Financial Benefits of Florida Generic Orange Juice Marketing

Arthur M. Thomas and Neil Canter

The benefits to Florida orange growers of generic orange juice advertising are assessed using additive, nonlinear, regional econometric models, measuring the impact of category and brand marketing efforts on category demand while controlling for pricing and various other factors. The study shows that generic marketing efforts increased orange juice category demand by 8.3 percent, resulting in increased orange prices and a benefit-to-cost ratio to Florida growers of 3.5 to 1. Branded promotional activity was found to primarily fuel brand switching and pantry-loading, with only modest impacts on overall category demand.

Key Words: marketing mix, marketing spend optimization, checkoff program, orange juice, benefit to cost ratio

The Florida Department of Citrus (FDOC) is a state government agency charged with the marketing, research, and regulation of the Florida citrus industry. The FDOC's mission is to help grow the demand for Florida citrus products and thus provide a direct benefit to Florida citrus growers. The department's activities are funded by a tax paid by citrus growers on each box of citrus that moves through commercial channels. Over 80 percent of the FDOC's annual budget is spent on advertising and promotional activities for Florida citrus in the United States, Canada, Europe, and Asia.

The department has a fiduciary responsibility and a practical need to measure the benefits of its marketing programs to Florida citrus growers and Florida's general economy, and the department has a long history of analytic efforts to provide such measurements. Early studies included work by Ward and Myers (1979), Ward and Davis (1978), Ward and Tilley (1980), and Lee and Brown (1985). Although comprehensive for the time, these studies did not benefit from the advent of weekly point-of-sale (POS) tracking data and the gradual transition from store sample data to store census data in the retail tracking industry over the last 20 years. These studies have also lost relevance as dramatic changes have taken place in the orange juice and general drink categories, including the sales decline of frozen orange juice concentrate (which dropped from 29.5 percent of category sales in 1988-2002 to 8 percent in 2007); the rise of premium, not-from-concentrate, ready-to-serve products; and the introduction of new drink categories such as bottled waters, flavored waters, and sport drinks.

More recently, the FDOC commissioned two studies from Forecast and Business Analytics, LLC (Capps, Bessler, and Williams 2004a, 2004b). The first of these utilized a forty-equation simulation model, the demand equation of which was estimated using econometric analysis of 33 years of annual demand and marketing data from 1967/68 through 1999/2000. The second utilized an econometric analysis of 165 monthly observations of retail sales in supermarkets and mass merchandiser stores with sales in excess of $2 million per year, collected by the A.C. Nielsen Company from January 1988 to September 2002. These studies indicated a quantifiable impact of FDOC market-

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ing efforts on orange juice demand but were limited by the granularity of annual and monthly input data.

In 2007, after a competitive review, the FDOC commissioned Marketing Accountability Partnership (MAP), a subsidiary of the Mediabrands unit of the Interpublic Group of Companies, to perform econometric analysis using more granular weekly data; the objective was to obtain a more nuanced view of the impact of FDOC marketing and to determine the level and allocation of FDOC marketing spend that maximizes benefit to Florida growers. MAP approached the engagement using modeling techniques that have been developed in the consumer packaged goods industry over the past two decades and employed proprietary estimation and optimization tools. This paper describes the MAP study, including details on the FDOC's programs, the data used, the modeling techniques employed, the approach to translating demand increases to grower benefit, the process of optimization, and the results obtained.

FDOC Marketing Programs

Since the mid-1980s, the FDOC's strategy for generic orange juice advertising has evolved based on market conditions. From 1985 through 1993, low crop yields led to a focus on juice that simply met Florida grower quality standards instead of being 100 percent Florida juice. A lack of funds necessitated a shift away from high-priced media to relatively inexpensive public relations, contests, and in-school promotions. From 1993 through 2005, more robust annual yields allowed FDOC advertising to promote juice that was 100 percent from Florida, using more costly media (notably television) at levels higher than ever before. The message shifted from general nutrition to the health and disease-fighting aspects of orange juice, a trend that has continued through the present day.

The period modeled by MAP in the present analysis covers 134 weeks ending in March 2008. During the modeled period, advertising messages emphasized health and nutrition, and cold and flu resistance. Commercials also became more competitive, comparing the chemical composition of new sports and energy drinks to the natural ingredients in orange juice. The tagline "Florida Orange Juice: Healthy. Pure and Simple" emphasized the health message and drove home the point that orange juice was as convenient as new drink alternatives without the chemical additives.

The FDOC's orange juice marketing program used television and online advertising supplemented with public relations during the modeling period. The FDOC message was delivered using a mix of broad-based television ads and online ads chosen to capture the attention of consumers most likely to be receptive to the health message. The objective of this integrated strategy was to move orange juice from a breakfast-only product to one with health benefits to enjoy all day.

Public relations programs carried messages of immunity and health and wellness. Public relations campaigns included coverage on TV, radio, and online, along with in-store activity and mentions in magazines, trade publications, and national and local newspapers. Public relations activity was higher during the winter cold and flu seasons but also took place during the lower consumption seasons to serve as a reminder to health-conscious consumers.

FDOC marketing expenditures totaled $14.0 million during the 52 weeks ending March 2007 and $16.2 million for the 52 weeks ending March 2008. About three quarters of this spending was on television advertising, with the remaining expenditures on online advertising and public relations.

Brand-Specific Marketing Programs

Orange juice is a commodity category with certain attributes that are common to all brands (e.g., taste, health benefits, and convenience). Each brand within the category strives to set itself apart from competitors with unique attributes such as distinct taste and an array of forms or mixes (e.g., pulp vs. no pulp, concentrate vs. not from concentrate). Each brand within the category implements its own media and trade promotion plan to communicate brand-specific advantages and drive increased sales and market share.

Previous FDOC studies (most notably Capps, Bessler, and Williams 2004a) found that media efforts by brands did not increase total category sales. Instead, they found that brand-specific advertising simply encouraged the buying of one brand at the expense of another, a behavior known as brand-switching.

Over the modeled period, the Tropicana, Minute Maid, and Florida's Natural brands comprised approximately 65 percent of U.S. orange juice sales. Each brand pursued a different approach to television advertising. Minute Maid aired ads from March through September only, Florida's Natural aired ads at consistent levels during the entire year, and Tropicana aired television ads in selected markets during most of the model period before going national during the first quarter of 2008.

Non-Marketing Drivers

In addition to FDOC and branded marketing programs, several non-marketing drivers are believed to affect orange juice demand and were considered in this study. These include seasonality, weather and precipitation, flu incidence, macroeconomic factors such as the Consumer Price Index (CPI) and disposable income, and cross-price elasticity effects of other beverage categories.

Data Overview

Volumetric data were provided on a weekly basis by the A.C. Nielsen Company from point-of-sale (POS) checkout scanners in sample stores that project to the universe of food, drug, and mass merchandiser retail stores (except Walmart) with more than $2 million in annual sales. Walmart does not release POS scanner data to Nielsen or other data companies; however, Walmart data were available on a monthly basis through Nielsen's in-home electronic household panel, in which tens of thousands of consumers scan all their retail purchases at home using Nielsen-provided handheld scanning equipment. Monthly Walmart data were converted to a weekly basis using an assumption of flat daily sales within a month and were added to the Nielsen weekly POS scanner data to derive the dependent variable of total orange juice single-strength equivalent (SSE) gallons sold at retail. The use of SSE gallons allows ready-to-serve orange juice and frozen concentrate orange juice to be combined on a consistent basis. Total Nielsen-measured retail sales (POS and Walmart) accounted for 51 percent of total U.S. orange juice consumption for the 52 weeks ending March 2008.

Combining weekly POS scanner data for food, drug, and mass merchandiser stores (excluding Walmart) with monthly household panel data for Walmart is not ideal from a data quality perspective, but it was deemed necessary in order to have adequate coverage of retail sales. Walmart accounted for 17 percent of U.S. retail refrigerated orange juice sales in the 52 weeks ending March 2008, which was judged too great a proportion of sales to omit. To validate the panel data, a sample of Walmart's Retail Link POS sales data was obtained by the FDOC. The sample data matched Nielsen's Homescan household panel sales for Walmart within 8 percent during the period for which both were available, lending additional confidence in the quality of the data that were modeled.

The models use purchase as a proxy for consumption. This is an acceptable assumption because orange juice is perishable and cannot be inventoried within consumer households (known as "pantry-loading") to any significant extent. Frozen concentrate orange juice can be more easily inventoried, but limited freezer space in most households and the declining proportion of sales for this form of orange juice (8 percent of total SSE gallons for the 52 weeks ending March 2008) per Nielsen make this a minor issue.

Advertising weight and cost data for both generic and branded advertising were obtained through Competitive Media Reporting, a syndicated data service, and through The Richards Group, the FDOC's principal advertising agency. The data covered television advertising and online advertising. Online advertising included banner ads displayed on select web sites; video ads appearing prior to online video (e.g., CNN news clips); and clicks on ads displayed as a result of entering particular words into online search engines. Exposure to television and banner ads was measured in gross rating points (GRPs), calculated as the percentage of viewers reached in a market multiplied by the average number of times each viewer is exposed. For example, an ad that reaches 50 percent of the viewing audience fives times during one week delivers 250 GRPs for that week. All television campaigns were national and therefore delivered approximately the same number of GRPs in each region.

Delivery of video ads and ads displayed as a result of entering selected search words was measured in click-throughs. Viewers had the opportunity

to click on ads to access further orange juice information. Click-throughs do not measure total exposure because they do not capture exposures of people who viewed ads and videos but did not click on them. Nonetheless, they were used as a proxy for total viewership under the assumption that the trends would follow similar patterns.

Public relations data were supplied by the FDOC's public relations agency, GolinHarris, and included GRP streams for public relations exposure in television, magazines, newspapers, and online mediums. Public relations activity consisted of several campaigns highlighting the health and weight loss benefits of orange juice. Campaign themes included "Drink to Your Health" and "Breakfast Habit," whose goal was creating an automatic association between everyday activities and the health benefits of orange juice among consumers. Public relations media impressions occurred in some of the same mediums as generic and branded advertising, but public relations messaging differed significantly in content and context from traditional media advertising and was modeled separately.

An important orange juice marketing driver is the extensive in-store trade promotion activity conducted by individual orange juice brands. Trade promotions are defined as retailer feature ads, in-store displays, and/or temporary price reductions. The most common measure of trade promotion pressure used in the consumer packaged goods industry is the percentage of market all-commodity dollar volume (ACV) moving through stores with a trade promotion. This is equivalent to the percentage of stores promoting, with each store weighted by its overall annual dollar sales level. Percent ACV promoting is a useful metric for capturing brand-level promotions, but it becomes less useful at the category level (i.e., for total orange juice) because in any given week, at least one brand or form is usually promoted in every store, which results in percent ACV promoting for the category being near 100 percent every week. An alternative metric for measuring category-level promotion activity is the total percent of volume sold on promotion. This avoids the metric being 100 percent every week because not every size and type of every brand is promoted, but it confounds cause and effect because the volume of promoted products is normally higher during promoted weeks than during non-promoted weeks.

This problem was solved through the use of a Nielsen-calculated measure called "baseline volume." Baseline volume is an estimate of what sales would be in the absence of any trade promotion, derived by Nielsen using an ARIMA(0,1,1) process on non-promoted store-level sales for each product with a unique universal product bar code, or UPC. Baseline volume is typically compared to total volume in a given week to derive an estimate of promotional volume lift. MAP used category baseline volume in promoting store-weeks as a percentage of total category baseline volume as the independent variable for promotion. This metric reflects depth of promotion (i.e., the number of products promoted in a given week) in a way that percent of ACV cannot, and it removes promotion lift as a source of bias in the independent variable in a way that percent of total volume on promotion cannot.

Pricing was captured as base price per SSE gallon. Base price is calculated by Nielsen as total weekly baseline dollars divided by total weekly baseline volume and can be interpreted as the "regular price" of a product when not on promotion. In contrast, the overall average price per SSE gallon includes promotional discounts in the calculation. The models used base price per SSE gallon instead of total price per SSE gallon to avoid over-specifying promotional effects.

In addition to orange juice pricing and promotion, Nielsen collected pricing and promotion for other beverage categories, including other juices and water. These variables were considered in the model specification and estimation process as discussed below, but they were not found to be statistically significant.

The health benefit of orange juice during the cold and flu season creates a distinct seasonality for the product. Variables considered in order to capture seasonality included average temperature, precipitation, and snowfall as measured by the National Oceanic and Atmospheric Association, and weekly flu incidence as reported by the U.S. Centers for Disease Control. In addition, a holiday variable was included to account for increased consumption in excess of the normal seasonal pattern during the weeks of Christmas and New Year's.

Consumption of orange juice was expected to vary with economic conditions, so macroeconomic variables were gathered to account for the indirect

demand effects of changes in disposable income as a percentage of total income. Several regional variables were tested, including average weekly gas prices collected by the U.S. Energy Information Administration and several monthly CPI measures collected by the U.S. Bureau of Labor Statistics.

Modeling Framework

The goals of the analysis were to: (1) determine the incremental orange juice demand generated by each component of FDOC marketing, and (2) determine the FDOC marketing budget level and allocation that maximizes benefits to Florida growers. Incremental orange juice demand is defined as sales that would not have occurred in the absence of a given marketing component. The first goal, decomposition, requires an additive model functional form. Distinct model terms were used for each marketing component to enable volume contributions and related productivity measures to be calculated for each type of FDOC marketing expenditure, with explicit interaction variables used as needed. The second goal, optimization, requires a nonlinear form that incorporates diminishing returns, since optimization can only be conducted on the basis of marginal returns relative to marginal costs.

The result is a model of the form

$$(1) \quad v_w = \beta_0 + \sum_{i \in Incr} \beta_i g_i(x_{iw}) + \sum_{j \in Base} \beta_j g_j(x_{jw})$$

where weekly volume v_w is explained by a constant β_0 and a linear combination of transformed marketing and non-marketing independent variables $g_i(x_{iw})$ and $g_j(x_{jw})$. Independent variables are classified as either "base" or "incremental." Incremental variables are marketing variables for which x_{iw} would be equal to zero in the absence of marketing spend. All other variables are classified as base variables. Note that "base" variables may be either marketing variables (e.g., price) or non-marketing variables (e.g., flu index). The key distinction is that incremental variables can be directly associated with marketing spend. Incremental variables include generic and branded advertising of all types, in-store trade promotion, and public relations. Base variables include pricing, seasonality, flu index, macroeconomic variables, and all other variables that are not classified as incremental.

The transformations g_i and g_j are specific to each independent variable x_i and x_j. They create the diminishing returns necessary for optimization and also can be used to capture the impact of variables whose effects have a variable time element. For example, every GRP aired has a carry-over effect, reflecting the tendency for a message to remain in the minds of consumers for a period of time following the airing of an ad and the effect of product purchase cycle on the link between ad exposure and purchase. The duration of this effect is quantified as a half-life, defined as the number of weeks until an ad's volume impact decays to half of its impact during the week it aired.

The media transformation used, known as "adstock," captures this carry-over effect as well as diminishing returns. Diminishing returns occur both within weeks (i.e., twice the weekly GRPs are expected to produce less than twice as much incremental volume due to advertising) and across weeks (i.e., GRPs following a flight of advertising are expected to generate less incremental volume than the same GRPs following an advertising hiatus). The adstock formulation must capture both types of diminishing returns.

The concept of adstock was first introduced by Broadbent (1979) and later was expanded upon by Broadbent (1984), Leone (1995), Joseph (2006), and others. Using prior studies as a foundation, MAP developed a proprietary, two-parameter adstock function that measures the level of "effective" or "operant" GRPs in the minds of consumers at any given time. It is a recursive function of the form

$$(2) \quad \text{Adstock}_t = f(\text{Adstock}_{t-1}, \text{GRP}_t, \text{A}, \text{D})$$

where A and D are parameters known as attack and decay, which determine the rate of diminishing returns and the half-life, respectively. The result is a set of candidate adstock transformations associated with each GRP series, as illustrated in Figure 1. The model estimation process determines the best values for these parameters, which have significant implications for media planning and scheduling.

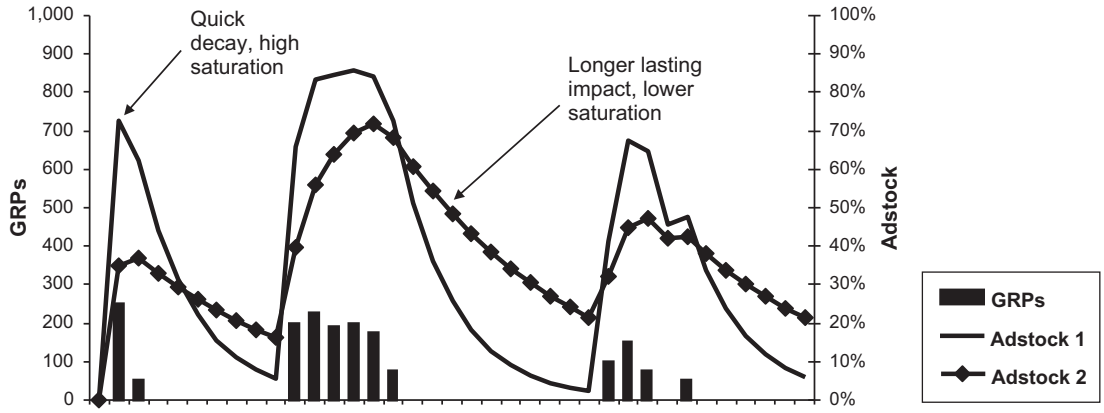


Figure 1. GRPs and Adstock

Model Estimation

As described in equation (1), the model functional form is a linear combination of nonlinear, parameterized transformations of independent variables. This form facilitates both volume decomposition and budget optimization, but it poses practical challenges for estimation. The βs in equation (1) can be estimated through ordinary least squares, but the parameters of the variable transformations g_i and g_j cannot be. Instead, combinations of transformation parameters must be tested within a range of feasible values. This, plus the need to explore multiple variable specifications for seasonality, trade promotion, macroeconomic factors, and other FDOC and brand marketing components, creates a potentially vast number of candidate models to be explored in the model estimation process.

Traditionally, the task of the modeler is to test different combinations of variables and transformation parameters through trial and error. But with the large number of candidate models involved here, the risks of this process, including order bias, omitted variable bias, and the possibility of human error, are simply too great. As a result, MAP developed and employs a unique and proprietary software tool called MegaStar™ to exhaustively test all possible models subject to statistical and face validity constraints. MegaStar allows the analysis of many thousands of candidate models in a very short period of time, with the assurance that all possibilities are explored and all models are evaluated on equal footing.

MegaStar evaluates models based on multiple statistical criteria, including: adjusted R-squared for quality of fit; Durbin-Watson and Breusch-Godfrey statistics for the presence of serial correlation; t-statistics for individual variable significance; variance inflation factors for the presence of multicollinearity; the Breusch-Pagan test for heteroskedasticity; the Ramsey-RESET test for functional form; the Chow-stability test for parameter stability; and the Chow-forecast test for predictive (holdout) accuracy. Two sample screens from the MegaStar system are shown in Figure 2.

In addition, MegaStar allows the screening of models based on a variety of analyst-defined screens for face validity. This allows the analyst to evaluate models based on experience in the industry and real-world practicality as well as statistical criteria. MegaStar evaluates every possible model given a wide range of possible transformation parameters and variable specifications, narrowing down the possibilities through statistical tests, and finally filtering according to a set of business and face validity screens. The resulting models were accurate, complete, and reasonable predictors of orange juice volume, and were suitable for use in practical optimization of the allocation of FDOC marketing expenditures.

Model Results

Total U.S. results are an aggregation of four regional models that were estimated independently using the procedure described above. The resultant

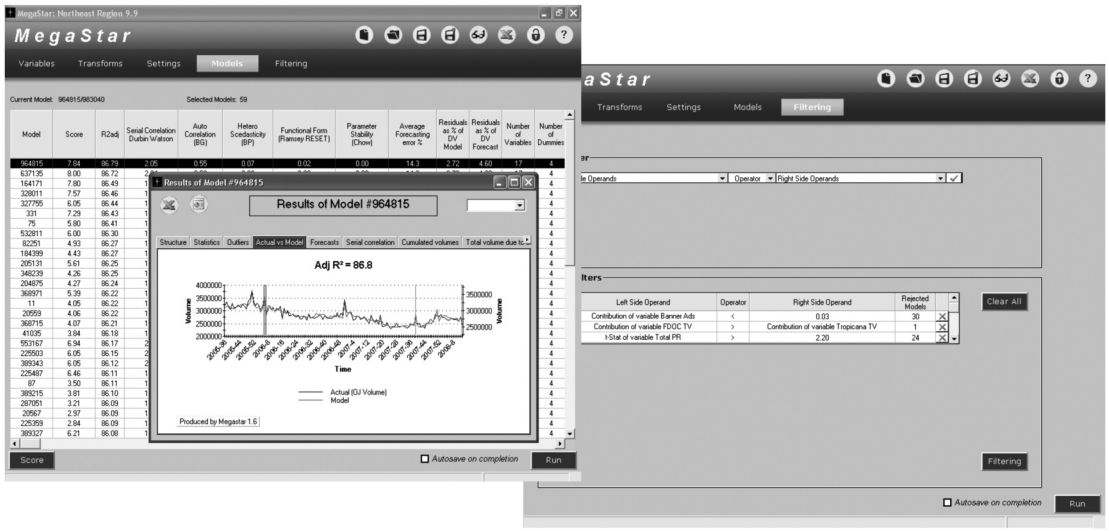


Figure 2. MegaStar™ Screens

model fit was very strong, explaining 96 percent of the variation in volume. The Durbin-Watson statistic was acceptable at 1.47 and was higher in the component regional models.

Most FDOC and brand marketing variables stayed in the models at significant levels, as well as overall orange juice price, the overall macroeconomic pricing environment, flu incidence, weather, and seasonality. Prices, promotional activity, and distribution of competitive drink categories—including other fruit juices, water, milk, carbonated beverages, coffee, and tea—were tested but found to be statistically insignificant determinants of orange juice sales. This may be a result of the relatively short time period modeled. Cross-category effects would be expected to be more significant over a longer time period.

Different variables stayed in the model in each region. Individual variable significance levels were generally 90 percent or better, although a few variables were allowed to enter at lower levels of statistical significance based on other considerations, including face validity, consistency across regions, and overall model quality. Table 1 shows the estimated point elasticities of modeled variables calculated at mean values of the independent and dependent variables, along with the significance levels for each.

The contribution of marketing to total U.S. orange juice volume was calculated by summing the product of coefficients and mean values of transformed marketing variables across the four regions. Orange juice marketing (both FDOC and branded) was found to contribute 17.0 percent of

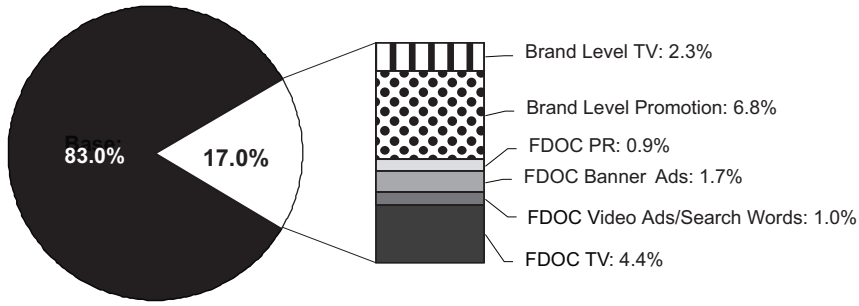


Figure 3. Marketing Contribution to Orange Juice Volume

Table 1. Independent Variables by Region

Marketing Variable Elasticities	Northeast	South	North Central	West
FDOC Television	0.041**	0.034**	0.039**	0.065**
FDOC Banner Ads	0.010*	0.012**	0.014*	0.013*
FDOC Video Ads/Search Words	0.006*	0.007*	0.008**	
FDOC PR	0.009**	0.008**	0.005*	0.005**
Brand Television	0.023**	0.028**	0.003*	
Promotion	0.143**	0.043**	0.058**	0.034*
Non-Marketing Variable Elasticities				
Base Price per SSE Gallon	-1.010**	-0.864**	-1.100**	-0.911**
Average Weekly Gas Price	-0.117**	-0.182**	-0.095**	-0.105**
Flu Incidence		0.012**	0.018	0.013**
Christmas	0.004**	0.001**	0.003**	
Easter				0.001**
Precipitation				0.025**
Snowfall	0.002*			0.006*
Seasonality	-0.002*	-0.002**	0.008**	-0.008**

*** Significant at a 90% confidence level* * *Significant at an 80% confidence level*

total orange juice volume during the 52-week period ending March 2008, as shown in Figure 3.

Of the 17.0 percent of orange juice volume contributed by brand and generic marketing efforts, 6.8 percent was generated by brand-level trade promotion and 2.3 percent was generated by brand-level television. The remaining 8.0 percent of volume was contributed by FDOC generic marketing programs, including contributions of 4.4 percent for television, 1.7 percent for banner ads, 0.9 percent for public relations programs, 0.7 percent for search word clicks, and 0.3 percent for video ads. Expressed in terms of demand generation, the current study found that FDOC marketing increased U.S. retail demand for orange juice by 8.3 percent for the 52 weeks ending March 2008.

The 8.3 percent increase in demand calculated in the current study is similar to that found in previous studies. In their study utilizing yearly data, Capps, Bessler, and Williams (2004a) found that FDOC programs increased orange juice demand by nearly 8 percent over the 33-year period of 1967/68 to 1999/2000. During the time period covered by that study, however, the mix of advertising channels used evolved dramatically and differs significantly from the current FDOC advertising mix, especially in its lack of online advertising.

Using monthly data from April 1990 through September 2002, Capps, Bessler, and Williams (2004b) found the average monthly increase in demand to be 7.7 percent; however, the period analyzed also did not fully utilize online banner advertising, search word clicks, and video impressions, which have significant impacts on demand in the current study.

Brown and Lee (2002) analyzed the impact of advertising using a differential demand system and found a category increase in demand of 5.5 percent in response to FDOC advertising. Another study by

Brown and Lee (1999), using monthly GRPs allocated equally across weeks, found that FDOC advertising increased demand by approximately 6.9 percent.

Although the incremental category volume contribution from brand-level trade promotion was high relative to other marketing efforts, its impact was only a small fraction of all orange juice sold on trade promotion. During the 52 weeks ending March 2008, Nielsen reported that 44.7 percent of all retail orange juice was sold on trade promotion (defined as any retailer feature ad, in-store display, and/or temporary price reduction) and that about half of this volume (24.3 percent) was incremental to the promoting brands—the rest subsidized consumers that would have purchased the promoted brands even in the absence of promotional activity. Non-promoted volume and subsidized volume together make up Nielsen's estimate of "baseline" volume that would be expected to sell in the absence of trade promotion. Of the 24.3 percent of volume that was incremental to promoting brands, only about one quarter (6.8 percent) was incremental to the total orange juice category as a whole. The remainder was category churn from consumers who switched brands in response to promotional activity but did not increase their overall orange juice purchases. The relationship between total promoted volume and orange juice sales that were incremental to the category is shown in Figure 4.

The finding that branded trade promotion contributes to category volume differs from the findings by Capps, Bessler, and Williams (2004b), in which brand advertising was not found to be a statistically significant driver of category volume but only led to brand-switching between advertised brands. However, that study used monthly observations created by aggregating weekly sales to match the periodicity of the available advertising data. Since trade promotion is a weekly phenomenon, this lack of granularity made it difficult to measure the true response to branded trade promotion.

During the 52 weeks ending March 2008, U.S. retail orange juice sales experienced a 2.9 percent decline. By examining the changes in the modeled determinants of volume over that period, the reasons for the volume loss—and the extent to which that loss was mitigated by FDOC marketing efforts—can be explained. The resulting source of volume change for the 52 weeks ending in March 2008 is shown in Figure 5.

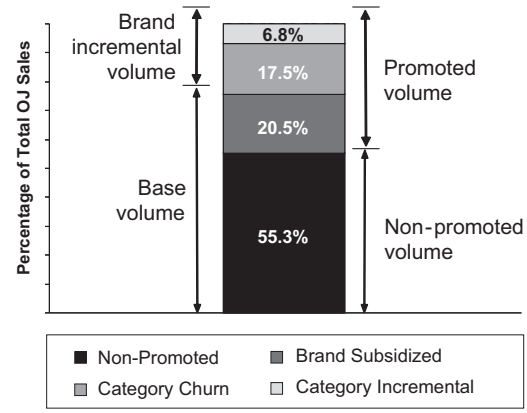


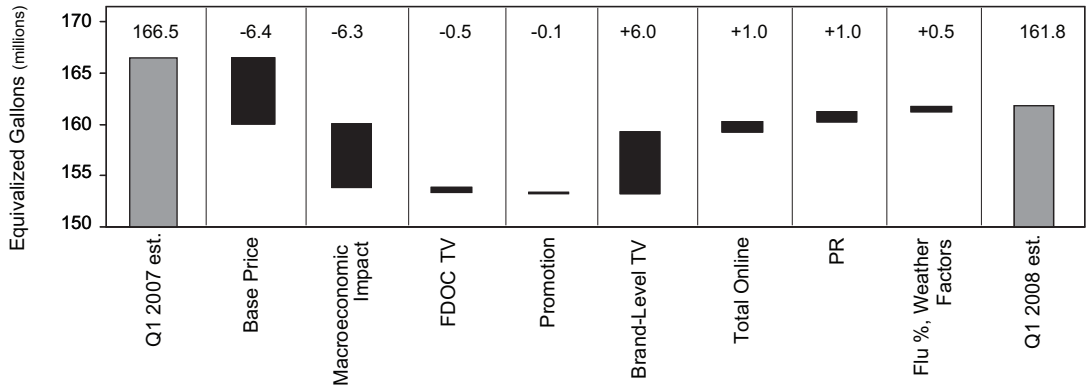
Figure 4. Trade Promotion Incrementality

During this period, the impact of increasing base (non-promoted) orange juice price and rising cost of living (captured in the model with average national weekly gas prices) led to 12.7 million fewer SSE gallons of orange juice sold at retail. The small decrease in volume sales attributed to FDOC television ads occurred despite a small increase in total GRPs as a result of the carry-over impact of GRPs aired in late 2006 on first quarter 2007 sales. The largest positive impact on volume from year to year was the increase in brand-level television advertising. Nonetheless, increased FDOC efforts online and through public relations were able to offset 2.0 million SSE gallons of the 12.7 million SSE gallons lost to price and cost of living increases.

Grower Benefits

The model results demonstrate that FDOC marketing had a positive impact on volume sales during the modeled period. The critical question for policy, however, is whether the financial benefit to Florida orange growers of the demand generated by FDOC marketing exceeded the cost of the programs.

The FDOC has studied the relationship between demand for orange juice and price per SSE gallon



Period	Avg. Base Price	Avg. Gas Price	FDOC TV GRPs	% Base Vol. on Promo	Brand TV GRPs	Online Imp. (MM)	PR Imp. (MM)
Q1 2007	$6.32	$2.42	1.052	44.1	108	19.2	65.2
Q1 2008	$6.55	$3.16	1,106	45.7	1,346	23.7	96.7

Figure 5. Source of Orange Juice Volume Change

realized by Florida growers using regression analysis and found that grower prices increased by 0.000625 cents per million SSE gallons of demand. Using this price-quantity slope, the price increase resulting from the 8.3 percent increase in volume generated by FDOC marketing activity (96.2 million SSE gallons, adjusting for un-modeled outlets) was 6.0 cents per SSE gallon. At the average crop size in the last two fiscal years of 941 million SSE gallons, this price increase equates to an increase in revenue to Florida growers of $56.6 million.

The relationship between demand and price is based on the inability of the domestic supply of oranges to adjust to changes in demand in the short term. In situations in which production is not fixed, the demand created by marketing can be met with a supply increase, enabling the producer to increase income by selling more product. Price effects in this situation are usually long-term due to the producer's ability to fix price and adjust supply.

However, the supply of orange juice is limited by yearly crop size. Orange trees do not bear fruit until at least 4-5 years following planting, with peak orange production between 20 years and 25 years of age. As a result, since consumer demand routinely exceeds Florida production and orange juice production cannot respond quickly to demand increases, the demand created by marketing results in increasing orange juice price, which signals foreign suppliers (most notably Brazil) to shift exports to the U.S. market to meet demand. The regression developed by the FDOC takes these dynamics into consideration in determining the short-term relationship between demand and price increases realized by growers. The equation is updated periodically to reflect the long-term adjustment of the U.S. and world markets to demand changes (Brown 2008).

Each FDOC marketing element contributed a measurable impact on volume and grower revenue and each had a known cost, so benefit-to-cost ratios (BCRs) were calculated for each program element. As shown in Figure 6, the BCR for television was 2.2, indicating that for every dollar FDOC spent on

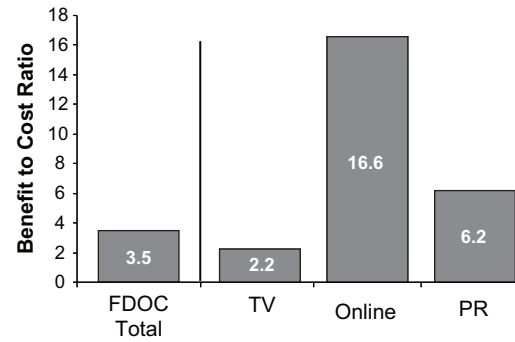


Figure 6: FDOC Benefit-to-Cost Ratios for 52 Weeks Ending March 2008

television advertising, approximately $2.20 in incremental revenue was realized by the growers. The BCR for public relations was 6.2, and the BCR for total online advertising was 16.6, although both were at much lower levels of spend than television.

In aggregate, the $56.6 million in incremental revenue received by Florida growers from the FDOC's $16.2 million marketing investment during the 52 weeks ending March 2008 resulted in an overall BCR of 3.5 for Florida growers. Capps, Bessler, and Williams (2004a) found the BCR for FDOC advertising to be 3.2 for the period 1983/84 through 1999/2000.

Budget Optimization

The models show that FDOC advertising for orange juice was profitable to Florida growers. However, the question remains: could the same $16.2 million marketing investment be allocated more efficiently to generate even greater incremental sales and therefore a BCR greater than 3.5?

MAP developed a proprietary, web-based software tool for this purpose called Origami™. Origami optimizes budgets based on two possible goals: maximize return given a fixed budget, or minimize budget given a fixed level of return. FDOC spending is capped yearly, so the goal of the optimization was to maximize efficiency of marketing dollars given that budget. Figure 7 shows an Origami optimization screen.

The optimization process is based on modeled response curves, as shown in Figure 8. Banner ads and search ads had the highest BCRs, but the search curve in particular showed rapid diminishing returns with higher spend. Television had the lowest BCR but showed few signs of reaching diminishing returns, even at very high spend levels. Public relations showed minimal or no diminishing returns at current levels of spend.

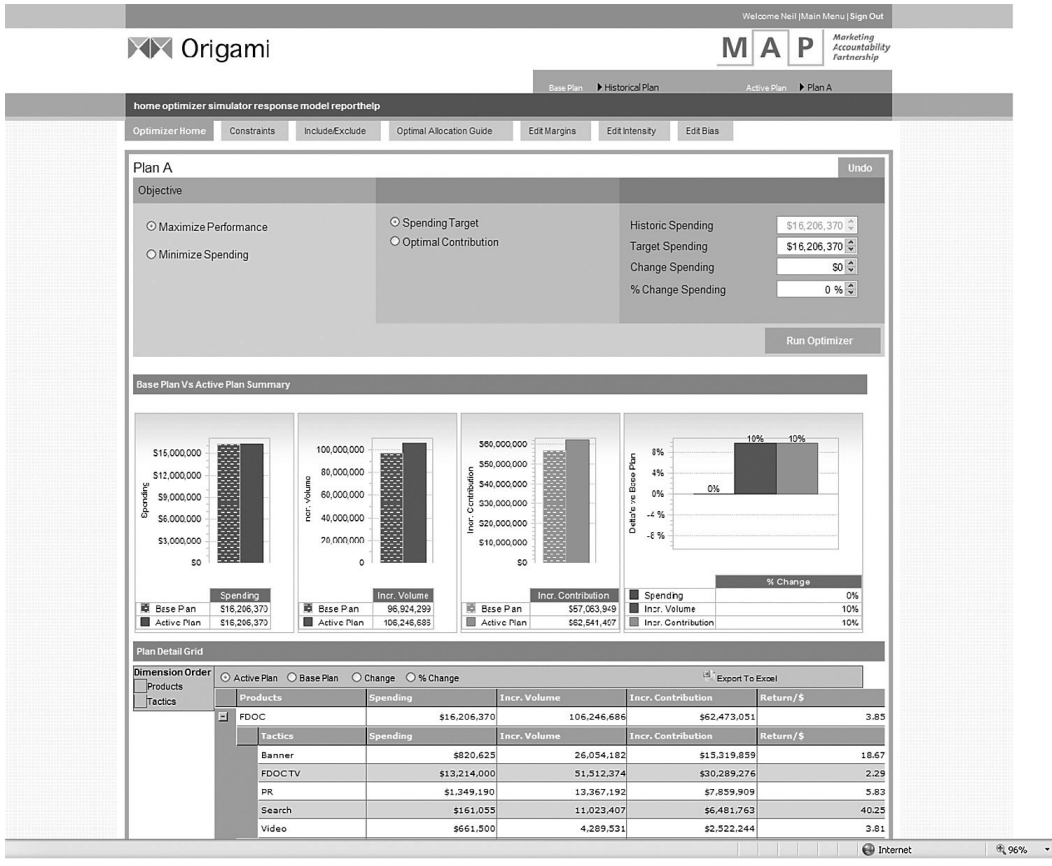


Figure 7. Origami™ Optimization Screen

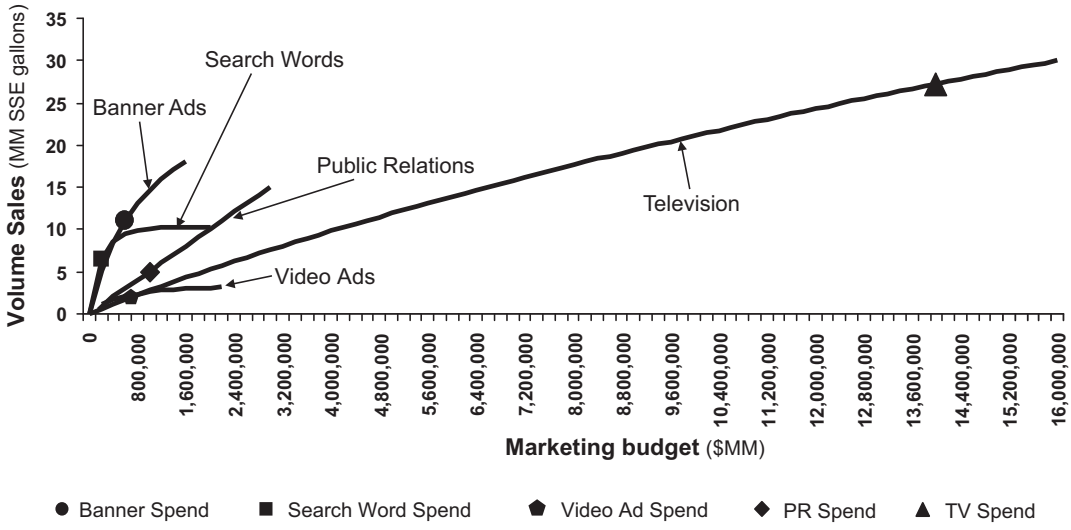


Figure 8. FDOC Marketing Response Curves for 52 Weeks Ending March 2008

The optimization shifts money from less efficient uses to more efficient uses in order to achieve maximum BCR. The resulting allocation shift depends on the rate of diminishing returns and the current spend level for each marketing type. By shifting spend from alternatives for which diminishing returns have reduced the impact of marginal spend to those for which marginal spend is more productive, the overall return on the budget is increased. The optimal budget allocation is the point at which a marginal dollar of marketing spend returns the same marginal benefit in all alternatives.

A practical issue constraining the optimization of the FDOC budget is the scalability of public relations and online advertising. At current spend levels, the BCR for both vehicles is very strong, but the FDOC has no experience at higher levels of spend and there may be an inherent limit to the amount of each vehicle that can be purchased. For this reason, online and PR spending were constrained to increase no more than 50 percent and 30 percent, respectively, versus historical spending levels, to ensure a realistic allocation that could be feasibly implemented. The constrained optimal allocation at current budget levels found by Origami is shown in Figure 9.

With optimal allocation of resources, the models suggest that FDOC marketing could have driven 10.0 million additional SSE gallons of orange juice

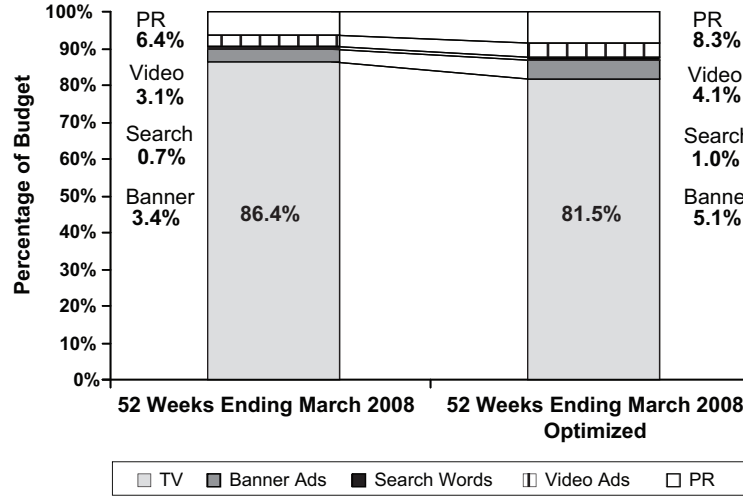


Figure 9. Optimized FDOC Budget Allocation

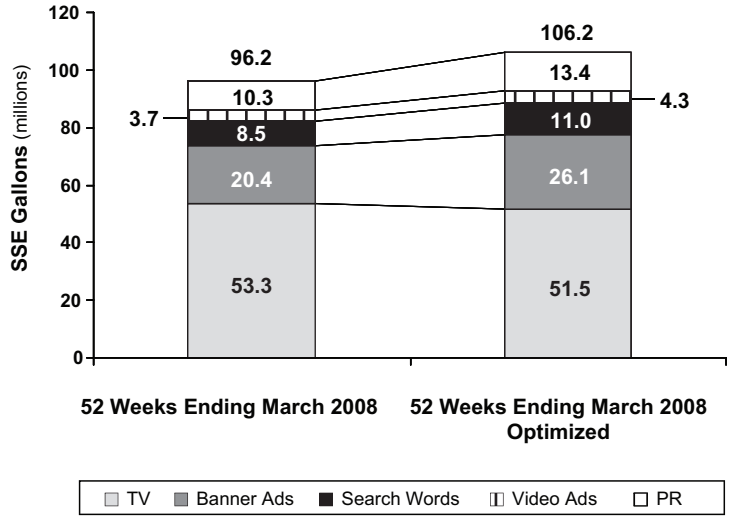


Figure 10. Optimized Volume Contribution of FDOC Marketing

sales during the 52-week period ending March 2008, as shown in Figure 10. The resulting BCR would be 3.9, a 10.4 percent increase over the historical measured return.

The most important benefit of software-based scenario planning is the ability to optimize plans on an ongoing basis using modeled results derived from recent experience in the orange juice category. As budgets or market conditions change due to weather events, new product introductions, or other factors, the FDOC can respond in the manner that maximizes the ongoing benefit that its programs deliver to Florida citrus growers.

Conclusion and Next Steps

Econometric modeling has shown that the investment in orange juice marketing by the FDOC significantly benefits Florida growers. For every dollar the FDOC spends on generic marketing of orange juice, approximately $3.50 in grower benefit is realized, indicating that the box tax is a good investment.

In the future, Florida growers will need to contend with an increasingly uncertain economic environment, continued changes in the beverage category, crop yield disturbances from fluctuations in weather, and crop diseases such as greening. In addition, emerging digital media and advanced television media capabilities bring exciting but uncertain factors into the marketing mix. Decisions regarding optimal allocation of marketing dollars will be more critical than ever and will require periodic remodeling of the orange juice response to marketing, re-estimation of the price-quantity slope, and computation of updated grower BCRs to support an ongoing optimization of marketing resources.

List of Acronyms

ACV: *All Commodity Volume.* The total dollar sales volume of a store across all product categories.

BCR: *Benefit-to-Cost Ratio.* Grower financial benefit from FDOC marketing divided by the cost of the marketing.

CPI: *Consumer Price Index.*

FDOC: *Florida Department of Citrus.*

GRP: *Gross Rating Point.* A measure of advertising pressure defined as the percentage of the target audience reached by advertising each week times the average frequency of exposure.

MAP: *Marketing Accountability Partnership.*

POS: *Point-of-Sale.* Nielsen data are gathered using point-of-sale scanners in retail food, drug, and mass merchandiser stores.

SSE: *Single Strength Equivalent.* When applied to gallons, gives a common measure for orange juice sales volume across ready-to serve, frozen concentrate, and shelf stable forms.

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