UF IFAS
UNIVERSITY of FLORIDA

Economic Impacts of the Florida Citrus Industry in 2012-13

Final sponsored project report to the Florida Department of Citrus

Alan W. Hodges, Ph.D., Extension Scientist
Mohammad Rahmani, Ph.D., Economic Analyst
Thomas J. Stevens, Ph.D., Post-Doctoral Research Associate
Thomas H. Spreen, Ph.D., Professor Emeritus

Food and Resource Economics Department
Gainesville, Florida

December 19, 2014

Photo credit: Florida Agricultural Coalition (www.flagcoalition.com)

Contents

Tables

Figures

Acknowledgements

This report was made possible by the support of the Florida Department of Citrus (FDOC) headquartered in Bartow, Florida. Valuable assistance in the preparation of the report was provided by Marisa Zansler, FDOC Director of Economic and Market Research, Robert Norberg, citrus industry consultant and former FDOC Deputy Executive Director, Mark Brown, former FDOC Director of Economic and Market Research, Shannon Shepp, FDOC Deputy Executive Director, Lori Ferrel, FDOC Database Analyst, Kathy Wolford, FDOC Administrative Assistant, and James Zellner, former executive with Tropicana Products, Inc. Information on citrus byproduct volumes and prices was provided by Peace River Citrus Products, Bartow, FL, and Florida Caribbean Distillers, LLC, Lake Alfred, FL. Finally, we wish to acknowledge the lifetime of service to the citrus industry by Ronald P. Muraro, Economist at the University of Florida-IFAS Citrus Research and Education Center, who passed away in February 2014.

Executive Summary

The Florida citrus industry encompasses a range of economic activities, including fruit production in 30 counties of central and south Florida, fresh fruit grading, packing and shipping to domestic and international markets, fruit processing for juice extraction, and juice packaging for retail distribution.

Florida citrus bearing grove area declined from over 750,000 acres in year 2000 to around 476,000 acres presently, a reduction of 37 percent, while production volume declined by 58 percent, primarily due to losses from citrus greening disease (HLB), which entered the state in 2005.

The purpose of this study is to estimate the economic impacts of the citrus industry in the State of Florida in fiscal year 2012-13, updating a previous study for 2007-08, as well as updating a previous estimate for the economic impact of citrus greening disease.

The analysis was conducted using the *IMPLAN* regional economic modeling system and associated databases (IMPLAN Group, LLC), to estimate the broad regional impacts of the industry, including economic multipliers that capture the secondary economic activity generated in other sectors by re-spending of income from the sale of Florida citrus products.

During the 2012-13 production season, 156 million boxes of citrus fruit were produced in Florida, including 134 million boxes of oranges, 18 million boxes of grapefruit, and 4 million boxes of specialty citrus, of which 10 percent was sold in the fresh market and 90 percent was utilized for processing. The total grower value of citrus fruit was $1.53 billion, with fruit for processing valued at $1.29 billion and fresh fruit valued at $243 million, based on delivered prices. Florida citrus juice processors produced 1.016 billion gallons of citrus juice in 2012-13, with a total producer value of $2.964 billion (F.O.B. basis). Florida citrus processors also produced byproducts of citrus pulp, meal, molasses, and the essential oil D-Limonene, valued at $176 million.

The economic impact analysis results show total industry output impacts of $10.68 billion, including $3.82 billion from citrus fruit production, $6.44 billion from citrus juice manufacturing, and $420 million for fresh citrus marketing. The citrus industry created or supported a total of 62,133 fulltime and part-time jobs in the State. Total value added impacts estimated at $5.32 billion represented the industry's contribution to Gross Domestic Product of the State. Labor income impacts amounted to $3.25 billion, representing earnings by employees and business owners. Total state and local tax impacts of the Florida citrus industry were $326 million. The Central Florida region had the highest share of citrus industry employment impacts (40,149 jobs), followed by Southern Florida (13,458 jobs) and the Indian River region (8,527 jobs).

Comparing the overall economic impacts of the Florida citrus industry in 2012-13 with a five-year earlier period (2007-08) using an updated regional model, employment declined by 17.8 percent, labor income decreased by 4.9 percent, value added decreased by 4.1 percent, and industry output decreased by 0.7 percent, in constant dollar terms.

The economic impacts of citrus greening (HLB) over the period 2006-07 through 2013-14 were estimated at a loss of -$7.80 billion in cumulative industry output, or an annual average of -$975 million, while total value added impacts averaged -$573 million, and employment impacts averaged 7,513 jobs (fulltime and part-time). These results do not include HLB impacts on the fresh citrus fruit market or grapefruit and specialty citrus for processing.

It is concluded that although citrus production volumes have declined since the mid-2000s, due to citrus canker and greening diseases, higher prices for citrus products have kept industry revenues stable, with the result that total economic output, value added and labor income impacts have declined only marginally, and the iconic citrus industry remains an important contributor to the Florida economy.

Introduction

The Florida citrus industry encompasses a wide range of economic activities. Citrus fruits, including oranges, grapefruit, and specialty fruits such as tangerines, tangelos, lemons and limes, are produced in 30 counties of central and south Florida, on over 500,000 acres of grove lands (Figure 1, Table 1). Citrus grove management is a year-round activity, with the largest number of workers employed during the November through June harvesting season. Fresh Florida citrus fruit is graded and shipped by packinghouses to both domestic and international markets. A majority of Florida citrus, however, is processed into fruit juices and other byproducts by 19 processing plants in the state, and packaged for retail sale to consumers through grocery stores and institutional food service establishments. Citrus juice is marketed in frozen concentrate and chilled or shelf-stable single-strength forms, and blended with other fruit juices as mixed juice products. Citrus juice is also shipped by Florida processors in bulk form to other firms for retail packaging and sale throughout the world. Citrus processors and packagers in Florida purchase bulk citrus juice from other countries on the world market.

Florida is the largest citrus producing area in the United States, which is one of the largest producing countries in the world. From 2001-02 to present, world production and consumption of all citrus types increased by about 15 percent, or an average annual rate of 1.3 percent (Appendix Figures A1 and A2). Global consumption of citrus, utilized for both fresh and processing, currently is about 89 million metric tonnes. The largest producer and consumer countries (or regions) are China, Brazil, the European Union and the United States. Production in China has increased steadily, reaching over 29 million metric tons in 2013-14, while production in Brazil has declined in recent years (Figure A2). Since 2001-02, world citrus exports have increased 68 percent, or 5.6 percent average annually, lead by large increases from South Africa, Turkey, Egypt and China, while U.S. exports have been flat (Figure A3). World orange juice consumption has declined by 16 percent, or 1.3 percent annually, notably in the European Union and United States (Figure A4).

Trends in Florida citrus bearing acreage, yields, production volume for utilization, and grower value over the 2000-14 period are summarized in Figures 2-5. Note that these data are for calendar years rather than citrus production years, and estimates for 2014 are preliminary. Bearing acreage declined by 37 percent, from over 750,000 acres in 2000 to 476,000 acres in 2014 (Figure 2). Based on a best-fitting linear regression analysis, bearing acreage has declined by an average of 22,000 acres annually during this period (r^2=0.937). Note that bearing acreage is less than total acreage (shown in Table 1), which includes young and old non-productive groves. Orange and grapefruit yields per acre have generally declined in recent years, presumably reflecting the effect of citrus greening disease (HLB), as well as damage by hurricanes during 2005-06. Orange yields peaked at 428 boxes per acre in 2004, then declined to around 250 to 300 boxes per acre during 2010-14, while grapefruit yields declined from a peak of nearly 500 boxes per acre to 363 boxes per acre during the same period (Figure 3). Florida citrus fruit production for fresh and processed utilization decreased by 58 percent, from 295 million boxes in 2000 to 124 million boxes in 2014 (Figure 4). Value of production at the

citrus grower level, however, has varied widely due to price fluctuations as well as yields, and showed no discernable trend over this time period, reflecting generally increased prices that offset declining production volumes (Figure 5).

The citrus industry produces a natural product that is transformed into a consumer good through value-added processing, and generates employment and income that contribute to the economic growth and development of Florida and the United States. Citrus fruit production, packing/shipping, and juice manufacturing activities are linked to an array of allied suppliers that provide production inputs and supporting services. Economic impact analysis assesses the effect of new or existing activities, industries, or events on the overall economy of a region such as a state or county. Any activity that generates direct expenditures, income or jobs has an effect on other parts of the economy in which it operates; an expenditure by one entity becomes income to another entity. As an analogy, consider the waves generated from a stone thrown in a lake that spread out in all directions. In economic impact analysis, these are called secondary effects and are measured through economic multipliers for each type of activity or industry sector estimated from regional economic models. Economic impacts are expressed in terms of industry output or revenues, employment (fulltime and part-time jobs), employee earnings (wages, salaries, benefits), business owner income, property income, value added (Gross Domestic Product), and personal and business tax receipts to local/state and federal governments.

The purpose of this study is to estimate the economic impacts of the Florida citrus industry to the State of Florida, based on industry statistics for the 2012-13 season (August 2012 to July 2013). Estimates are presented for citrus fruit production, marketing of fresh citrus fruit, and citrus juice manufacturing. Economic impact estimates are provided for three citrus production regions in Florida. Wholesale and retail distribution of citrus juice products were not considered in this analysis, as is typical for economic impact studies, since these activities do not represent new final demand to the state of Florida.

This study updates previous studies of the Florida citrus industry for 1999-2000, 2003-04, and 2007-08 (Hodges et al., 2001, 2006; Rahmani and Hodges, 2012). In the previous study for 2007-08, total economic impacts for the Florida citrus industry were estimated at $8.906 billion in industry output, $4.619 billion in value added (GDP) and 75,828 fulltime and part-time jobs. In this report, results for the 2007-08 season were revised using an updated economic model and expressed in current dollars, in order to indicate the change in impacts over time in comparable terms.

In addition, this study updates previous estimates for the economic impact of citrus greening (HLB) disease through citrus production year 2013-14. Previously, Hodges and Spreen (2012) estimated the cumulative economic impact of HLB over the five year period 2006-07 through 2010-11 at -$4.541 billion in output, and -41,284 job-years, or an annual average of -$908 million and -8,257 jobs.

Figure 1. Map of Florida citrus producing regions

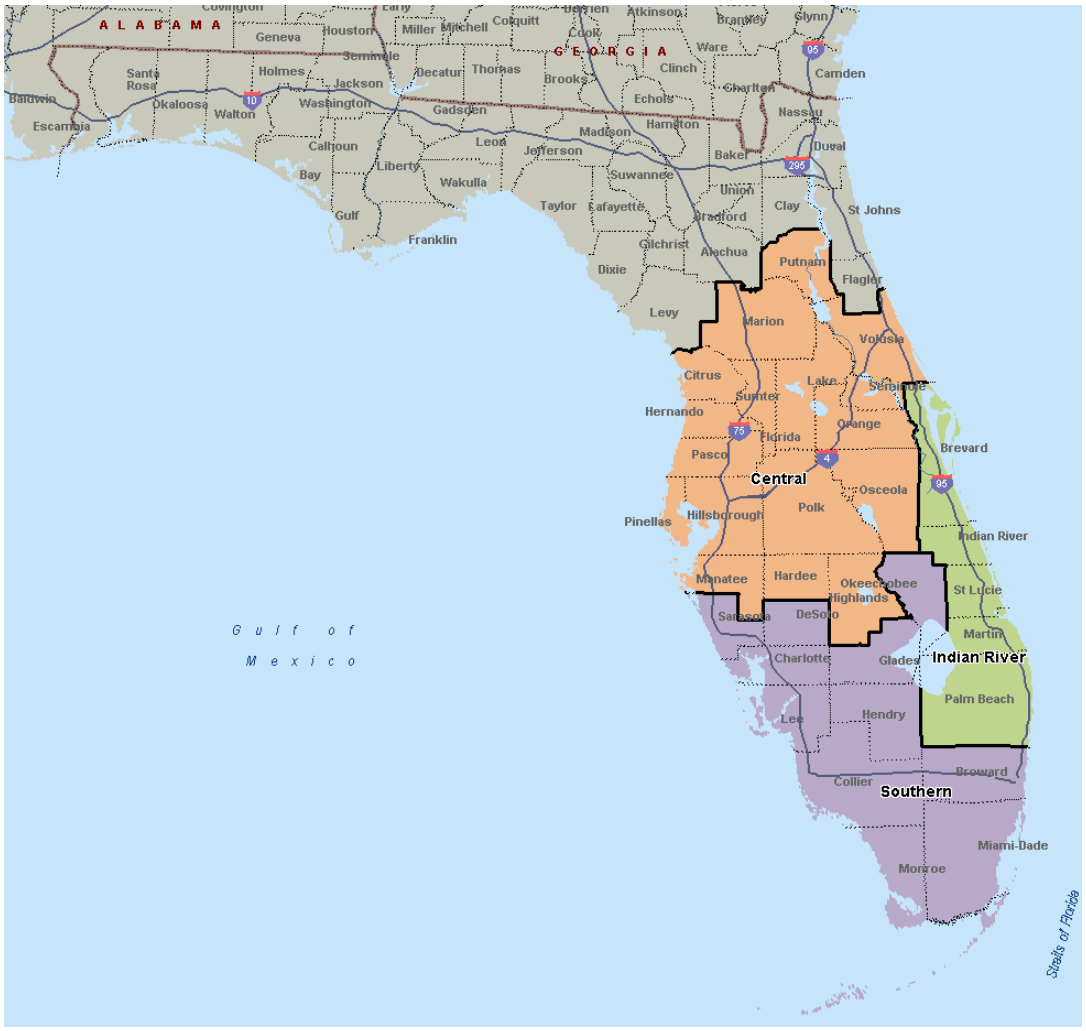
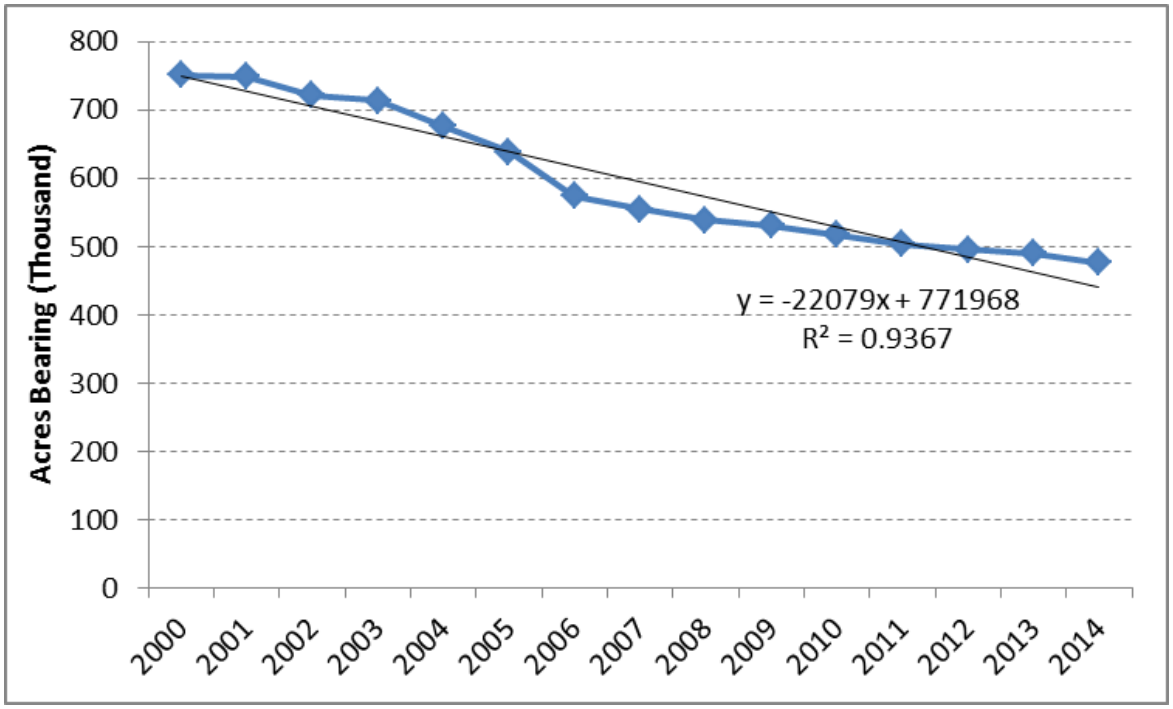
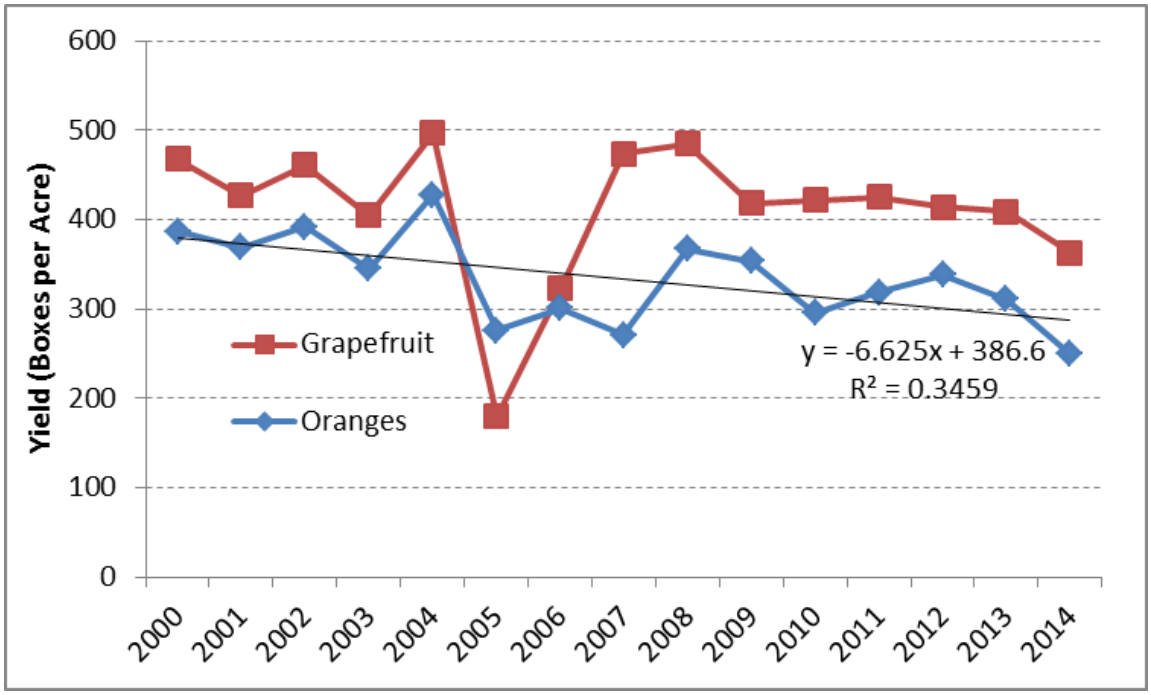


Figure 2. Trend in Florida citrus bearing acreage, 2000-14



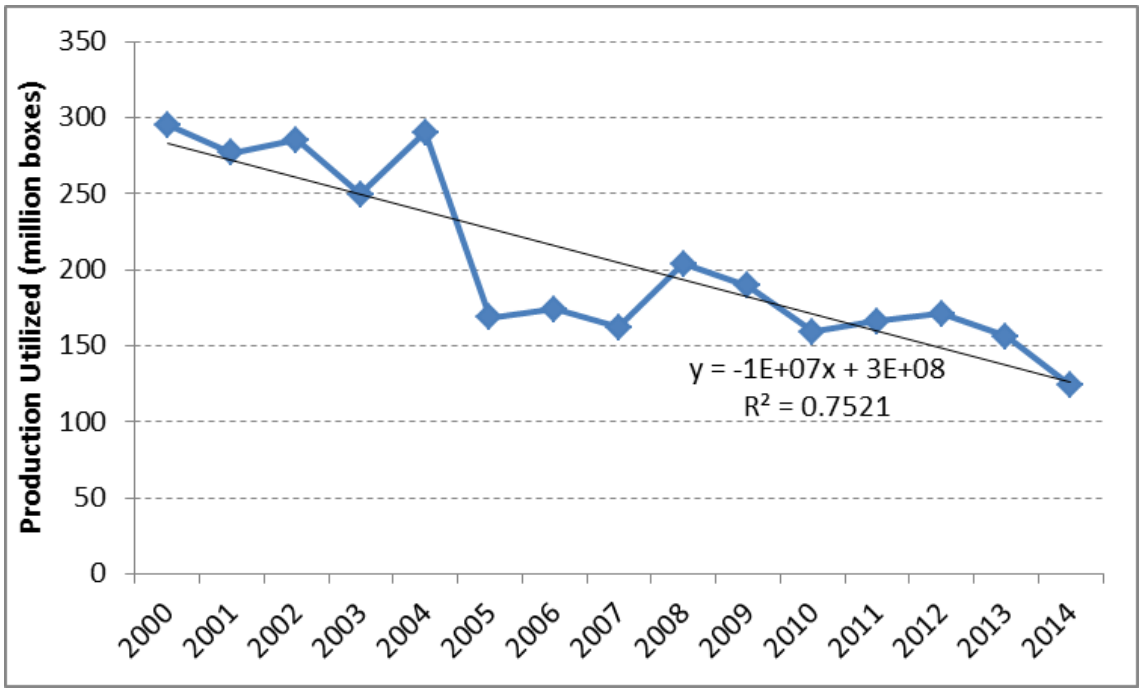
Note: straight line shows best fitting regression equation for time series. Data for 2014 is preliminary.
Source: USDA-NASS, Quick Stats, online data retrieval tool.

Figure 3. Trend in Florida orange and grapefruit yields, 2000-14



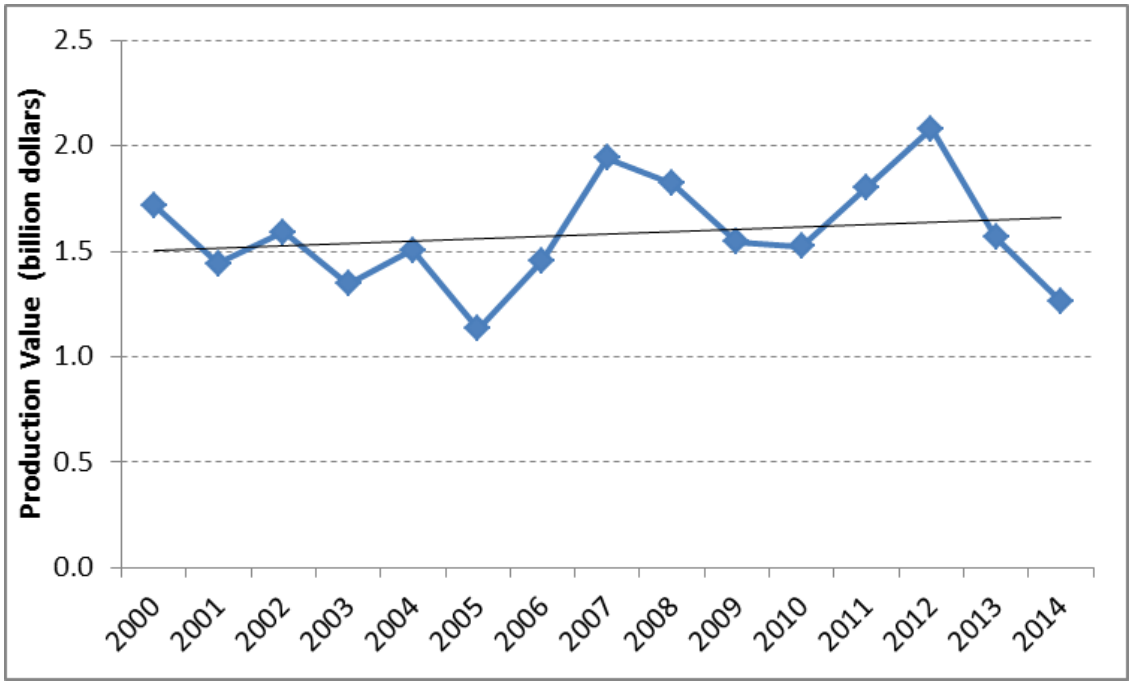
Note: Yields for 2005 to 2007 were affected by hurricanes in Florida. Data for 2014 is preliminary.
Source: USDA-NASS, Quick Stats.

Figure 4. Trend in Florida citrus production for utilization, 2000-14



Data for 2014 is preliminary.
Source: USDA-NASS, Quick Stats.

Figure 5. Trend in Florida citrus grower production value, 2000-14



Data for 2014 is preliminary.
Source: USDA-NASS, Quick Stats.

Methods and Data Analysis

The economic impacts of the Florida citrus industry in 2012-13 were evaluated using published estimates of citrus fruit production, packed fresh fruit shipments, processed citrus juices and by-products, together with a regional input-output model for Florida. Data for citrus fruit were taken from reports by the USDA-National Agricultural Statistics Services (NASS), Florida Agricultural Statistics Service (FASS), and Florida Department of Citrus (FDOC) Economic and Market Research Department. Data on the value and volume of processed citrus juice were provided by the FDOC. Data on quantity of processed citrus byproducts were provided by the Florida Citrus Processors Association, and data on the values of byproducts were provided by other industry sources.

This analysis was conducted using the *IMPLAN* regional economic modeling system and associated databases (IMPLAN Group, LLC), to estimate the economic multipliers that capture the additional economic activity generated by re-spending of income in the local economy arising from the sale of Florida citrus products and by-products. The extent of the total economic impacts of the citrus industry in Florida is measured by several yardsticks, including employment, labor income, value added, and output. The concept of value added is similar to Gross Domestic Product. A glossary of Economic Impact Terms provided in the Appendix will orient the reader to technical terms used in this report.

Economic multipliers measure the total changes in an economy resulting from a given change in direct output or employment. There are three components of multipliers: direct, indirect and induced. 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 employee and proprietor households and state/local and federal governments. Social Accounting Matrix (SAM) multipliers in IMPLAN account for capital investment, taxes, and transfer payments such as social security, welfare, retirement pensions, and savings by household. 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 study region was defined as the state of Florida. Regional data for the model represent 2012, the most recent information available from IMPLAN based on 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 of Florida for industry output, employment, income, and trade, while national averages are used to estimate transactions between industries. The model was constructed with social accounts for households, governments (state/local, federal), and capital investment internalized. This analysis used the Regional Purchase Coefficients (RPC) version of the model for estimating trade flows to be consistent with past studies.

Four industry sectors in *IMPLAN* were used to analyze the Florida citrus industry: fruit farming (sector #4), frozen foods (#53), canned fruit and vegetables (#54), and wholesale trade (#319). These industry sectors are defined under the North American Industry Classification System (NAICS) based on the primary product or

service produced or technology used. 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, packed fresh citrus fruit in the wholesale trade sector, frozen citrus juices (FCOJ) in the frozen foods sector, and chilled or shelf-stable single strength citrus juices in the canned (bottled) food sector. Values of processed by-products 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 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 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. Fruit purchases were removed from processing sectors by zeroing the regional purchase coefficient to avoid double counting fruit production impacts. The production function for the fruit farming sector was adjusted based on budgeted citrus production costs for Florida as reported by Muraro (2011-12). Production expenditures are shown in Appendix Table A1, for the major citrus types and production regions in Florida, including fresh and processed early and mid-season oranges, Valencia oranges, white and red grapefruit, in the Central, Southern, and Indian River regions, respectively. Budgeted citrus production costs ranged from $3,176 to over $4,000 per acre, including chemical and fertilizer application, pruning, mowing, replanting, harvest labor, forwarding, management, interest, and various taxes and fees. These budgeted costs reflect the recommended best management practices (BMP) for control of citrus greening disease (HLB).

The cost per box of citrus fruit produced was estimated for each type based on the budgeted costs per acre and average yield per acre. Then the total cost of production was calculated as the number of boxes produced multiplied by the cost per box. The total citrus grower expenditures for fresh and processed fruit were allocated to the input supply and service industries in the IMPLAN regional model, as shown in Appendix Table A2. The supporting industries, and their share of input costs were: Greenhouse and nursery products (1.40 percent), Agricultural support services (43.49 percent), Fertilizer manufacturing (18.57 percent), Pesticides and other agricultural chemical manufacturing (14.91 percent), Plastic pipe and pipe manufacturing (5.78 percent), Monetary authorities and depository credit intermediaries (12.11 percent), and Management of companies (1.43 percent).

The total acreage and volume of citrus fruit produced in Florida counties and regions in the 2012-13 season are shown in Table 1. In 2012-13, the total citrus area exceeded 524,000 acres in the State, including 244,000 acres in the Central region, 201,000 acres in the Southern region, and 80,000 acres in the Indian River region.

The total value of citrus fruit production for fresh market and processing is summarized by citrus variety in Table 2. For the 2012-13 season, the total volume of citrus fruit production in Florida was 156.2 million boxes, including 133.6 million boxes of oranges; 18.3 million boxes of grapefruit; and, 4.3 million boxes of

specialty citrus (tangelos, tangerines, mandarins). Of the total citrus crop, some 16.5 million boxes (10 percent) were produced for the fresh market and 140 million boxes (90 percent) were utilized for processing (Table 2). About 51 percent of the red grapefruit was produced for the fresh market, while 81 percent of the white grapefruit and more than 95 percent of the oranges were processed for juice (Table 4). Free on board (F.O.B.) prices for fresh market fruit sold from packinghouses averaged $23.58 per box for Valencia oranges, $24.40 for early, midseason, and Navel oranges, and $35.90 for and tangerines and mandarins. Average packing house door (P.H.D.) prices received by producers for fresh fruit were $14.45 per box for early, midseason, and Navel oranges, $12.05 for Valencia oranges, and $14.55 for white grapefruit, and $13.05 for red grapefruit (Table 3).

The total grower value of Florida citrus fruit, based on delivered prices, was $1.53 billion in 2012-13, of which fruit for processing was valued at nearly $1.29 billion and fresh fruit was valued at $243 million (Table 4). The value of red seedless grapefruit sold to the fresh market was $88.2 million or 36 percent of the total value of fresh market citrus. Sales of Valencia Oranges for juice represented $705 million, or 55 percent of the total value of processed citrus in Florida in the 2012-13 season. Early, Midseason and Navel oranges accounted for $512 million, or 40 percent of processed citrus, and $53 million, or 20 percent of the fresh fruit market value. The total values of Florida fresh and processed citrus as well as the value of fresh packed product are based on F.O.B. prices as shown in Table 3. The wholesale margin on fresh packed fruit is the difference between what is paid by packinghouses (delivered prices) and the value of shipped fruit (F.O.B. prices).

Florida citrus juice processors produced 1.016 billion gallons of citrus juice in 2012-13, based on Florida citrus processor statistics. The total producer value of citrus juice was $2.964 billion (Table 5). Production of packaged canned orange juice exceeded 454 million gallons (single-strength equivalent basis), generating a total value of $1.978 billion. Bulk frozen orange juice production totaled 343 million gallons, with a total producer value of $449 million in 2012-13. The producer values were estimated using an average wholesale price for bulk juice sales, and average retail values for packaged products, less an assumed 40 percent retail markup, based on information from Florida citrus processor statistics (FDOC). In-state sales of packaged frozen and canned citrus juices represented 14.53 percent and 8.09 percent of total production, respectively, based on Nielson retail scanner data (FDOC). All bulk juice was shipped out-of-state to packaging firms. The total value of packaged and bulk citrus juice shipped from Florida to other states and foreign countries was estimated at $2.644 billion, or 89 percent of total Florida citrus juice sales in 2012-13. Table 6 shows the shares of in-state sales and out-of-state sales of Florida citrus juices in 2012-13.

In addition to orange and grapefruit juices, the Florida citrus processing industry produces several other important byproducts, including citrus pulp and meal, molasses, and citrus oil. The essential oil d-Limonene, recovered from the distilled extracts of fruit peel and seeds (citrus oil), is used for a variety of chemical products such as cleaners, disinfectants, flavors, and fragrances. Citrus pulp, meal, and molasses are sold as livestock feed ingredients. During the 2012-13 season, Florida citrus processors produced 605,659 tons of

citrus pulp and meal, 48,439 tons of molasses, and more than 16.3 million pounds of d-Limonene. The total value of these byproducts in 2012-13 was more than $176 million, with citrus pulp and meal representing about 84 percent of the total value (Table 7). Note that there were no industry data available on volumes or prices of orange oil and other high-valued food grade, cold pressed citrus oils and essences, so these byproducts were not considered in the analysis, however, their economic impact is believed to be relatively small.

Table 1. Florida citrus acreage and production volume by county and region, 2012-13

Region / County	Oranges	Grapefruit	Specialty Fruit[1]	All Citrus	All Citrus Production
	- - - - - - - - - - - - - - - - - - Acres - - - - - - - - - - - - - - - - - -				(1000 Boxes)
Central	231,612	5,984	6,289	243,885	76,698
Hardee	45,450	369		45,819	13,859
Hernando	768	10		778	199
Highlands	59,361	992		60,353	19,073
Hillsborough	6,820	88		6,908	2,310
Lake	7,589	665		8,254	3,474
Manatee	17,515	183		17,698	6,095
Marion	959	28		987	306
Orange	2,941	45		2,986	1,088
Osceola	8,140	825		8,965	2,956
Pasco	6,464	70		6,534	2,474
Polk	74,276	2,605		76,881	24,596
Putnam	140	4		144	
Seminole	314	14		328	92
Volusia	706	59		765	176
Indian River	38,843	35,741	5,531	80,115	24,864
Brevard	2,739	143		2,882	587
Indian River	13,172	17,601		30,773	8,253
Martin	5,527	333		5,860	1,722
St. Lucie	17,405	17,664		35,069	8,502
Southern	188,856	5,931	5,855	200,642	60,325
Charlotte	11,535	1,116		12,651	3,607
Collier	28,751	947		29,698	9,940
De Soto	64,092	500		64,592	17,865
Glades	7,968	57		8,025	2,713
Hendry	60,621	1,576		62,197	20,751
Lee	9,399	622		10,021	3,257
Okeechobee	5,502	879		6,381	1,841
Sarasota	988	234		1,222	351
Other Counties: Citrus, Palm Beach, Pinellas, Putnam	169	27		196	143
Total all regions	459,311	47,656	17,673	524,642	156,230

[1]Specialty fruit includes tangelos, tangerines, limes, lemons, and other.

Source: Florida Citrus Statistics 2012-13, USDA, NASS, Florida Field Office.

Table 2. Florida citrus production volume and fresh or processed utilization, 2012-13

Citrus Type	Total Production	Fresh Utilization	Processed Utilization
		- - - - - - 1000 boxes - - - - - - -	
Oranges	133,600	6,031	127,569
Grapefruit	18,350	7,759	10,591
Specialty Fruit [1]	4,280	2,685	1,595
Total	156,230	16,475	139,755

[1]Tangelos, tangerines, lemons, and other

Source: Florida Citrus Statistics 2012-13, USDA, NASS, Florida Field Office.

Table 3. Prices received by Florida citrus growers and packers, 2012-13

Citrus Type	Fresh Fruit	Processed Fruit	Packed Fresh Fruit
	- - - - - - - - - Dollars per box - - - - - - - -		
Non-Valencia (Early, Midseason, Navel oranges)	14.45	8.08	24.40
Valencia Orange	12.05	11.00	23.58
White seedless grapefruit	14.55	6.43	24.91
Red seedless grapefruit	13.05	4.88	23.59
Tangelos	19.55	7.07	29.93
Tangerines and Mandarins	22.30	6.19	35.90

Prices are equivalent packinghouse-door return basis.

Source: Citrus Fruits 2013 Summary, USDA-NASS, September 2013.

Table 4. Value of fresh and processed Florida citrus fruit and packinghouse margin, 2012-13

Citrus Type	Grower value fresh fruit	Grower value processed fruit	Total grower value	Value packed fresh fruit	Packinghouse margin
	- - - - - - - - - - - - - - - - - - Million Dollars - - - - - - - - - - - - - - - - - -				
Early, Midseason, Navel oranges	53.4	512.3	565.7	90.2	36.8
Valencia orange	28.1	705.8	734.0	55.1	26.9
White seedless grapefruit	14.6	27.3	41.9	25.0	10.4
Red seedless grapefruit	88.2	31.0	119.1	159.3	71.2
Tangelos	9.3	3.7	13.0	14.2	4.9
Tangerines and Mandarins	49.3	6.6	55.9	79.4	30.1
Total	242.9	1,286.7	1,529.6	423.1	180.3

Grower values based on delivered-in prices; packed fresh fruit values based on F.O.B. prices.

Source: Citrus Fruits 2013 Summary, USDA, NASS, Sep. 2013.

Table 5. Volume and producer value of Florida citrus juice, 2012-13

Product	Shipped volume (Million gallons)	Producer F.O.B. value (Million dollars)
Bulk frozen concentrated orange juice	342.99	449.32
Bulk frozen concentrated grapefruit juice	38.15	53.41
Packaged frozen concentrated orange juice	94.97	271.79
Packaged frozen concentrated grapefruit juice	0.47	1.27
Bulk single strength orange juice	62.32	124.65
Bulk single strength grapefruit juice	5.28	9.25
Packaged single strength orange juice	454.72	1,978.05
Packaged single strength grapefruit juice	16.95	76.57
Total all citrus juice products	1,015.85	2,964.31

Source: Florida Department of Citrus, Economic and Market Research Department, Nov. 2014.

Table 6. Producer value of Florida citrus juice sold in-state and out-of-state, 2012-13

Citrus Product	In-state sales	Out-of-state sales
	- - - - Million Dollars - - - -	
Bulk frozen concentrated juice	0.00	502.73
Bulk single strength juice	0.00	133.9
Packaged frozen concentrated juice	22.09	250.97
Packaged single strength juice	298.54	1,756.08
Total frozen concentrated juice	22.09	753.70
Total single strength juice	298.54	1,889.98
Total all citrus juice	320.63	2,643.68

Source: Florida Department of Citrus, Economic and Market Research Department, Nov. 2014, estimated from Nielson retail sales, Annual Topline Report 2012-13 Season, Dec. 2013.

Table 7. Volume and value of Florida citrus byproducts, 2012-13

By-product	Production Volume	Unit	Price (Dollars per unit)	Value (Million Dollars)
Citrus pulp & meal	605,659	U.S. Tons	243.73	147.62
Molasses	48,439	U.S. Tons	156.00	7.56
d-Limonene	16,266,803	Pounds	1.32	21.47
Total				176.65

Note: There are no official data for volume or price of orange oil or other cold-pressed essential oils.

Sources: Florida Citrus Processors Annual Statistical Report 2012-13, and Feedstuffs Magazine (volume); Florida Caribbean Distillers, LLC and Peace River Citrus Products (Price).

Economic Impact Results

Total economic impacts estimated for the Florida citrus industry in 2012-13 are summarized in Table 8. The direct output or sales revenue for all activities was more than $4.851 billion, and the total industry output impact of the industry exceeded $10.682 billion, including $3.822 billion from citrus fruit production, $6.440 billion from citrus juice manufacturing and byproducts, and about $420 million as fresh citrus marketing margins. The indirect output impact resulting from purchases of inputs from other industry sectors, was $1.465 billion, while the induced output impact resulting from consumer spending by employee households and governments was nearly $4.367 billion. The ratio between the total output impact and direct output implies an overall multiplier effect of about 2.2. The multiplier effects are significant because the export-based nature of the Florida citrus industry represents new final demand, bringing new money into the state economy.

The Florida citrus industry created or supported of a total of 62,133 jobs in the State in the 2012-13 season, including of 29,448 jobs from citrus fruit production, 29,913 jobs from citrus juice manufacturing, and 2,772 jobs from citrus fruit packing for the fresh market. These employment impacts represent both full-time and part-time jobs (they are not adjusted to a full-time equivalent basis).

Total value added impacts of the Florida citrus industry in 2012-13 were estimated at $5.324 billion. Value added is a broad measure of income to the economy, including employee wages, salaries and benefits, business owner profits, rents, interest, dividends, and personal and business taxes generated by the industry. It is comparable to Gross Domestic Product (GDP).

Labor income impacts amounted to $3.248 billion, representing earnings by industry employees and business proprietor (owner) income. Note that output, value added and labor income are independent measures of economic impact and should not be added together.

Citrus juice manufacturing generated the highest value added of $2.802 billion, followed by citrus fruit production with $2.245 billion, and fresh fruit packinghouse operations with $277 million.

Economic Impacts by Industry Group

Total economic impacts of the Florida citrus industry by major industry group are shown in Table 9. The largest impacts occurred in the agriculture and manufacturing industry groups where citrus fruit production and processing/juice packaging activities occur, with industry output impacts of $1.85 billion and $3.72 billion, respectively. Large output impacts also occurred via indirect/induced multiplier effects in the sectors for real estate and rentals ($669 million), wholesale trade ($598 million), health and social services ($532 million), government ($462 million), finance and insurance ($451 million), retail trade ($373 million), construction ($366 million), and professional, scientific & technical services ($364 million). Employment impacts in the agriculture sector (14,595 jobs) were much greater than for manufacturing (7,448 jobs) due to

the labor-intensive nature of agriculture, particularly for fruit harvesting. Significant employment impacts also occurred in the sectors health and social services (5,424 jobs), retail trade (5,113 jobs), and government (4,892 jobs). The impacts in other industries indicate the important linkages of the citrus industry throughout the Florida economy.

Tax Impacts

Local/state and federal tax impacts generated by Florida's citrus industry in 2012-13 are presented in Table 10. Total state and local tax impacts of the Florida citrus industry were $326 million. This includes most forms of local and state taxes, such as property tax, sales tax, water management district, intangible taxes, motor fuel and vehicle taxes, excise taxes, etc. The largest state/local tax impacts were sales taxes ($148 million), and property taxes ($117 million).

Total federal tax impacts of the Florida citrus industry in 2012-13 were estimated at $686 million, including personal income taxes of $236 million, and employer and employee contributions to Social Security of $142 million and $157 million, respectively (Table 10).

Allocation of Economic Impacts by Florida Region

Citrus fruit production, packing/shipping and juice manufacturing occurs in 30 counties in Florida across three citrus producing regions of the state (Figure 1). The statewide economic contributions of the citrus industry were allocated to counties and aggregated to regions based on the proportional share of each major industry activity: citrus fruit production by county (USDA-NASS), certified fresh fruit shipments, and certified fruit receipts by processors, by location (FDACS). Note that separate regional economic models were not used for this analysis, which would have given quite different results, because of considerations for regional trade balances and generally smaller economic multipliers.

Regional results for 2012-13 are summarized in Table 11. The Central Florida region had the highest share of citrus industry economic impacts, with total employment impacts of 40,149 jobs, output impacts of $7.3 billion, and value added impacts of $3.52 billion. The Southern Florida region had employment impacts of 13,458 jobs, output impacts $1.92 billion, and value added impacts of $1.06 billion. The Indian River region generated 8,527 jobs, $1.43 billion in output impacts and $754.4 million in value added impacts.

Comparison of Economic Impacts for 2012-13 Versus 2007-08

Results for the present study of the Florida citrus industry in 2012-13 were compared to a previous study for 2007-08 (Rahmani and Hodges, 2009), to indicate the changes that have occurred due to developments in the industry. Results for monetary measures from the previous study were restated to be comparable with the

present study by using the updated regional economic model for 2012, and expressing all results in 2013 dollars. Note that IMPLAN uses industry-specific deflators rather than a broad index such as the Producer Price Index.

Results for the two study periods are shown in Table 12. The updated results for 2007-08 are generally larger than those originally published, except for employment, mainly due to the effect of inflation adjustment to express in 2013 prices. The total industry output impact for 2007-08 is now restated as $10.757 billion, compared to $8.906 billion originally. Comparing the overall economic impacts for all citrus industry activities in 2007-08 and 2012-13, labor income decreased by 4.9 percent, value added decreased by 4.1 percent, and industry output decreased by 0.7 percent, in constant dollar terms. Total employment impacts declined from 75,828 jobs in 2007-08 to 62,133 jobs in 2012-13, a decrease of 17.8 percent. Total monetary impacts were 17 to 20 percent lower for citrus fruit production and fresh fruit packinghouses, respectively, in 2012-13 compared to the earlier period, however, impacts for citrus juice manufacturing were actually 15 to 18 percent higher, reflecting higher prices for citrus juices and byproducts. The significant decrease in employment impacts from the previous period reflects changes in the employment multipliers in the 2012 IMPLAN model, denominated as jobs per million dollars output.

Economic Impacts of Citrus Greening Disease (HLB)

The economic impacts of citrus greening disease, also known as *Huonglongbing* (HLB) in its native China, were previously estimated for Florida oranges utilized for processing during the 2006-07 to 2010-11 period (Hodges and Spreen, 2012). This analysis updates these results through the 2013-14 production season. Note that estimates for actual production in 2013-14 are preliminary.

Scenarios for with and without the presence of HLB were evaluated with a mathematical model of the world orange juice market (Spreen et al., 2003). The model uses data on tree inventories, processor utilization, juice yields and market prices in Florida and Brazil (Sao Paulo state), the two largest global production regions, to predict annual orange production, juice production, and grower revenues in each area. The model allocates annual juice production in Florida and Sao Paulo across the major markets of the United States, European Union, Canada, and the rest of the world, accounting for transportation costs and tariffs to achieve a spatial price equilibrium. The impact of HLB is incorporated into the model through increased tree mortality rates, based on information from citrus experts at the University of Florida. Florida orange production and grower prices were projected over the period 2006-07 through 2013-14 for "with-HLB" (actual) and "without-HLB" (hypothetical) scenarios. After deducting the estimated cost of processing, delivered-in prices were calculated, and delivered-in revenues were computed by multiplying delivered-in prices times orange production.

Estimated production volumes, prices, and revenues for oranges produced in Florida and Brazil during 2006-07 through 2013-14 are summarized in Table 13, and Figures 6-8. Total cumulative production in Florida over the 8-year period under the without-HLB scenario was estimated at 1,476 million boxes, while actual

production under the with-HLB scenario was 1,120 million boxes, or about 24 percent lower (Figure 2). Production volumes would decline over time in the without-HLB scenario due to other changes in market demand and technical and factors. Brazilian production is estimated by the model to average 287 million boxes annually, and is also declining during this period. Cumulative orange juice production in Florida was estimated at 9.646 billion single-strength equivalent (SSE) gallons under the without-HLB scenario, and 6.965 billion gallons with-HLB. Prices received by growers for oranges delivered to processing plants ranged from $1.55 to $2.02 per gallon over the period under the without-HLB scenario, with a weighted average of $1.73, while actual prices under with-HLB ranged from $1.66 to $2.33 and averaged $1.96 (Figure 3). Total revenue received by Florida orange growers over the 8-year period would have been $16.648 billion without-HLB compared to $13.655 billion with-HLB, or about 18 percent lower (Figure 4). These econometric model results represent revenues to growers on a delivered-in basis, i.e. on-tree value plus harvest and transportation cost, so although prices rise under the lower supply conditions with-HLB, this does not completely offset the lower production volumes.

The direct economic impacts of HLB were taken as the difference between the with-HLB versus without-HLB scenarios in grower revenues received over the 2006-07 to 2012-13 period. The results summarized in Table 14 show the cumulative impacts over the 8 year period as well as the annual average impacts. The cumulative total impacts of HLB were estimated at -$7.802 billion in industry output, or an annual average of $975 million. Total value added impacts of HLB were -$4.583 billion, or $573 million annually, and labor income impacts were $2.915 billion, or $364 million annually. Total employment impacts were 60,101 job-years, or an average of 7,513 ongoing jobs, including both fulltime and part-time positions. These results do not include HLB impacts on the fresh citrus fruit market or grapefruit for processing.

Table 8. Summary of economic impacts of Florida citrus industry activities, 2012-13

Industry Activity	Impact Type (multiplier)	Employment (Jobs)	Labor Income (Million $)	Value Added (Million $)	Industry Output (Million $)
Citrus Fruit Production	Direct Effect	8,398	515	796	1,530
	Indirect Effect	5,869	187	225	387
	Induced Effect	15,181	727	1,225	1,906
	Total Effect	29,448	1,428	2,245	3,823
Citrus Juice Manufacturing	Direct Effect	6,315	451	798	3,141
	Indirect Effect	5,511	336	548	1,043
	Induced Effect	18,088	871	1,456	2,257
	Total Effect	29,913	1,658	2,802	6,440
Fresh Fruit Packinghouse Operations	Direct Effect	831	66	122	180
	Indirect Effect	277	15	23	36
	Induced Effect	1,663	81	133	204
	Total Effect	2,772	162	277	420
Total All Activities	Direct Effect	15,545	1,032	1,715	4,851
	Indirect Effect	11,657	538	796	1,465
	Induced Effect	34,932	1,679	2,814	4,367
	Total Effect	62,133	3,248	5,325	10,683

Note: Totals for all activities include direct, indirect and induced multiplier effects for out-of-state sales, and direct multiplier effects only for in-state sales. Numbers may not sum due to rounding.

Values in 2013 dollars. Employment includes fulltime and part-time jobs.

Source: *IMPLAN* software and 2012 region data for Florida (*IMPLAN* Group LLC).

Table 9. Economic impacts of the Florida citrus industry by industry group, 2012-13

Industry Group (NAICS)	Employment (Jobs)	Labor Income (Million $)	Value Added (Million $)	Industry Output (Million $)
11. Agriculture, forestry, fishing & hunting	14,595	703.9	1,022.1	1,853.4
21. Mining	63	0.8	1.0	10.2
22. Utilities	137	16.9	101.8	144.5
23. Construction	2,210	108.8	157.9	366.2
31-33. Manufacturing	7,448	526.2	926.1	3,720.2
42. Wholesale trade	2,756	220.1	402.8	597.6
44-45. Retail trade	5,113	176.7	279.3	372.7
48-49. Transportation & warehousing	1,493	70.0	90.2	186.7
51. Information	457	35.1	79.6	157.9
52. Finance & insurance	2,163	134.7	239.6	451.4
53. Real estate & rental	1,675	40.6	511.4	669.2
54. Professional, scientific & technical services	2,924	197.0	257.2	364.0
55. Management of companies	755	83.8	100.5	160.6
56. Administrative & waste services	2,444	79.6	94.3	145.9
61. Educational services	856	30.9	35.3	55.3
62. Health & social services	5,424	304.1	339.5	531.8
71. Arts, entertainment & recreation	778	25.6	37.4	56.2
72. Accommodation & food services	3,197	83.9	126.9	216.0
81. Other services	2,755	88.2	100.8	161.2
92. Government & non-NAICs	4,892	321.3	421.0	461.9
Total all industry groups	62,134	3,248.1	5,324.8	10,682.8

Industries are classified by the North American Industry Classification System (NAICS).

Values in 2013 dollars. Employment includes fulltime and part-time jobs.

Table 10. State/local and federal tax impacts of the Florida citrus industry, 2012-13

Tax Description	Amount ($1000)
Dividends	749
Social Ins Tax- Employee Contribution	1,932
Social Ins Tax- Employer Contribution	3,798
Tax on Production and Imports: Sales Tax	148,340
Tax on Production, Imports and Personal: Property Tax	117,336
Tax on Production and Imports: Motor Vehicle License	2,725
Tax on Production and Imports: Severance Tax	310
Tax on Production and Imports: Other Taxes	14,478
Tax on Production and Imports: S/L Non-Taxes	3,114
Corporate Profits Tax	13,311
Personal Tax: Non-Taxes (Fines- Fees)	15,572
Personal Tax: Motor Vehicle License	3,738
Personal Tax: Other Tax (Fish/Hunt)	240
Total State and Local Tax Impact	325,643
Social Ins. Tax- Employee Contribution	142,313
Social Ins. Tax- Employer Contribution	156,998
Tax on Production and Imports: Excise Taxes	25,077
Tax on Production and Imports: Custom Duty	9,942
Tax on Production and Imports: Fed Non-Taxes	2,849
Corporate Profits Tax	112,699
Personal Tax: Income Tax	236,108
Total Federal Tax Impact	685,986

Values in 2013 dollars. Note: numbers may not sum due to rounding.

Table 11. Allocation of economic impacts of the Florida citrus industry by producing region, 2012-13

Florida Region	Employment (jobs)	Labor Income (Million $)	Value Added (Million $)	Industry Output (Million $)
Central	40,149	2,129	3,516	7,331
Indian River	8,527	452	745	1,428
Southern	13,458	667	1,062	1,924
Total all Regions	62,133	3,248	5,324	10,683

Values in 2013 dollars. Employment includes fulltime and part-time jobs. Note: numbers may not sum due to rounding.

Table 12. Comparison of economic impacts of the Florida citrus industry in FY 2012-13 and 2007-08

Citrus Production Year	Employment (Jobs)	Labor Income (Million $)	Value Added (Million $)	Industry Output (Million $)
2012-13	62,133	3,248	5,325	10,683
2007-8	75,828	3,416	5,554	10,757
Percent change	-17.8%	-4.9%	-4.1%	-0.7%

Values in 2013 dollars. Employment represents fulltime and part-time jobs.

Note: results for labor income, value added and industry output in 2007-08 were restated from the original study by Rahmani and Hodges (2012).

Table 13. Florida and Brazil orange production, price, and value for processing utilization with and without citrus greening disease (HLB), 2006-07 to 2013-14

Measure	Scenario	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	Total 8 years	Average Annual
Fruit production (million boxes)	Without-HLB	196	194	191	187	183	179	175	171	1,476	185
	With-HLB	129	170	163	134	140	147	133	104	1,120	140
Juice production (million single-strength equivalent gallons)	FL Without-HLB	1,303	1,290	1,270	1,244	1,217	1,131	1,112	1,079	9,646	1,206
	FL With-HLB	816	1,107	1,035	806	854	920	812	615	6,965	871
	Brazil	1,922	1,977	1,664	1,699	1,434	1,942	1,741	1,212	13,591	1,699
	Total Without-HLB	3,225	3,267	2,934	2,943	2,651	3,073	2,853	2,291	23,237	2,905
	Total With-HLB	2,738	3,084	2,699	2,505	2,288	2,862	2,553	1,827	20,556	2,569
Florida grower prices received (dollars per gallon)	Without-HLB	1.546	1.511	1.788	1.781	2.024	1.673	1.606	1.908		1.726
	With-HLB	1.951	1.664	1.984	2.146	2.327	1.900	1.700	2.150		1.961
	Difference	0.406	0.153	0.196	0.365	0.302	0.228	0.094	0.243		0.235
	% Difference	26.3%	10.1%	11.0%	20.5%	14.9%	13.6%	5.8%	12.7%		13.6%
Florida grower revenues (million dollars)	Without-HLB	2,014	1,949	2,271	2,215	2,463	1,892	1,785	2,058	16,648	2,081
	With-HLB	1,593	1,841	2,053	1,730	1,987	1,748	1,380	1,322	13,655	1,707
	Difference	421	108	218	485	476	144	405	736	2,994	374
	% Difference	-20.9%	-5.5%	-9.6%	-21.9%	-19.3%	-7.6%	-22.7%	-35.8%		-18.0%

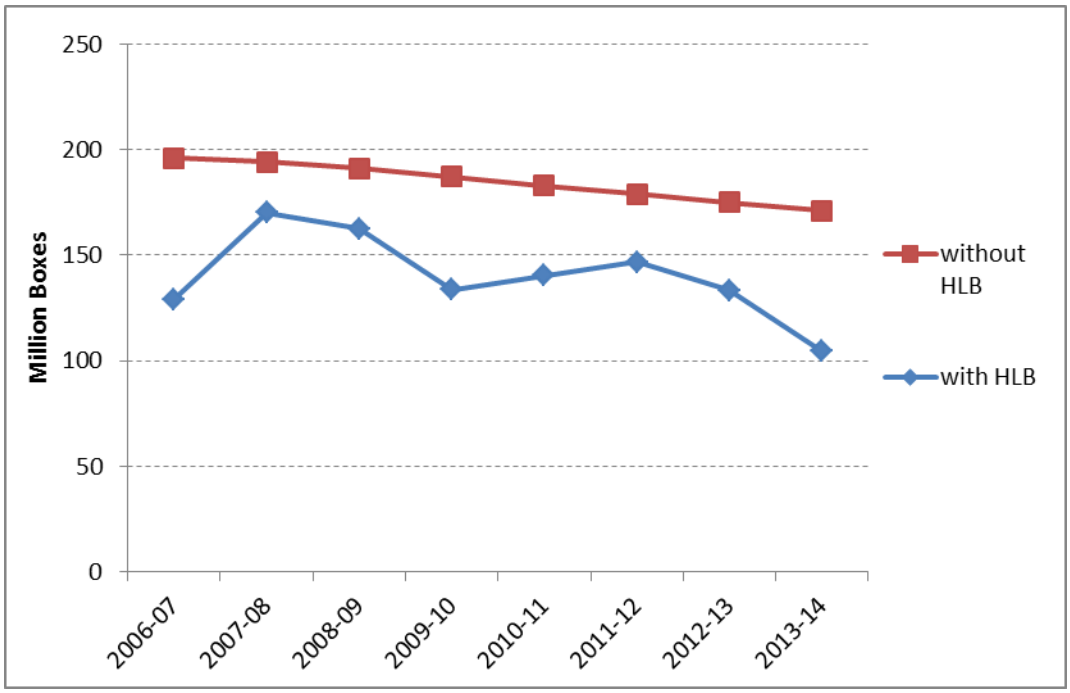
Source: World orange juice economic model (Spreen et al, 2003).

Table 14. Summary of economic impacts of citrus greening disease (HLB) for Florida processed orange production, 2006-07 to 2012-13

Impact Type	Employment (Job-Years)	Labor Income (Million $)	Value Added (Million $)	Industry Output (Million $)
Direct Effect	-17,140	-1,050	-1,624	-3,122
Indirect Effect	-11,978	-381	-460	-790
Induced Effect	-30,983	-1,484	-2,499	-3,891
Total Effect	-60,101	-2,915	-4,583	-7,802
Average annual impact over 8 years	-7,513	-364	-573	-975

Values in 2013 dollars. Employment represents fulltime and part-time jobs.
Source: *IMPLAN* software and Florida region data (*IMPLAN* Group LLC).

Figure 6. Florida orange production for processing with and without citrus greening disease (HLB), 2006-07 to 2013-14



Note: data for 2013-13 "with HLB" is preliminary.

Figure 7. Florida processed orange grower prices received with and without citrus greening disease (HLB), 2006-07 to 2013-14

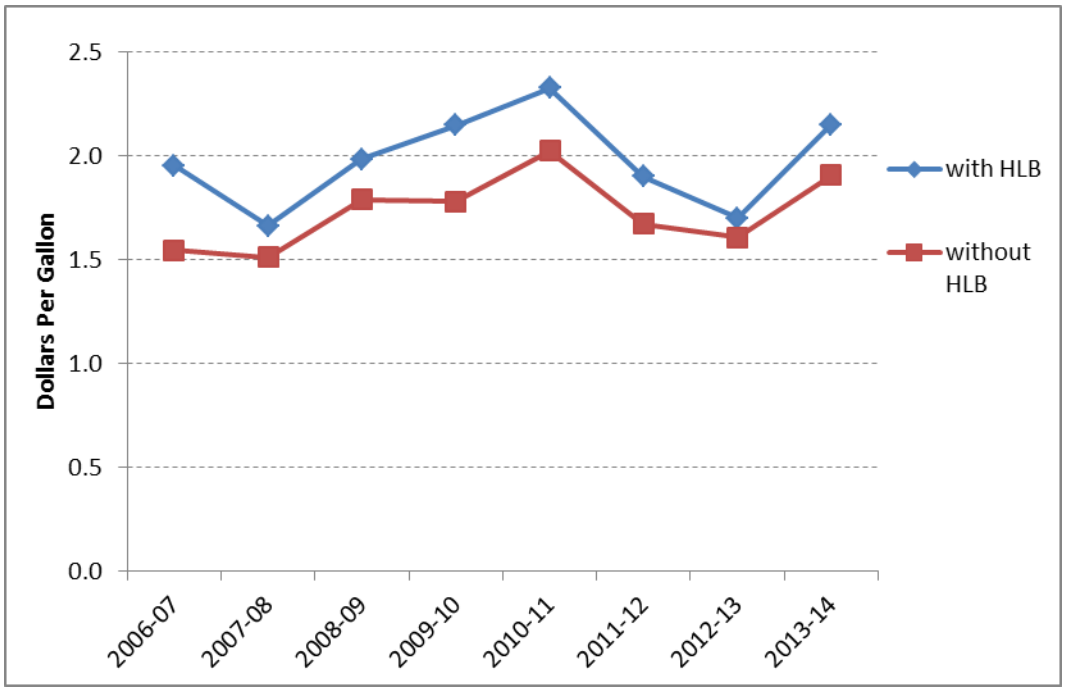
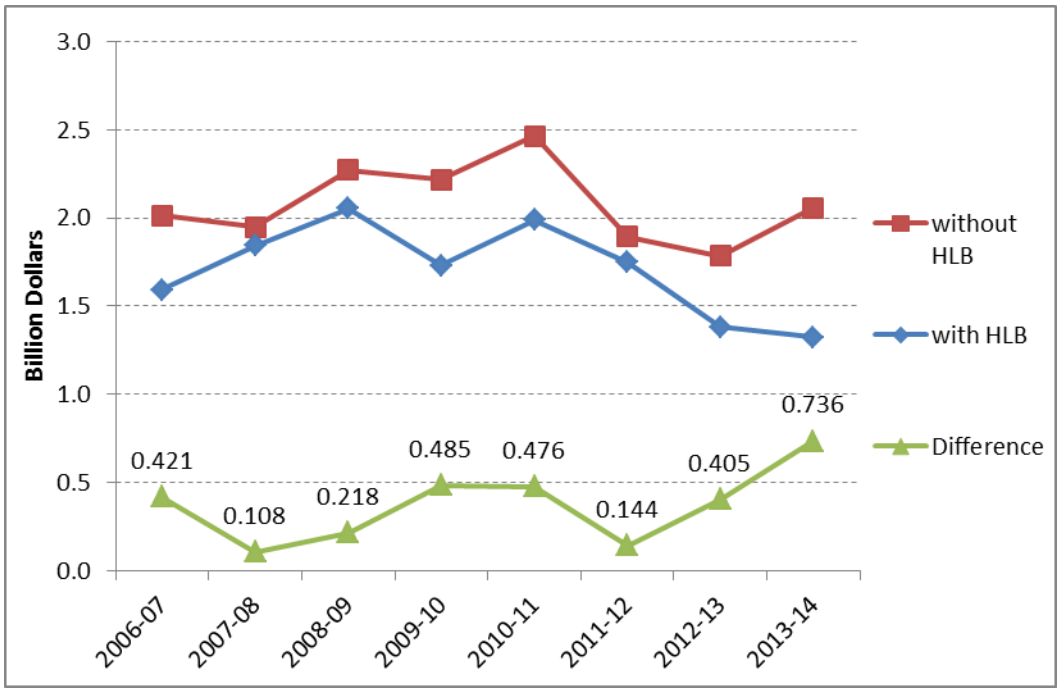


Figure 8. Florida orange grower revenues received with and without citrus greening disease (HLB), 2006-07 to 2013-14



Conclusions

Production acreage, yields and volumes in the Florida citrus industry have generally declined over the past 14 years, due to land conversion, and the deleterious effects of citrus canker and greening (HLB) disease. However, the Florida citrus industry remains a significant contributor to Florida's economy, with total industry revenues of $4.848 billion in 2012-13, and the resulting total economic impacts of 62,313 fulltime and part-time jobs, $3.248 billion in labor income, $5.325 billion in value added (GDP), and $10.683 billion in industry output. The industry also has significant impacts on government tax revenues, with total tax impacts for Florida state/local government of $326 million, including $117 million in business and personal property taxes and $148 million in sales taxes, that are important for funding public services.

Citrus fruit production and juice manufacturing were roughly equal in terms of employment impacts of (29,448 vs. 29,913 jobs, respectively) and value added impacts of ($2.245 vs. 2.802 billion), while the impacts of the fresh fruit packinghouse sector were much smaller: 2,771 jobs and $277 million in value added. Although the economic impacts were largest in the agriculture (fruit production) and manufacturing (juice processing) sectors, the industry also has significant impacts in many other sectors due to the supply chain linkages and household spending of income from new final demand that are captured by the indirect and induced multiplier effects in the regional economic model.

Since the previous economic study of the Florida citrus industry for 2007-08, economic impacts in 2012-13 declined by 17.8 percent in terms of employment, 4.1 percent in terms of value added, and 0.7 percent in terms of industry output, in constant dollar terms, based on a re-analysis of the earlier data using the updated regional economic model multipliers for 2012, and monetary measures expressed constant 2013 dollars. Although these results may seem counterintuitive in view of the decreasing trend in acreage, yields and production volumes, the increased prices for citrus products at both wholesale and retail levels have largely offset the decline in volumes, resulting in total industry revenues actually increasing. Citrus fruit production costs have also increased significantly for chemicals, fertilizers, replanting and management to combat citrus greening disease. In addition, regional economic multipliers for citrus industry sectors in the updated IMPLAN model are slightly higher than previously, except for employment, reflecting increased economic integration in the Florida economy.

This study confirmed the continuing and increasing economic impact of citrus greening (HLB) disease on the Florida citrus industry during recent years, since the disease first appeared in the state in 2006. Using a model for the world orange juice industry, Florida orange production, prices and grower revenues were estimated under a hypothetical scenario without-HLB, and compared to the actual production history (with-HLB). It was concluded that HLB has caused a cumulative loss of $2.994 billion in grower revenues over the 2006-07 to 2013-14 period, or an average of $374 million annually. This revenue loss resulted in average annual total economic impacts to the Florida economy of -7,513 jobs, $573 million in value added, and $975 million in industry output. Note that this analysis did not attempt to quantify the impacts of citrus greening on the market for fresh citrus and processed grapefruit, although it is believed that these impacts are relatively small

compared to that for processed oranges. These results should assist citrus industry stakeholders, government regulators, policy makers, and researchers to better understand the economic importance of finding solutions to citrus greening.

The economic impact estimates reported here were based on published values and official industry statistics, 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 a lack of specific information available on production input purchases for citrus processing and juice packaging plants, and packinghouse operations, which would enable a more precise analysis of the impacts of these activities.

References

Feedstuffs, the Weekly Newspaper for Agribusiness. Price data for citrus pulp and meal. Minnetonka, MN, 2013 issues.

Florida Department of Citrus (FDOC). Annual Processors' Statistical Report 2012-13.

Florida Department of Citrus (FDOC). Nielson Retail Sales. Annual topline report on retail sales for Florida citrus juice, 2012-13 season, Dec. 2013.

Florida Caribbean Distillers, LLC, Lake Alfred, FL (price data citrus byproducts).

Florida Department of Agriculture and Consumer Services (FDACS), Certified fresh fruit to canning plants, by processor, for Florida advertising tax, and certified fresh fruit shipments by packing houses for Florida advertising tax, for period 8/1/12 to 7/31/13, Division of Fruit and Vegetable Inspection, Winter Haven, FL, Aug. 15, 2013.

Hodges, A.W, E. Phillippakos, W.D. Mulkey, T. Spreen and R. Muraro. Economic impact of Florida's citrus industry, 1999-2000. Economic Information Report 01-02. University of Florida-IFAS, Food & Resource Economics, Gainesville, FL, July 2001, 14 pages, available at http://economicimpact.ifas.ufl.edu.

Hodges, A.W., M. Rahmani, and W.D. Mulkey, Economic impact of the Florida's citrus industry, 2003-04. EDIS document FE 633. University of Florida-IFAS, Food & Resource Economics, Gainesville, FL, available at http://edis.ifas.ufl.edu/fe633.

Hodges, A.W. and T.H. Spreen. Economic impacts of citrus greening (HLB) in Florida, 2006/07—2010/11. EDIS document FE 903, University of Florida-IFAS, Food & Resource Economics, Gainesville, FL, 6 pages, Jan. 2012, available at http://edis.ifas.ufl.edu/fe903.

IMPLAN Group, LLC. IMPLAN economic impact analysis and social accounting software, and 2008 and 2012 data for Florida. Huntersville, NC, 2014, http://www.implan.com/.

Muraro, Ronald P. Summary of 2011-2012 Citrus Budgets for the Southwest Florida Production Region. University of Florida-IFAS, Citrus Research and Education Center, Lake Alfred, Florida, Sep. 2012, available at http://www.crec.ifas.ufl.edu/.

Muraro, Ronald P. Summary of 2011-2012 Citrus Budgets for the Central Florida (Ridge) Production Region. University of Florida-IFAS, Citrus Research and Education Center, Lake Alfred, Florida, Sep. 2012, available at http://www.crec.ifas.ufl.edu/.

Muraro, Ronald P. Summary of 2011-2012 Citrus Budgets for the Indian River Production Region. University of Florida-IFAS, Citrus Research and Education Center, Lake Alfred, Florida, Sep. 2012, available at http://www.crec.ifas.ufl.edu/.

Peace River Citrus Products. Price data for citrus byproducts. Bartow, FL.

Rahmani, Mohammad and Alan W. Hodges. Economic impact of the Florida's citrus industry, 2007-08. EDIS document FE802. University of Florida-IFAS, Food & Resource Economics, Gainesville, FL, 2012, available at http://edis.ifas.ufl.edu/fe802.

Spreen, Thomas H., Charlene Brewster, and Mark G. Brown. The Free Trade Area of the Americas and the world processed orange market. *Journal of Agricultural and Applied Economics* 35(2003): 107-26.

U.S. Department of Agriculture, National Agricultural Statistics Service (USDA-NASS). *Citrus Fruits 2013 Summary*, September 2013.

U.S. Department of Agriculture, National Agricultural Statistics Service (USDA-NASS). *Florida Citrus Statistics 2012-13*.

U.S. Department of Agriculture, National Agricultural Statistics Service (USDA-NASS). Quick Stats online data retrieval tool, available at http://www.nass.usda.gov/Quick_Stats/.

U.S. Department of Agriculture, Foreign Agricultural Service (USDA-FAS). World production, supply and distribution online database, available at http://apps.fas.usda.gov/psdonline/psdHome.apx.

Appendices

Table A1. Florida citrus production budgets, by type and region, 2011-12

Expense Item	Central, processed oranges	Central, fresh oranges	Indian River, processed grapefruit	Indian River, fresh, grapefruit	Southwest, processed oranges	Southwest, fresh oranges
	- Dollar per acre -					
Tree Replacement prepare Site and Plant Tree	41.2	41.2	51.5	51.5	51.5	51.5
Mechanical Mow Middle (4/year)	52.8	52.8	52.8	52.8	40.5	40.5
Chemical Mow Middle (2/year)	12.8	12.8	12.8	12.8	12.6	12.6
W.M., General Grove work (2 hour/A)	33.6	33.6	33.6	33.6	33.6	33.6
Herbicide application (Programs #1,#2 and #3)	44.2	44.2	42.2	42.2	31.4	31.4
Herbicide Material (Programs #1,#2 and #3)	92.7	92.7	93.0	93.0	86.0	86.0
Spray Programs: All application costs	176.3	176.3	312.6	312.6	159.1	159.1
Spray Programs: All Material	242.4	242.4	459.1	459.1	241.5	241.5
Enhanced Foliar Nutrient Spray	265.7	265.7	266.0	266.0	266.0	266.0
Fertilizer Application cost (4 application)	47.4	47.4	47.4	47.4	33.3	33.3
Fertilizer material (4 application)	358.7	358.7	261.6	261.6	391.8	391.8
Dolomite, Material/Application	14.1	14.1	18.7	18.7	16.9	16.9
Total Pruning Hedging- Chop/Mow Brush	36.4	36.4	48.1	48.1	36.4	36.4
Irrigation: Micro-sprinkler System	165.2	165.2	215.6	215.6	215.6	215.6
Tree Removal & Site Cleanup-Preparation	52.6	52.6	57.1	57.1	57.1	57.1
Mandatory Citrus Canker Decontamination Costs	31.8	31.8	31.8	31.8	31.8	31.8
Field Inspection for Citrus Greening (4 Inspections)	55.5	55.5	55.5	55.5	55.5	55.5
Clean Block before Certification and Harvesting			35.2	35.2		
Inspection before "Canker Free" Certification			53.8	53.8		
Supplemental Fertilizer, Spray, Sprout, (Tree Repl.)	94.6	94.6	119.8	119.8	119.8	119.8
Management Costs	48.0	48.0	48.0	48.0	48.0	48.0
Harvesting Costs: Pick/Spot Pick, Roadside &Hauling	844.0	919.0	1,110.0	1,023.0	844.0	919.0
Interest on Operating (Cultural) Costs	84.1	84.1	104.9	104.9	83.8	83.8
Interest on Average Capital Investment Costs	321.2	321.2	321.2	321.2	321.2	321.2
Fly Protocol Cost			56.7	56.7		
Water Drainage District Tax			65.2	65.2		
DOC Assessment	61.0	61.0	61.0	61.0	61.0	61.0
Total Cost	3,176.3	3,251.3	4,035.1	3,948.1	3,238.3	3,313.3

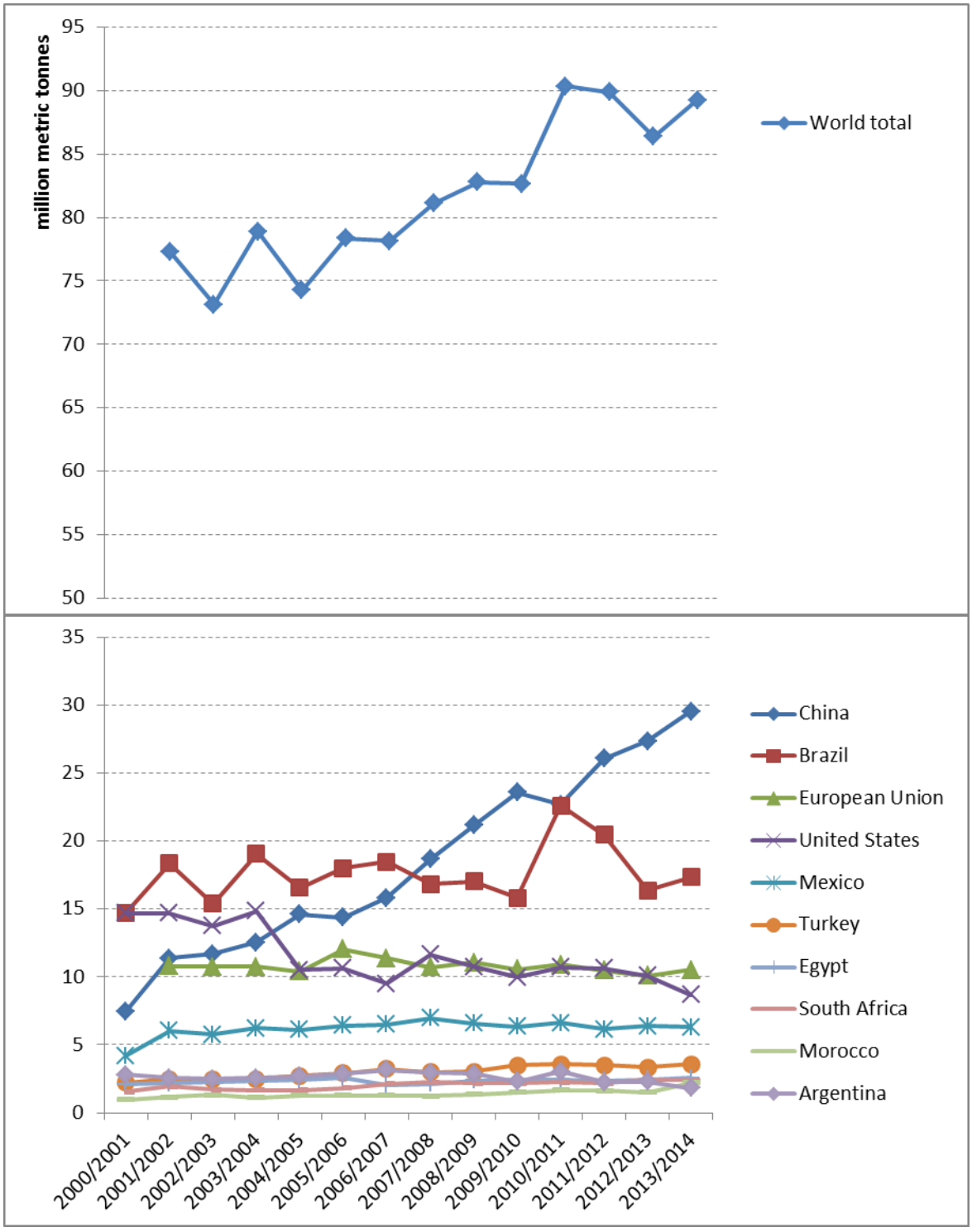
Source: Muraro, 2012.

Table A2. Industry purchases for Florida citrus fruit production by *IMPLAN* sector

IMPLAN Industry Sector	Percent of total expenditures
6-Greenhouse & nursery products	1.40%
19-Support activities for agriculture and forestry	43.49%
130-Fertilizer manufacturing	18.57%
131-Pesticide and other agricultural chemical manufacturing	14.91%
144-Plastics pipe and pipe fitting manufacturing	5.78%
354-Monetary authorities and depository credit intermediaries	12.11%
381-Management of companies	1.43%
Total	100%

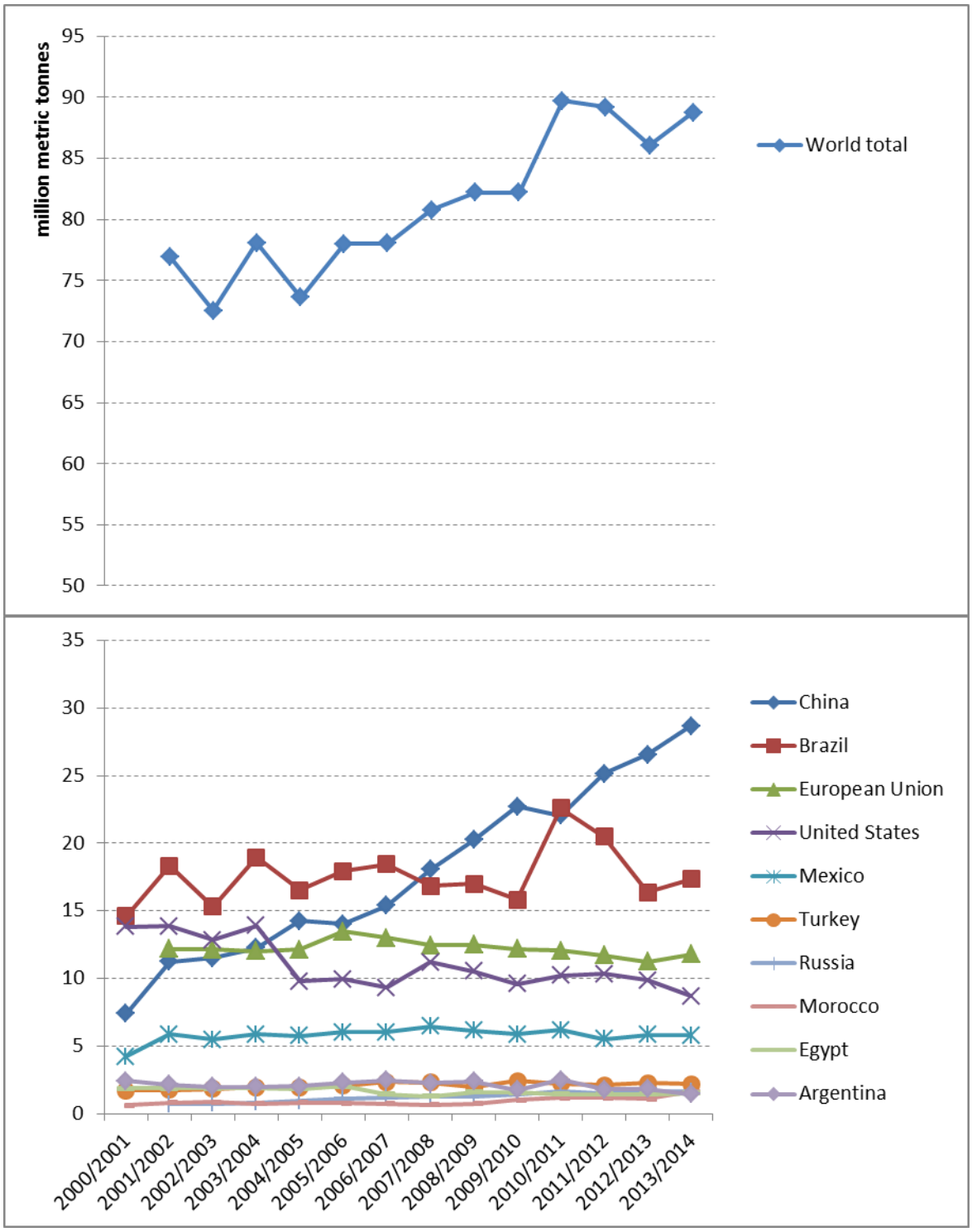
Sources: Muraro, 2012; *IMPLAN* model for Florida (*IMPLAN* Group LLC).

Figure A1. World citrus production, all citrus types, and top ten countries, 2000-01 to 2013-14



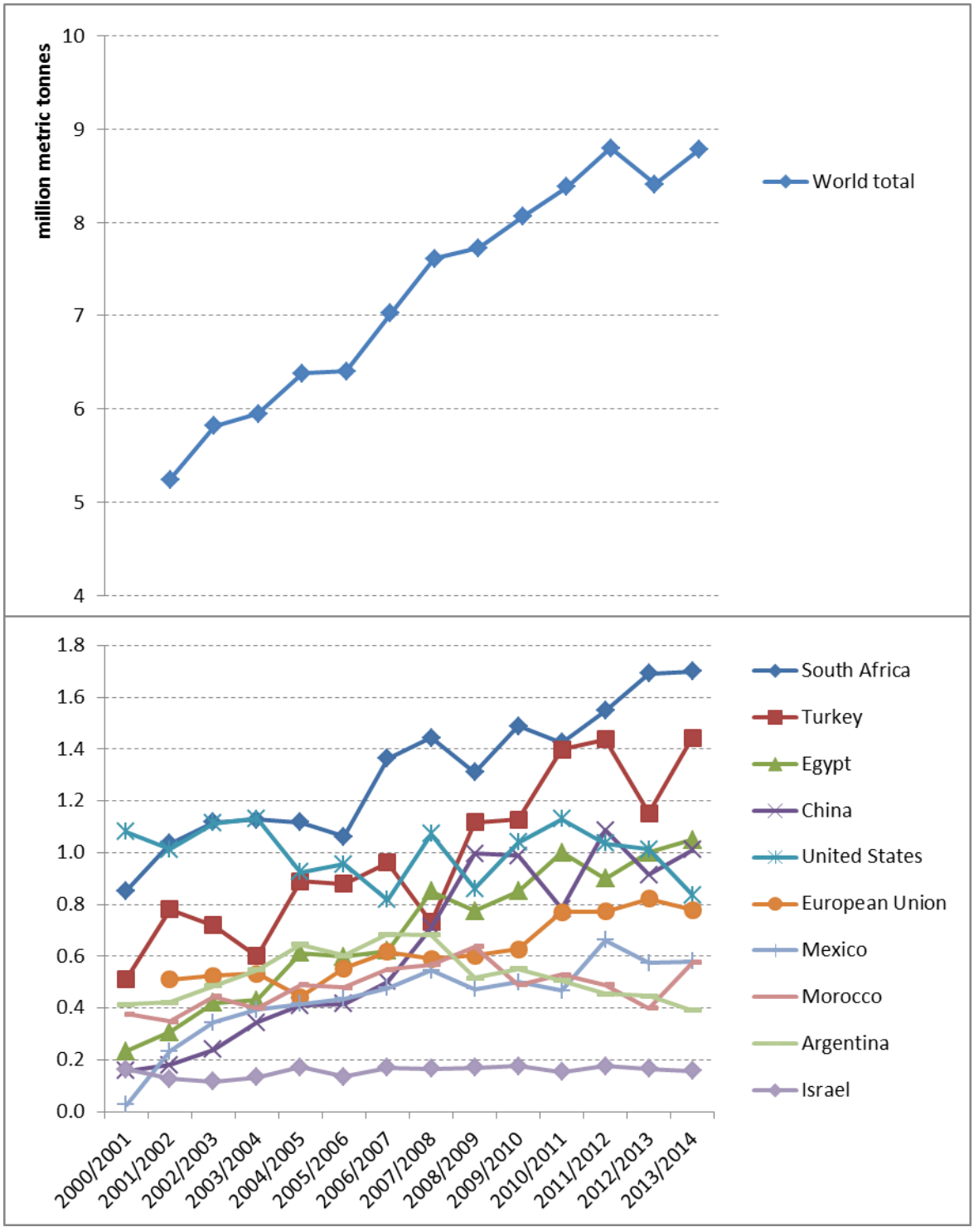
Source: USDA-FAS, World production, supply, and distribution online database.

Figure A2. World citrus consumption, all citrus types for fresh and processed utilization, and top ten countries, 2000-01 to 2013-14



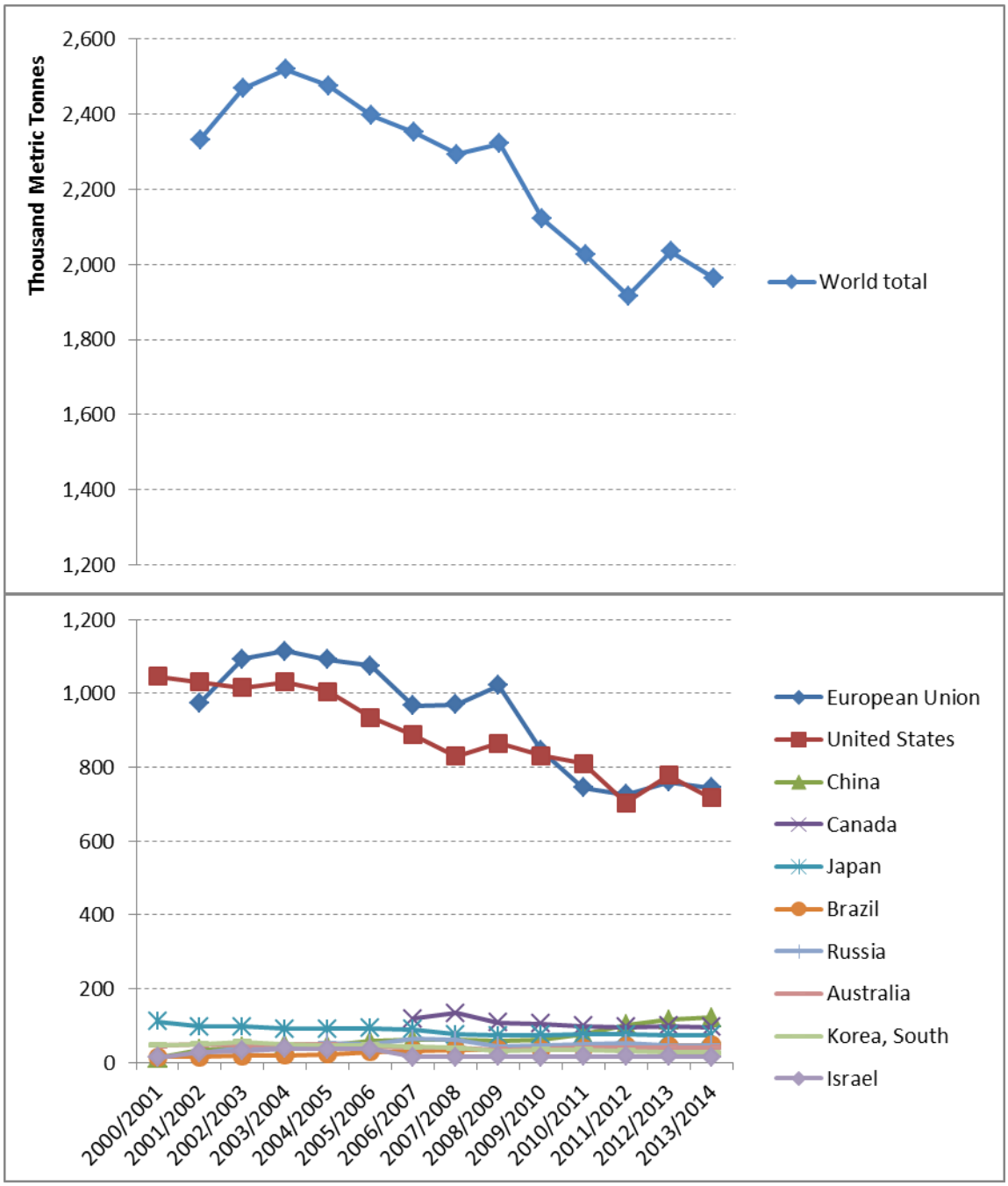
Source: USDA-FAS, World production, supply, and distribution online database.

Figure A3. World citrus exports, all citrus types, and top ten countries, 2000-01 to 2013-14



Source: USDA-FAS, World production, supply, and distribution online database.

Figure A4. World citrus juice consumption, all citrus types, and top ten countries, 2000-01 to 2013-14



Source: USDA-FAS, World production, supply, and distribution online database.

Glossary of Economic Impact Terms

Contribution (economic) represents the gross change in economic activity associated with an industry, event, or policy in an existing regional economy.

Employee compensation is comprised of wages, salaries, commissions, and benefits such as health and life insurance, retirement and other forms of cash or non-cash compensation.

Employment is a measure of the number of jobs involved, including fulltime, part-time and seasonal positions. It is not a measure of fulltime equivalents (FTE).

Exports are sales of goods to customers outside the region in which they are produced, which represents a net inflow of money to the region. This also applies to sales of services to customers visiting from other regions.

Final Demand represents sales to final consumers, including households, governments, and exports from the region.

Gross Regional Product is a measure of total economic activity in a region, or total income generated by all goods and services. It represents the sum of total value added by all industries in that region, and is equivalent to Gross Domestic Product for the nation.

IMPLAN is a computer-based input-output modeling system that enables users to create regional economic models and multipliers for any region consisting of one or more counties or states in the U.S. The current version of the *IMPLAN* software, version 3, accounts for commodity production and consumption for 440 industry sectors, 10 household income levels, taxes to local/state and federal governments, capital investment, imports and exports, transfer payments, and business inventories. Regional datasets for individual counties or states are purchased separately.

Impact or total impact is the change in total regional economic activity (e.g. output or employment) resulting from a change in final demand, direct industry output, or direct employment, estimated based on regional economic multipliers.

Imports are purchases of goods and services originating outside the region of analysis.

Income is the money earned within the region from production and sales. Total income includes labor income such as wages, salaries, employee benefits and business proprietor income, plus other property income.

Tax on Production and Imports are taxes paid to governments by individuals or businesses for property, excise and sales taxes, but do not include income taxes.

Input-Output (I-O) model and Social Accounting Matrix (SAM) is a representation of the transactions between industry sectors within a regional economy that captures what each sector purchases from every other sector in order to produce its output of goods or services. Using such a model, flows of economic activity associated with any change in spending may be traced backwards through the supply chain.

Local refers to good and services that are sourced from within the region, which may be defined as a county, multi-county cluster, or state. Non-local refers to economic activity originating outside the region.

Margins represent the portion of the purchaser price accruing to the retailer, wholesaler, and producer/manufacturer, in the supply chain. Typically, only the retail margins of many goods purchased by consumers accrue to the local region, as the wholesaler, shipper, and manufacturer often lie outside the local area.

Multipliers capture the total effects, both direct and secondary, in a given region, generally as a ratio of the total change in economic activity in the region relative to the direct change**.** Multipliers are derived from an I-O model of the regional economy. Multipliers may be expressed as ratios of sales, income, or employment, or as ratios of total income or employment changes relative to direct sales. Multipliers express the degree of interdependency between sectors in a region's economy and therefore vary considerably across regions and sectors. A **sector-specific multiplier** gives the total changes to the economy associated with a unit change in output or employment in a given sector (i.e. the **direct economic effect)** being evaluated. **Indirect effects multipliers** represent the changes in sales, income, or employment within the region in backward-linked industries supplying goods and services to businesses (e.g., increased sales in input supply firms resulting from more nursery industry sales). **Induced effects multipliers** represent the increased sales within the region

from household spending of the income earned in the direct and supporting industries for housing, utilities, food, etc. An **imputed multiplier** is calculated as the ratio of the total impact divided by direct effect for any given measure (e.g. output, employment).

Other property income represents income received from investments, such as corporate dividends, royalties, property rentals, or interest on loans.

Output is the dollar value of a good or service produced or sold, and is equivalent to sales revenues plus changes in business inventories.

Producer prices are the prices paid for goods at the factory or point of production. For manufactured goods the purchaser price equals the producer price plus a retail margin, a wholesale margin, and a transportation margin. For services, the producer and purchaser prices are equivalent.

Proprietor income is income received by non-incorporated private business owners or self-employed individuals.

Purchaser prices are the prices paid by the final consumer of a good or service.

Region or Regional Economy is the geographic area and the economic activity it contains for which impacts are estimated. It may consist of an individual county, an aggregation of several counties, a state, or aggregation of states. These aggregations are sometimes defined on the basis of worker commuting patterns.

Sector is an individual industry or group of industries that produce similar products or services, or have similar production processes. Sectors are classified according to the North American Industrial Classification System (NAICS).

Value Added is a broad measure of income, representing the sum of employee compensation, proprietor income, other property income, indirect business taxes and capital consumption (depreciation), that is comparable to Gross Domestic Product. Value added is a commonly used measure of the contribution an industry to regional economy because it avoids double counting of intermediate sales.