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**EFFECTIVENESS OF MARKETING ORDER
906 IN PROMOTING SALES OF TEXAS
GRAPEFRUIT AND ORANGES**

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*TAMRC Commodity Market Research
Report No. CP-01-07*

February 2007

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Texas Agribusiness Market Research Center (TAMRC) Commodity Market Research Report
No. CM-02-07, February 2007, by Dr. Gary Williams, Oral Capps Jr., and Marco Palma.

ABSTRACT:

This study of the effectiveness of Marketing Order 906 in promoting Texas grapefruit and oranges was requested by TVCC in compliance with the FAIR Act promotion evaluation requirement. The report first provides some background on the U.S. and Texas citrus industries and the citrus promotion programs conducted by TexaSweat over the years and then presents the analytical methodology employed. Based on the statistical analysis conducted, the study concludes that the citrus promotion programs have been effective in enhancing shipments of Texas citrus and that the benefits of the promotion efforts have exceeded the costs.

ACKNOWLEDGEMENTS:

This study was conducted under contract with the Texas Valley Citrus Committee (TVCC). The authors acknowledge the assistance of both TVCC and TexaSweat Citrus Marketing, Inc. in collecting and compiling a large amount of data relating to Texas citrus shipments and TexaSweat marketing plans and budgets, financial statements, and income and expense data.

The Texas Agribusiness Market Research Center (TAMRC) has been providing timely unique and professional research on a wide range of issues relating to agricultural and agribusiness markets and products of importance to Texas and the nation for nearly forty years. TAMRC is a market research service of the Texas Agricultural Experiment Station (TAES) and Texas Cooperative Extension (TCE). The mission of TAMRC is to provide high quality, objective, and timely market research to support strategic agribusiness decision-making at all levels along the supply chain from producers to processors, wholesalers, retailers, and consumers. Major TAMRC research divisions include International Market Research, Consumer and Product Market Research, Commodity Market Research, and Contemporary Market Issues Research.

**EFFECTIVENESS OF MARKETING ORDER 906
IN PROMOTING SALES OF TEXAS GRAPEFRUIT AND ORANGES**

EXECUTIVE SUMMARY

Marketing Order 906 was established through federal legislation in 1960 to regulate the movement of fresh grapefruit and oranges from the Lower Rio Grande Valley of Texas. Although the Marketing Order was authorized to assess and collect a fee on all cartons of grapefruit and oranges shipped from Texas to finance the operation and administration of the Order, the use of the assessment revenue to fund promotional activities was not authorized until 1966 when the Marketing Order was first amended. The Texas Valley Citrus Committee (TVCC), which administers the Order, contracts with TexaSweat Citrus Marketing, Inc., a nonprofit corporation under the laws of the state of Texas, specifically for the purpose of developing and carrying out promotional programs for Texas grapefruit and oranges.

The Federal Agriculture Improvement and Reform (FAIR) Act of 1996 includes a requirement that “all commodity boards established under the supervision and oversight of the Secretary of Agriculture pursuant to a commodity promotion law shall, not less than every 5 years, authorize and fund, from funds otherwise available to the board, an independent evaluation of the effectiveness of the generic commodity promotion programs and other programs conducted by the board pursuant to a commodity promotion law.” This study of the effectiveness of Marketing Order 906 in promoting Texas grapefruit and oranges was requested by TVCC in compliance with the FAIR Act promotion evaluation requirement.

Specifically, this study focuses on the answers to two key questions:

- What have been the effects of the promotion programs funded under Marketing Order 906 on shipments of Texas grapefruit and oranges?
- What has been the return on the investment made under Marketing Order 906 on promotion of sales of Texas grapefruit and oranges?

The report first provides some background on the U.S. and Texas citrus industries and the citrus promotion programs conducted by TexaSweat over the years. Then, following a discussion of the analytical methodology employed, the results of the analysis of the two key questions are presented and discussed. The analysis is followed by a summary of key findings and conclusions.

In the U.S. citrus industry, Florida means processed, California means fresh, and Texas means fresh grapefruit. The Texas citrus industry is situated in the southern part of the state, concentrated almost totally in the Lower Rio Grande Valley. The typical Texas grapefruit and orange marketing season begins in October and continues through May with shipments of both citrus fruits typically peaking in the first few months of each calendar year. Texas citrus prices fluctuate from season to season along with shipments. Weather-related variability in production and shipments have a particular impact on the seasonal variation in Texas citrus prices.

The Texas grapefruit industry has developed around various varieties of seedless, red-fleshed grapefruit with varying degrees of redness in the peel, all of which were developed in Texas from mutations of existing grapefruit. The industry has worked to create a strong brand image for

its red grapefruit. Texas also produces various varieties of low acidity, thin peel oranges and markets them in 3 basic categories: (1) navels and early oranges; (2) mid-season oranges; and (3) late-season oranges. Navel oranges normally mature in October and are shipped through January. Most mid-season oranges come to market in late November through February. The late-season oranges, primarily Valencia varieties, normally achieve maturity in late January, providing a late-season surge in Texas orange shipments through May.

Each year, TVCC recommends to USDA for approval the annual assessment rate to be applied to shipments of grapefruit and oranges. Over the last several years, the annual per carton (7/10 bushel equivalent) assessment has varied from 11.0¢ to 14¢. Currently, the rate is set at 12.0¢/carton. Except for a few years of reduced shipments and/or declines in the assessment rate, annual assessment revenues since the mid-1990s have varied from a low of about \$1.0 million to a high of \$1.2 million. In 2004/05 and 2005/06, however, TVCC decided to reduce the assessment rate from 14.0¢/carton to 12.0¢/carton and cut back the budget for promotion leading to a drop in total citrus assessment funds to \$868,000 and \$914,000 in 2004/05 and 2005/06, respectively.

The majority of the assessment revenue collected under Marketing Order 906 is allocated to TexaSweat Citrus Marketing, Inc. to fund advertising and promotion programs although the share allocated to TexaSweat has declined since the early 1990s. From a high of 81% in 1993/94, the allocation to TexaSweat declined to just over half of total assessment revenue in 2004/05 and in 2005/06. The sharp decline in the allocation to TexaSweat in 2004/05 and 2005/06 occurred precisely when the total assessment revenues also declined which together resulted in a sharp decline in the total dollars allocated to TexaSweat for promotion in those years. From a high of about \$795,000 in 2003/04, allocations to TexaSweat fell to their lowest level in 2004/05 (\$446,000) since the freeze years of the early 1990s.

TexaSweat promotion program categories have traditionally included five areas of expenditure: (1) merchandising, (2) public relations, (3) conventions, (4) point-of-purchase (POP) materials, and (5) trade media advertising. Between 2000/01 and 2005/06, TexaSweat used about 54% of the funds allocated from the citrus assessment for promotion programs with the remainder for supporting administrative costs. Over that period, however, the promotion share of TexaSweat spending declined from about 60% to a little over 48%. With the decline in total assessment dollars allocated to TexaSweat in 2004/05 and 2005/06, TexaSweat cut administrative costs in an attempt to minimize the impact on the funds available for promotion programs. Nevertheless, the share that TexaSweat allocated to cover administrative costs in those two years became larger than the share used for promotion programs for the first time. The increase in the administrative cost share in the last two years is not surprising, however, since many costs (e.g., fixed costs and employee salaries) cannot be easily cut with reductions in overall assessment revenues if a continuous program is to be maintained from year to year despite changes in revenues.

Of the funds TexaSweat has spent on assessment-funded promotion programs since 2000/01, over 80% has been spent on merchandising and public relations activities. Advertising was dropped from the TexaSweat portfolio of promotional tools in 2002/03. POP materials was also effectively eliminated as a promotion category after 2001/02 with a small amount spent on this

category in 2005/06. Over time, the share of promotion funds allocated to merchandising has declined steadily while the share allocated to public relations has increased.

For a few years (2000/01 through 2002/03), TexaSweat leveraged its promotion funds with funds for joint promotion programs and related promotional activities from various other groups, including the Texas Department of Agriculture through the “Go Texan – Citrus” and the “Fresh from Texas” campaigns, the USDA Market Access Program (MAP), the South Texas Onion and Melon Committees, and the Texas Produce Association.

Although the largest share of TexaSweat promotion expenditures have typically occurred during the Texas citrus marketing year, expenditures have typically spiked in the inter-season months of June through September when there are no shipments of citrus. Before the drop in funding for promotion in 2004/05 and 2005/06, much of the inter-season promotional expenditures supported merchandising activities. With the drop in funding in 2004/05 and 2005/06, promotion expenditures became more evenly distributed throughout the year and inter-season promotion expenditures focused on public relations activities.

The only previous analysis of Texas citrus promotion programs was completed in 1999 by the Data and Information Systems Center (DISC) at the University of Texas – Pan American. The study concluded that over marketing years of 1993/94 to 1999/00 increases in advertising expenditures tended to increase orange shipments within one week of the expenditures and had an even more immediate and relatively larger effect on grapefruit shipments. The study also found that the full effect of the advertising dissipated after three weeks. Unfortunately, the DISC study considered only advertising expenditures rather than the full range of promotional activities carried out by TexaSweat. The DISC study failed to report how responsive Texas citrus sales were to changes in advertising expenditures. Although finding that TexaSweat advertising had an effect on Texas grapefruit and orange sales, the study also failed to provide any measure of the benefits related to TexaSweat advertising.

This study updates the DISC analysis for the more recent, six-year period of 2000/01 to 2005/06. In contrast to the DISC study, the basic analytical tool used in this study is the more well-accepted structural econometric modeling approach which provides measures of the responsiveness of citrus shipments to changes in TexaSweat spending on promotion and makes the calculation of the benefit-cost ratios (BCRs) associated with TexaSweat promotion expenditures possible. In addition, rather than considering only the trade media advertising expenditures, this study considers the effectiveness of all funds used by TexaSweat to promote Texas citrus.

Three statistical models are developed and used to explain the effect of promotion expenditures on: (1) total Texas citrus shipments (the aggregation of grapefruit and orange shipments), (2) Texas grapefruit shipments alone, and (3) Texas orange shipments alone. In essence, the statistical analysis isolates and measures the specific effects of the main factors, including promotion, that influenced monthly shipments of grapefruit, oranges, and all citrus from the Rio Grande Valley over the 2000/01 through the 2005/06 marketing years.

Salient results from the statistical analysis of *all citrus shipments* are the following:

- *Monthly citrus shipments are relatively insensitive to monthly price changes.*

This finding is positive for the industry because it implies that an increase in Texas citrus prices induced by bad weather or other factors is less likely to drive buyers away from Texas citrus than would be the case if the demand for Texas citrus were more price sensitive.

- *The reduction in assessment funding during 2004/05 and 2005/06 reduced the price sensitivity of Texas citrus shipments compared to previous years and helped improve the loyalty of buyers to Texas citrus products.*

No such result was found, however, for the additional funding from non-assessment sources. That is, the use of non-assessment sources of funding had no measurable effect on the price behavior of Texas citrus buyers.

- *Citrus shipments have been impacted by promotion.*

The promotion elasticity for all citrus products is estimated to be 0.183 which means that for every 10% increase in promotion expenditures, shipments of citrus increase by 1.8%, all other factors held constant. However, the marginal effectiveness of TexaSweat promotion programs declined when funding was reduced during the 2004/05-2005/06 period. The marginal effectiveness of TexaSweat promotion efforts was not enhanced by the addition of non-assessment promotion funds and may even have been slightly lower as a result.

Salient results from the statistical analysis of orange and grapefruit shipments are the following:

- *Grapefruit and orange shipments are both relatively insensitive to monthly price changes.*

As for all citrus, the implication is that buyers tend to demonstrate some loyalty to Texas grapefruit and oranges when prices increase. The study also finds that both the addition of non-assessment sources of promotion funding during 2000/01-2003/04 as well as the reduction in funding during the 2004/05-2005/06 period actually helped improve the loyalty of buyers to Texas oranges but not to Texas grapefruit.

- *The estimated effects of promotion expenditures on shipments of Texas oranges are not statistically different from zero.*

Promotion expenditures were found to be ineffective in shifting out the demand for Texas oranges. Thus, while promotion has had a tendency to make the Texas orange demand curve more price inelastic, and, therefore, enhance buyer loyalty, promotion has not been effective in shifting out the demand for Texas oranges.

- *Promotion has had a highly statistically significant effect on Texas grapefruit shipments.*

The promotion elasticity for grapefruit shipments is estimated to be 0.264, meaning that a 10% increase in promotion funding increases Texas grapefruit shipments by 2.6%. However, the marginal effect of promotion expenditures on grapefruit shipments declined when funding was reduced in 2004/05 and 2005/06. Also, the addition of funding from non-

assessment sources in 2000/01 to 2003/04 reduced the marginal effectiveness of promotion in shifting out the demand for Texas grapefruit.

The results of the statistical analysis are the basis for the evaluation of the two key questions that are the specific focus of this study. In general, the study finds that citrus promotion programs have been effective in enhancing shipments of Texas citrus and that the benefits of the promotion efforts in terms of increased industry revenues are greater than the costs.

More specifically, the study finds the following:

- *The Texas citrus promotion program has effectively shifted out the demand for Texas grapefruit over the 2000/01-2005/06 shipping seasons.*

The program added an average of 198,915 boxes monthly (\$1.1 million) and 9,746,832 boxes (\$56.1 million) in total to Texas grapefruit shipments over the last five shipping seasons.

- *The promotion expenditures had no statistically discernible effect on shipments of Texas oranges over the last six seasons.*

This result is not surprising because: (1) Texas oranges are more of a generic commodity than Texas grapefruit and, thus, less susceptible to promotion efforts; (2) the DISC study also found a much smaller effect of advertising on Texas orange shipments than on grapefruit; and (3) grapefruit are the exclusive program focus of the specific objectives and strategies of TexaSweat promotion programs each year.

- *Promotion has helped increase the loyalty of buyers to Texas oranges but not to grapefruit.*

For grapefruit, promotion has tended to shift out the demand rather than reduce the price elasticity of demand.

- *The reduction in funding for promotion over the last two years limited the impact of promotion on the demand for Texas grapefruit.*

From an average annual impact of nearly 2.0 million boxes in the first three seasons, the annual promotion-induced increase in grapefruit shipments dropped by more than half to an average of about 876,000 boxes in the last two seasons.

- *Despite fewer boxes of grapefruit added by promotion in the last two seasons, a jump in the price per box boosted the average annual additional earnings generated by promotion.*

Industry revenues from promotion-induced increases in grapefruit shipments increased from an annual average \$7.8 million in 2000/01-2003/04 to an annual average \$12.5 million in 2004/05-2005/06.

- *Leveraging assessment funds with non-assessment sources of promotion funds increased shipments of Texas grapefruit in 2000/01-2003/04.*

The increase occurred at a lower rate per dollar spent on promotion than achieved with the expenditure of citrus assessment funds. The expenditure of non-assessment sources of

funding increased grapefruit shipments by an annual average of 522,000 boxes annually for a total of \$2.0 million in total industry revenues over those three seasons.

- *The BCR to grapefruit promotion at the packinghouse level was 28.3 (19.8 grower level).*

That is, for every dollar spent on promotion from 2000/01 through 2005/06, the return to the Texas grapefruit industry at the packinghouse level was \$28 in additional revenues (\$20 at the grower level) from increased shipments of grapefruit.

- *The grapefruit Shipment BCR over the same period averaged 4.9 boxes per dollar of promotion.*

For every dollar spent on promotion over the last six seasons, grapefruit shipments increased by an average of 4.9 boxes.

- *The grapefruit Shipment BCR dropped from 5.2 boxes per promotion dollar spent in the first three seasons to 4.0 boxes per promotion dollar spent in the last two seasons.*

The drop in the Shipment BCR may have occurred because: (1) the proportion of funding spent on promotion by TexaSweat in the last two seasons dropped and (2) TexaSweat shifted promotion strategies away from merchandising and other historical promotion methods to public relations as the main tool for citrus promotion.

- *The average effectiveness of the non-assessment funds used to promote grapefruit shipments in the first three seasons of the study was lower than the effectiveness of the assessment funds spent on promotion.*

This difference in effectiveness may have occurred because the expenditure of funds from non-assessment sources is typically for joint promotion programs and related promotional activities that are less focused on the specific promotional goals and objectives of the promotion organization than is the expenditure of funds exclusively from assessment sources.

- *The calculated BCR for Texas grapefruit shipments is high relative to those generally reported for the larger commodity promotion programs.*

This result is neither unexpected nor unusual for smaller promotion programs with low levels of promotion expenditure.

- *The high BCR for Texas grapefruit promotion implies that while Texas citrus promotion efforts have been successful, the promotion activities also are greatly under-funded.*

Both experience and the theory of advertising suggest strongly that a substantial increase in funding over time would likely reduce the Texas citrus BCR to levels more in line with those of the better-funded commodity promotion programs.

TABLE OF CONTENTS

Author Bio-Sketches, Abstract, and Acknowledgements.....	i
Executive Summary	ii
List of Figures	ii
List of Tables	ii
Introduction.....	1
The U.S. and Texas Citrus Industries	2
The U.S. Citrus Industry	2
The Texas Citrus Industry.....	6
Texas Citrus Promotion Programs	9
Methodology and Statistical Results	14
Previous Research.....	16
Econometric Models and Data.....	16
Empirical Results	20
Analysis of the Effectiveness of Texas Citrus Promotion.....	26
Effects of Promotion on Shipments of Texas Grapefruit and Oranges	27
Benefit-Cost Analysis of Texas Citrus Promotion Programs	29
Summary and Conclusions.....	32
References.....	38

LIST OF FIGURES

Figure	Page
1 Value of U.S. Citrus Production, 1990/91 – 2005/06	3

2	U.S. Citrus Production by State, 1990/01- 2005/06	3
3	U.S. Fresh and Processing Orange Production by State, 1990/91-2005/06.....	4
4	U.S. Fresh and Processing Grapefruit Production by State, 1990/91-2005/06.....	5
5	Annual Per Capita Consumption of Fresh Grapefruit and Oranges, 1970-2004	5
6	Texas Citrus Production and Utilization, 1990/91-2005/06	7
7	Texas Grapefruit and Orange Production by Utilization, 1990/91-2005/06.....	7
8	Texas Grapefruit and Orange Shipments, August 1996-July 2006	8
9	Texas Grapefruit and Orange Prices, 1995/96-2005/06	8
10	Total Assessments Under Marketing Order 906, TexaSweat Expenditures, and the Per Carton Assessment, FY 1989 – FY 2005.....	11
11	Allocation of Total Assessments Under Marketing Order 906 to TexaSweat for Promotion and to Administrative and Other Costs, FY 1992 – FY 2005.....	11
12	TexaSweat Expenditures By Category and the Share Allocated to Promotion, FY 2000 – FY 2005	13
13	TexaSweat Promotion Expenditure Shares By Category, FY 2000 – FY 2005	13
14	TexaSweat Promotion Funding from Assessment and Non-Assessment Sources, FY 2000 – FY 2005	14
15	Monthly Distribution of Texas Citrus Shipments and TexaSweat Promotional Expenditures, August 2000–July 2006	14
16	Illustration of the Shift in Demand for Texas Citrus Due to Promotion.....	16
17	Seasonally and Inflation-Adjusted TexaSweat Promotion Expenditures, 2000/01 – 2005/06 Shipping Seasons	20

LIST OF TABLES

Table		Page
1	Marketing Seasons and Net Weight Per Box by State.....	4
2	Single-Equation Model for Shipments of All Citrus	22
3	Equation for Grapefruit Shipments from SUR Model.....	24
4	Equation for Orange Shipments from SUR Model.....	25
5	Benefit-Cost Analysis of Texas Citrus Promotion, 2000/01-2005/06.....	28
6	Effects of Leveraging TexaSweat Promotion Funds in 2000/01-2003/04.....	30

EFFECTIVENESS OF MARKETING ORDER 906 IN PROMOTING SALES OF TEXAS GRAPEFRUIT AND ORANGES

Federal Marketing Orders and Agreements for many fruits, vegetables, nuts, and specialty crops in many parts of the country were established in 1960 under Chapter 9 of Title 7 (Agriculture) of the Code of Federal Regulations (CFR) (USDA, 2006c and U.S. GPO, 2007). Part 906 of that chapter established a marketing order for grapefruit and oranges grown in the Lower Rio Grande Valley (known as Marketing Order 906). The general intent of marketing orders and agreements is to facilitate collective efforts among farmers in solving marketing problems they all face. Marketing Order 906 authorizes grade, size, container, and pack regulations for shipments of Texas grapefruit and oranges.

The enabling legislation that established the Order also established the Texas Valley Citrus Committee (TVCC), composed of nine growers and six handlers, to administer the Order. To cover the expenses of TVCC, the Order provides for “the levying of assessments upon handlers” (7 CFR § 906.34). The order defines “handlers” as being synonymous with “shippers” including “any person who handles fruit or causes fruit to be handled” (7 CFR § 906.6). The original order was amended in 1966 to allow the use of assessment funds “for the establishment of marketing research and development projects, including paid advertising, designed to assist, improve, or promote the marketing, distribution, and consumption of fruit” (7 CFR § 906.37). As a result, TexaSweat Citrus Marketing, Inc. was established as a nonprofit corporation under the laws of the state of Texas specifically for the purpose of developing and carrying out promotional programs for Texas grapefruit and oranges under contract with TVCC.

In 1996, the Federal Agriculture Improvement and Reform (FAIR) Act included a requirement that “all commodity boards established under the supervision and oversight of the Secretary of Agriculture pursuant to a commodity promotion law shall, not less than every five years, authorize and fund, from funds otherwise available to the board, an independent evaluation of the effectiveness of the generic commodity promotion programs and other programs conducted by the board pursuant to a commodity promotion law” (Title 5, Subtitle A, Section 501, § c). This study of the effectiveness of Marketing Order 906 in promoting Texas grapefruit and oranges was requested by TVCC in compliance with the FAIR Act promotion evaluation requirement.

Specifically, this study focuses on the answers to two key questions:

- What have been the effects of the promotion programs funded under Marketing Order 906 on shipments of Texas grapefruit and oranges?
- What has been the return on the investment made under Marketing Order 906 on promotion of sales of Texas grapefruit and oranges?

Before analyzing the answers to these questions, however, this report first provides some background on the U.S. and Texas citrus industries and the citrus promotion programs conducted by TexaSweat over the years. Then, following a discussion of the analytical methodology employed, the results of the analysis of the two key questions above are presented and discussed. The analysis is followed by a summary of key findings and conclusions.

The United States is one of the leading citrus producers in the world, behind Brazil and China.

Grapefruit and oranges are the major citrus crops in the U.S. with lesser production of lemon tangerines, tangelos, temples, and an increasing variety of specialties (Figure 1).

THE U.S. CITRUS INDUSTRY

Together, grapefruit and oranges account for 88.5% of total U.S. citrus-bearing acreage. Production is concentrated in Florida, California, Arizona, and Texas. In 2005/06, Florida was the leading citrus-producing state, accounting for 68% of total U.S. citrus production, followed by California with 28% and with Texas and Arizona together accounting for the remaining 4% (Figure 2). Marketing and growing seasons and net weights per box are different for every producing state and product (Table 1).

Grapefruit and oranges can be consumed as fresh fruit or processed. Juice is by far the most common processed form of citrus. Processing also generates a number of byproducts such as food additives, pectin, marmalades, animal feed, essential oils, fuels, chemicals, and cosmetics. The majority of U.S. citrus production is processed, with 78% of oranges and 51% of grapefruit processed in 2005/06. Even though both fresh fruit and processed citrus are sold in all states, each state is recognized with specific product types. As demonstrated in Figures 3 and 4, in the U.S. citrus industry, Florida means processed, California means fresh, and Texas means fresh grapefruit.

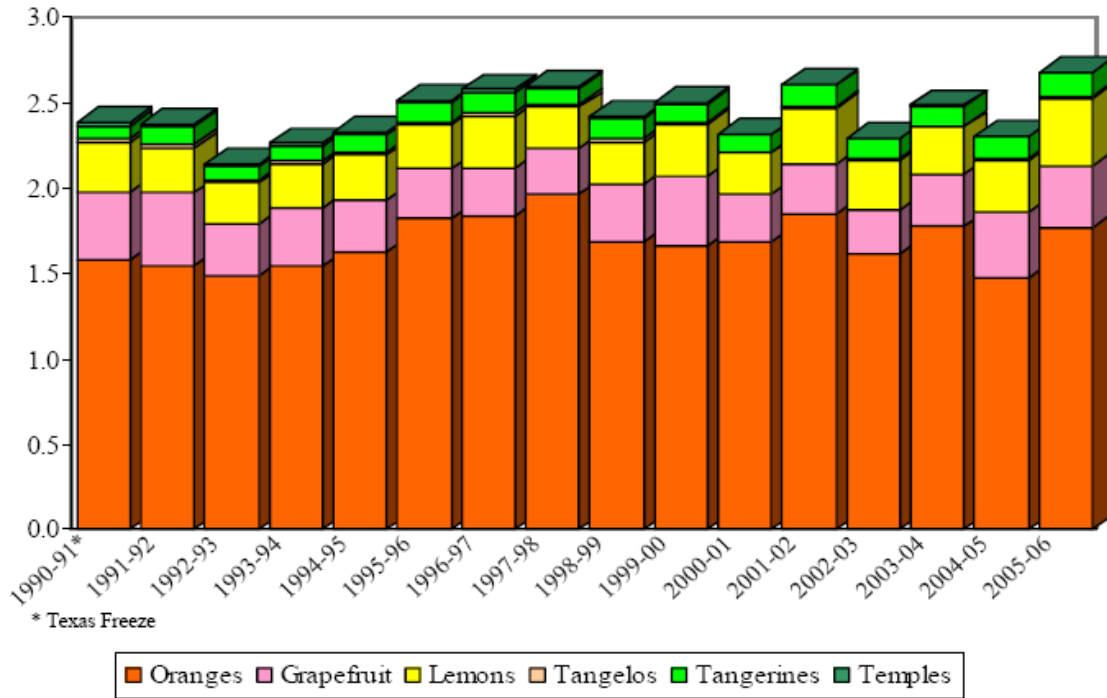
Competition is strong in the fresh fruit market, especially considering that per capita consumption of fresh grapefruit and oranges has declined in recent years. Per capita consumption of oranges dropped from 16.2 lb in 1970 to 10.8 lb in 2004 while that of fresh grapefruit decreased from 8.2 lb 1970 to 4.1 lb in 2004 (Figure 5). Processed fruit has two forms: ready-to-serve juice, also known as single-strength equivalent or SSE and concentrate. Both processed forms have become very popular among consumers, mostly for their convenience.

Total citrus utilization for the 2005/06 season was 11.6 million tons (mt), practically unchanged from the 2004/05 season but 35% lower than the record high production of 17.8 mt for the 1997/98 season. The value of the 2005/06 U.S. citrus crops is \$2.68 billion, up 16% from last season. Citrus prices vary by product and producing state. Because net weights per box are different for every citrus product and state, the price per box of citrus in each state cannot be compared directly. Clearly, fresh fruit prices are higher than fruit used for processing. Physical appearance of the fruit is important for the fresh market. Some fruit not suitable for fresh consumption may be sold for processing at a lower price.

Citrus products are highly susceptible to weather-induced supply shocks, especially freezes. Consequently, U.S. citrus production occurs only in semi-tropical zones (i.e., Florida, southern and central California, the Arizona desert, and extreme South Texas). Freezes have a double negative impact on citrus. They damage the fruit that is already on the trees as well as the trees

Figure 1: Value of U.S. Citrus Production, 1990/91 – 2005/06

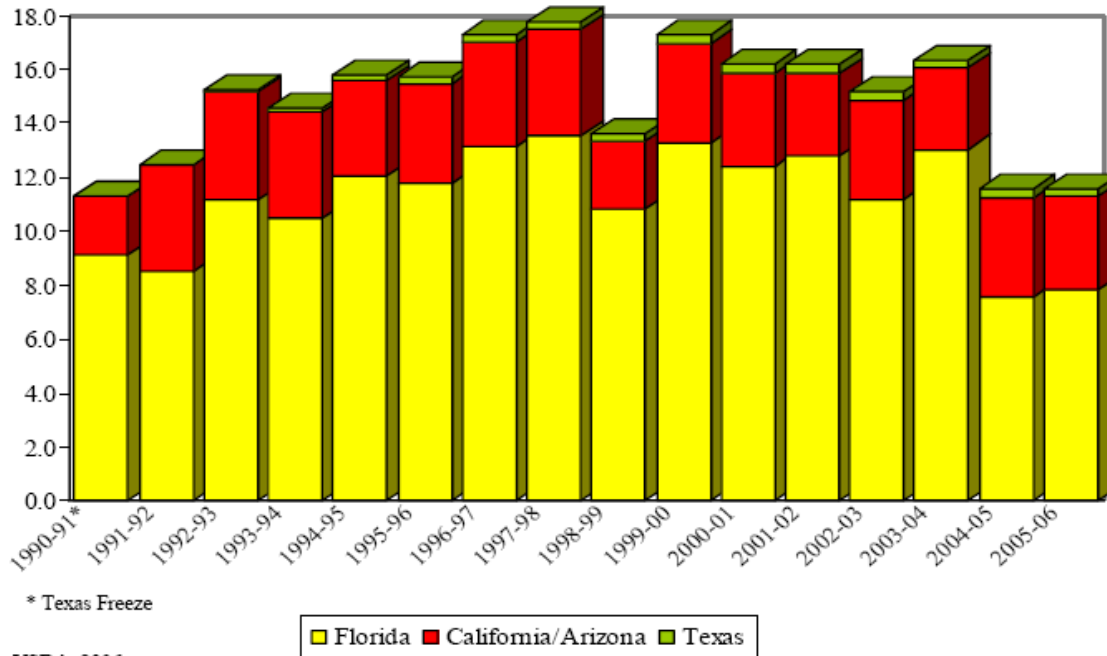
Billion \$



Source: USDA, 2006a.

Figure 2: U.S. Citrus Production by State, 1990/01- 2005/06

Million Tons



Source: USDA, 2006a.

Table 1: Marketing Seasons and Net Weight Per Box by State

<u>Oranges</u>		
State	Season	Weight/box
Arizona Early, Mids and Navel	Nov 01 - Mar 31	75 pounds
Arizona Valencias	Feb 01 - Jun 30	75 pounds
California Navels	Nov 01 - Jun 15	75 pounds
California Valencias	Mar 15 - Dec 20	75 pounds
Florida Early and Midseason	Oct 01 - Apr 01	90 pounds
Florida Valencias	Jan 01 - Jul 01	90 pounds
Texas Early, Mids and Navel	Sep 25 - Feb 15	85 pounds
Texas Valencias	Jan 15 - May 15	85 pounds

<u>Grapefruit</u>		
State	Season	Weight/box
Arizona	Nov 01 - Jun 30	67 pounds
California	Nov 01 - Oct 31	67 pounds
Florida	Sep 10 - Jul 01	85 pounds
Texas	Oct 01 - May 30	80 pounds

Figure 3: U.S. Fresh and Processing Orange Production by State, 1990/91-2005/06

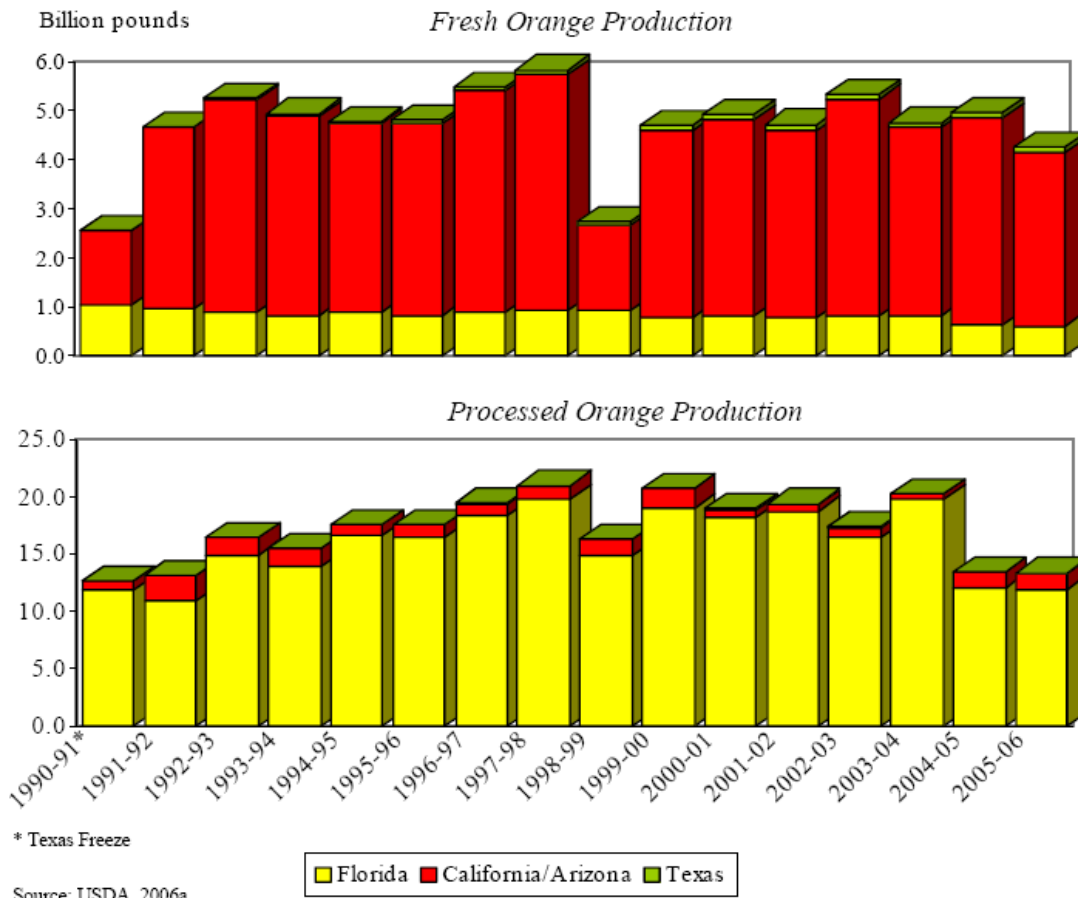


Figure 4: U.S. Fresh and Processing Grapefruit Production by State, 1990/91-2005/06

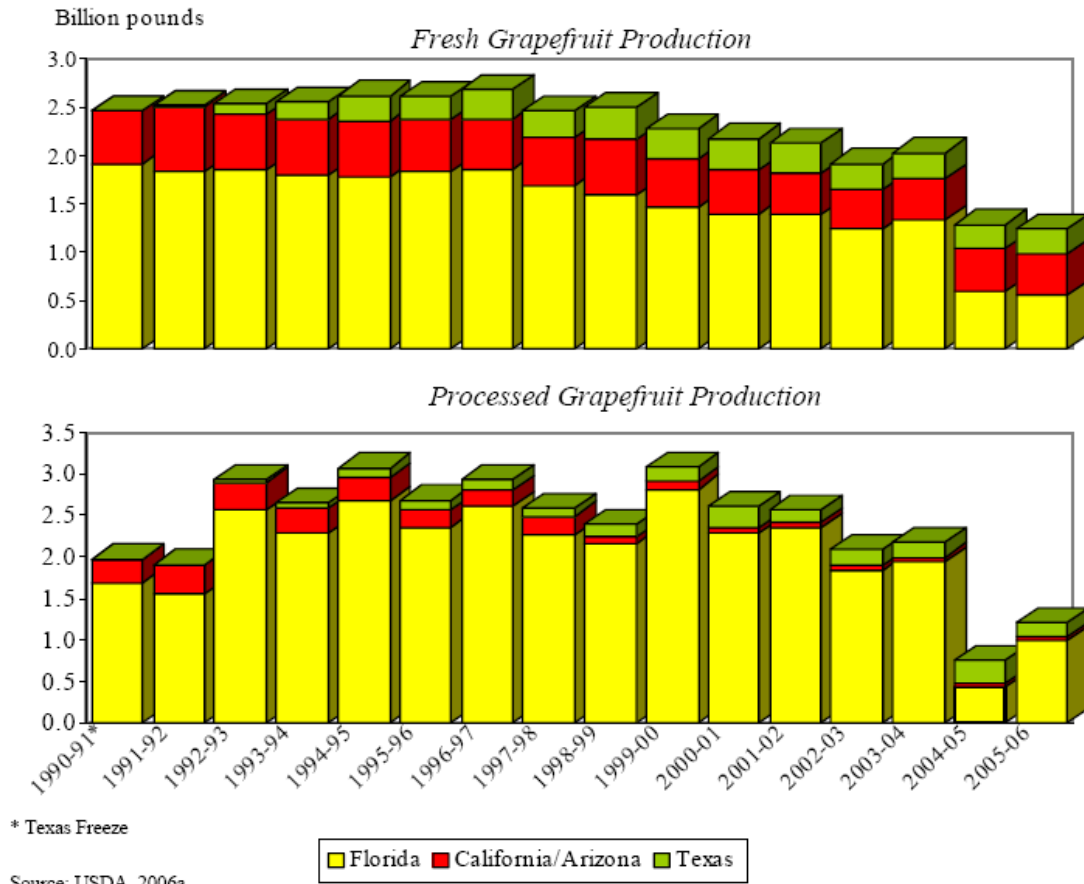
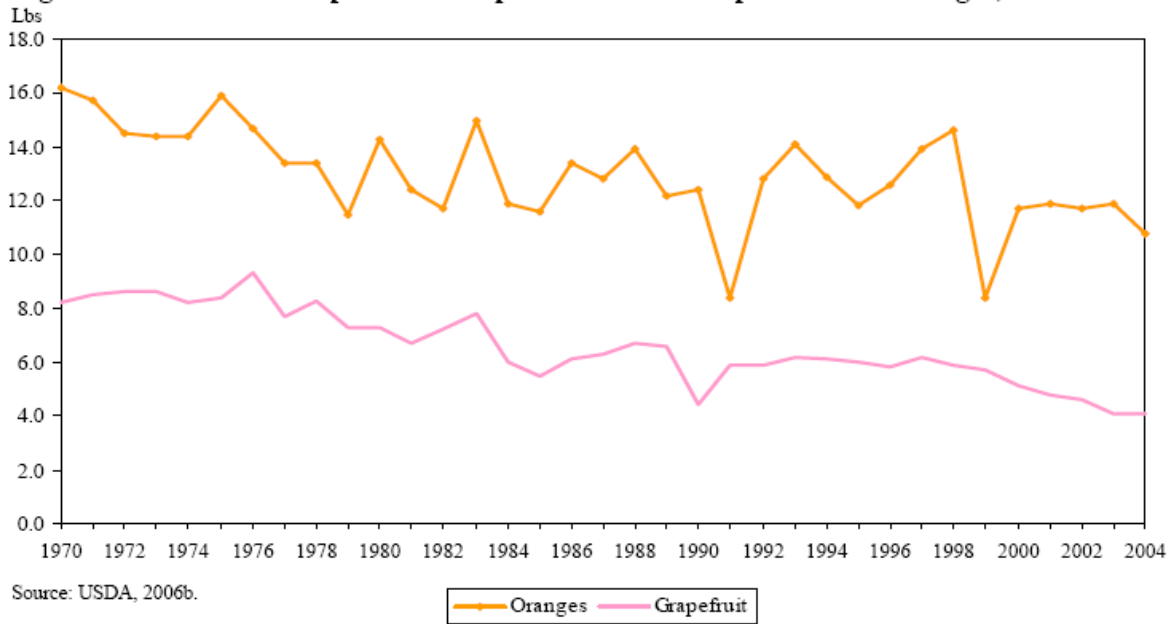


Figure 5: Annual Per Capita Consumption of Fresh Grapefruit and Oranges, 1970-2004



themselves. Hence, the impact of a freeze depends on the amount of fruit on the trees and the severity of the damages to the trees. Normally, citrus fruit can be “stored on the tree” for many weeks, allowing the marketing season to expand over a few months. However, after a freeze, the fruit must be harvested without delay to salvage fruit before it rots from freeze damage. These freeze supply shocks increase citrus prices and also have an impact on future citrus production. The location of the freeze determines the relative impact on fresh and processed citrus prices. Fresh markets are generally more affected by a freeze in California while the processed markets are influenced most by a freeze in Florida.

The Texas Citrus Industry

The Texas citrus industry is situated in the southern part of the State, concentrated almost totally in the Lower Rio Grande Valley. Hidalgo County is the leading citrus county in the State accounting for about 85% of the acreage, followed by Cameron County with 14%, and Willacy County with the remaining 1% (Sauls 2005). The total grower value of production for the State in the 2005/06 growing season was \$73.9 million on approximately 27,300 acres in production. Of the 277,000 tons of citrus produced in the 2005/06 growing season, about two-thirds were used in the fresh fruit market (Figure 6).

Grapefruit and oranges are the dominant citrus crops in the state with very little commercial production in other specialty citrus. Grapefruit typically account for 75%-80% of the production and use of the two citrus crops each year (Figure 7). The domestic U.S. and Canadian fresh fruit markets have been the primary destination for both grapefruit and oranges. Nevertheless, between 30%-40% of the grapefruit and 20%-30% of the oranges (primarily those that do not meet the fresh fruit marketing standards of the Marketing Order) are destined for juice markets each year (Figure 7). In 2004/05, over half of all grapefruit was shipped to processors.

The typical Texas grapefruit and orange marketing season begins in October and continues through May (Figure 8). Sometimes, however, depending on weather conditions, shipments of both grapefruit and oranges can begin a month earlier, as occurred in 2000/01, and/or extend for up to an additional month or more. Shipments of both citrus fruits typically peak in the first few months of each calendar year (January through February) and then trail off slowly through about May before disappearing completely until the following season as the new crop harvest begins.

Between 1996/97 and 2003/04, annual shipments of Texas grapefruit varied between about 500,000 lb and 600,000 lb. Over the same period, Texas orange shipments varied between about 135,000 lb and 200,000 lb. In 2004/05, however, extensive high temperatures beginning in the early spring and throughout the summer months combined to lower grapefruit shipments to just under 400,000 lb. Then, a few cold fronts, along with rains in October, helped fruit maturity leading to a slight increase in grapefruit shipments in 2005/06 to 428,000 lb. In contrast, Texas orange shipments improved somewhat in 2004/05 and held steady in 2005/06.

Texas citrus prices fluctuate from season to season along with shipments (Figure 9). Weather-related variability in production and shipments has a particular impact on the seasonal variation in Texas citrus prices. Although the probability of a freeze is about the same in Texas as in Florida, Texas freezes usually have a more devastating impact due to the concentration of Texas

Figure 6: Texas Citrus Production and Utilization, 1990/91-2005/06

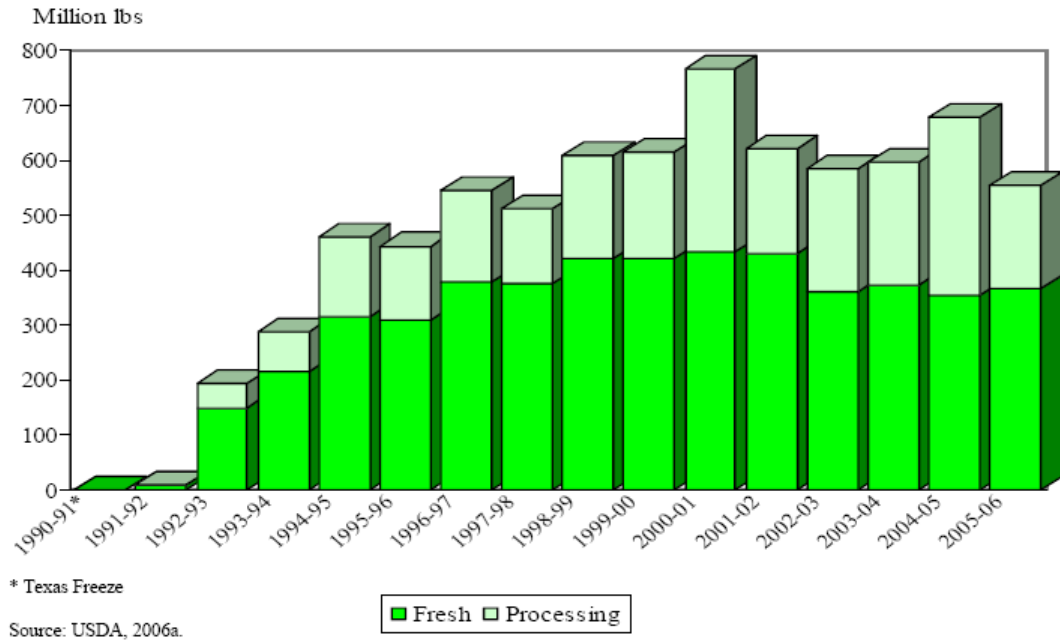


Figure 7: Texas Grapefruit and Orange Production by Utilization, 1990/91-2005/06

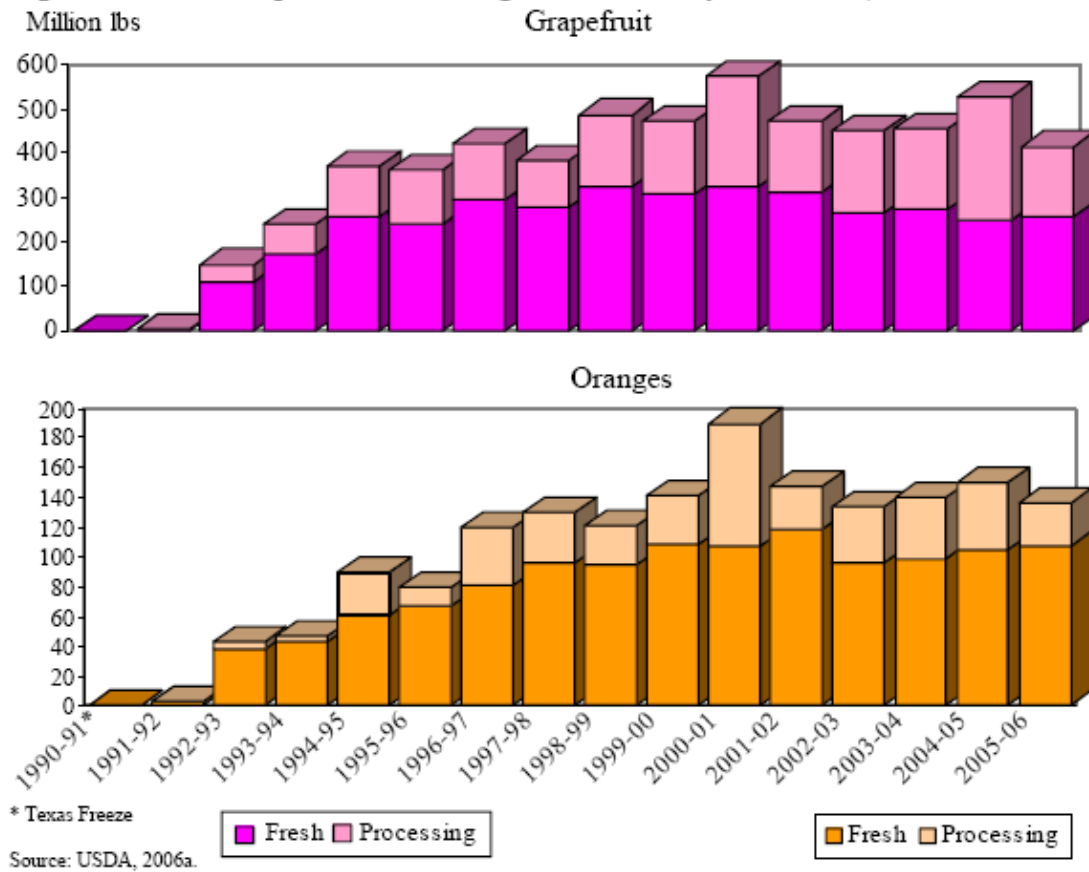


Figure 8: Texas Grapefruit and Orange Shipments, August 1996–July 2006

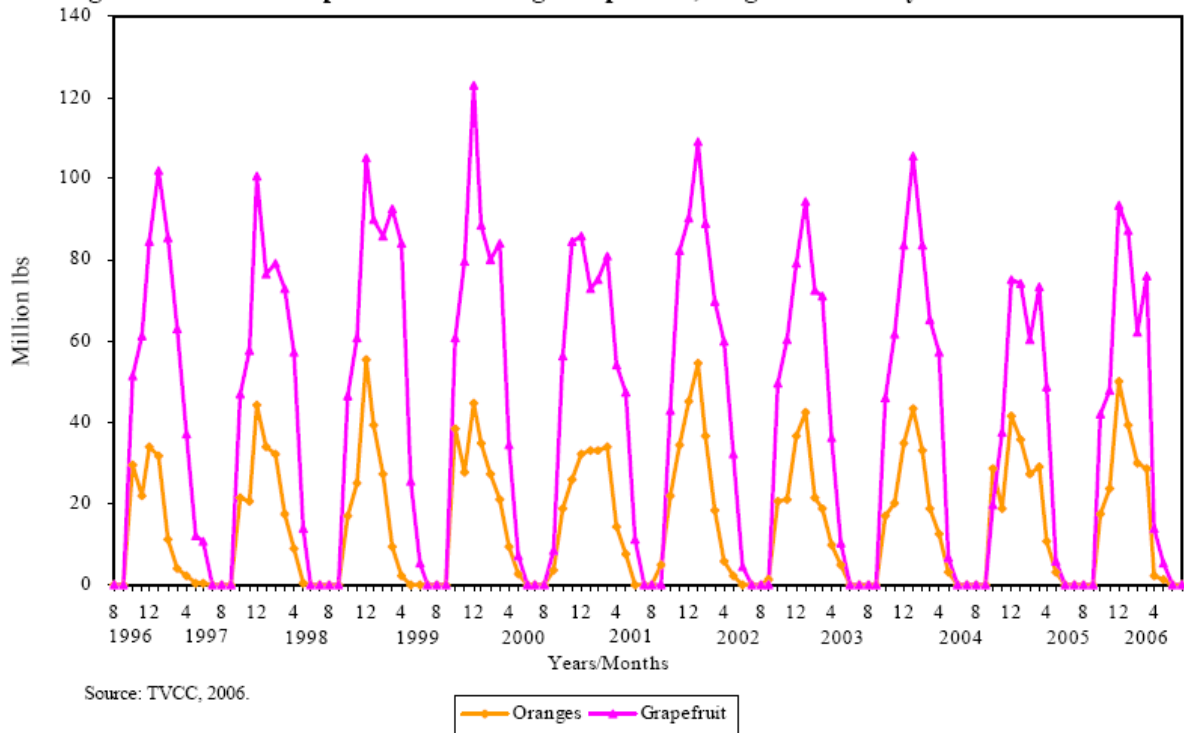
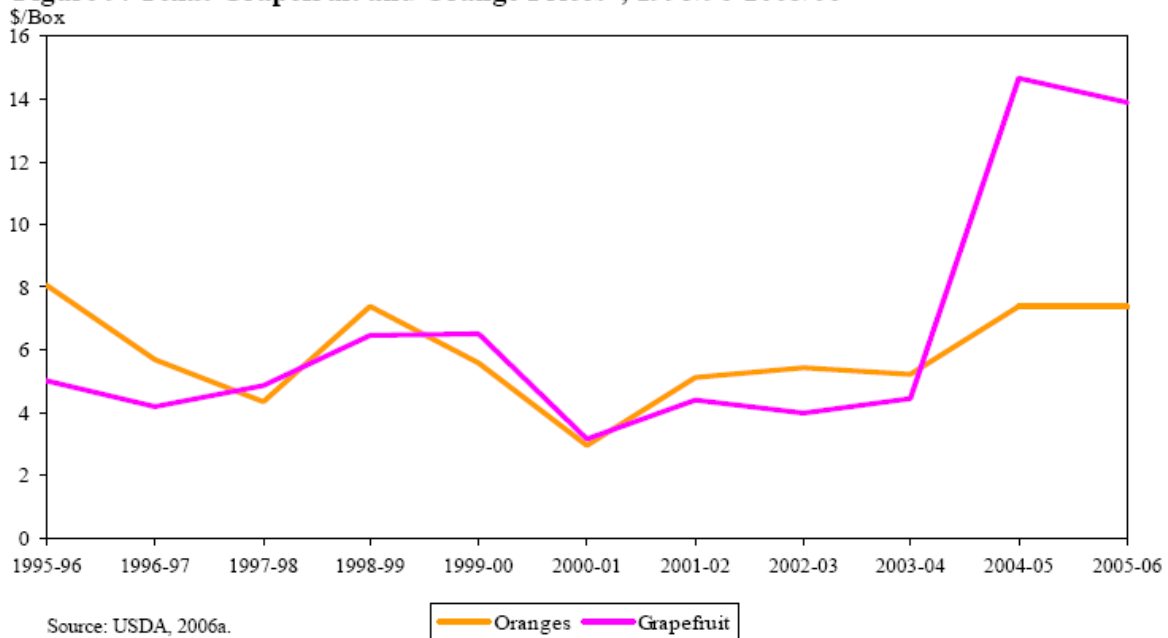


Figure 9: Texas Grapefruit and Orange Prices*, 1995/96–2005/06



* All grapefruit and oranges (fresh and processed), packinghouse door (PHD) equivalent prices calculated by deducting handling costs, such as transporting, picking, sorting, grading, packing, cooling, marketing, and other costs from base weighted free on board (fob) prices.

production in a relatively small geographic area. Thus, a freeze in the south tip of Texas damages almost all citrus production in the state. Dry weather can also lead to a run-up in prices as occurred particularly for grapefruit in 2004/05 (Figure 9). Other threats to Texas citrus production include diseases already present in Florida, such as canker and greening. Industry leaders, the Texas Department of Agriculture, Texas A&M University, and other collaborators are joining forces to assess potential damages and prevention strategies for protecting the Texas citrus industry (Sauls, 2005).

The Texas grapefruit industry has developed around various varieties of seedless, red-fleshed grapefruit with varying degrees of redness in the peel, all of which were developed in Texas from mutations of existing grapefruit. The industry has worked to create a strong brand image for its red grapefruit. The major grapefruit varieties in Texas are Ruby Red, Henderson/Ray, Rio Red, and Star Ruby. Texas markets the Ruby Red and the redder Henderson/Ray varieties under the trademarked name “Ruby-Sweet.” The Ruby-Sweet grapefruit are 3 to 5 times darker than were the original red grapefruit. They have a yellow skin with a red blush and account for less than about 25% of Texas grapefruit acreage (Sauls, 2002). The Rio Red and Rio Star varieties are marketed under the trademark “Rio Star.” The Rio Star grapefruit are 5 times darker than Ruby-Sweets and have peels with an overall red blush. Some less red Henderson varieties are marketed under the trademark “Flame” to distinguish it from the Ruby Red varieties and to capitalize on Florida's “Flame” grapefruit which are related to the Henderson variety.

In contrast to Texas grapefruit, Texas oranges do not have trademarked brand names, primarily because they are not particularly differentiated from the oranges of the same or similar varieties grown in other states. Texas produces various varieties of low acidity, thin peel oranges with a yellow peel color and generally light juice color (Sauls, 2002). Texas markets its oranges in 3 basic categories: (1) navels and early oranges; (2) mid-season oranges; and (3) late-season oranges. Navel oranges normally mature in October and are shipped through January. Their primary use is for gift packs and the fresh market. Most mid-season oranges come to market in late November through February. The late-season oranges, primarily Valencia varieties, normally achieve maturity in late January, providing a late-season surge in Texas orange shipments through May. Most Valencias are used for both the fresh market and for processing to upgrade the quality of juice from early oranges.

Texas Citrus Promotion Program

When established in 1960 through federal legislation to regulate the movement of fresh grapefruit and oranges from Hidalgo, Cameron, and Willacy Counties in the Lower Rio Grande Valley of Texas, Marketing Order 906 also authorized the assessment and collection of a fee on all cartons of grapefruit and oranges shipped from the three counties in Texas to finance the operation and administration of the Order. However, the use of the assessment revenue to fund “marketing research and development projects, including paid advertising, designed to assist, improve, or promote the marketing, distribution, and consumption of fruit” (7 CFR §906.37) was not authorized until 1966 when the Marketing Order was first amended.

The Texas Valley Citrus Committee (TVCC), which administers the Marketing Order, recommends the annual assessment rate to the U.S. Department of Agriculture (USDA) for approval. Since at least the late 1980s, the annual per carton (7/10 bushel equivalent) assessment

has averaged 12.7¢ excluding 1991/92 when no assessment rate was set as Texas citrus shipments continued to feel the effects of the devastating freeze of December 1989.

As Texas citrus shipments began to slowly recover, the per carton assessment rate jumped to record highs of 15.0¢, 18.0¢, and 16.0¢ in 1992/93 through 1994/95 before dropping to a low of 10.0¢ in 1995/96 (Figure 10). Since then, the annual per carton assessment has been fairly steady averaging about 12.0¢ except for a one-year increase to 14.0¢ in 2003/04.

Annual assessment revenue under the Marketing Order in 1989/90 was about \$440,000 before the December 1989 freeze prevented the Texas citrus industry from competing in national fresh citrus markets (Figure 10). Assessment revenue recovered to \$430,000 in 1992/93 and then jumped sharply to \$1.1 million in 1994/95 with the increased per carton assessment and the continued recovery of Texas citrus shipments following the 1989 freeze. Except for a few years of reduced shipments and/or declines in the assessment rate, assessment revenues since the mid-1990s have varied from a low of about \$1.0 million to a high of \$1.2 million. In 2004/05 and 2005/06, however, TVCC decided to reduce the assessment rate from 14.0¢/carton to 12.0¢/carton and cut back the budget for promotion. Consequently, the total citrus assessment funds dropped to \$868,000 and \$914,000 in 2004/05 and 2005/06, respectively.

The majority of the assessment revenue collected under Marketing Order 906 is allocated to TexaSweat, Inc. to fund advertising and promotion programs. With some year-to-year variation, however, the share of the assessment revenue allocated to TexaSweat has trended slowly downward since the early 1990s (Figure 11). From a high of 81% in 1993/94, the allocation of assessment revenue to TexaSweat declined to 61% in 2001/02. After a one-year jump to 78% in 2002/03, the TexaSweat share continued to decline to just over half of total assessment revenue in 2004/05 and in 2005/06.

The sharp decline in the share of total assessment revenues allocated to TexaSweat in 2004/05 and 2005/06 occurred precisely when the assessment revenues also declined which together resulted in a sharp decline in the total dollars allocated to TexaSweat for promotion in those years. From a high of about \$795,000 in 2003/04, allocations to TexaSweat fell to their lowest level in 2004/05 (\$446,000) since the freeze years of the early 1990s (Figure 11).

TexasSweet promotion program categories have traditionally included five areas of expenditure: (1) merchandising, (2) public relations, (3) conventions, (4) point-of-purchase (POP) materials, and (5) trade media advertising. *Merchandising* has included a wide variety of activities including communications with supermarkets, wholesalers, foodservice companies, and other produce buyers; various promotions to retailers, foodservice, and consumers such as recipe and other contests, giveaways, and incentives; training seminars; direct mailers; development of market profiles; sponsoring tours of buyers to the Texas citrus growing region; and much more. *Public relations* has included the development and distribution of kits with various information and promotional materials to retailers and foodservice establishments, the media, food editors, and consumers; media releases to trade magazines; materials to promote special events such as National Grapefruit Month; food writer materials; radio and TV show sponsorships; recipe development; bulletins and newsletters; and various public relations events. TexaSweat expenditures on *conventions* have typically included attending, exhibiting at, and sponsoring a

Figure 10: Total Assessments Under Marketing Order 906, TexaSweat Expenditures, and the Per Carton Assessment, FY 1989 – FY 2005

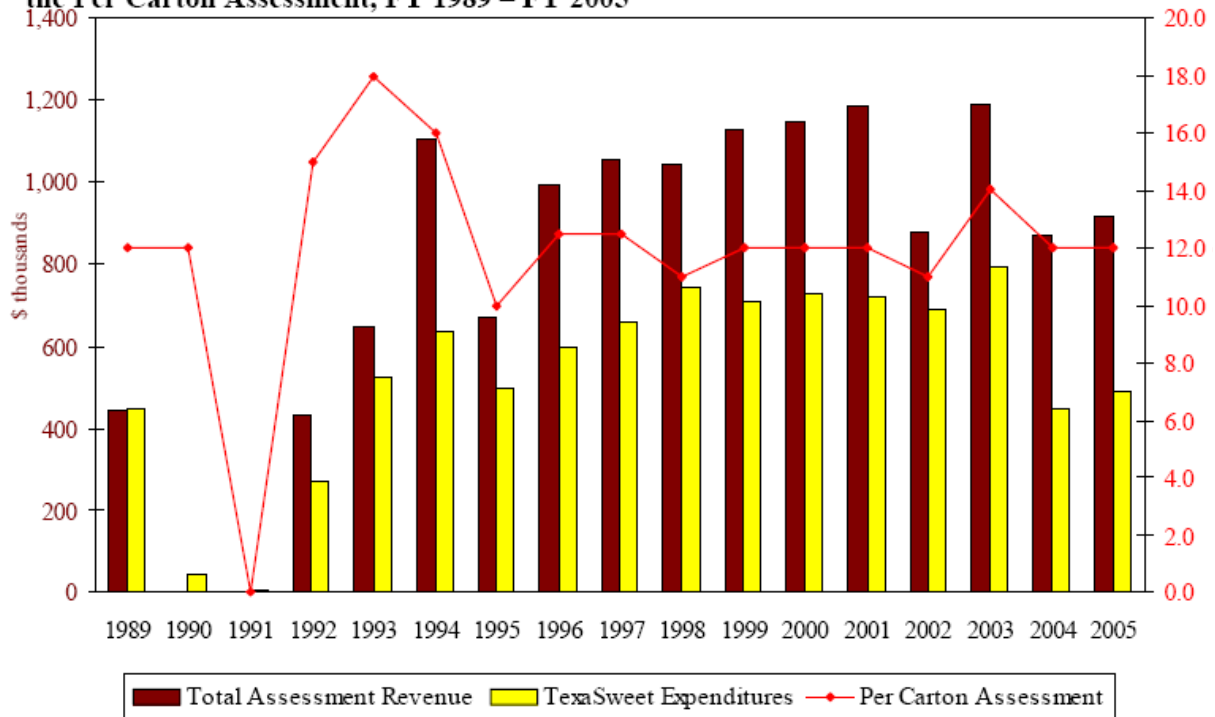
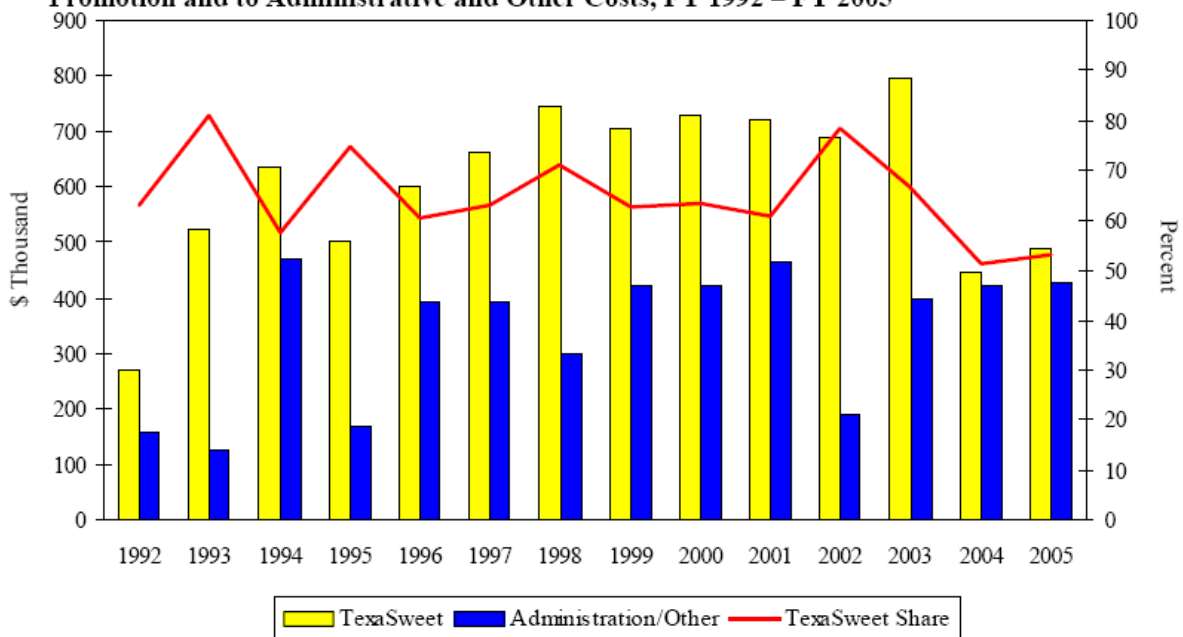


Figure 11: Allocation of Total Assessments Under Marketing Order 906 to TexaSweat for Promotion and to Administrative and Other Costs, FY 1992 – FY 2005



number of produce-related conventions, fairs, programs, and other meetings. *POP materials*, such as kits, recipe materials, retail display bin paper, and banners, are developed and distributed to supermarkets, fundraisers, and other locations where Texas citrus is sold. *Trade advertising* has primarily included placing ads in various trade publications (for example, *The Packer*, *Progressive Grocer*, and *Produce Business*) during peak periods in the market.

On average between 2000/01 and 2005/06, TexaSweat used about 54% of the funds allocated from the citrus assessment for promotion programs with the remainder for supporting administrative costs (Figure 12). Over that period, however, the promotion share of TexaSweat spending declined from about 60% in 2000/01 and 2001/02 to a little over 48% in 2004/05 and 2005/06. The largest category of expenditures, administrative cost was also the fastest growing category through 2003/04. With the decline in total assessment dollars allocated to TexaSweat in 2004/05 and 2005/06, TexaSweat cut administrative costs in an attempt to minimize the impact on the funds available for promotion programs (Figure 12). Nevertheless, the share that TexaSweat allocated to cover administrative costs in those two years became larger than the share used for promotion programs for the first time. The increase in the administrative cost share in the last two years is not surprising, however, since many costs (e.g., fixed costs and employee salaries) cannot be easily cut with reductions in overall assessment revenues if a continuous program is to be maintained from year to year despite changes in revenues.

Of the funds TexaSweat has spent on assessment-funded promotion programs since 2000/01, over 80% has been spent on merchandising and public relations activities (Figure 13). In 2000/01, merchandising accounted for the largest share of promotion expenditures (46%) followed by POP materials (21%) and public relations (18%). Trade advertising accounted for 12% of expenditures in 2000/01 and about 8% in 2001/02. Beginning with the 2002/03 marketing year (August – July), TexaSweat dropped trade advertising from its portfolio of promotional tools “due to the proliferation of advertising on behalf of the citrus shippers and the high cost of placement” (TexaSweat). POP materials was also effectively eliminated as a promotion category after 2001/02 before being revived again in 2005/06 with an allocation amounting to nearly 10% of the total funds spent on promotion. Over time, the share of promotion funds allocated to merchandising has declined steadily to only 29% in 2005/06 while the share allocated to public relations has increased to nearly 63% in 2004/05. In 2005/06, the allocation of funds to POP materials once again resulted in a smaller share being allocated to public relations that year (56%).

For several years, TexaSweat was able to leverage its promotion funds with funds from various groups for joint promotion programs and related promotional activities. In 2000/01 through 2002/03, TexaSweat received between \$150,000 and \$330,000 annually in promotion funding from various outside sources, including the Texas Department of Agriculture through the “Go Texan – Citrus” and the “Fresh from Texas” campaigns, the USDA Market Access Program (MAP) to finance promotional activities in Canada, the South Texas Onion and Melon Committees, and the Texas Produce Association (Figure 14). In those three years, this non-assessment funding accounted for 17%, 32%, and 26%, respectively, of the total funds available from all sources for citrus promotion. The outside sources of promotion funding, however, dried

up after 2002/03 resulting in an additional hit on TexaSweat promotion activities in years when funding from assessments also declined.

Figure 12: TexaSweat Expenditures By Category and the Share Allocated to Promotion, FY 2000 – FY 2005

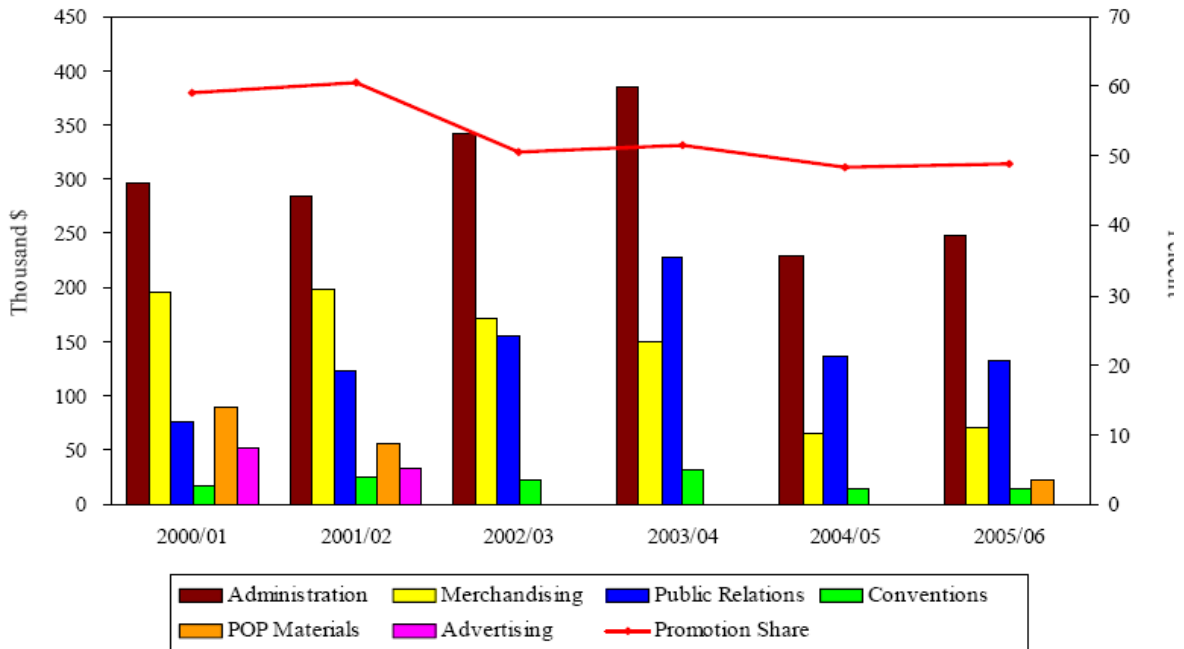


Figure 13: TexaSweat Promotion Expenditure Shares By Category, FY 2000 – FY 2005

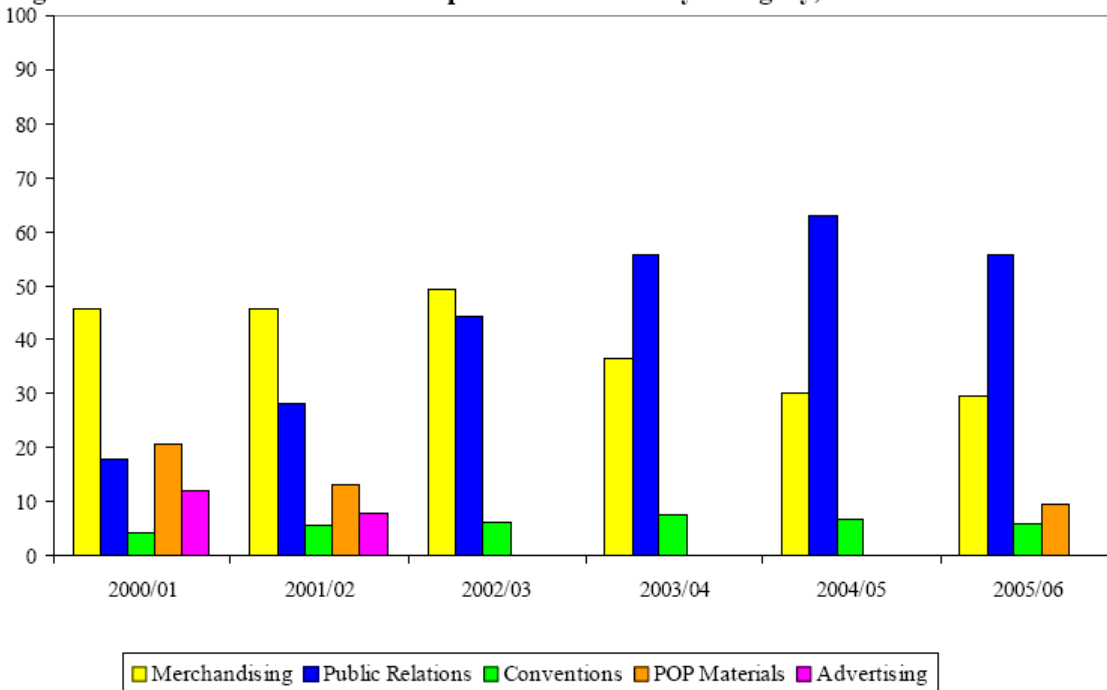


Figure 14: TexaSweat Promotion Funding from Assessment and Non-Assessment Sources, FY 2000 – FY 2005

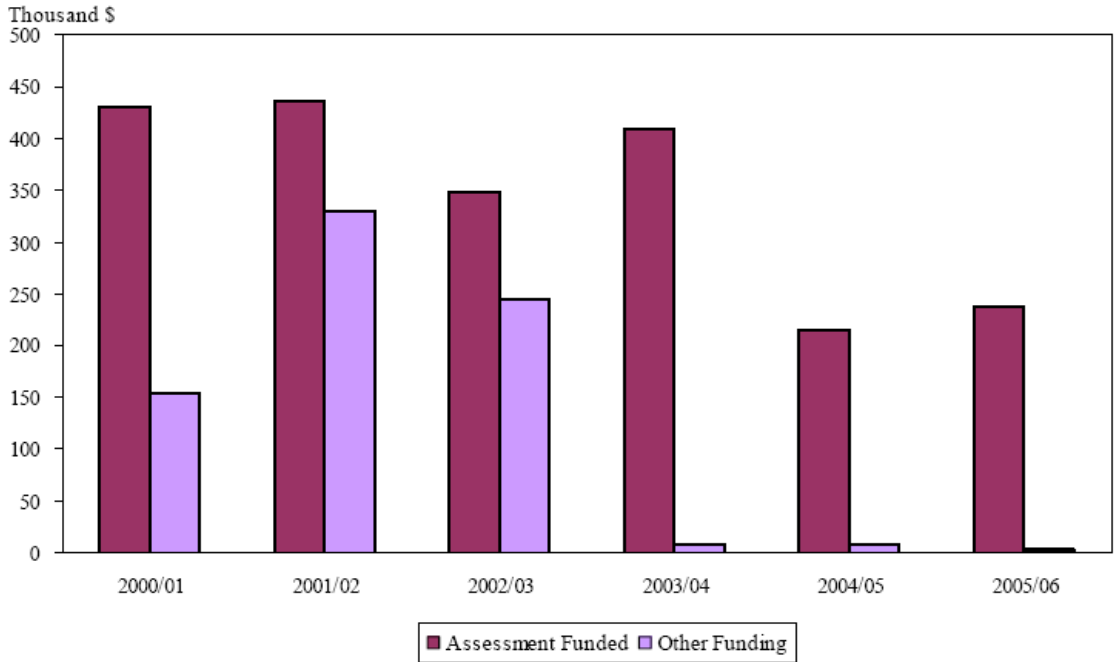
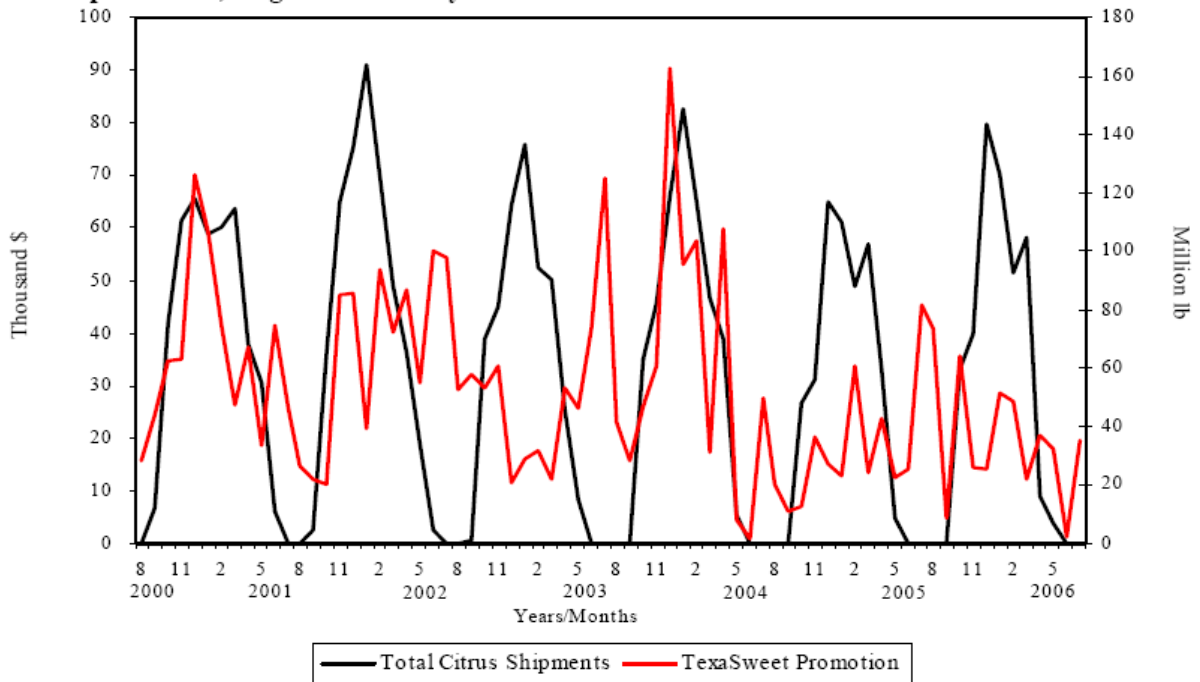


Figure 15: Monthly Distribution of Texas Citrus Shipments and TexaSweat Promotional Expenditures, August 2000 – July 2006



Although the largest share of TexaSweat promotion expenditures have typically occurred during the Texas citrus marketing year, expenditures have generally spiked in the inter-season months of June through September when there are no shipments of citrus (Figure 15). Before the drop in funding for promotion in 2004/05 and 2005/06, much of the inter-season promotional expenditures supported merchandising activities, such as personal communications with buyers to maintain contact and develop new sales opportunities for the coming production season. With the drop in funding in 2004/05 and 2005/06, promotion expenditures became more evenly distributed throughout the year. Inter-season promotion expenditures in those two years focused on public relations activities, such as the development of recipe brochures, food writer kits, and food service promotion materials to be distributed throughout the year.

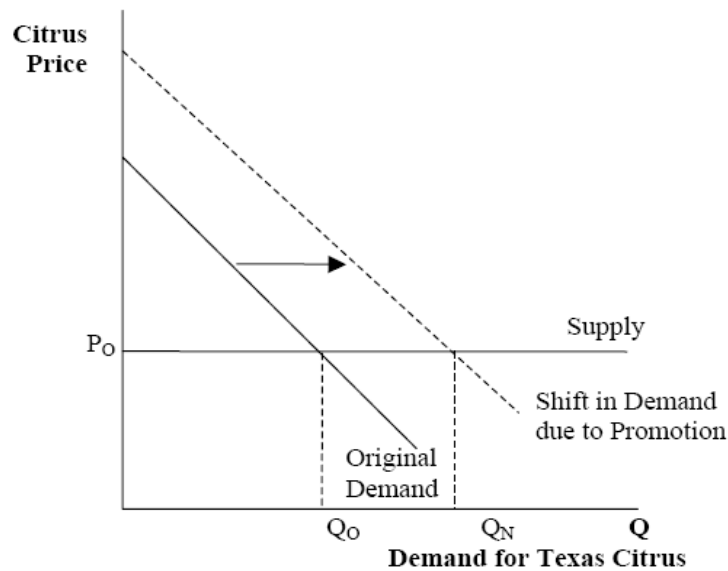
METHODOLOGY AND STATISTICAL RESULTS

Measuring the effects of promotion on the shipments of Texas citrus is simple in concept. Promotion is intended to increase the demand for Texas citrus as illustrated in Figure 16. If successful, the consequence is a shift in the demand for Texas citrus to the right. All that the analyst needs to do, then, is measure the extent of the demand shift. However, actually measuring the magnitude of any shift in the demand for Texas citrus that can reliably be attributed specifically to the promotional efforts funded under Marketing Order 906 is a good deal more complicated. Early efforts to measure the demand effects of promotion programs relied largely on anecdotal evidence and simple comparisons of gross investments in promotion and gross changes in sales. During periods of rapidly expanding markets and rising prices, this approach tends to yield some persuasive stories and even more impressive upward-sloping graphical relationships between promotion expenditures and sales. The problem with this approach, however, is that various factors other than the promotion program affect the volume and value of commodity sales, such as relative price changes, agricultural policies, changes in incomes, population growth, competition from other products, and consumer health concerns and demographics, just to name a few. The problem becomes all too apparent in years when markets turn down and prices drop. Program managers find that taking credit for rising demand and prices in good years forces them to take the blame for declining demand and prices in bad years.

Over the years, increasingly sophisticated statistical methods have been developed to isolate and measure the unique contribution of promotion programs to the performance of the sales of the commodity being promoted. Most common has been the use of econometric regression techniques and models to statistically disentangle the effects of promotion program activities on commodity sales and demand from those of other market forces. The process usually requires a large amount of historical data on not only the sales of the product and advertising expenditures over time but also data related to the many other relevant market forces that might have affected sales over the same period. The application of the statistical technique to the data allows for the measurement of the unique contribution of each market force considered, including promotion, to the change in sales observed over the years.

Even if the statistical analysis indicates that promotion programs have had a positive and statistically significant effect on market sales, however, the question remains as to whether the

Figure 16: Illustration of the Shift in Demand for Texas Citrus Due to Promotion



increase has been large enough to cover the cost of the program. For that reason, the next step in the measurement process is to use the statistical results to calculate some aggregate measure of the effectiveness of the promotion expenditures. The most commonly reported measure is the benefit-cost ratio (BCR).

Previous Research

The only previous analysis of the impact of promotion programs on citrus sales from the Texas Rio Grande Valley was completed in 1999 by the Data and Information Systems Center (DISC) at the University of Texas – Pan American (later reported in Pagan, Sethi, and Soydemir 2001). They used a bivariate vector autoregressive model using weekly data on the dollar value of trade media advertising expenditures and carton equivalent shipments over the 1993/94 to 1999/00 marketing years. They found that increases in advertising expenditures tended to increase orange shipments relatively quickly – within one week of the expenditures. On the other hand, they found that advertising had an even more immediate and relatively larger effect on grapefruit shipments. They also found that the full effect of the advertising dissipated after three weeks. Unfortunately, the DISC study considered only advertising expenditures rather than the full range of promotional activities carried out by TexaSweat. As discussed earlier, TexaSweat discontinued expenditures on advertising in 2002/03. Also, the DISC study failed to report how responsive Texas citrus sales were over the 1993/94 to 1999/00 period to changes in the advertising expenditures¹. Moreover, although the DISC study results are consistent with a conclusion that TexaSweat advertising expenditures have an effect on Texas grapefruit and orange sales, the study fails to provide any measure of the benefits or the ratio of benefits to costs related to TexaSweat advertising.

¹ In technical terms, the DISC study failed to report the estimated advertising elasticities which typically are used in studies of advertising response as measures of the effectiveness of advertising programs.

Econometric Models and Data

This study updates the DISC analysis for the more recent period of 2000/01 to 2005/06. In contrast to the DISC study, the basic analytical tool used in this study is the more well-accepted structural econometric modeling approach which provides measures of the responsiveness of citrus shipments to changes in TexaSweat spending on promotion and makes the calculation of the benefit-cost ratios associated with TexaSweat promotion expenditures possible. In addition, rather than considering only the trade media advertising expenditures, this study considers the effectiveness of all funds used by TexaSweat to promote Texas citrus.

To this end, three econometric models are developed and used to explain the effect of promotion expenditures on: (1) Texas grapefruit shipments alone, (2) Texas orange shipments alone, and (3) total Texas citrus shipments (the aggregation of grapefruit and orange shipments). The parameters of the first two models are estimated together using the seemingly unrelated regression (SUR) estimator. Because the correlation of factors embedded in the disturbance terms which are common to both equations is taken into account, the SUR estimator provides more precise estimates of the structural parameters than could be achieved by estimating the parameters of each equation separately with the ordinary least squares (OLS) estimator as is typically done. The parameters of the aggregate grapefruit and orange shipment equation are estimated separately with the OLS estimator.

The process of statistically isolating the effects of a promotion program on market variables like citrus shipments requires that the effects of other factors that may affect the market besides the promotion activities to be measured. Thus, a critical step in the evaluation of any commodity promotion program is to identify the other important factors that affect the market and then to obtain the data related to those factors. In this analysis, the primary factors other than promotion that are included in the analysis as potentially affecting Texas citrus shipment include the price of grapefruit, the price of oranges, market season, seasonality, inflation, and stickiness or inertia in citrus shipments. In essence, the statistical analysis isolates and measures the specific effects of all these factors, including promotion, on citrus shipments. The measure of the effects of promotion, then, are used to calculate the “payoff ratio,” more commonly known as the “benefit-cost ratio” (or BCR) of the expenditures designed to enhance the shipments of Texas citrus.

The analysis specifically focuses on explaining changes in monthly shipments of grapefruit, oranges, and citrus from the Rio Grande Valley over the 2000/01 through the 2005/06 marketing years², 6 marketing years in total. The general form of each of the three econometric models used for this analysis is expressed as follows:

citrus shipments = f(real packinghouse door (PHD) price of the particular citrus product; real promotion expenditures by TexaSweat; potential differences in production/shipping seasons; seasonality; and citrus shipments made in the previous month)

Grapefruit and orange shipment data are in terms of boxes (80 lb/box for grapefruit and 85 lb/box for oranges). Shipment data for all citrus (grapefruit and oranges) are aggregated together

² Texas citrus shipments generally begin in about October and end the following June. However, in a few years, as noted in an earlier section, shipments have begun a month earlier and/or ended a month later than normal.

in pounds. The promotion expenditure data used in the analysis were provided by TexaSweat Citrus Marketing, Inc. as monthly totals by category of expenditure. The citrus shipment data used were provided by the TVCC as weekly observations. The monthly data on Texas citrus prices came from the USDA (2006a and 2006b). For the analysis, the citrus prices and the promotion expenditure data were deflated by the consumer price index to form “real” prices and “real” promotion expenditures, respectively, to account for the effects of inflation. To match the periodicity of the monthly shipment and price data with the weekly promotion data for analysis, the weekly shipment data were aggregated into monthly observations. For the total citrus shipment model, the monthly prices of grapefruit and oranges were weighted by their shares of total monthly citrus shipments to form a weighted average citrus price. Each of the three models estimated accounts for potential differences across production/shipping seasons and seasonality within a particular shipping season through the use of indicator variables. Additionally, the models account for stickiness (or inertia) in citrus shipments through the use of a one-month lag of the respective dependent variable.

Although the analysis covered 6 marketing years with potentially 72 monthly observations, because shipments only occur for 8-10 months of the year beginning in about September or October of each year, only 49 monthly observations of shipments and prices of Texas citrus over the 2000/01 to 2005/06 period were available for the analysis. Recall from the previous section, however, that despite the 2-4 month hiatus in Texas citrus shipments each year, TexaSweat runs a year round promotion program and, therefore, finances promotion activities in all 12 months of the year, yielding a total of 72 monthly observations on promotion expenditures over the period of analysis. Because of seasonality in the promotion expenditures, they were seasonally adjusted using the X12 procedure developed originally by the Bureau of the Census.

A key issue in the econometric analysis was how to match up the year round seasonally-adjusted promotion expenditures with the 8-10 month marketing season of citrus shipments. Recall from the earlier discussion that inter-season promotion expenditures by TexaSweat each year are used primarily to develop materials and otherwise prepare for the following shipping season³. Consequently, for the inter-season months when there were no shipments (typically, June, July, August, and September), promotion expenditures were added together and then apportioned across the remaining months of each marketing year based on the monthly shares of total shipments in each year. The result is 49 monthly observations of promotion expenditure data where, for a given shipping season, the expenditure data in a given month is the sum of the actual expenditures made in that month plus the aforementioned apportioned sum. Recall that these expenditures were seasonally adjusted initially to remove any confounding of seasonality in citrus shipments from seasonality in advertising and promotion expenditures. Finally, the seasonally-adjusted advertising and promotion expenditures were adjusted further for inflation.

As discussed in an earlier section, shipments of Texas grapefruit and oranges are highly seasonal (see Figure 15). Over the shipping seasons of 2000/01 through 2005/06, monthly grapefruit shipments averaged roughly 750,000 boxes but ranged from a low of 57,972 boxes to a high of 1,237,790 boxes. Monthly orange shipments over the same period averaged 280,000 boxes but

³ The Texas citrus shipping season generally runs from September/October through May/June (8-10 months) whereas the marketing year is the 12 months of August through July and includes the inter-season months of June through September.

ranged from a low of 1,549 boxes to a high of 581,831 boxes. For total citrus, the average monthly shipment was close to 84 million pounds, ranging from a low of nearly 6 million pounds to a high of 148 million pounds.

Over the same period, monthly nominal prices for all Texas grapefruit and oranges (fresh and processed) at the packinghouse (PHD) averaged \$7.41/box and \$5.57/box, respectively. The nominal weighted price for both averaged roughly 8¢/lb over that same period. When adjusted for inflation, monthly prices averaged \$3.86/box for grapefruit, \$2.95/box for oranges, and about 4¢/lb for both. Monthly nominal on-tree prices averaged \$6.26/box for grapefruit and \$4.24/box for oranges. The grower share of revenue at the packinghouse door level of the marketing chain over the same period averaged 71.0% for grapefruit and 68.7% for oranges.

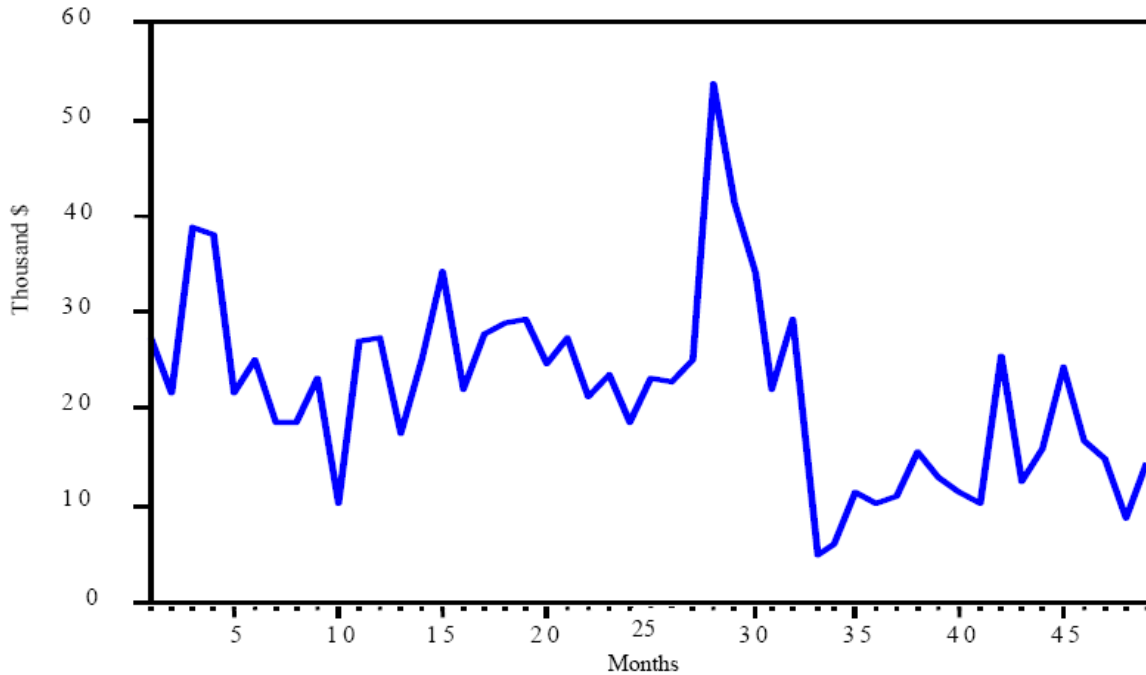
The nominal, seasonally adjusted TexaSweat promotion expenditures over the 49 citrus shipping months of 2000/01 through 2005/06 averaged roughly \$40,400/month or nearly \$490,000 annually and ranged from a low of \$9,357/month to \$99,259/month. Adjusting for inflation as well, TexaSweat promotion expenditures averaged about \$22,000/month (Figure 17).

For estimating the parameters of the three models discussed above, we assume that the relationship among the variables is linear in logarithms. This functional form assumes that the own-price and promotion elasticities of the demand for Texas citrus are constant over the sample period. Also, the use of the logarithmic transformation insures that the normal assumption of diminishing marginal returns with respect to promotion expenditures is met. Seasonality, as well as the effects of different shipping/marketing seasons, are modeled using monthly indicator (dummy) variables. Finally, the stickiness or inertia in shipments (often referred to as the “habit persistence” of buyers) is represented with a one-month lag of shipments in each model.

To account for potential carryover effects in the TexaSweat promotion program, we utilize the polynomial distributed lag (PDL) procedure often used in studies of promotion effects (see, for example, Clarke 1976; Lee and Brown 1992; and Forker and Ward 1998). The attractive features of the PDL procedure include: (1) a flexible representation of the lag structure allowing for the possibility of humped-shaped or monotonically declining lag weight distributions and (2) a parsimonious representation of the lag structure. The search for the polynomial degree and lag length associated with the carryover effects involves a series of regression estimations with various lags. We allow for carryover effects of up to eight months in the analysis, consistent with the length of the shipping season for citrus. Second and third degree polynomials are considered both in the estimation of the equation for all citrus products and for the two equations for grapefruit shipments and orange shipments estimated with SUR. Also, based on the Akaike Information Criterion (AIC) and on the Schwarz Information Criterion (SIC) statistics, both head and tail endpoint restrictions are employed in all three equations.

The AIC and SIC statistics also indicate that there are no carryover effects associated with TexaSweat promotion expenditures in either of the two equations estimated with SUR or the equation for all citrus shipments. This result also is consistent with the findings of the DISC study (1999) for the 1993/94 through 1999/00 shipping seasons. Consequently, only the contemporaneous effects of TexaSweat promotion expenditures are considered in the analysis.

Figure 17: Seasonally and Inflation-Adjusted TexaSweat Promotion Expenditures, 2000/01 – 2005/06 Shipping Seasons



Based on the AIC and SIC statistics, we also test various price expectations mechanisms involving different lag lengths on prices and find that for grapefruit and all citrus, only the contemporaneous effects of the respective prices must be considered – a sort of rational expectations result. That is, monthly purchase decisions of Texas grapefruit buyers are found to be unaffected by changes in the grapefruit price in recent months. Rather, their buying decisions are affected only by the price in the month in which they purchase the grapefruit. For oranges, however, we find that the impact of price on shipments is not felt all at once but are spread over a period of four months. That is, the orange model as estimated captures the effects of the real price of oranges on shipments through the use of a second degree polynomial distributed lag with lag length of four months. Thus, monthly purchase decisions of Texas orange buyers are affected by how orange prices have changed over the most recent four-month period.

Empirical Results

For each of the three models defined above, the empirical analysis considers three cases of effectiveness of citrus promotion programs:

Case 1: The effectiveness of TexaSweat promotion expenditures using only citrus assessment funds over the entire 2000/01 through 2005/06 marketing years. This is the central case of interest for analysis. The basic question being asked here is whether the expenditures by TexaSweat on promotion activities effectively increased Texas shipments of grapefruit and oranges.

Case 2: The effectiveness of TexaSweat promotion expenditures using only citrus assessment funds over the 2000/01 through 2003/04 marketing years compared to the 2004/05

through 2005/06 marketing years. In this case, the effects of the drop in funding during the last two shipping seasons (2004/05 and 2005/06) are analyzed. (See Figure 11 and related discussion for details). The basic question in this analysis is whether the reduction in promotion funding from the citrus assessment during 2004/05 and 2005/06 had any consequences for the effectiveness of TexaSweat efforts to promote shipments of Texas citrus.

Case 3: The effectiveness of TexaSweat promotion expenditures using citrus assessment funds plus funds from non-assessment sources over the 2000/01 through 2003/04 marketing years. In this case, the effects of leveraging the citrus funds available to TexaSweat from the citrus assessment with funds from non-assessment sources in 2000/01 through 2003/04 are analyzed. (See Figure 14 and related discussion for details). The basic question in this case is whether or not the additional funds from non-assessment sources during those years enhanced the effectiveness of TexaSweat efforts to promote shipments of Texas citrus.

All Citrus (Grapefruit and Oranges) Equation

The empirical results for the single-equation model for all citrus in all three cases are exhibited in Table 2. All estimated coefficients in each case have the proper signs and are all statistically significant at the 0.10 level. For Case 1, the goodness-of-fit (R-squared) is 0.91, meaning that the model accounts for roughly 91% of the variability in total citrus shipments. For Cases 2 and 3, the goodness-of-fit is on the order of 0.95-0.96, meaning that the models account for roughly 95%-96% of the variability in total citrus shipments.

Seasonal differences by month within shipping/marketing seasons are evident in all 3 cases. Shipment volume is highest in October, November, and December and lowest in April and May in all cases. Differences in shipment volume also are evident across shipping/marketing seasons. Habit persistence (stickiness or inertia in shipments) is somewhat evident only in Case 1.

The own-price elasticities for citrus products in Case 1 is -0.45 . The estimated price elasticity for Cases 2 and 3 are higher at -0.67 and -0.62 , respectively. The similar price elasticities for Cases 2 and 3 indicate that adding the non-assessment funding to total promotion expenditures during the 2000/01 to 2003/04 period had little effect on the price sensitivity of Texas citrus shipments. However, the reduction in assessment funding during 2004/05 and 2005/06 reduced the price sensitivity of Texas citrus shipments compared to previous years. In other words, the demand for Texas citrus became more price inelastic after assessment funding was reduced. An effective promotion program would be expected to reduce the price sensitivity of demand making the demand curve more price inelastic. The more inelastic the demand for a particular product (that is, the less price sensitive), the more loyal buyers are to that product and the less willing they become to switch to the same product from competing sources when the price changes. The conclusion, therefore, is that the reduction in funding during the 2004/05-2005/06 period actually helped improve the loyalty of buyers to Texas citrus products. This could happen if the reduction in funding forced promotion expenditures to shift to activities that more effectively enhance buyer loyalty. Recall from the earlier discussion in the section on Texas

Table 2: Single-Equation Model for Shipments of All Citrus^a

Variable	Dependent Variable: LN(CSHIPMENTS)					
	Case 1		Case 2		Case 3	
	coefficient	std error	coefficient	std error	coefficient	std error
LN(CPRICE)	-0.4470**	0.2326	-0.6712***	0.1934	-0.6164***	0.1992
LN(CPROMOA)	0.1828*	0.1265	0.2271**	0.1055		
LN(CPROMOPLUS)					0.1912**	0.1001
LN(CSHIPMENTS) _{t-1}	0.3637*	0.2047	0.1202	0.2278	0.1281	0.2332
JAN	2.2302***	0.4061	2.4161***	0.3407	2.3454***	0.3492
FEB	1.9780***	0.3989	2.2287***	0.3314	2.1624***	0.3379
MAR	1.9454***	0.3733	2.0763***	0.3050	2.0161***	0.3117
APR	1.4171***	0.3656	1.7215***	0.2922	1.6616***	0.2972
MAY	0.4289	0.3310	0.8136***	0.2511	0.7355***	0.2522
OCT	2.8519***	0.4818	2.9003***	0.4040	2.7659***	0.4214
NOV	2.3378***	0.3954	2.6266***	0.3144	2.5209***	0.3251
DEC	2.4795***	0.3864	2.6626***	0.3109	2.5956***	0.3221
SEASON2000	6.1162*	3.7986	8.9797**	3.9131	9.4338**	3.9894
SEASON2001	6.2889*	3.7988	9.2483**	3.9175	9.6491**	3.9961
SEASON2002	5.9830*	3.7910	8.9147**	3.9052	9.2938**	3.9839
SEASON2003	6.0888*	3.7790	9.0153**	3.8917	9.5036**	3.9660
SEASON2004	6.5517*	3.7160				
SEASON2005	6.4149*	3.7185				
R ² (Adj R ²)	0.9142 (0.8700)		0.9565 (0.9206)		0.9544 (0.9168)	
Log likelihood	2.4740		16.2941		15.5419	
Durbin-Watson	1.8039		1.3036		1.6645	
Durbin-h	b		b		b	
No. of Observations	48		32		32	

^a CSHIPMENTS= Monthly shipments of total citrus (grapefruit and oranges), pounds; CPRICE=Texas citrus price, inflation-adjusted, weighted average of monthly Texas packinghouse delivered (PHD) grapefruit and orange prices (\$/pound), CPROMOA=seasonally adjusted, inflation adjusted, monthly TexaSweat promotion expenditures of citrus assessment funds; CPROMOPLUS=seasonally adjusted, inflation adjusted, monthly TexaSweat promotion expenditures of citrus assessment funds plus non-assessment funds; JAN, FEB, MAR, APR, MAY, OCT, NOV, DEC=indicator variables for corresponding month in which citrus shipments occurred where JAN=1 if the month is January and 0 otherwise, etc.; SEASON200i (where i=1,2,3,4,5)=indicator variables for corresponding season of citrus shipments where the variable = 1 if the season is 2001 and 0 otherwise, etc.

^b The Durbin-h statistic is not applicable for any of the three models because the value of N times the variance of the lagged dependent variable coefficient exceeds 1 in each case.

Note: Asterisks (*, **, ***) denote that the estimated coefficient is statistically different from zero at the 10%, 5%, and 1% hypothesis levels, respectively.

from non-assessment sources actually reduced the responsiveness of orange shipments to price changes over a longer time period (four months). Also, comparing the estimated elasticities from Case 1 and Case 2 suggests that the reduction in assessment funding during 2004/05 and 2005/06 reduced the short-run and long-run price sensitivity of Texas orange shipments compared to previous years so that the demand for Texas oranges became more price inelastic. The conclusion is that the addition of funding from non-assessment sources and the reduction in funding during the 2004/05 to 2005/06 period helped improve the loyalty of buyers to Texas orange products.

The increase in shipments achieved from promotion expenditures was lower during that period because funding was lower. At the same time, the marginal effectiveness of promotional activities (that is, the change in shipments that can be achieved from a change in promotion funding) was also lower. The somewhat lower promotion elasticity of 0.191 for Case 3 compared to Case 2 implies that the marginal effectiveness of TexaSweat promotion efforts was not

enhanced by the addition of non-assessment promotion funds and may even have been slightly lower as a result. The overall impact on shipments was greater because funding was greater. But the effectiveness of each additional dollar added from non-assessment sources in promoting shipments was slightly less than the marginal effectiveness of just the assessment dollars spent on promotion.

Although the magnitudes of the estimated citrus promotion elasticities is somewhat higher than found for many checkoff commodities, they are not out of the range of those found by a number of researchers for a number of commodities (Williams and Nichols 1998). Given the low level of promotion expenditures for Texas citrus compared to the promotion expenditures for the major checkoff commodities like cotton, soybeans, beef, and pork, the somewhat higher elasticity of promotion expenditures found for Texas citrus is not unreasonable.

Grapefruit Shipment and Orange Shipment Equations

The empirical results for the grapefruit shipment and orange shipment equations estimated using the SUR estimator are exhibited in Tables 3 and 4. All estimated coefficients for both equations for all three cases considered have the expected signs and are statistically significant at the 0.10 level. The goodness-of-fit (R-squared) for both equations in all three cases are 0.90 or above. The non-zero elements of the residual correlation matrices for all three cases considered offers evidence that the SUR model is statistically superior to estimating a model for each market separately using OLS. Also, the SUR model offers gains in statistical efficiency in the estimation of the structural parameters. That is, the standard errors of the parameters in the SUR model are lower than comparable standard errors generated from estimating each equation individually with OLS. The gains in efficiency were more evident for Case 1 than for Cases 2 and 3.

Seasonal differences by month within shipping/marketing seasons are evident for both grapefruit and oranges in all 3 cases. Shipment volume for oranges is highest in December and January and lowest in April and May. Shipment volume for grapefruit is highest in October, November, and December and lowest in April and May. Differences in shipment volume also are evident across shipping/marketing seasons for both grapefruit and oranges in all three cases.

All estimated own-price elasticities for both grapefruit and oranges are in the inelastic range. The short-run own-price elasticity for orange shipments in Case 1 (TexaSweet promotion expenditures over the entire 2000/01 to 2005/06 period) is -0.11 and the long-run own-price elasticity over that period is -0.79. For Case 2 and Case 3, the short run elasticities (-0.16 and -0.13, respectively) as well as the long-run elasticities (-1.09 and -0.88, respectively) are somewhat higher than those for Case 1. As was the case for all citrus shipments, the similar price elasticities for Cases 2 and 3, at least in the short run, indicate that adding the non-assessment funding to total promotion expenditures during the 2000/01 to 2003/04 period had little effect on the month-to-month sensitivity of Texas orange shipments to price. However, the lower long-run price elasticity for Case 3 compared to Case 2 indicates that the addition of promotion funds

Table 3: Equation for Grapefruit Shipments from SUR Model^a

Variable	Dependent Variable: LN(GSHIPMENTS)					
	Case 1		Case 2		Case 3	
	coefficient	std error	coefficient	std error	coefficient	std error
LN(GPRICE)	-0.7624***	0.1806	-0.7918***	0.1559	-0.7573***	0.1574
LN(CPROMOA)	0.2645***	0.1066	0.3008***	0.0894		
LN(CPROMOPLUS)					0.2728****	0.0837
LN(GSHIPMENTS) _{t-1}	0.1473	0.1338	0.1751	0.1569	0.1509	0.1582
JAN	2.2914***	0.3103	2.1661***	0.2490	2.0968***	0.2523
FEB	2.0129***	0.3035	1.9732***	0.2381	1.9106***	0.2397
MAR	1.9110***	0.2903	1.8011***	0.2246	1.7437***	0.2265
APR	1.4184***	0.2875	1.4671***	0.2206	1.4188***	0.2213
MAY	0.2203	0.2759	0.5208***	0.2053	0.4416**	0.2034
OCT	2.6800***	0.4047	2.8995***	0.3437	2.7324***	0.3508
NOV	2.4895***	0.3243	2.5336***	0.2565	2.4254***	0.2619
DEC	2.5032***	0.3115	2.4317***	0.2454	2.3678***	0.2510
SEASON2000	7.3302***	2.0982	6.5953***	2.1521	7.1784***	2.1260
SEASON2001	7.6385***	2.1107	6.8868***	2.1636	7.4151***	2.1430
SEASON2002	7.2185***	2.1060	6.4625***	2.1555	6.9564***	2.1368
SEASON2003	7.3858***	2.0975	6.6350***	2.1433	7.2818***	2.1129
SEASON2004	8.2431***	2.0646				
SEASON2005	8.1228***	2.0842				
R ² (Adj R ²)	08988 (0.8466)		0.9.352 (0.8818)		0.9342 (0.8800)	
Durbin-Watson	1.6903		1.5654		1.9210	
Durbin-h	2.8566 ^b		2.6677 ^b		0.5005 ^b	
No. of Observations	48		32		32	

^a GSHIPMENTS= Monthly Texas shipments of grapefruit, boxes; GPRICE=Texas grapefruit price (fresh and processed), inflation-adjusted, packinghouse delivered (PHD), (\$/box); CPROMOA=seasonally adjusted, inflation adjusted, monthly TexaSweat promotion expenditures of citrus assessment funds; CPROMOPLUS=seasonally adjusted, inflation-adjusted, monthly TexaSweat promotion expenditures of citrus assessment funds plus non-assessment funds; JAN, FEB, MAR, APR, MAY, OCT, NOV, DEC=indicator variables for corresponding month in which grapefruit shipments occurred where JAN=1 if the month is January and 0 otherwise, etc.; SEASON200i (where i=1,2,3,4,5) = indicator variables for corresponding season of grapefruit shipments where the variable=1 if the season is 2001 and 0 otherwise, etc.

^b The Durbin-h statistic is not particularly meaningful when the coefficient of the lagged dependent variable is not statistically significant.

Note: Asterisks (*, **, ***) denote that the estimated coefficient is statistically different from zero at the 10%, 5%, and 1% hypothesis levels, respectively.

from non-assessment sources actually reduced the responsiveness of orange shipments to price changes over a longer time period (four months). Also, comparing the estimated elasticities from Case 1 and Case 2 suggests that the reduction in assessment funding during 2004/05 and 2005/06 reduced the short-run and long-run price sensitivity of Texas orange shipments compared to previous years so that the demand for Texas oranges became more price inelastic. The conclusion is that the addition of funding from non-assessment sources and the reduction in funding during the 2004/05 to 2005/06 period helped improve the loyalty of buyers to Texas orange products.

The own-price elasticity for grapefruit shipments in Case 1 is estimated to be -0.76 while the own-price elasticities for grapefruit for Cases 2 and 3 were estimated to be -0.79 and -0.76,

Table 4: Equation for Orange Shipments from SUR Model^a

Variable	Dependent Variable: LN(OSHIPMENTS)					
	Case 1		Case 2		Case 3	
	coefficient	std error	coefficient	std error	coefficient	std error
LNOPRICE	0.0226***	0.0074	0.0311***	0.0076	0.0253***	0.0084
LN(CPROMOA)	0.0695	0.1213	0.1383	0.1026		
LN(CPROMOPLUS)					0.0220	0.1018
LN(OSHIPMENTS) _{t-1}	0.1518**	0.0723	0.0921	0.0645	0.0976	0.0660
JAN	5.9346***	0.3217	6.1972***	0.2377	6.1451***	0.2448
FEB	5.5070***	0.3153	5.6255***	0.2264	5.6083***	0.2366
MAR	5.1405***	0.3115	5.0734***	0.2341	5.1046***	0.2529
APR	4.1426***	0.3047	4.2803***	0.2217	4.2958***	0.2352
MAY	3.3481***	0.2862	3.5664***	0.1962	3.5210***	0.1988
OCT	5.6889***	0.3064	5.7511***	0.2352	5.6985***	0.2396
NOV	5.55475***	0.3091	5.8567***	0.2202	5.7931***	0.2234
DEC	6.1057***	0.3121	6.3755***	0.2235	6.3252***	0.2291
SEASON2000	5.1787***	1.3419	5.2551***	1.1870	6.2972***	1.2617
SEASON2001	5.2987***	1.2932	5.4196***	1.1024	6.3610***	1.1648
SEASON2002	5.2331***	1.3059	5.3651***	1.1136	6.3081***	1.1884
SEASON2003	5.3273***	1.3050	5.5040***	1.1037	6.4349***	1.1283
SEASON2004	5.64361***	1.2251				
SEASON2005	5.3013***	1.2531				
R ² (Adj R ²)	0.9572 (0.9327)		0.9835 (0.9671)		0.9826 (0.9652)	
Durbin-Watson	1.5095		1.5121		1.6196	
Durbin-h	1.9815 ^b		1.4821 ^b		1.1598 ^b	
No. of Observations	48		32		32	

^a OSHIPMENTS= Monthly Texas shipments of oranges, boxes; LNOPRICE=-5*LN(OPRICE)-8*LN(OPRICE)_{t-1}-9*LN(OPRICE)_{t-2}-8*LN(OPRICE)_{t-3}-5*LN(OPRICE)_{t-4} where OPRICE=Texas orange price, inflation-adjusted, packinghouse delivered (PHD), (\$/box); CPROMOA=seasonally adjusted, inflation adjusted, monthly TexaSweat promotion expenditures of citrus assessment funds; CPROMOPLUS=seasonally adjusted, inflation-adjusted, monthly TexaSweat promotion expenditures of citrus assessment funds plus non-assessment funds; JAN, FEB, MAR, APR, MAY, OCT, NOV, DEC=indicator variables for corresponding month in which orange shipments occurred where JAN=1 if the month is January and 0 otherwise, etc.; SEASON200i (where i=1,2,3,4,5)=indicator variables for corresponding season of grapefruit shipments where the variable = 1 if the season is 2001 and 0 otherwise, etc.

^b The Durbin-h statistic is not particularly meaningful when the coefficient of the lagged dependent variable is not statistically significant.

Note: Asterisks (*, **, ***) denote that the estimated coefficient is statistically different from zero at the 10%, 5%, and 1% hypothesis levels, respectively.

respectively. Given the similarity of the estimated elasticities in the three cases, the conclusion is that neither the addition of funding from non-assessment sources during the 2000/01-2003/04 period or the reduction in funding from the citrus assessment in 2004/05-2005/06 had any perceptible effect on the elasticity of demand for Texas grapefruit.

For all three cases, the estimated effects of promotion expenditures on shipments of Texas oranges are not statistically different from zero. In other words, promotion expenditures were found to be ineffective in shifting out the demand for Texas oranges. Thus, while promotion has had a tendency to make the demand curve more price inelastic and, therefore, enhance buyer loyalty, promotion has not been effective in shifting out the demand for Texas oranges.

The same is not true for the effect of promotion on grapefruit shipments, however. The promotion elasticity for grapefruit shipments in Case 1 is estimated to be 0.264, meaning that a

10% increase in promotion funding increases Texas grapefruit shipments by 2.6%. The somewhat higher promotion elasticity of 0.301 in Case 2 indicates that the marginal effect of expenditures declined when funding was reduced in 2004/05 and 2005/06. Recall that this was also the result for the case of all citrus shipments. As for all citrus, this result for grapefruit indicates that the increase in grapefruit shipments achieved from promotion expenditures was lower during that period because funding was lower and that the marginal effectiveness of promotional activities (that is, the change in shipments that can be achieved from a change in promotion funding) was also lower. As was the case for all citrus, the promotion elasticity in Case 3 (assessment and non-assessment sources of promotion funding in 2000/01 through 2003/04) at 0.273 is lower than in Case 2 (only assessment sources of promotion funding in the same period) indicating that the addition of funding from non-assessment sources in 2000/01 to 2003/04 reduced the marginal effectiveness of promotion in shifting the demand for grapefruit. Again, the total effect on shipments was larger because funding was larger but an increase in shipments achieved with each additional dollar added from non-assessment sources was lower.

Again, these findings suggest a highly effective promotion program for grapefruit at least compared to many of the major checkoff commodities. This result is neither unexpected nor unreasonable given the size of the Texas citrus promotion program. Bottom line, the TexaSweat promotion effort has significantly affected the volume of grapefruit shipments but not the volume of orange shipments.

ANALYSIS OF THE EFFECTIVENESS OF TEXAS CITRUS PROMOTION

The econometric results presented in the previous section allows an analysis of the two key questions that are the specific focus of this study: (1) What have been the effects of the promotion programs funded under Marketing Order 906 on shipments of Texas grapefruit and oranges? and (2) What has been the return on the investment made under Marketing Order 906 on promotion of sales of Texas grapefruit and oranges?

In analyzing the answer to first question, the focus is on whether the expenditures of citrus assessment revenues under Marketing Order 906 by TexaSweat to promote Texas citrus have effectively and consistently increased the shipments of Texas grapefruit and oranges over the six-year period of 2000/01 to 2005/06. The analysis of the answer to the second question (whether there has been any return to Texas citrus promotion activities) emphasizes the Benefit-Cost Ratio (BCR) related to Texas citrus promotion which is calculated as the dollar increase in sales per promotion dollar spent over the 2000/01 to 2005/06 period. The BCR for the promotion of Texas citrus is calculated at both the packinghouse and grower levels.

The econometric results also provide insight into at least two related questions of potential interest: (1) What effect did the drop in assessment revenues allocated for promotion in 2004/05 and in 2005/06 have on shipments of Texas grapefruit and oranges and on the return to the investment in promotion? and (2) What effect did the leveraging of promotional funds by TexaSweat (with funds from USDA, Texas Department of Agriculture, and other non-assessment sources) during the 2000/01 to 2003/04 period have on the level of shipments of Texas grapefruit and oranges and on the return to the investment in promotion?

Effects of Promotion on Shipments of Texas Grapefruit and Oranges

Based on the results from the econometric models presented in the previous section, the Texas citrus promotion program under the direction of TexaSweat Citrus Marketing, Inc. effectively shifted out the demand for Texas grapefruit over the 2000/01-2005/06 shipping seasons. The results indicate that promotion expenditures over that period added 198,915 boxes monthly to grapefruit shipments for a total of 9,746,832 boxes over the five seasons that would have not been grown or shipped in the absence of the promotion program (Table 5). In terms of additional industry revenues, the analysis indicates that the promotion program added an average of over \$1.1 million per month for a total of over \$56.1 million over the same six seasons that would not have been added if the promotion program had not been in place.

For Texas oranges, however, the analysis indicates that promotion expenditures had no statistically discernible effect on shipments. This result is not surprising for several reasons. First, as discussed in an earlier section, Texas oranges are not particularly differentiated from the oranges of the same or similar varieties grown in other states. Compared to Texas grapefruit, Texas oranges are more of a generic commodity so that promotion efforts are less likely to increase the demand for Texas oranges than for Texas grapefruit. Given the efforts of states like California to differentiate their fresh oranges in the minds of consumers and the much larger promotion budgets and programs they operate, Texas promotion is unlikely to have a measurable effect on orange shipments. The DISC study also found a much smaller effect of advertising on Texas orange shipments than they found for grapefruit. At the same time, a close study of the annual TexaSweat marketing plans for the 2000/01 through 2005/06 marketing years reveals that grapefruit are the exclusive program focus of the specific objectives and strategies of TexaSweat promotion programs each year. Oranges are not mentioned even once in the specific program element objectives or strategies for any marketing year for any of the last six marketing years. Evidently, TexaSweat has understood the inherent difficulty in attempting to promote Texas oranges and has focused on grapefruit where promotion programs are likely to be more effective and the bang for the buck likely to be greater.

The statistical analysis also found, however, that promotion has played a role in increasing the loyalty of buyers to Texas oranges. The results show clearly that the demand for Texas oranges is becoming more price inelastic meaning that buyers are increasingly less likely to switch to oranges from other sources given a change in the price of Texas oranges. This result is good news because the implication is that a weather-induced run-up in the price of Texas oranges relative to the price of oranges from other sources is increasingly less likely to drive buyers away from Texas oranges as a result of promotion efforts related to oranges.

In the last two seasons of the study period (2004/05 and 2005/06), TVCC cut back the TexaSweat budget which reduced expenditures on promotional activities by TexaSweat from an annual average of about \$386,000 in the first three seasons of the study period (2000/01 through 2003/04) to an annual average of about \$218,000 a decline of nearly 44% (Table 5). The

Table 5: Benefit-Cost Analysis of Texas Citrus Promotion, 2000/01 – 2005/06¹

	Grapefruit			Oranges ²		
	First Three Seasons (2000/01-2003/04)	Last Two Seasons (2004/05-2005/06)	All Seasons (2000/01-2005/06)	First Three Seasons (2000/01-2003/04)	Last Two Seasons (2004/05-2005/06)	All Seasons (2000/01-2005/06)
Additional Shipments (boxes)						
Monthly Average	242,272	109,492	198,915	--	--	--
Annual Average	1,998,742	875,933	1,624,472	--	--	--
Total	7,994,967	1,751,865	9,746,832	--	--	--
Average Monthly Price (\$/box)						
	3.89	14.26	5.75	--	--	--
Additional Revenue (\$)						
Monthly Average	942,473	1,561,350	1,144,531	--	--	--
Annual Average	7,775,105	12,490,797	9,347,002	--	--	--
Total	31,110,421	24,981,594	56,082,015	--	--	--
Promotion Expenditures¹ (\$)						
Monthly Average	46,770	27,222	40,387	--	--	--
Annual Average	385,850	217,773	329,824	--	--	--
Total	1,543,400	435,545	1,978,945	--	--	--
Benefit-Cost Ratio (\$/\$)						
Packinghouse Level	20.1	57.4	28.3	--	--	--
Grower Level	14.1	40.2	19.8	--	--	--
Shipment BCR (boxes/\$)						
	5.2	4.0	4.9	--	--	--

¹ The analysis includes only promotion expenditures from assessment funds and not from non-assessment sources.

² Promotional expenditures were found to have no statistically significant effect on Texas orange shipments.

statistical analysis demonstrates that the reduction in funding for promotion in the last two years limited the impact of promotion on the demand for Texas grapefruit. From an average annual impact of nearly 2.0 million boxes in the first three seasons, the effect of promotion dropped by more than half to an average of about 876,000 boxes in the last two seasons (Table 5). However, because market forces boosted the average price per box between the first three seasons and the last two seasons by almost four-fold from \$3.89 to \$14.26, the additional earnings generated by the promotion programs in each year actually increased in the last two seasons despite the fewer boxes added by promotion in each of those two seasons. From an annual average of \$7.8 million in the first three seasons, the sharp increase in the price of grapefruit increased the added annual earnings from promotion to \$12.5 million.

As discussed in connection with Figure 14, TexaSweat leveraged its promotion funds from assessment sources with non-assessment funds from various groups for joint promotion programs and related promotional activities during the first three seasons of the study period (2000/01 through 2002/03). The analysis indicates that the non-assessment promotion funds added nearly 522,000 boxes a year to shipments of Texas grapefruit and more than \$2.0 million to total revenues over what was added by the assessment funds spent by TexaSweat on promotion during those years (Table 6).

Benefit-Cost Analysis of Texas Citrus Promotion Programs

Although the Texas citrus promotion program over the last six years has effectively increased the demand for Texas grapefruit as shown in the previous section, the critical question is whether the cost of achieving the increase has been less than the revenues generated by the increased demand. To explore this question, the statistical results can be used to calculate a benefit-cost ratio (BCR) as a measure of the cost effectiveness of the promotion program. The standard BCR is calculated as the net revenues generated (that is the gross revenues from additional shipments minus the cost of the promotion) divided by the cost of the promotion program. If the calculated BCR is greater than one, the promotion program can be considered to be “effective” because more than one dollar in shipment revenue is generated for every dollar spent. On the other hand, if the calculated BCR is less than one, the program would be considered to be “ineffective.”

The BCR is calculated at both the packinghouse and the grower levels. From the econometric results presented in the previous section, we first calculate the BCR at the packinghouse door level. Over the shipping seasons from 2000/01-2005/06, the grapefruit grower share of packinghouse door dollars averaged 71.0%. Consequently, we calculate the BCR at the grower level assuming that the grapefruit grower share of packinghouse door dollars is about 70%.

One problem with the BCR as a measure of “effectiveness” is that for a given expenditure of promotion funds, the BCR in one period can be higher than the BCR in another period simply because the market price is different in the two periods. For example, let’s say that the same promotion expenditure is made in two different years and generates exactly the same increase in shipments in both years. However, if the price is higher in the second year due to weather problems or other issues, the calculated BCR will be higher in the second year because the revenue from the shipments will be higher in that year even though the number of boxes shipped is the same in both years. For this reason, we also provide a “shipment” BCR calculated as the increase in the number of boxes of citrus shipped for every dollar spent on promotion. Because the price is no longer involved, this measure of BCR provides a better indication of the cost effectiveness of the promotion program in expanding shipments of citrus.

Over the full six-season analysis of the Texas citrus program, the BCR to grapefruit promotion at the packinghouse level is 28.3 (19.8 at the grower level) (Table 5). In other words, for every dollar spent on promotion over the 2000/01 through 2005/06 period, the return to the Texas grapefruit industry at the packinghouse level was \$28 in additional revenues (\$20 at the grower level) from increased shipments of grapefruit. This return is revenue that would not have been earned by the industry had it not been for the TexaSweat promotion programs. Comparing the grapefruit BCR for the first three seasons (2000/01 through 2003/04) to that of the last two

Table 6: Effects of Leveraging TexaSweat Promotion Funds in 2000/01-2003/04

	Grapefruit			Oranges ¹		
	Assessment Funds Only	Added by Non-Assessment Funds	Total Promotion Funds	Assessment Funds Only	Added by Non-Assessment Funds	Total Promotion Funds
Additional Shipments (boxes)						
Monthly Average	242,272	63,268	305,540	--	--	--
Annual Average	1,998,742	521,962	2,520,704	--	--	--
Total	7,994,967	2,087,848	10,082,815	--	--	--
Average Monthly Price (\$/box)	3.89	3.89	3.89	--	--	--
Additional Revenue (\$)						
Monthly Average	942,675	246,113	1,188,788	--	--	--
Annual Average	7,777,071	2,030,543	9,897,614	--	--	--
Total	31,108,282	8,121,729	39,230,011	--	--	--
Promotion Expenditures (\$)						
Monthly Average	46,770	22,195	68,965	--	--	--
Annual Average	385,850	183,107	568,957	--	--	--
Total	1,543,400	732,428	2,275,828	--	--	--
Benefit-Cost Ratio (\$/\$)						
Packinghouse Level	20.1	11.1	17.2	--	--	--
Grower Level	14.1	7.9	12.1	--	--	--
Shipment BCR (boxes/\$)	5.2	2.9	4.4	--	--	--

¹ Promotional expenditures were found to have no statistically significant effect on Texas orange shipments.

seasons (2004/05 through 2005/06), the calculated BCR jumped dramatically from 20.1 to 57.4 (14.1 to 40.2 at the grower level) despite a reduction in promotion funding during the last two seasons and a reduction in the marginal effectiveness of promotion expenditures. This result occurs because the average price of grapefruit in the first three seasons of \$3.89/box jumped to \$14.26/box in the last two seasons (see Figure 9 and related discussion). Consequently, a more reasonable measure of the effectiveness of the TexaSweat promotion efforts is given by the Shipment BCR. The Shipment BCR dropped from 5.2 boxes per promotion dollar spent in the first three seasons to 4.0 boxes per promotion dollar spent in the last two seasons (Table 5).

Earlier, the reduction in the average monthly and annual impacts of promotion on grapefruit shipments in the last two years was attributed to the reduction in citrus assessment funds allocated to Texas Sweet for promotion. Because the number of boxes of grapefruit being added each month to total shipments as a result of promotion dropped at the same time that the funding dropped, one would not necessarily expect that the additional boxes shipped per dollar spent on

promotion would necessarily fall. Then why did the Shipment BCR drop in the last two years of the study period? At least two factors likely worked together to reduce the cost effectiveness of promotion expenditures during that period:

- *Reduced Proportion of Funding Spent on Promotion in the Last Two Years*

Recall from the discussion related to Figure 12 that the reduction in assessment funding allocated to TexaSweat for promotion was accompanied by a reduction in the proportion of those funds that TexaSweat used to fund promotion activities. In those two years, the share TexaSweat allocated to cover administrative costs became larger than the share used for promotion programs for the first time as they struggled to cover fixed costs and employee salaries to maintain a continuous program despite revenue changes. The consequence, however, was that for every dollar of assessment funds allocated to TexaSweat, the less the average impact of those dollars on grapefruit shipments.

- *A Change in TexaSweat Promotion Emphasis*

In the last two to three years of the study period, TexaSweat changed its promotion strategy from the historical emphasis on merchandising, advertising, and POP materials to concentrating on public relations as its primary promotional tool (see Figure 13 and related discussion). To the extent that the public relations activities funded were less effective than the combination of activities previously funded, the lower the average impact of the funds spent on promotion would have been in the last two to three years of the study period.

Finally, as shown in Table 6, even though the non-assessment funds spent on promotion during the first three years of the study period added boxes to grapefruit shipments that would not have been shipped otherwise, the average effectiveness of those funds in promoting grapefruit shipments during that period was lower than the effectiveness of the assessment funds spent on promotion. The BCR of the non-assessment funds was 7.9 at the grower level compared to 14.1 for assessment funds. The Shipment BCR for the non-assessment funds during that period was 2.9 boxes per dollar spent compared to 5.2 boxes per assessment dollar spent on promotion. There may be many reasons why the return to the non-assessment funding was lower during those years. Most importantly, perhaps, is that the expenditure of funds from non-assessment sources is typically for joint promotion programs and related promotional activities that are less focused on the specific promotional goals and objectives of the promotion organization than is the expenditure of funds exclusively from assessment sources.

As noted earlier for the estimated promotion expenditure elasticities, these calculated BCRs seem high at least relative to those generally reported for the larger commodity promotion programs (Williams and Nichols (1998)). Given the low level of promotion expenditures for Texas citrus compared to the promotion expenditures for the major checkoff commodities like cotton, soybeans, beef, and pork, the somewhat higher BCRs found for Texas citrus are not unreasonable. The higher BCRs would imply that while Texas citrus promotion efforts have been successful, the promotion activities also are greatly under-funded. Both experience and the theory of advertising suggest strongly that a substantial increase in funding over time would likely reduce the Texas citrus BCR to levels more in line with those of the better-funded commodity promotion programs.

Summary and Conclusions

This study of the effectiveness of Marketing Order 906 in promoting Texas grapefruit and oranges was requested by TVCC in compliance with the FAIR Act promotion evaluation requirement. Specifically, this study focuses on the answers to two key questions:

- What have been the effects of the promotion programs funded under Marketing Order 906 on shipments of Texas grapefruit and oranges?
- What has been the return on the investment made under Marketing Order 906 on promotion of sales of Texas grapefruit and oranges?

The Texas citrus industry is situated in the southern part of the state, concentrated almost totally in the Lower Rio Grande Valley. Grapefruit and oranges are the dominant citrus crops in the state with very little commercial production in other specialty citrus. The typical Texas grapefruit and orange marketing season begins in October and continues through May with shipments of both citrus fruits typically peaking in the first few months of each calendar year. Texas citrus prices fluctuate from season to season along with shipments. Weather-related variability in production and shipments has a particular impact on the seasonal variation in Texas citrus prices.

The Texas grapefruit industry has developed around various varieties of seedless, red-fleshed grapefruit with varying degrees of redness in the peel, all of which were developed in Texas from mutations of existing grapefruit. The industry has worked to create a strong brand image for its red grapefruit. Texas also produces various varieties of low acidity, thin peel oranges and markets them in 3 basic categories: (1) navels and early oranges; (2) mid-season oranges; and (3) late-season oranges. Navel oranges normally mature in October and are shipped through January. Most mid-season oranges come to market in late November through February. The late-season oranges, primarily Valencia varieties, normally achieve maturity in late January, providing a late-season surge in Texas orange shipments through May.

Marketing Order 906 was established through federal legislation in 1960 to regulate the movement of fresh grapefruit and oranges from the Lower Rio Grande Valley of Texas. Although the Marketing Order was authorized to assess and collect a fee on all cartons of grapefruit and oranges shipped from Texas to finance the operation and administration of the Order, the use of the assessment revenue to fund promotional activities was not authorized until 1966 when the Marketing Order was first amended. The Texas Valley Citrus Committee (TVCC) administers the Marketing Order and recommends to USDA for approval the annual assessment rate to be applied. Over the last several years, the annual per carton (7/10 bushel equivalent) assessment has varied from 11¢ to 14¢. Currently, the rate is set at 12¢/carton. Except for a few years of reduced shipments and/or declines in the assessment rate, assessment revenues since the mid-1990s have varied from a low of about \$1.0 million to a high of \$1.2 million. In 2004/05 and 2005/06, however, TVCC decided to reduce the assessment rate from 14.0¢/carton to 12.0¢/carton and cut back the budget for promotion leading to a drop in total citrus assessment funds to \$868,000 and \$914,000 in 2004/05 and 2005/06, respectively.

The majority of the assessment revenue collected under Marketing Order 906 is allocated to TexaSweat, Inc. to fund promotion programs but the share allocated to TexaSweat has declined since the early 1990s. From a high of 81% in 1993/94, the allocation of total assessment revenue to TexaSweat declined to just over half of total assessment revenue in 2004/05 and in 2005/06.

The sharp decline in the share of total assessment revenues allocated to TexaSweat in 2004/05 and 2005/06 occurred precisely when the total assessment revenues also declined which together resulted in a sharp decline in the total dollars allocated to TexaSweat for promotion in those years. From a high of about \$795,000 in 2003/04, allocations to TexaSweat fell to their lowest level in 2004/05 (\$446,000) since the freeze years of the early 1990s.

TexaSweat promotion program categories have traditionally included five areas of expenditure: (1) merchandising, (2) public relations, (3) conventions, (4) point-of-purchase (POP) materials, and (5) trade media advertising. Since 2000/01, TexaSweat has used about 54% of the funds allocated from the citrus assessment for promotion programs with the remainder for supporting administrative costs. However, the promotion share of TexaSweat spending declined since 2000/01 from about 60% to a little over 48%. The decline in total assessment dollars allocated to TexaSweat in 2004/05 and 2005/06 forced them to cut administrative costs but the share that allocated to cover administrative costs in those two years became larger than the share used for promotion programs for the first time.

TexaSweat has spent over 80% of promotion funds on merchandising and public relations activities. POP materials was effectively eliminated as a promotion category after 2001/02 and advertising in 2002/03. Over time, the share of promotion funds allocated to merchandising has declined steadily while the share allocated to public relations has increased. For a few years (2000/01 through 2002/03), TexaSweat leveraged its promotion funds with funds for joint promotion programs and related promotional activities from various other groups.

Although the largest share of TexaSweat promotion expenditures have typically occurred during the Texas citrus marketing year, expenditures have typically spiked in the inter-season months of June through September when there are no shipments of citrus. Before the drop in funding for promotion in 2004/05 and 2005/06, much of the inter-season promotional expenditures supported merchandising activities. With the drop in funding in 2004/05 and 2005/06, promotion expenditures became more evenly distributed throughout the year and inter-season promotion expenditures focused on public relations activities.

The only previous analysis of the impact of promotion programs on citrus sales from the Texas Rio Grande Valley was completed in 1999 by the Data and Information Systems Center (DISC) at the University of Texas – Pan American. Although finding that TexaSweat advertising had an effect on Texas grapefruit and orange sales, the DISC study considered only advertising expenditures rather than the full range of promotional activities carried out by TexaSweat. The DISC study also failed to report how responsive Texas citrus sales were to changes in the advertising expenditures or to provide any measure of the benefits derived.

This study updates the DISC analysis for the more recent, six-year period of 2000/01 to 2005/06. In contrast to the DISC study, the basic analytical tool used in this study is the more well-accepted structural econometric modeling approach which provides measures of the

responsiveness of citrus shipments to changes in TexaSweat spending on promotion and makes the calculation of the benefit-cost ratios associated with TexaSweat promotion expenditures possible. Also, rather than considering only advertising expenditures, this study considers the effectiveness of all funds used by TexaSweat to promote Texas citrus.

Three econometric models are developed and used to explain the effect of promotion expenditures on: (1) Texas grapefruit shipments alone, (2) Texas orange shipments alone, and (3) total Texas citrus shipments (the aggregation of grapefruit and orange shipments). For each of the 3 estimated, the empirical analysis considers 3 cases of effectiveness of citrus promotion programs: (1) *Case 1* - the effectiveness of TexaSweat promotion expenditures using only citrus assessment funds over the entire 2000/01 through 2005/06 marketing years; (2) *Case 2* - the effectiveness of TexaSweat promotion expenditures using only citrus assessment funds over the 2000/01 through 2003/04 marketing years compared to the 2004/05 through 2005/06 marketing years; and (3) *Case 3* - the effectiveness of TexaSweat promotion expenditures using citrus assessment funds plus funds from non-assessment sources over the 2000/01 through 2003/04 marketing years.

Case 1 is the central case of interest for analysis. The basic question being asked is whether the expenditures of assessment funds on promotion activities by TexaSweat effectively increased Texas shipments of grapefruit and oranges. In *Case 2*, the effects of the drop in funding during the last two shipping seasons (2004/05 and 2005/06) are analyzed. The basic question in this analysis is whether the reduction in promotion funding from the citrus assessment during 2004/05 and 2005/06 had any consequences for the effectiveness of TexaSweat efforts to promote shipments of Texas citrus. *Case 3* is an analysis of the effects of leveraging the promotion funds available to TexaSweat from the citrus assessment with funds from non-assessment sources in 2000/01 through 2003/04. The basic question in this case is whether or not the additional funds from non-assessment sources during those years enhanced the effectiveness of TexaSweat efforts to promote shipments of Texas citrus.

Salient results from the statistical analysis of all citrus shipments include the following:

- *Citrus shipments are price-inelastic.* Monthly citrus shipments are relatively insensitive to monthly price changes. The estimated own-price elasticities estimated for all three cases for all citrus shipments implies: (1) that the reduction in assessment funding during 2004/05 and 2005/06 reduced the price sensitivity of Texas citrus shipments compared to previous years and helped improve the loyalty of buyers to Texas citrus products and (2) the non-assessment funding of promotion (2000/01-2003/04) had little effect on the price sensitivity of Texas citrus shipments.
- *Citrus shipments have been impacted by promotion.* The promotion elasticity for all citrus products over the full six seasons is estimated to be 0.183 which means that for every 10% increase in promotion expenditures, shipments of citrus increase by 1.8%, all other factors held constant. Comparing the estimated promotion elasticities in all three cases considered indicates that: (1) the marginal effectiveness of TexaSweat promotion programs declined when funding was reduced during the 2004/05-2005/06 period and (2) the marginal effectiveness of TexaSweat promotion efforts was not enhanced by the addition of non-assessment promotion funds and may even have been slightly lower as a result.

Salient results from the statistical analysis of *orange shipments and grapefruit shipments* include the following:

- *Orange shipments and grapefruit shipments are individually price inelastic.* Monthly shipments of both grapefruit and oranges individually are relatively insensitive to monthly

price changes. A comparison of the estimated price elasticities for grapefruit and oranges in all three cases reveals that: (1) adding the non-assessment funding to total promotion expenditures during the 2000/01 to 2003/04 period reduced the long-run price sensitivity of Texas oranges but had no effect on the price sensitivity of grapefruit shipments and (2) the reduction in assessment funding during 2004/05 and 2005/06 reduced the price sensitivity of Texas orange shipments but not grapefruit shipments. The implication is that both the addition of non-assessment sources of promotion funding during 2000/01-2003/04 as well as the reduction in funding during the 2004/05-2005/06 period actually helped improve the loyalty of buyers to Texas oranges but not to Texas grapefruit.

- *The estimated effects of promotion expenditures on shipments of Texas oranges are not statistically different from zero.* Promotion expenditures were found to be ineffective in shifting out the demand for Texas oranges. Thus, while promotion has had a tendency to make the Texas orange demand curve more price inelastic, and, therefore, enhance buyer loyalty, promotion has not been effective in shifting out the demand for Texas oranges.

- *Promotion has had a highly statistically significant effect on Texas grapefruit shipments.* The promotion elasticity for grapefruit shipments over the full six seasons is estimated to be 0.264, meaning that a 10% increase in promotion funding increases Texas grapefruit shipments by 2.6%. Comparing the promotion elasticities for grapefruit in the three cases indicates that: (1) that the marginal effect of promotion expenditures on grapefruit shipments declined when funding was reduced in 2004/05 and 2005/06 and (2) the addition of funding from non-assessment sources (2000/01-2003/04) reduced the marginal effectiveness of promotion in shifting out the demand for Texas grapefruit.

The results of the statistical analysis are the basis for the analysis of the two key questions that are the specific focus of this study: (1) What have been the effects of the promotion programs funded under Marketing Order 906 on shipments of Texas grapefruit and oranges? and (2) What has been the return on the investment made under Marketing Order 906 on promotion of sales of Texas grapefruit and oranges? The following are key conclusions related to those two questions:

Effects of the Citrus Promotion Programs on Texas Grapefruit and Orange Shipments

- The Texas citrus promotion program has effectively shifted out the demand for Texas grapefruit over the 2000/01-2005/06 shipping seasons. The program added an average of 198,915 boxes monthly (\$1.1 million) and 9,746,832 boxes (\$56.1 million) in total to Texas grapefruit shipments over the last six shipping seasons.
- The promotion expenditures had no statistically discernible effect on shipments of Texas oranges over the last six seasons (the study period). This result is not surprising for several

reasons: (1) Texas oranges are not particularly differentiated from the oranges of the same or similar varieties grown in other states and thus, are more of a generic commodity than Texas grapefruit and less susceptible to promotion efforts; (2) the DISC study also found a much smaller effect of advertising on Texas orange shipments than for grapefruit; and (3) grapefruit are the exclusive program focus of the specific objectives and strategies of TexaSweat promotion programs each year.

- Promotion has played a role in increasing the loyalty of buyers to Texas oranges but not to grapefruit. For grapefruit, promotion has tended to shift out the demand rather than reduce the price elasticity of demand.
- The reduction in funding for promotion over the last two years limited the impact of promotion on the demand for Texas grapefruit. From an average annual impact of nearly 2.0 million boxes in the first three seasons, the annual promotion-induced increase in grapefruit shipments dropped by more than half to an average of about 876,000 boxes in the last two seasons.
- Despite the fewer boxes of grapefruit added annually by promotion in the last two seasons, a market-led jump in the average price per box boosted the average annual additional earnings generated by promotion from \$7.8 million in the first three seasons to \$12.5 million in the last two seasons.
- Leveraging assessment funds with non-assessment sources of promotion funds added nearly 522,000 boxes annually in 2000/01-2003/04 to Texas grapefruit shipments and more than \$2.0 million annually during those years to industry revenues.

Return on the investment in the promotion of sales of Texas grapefruit and oranges

- The BCR to grapefruit promotion at the packinghouse level was 28.3 (19.8 at the grower level) meaning that for every dollar spent on promotion from 2000/01 through 2005/06, the return to the Texas grapefruit industry at the packinghouse level was \$28 in additional revenues (\$20 at the grower level) from increased shipments of grapefruit.
- The grapefruit shipment BCR averaged 4.9 boxes per promotion dollar meaning that for every dollar spent on promotion over the last six seasons, grapefruit shipments increased by an average of 4.9 boxes.
- The grapefruit shipment BCR dropped from 5.2 boxes per promotion dollar spent in the first three seasons to 4.0 boxes per promotion dollar spent in the last two seasons perhaps because: (1) the proportion of funding spent on promotion by TexaSweat in last two seasons dropped and (2) TexaSweat shifted promotion strategies away from merchandising and other historical promotion methods to public relations as the main tool for citrus promotion.
- The average effectiveness of the non-assessment funds used to promote grapefruit shipments in the first three seasons of the study was lower than the effectiveness of the assessment funds spent on promotion perhaps because the expenditure of funds from non-assessment sources is typically for joint promotion programs and related promotional activities that are less focused on the specific promotional goals and objectives of the promotion organization than is the expenditure of funds exclusively from assessment sources.

- The calculated BCR for grapefruit is high relative to those generally reported for the larger commodity promotion programs but not unexpected or unusual for smaller promotion programs with low levels of promotion expenditure.
- The relatively high BCR for Texas grapefruit promotion implies that while Texas citrus promotion efforts have been successful, the promotion activities also are greatly under-funded. Both experience and the theory of advertising suggest strongly that a substantial increase in funding over time would likely reduce the Texas citrus BCR to levels more in line with those of the better-funded commodity promotion programs.

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