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Economic Impacts of the Florida Citrus Industry in 2003-04[1]

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Introduction

The citrus industry remains a major part of Florida's agricultural and natural resource economy. However, recently it has been adversely affected by hurricanes and diseases such as citrus canker and citrus greening. This paper presents estimates of the total impacts of the Florida citrus industry on the state's economy based on production values for the 2003-2004 crop year. Estimates are presented separately for fresh market citrus fruit and for processed juices and other byproducts. Impacts are expressed in terms of output, value added, employment, labor income, and indirect business taxes.

Methods

The total economic impacts of the Florida citrus industry in 2003-04 were evaluated using published values for citrus fruit, processed juices, and byproducts, together with a regional input-output model for Florida. Data for citrus fruits were taken from reports by the USDA/National Agricultural Statistics Service and the Florida Department of Citrus, while data on value of processed citrus juices and byproducts were available from Florida Citrus Mutual, an industry trade association.

The *IMPLAN Pro* economic impact and social accounting software package, licensed to the University of Florida by the Minnesota Implan Group, Inc. (MIG), was used to develop a regional input-output model of the Florida economy with adjustments for the citrus industry. *IMPLAN*, which is an acronym for *Impact Analysis for Planning*, is an input-output modeling system that enables the estimation of the overall effects of changes in final demand for one or more industries in a defined region through the use of economic multipliers. Multipliers measure total changes in output, income, employment, or value added for a given change in direct output or employment, and estimate three components of change within the local area: direct effects represent the initial change in the industry in question, indirect effects represent changes in inter-industry transactions as supplying industries respond to changes in demands from the directly affected industries, and induced effects reflect changes in local spending that result from income changes in industry employee households. Social Accounting Matrix (SAM) multipliers in *IMPLAN* account for

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capital investment, taxes, and transfer payments (e.g., social security, welfare, retirement pensions, and savings by households).

Regional models may be constructed with *IMPLAN* for a single county, groups of contiguous counties, or an entire state or region. In this case, the region of interest was defined as the state of Florida. Regional data for the model represent 2003, the most recent information available from the U.S. system of national accounts and the Regional Economic Information System maintained by the U.S. Commerce Department. Information used in the model is specific to the state for industry output, employment, income, and trade while national averages are used to estimate transactions between industries. The model was constructed with all social accounts endogenous, including households, governments (state/local, federal), and capital investment.

Three industry sectors in *IMPLAN* were used to analyze the Florida citrus industry: fruit farming (#5), frozen foods (#60), and canned fruit and vegetable juices (#61). These industry sectors are defined based on the primary product or service produced, under the North American Industry Classification System (NAICS). The output value of each major type of product was specified as an impact event in the appropriate industry sector: fresh market citrus fruit in the fruit farming sector, frozen citrus juices in the frozen foods sector, and chilled citrus juices in the canned juices sector. Values of processed byproducts were entered as impact events to the two processing sectors in proportion to their primary product values. Also, the export and local consumption values of citrus juice and byproducts were treated separately; only the direct impacts were considered for local consumption, since these values do not necessarily represent a change in overall regional economic activity.

Several adjustments were made to the *IMPLAN* model to reflect the special characteristics of the Florida citrus industry, as distinguished from the national economy for fruit farming and frozen/canned food processing, which includes a variety of other food commodities. The set of inputs purchased by these industries, known as production functions, is what drives the estimates of indirect and induced impacts. The production functions for the two processing sectors were adjusted, such that purchases from the fruit farming sector represented 38 percent of output, and other agricultural sectors were removed from the model. The production function for the fruit farming sector was adjusted based on budgeted production costs reported by Muraro, et al. (2004). Production expenditures for the major types of citrus and various production regions in Florida are shown in Table 1, including both fresh and processed Valencia and Hamlin oranges and white and red grapefruit in the Central, Southern, and Indian River regions, respectively. Weighted average expenditures in relation to production volume were assigned to appropriate *IMPLAN* sectors as indicated in Table 2. Industry purchases from other sectors included financial lenders, fertilizers, agricultural chemicals, greenhouse and nursery products, plastic pipes and fittings, other state and local government enterprises, and government (non-education). Many of the cultural operations were treated as labor inputs to production, and as such represent value added rather than industry purchases. Finally, the regional purchase coefficient for fruit farming was set to the maximum allowable level (0.88) to force the processing sectors to purchase all available fruit from local (in-state) sources. Industry information on value added, including employee compensation, proprietor income, other property income, and indirect business taxes, were left at default levels in the *IMPLAN* model.

Results and Discussion

The value of citrus fruit production was estimated separately for fresh market fruit and processed fruit, by citrus variety (Table 3). In the 2003-04 season, total citrus fruit production in Florida was 292 million boxes, including 242 million boxes of early, midseason, Navel and Valencia oranges; 41 million boxes of grapefruit; and 9 million boxes of specialty citrus (tangelos, tangerines, temples). Of the total citrus crop, some 32 million boxes (11 percent) were produced for the fresh market and 260 million boxes (89 percent) were utilized for processing. About 53 percent of the red seedless grapefruit was produced for the fresh market, while 80 percent of the white seedless grapefruit and

96 percent of the oranges were processed for juice. Average free on board (F.O.B.) prices for fresh market fruit sold from packinghouses ranged from $13.20 per box for Valencia oranges to $24.50 for tangelos and tangerines. Average packing house door (P.H.D.) prices for processed fruit were $4.14 per box for early, midseason, and Navel oranges; $5.82 for Valencia oranges; and $2.84 to $3.02 for grapefruit. The total value of Florida citrus fruit in 2003-04 was $1.778 billion, including fresh fruit shipments from packinghouses valued at $548 million and fruit delivered to processing plants valued at $1.230 billion. Red seedless grapefruit and tangerines accounted for 41 percent and 20 percent, respectively, of fresh market value. Valencia oranges represented 53 percent of the processed fruit market value, while Early, midseason, and Navel oranges accounted for 41 percent.

The value of Florida processed citrus juice product shipments in the 2003-04 season is shown in Table 4. The total value of citrus juice products was $3.00 billion, including $1.93 billion for chilled (canned) juice, and $1.08 billion for frozen concentrate juice. The vast majority of juice shipments, $2.85 billion or 95 percent, were for processed orange juice. More than 97 percent of citrus juice products were exported outside of Florida to other states or foreign countries, while only 3 percent was consumed in the state. The share of juice consumed locally in Florida was estimated based on the Florida population and U.S. average per capita consumption.

In addition to orange and grapefruit juices, the citrus processing industry produces several other important byproducts, including citrus pulp and meal, molasses, and D-limonene. The essential oil D-limonene, recovered from the distilled extracts of fruit peel and seeds, is used for a variety of chemical products such as cleaners, disinfectants, flavors, and fragrances. Citrus pulp and meal, and molasses are sold as livestock feed ingredients. During the 2003-04 season, Florida citrus processors produced more than 1.1 million tons of citrus pulp and meal, 38,000 tons of molasses, and nearly 36 million pounds of D-limonene. The total value of these byproducts was about $136 million (Table 5). Citrus pulp and meal represented about 66 percent of the total byproduct value.

Total economic impacts estimated for the Florida citrus industry in 2003-04 are summarized in Table 6. The direct output or sales revenue in 2003-04 was $3.69 billion. The total output impact of the industry was $9.29 billion, including $8.01 billion from processed citrus juice and byproducts, and $1.28 billion from fresh market citrus fruit sales. The indirect output impacts resulting from purchases of inputs from other industry sectors, including the purchase of round fruit from growers by the processing sector, were $1.93 billion. The induced output impacts resulting from consumer spending by employee households were $3.67 billion. The ratio between the total output impact and direct output implies an overall multiplier effect of 2.52. These multiplier effects are significant because the export-based nature of the Florida citrus industry brings new money into the state economy.

Total employment impact of the Florida citrus industry was 76,336 jobs, with 61,307 jobs from the processing sector and 15,029 jobs from fresh fruit. These employment impacts represent both full-time and part-time jobs, and are *not* adjusted to a full-time equivalent basis. Total value added impacts were $4.87 billion. Value added is a broad measure of total labor and property income generated, and is equivalent to industry output less industry purchases. The value added impact of the citrus industry represented 0.9 percent of the gross state product of Florida in 2003 ($548 billion). Labor income impacts amounted to $2.73 billion, which represents all wages and salary earnings by industry employees and proprietor's income to business owners. Indirect business tax impacts were $288 million, which include most forms of local and state taxes, such as property tax, sales tax, water management district levies, intangible taxes, motor fuel and vehicle taxes, excise taxes, etc. but do not include federal income taxes.

Total economic impacts of Florida citrus are shown by major industry group in Table 7. Naturally, the largest impacts occurred in the agriculture and manufacturing groups, where the direct impacts occurred from fruit farms and citrus processing.

Output impacts in manufacturing and agriculture were $3.54 billion and $1.58 billion, respectively. Large output impacts also occurred in government enterprises ($769 million), construction ($478 million), finance and insurance ($419 million), health and social services ($369 million), retail trade ($335 million), wholesale trade ($289 million), professional-scientific and technical services ($288 million), and real estate and rentals ($225 million). Employment impacts in agriculture (21,814 jobs) were greater than for manufacturing (9,836 jobs) due to the labor-intensive nature of agriculture, particularly for fruit harvesting in the citrus industry. Important employment impacts also occurred in retail trade (5,945 jobs), health and social services (4,897 jobs), and construction (4,281 jobs). These impacts in other industries indicate the significant linkages of the citrus industry throughout the Florida economy.

The economic impacts of the Florida citrus industry presented here for the 2003-04 season are consistent with those reported in a previous study for the 1999-2000 season (Hodges, et al., 2001), in which total output impacts were estimated at $9.13 billion, total employment impacts were 89,778 jobs, and total value added impacts were $4.18 billion. This would suggest that the industry grew during the 1999-2003 period. In fact, however, total sales of fresh and processed citrus juice and byproducts have actually declined from $4.07 billion to $3.55 billion. Although the impact estimates in both studies were made using similar data sources and analytic procedures, there are important differences that account for this discrepancy. Notably, the earlier study was done using a previous version of the *IMPLAN* software, which used the Standard Industrial Classification (SIC) system rather than the NAICS. Also, it is possible that the structure of the Florida economy has become more integrated, leading to greater multiplier effects. If we use the current (2003) *IMPLAN* model to evaluate the direct output of fresh and processed citrus for the 1999-2000 period, we get a total output impact of $9.80 billion (in 2003 dollars). This restated result would suggest that the total economic impact of the Florida citrus industry has declined by about 5 percent during this period in real terms.

These economic impact estimates are based on well-documented values for citrus products; however, there are certain limitations of the analysis that should be borne in mind when interpreting the results. First, the budget information for citrus fruit production was aggregated into a relatively small number of *IMPLAN* sectors, which may lead to an underestimate of the linkages to other sectors of the state's economy. Second, there was no specific information available for the citrus processing sector, other than purchases from the fruit farming sector, which would enable adjustment of the production function for this sector. To more accurately estimate the economic impacts of this large sector would require further details on processing expenditures.

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Table 1. Florida citrus production expenditures, by type and region, 2003-04 season.

Expense	Central, Processed Valencia Oranges	Central, Fresh Valencia Oranges	Indian River, Processed White Grapefruit	Indian River, Fresh White Grapefruit	Southern, Processed Hamlin Oranges	Southern, Processed Red Grapefruit	Southern, Fresh Hamlin Oranges	Southern, Fresh Red Grapefruit
	----------*(dollars per box)*----------							
Tree replacement (prepare & plant)	0.056	0.056	0.134	0.134	0.092	0.064	0.092	0.064
Mechanical mow middles (4/year)	0.086	0.086	0.067	0.067	0.044	0.041	0.044	0.041
Weed control: discing (2/year)	0.042	0.042	0.025	0.025	0.021	0.020	0.021	0.020
Weed control: grove work (2 hours/acre)	0.056	0.056	0.057	0.057	0.049	0.046	0.049	0.046
Herbicide (application)	0.059	0.059	0.082	0.082	0.050	0.046	0.050	0.046
Weed control: spot treatment (application + material)	0.032	0.032	0.000	0.000	0.000	0.000	0.000	0.000
Spray summer oil #1 (application)	0.048	0.048	0.064	0.064	0.000	0.000	0.047	0.043
Spray summer oil #2 (application)	0.048	0.062	0.064	0.064	0.047	0.043	0.047	0.043
Supplemental fall miticide (application)	0.000	0.048	0.064	0.064	0.047	0.043	0.047	0.043
Fertilizer (application)	0.055	0.055	0.049	0.049	0.030	0.028	0.030	0.028
Dolomite (application and material)	0.020	0.020	0.028	0.028	0.023	0.022	0.023	0.022
Pruning/topping	0.030	0.030	0.031	0.031	0.021	0.020	0.021	0.020
Pruning/hedging	0.036	0.036	0.037	0.037	0.024	0.022	0.024	0.022
Chop/mow brush after hedging	0.009	0.009	0.013	0.013	0.008	0.008	0.008	0.008

Table 1. Florida citrus production expenditures, by type and region, 2003-04 season.

Expense	Central, Processed Valencia Oranges	Central, Fresh Valencia Oranges	Indian River, Processed White Grapefruit	Indian River, Fresh White Grapefruit	Southern, Processed Hamlin Oranges	Southern, Processed Red Grapefruit	Southern, Fresh Hamlin Oranges	Southern, Fresh Red Grapefruit
	----------*(dollars per box)*----------							
Raise skirt of trees	0.000	0.000	0.015	0.015	0.000	0.012	0.000	0.012
Tree replacement, remove trees	0.030	0.030	0.053	0.053	0.037	0.026	0.037	0.026
Clean ditches (weed control)	0.000	0.000	0.029	0.029	0.025	0.024	0.025	0.024
Ditch and canal maintenance	0.000	0.000	0.033	0.033	0.029	0.027	0.029	0.027
Water control	0.000	0.000	0.029	0.029	0.025	0.023	0.025	0.023
Supplemental post bloom spray (application)	0.000	0.000	0.000	0.111	0.000	0.000	0.047	0.044
Fall miticide (application)	0.000	0.056	0.000	0.055	0.000	0.000	0.016	0.014
Management costs	0.101	0.101	0.108	0.108	0.093	0.086	0.093	0.086
Harvesting costs (pick/spot pick, canker decontamination, roadside & haul)	2.190	2.190	1.885	2.086	2.217	1.885	2.217	2.086
Fruit drenching	0.000	0.000	0.000	0.170	0.000	0.000	0.000	0.170
Fertilizer material	0.295	0.295	0.182	0.226	0.233	0.165	0.233	0.165
Weed management (herbicide material)	0.156	0.156	0.200	0.200	0.157	0.146	0.157	0.146
Spray summer oil #1 (material)	0.127	0.128	0.128	0.128	0.000	0.000	0.051	0.047

Table 1. Florida citrus production expenditures, by type and region, 2003-04 season.

Expense	Central, Processed Valencia Oranges	Central, Fresh Valencia Oranges	Indian River, Processed White Grapefruit	Indian River, Fresh White Grapefruit	Southern, Processed Hamlin Oranges	Southern, Processed Red Grapefruit	Southern, Fresh Hamlin Oranges	Southern, Fresh Red Grapefruit
	----------*(dollars per box)*----------							
Spray summer oil #2 (material)	0.062	0.138	0.141	0.141	0.110	0.102	0.110	0.102
Supplemental fall miticide (material)	0.000	0.020	0.046	0.046	0.052	0.048	0.036	0.034
Supplemental post bloom spray (material)	0.000	0.000	0.000	0.042	0.000	0.000	0.098	0.092
Fall miticide (material)	0.000	0.069	0.000	0.070	0.000	0.000	0.055	0.051
Canker decontamination costs	0.012	0.012	0.014	0.010	0.009	0.011	0.009	0.011
Irrigation, microsprinkler system	0.319	0.048	0.047	0.117	0.074	0.032	0.074	0.043
Interest on operating (cultural) costs	0.045	0.048	0.047	0.117	0.074	0.032	0.074	0.043
Interest on average capital investment costs	0.675	0.675	0.722	0.722	0.623	0.579	0.623	0.579
Water drainage district tax	0.000	0.000	0.142	0.135	0.000	0.000	0.000	0.099
Fly protocol costs	0.000	0.000	0.123	0.117	0.000	0.000	0.000	0.000
Doc assessment	0.150	0.150	0.240	0.250	0.150	0.240	0.150	0.250
Property tax and water mangement tax	0.130	0.130	0.106	0.101	0.118	0.092	0.118	0.092
TOTAL	4.928	5.217	5.402	6.155	4.773	4.224	5.071	4.992

Source: Muraro, et al., 2004.

Table 2. Industry purchases for Florida citrus fruit production, by *IMPLAN* sector, 2003-04.

IMPLAN Sector (*number*)	Total Expenditures (*dollars*)	Percent of Output
Greenhouse & nursery products (6)	21,589,880	1.22%
Fertilizer mixing, manufacturing (158)	87,820,996	4.97%
Pesticides & agricultural chemicals (159)	98,360,748	5.57%
Plastic pipes & fittings (173)	84,838,081	4.80%
Financial lenders (430)	195,331,379	11.06%
Other state & local government enterprises (499)	49,354,411	2.79%
State & local government non-education (504)	33,311,668	1.89%
Total industry purchases	500,607,163	32.31%

Table 3. Production volume, price, and value of fresh and processed Florida citrus fruit, 2003-04.

Citrus Type	Fresh Market Fruit			Processed Fruit			All Fruit	
	Production (1000 boxes)	F.O.B. Price ($/box)	Total Output (Mn$)	Production (1000 boxes)	P.H.D. Price ($/box)	Total Output (Mn$)	Production (1000 boxes)	Total Output (Mn$)
Early, Midseason, Navel Oranges	5,615	$15.00	84.2	120,385	$4.14	498.4	126,000	582.6
Valencia Oranges	4,287	$13.20	56.6	111,722	$5.82	650.2	116,009	706.8
White Seedless Grapefruit	3,273	$17.00	55.6	12,627	$2.84	35.9	15,900	91.5
Red Seedless Grapefruit	13,384	$16.80	224.9	11,616	$3.02	35.1	25,000	260.0
Tangelos	545	$24.50	13.4	455	$2.56	1.2	1,000	14.6
Tangerines	4,440	$24.50	108.8	2,060	$3.04	6.3	6,500	115.1
Temples	342	$14.30	4.9	1,058	$2.69	2.8	1,400	7.7
Total	31,886		548.3	259,923		1,229.8	291,809	1,778.1

Sources: Citrus Fruits, 2005 Summary, September 2005, U.S. Department of Agriculture, National Agricultural Statistics Service; and Florida Department of Citrus, Economic and Market Research Center, Gainesville, Florida, Februray 2006.

Table 4. Value of Florida frozen and canned citrus juice for local consumption and export, 2003-04 season.

Product	Export Shipments (out of state)	Local Consumption (in state)	Total Value
	----------(*million dollars*)----------		
Frozen orange juice	969.3	31.5	1,000.8
Chilled & canned orange juice	1,805.2	39.7	1,844.9
Frozen grapefruit juice	73.9	1.7	75.6
Chilled & canned grapefruit juice	82.8	0.9	83.6
Total frozen citrus juice	1,043.1	33.3	1,076.4
Total chilled & canned citrus juice	1,887.9	40.6	1,928.5
Total all juice products	2,931.1	73.8	3,004.9

Source: Florida Citrus Mutual, Annual Statistical Report, 2003-04 Season.

Table 5. Volume and value of processed Florida citrus byproducts, 2003-04 season.

Byproduct	Production Volume	Units	Price ($/unit$)	Total Value (*million $*)
Citrus plup & meal	1,130,601	tons	$80	$90.5
Molasses	38,337	tons	$55	$2.1
D-Limonene	35,782,731	pounds	$1.20	$42.9
Total				$135.5

Sources: Florida Citrus Processors Association, 2003-04 Statistical Summary (production volumes); *Feedstuffs* magainze, *Chemical Market Reporter*, Florida Distillers, Inc. (prices).

Table 6. Summary of economic impacts of the Florida citrus industry, 2003-04 season.

Industry Sector	Impact Measure	Output	Employment	Value Added	Labor Income	Indirect Business Taxes
		(*Mn$*)	(*jobs*)	(*Mn$*)	(*Mn$*)	(*Mn$*)
Citrus juice & byproducts	Direct-local consumption	77.2	212	25.8	12.6	0.6
	Direct-exports	3,063.2	8.085	1,022.3	495.4	25.4
	Indirect	1,804.6	19,775	1,106.3	539.4	66.5
	Induced	3,061.1	33,235	1,912.0	1,248.3	147.7
	Total	8,006.1	61,307	4,066.3	2,295.6	240.2
Fresh Market Citrus Fruit	Direct	547.3	7,566	350.5	145.4	16.3
	Indirect	127.5	865	77.1	41.9	1.9
	Induced	608.0	6,599	379.3	248.4	29.1
	Total	1,282.7	15,029	806.8	435.8	47.3

Table 7. Economic impacts of the Florida citrus industry, by industry group, 2003-04 season.

Industry Group	Output (*Mn$*)	Employment (*jobs*)	Value Added (*Mn$*)	Labor Income (*Mn$*)	Indirect Business Taxes (*Mn$*)
Agriculture, forestry, fisheries, & hunting	1,577.1	21,814	1,012.0	420.0	46.7
Mining	9.6	37	2.2	0.9	0.2
Utilities	88.3	163	60.3	18.5	8.8
Construction	478.4	4,281	205.4	168.6	2.5
Manufacturing	3,540.2	9,836	1,172.2	589.0	28.7
Wholesale trade	288.7	2,184	219.6	123.1	47.4
Transportation & warehousing	159.4	1,712	88.4	65.0	3.4
Retail trade	334.7	5,945	249.6	130.4	8.5
Information	131.2	538	61.0	32.1	5.2
Finance & insurance	418.8	2,496	264.6	130.4	8.5
Real estate & rental	224.7	1,537	149.9	39.4	23.5
Professional, scientific & technical services	288.1	2,808	172.0	144.4	2.8
Management of companies	92.5	578	55.2	42.5	0.9
Administrative & waste services	110.6	2,031	67.6	54.9	1.7
Educational services	32.9	684	19.1	18.6	0.4
Health & social services	368.6	4,897	228.2	199.7	2.5
Arts, entertainment & recreation	43.5	741	27.7	19.0	2.9
Accomodation & food services	170.3	3,371	88.0	60.3	9.6
Other services	162.8	3,066	85.1	66.0	6.7
Government and non-NAICS	768.5	7,616	645.1	383.6	37.6
Total	9,288.8	76,336	4,873.2	2,731.4	287.5