Understanding and Using Economic Multipliers

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Definition: Economic multipliers capture the effect on overall economic activity in a specific region as the result of changes in sales, spending or employment in a given industry, or for a project or event.

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Applications of Economic Multipliers

- New business location or new industry
- Business expansion, downsizing, closure
- Assessment of role and contribution of existing business/industry
- Local economic development and design of incentives
- Target industry analysis
- Fiscal impact analysis
- Environmental impact analysis

Examples of Economic Impact Studies Conducted at University of Florida

Industry Studies

- Aquaculture in Alabama
- Agriculture in Dade County, Florida
- Florida Citrus Industry (2000, 2004)
- Florida Apiculture (Beekeeping) Industry
- Florida Forest Industry
- Florida Environmental Horticulture Industry (1997, 2000, 2005)
- Green Industry in the United States
- Florida Golf Industry
- San Carlos Island Shrimp Industry (Ft. Meyers, FL)
- Tourism: Indian River County, Florida; Norfolk, Virginia

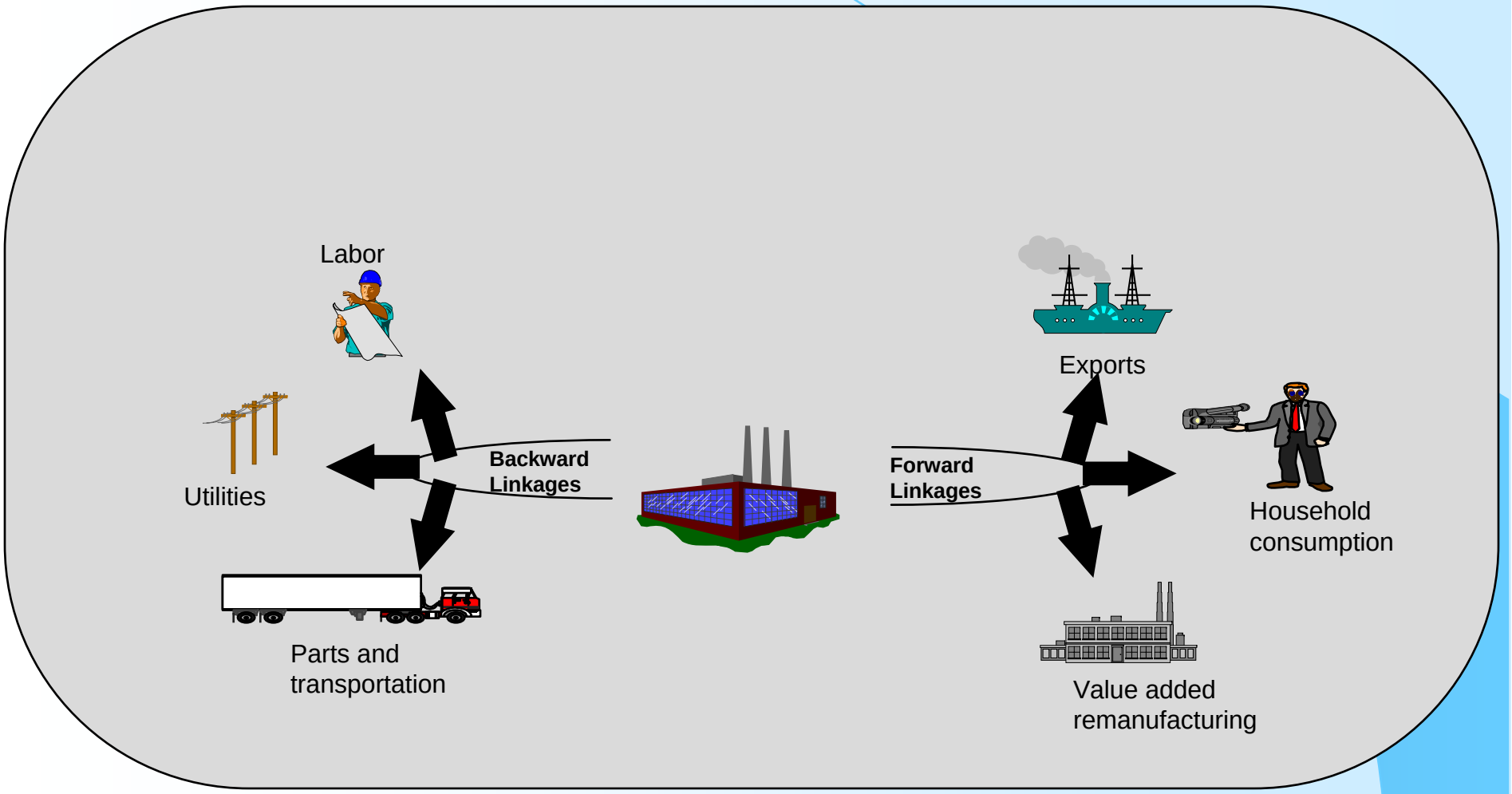
Events and Public Works Projects

- Golf Tournaments: TPC, WGC American Express Championship
- Everglades restoration Project in Southwest Florida (C-43 Reservoir)
- International Boat Shows (New York, Ft. Lauderdale, Miami)
- World Golf Village (St. Augustine, FL)

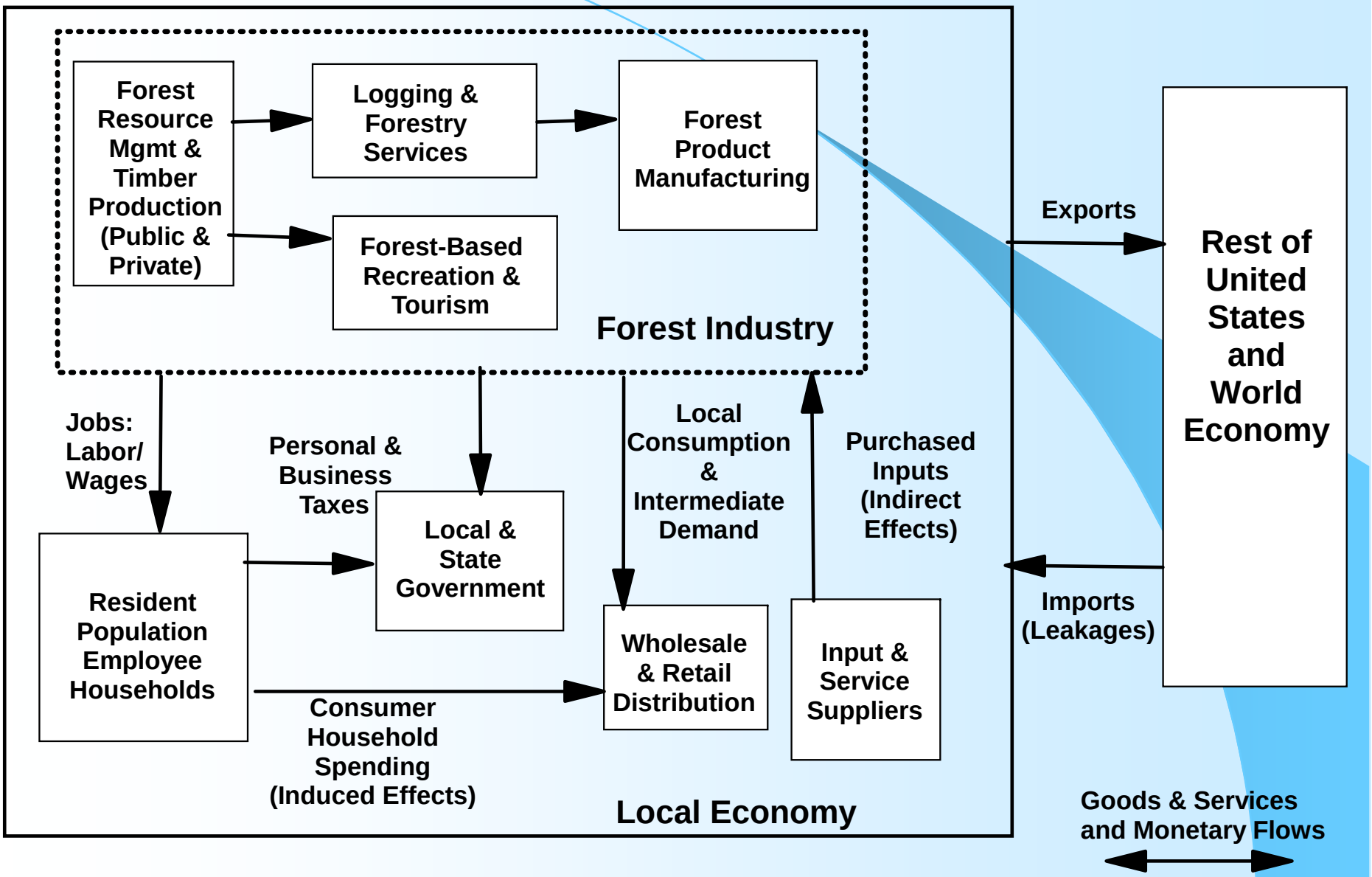
Economic Development, Environmental/Social Issues

- Red Tide in Southwest Florida
- Rural Health Care in Florida
- County Fairs in Florida
- Atlantic Coast Fisheries
- Woody Biomass for Electric Power Generation in Southern U.S.
- Impact of the University of Florida

Linkages in a Regional Economy



Economic Structure of the Forest Industry



Types of Multipliers

- Direct Effects: direct change in industry output, expenditure or employment
- Indirect Effects: change in input purchases (supply chain) due to direct effect
- Induced Effects: change in employee household personal consumption expenditures due to direct and indirect changes
- Type I: (direct + indirect) / direct
- Type II: (direct + indirect + induced) / direct (income or employment based)
- SAM: includes income effects of household s, government spending, investment, transfer payments

Multipliers for Florida Agriculture & Natural Resource Industries (2004)

Industry	Output (Revenue)				Total Value Added	Labor Income	Indirect Business Taxes	Employ-ment (jobs / mil$)
	Direct Effects	Indirect Effects	Induced Effects	Total Effects				
ed farming	1.00	0.17	1.10	2.27	1.48	0.63	0.08	24.6
farming	1.00	0.23	1.02	2.25	1.36	0.61	0.08	31.3
able and melon farming	1.00	0.15	1.20	2.35	1.60	0.79	0.07	20.3
ut farming	1.00	0.15	1.21	2.36	1.60	0.77	0.09	22.5
arming	1.00	0.24	1.06	2.31	1.39	0.80	0.09	26.2
house and nursery production	1.00	0.17	1.22	2.40	1.59	1.01	0.08	25.3
co farming	1.00	0.11	1.20	2.32	1.61	0.71	0.08	31.9
n farming	1.00	0.28	1.03	2.31	1.37	0.70	0.07	21.9
cane and sugar beet farming	1.00	0.34	0.91	2.25	1.19	0.66	0.10	44.0
er crop farming	1.00	0.21	1.02	2.24	1.36	0.66	0.08	18.7
ranching and farming	1.00	0.46	0.55	2.01	0.72	0.40	0.07	20.0
y and egg production	1.00	0.17	0.84	2.01	1.12	0.51	0.05	12.2
animal production	1.00	0.33	0.47	1.80	0.60	0.40	0.06	37.5
ng	1.00	0.44	0.75	2.19	0.97	0.60	0.06	16.8
: products and timber tracts	1.00	0.70	0.93	2.63	1.18	0.80	0.09	30.2
g	1.00	0.47	0.84	2.31	1.06	0.85	0.08	44.8
ng and trapping	1.00	0.57	1.03	2.60	1.32	0.80	0.12	31.5
lture/forestry support activities	1.00	0.28	1.09	2.38	1.39	1.13	0.08	48.5

Source: MIG, Inc., *IMPLAN* data for Florida

Multipliers for Selected Florida Food Manufacturing Industries (2004)

Industry	Output				Total Value Added	Labor Income	Indirect Business Taxes	Employ-ment (jobs / mil.$)
	Direct Effects	Indirect Effects	Induced Effects	Total Effects				
Flour milling	1.00	0.47	0.69	2.16	0.90	0.55	0.08	11.8
Rice milling	1.00	0.49	0.67	2.16	0.88	0.55	0.08	12.1
Wet corn milling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
Soybean processing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
Other oilseed processing	1.00	0.53	0.59	2.11	0.76	0.45	0.08	10.4
Fats and oils refining and blending	1.00	0.22	0.36	1.58	0.47	0.28	0.04	6.0
Sugar manufacturing	1.00	0.95	0.85	2.80	1.10	0.70	0.09	23.7
Frozen food manufacturing	1.00	0.43	0.82	2.25	1.07	0.64	0.07	14.9
Fruit and vegetable canning and drying	1.00	0.44	0.81	2.25	1.06	0.61	0.07	13.6
Fluid milk manufacturing	1.00	0.68	0.54	2.22	0.70	0.44	0.06	13.2
Cheese manufacturing	1.00	0.61	0.47	2.08	0.61	0.38	0.06	11.4
Dry, condensed, evap. dairy products	1.00	0.61	0.58	2.19	0.76	0.43	0.06	12.5
Ice cream and frozen desserts	1.00	0.54	0.66	2.20	0.87	0.51	0.06	12.9
Animal slaughtering (exc. poultry)	1.00	0.70	0.51	2.21	0.66	0.43	0.06	17.0
Meat processed from carcasses	1.00	0.55	0.53	2.08	0.69	0.44	0.05	12.5
Rendering and meat byproducts	1.00	0.79	0.83	2.62	1.09	0.61	0.07	14.4
Poultry processing	1.00	0.45	0.59	2.04	0.76	0.50	0.05	13.4
Seafood product preparation	1.00	0.50	0.65	2.16	0.84	0.59	0.07	15.3

Source: MIG, Inc., *IMPLAN* data for Florida

Input-Output (I-O) Models

- Constructed for a specific region
- Represents economic linkages between industries, households, and governments in terms of purchases and expenditures
- The economy is driven by consumption or final demand, including exports, and local purchases.

Example I-O Transactions Table

Transactions Table ($millions)

Processing Sectors	Purchasing Sectors: Agriculture	Manufacturing	Services	Final Demand	Total Output
Agriculture	10	6	2	18	36
Manufacturing	4	4	3	26	37
Services	6	2	1	35	44
Payments	16	25	38	0	79
Total Outlay	36	37	44	79	196

Example I-O Direct Requirements Table

Direct Requirements Table

Processing Sectors	Purchasing Sectors: Agriculture	Manufacturing	Services	Final Demand	Total Output
Agriculture	.27778	.16216	.04545		
Manufacturing	.11111	.10811	.06818		
Services	.16667	.05405	.02273		
Payments	.44444	.67567	.86363		
Total Outlay	1.0	1.0	1.0		

I-O Direct Requirements Equation, Matrix Notation and Predictive Model Derivation

$$X_1 = 0.278 * X_1 + 0.162 * X_2 + 0.045 * X_3 + Y_1$$

$$X_2 = 0.111 * X_1 + 0.108 * X_2 + 0.068 * X_3 + Y_2$$

$$X_3 = 0.167 * X_1 + 0.054 * X_2 + 0.023 * X_3 + Y_3$$

$$\begin{vmatrix} X_1 \\ X_2 \\ X_3 \end{vmatrix} = \begin{vmatrix} .278 & .162 & .045 \\ .111 & .108 & .068 \\ .167 & .54 & .023 \end{vmatrix} * \begin{vmatrix} X_1 \\ X_2 \\ X_3 \end{vmatrix} + \begin{vmatrix} Y_1 \\ Y_2 \\ Y_3 \end{vmatrix}$$

$$X = A * X + Y$$

$$\Delta TIO = (I-A)^{-1} * \Delta FD$$

Multiplier Table

Total Requirements Table (Direct & Indirect Coefficients Table)

	Purchasing Sectors		
Processing Sectors	**Agriculture**	**Manufacturing**	**Services**
Agriculture	**1.44568**	**0.26806**	**0.08549**
Manufacturing	**0.19979**	**1.16301**	**0.09043**
Services	**0.25760**	**0.11004**	**1.04291**
Total	**1.90307**	**1.54111**	**1.21883**

Example Augmented I-O Accounts and Social Accounting Matrices

		Purchasing Industries					Final Demand			
		Agri-culture	Mining	Manu-facturing	Trade	Services	House-holds	Govern-ment	Exports	Total
Selling Industries	Agriculture	12	2	10	6	0	1	1	7	39
	Mining	5	2	20	0	0	0	2	11	40
	Manufacturing	5	3	6	20	5	9	10	40	98
	Trade	2	3	2	1	5	25	10	5	53
	Services	7	10	30	2	10	18	10	0	87
Value Added	Indirect Business Taxes	1	2	4	4	7				
	Household Earnings	5	14	20	12	40				
	Corporate Profits	1	2	3	4	10				
	Imports	1	2	3	4	10				
	Total	39	40	98	53	87	53	33	63	617

Social Accounting Matrix for Florida (2002)

Institution Receipts	Industry Total	Com-modity Total	Value Added	House-holds	Fed. Govt.	State-Local Govt	Enter-prises (Corp.)	Capital	Inv. Change	Foreign & Dom. Trade	Total
	Institution Payments										
Industry Total	0	633,463	0	0	0	0	0	0	0	208,465	841,928
Commodity Total	199,832	0	0	293,406	20,765	59,276	0	67,829	166	0	641,273
Employee Compensation	303,263	0	0	0	0	0	0	0	0	0	303,263
Proprietary Income	28,872	0	0	0	0	0	0	0	0	0	28,872
Other Property Income	141,833	0	0	0	0	0	0	0	0	0	141,833
Indirect Business Taxes	39,929	0	0	0	0	0	0	0	0	0	39,929
Households	0	208	352,128	15,671	76,562	5,774	31,427	20,099	0	600	502,469
Fed. Govt. Other	0	78	40,019	1,317	0	0	7,062	70,844	0	93	119,413
Fed. Govt. Defense	0	0	0	0	18,142	0	0	0	0	0	18,142
Fed. Govt. Investment	0	0	0	0	3,363	0	0	0	0	0	3,363
State/Local Govt Other	0	5,418	36,386	3,563	12,791	0	5,780	10,358	0	355	74,653
State/Local Govt Education	0	0	0	0	0	18,205	0	0	0	0	18,205
State/Local Govt Invest.	0	0	0	0	0	12,904	0	0	0	0	12,904
Enterprises (Corporations)	0	0	41,240	0	1,738	47	0	1,245	0	0	44,270
Capital	0	2,056	63,460	61,213	0	0	0	0	0	53,518	180,246
Inventory Change	0	51	0	0	0	0	0	269	0	67	387
Foreign Trade	11,032	0	20	20,300	2,063	1,213	0	1,867	34	372	36,899
Domestic Trade	117,167	0	-19,356	106,999	5,494	8,343	0	7,736	188	0	226,570
Total	841,928	641,273	513,897	502,469	140,917	105,762	44,270	180,246	387	263,469	3,234,618

*All values are in Millions of Dollars

Input-Output Analysis Assumptions

- Constant returns to scale (i.e. linear)
- Homogeneous sector output
- Fixed technology
- Fixed prices
- No supply constraints

Impact Analysis Steps and Considerations

- Gathering primary or secondary data on direct impacts.
- Selecting appropriate industry sector(s) based on SIC or NAICS codes
- Deflating values to base year of regional model
- Applying margins for wholesale/retail distribution and transportation to express consumer purchases in producer prices
- Distinguishing between local and nonlocal purchases
- Distinguishing between endogenous and exogenous sources of revenue (“new money”)
- Representing unique structure of local industries

U.S. Agricultural Commodity Trade Multipliers

Commodity	Producer employment multiplier (Jobs/billion $ export value)	Port employment multiplier (Jobs/billion $ export value)	Producer output multiplier ($ total economic output/$ export value)	Port output multiplier ($ total economic output/$ export value)
Soybeans	18,697	13,716	2.26	2.15
Other oilseeds	8,280	8,936	2.26	2.15
Wheat	23,116	16,198	2.31	2.34
Rice	22,573	15,950	2.35	2.36
Corn	23,379	16,310	2.31	2.33
Other feed crops	7,249	10,022	2.31	2.33
Vegetables and melons	14,471	10,808	2.10	1.82
Tree nuts	23,661	16,633	2.12	1.92
Fruits	23,864	15,056	2.30	2.01
Greenhouse and nursery products	19,835	14,521	1.58	1.62
Tobacco	24,504	18,901	1.97	2.15
Cotton	17,363	18,911	2.38	2.70
Sugarcane and sugar beets	37,632	25,137	2.48	2.66
All other crops	15,967	12,788	2.36	2.26
Cattle	36,420	20,542	3.71	2.97
Poultry and eggs	31,579	17,160	3.19	2.72
Fish	10,379	9,612	2.13	1.99
Wet corn milling products	2,478	9,892	2.91	2.65
Processed soybean products	2,804	10,581	3.52	2.71
Other oilseed products	2,716	10,617	3.35	2.58
Sugar	4,745	13,903	3.17	2.99

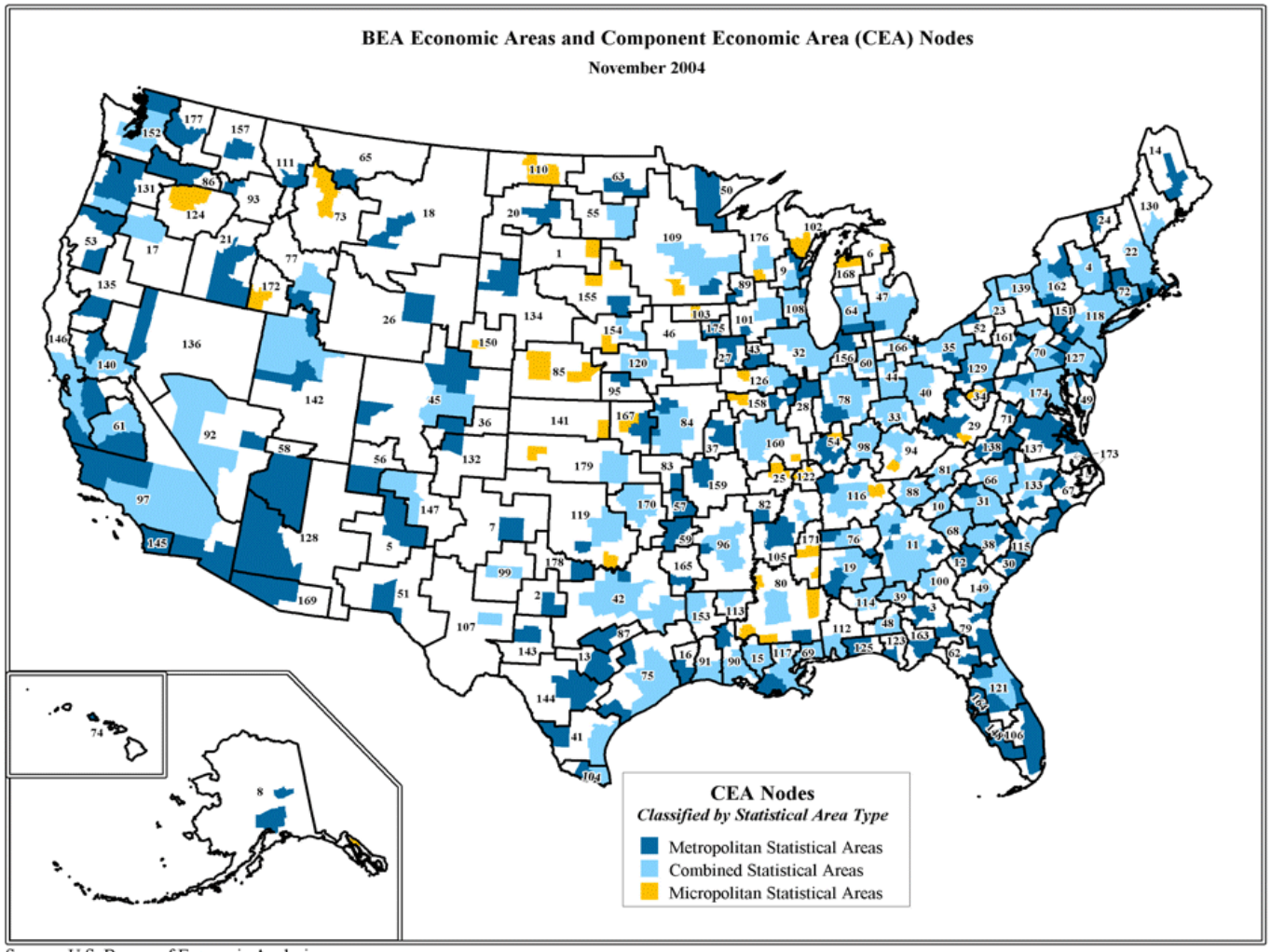
Source : USDA/ERS

Environmental Impact Multipliers for $1 Million Output of Selected U.S. Industries (1997)

Industry	Value Purch. (mil. $)	Total Energy Used (TJ)	Elec-tricity Used (Mkw-hr)	Fuels Used (Tera-joules)	Water Used (billion gal.)	Ferti-lizers Used (mil. $)	Conventional Pollut-ants Released (Mg)	Green-house Gases Released (Mg CO2 equiv.)	RCRA Hazar-dous Waste Gener-ated (Mg)	Weighted Toxic Releases and Transfers (Mg)	OSHA Safety (fatalities)
Forestry products	1.98	6.1	0.18	5.90	0.002	0.018	29.31	391	22.6	1.67	0.002
Logging	2.19	7.2	0.16	7.04	0.002	0.007	16.78	470	15.4	1.18	0.008
Sawmills	2.24	7.3	0.45	6.84	0.004	0.004	13.18	519	11.4	0.73	0.003
Veneer and plywood	2.44	9.5	0.62	8.86	0.002	0.003	11.02	681	20.1	0.83	0.002
Pulp mills	2.28	23.2	0.70	22.41	0.065	0.002	10.08	1,600	89.8	2.47	0.001
Paper mills	2.22	27.8	1.17	26.48	0.040	0.001	8.30	2,024	78.0	1.42	0.001
Commercial fishing	1.82	10.7	0.13	10.53	0.001	0.000	7.32	770	21.6	0.70	0.022
Landscape and horticultural services	1.53	4.9	0.13	4.73	0.001	0.010	26.70	338	9.6	0.57	0.005
Chemical and fertilizers	1.71	30.3	1.45	28.64	0.003	0.000	9.32	2,582	33.4	1.20	0.001
Greenhouse and nursery products	1.33	6.2	0.46	5.67	0.001	0.005	4.16	473	10.7	1.09	0.002
Sugar crops	1.77	8.4	0.26	8.08	0.002	0.009	46.94	583	58.0	5.23	0.002
Vegetables	1.92	7.7	0.25	7.45	0.002	0.014	42.08	529	39.0	1.88	0.003
Fruits	2.17	16.6	0.35	16.24	0.003	0.012	69.23	1,189	83.6	2.49	0.003
Dairy farm products	3.14	18.0	0.88	17.02	0.003	0.029	68.51	1,263	58.8	3.07	0.006
Frozen fruits, fruit juices, and vegetables	2.56	14.0	0.63	13.29	0.008	0.003	20.67	997	34.9	2.20	0.001

Source: Green Design Institute, EIOLCA Program, Carnegie Mellon University (http://www.eiolca.net/)

Study Area Considerations



Source: U.S. Bureau of Economic Analysis

- Location of buyers and sellers of the goods and services (forward and backward linkages)
- Location of workers: many live in outlying residential areas

IMPLAN System

- Microcomputer system for I-O/SAM model construction and impact analysis
- Licensed by Minnesota Implan Group, Inc. since 1995 (www.implan.com)
- Module for simple specification of impact events
- Software available at low cost ($450)
- Regional economic database for US states and counties, updated annually, purchased separately ($500-$2600)

IMPLAN Database Components

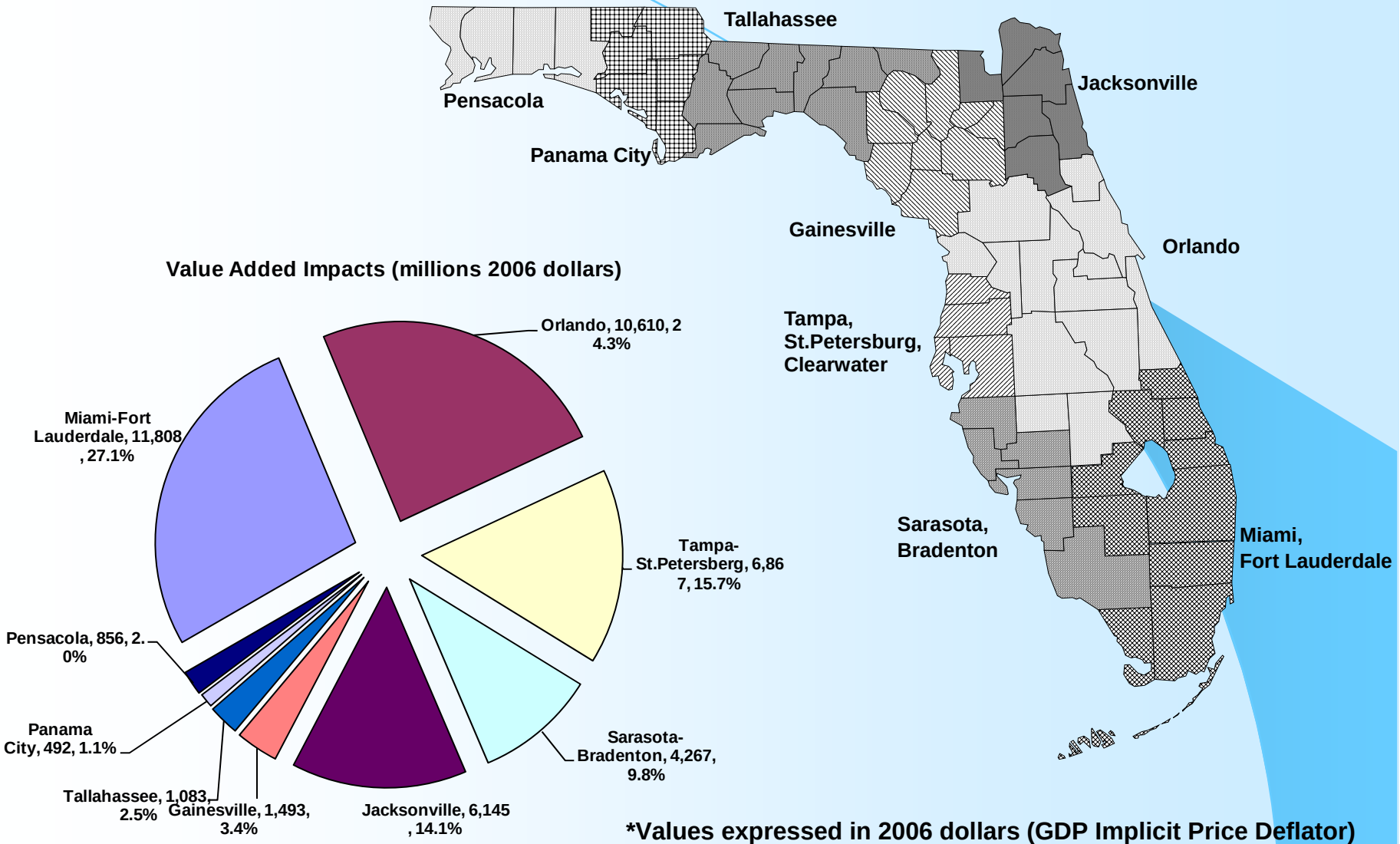
- Industry Output, Employment, Value Added: 509 Industrial Sectors, 3 or 4 digit NAICS
- National Structural Matrices (Make, Use tables)
- Value Added: wages, salaries, proprietor income, property income, indirect business taxes
- Final Demands: household commodity purchases (7 income levels); state/local and federal government expenditures
- Transfer payments (e.g. welfare, retirement pensions).
- Commodity trade (regional purchase coefficients)
- Capital investment
- Margins: household, government, industry
- Deflators (industry specific)
- Library of personal consumption expenditures

Economic Impacts of Food, Agriculture and Natural Resource Industry Groups in Florida, 2004*

Industry Group	Output (Revenue) Impacts (Mill.$)*	Employ-ment Impacts (jobs)	Total Value Added Impacts (Mill.$)*
Agricultural Inputs & Services	17,092	166,835	6,929
Forest Products	17,037	110,823	7,347
Other Food Product Manufacturing	14,603	67,998	5,584
Environmental Horticulture	11,487	160,785	6,764
Fruit and Vegetable Products	14,191	107,478	7,954
Livestock, Dairy & Animal Products	5,403	33,030	1,342
Mining	4,740	25,444	1,910
Tobacco Products	6,435	29,342	3,074
Sugarcane and Refined Sugar	4,556	47,022	1,795
Seafood Products	1,261	12,364	391
Other Crop Farming	427	3,350	258
Wildlife (hunting)	344	3,110	157
Grain & Oilseed Products	259	1,644	114
Grand Total	97,836	769,224	43,621

*Values in 2006 Dollars (GDP Implicit Price Deflator)

Value Added Impacts of Food, Agriculture and Natural Resource Industries in Florida Regions, 2004*



*Values expressed in 2006 dollars (GDP Implicit Price Deflator)

Resources on I-O Modeling, Impact Analysis, *IMPLAN,* and Regional Data

- Using *Implan* for local economic impact analysis, by W. Mulkey & A. Hodges: http://edis.ifas.ufl.edu/fe168
- Economic impact analysis program at UF/IFAS: http://economicimpact.ifas.ufl.edu
- Web book of regional science: http://www.rri.wvu.edu/regscweb.htm
- Minnesota Implan Group, Inc.: http://www.implan.com
- Regional economic accounts (USDOC/BEA): http://bea.gov.bea/regional/data.htm
- Regional Input-Output Modeling System (RIMS II): http://bea.gov/bea/regional/rims/brfdesc.cfm
- Regional Economic Models, Inc., Policy Insight and TranSight software: http://www.remi.com
- Economic input-output analysis and life cycle assessment (web tool), Carnegie Mellon University Green Design Institute: http://www.eiolca.net