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THE ESTIMATED IMPACT OF ADDITIONAL GENERIC ADVERTISING EXPENDITURE ON FLORIDA FRESH GRAPEFRUIT SHIPMENT

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The Florida Department of Citrus (FDOC) is going to propose an increase in the box tax on fresh grapefruit from 30 cents per box to 40 cents per box for the 2000-01 season. The additional 10 cents of tax will be earmarked to promote fresh grapefruit in the domestic market. The Economic and Market Research Department was asked to predict the impact of this increased tax revenue on fresh grapefruit shipment and on growers' revenue.

Florida ships fresh grapefruit to both domestic and foreign markets. In recent years, Florida has shiped about 40 million cartons of fresh grapefruit. This season, 1999-00, shipment are expected to be down at 32.5 million cartons. Table 1 shows that domestic fresh grapefruit shipment decreased steadily from 24 million cartons in 1978-79 to 15 million cartons in 1998-99, a decrease of 37% over this time period. Exports of fresh grapefruit to Europe increased from 3 million cartons to 8 million cartons during the same period, an increase of 45%. Exports of fresh grapefruit to Japan also increased from 7 million cartons in 1978-79 to 12 million cartons in 1988-89, then decreased to about 10 million cartons in the late 1990s. Exports of fresh grapefruit to Canada have been around 3 million cartons during the same period. Because grapefruit shipments to domestic and foreign markets are interrelated, four markets (domestic, Japan, Europe, and Canada) were studied as a system.

The demand equations employed in this study specify that the total Florida fresh grapefruit fruit demand by a particular country depends on the price charged by Florida wholesalers, the exchange rate, a time trend, and FDOC advertising expenditures. Formally, the demand equation can be written as

(1) $\qquad q_{it} = f_i\left(r_{it}(p_{it}/cpi_{it}), r_{it}(m_{it}/cpi_{it}), t\right)$

where subscript i and t refer to the ith country and the tth year, respectively; q is the quantity demand in million cartons; r is the exchange rate, the number of units of foreign currency per US dollar; p is the FOB price of Florida fresh grapefruit in US dollars per carton; cpi is the consumer price index; and m is the FDOC advertising expenditure in thousands of US dollars. Note that in (1), both FOB price and FDOC advertising expenditures are deflated by the CPI to reflect real purchasing power. For the US equation, $r_{it} = 1$, i.e., a dollar equals a dollar in the U.S. A double logarithmic functional form[1] was used, i.e.,

(2) $\qquad ln\ q_{it} = \alpha_0 + \alpha_1\ ln\ (p_{it}/cpi_{it}) + \alpha_2\ ln\ (m_{it}/cpi_{it}) + \alpha_3\ ln\ t + \varepsilon_{it};$

where ε if the disturbance term. FOB prices for white seedless and colored seedless grapefruit of the Indian River district were used in this study. Since export prices are not available, colored seedless grapefruit FOB prices were used as proxies of export prices for grapefruit exported to Europe and Canada, and white seedless grapefruit FOB prices were used as proxies of the export prices for grapefruit sent to Japan. Colored seedless grapefruit FOB prices were used in the domestic demand equation. The time trend variable runs from 1 for 1978-79 to 21 for 1998-99.

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[1] A linear functional form was also tried, but based on the goodness-of-fit, the double logarithmic functional form was chosen.

Because the demand relationships represented by (2) are measured in common points in time, it is likely that the errors across these demand equation are related. When the errors are correlated across equations and ordinary least squares estimators are used, it is easily shown that the results are unbiased but no longer efficient. Therefore, the seemingly unrelated regression (SUR) technique was used to estimate the parameters in the set of country equation (2). Results are presented in Table 2. Note that the parameter estimates are demand elasticities.

Results in Table 2 show that the demand for fresh grapefruit is price inelastic, i.e., a one percent increase in price would decrease the demand for fresh grapefruit by less than one percent. Exports to Japan and Europe are relatively more price elastic than the demand in the domestic and Canadian markets. Results also show that there was a negative time trend in the domestic and Japanese markets while there was a positive time trend in exports to Europe. In addition, results show that FDOC generic advertising expenditures had a positive impact on the demand for fresh grapefruit in all markets studied, although the estimate for the Canadian market was insignificant.

In order to estimate the impact of the additional advertising expenditures on the demand for Florida fresh grapefruit, the following formula was used

(3) $$dq_{it} = \alpha^{*}(p_{it}/cpi_{it})^{\alpha_1} t^{\alpha_3}[(m_{it}^{1}/cpi_{it})^{\alpha_2} - (m_{it}^{0}/cpi_{it})^{\alpha_2}]$$

where dq represents the change in the demand for Florida fresh grapefruit due to a change in generic expenditure from m^{0} to m^{1}; $\alpha^{*} = \exp(\alpha_0)$; and αs are the demand parameter estimates from (2).

The approved budget for marketing fresh grapefruit is $2.241 million for the 1999-00 season. It is expected that fresh grapefruit shipment will reach 20 million boxes in the 2000-01 season. In other words, there will be an additional $2 million for domestic fresh grapefruit advertising. In this study, it is assumed that generic expenditure would increase from $2.241 million to $4.241 million in the 2000-01 season. The current FOB price is about $7.86 per carton for Indian River colored grapefruit. It is assumed that this price will not change[2] for the 2000-01 season. The CPI for 2000-01 is assumed to be 1.322 (1990 = 100), an increase of about 3% from 1999-00.

The result from (3) shows that under the assumption that FDOC's advertising and promotional activities are as effective as they had been in the past, the addition of $2 million in the fresh grapefruit advertising expenditure would increase domestic fresh grapefruit shipments by 792,353 cartons. The average cost is $2.52 per carton ($2 million/0.792 million cartons) or about $5.04 per box.

How much does the program benefit growers depends on where the additional grapefruit comes from. Two scenarios were analyzed: the additional grapefruit comes directly from groves

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[2] The FOB price may decrease if the crop size for the 2000-01 season increases to more than 46 million boxes.

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(or the new fruit) and comes from grapefruit that was supposed to be processed. Table 3 shows the results.

With the current FOB price equals $7.86 per carton, Brown estimated the on-tree price to be $5.66 with100% pack-out rate (Indian River colored grapefruit) per box or $4.23 per box with 60% pack-out rate for fresh grapefruit, $3.18 per box for field-run processed grapefruit, and $2.08 per box for elimination. Muraro estimated the production cost of fresh-oriented grapefruit is $3.23 per box and process-oriented grapefruit is about $2.50. The net revenues per box are $1.00 and $1.78, respectively, for fresh grapefruit from new fruit and for fresh grapefruit diverted from processed fruit.

Table 1. Florida fresh grapefruit shipments, 1978-79 through 1998-99

Year	Europe	Japan	Other	Canada	Domestic	Total Fresh
1978-79	3,297	7,083	143	2,999	24,301	37,823
1979-80	3,862	5,954	134	3,182	23,383	36,515
1980-81	3,644	6,438	156	2,767	19,318	32,323
1981-82	3,022	6,828	82	2,840	18,887	31,659
1982-83	3,019	6,467	57	2,863	22,212	34,618
1983-84	3,473	6,120	101	2,609	18,236	30,539
1984-85	3,050	2,559	48	2,646	21,325	29,628
1985-86	4,752	6,190	137	3,144	24,469	38,692
1986-87	6,150	8,919	403	2,940	22,764	41,176
1987-88	8,266	10,936	1,466	3,191	21,337	45,196
1988-89	8,640	12,042	2,886	3,313	19,482	46,363
1989-90	3,781	5,200	347	2,106	14,276	25,710
1990-91	7,332	11,184	837	3,616	23,467	46,436
1991-92	6,552	11,011	1,074	2,983	22,244	43,864
1992-93	6,956	9,184	1,338	3,809	22,910	44,197
1993-94	7,411	11,541	1,396	3,206	19,472	43,026
1994-95	8,027	10,428	1,256	3,133	19,561	42,405
1995-96	9,339	11,324	1,681	2,960	18,230	43,534
1996-97	9,337	11,045	2,162	3,042	18,638	44,224
1997-98	8,657	9,309	1,062	2,833	18,062	39,923
1998-99	8,072	9,967	1,470	2,617	15,273	37,399

Table 2. SUR estimates for fresh grapefruit demand, 1978-79 through 1998-99

	Demand Parameter	Standard Error	t-Statistics	Probability
U.S.				
Intercept	3.0737	0.3447	8.9170	0.0001
FOB Price	-0.1929	0.1743	-1.1060	0.2840
Ad Expenditure	0.0673	0.0388	1.7330	0.1012
Time	-0.1065	0.0426	-2.5010	0.0229
Canada				
Intercept	-4.9326	0.4873	-10.1230	0.0001
FOB Price	-0.4570	0.1727	-2.6460	0.0170
Ad Expenditure	0.0156	0.0216	0.7250	0.4784
Time	-0.0412	0.0390	-1.0550	0.3063
Japan				
Intercept	7.3169	3.1623	2.3140	0.0335
FOB Price	-0.8629	0.2295	-3.7590	0.0016
Ad Expenditure	0.3035	0.0882	3.4410	0.0031
Time	-0.2127	0.1015	-2.0960	0.0514
Europe				
Intercept	2.5278	0.5678	4.4520	0.0004
FOB Price	-0.5414	0.1329	-4.0720	0.0008
Ad Expenditure	0.0887	0.0307	2.8880	0.0102
Time	0.2039	0.0727	2.8050	0.0122

Table 3. Estimated returns

	From New Fruit	From Processed Fruit
FOB Price ($/carton)	7.86	
On-Tree Price ($/box)	4.23	3.18
Cultivation Cost ($/box)	3.23	2.50
Trade Off ($/box)		4.23
Additional Return ($/box)	1.00	1.78

Based on the following assumptions
     (1) the FOB price of fresh grapefruit is $7.86/carton (Indian River Colored);
     (2) 60% pack-out rate;
     (3) cultivation cost is $3.23/box for fresh grapefruit and $2.50/box for processed grapefruit;
     (4) on-tree return for processed grapefruit is $3.18/box (field-run price).