37	19.2	0.30	6.37	520,807	0	45,007
2002	4.7	0.31	20.3	0.316	6.57	391,394	679	45,376
2003	4.4	0.38	19.4	0.375	7.11	497,938	61	46,221
2004	4.9	0.32	20	0.374	7.01	515,111	566	47,540
2005	4.5	0.50	20.2	0.416	7.08	584,115	277	48,677
2006	4.0	0.41	19.8	0.437	7.31	693,242	349	49,502
2007	4.3	0.31	19.2	0.348	7.81	894,723	149	49,902
2008	3.7	0.55	18.5	0.453	8.06	839,392	1538	49,291
2009	3.8	0.33	19.6	0.44	8.54	1,039,540	21	47,503

2010	2.3	0.58	20.6	0.482	10.89	804,464	118	48,303
2011	2.9	0.48	21	0.361	10.53	682,776	190	48,713
2012	3.0	0.27	20.8	0.305	10.75	647,168	102	49,437
2013	2.8	0.43	20.2	0.448	10.69	664,255	181	49,919
2014	2.8	0.39	20.6	0.415	10.77	416,723	0	50,731
2015	2.8	0.46	20.5	0.463	10.80	553,729	194	51,677
2016	2.2	0.43	20.4	0.425	12.19	295,429	10	52,152

Table 2: Variable definitions and sources

Variables: Definition
- Source

FLQ: Annual per capita consumption of Florida tomatoes

- Calculated as total annual production by Florida Tomato Committee annual reports (1972-2017) divided by U.S. Population reported by Economic Research Service's International Macroeconomic Data Set (2017).

USQ: Annual per capita consumption of US fresh tomatoes

- Economic Research Service Vegetables and Specialties Situation and Outlook Yearbook (USDA, 2017).

USIMP: Annual per capita consumption of imported tomatoes

- Calculated as total annual imports of tomatoes reported by Economic Research Service Vegetables and Specialties Situation and Outlook Yearbook (USDA, 2017) divided by U.S. Population

Promo: Education and promotion expenditures by the Florida Tomato Committee

- Florida Tomato Committee annual reports (1972-2017)

GDP Deflator: Base year 2010

- Economic Research Service International Macroeconomic Data Set (USDA, 2018)

rINC: Per capita Gross Domestic Product for the U.S., expressed in 2010 dollars

- Economic Research Service International Macroeconomic Data Set (USDA, 2018)

USGP: Average per pound price of U.S. tomatoes in dollars/pound

- Economic Research Service Vegetables and Specialties Situation and Outlook Yearbook (USDA, 2018).

FLP: Average per pound price of Florida tomatoes in dollars/pound

- Calculated as Florida cents per pound by the Florida Tomato Committee annual reports (1972-2017), divided by GDP deflator, multiplied by 100

ILL: Annual number of salmonella illnesses in the U.S. related to tomato consumption

- Center of Disease Control Outbreak Net Surveillance Data: Historical Data (1990-2016) and CDC Food Outbreak Online Database (all year, all state, all location, salmonella)

Table 3. OLS estimates for parameters in the U.S. (USQ and USGP) and Florida (FLQ and FLP) tomato consumption promotion equations for scenario 1.

Equation/ variable	FLQ	USQ	USIMP
Intercept	-5.605	-5.025	-27.17
	(-1.80)*	(-8.01)***	(-9.54)***
rPromo	0.02768	0.00263	-0.03217
	(4.39)***	(1.27)	(-3.42)***
USIMP	-0.746	-------	------
	(-7.78)***	-------	------
rINC	0.7398	0.7366	2.768
	(2.34)**	(11.73)***	(9.72)***
ILL	-0.124	-0.0335	-0.1297
	(-2.01)*	(-1.51)	(-1.28)
rFLP/	-0.275		
rUSGP		-0.0728	0.02456
	(-2.13)**	(-1.18)	(0.09)
Adj. R^2	0.783	0.935	0.924

Note: The OLS regression was run in the log-log or “double log” form to yield elasticities for each variable. The first value for each variable shows the percentage change in quantity/price that results from a 1 percent increase in the value of that specific variable. The second value in parenthesis is the t-statistic for that parameter. The * following the t-statistic indicated level of significance for the factor - * =90%, **= 95% and *** =99% levels of confidence.

Table 4. Eigenvectors (normalized to first column) for Johansen test

Cointergration relations[1]	rINC	rPromo	rFLP	FLQ
rINC	1.0000	1.0000	1.0000	1.0000
rPromo	0.0235	-0.0441	-0.0145	-0.0254
rFLP	-1.4612	-0.2089	-0.2169	0.0332
FLQ	-0.0372	0.4925	0.3091	-1.2352

[1]Cointegration relation tells us whether the data contains a stationary linear combination of nonstationary random variables, while such variables behave individually as non-stationary random walks that give us little information about relationships within the model we are interested in.

Table 5. Critical values for the four information criteria (scenario 2)[1]

Selection					
AIC(n)	HQ(n)	SC(n)	FPE(n)		
1	1	1	1		
Criteria (lag)					
	1	2	3	4	5
AIC(n)	-1.36E+01	-1.34E+01	-1.30E+01	-1.27E+01	-1.28E+01
HQ(n)	-1.34E+01	-1.29E+01	-1.22E+01	-1.18E+01	-1.16E+01
SC(n)	-1.29E+01	-1.20E+01	-1.09E+01	-1.00E+01	-9.37E+00
FPE(n)	1.22E-06	1.62E-06	2.53E-06	3.63E-06	4.32E-06

[1]AIC, HQ, SC and FPE refer to Akaike information criterion, Hannan–Quinn information criterion, Bayesian information criterion and Akaike's Final Prediction Error Criterion.

Table 6. Estimation of coefficient matrix A_1(for scenario 2, lag order=1).

-	Estimate	Test statistic	p value
a_{11}	1.000	613.634	<2e-16
a_{12}	0.000	0.063	0.950
a_{13}	(0.014)	(0.824)	0.415
a_{14}	0.012	0.982	0.332
a_{21}	(0.165)	(1.055)	0.298
a_{22}	0.723	9.367	0.000
a_{23}	4.466	2.837	0.007
a_{24}	2.896	2.381	0.022
a_{31}	0.007	0.464	0.645
a_{32}	0.025	3.195	0.003
a_{33}	0.266	1.678	0.101
a_{34}	(0.121)	(0.989)	0.329
a_{41}	0.008	0.696	0.491
a_{42}	(0.008)	(1.512)	0.138
a_{43}	0.099	0.905	0.371
a_{44}	0.988	11.714	0.000

Table 7. Correlations between FLQ variables

	Intercept	*rPromo*	*USIMP*	*rINC*	*iLL*	*rFLP*
Intercept	1					
rPromo	0.6616	1				
USIMP	0.8349	0.4918	1			
rINC	-0.9996	-0.6602	-0.8414	1		
iLL	0.4122	-0.0426	0.1993	-0.4054	1	
rFLP	-0.2	0.0667	-0.0164	0.2172	-0.0067	1

Table 8. Correlations between USQ variables

	Intercept	*rPromo*	*rINC*	*iLL*	*rUSGP*
Intercept	1				
rPromo	0.2458	1			
rINC	-0.9565	-0.4158	1		
iLL	0.4593	-0.1985	-0.4972	1	
rUSGP	-0.6518	0.2812	0.4027	-0.1489	1

Note: As mentioned in the evaluation, trend and income show a correlation of .989. Trend is therefore captured in the income variable and need not be considered in this evaluation.

Table 9. Estimated average and marginal benefits to Florida producers from Education and Promotion programs[1]

	dQ/dA		AVG(B/C)		Marginal Benefits	
Year	Scenario1	Scenario2	Scenario1	Scenario2	Scenario1	Scenario2
2011	2.89E-08	-7.18E-09	($3.11)	($3.09)	$14.75	$9.64
2012	3.21E-08	-8.89E-09	($0.59)	($1.17)	$7.79	$7.04
2013	2.88E-08	-8.64E-09	$0.41	($0.52)	$13.01	$10.60
2014	4.58E-08	-8.40E-09	($13.73)	$0.36	$18.73	$9.58
2015	3.51E-08	-1.36E-08	$4.78	($6.94)	$15.93	$16.83
2016	5.05E-08	-7.88E-09	($28.39)	$4.86	$27.57	$11.24
2011-2016	3.69E-08	-9.10E-09	($6.77)	($1.08)	$16.30	$10.82

[1]Calculated based on results from scenario1 and scenario2.

Table 10. Estimated average and marginal benefits to U.S. tomato producers from Education and Promotion programs[1]

	dQ/dA		AVG(B/C)		Marginal Benefits	
Year	Scenario1	Scenario2	Scenario1	Scenario2	Scenario1	Scenario2
2011	2.00E-08	1.94E-08	($1.62)	($4.70)	$7.24	$14.26
2012	2.09E-08	2.27E-08	($0.45)	($2.84)	$6.13	$13.82
2013	1.97E-08	2.32E-08	$0.29	($1.33)	$9.48	$22.03
2014	3.21E-08	2.31E-08	($10.22)	$0.58	$14.14	$20.24
2015	2.40E-08	3.66E-08	$3.58	($23.75)	$12.16	$36.46
2016	4.48E-08	2.74E-08	($21.80)	$6.84	$20.59	$25.00
2011-2016	2.69E-08	2.54E-08	($5.04)	($4.20)	$11.62	$21.97

[1]Results for scenario2 are calculated using the same method as described in Florida tomato model. Full results are available upon request.

Table 11. Estimated average and marginal benefits to importing tomato producers from Education and Promotion programs[1]

Year	dQ/dA	AVG(B/C)	Marginal Benefits
2011	-1.23E-07	$9.96	($62.78)
2012	-1.32E-07	$2.82	($47.88)
2013	-1.28E-07	($1.89)	($37.55)
2014	-2.05E-07	$65.38	($98.57)
2015	-1.55E-07	($23.08)	($68.28)
2016	-3.28E-07	$159.36	($165.77)
2011-2016	-1.78E-07	$35.42	($80.14)

[1]This estimation only applies to scenario1.