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FE168

Using Implan to Assess Local Economic Impacts[1]

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Introduction

Policymakers, industry officials, and others often need information on the total economic impacts of specific local economic sectors or on the impacts of various changes in the local economy. Changes in employment or output often occur locally as a result of new business locations, plant closings, regulatory changes, or other community events, and such changes have implications for other parts of the local economy.

For example, expansion of sales by farms within a local area will mean increased sales for agricultural support firms, increased incomes for farm proprietors and workers, and increased sales for local retail and service businesses that support the agricultural sector and provide goods and services to farm owners and employees. The initial change, the "direct" effect, has "indirect" or "multiplier" effects that reverberate throughout the local economy. A computer software/database package that allows more precise estimates of these effects for local areas is the subject of this article.

The intent here is to provide an introduction to IMPLAN, a software package and database for estimating local economic impacts, which is available from Minnesota IMPLAN Group, Inc. (Users Guide, IMPLAN Professional Version 2.0. Minnesota IMPLAN Group, Inc., Stillwater, Minnesota, April 1999, http://www.implan.com). The following sections first provide general information to aid in understanding a local economy—the framework for economic impact analysis. This discussion of the role of basic and service industries within a local economy is followed by a more specific discussion of the IMPLAN database, software, and applications.

The Role of Basic and Service Industries

Export base theory provides a general framework for understanding a local economy and assessing the total impacts of specific local changes in economic activity. This approach holds that a local economy consists of two parts or two distinct types of activities: (1) *basic industries* that sell goods and services to markets located outside the local area, and (2) *service industries* that provide goods and services to local businesses and residents. Basic industries attract money from outside into the local economy; this money then circulates within the local area through spending and re-spending by local service industries and employees of local businesses. Money generated by the basic industries starts the spending chain that supports the services segment of the local economy. New dollars eventually are lost from the local economy (leakages) in the form of tax payments to state and federal government, savings, profits that accrue to non-residents, and payments for goods and services imported from outside the local area.

Basic Industry

The key to identifying basic industries at the local level is the location of markets served, a distinction more

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important than the nature of the goods or services involved. Typically, basic industries are associated with activities such as agriculture, mining, or manufacturing. However, almost any type of local business may be classified as a basic industry if its products or services are sold outside the local area or if it attracts customers from other areas.

What are the basic industries in Florida and in local areas within Florida? Clearly, any such listing would include the traditional basic industries (agriculture, forestry, fisheries, mining, manufacturing, etc.) that ship a variety of products to markets located elsewhere within the United States and abroad. In addition, many other businesses, typically thought of as service activities (banking and financial services, real estate services, consulting firms, etc.), are considered basic industries when they provide services to non-local clients; new dollars are attracted to the local area as a result of their activities.

Many local areas within Florida also depend on a variety of businesses that serve the large number of tourists who visit Florida each year. Visitors spend money locally for food and lodging, entertainment, travel services, and other goods and services associated with vacation or business travel. Firms in tourist-related businesses differ from traditional basic industries only in the nature of the goods and services provided and in the fact that their customers travel to Florida rather than purchasing Florida products that are shipped to their home state or country.

Finally, basic industries in Florida include businesses that serve the large number of retirees who spend all or a part of the year in the state. When retirees receive payments from Social Security, retirement plans, and health insurance from out-of-state sources, such payments represent new dollars within the local economy and represent basic activity in the same way as tourist expenditures. New dollars, when spent, support local service businesses and result in additional local spending, employment, and income.

Service Industry

Service industries, unlike basic industries, consist of business firms that serve local markets. Examples include the full range of retail and service establishments that serve local residents as well as firms that provide goods and services (inputs) to businesses engaged in basic activities. Again, the key factor that distinguishes basic from service activity is the location of the market served and not the type of goods or services provided. Any of the activities characterized above as basic may, in fact, be service activities if they are serving local markets.

Other Considerations. Two additional considerations must be noted when distinguishing between basic and service activities for particular industries or business firms. First, many businesses perform both basic and service functions at the same time. Florida agriculture is an example of such an industry at the state level. Florida agriculture produces a number of commodities that are sold both outside the state and to consumers within the state. The same dual role exists for a number of other Florida industries. Examples include financial service firms, restaurants, amusement parks, retail stores, and repair shops that serve both local residents and tourists. Although this mix of basic-service activities within the same industry groups is a complicating factor in local impact analysis, it is important to remember that each has a distinctly different effect within the local economy. Basic activities attract new dollars while service industries circulate those dollars within the local area.

At the local or regional level within the state, an additional basic-service consideration emerges. The geographic definition of an economic region (for example, a county or multi-county area) may determine whether a particular industry or firm should be considered to be a basic or service activity for analytical purposes. For example, if the local area of interest consists of one county within the state, then markets located elsewhere in Florida are considered non-local in nature. Examples of such activity might include a Florida resident from Pensacola who vacations in Miami, an Orlando consulting firm working for state government in Tallahassee, or a Sarasota nursery selling plants to a retail firm located in Gainesville.

At the state level, each activity noted clearly represents a service activity—the market served is local (within the state) and no new dollars are generated. However, when a particular area within the state is considered, each activity attracts new money to the area (a basic activity). The fact that the new money comes from Pensacola, Tallahassee, or Gainesville rather than from New York, Chicago, or Boston is irrelevant to the determination of economic impacts in Miami, Orlando, or Sarasota.

With the considerations noted, the basic-service industry dichotomy from export base theory provides the framework within which total economic impacts can be estimated. The key is to determine the division between basic and service activities within a local area and then to assess the relationship between changes in the basic components of the economy and the resulting changes in the service components. An increase or decrease in production and employment within a local area has a "multiplier" effect as other sectors of the local economy are impacted by the

changes in local spending. For a given industry, the size of the multiplier depends on the level of local spending; firms that purchase more local inputs have higher multipliers. The total impact for an industry also depends on the level of sales outside the local region; firms with greater external sales have greater impacts. The estimation of the multiplier effect for each sector is the objective of economic impact analysis.

Input-Output Models

The estimation of multipliers relies on input-output models, a technique for quantifying interactions between firms, industries, and social institutions within a local economy. Before discussing the IMPLAN software and databases that allow the estimation of local area input-output models, a brief overview of the general input-output approach is needed.

As noted, an input-output model is a technique built around quantifying the interactions between industries (or sectors) within an economy. Each industrial or service activity within the economy (agriculture, mining, manufacturing, trade, services, etc.) is assigned to an economic sector with the number of sectors determined by the level of detail desired. Then, for a one-year production period, a transactions table reflects the value of goods and services exchanged between sectors of the economy.

Figure 1 provides a hypothetical transactions table for a local economy. (More detail is provided in the IMPLAN Users Guide cited earlier. For a more advanced discussion, see: William A. Shaffer, *Regional Impact Models,* The Web Book of Regional Science, http://www.rri.wvu.edu/regscweb.htm.) The transactions table contains three components of the local economy: producing industries, final demand, and value added, which capture all transactions within the economy.

		Purchasing Industries					Final Demand			
		Agriculture	Mining	Manufacturing	Trade	Service	Households	Government	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
	Service	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				
	Profits	1	2	3	4	10				
	Imports	1	2	3	4	10				
	Total	39	40	98	53	87	53	33	63	617

Figure 1. A hypothetical transactions table for a local economy.

Producing industries in the economy (agriculture, mining, manufacturing, trade, and services) are each listed twice in the transactions table. Rows in the table reflect the sales of output by each producing industry to other industries or institutions within the local economy or to final consumers (households, government, and exports). Columns in the table reflect purchases by each producing industry from other industries as well as profits, payments to workers, taxes, and imports. The table is balanced in that the total sales of each producing industry (intermediate sales to other industries plus sales to final consumers) equals total purchases by that industry (input purchases plus value added).

For the one-year production period, the transactions table shows how much each local industry purchased and/or sold to every other industry within the local economy. Values are expressed in dollars and track the movement of goods and services between industry sectors and between producing industries and final demand and value added components of the economy. In some cases, households may be reflected in the table as a producing industry that sells services (labor) and purchases inputs (consumption) in order to capture the effects of spending associated with changes in household earnings.

Looking at the agricultural sector as an example, we see that total output is 39 and that of the total, 30 is sold to other producing industries as intermediate inputs (12 to other components of the agricultural sector, 2 to mining, 10 to manufacturing, and 6 to trade). The remainder of 9 is sold to final consumers. To produce the output, the agricultural sector makes purchases from other parts of the agricultural sector (12) and from each of the other producing industries (5 from mining, 5 from manufacturing, 2 from trade, and 7 from services). The remainder of 8 is value added (profits, indirect business taxes, and payments to households).

Importantly, the transactions table reflects the way in which the agricultural sector is linked to each of the other industries and to the final demand component of the local economy. The value added section of the table shows how agriculture is linked to household income in the local area, and the household component of final demand reflects how agriculture is impacted by local household spending. Changes in the agricultural sector affect other sectors of the local economy through the linkages indicated. Estimating such effects is the focus of economic impact analyses.

Manipulation of the transactions table allows the calculation of multipliers that measure the total impact of a change in one industry on all other industries within the local

economy. Impacts are usually measured in terms of gross output (sales), income, employment, and value added. The intent is to measure the total impact on the local economy for a given change in one industry.

Input-output models are driven by changes in final consumption (final demand). Producing industries then respond directly by selling to final consumers or indirectly by selling goods and services (intermediate inputs) to other industries. The IMPLAN software and database described in the following sections allow both the estimation of the transactions table for specific local areas and the manipulation of the resulting table to estimate multipliers that capture the direct and indirect effects of changes in a particular sector for use in economic impact studies. The IMPLAN software also allows modification of the model so that, in addition to direct and indirect effects, the multiplier will capture the effects of increased consumer spending resulting from direct and indirect income changes or *induced* effects.

IMPLAN Software and Database

The IMPLAN Software

IMPLAN (see earlier citation) is a computer software package that consists of procedures for estimating local input-output models and associated databases. The acronym is for *Impact Analyses and Planning*. IMPLAN was originally developed by the US Forest Service in cooperation with the Federal Emergency Management Agency and the US Department of the Interior's Bureau of Land Management to assist in land and resource management planning. Since 1993, the IMPLAN system has been developed under exclusive rights by the Minnesota Implan Group, Inc. (Stillwater, Minnesota) which licenses and distributes the software to users. Currently, there are hundreds of licensed users in the United States including universities, government agencies, and private companies. The UF/IFAS Food and Resource Economics Department is a licensed user of IMPLAN software and maintains current copies of all databases for Florida. Additional information is available on our website at http://www.fred.ifas.ufl.edu/impact.

The IMPLAN Database

The economic data for IMPLAN comes from the system of national accounts for the United States based on data collected by the US Department of Commerce, the US Bureau of Labor Statistics, and other federal and state government agencies. Data are collected for 528 distinct producing industry sectors of the national economy corresponding to the Standard Industrial Categories (SICs). Industry sectors are classified on the basis of the primary commodity or service produced. Corresponding data sets are also produced for each county in the United States, allowing analyses at the county level and for geographic aggregations such as clusters of contiguous counties, individual states, or groups of states.

Data provided for each industry sector include outputs and inputs from other sectors, value added, employment, wages and business taxes paid, imports and exports, final demand by households and government, capital investment, business inventories, marketing margins, and inflation factors (deflators). These data are provided both for the 528 producing sectors at the national level and for the corresponding sectors at the county level. Data on the technological mix of inputs and levels of transactions between producing sectors are taken from detailed input-output tables of the national economy. National and county level data are the basis for IMPLAN calculations of input-output tables and multipliers for local areas.

IMPLAN Multipliers

The IMPLAN software package allows the estimation of the multiplier effects of changes in final demand for one industry on all other industries within a local economic area. Multipliers may be estimated for a single county, for groups of contiguous counties, or for an entire state; they measure total changes in output, income, employment, or value added. Definitions are provided below. More detail on the derivations of multipliers is available in the earlier cited IMPLAN Users Guide.

For a particular producing industry, multipliers estimate three components of total change within the local area:

- *Direct effects* represent the initial change in the industry in question.
- *Indirect effects* are changes in inter-industry transactions as supplying industries respond to increased demands from the directly affected industries.
- *Induced effects* reflect changes in local spending that result from income changes in the directly and indirectly affected industry sectors.

IMPLAN allows the analyst to choose from multipliers that capture only direct and indirect effects (Type I), multipliers that capture all three effects noted above (Type II), and multipliers that capture the three effects noted above and further account for commuting, social security and income taxes, and savings by households (Type SAM). Total effects

multipliers usually range in size from 1.5 to 2.5 and are interpreted as indicated below:

- *Output multipliers* relate the changes in sales to final demand by one industry to total changes in output (gross sales) by all industries within the local area. An industry output multiplier of 1.65 would indicate that a change in sales to final demand of $1.00 by the industry in question would result in a total change in local output of $1.65.
- *Income and employment multipliers* relate the change in direct income to changes in total income within the local economy. For example, an income multiplier for a direct industry change of 1.75 indicates that a $1.00 change in income in the direct industry will produce a total income change of $1.75 in the local economy. Similarly, an employment multiplier of 1.75 indicates that the creation of one new direct job will result in a total of 1.75 jobs in the local economy.
- *Value added multipliers* are interpreted the same as income and employment multipliers. They relate changes in value added in the industry experiencing the direct effect to total changes in value added for the local economy.

A Case Study

A case study can be used to illustrate a straightforward application of the IMPLAN input-output modeling system. The example chosen is a hypothetical information technology support center that will be located in a rural area of Florida. The example is hypothetical, but impacts are representative of an actual firm in this sector. The region defined for purposes of the analysis includes the geographic area from which the firm is expected to draw workers, an eight-county region in a rural area of Florida. The IMPLAN software is used to develop the input-output model for the region and to structure the impact scenario.

Direct Impacts

Analytical results are presented for a two-year period. The firm will initiate construction in March 2000 and will become fully operational by August 2001. This firm will employ 375 individuals during the year 2000 and, in subsequent years, employment will increase to 500 jobs. The impact scenario was constructed based on knowing the number of jobs in the first and second year of operation, company expenditures for construction, and annual company expenditures on job training activities.

The initial year employment number (375 jobs) was adjusted to reflect the annual equivalent of 125 full-time employees since daily operations and employment will actually begin in August of the first year. Construction expenditures during the first year are estimated at $1.5 million, and 75 percent of this value ($1.125 million) will be spent within the region. Estimated expenditures of $750,000 for furniture and $2 million for equipment are not considered in the impact analysis because they will take place outside the local region. Training expenditures all take place within the region. The firm will spend $500,000 on training during the first year of operation and $2 million during the second year.

Table 1 reports the information entered into the IMPLAN model for each annual period. As noted, estimates of employment and training expenditures were adjusted to reflect operations beginning in August of the first year. Values for output for the new firm and employment estimates for construction and training are based on the IMPLAN data set for the region. In terms of the earlier discussion, the values in Table 1 reflect the *direct* effect of the new firm.

Impact Estimates

Table 2 reports the total (direct, indirect, and induced) effects on output, employment, value-added, and labor income resulting from the location of the example information technology support center in the eight-county region. All values are expressed in year 2000 dollars and reflect the three impact components noted earlier.

The first year's increases are: regional output, over $11.5 million; employment, 194 jobs; value-added, over $5.6 million; and labor income, almost $4.6 million. The second year's increases are: regional output, over $40.5 million; employment, 700 jobs; value-added, over $20 million; and labor income, just under $17 million.

Direct effects account for the largest portion of the total economic impact in each impact category (approximately 76 percent of total output and employment, 70 percent of value-added, and 78 percent of labor income) for the example firm. Indirect effects amount to 12 percent of output, 10 percent of employment and labor income, and approximately 13 percent of value-added. Induced effects account for approximately 13 percent of total output, 14 percent of employment, 17 percent of value-added, and 12 percent of labor income.

Note the table reports estimates for two years—a start-up year and a second year in which the plant is in full operation. The estimates for the second year, when the firm expands to the expected level of total employment,

represent a continuing impact that will occur within the region on an annual basis.

Distribution of Impacts

The IMPLAN model also allows the analyst to determine the distribution of total impacts across other sectors of the local economy. That is, the total impacts reported in Table 2 may be disaggregated across other producing industries. For purposes of illustration here, Table 3 reports disaggregated impacts of industry output for the 10 sectors that are most impacted in the example.

Note that the largest output impact occurs in the Computer and Data Processing Services sector, the sector where the direct impact took place. Indirect and induced impacts take place in other sectors of the local economy. The other sector experiencing major impacts is the sector providing job training and related services. Other impacted sectors include the range of sectors providing goods and services to local residents who earn increased income as a result of the new firm's location.

Concluding Comments

Sections above provided a basic discussion of regional economic impact analysis and described the IMPLAN modeling software and databases. The case study represented a simple application to estimating the total impacts of a new firm location in a rural area of Florida where the known information was the direct employment impact and direct expenditures on construction and training. The IMPLAN data set provided estimates of firm output, worker earnings, and employment in other sectors. The estimated input-output model then allowed an assessment of impacts based on interactions between various sectors of the local economy. In some cases, more complete information may be available on a particular firm or industry, and, in such cases, IMPLAN provides the flexibility to use the additional information in place of the data provided with the software package.

Further Information

Further information about current research efforts, about arranging IMPLAN studies in Florida, and copies of publications may be obtained by contacting the authors directly or by consulting our website at http://www.fred.ifas.ufl.edu/economic-impact-analysis/.

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		Purchasing Industries					Final Demand			
		Agriculture	Mining	Manufacturing	Trade	Service	Households	Government	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**
	Service	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				
	Profits	1	2	3	4	10				
	Imports	1	2	3	4	10				
	Total	**39**	**40**	**98**	**53**	**87**	**53**	**33**	**63**	**617**

Table 1. Impact construction in the IMPLAN model for example of new firm in rural Florida.

Impact	Value ($1,000)	Employment
Year 1 (2001)		
Construction	$1,125	12
New Firm	$7,416	125
Training	$500	15
Year 2 (2002)		
New Firm	$29,663	500
Training	$2,000	59

Table 2. Estimated economic impacts for example of new firm in rural Florida.

	Output ($1,000)	Employment	Value-Added ($1,000)	Labor Income ($1,000)
Year 1 (2001)				
Total	**$11,520**	**194**	**$5,612**	**$4,595**
Direct	$8,748	147	$3,938	$3,584
Indirect	$1,283	20	$746	$468
Induced	$1,489	28	$928	$542
Year 2 (2002)				
Total	**$40,514**	**707**	**$20,297**	**$16,619**
Direct	$30,833	544	$14,423	$13,094
Indirect	$4,296	64	$2,516	$1,563
Induced	$5,385	100	$3,358	$1,962
* Totals may not add to sum of components due to rounding.				

Table 3. Estimated output change in the ten most impacted sectors (2002).

Rank	Sector	Output* ($1,000)
1	Computer and Data Processing Services	$30,163
2	Job Training and Related Services	$2,014
3	Wholesale Trade	$767
4	Banking	$731
5	Communications—Except Radio and Television	$651
6	Real Estate	$585
7	Owner-Occupied Dwellings	$515
8	Eating and Drinking	$465
9	Hospitals	$370
10	Doctors and Dentists	$320
* Year 2000 dollars		