

Economic Base Assessment of Southeastern Ohio

Athens, Meigs, Morgan, & Washington Counties

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November 2001

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Economic Background

Southeastern Ohio is made up of eight notably diversified counties,¹ but they also have many commonalities that unite them as both a cultural and economic region. They are part of Ohio's Appalachian region and each is predominately rural by definition as well as in character. The population holds little ethnic or racial diversity and the majority of the region's residents are distributed throughout numerous small towns, with only two counties consisting of a population that exceeds 35,000. The area has a rich history in agriculture, resource extraction, and heavy manufacturing industries that have benefited from the region's natural amenities and hardworking labor pool. All of the counties are 50 to 74 percent forested and both forest related and mining industries remain at the heart of the area economy.² However, like most of Ohio and the rest of the midwestern states, there has been an increasing shift from those industries to services, and in relation, a decline in high paying jobs. That economic change, in addition to the state's largest percentage of residents age 65 years and older, contribute to the region having the highest level of transfer payments, accounting for 25 percent or greater of personal income, the most compared to all other regions of Ohio. Also, the region's counties have the highest unemployment rates in the state.

The four counties that are the focus of this study consist of Washington County, designated as a fringe small metro county,³ and three surrounding counties to the west and southwest that are closely tied to Washington through such things as migration⁴ and commuting patterns,⁵ including Athens, Meigs, and Morgan. Each of the four counties has had persistently high poverty rates that outweigh state averages and in conjunction, have been among the lowest

¹The counties included in what is referred to as southeastern Ohio vary depending on the source. Some include all of the 29 counties that make up Ohio's Appalachian region, while others count only a portion of that region. In this study southeastern Ohio consists of Athens, Hocking, Meigs, Monroe, Morgan, Noble, Perry, and Washington Counties as defined in *Ohio: America's Crossroads*, by L. Liston, 1997.

² Ohio State University Extension. *Forests of Ohio: Forests and Geologic Regions*. ODNR-Division of Forestry.

³ County designation obtained from Ohio State University Extension, *Ohio Rural-Urban Interface Series: RU-I*, Ohio State Data Center.

⁴ The regional trend during the 1990s, like that of other metro centers and surrounding counties in Ohio, was one of migration from where the metro city is located to the contiguous rural counties, as reported by the Ohio State University Extension in *A Report on the Status of Ohio*, Bulletin 881, December 1999.

⁵ In 1990 the majority of outcommuters and incommuters for Washington County were tied to neighboring counties in West Virginia, however among those commuting between Ohio counties, 61.6 percent of Washington's incommuters and 41 percent of its outcommuters had ties to Athens, Meigs, and Morgan counties. Likewise, the majority of in-state outcommuters in Athens went to Washington and Meigs counties; Meigs to Athens and

ranked of the state's 88 counties for median household income, with little change in that ranking since 1969 (*see* Table 1). Other indicators of the area's low level of affluence and economic self-sufficiency among the population include the lowest rates of owner occupied housing in the state (as represented by Morgan and Athens counties), a significant number of adults and children lacking health insurance, high percentages of single female-headed households with children under 18, low expenditures per pupil on education and low levels of adult literacy (concentrated in Meigs and Morgan counties).⁶

Table 1. Historical Poverty Rate & Median Household Income County Rank; Four-County Region and Ohio

	Poverty Rate (all persons)				Median Household Income County Rank			
	1989	1993	1995	1997	1969	1979	1989	1995
Athens	29.0	23.4	20.1	19.1	86	86	83	80
Meigs	26.0	23.2	21.4	20.4	82	82	86	87
Morgan	21.0	19.5	15.7	15.3	80	80	75	77
Washington	14.0	14.4	12.3	12.3	59	59	62	59
Ohio	12.5	13.7	11.3	11.0	***	**	n/a	**

Data Source: Ohio State University Extension, Data Center, Department of Human and Community Resource Development, 1999 County Profiles.

The root of these economic and social conditions is said to rest in the post-WWII mechanization of the area's major industries and increasing labor disputes and environmental regulations, that lessened the degree of employment opportunity and capital investment in the region and intensified the rate of migration from the rural southeast to metro areas of the northwest. The persistence of the resultant conditions added to current industry trends, as noted previously, raise doubt as to the long-term sustainability of the study region. As such, the goal of this work is to provide an assessment of how the economy of the four-county region has changed over time, where it stands today, and how its current structure will likely influence that of its future. This task is completed by way of an economic base analysis and in doing so, particular attention is paid to the forest industry.

The forest industry is unique in comparison to most other industries as it carries both aesthetic and natural resource value, in terms of tourism and raw materials in addition to manufactured products.⁷ The four-county region is home to a number of state forests, parks, and

Washington; and Morgan to Washington and Athens. U.S. Census Bureau, *1990 Census of Population and Housing*, Summary Tape File S-5.

⁶ As indicated in *A Report on the Status of Ohio*, Bulletin 881, December 1999, Ohio State University Extension.

⁷ Romig, R. 2001. *Ohio's Hardwood Industry*. Ohio State University Extension.

wildlife preserves that attract visitors from all over, but the remote forest areas have also become more appealing as residential destinations. As a result the percentage of forest land owned by non-industrial private landowners has been increasing and the average size of forest land ownership has been declining. That change has been assisted by a drastic reduction in corporate ownership, reflected in a 75 percent decrease across the state since 1979, and the overall expansion in acres of forested land.⁸ In conjunction, small business has become an integral component of the forest industry.⁹

The region's forest industry is housed mainly in the manufacturing sector of the economy and is represented by both primary and secondary manufacturing firms, from logging contractors and sawmills to the producers of composite wood and pulp products (e.g. furniture and paper). Yet, value added is mostly concentrated in secondary manufacturing, such as the production of pallets and flooring from low-grade hardwood.¹⁰ There are also a number of non-timber based forest goods produced in the region, including edibles (e.g. shiitake mushrooms) and natural medicinals (e.g. ginseng) as well as special wood products.¹¹ Although overshadowed by timber products, the non-timber based forest products sector is receiving increased attention and is viewed as a viable means for sustainable growth in the regional economy. The extent of that potential is addressed, in part, in the second half of this work, but first a broad historical assessment of the regional base is given.

Trend Analysis of Economic Base

A region's wealth is a function of its resources and the ability to utilize those resources in a sustainable manner to produce income. Income is maintained and generated in a number of ways, such as: through the conversion of resources to commodities by local businesses and the selling of those commodities to customers outside the region, the attraction of new customers or

⁸ Ohio State University Extension. *Forests of Ohio: Forests and Geologic Regions*. ODNR-Division of Forestry.

⁹ As reported by Romig in *Ohio's Hardwood Industry*, 80 percent of Ohio's timberland is controlled by non-industrial private landowners and the majority of timber sold in Ohio originates from those sources, in addition, more than 70 percent of the industry's wood products businesses have fewer than 20 employees.

¹⁰ Output and employment are greater in the primary manufacturing sector, but the generation of economy-wide wealth, as measured by income, is higher for the secondary sector. (See for example code 134 vs. 142 in the Appendix.)

¹¹ Non-timber specialty wood products are produced from trees or parts of trees (e.g. twigs and branches), but not from sawn wood, thereby bypassing the intermediate processing stage. Chamberlain et al., Non-Timber Forest Products: The OTHER Forest Products, *Forest Products Journal*, October 1998, vol 48 #10.

businesses into the region, capture of local demand for goods and services, and obtainment of government transfers. The purpose of an economic base study is to define the linkages between local resources and income that flows from outside to inside the region in order to identify current and potential factors of economic growth. However, as indicated, economic systems are comprised of circular rather than linear flows. A regional economy consists of export producers, businesses that support export producers as well as residents, and a resident population that buys both locally and externally produced goods and services. Thus, all contribute to a region's economy and must be considered in the analysis. Indicators of economic growth and stability examined in this section include historical changes in population, employment, industry structure, and income. The relationships among those factors are further defined in the second part of this work, which consists of an input-output analysis of the study region's economic base.

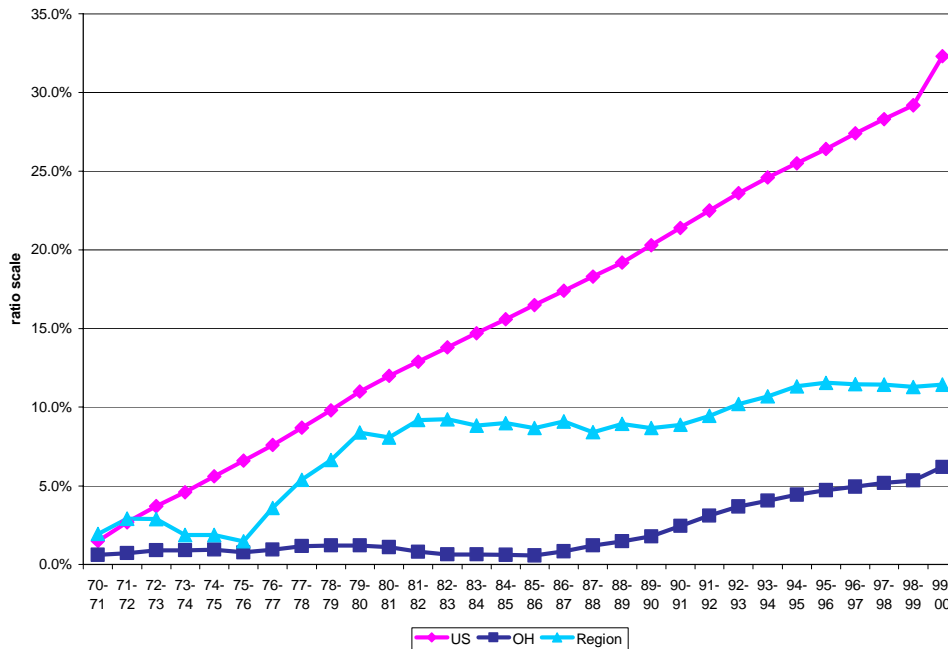
Population

Maintaining a healthy economy requires a stable or growing population, to work and consume and thereby support economic activity. A changing population is a reflection of a region's ability to attract and retain resident consumers and producers over a given period of time. Therefore population change is an indirect measure of past and potential economic prosperity. The following paragraphs summarize population change for the four-county region from 1970 to 2000 and compare it to population change rates for the State of Ohio and the United States.

Between 1970 and 2000, the region's population increased by 10.9 percent or 4,473 persons while the population for the State of Ohio as a whole grew by 6 percent. The population growth rates for both the four-county region and the state were significantly below that of the nation, which increased by 27.6 percent during the same period. The rapidity and periodicity of that relational change is shown in Figure 1, whereby population change is plotted on a ratio scale so that the slope of the line represents per annum growth. By looking at the relative slope of the lines and distance between point markers the difference in growth rates at various times for the region is immediately apparent. So too are the points of divergence and convergence with the state and nation.

Figure 1 reveals that the study region, a predominately non-metropolitan and rural area (see Table 2),¹² has exhibited similar trends in the distribution of population change among urban and rural places in the U.S. over time. During the 1970s non-metropolitan counties and rural places across the nation witnessed a reverse in population movements, from multiple decades of out-migration to one of significant population growth as more Americans chose to move to areas of lesser density.¹³ That growth was halted due to the 1980s farm crisis, then picked up again during the early 1990s, but has since slowed.

Figure 1. Population; Relative Percent Change; U.S., OH, & Four-County Region, OH; 1970-2000



Data Source: Bureau of Economic Analysis, Regional Accounts Data, Local Area Personal Income, CA1-3 Population, Number of Persons.

Ohio is unique in that in 1990 it ranked as the 7th most populated state and 9th as the most densely populated state, while also ranking 5th in the nation in number of rural residents.¹⁴ In addition, 54.5 percent of Ohio’s 1990 rural population were found in metropolitan counties,

¹² A distinction is made between non-metro and rural areas because metropolitan designation is made at the county level while rural/urban is place specific. As such, rural residents can be found in both non-metropolitan and metropolitan counties. In order to qualify for the latter, they need only live in a community of less than 2,500 or open country neighborhoods that fall within a county that has a city with a population greater than 50,000.

¹³ This phenomenon is often referred to as the non-metropolitan turnaround (see for example Fuguitt, 1985).

¹⁴ Ohio rankings and statistics taken from Ohio State University Extension, *Ohio Rural-Urban Interface Series: RU-1*, Ohio State Data Center.

which was likely a result of the predominately metro growth of the 1970s, with a 15.5 percent metro increase compared to 5.5 percent non-metro. However, since 1990 increases in the rural population in non-metro counties has been approximately double that of metro. Underlying that change in part is that the core metro counties in Ohio have lost population largely due to domestic migration to fringe counties, even though that loss has been offset by natural increase. The study region is representative of those statewide demographic characteristics, as shown in Table 2.

Table 2. Population Density, Designation, & Change; Four-County Region, OH

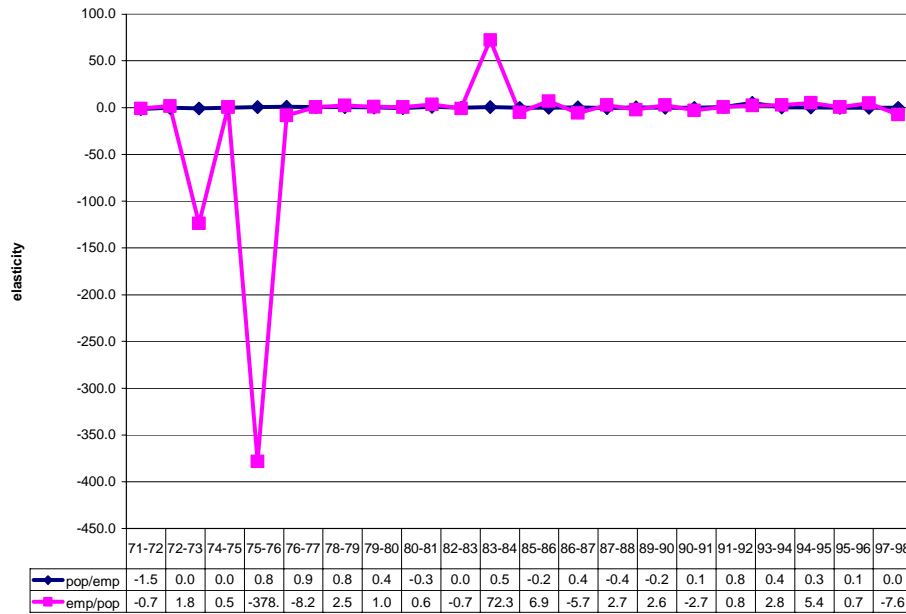
	Population Density (2000) ^a	Percent Rural (1990) ^b	Metro / Non-Metro (1990) ^a	Percent Population Change (1990-2000) ^a	Net Migration Flow (1988-1999) ^c
Athens	122.7	52.2	n-m	4.5	-243
Meigs	53.8	88.1	n-m	0.4	1347
Morgan	35.6	100.0	n-m	5.0	153
Washington	99.6	60.5	m	1.6	-947

Data Sources: a) U.S. Census Bureau. 1990. *1990 Census of Housing and Population*. b) Ohio Department of Development. 1999. *Ohio County Profiles*. Office of Strategic Research. c) Ohio Department of Development. 1999. *IRS Net Migration Flows*. Office of Strategic Research.

Employment

Traditionally, it is understood that changes in population reflect changes in employment opportunity in a region. However, it has also been suggested that the reverse is true where quality of life factors rather than employment draw individuals to an area. In the latter case economic growth takes place to meet the demands of an increasing population. Historical change in the region supports neither scenario to its fullest, but indicates that outmigration may be the result of both the lack of employment opportunity and desirable living conditions. However, it is difficult to quantify the latter without a more detailed analysis, which is beyond the scope of this work. Therefore, the following figures provide greater detail as to the make-up of the transitions in regional employment and information pertaining to the relationship of those changes to regional population and state and national employment rates (Figures 2-5).

Figure 2. Population and Employment Elasticity; Lagged ($\Delta X/\Delta Y_{t-1}$); Four-County Region, OH; 1970-1998



Data Source: Bureau of Economic Analysis, Regional Accounts Data, Local Area Personal Income, CA1-3 Population, Number of Persons and CA25- Total Full- and Part-time Employment by Industry.

Figure 2 compares population and total employment change rates from 1970 to 1998 by way of elasticity measures. Elasticity is a concept that measures the responsiveness or sensitivity of one variable to another. A value equal to one is referred to as unit elasticity or proportional change, while a value greater than one is elastic and less than one, inelastic.¹⁵ Both population and employment change in the county compared to each other for the prior year show very little fluctuation in measures of elasticity over time. For the most part, it is difficult to determine which is the most influential factor,¹⁶ yet two significant trends are clear, that is the non-metro population surge during the 1970s and the impact of the farm crisis in the early 1980s. In the former case, employment is extremely insensitive to changes in population. A comparison to changes in employment (Figure 3) offers some explanation, suggesting that employment growth took place first, followed by population growth,¹⁷ at which time employment in the region was stagnant. In the latter scenario, employment became more sensitive to changes in population, but

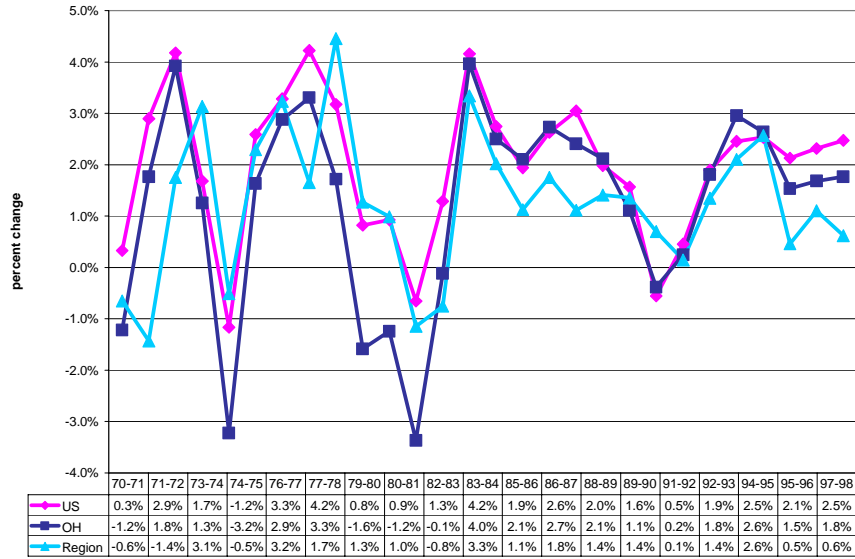
¹⁵ Elasticity measure = $\Delta X/\Delta Y$. Unit elasticity ($\Delta X=\Delta Y$); Elastic ($\Delta X>\Delta Y$); Inelastic ($\Delta X<\Delta Y$)

¹⁶ This conclusion is based on a special case of elasticity whereby any change in Y will have an infinite effect in X ($\Delta X/\Delta Y = 0$), which is known as perfect inelasticity. Both employment and population exhibit near perfect inelasticity to each other the majority of the time.

¹⁷ Lagged ($\Delta X/\Delta Y_{t-1}$)

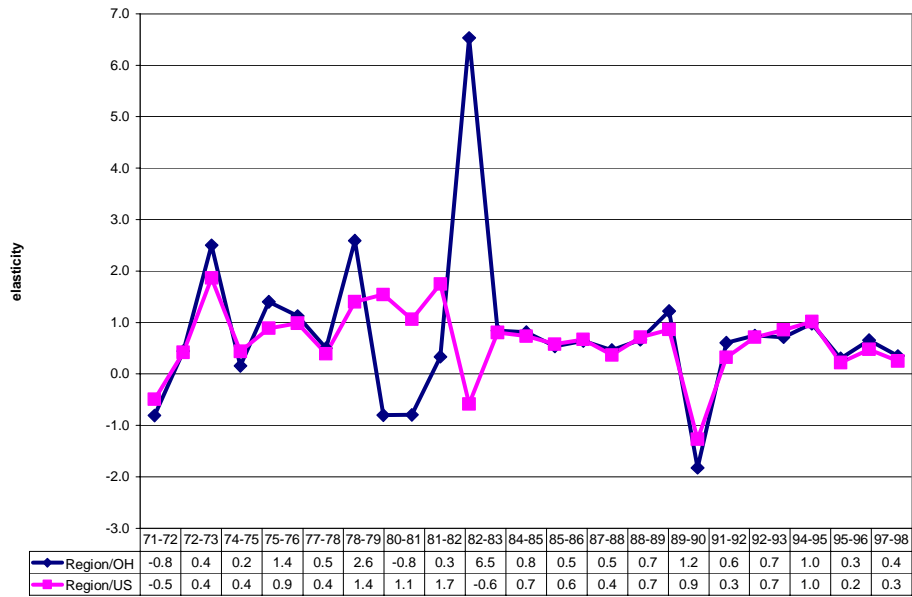
this time the regional change was more likely influenced by employment trends across the state, as indicated in the region to state employment elasticity shown in Figure 4.

Figure 3. Percent Change in Total Full-time & Part-time Employment; U.S., OH, & Four-County Region, OH; 1970-1998



Data Source: Bureau of Economic Analysis, Regional Accounts Data, Local Area Personal Income, CA25- Total Full- and Part-time Employment by Industry.

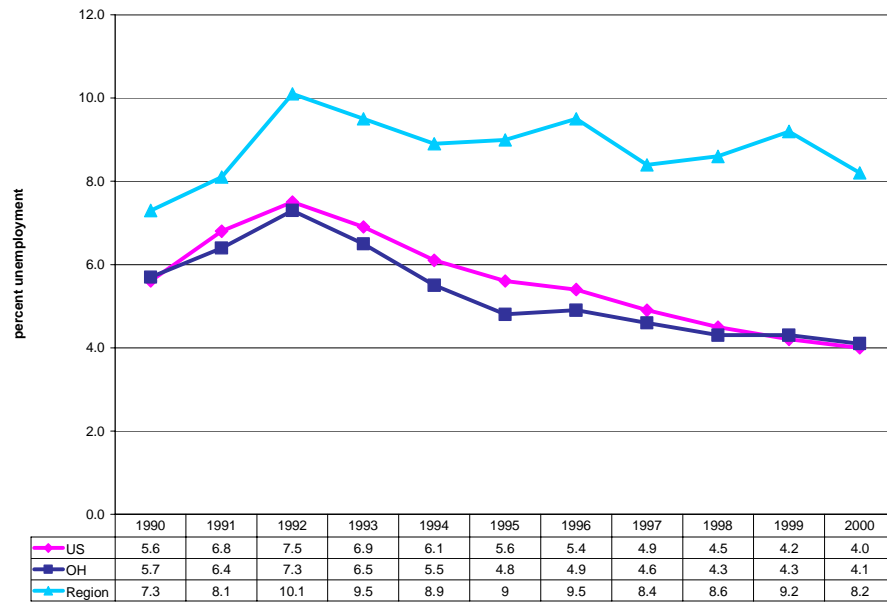
Figure 4. Employment Elasticity; U.S., OH, & Four-County Region, OH; 1970-1998



Data Source: Bureau of Economic Analysis, Regional Accounts Data, Local Area Personal Income, CA25- Total Full- and Part-time Employment by Industry.

The unemployment rate for the four-county region has consistently been higher than both the state and the nation (*see* Figure 5), which have remained virtually the same over the last thirty years. However, the regional rate is skewed by the persistently high unemployment rates in Meigs and Morgan counties, which are currently designated labor surplus areas.¹⁸ In fact, according to recent statistics published by the Ohio Department of Job and Family Services, Morgan County reigns as the county with the highest unemployment rate in the state at 13.6 percent and Meigs County follows in second place with 8.8 percent. In opposition, Washington and Athens counties have fallen below both the state and national rates of 4.3 and 4.7 percent, respectively.¹⁹ An examination of industry structure may explain why these differences exist.

Figure 5. Unemployment Rate; Monthly Average; U.S., OH, & Four-County Region, OH; 1990-2000



Data Source: Bureau of Labor Statistics, Local Area Unemployment Statistics, Unemployment Rates, NSA

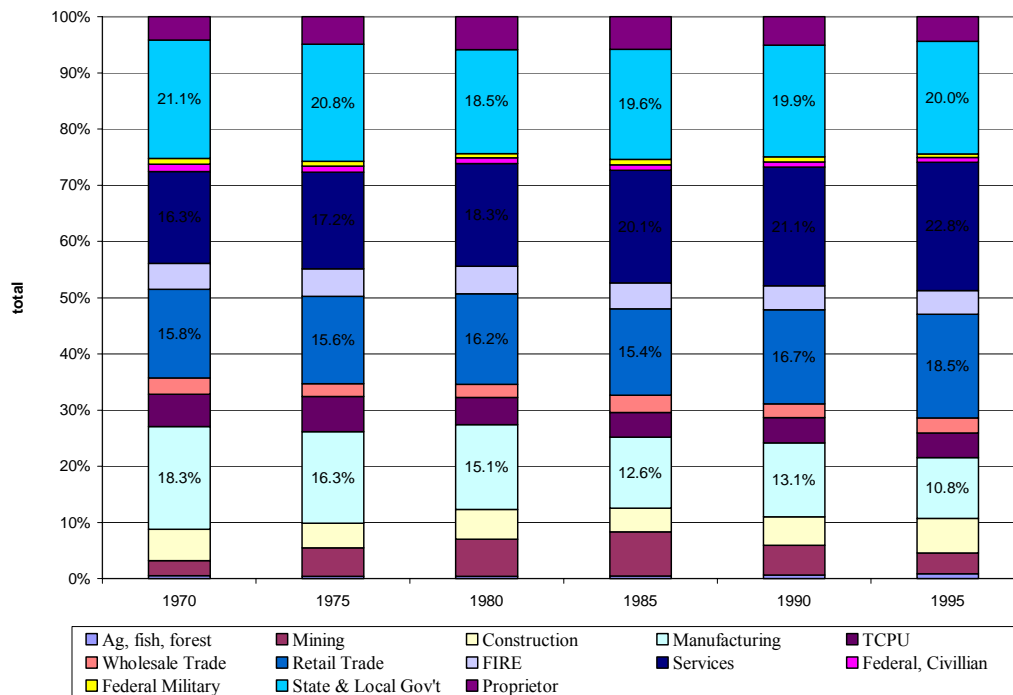
¹⁸ The U.S. Department of Labor classifies a county a labor surplus area if the average unemployment rate in that area has been at least 6 percent or greater for a two-year period. According to the Ohio Department of Job and Family Services all of southeastern Ohio counties except for Washington and Athens have been named labor surplus counties for the October 2000 to September 2001 period.

¹⁹ According to the Ohio Department of Job and Family Services, September 2001 unemployment rates for Washington and Athens counties were 3.4 and 4.0 percent. The average annual rates for those counties in 2000 were 5 percent and 4.9 percent, respectively, while the national rate was 4.0 percent and the state was 4.1 percent.

Industry Structure

Changes in the activity-mix of the region can be measured by focusing on the relative importance of each industry. That relationship to total employment in the region between 1970 and 1995 is examined (Figure 6 and Table 3) as well as the concentration of that employment in comparison to the nation (Table 4). A preliminary discussion of import/export activity in conjunction with industry employment is also offered, but this is better explained by way of the input-output analysis that follows the trend analysis.

Figure 6. Percent Total Full- & Part-time Employment by Industry; Four-County Region, OH; 1970, 1975, 1980, 1985, 1990, & 1995



Data Source: Bureau of Economic Analysis, Regional Economic Information System, County Level Variables, CA25- Total Full- and Part-time Employment by Industry.

Percent employment by industry, as shown in Figure 6, indicates that the region's industry mix has for the most part remained the same. State and local government, services, retail trade, and manufacturing industries have consistently been the leading employers in the region, together accounting for more than 70 percent of employment since 1970. However, manufacturing has lost a significant percentage of that employment to services and retail trade. This change was mostly concentrated in Athens and Washington counties (*see* Table 3). Meigs

also lost a high percentage of manufacturing jobs and an even greater percentage in retail trade, but has witnessed the least recovery. Morgan, on the other hand, maintained its concentration of manufacturing jobs as a percent of all jobs in the county while also becoming increasingly more diversified with significant growth in services.

Table 3. Employment by Dominant Industries of Region by County as a Percentage of County Employment; Four-County Region, OH; 1970 & 1995

County / Year		1970	1995	% chg
Manu- facturing	Athens	9.7%	3.8%	-5.8%
	Meigs	8.8%	3.4%	-5.4%
	Morgan	19.8%	19.1%	-0.6%
	Washington	26.8%	16.7%	-10.1%
Retail Trade	Athens	15.0%	19.2%	4.3%
	Meigs	24.9%	18.2%	-6.7%
	Morgan	12.3%	13.2%	0.9%
	Washington	15.3%	18.9%	3.6%
Services	Athens	15.3%	21.6%	6.3%
	Meigs	16.7%	21.1%	4.4%
	Morgan	10.5%	15.7%	5.2%
	Washington	18.2%	25.4%	7.2%
State & Local Gov't	Athens	37.6%	36.8%	-0.8%
	Meigs	16.4%	14.3%	-2.1%
	Morgan	12.7%	11.3%	-1.5%
	Washington	10.6%	9.4%	-1.2%

Data Source: Bureau of Economic Analysis, Regional Economic Information System, County Level Variables, CA25- Total Full- and Part-time Employment by Industry.

Table 4 presents a series of location quotients, which compare the percentage of population employed in each industry in the region to the corresponding percentage for the nation in the same year.²⁰ For example, the location quotient for retail trade in 1970, 1.0488 or 104.9 percent, tells us that the region had a fairly proportional concentration of retail trade employment to that of the nation.²¹ Reading across for the same industry, the coefficient rises to 1.1224 in 1995, indicating a more than proportional representation of retail trade in the region to the U.S. (12 percent greater) and a potentially growing industry specialization for the area. However, in the past and to this day, mining remains the most concentrated industry in the region in comparison to the rest of the nation, despite considerable employment decreases since 1970, particularly in Morgan County.

²⁰ The location quotients were obtained by dividing employment in each sector for the region by total regional employment ($E_i/\sum E_{i-n}$). The same was done for the United States and the resultant decimals were divided into those derived for the region.

²¹ Assumes even distribution of industry activity across geographic areas.

Table 4. Location Quotients; County Industry Sector Compared to U.S.;
Four-County Region, OH; 1970, 1975, 1980, 1985, 1990, & 1995

Industry Sector	1970	1975	1980	1985	1990	1995
Ag, Fishing, Forestry	0.8740	0.6345	0.4846	0.5267	0.6508	0.7333
Mining	3.2789	5.8060	6.0568	7.2857	7.2428	6.4030
Construction	1.1524	0.9258	1.0976	0.8367	1.0037	1.2153
Manufacturing	0.8479	0.8720	0.8522	0.8191	0.9575	0.8646
TCPU	0.6244	0.4602	0.4849	0.6370	0.5349	0.5846
Wholesale Trade	1.0488	1.0255	1.0592	0.9769	1.0478	1.1224
Retail Trade	1.0488	1.0255	1.0592	0.9769	1.0478	1.1224
FIRE	0.6871	0.6640	0.6529	0.6225	0.5652	0.5776
Services	0.8733	0.8477	0.8567	0.8259	0.7840	0.7798
Gov't Federal, civilian	0.4076	0.3614	0.3930	0.3981	0.4165	0.4411
Gov't Military	0.2993	0.3468	0.3793	0.4560	0.4628	0.4459
Gov't State and local	1.9330	1.7395	1.6363	1.8700	1.8743	1.8652

Data Source: Bureau of Economic Analysis, Regional Accounts Data, Local Area Personal Income, CA25- Total Full- and Part-time Employment by Industry.

Another use of the location quotient comes from recognizing that industry activities in a region supply both a local market and an external or export market and the desire to estimate how much of each activity is for export consumption. The simplest way to make such estimates is to use location quotients in conjunction with the basic/non-basic industry concept.²² The idea is that some regional activities (basic) lead to growth while others (non-basic) are simply consequences of growth. In other words, a region, like a business, must earn its livelihood by producing something for which there is a willingness to pay by others. Economic activities that serve the local market are simply the result of the level of income and demand achieved in the past and as such, they are participants in growth but not the motivating factors of that growth. On the other hand, activities that serve an external market provide the means for generating income. A useful example is the difference between subsistence farming and commercial farming. That which is generated for consumption by the farmer alone cannot advance the economic position of that farmer, but production in excess of primary needs provides the opportunity for the generation of wealth (given market demands for farm product).

A location quotient greater than one suggests that the area economy has more than enough employment in that industry to supply the region with the amount of industry product demanded while also having a surplus of employment (i.e. production of goods/services) that can be sold outside of the region. Such industries are defined as basic and benefit the local economy

²² Location quotients used in this manner assume homogenous consumption patterns, constant labor productivity across regions, and that local demands are first met by local production.

by drawing dollars into the area from the outside, thus contributing to total county wealth. A location quotient less than one is interpreted as an industry that does not provide the necessary level of employment to produce that which is required to maintain normal consumption patterns. This is referred to as a non-basic industry, which leads to the importation of goods and services, and is therefore a source of loss or leakage of wealth from the region.²³

According to Table 4, services, FIRE (Finance, Insurance, and Real Estate), TCPU, manufacturing and agricultural, fishing, and forestry services have historically been sources of leakage for the region in addition to the federal civilian and military sector. But this can only be thought of as a rudimentary measure since location quotients only estimate net surpluses over area consumption for aggregated industries.²⁴ However, they are helpful in gaining an initial understanding of the efficiencies and deficiencies of industry make-up over time as they pertain to regional growth.

Income

Income serves as one of the main indicators of regional economic prosperity. While there are multiple measures of income, the one most widely used in tracking growth is personal income.²⁵ Per capita income, in addition to total personal income, can be used as scale measures of a region's economic health and that of the individuals that reside there. The following figures illustrate income in the four-county region of southeastern Ohio in both current and real dollars and in comparison to change in income for the nation and state (Figures 7-10).

Annual change in personal income in the region has remained variable over time, but has increasingly converged with the state in real terms, which has been increasing at a decreasing rate in comparison to the U.S. since the 1980s (*see* Figures 7 and 8). This is clear in Figure 9, which shows per capita income for the state and region as a percentage of the U.S. from 1970 to 1999. Per capita income for the state was on par with the nation until the farm crisis, at which point growth slowed and never recovered, dropping nearly 5 percentage points since that time. The region had been well below the national average even before the crisis, but was becoming

²³ Leakages are payments made to imports or value added sectors that do not re-spend the dollars in the region.

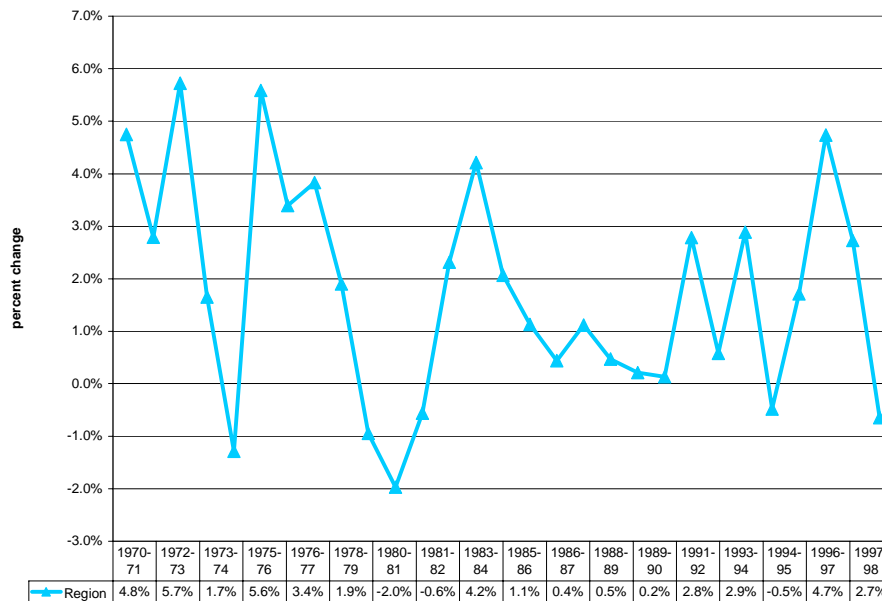
²⁴ The under-estimation of a region's gross exports are likely due to factors of aggregation and previously noted assumptions in reference to consumption and production patterns.

²⁵ Personal income, as defined by the U.S. Department of Commerce, Bureau of Economic Analysis, is the sum of wages and salaries, dividends, rents, and interests, transfer payments, other labor income, and income of proprietors.

more equitable during the 1970s, yet it too has dropped approximately 5 percentage points over the last two decades, hovering around 70 percent of the national average.

In 1999 the difference between the nation, the state, and the region was quite dramatic with a regional PCI of 19,486 dollars to the state’s 27,171 and the nation’s 28,546. Yet, it is difficult to derive anything meaningful from weighing the study region against the State of Ohio and the United States. Aggregate measures are deceiving because there is substantial variation in per capita income among regional divisions across the U.S. and within Ohio, particularly between the Appalachian counties of the southeast and the remainder of the state. This variation is due to a number of factors, including relative costs of living, but it is most notably correlated with size. In the United States as a whole, per capita income levels have been consistently higher in metropolitan than in non-metropolitan areas.²⁶ Due to this positive association with size it would be least expected for per capita income levels in a predominately rural and non-metro area like that under consideration to exceed state and national averages. A better measure is to look at relative rates of change.

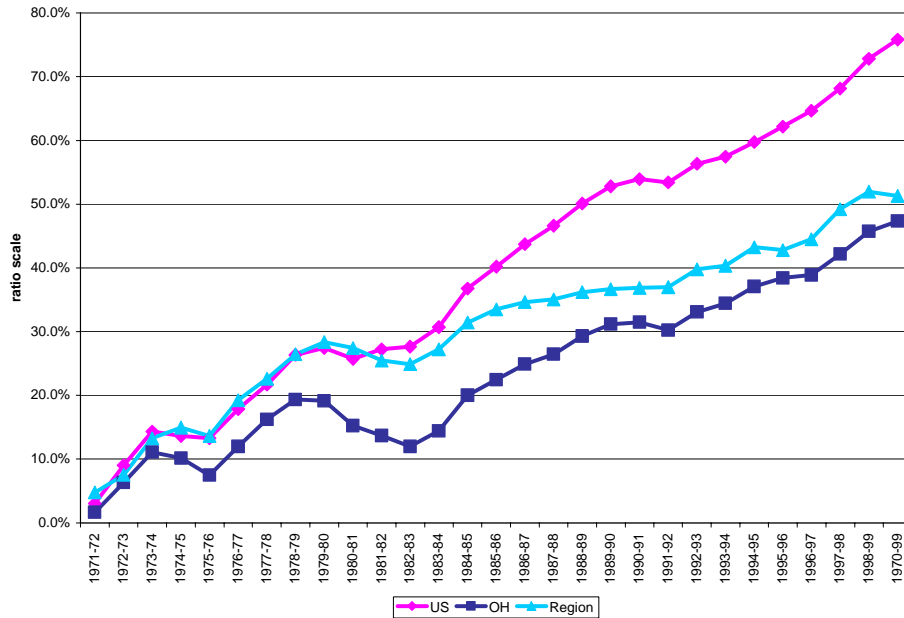
Figure 7. Personal Income; Real (2000) Change Thousands of Dollars; Four-County Region, OH; 1970-1999



Data Source: Bureau of Economic Analysis, Regional Accounts Data, Local Area Personal Income, CA05 Personal Income by Major Source and Earnings by Industry,

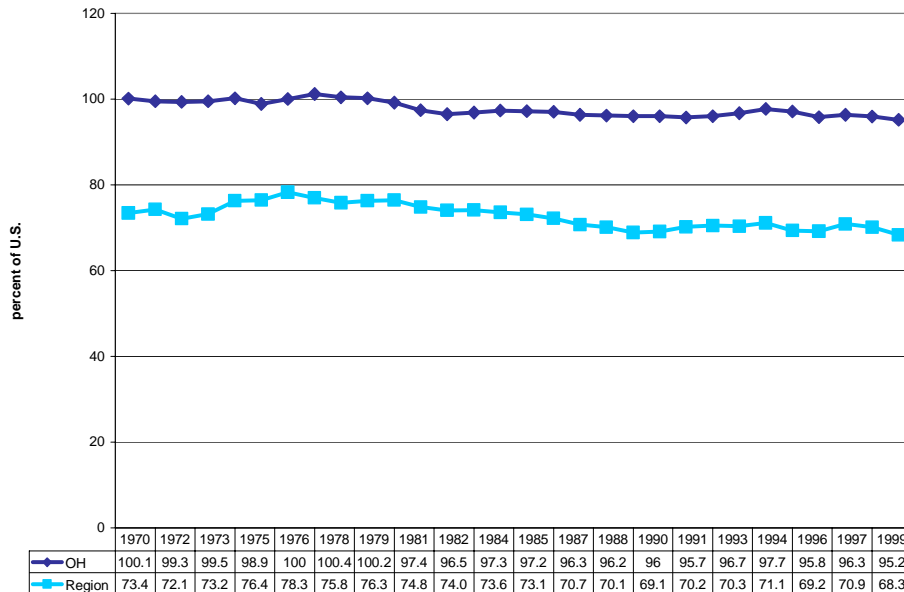
²⁶ As documented by the US. Department of Agriculture, Economic Research Service in *Understanding Rural America*.

Figure 8. Personal Income; Real (2000) Relative Change; Thousands of Dollars; U.S., OH, & Four-County Region, OH; 1970-1999



Data Source: Bureau of Economic Analysis, Regional Accounts Data, Local Area Personal Income, CA05 Personal Income by Major Source and Earnings by Industry,

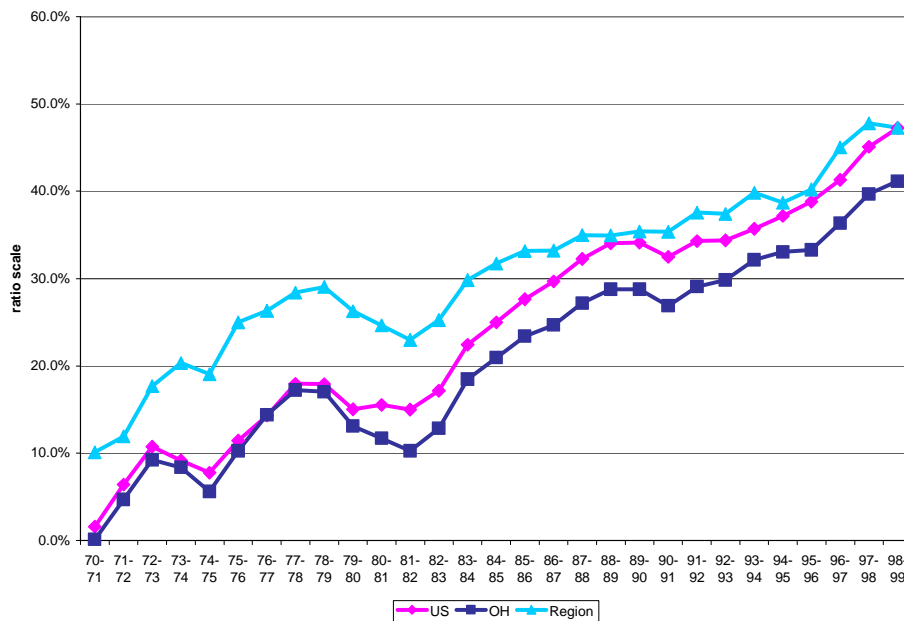
Figure 9. Per Capita Income; Percent of the U.S.; OH, & Four-County Region, OH; 1970-1999



Data Source: Bureau of Economic Analysis, Regional Accounts Data, Local Area Personal Income, CA1-3 Per Capita Personal Income, Percent of U.S.

Relative per capita income rates of change in the region have become increasingly more in line with the nation, with real change from 1990 to 1999 at 11.4 percent for the region, 11.8 percent for Ohio, and 12.5 percent for the United States (*see* Figure 10). But the most significant increase came during the 1970s growth period, in which per capita income change for the region exceeded both that of the state and nation with a 17.8 percent decade increase compared to 13.6 percent and 14.4 percent for Ohio and the U.S., respectively. Among the region's counties all have had a relatively similar increase in PCI over the last thirty years, with Morgan County slightly below the rest, and with increases taking place at a decreasing rate over the course of the three decades for all four counties.

Figure 10. Per Capita Income; Relative Change; Real (2000) Dollars; U.S., OH, & Four-County Region, OH; 1970-1999



Data Source: Bureau of Economic Analysis, Regional Accounts Data, Local Area Personal Income, CA1-3 Per Capita Personal Income, Percent of U.S.

Summary Trend Analysis

The region has a slowly growing population. In the more densely populated counties of Washington and Athens growth lies mainly in natural increase, while in the less densely populated counties of Meigs and Morgan that growth is a combination of natural increase and in-

migration from the larger two.²⁷ Therefore, few new residents are moving in from the outside and the region is witnessing a redistribution of its population to the more rural areas. This may be contributing to the labor excesses in Meigs and Morgan counties. However, over the last decade both of those counties experienced a decrease in the size of their labor force, a 2.4 percent decline in Meigs and 2.7 percent in Morgan.²⁸ This suggests that the lofty rates of unemployment in those counties may be related to a reduction in the number of jobs in the area and/or a high degree of net in-commuters.

In reference to the latter point, in 1990 about 51 percent of persons employed in Morgan County and 44 percent employed in Meigs resided outside those counties, while the rates were much lower for Athens and Washington, with 21 percent and 34 percent, respectively.²⁹ If these commuting patterns have persisted then it is likely that many of the job opportunities in Meigs and Morgan have been consumed by non-residents, while those living in the counties have failed to find work elsewhere.

In relation to the availability of work, the number of jobs in the region has continued to grow and to do so at a rate approximately three times that of population growth. The economy is relatively diversified throughout and the industry mix has changed little overall. However, where changes in the percent of jobs by industry have taken place it has meant an exchange for higher paying jobs in the manufacturing and mining industries to lower wage occupations in services and retail trade. This is particularly true for Morgan County where service industry jobs paying on average 200 to 300 dollars per week for full-time work in 1995 dollars grew by 5.2 percent from 1970 to 1995, while mining industry jobs paying 800 to 1000 dollars per week in comparison decreased by 6.5 percent during the same period. This is likely a major contributor to the continued high rates of poverty and unemployment in the county despite a stable and diversified economy.

A similar exchange has taken place for manufacturing jobs in Washington County; however, Washington has been able to maintain a large percentage of jobs in other high pay industries where Morgan has not. For instance in 1995, 20 percent of Washington County jobs were in transportation, communications, and public utilities (TCPU), which at that time had a

²⁷ Ohio State University Extension, *A Report on the Status of Ohio*, Bulletin 881, December 1999.

²⁸ Labor force, employment, and wage estimates throughout this section obtained from Ohio Department of Development, Office of Strategic Research, *Ohio County Profiles*.

²⁹ U.S. Census Bureau, *1990 Census of Population and Housing*, Summary Tape File S-5.

wage rate that was about 84 percent of that in manufacturing, while in Morgan county TCPU jobs paid 163 percent of manufacturing but consisted of only 8 percent of total county employment.

Conditions in Meigs and Athens counties are somewhat the extreme of Morgan and Washington. Both are dependent on low-earnings trade and government jobs, although employment in the government sector in Athens makes up about 17 percent more of employment and pays about 59 percent more than in Meigs. In addition, Athens County has had about a 4 percent increase in employment in the region's major industries since 1970 while Meigs had a 10 percent reduction. Regardless of those differences, Meigs and Athens counties have maintained similarly high rates of poverty and have the lowest level of median income within the four-county region (*refer to Table 1*).

Clearly, the challenge for the region as a whole is to not only increase the number of jobs available to its residents, but to target those industries that offer the greatest degree of value added. This would allow the region to capitalize on its growth potential in the most sustainable manner. Therefore a more formal analysis of the region's current economic structure, how that structure relates to growth, and the structural changes needed to foster growth is warranted.

Input-Output Analysis of Economic Base

There are many methods used to describe the economic base of a regional economy, including the simple location quotient approach applied previously. Among those methods is input-output modeling, which provides detailed information on individual sectors in relation to their contribution to the local economy. This technique requires the application of rigorous mathematical procedures to an itemized framework of regional accounts, which is information that describes the transactions between a specified region and the rest of the world as well as among the economic activities within that region.³⁰ It also offers a means for predicting how that economy will respond to change through the production of some type of multiplier ratio that represents the manner in which an initial increase in demand for regional goods and services ultimately impacts levels of income and employment in the region.

³⁰ For a full explanation of methods a useful source is Miller and Blair, 1985.

Input-output modeling is made easy by the availability of computer software programs and databases specifically designed for such analysis. There are a number of programs that have been developed, but at their core is the IMPLAN (IMpact analysis for PLANning) modeling system that was introduced by the USDA Forest Service.³¹ The initial creation of IMPLAN was aimed at internal use by the Forest Service, but due to the overabundance of analyses requested its developers packaged the software and related databases for dissemination among interested parties.³²

The IMPLAN system can be used to construct custom input-output models for any county or multi-county region in the United States.³³ The research presented in the remainder of this work is the result of its application to the southeastern Ohio region consisting of Athens, Meigs, Morgan, and Washington counties. The regional model was constructed from relevant IMPLAN Pro 1998 data sets and parameters obtained from the Minnesota IMPLAN Group. The model and its interpretation reported here should be perceived of as descriptive in nature and should not be used for any detailed analysis without further consultation with the primary investigators. An overview of the input-output framework is first given in order to assist in the understanding of the technique's offerings and shortcomings.

Overview of Input-Output

The focus of input-output analysis is the interdependency of each industry's sales and purchases with the contraction and expansion of the region's overall economy. In tracing those changes the flow of money can be followed backward as payments from purchaser to seller or forward in the form of goods and services from the producer to consumer. The framework of the economy is thereby symmetrical with respect to supply and demand, or in other words, inputs and outputs. As such, neither supply nor demand is assumed to be the sole determinant of growth.

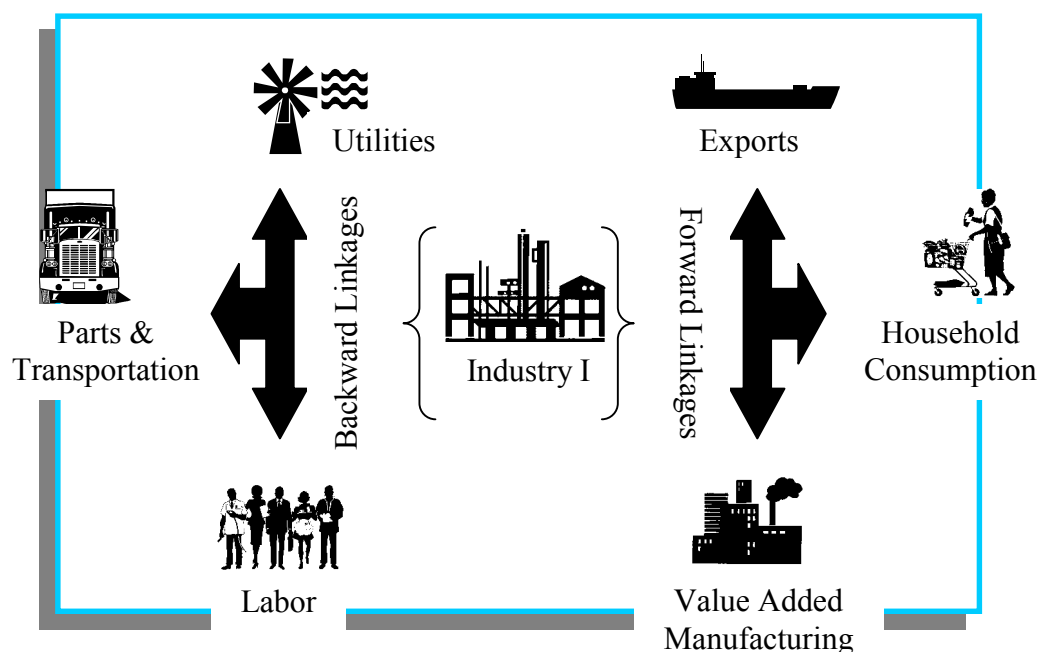
³¹ Alward, G., et al., *Micro-IMPLAN*. USDA Forest Service, 1989.

³² IMPLAN was made available to the public through a joint effort by the Center for Community Economic Development and the University of Wisconsin Extension and is currently available for purchase through the Minnesota IMPLAN Group, Inc.

³³ Databases are also available by zip-code designation, therefore regions may also be specified on that basis.

A simplistic example of the linkages between an industry and its suppliers and consumers are depicted in Figure 11.³⁴ Industry I purchases the inputs needed to produce its products, such as labor, parts and transportation, utilities, and so forth. Those transactions or accounts with suppliers of goods and services are referred to as backward linkages. Forward linkages exist between an industry producing a good or service and its consumers. Those consumers may be households,³⁵ the outside world (exports),³⁶ or other local industries (intermediate demand³⁷) or institutions (e.g. government³⁸) that may use the product of industry I for consumption (final demand³⁹) or as inputs to which they will add further value in the production of their own product.⁴⁰

Figure 11. Forward and Backward Linkages Supporting Industry



³⁴ Derived from conceptual model presented in *IMPLAN Pro Version 2 (2000) User's Guide, Analysis Guide, and Data Guide*.

³⁵ Households are considered both consumers of goods and services as well as sellers (e.g. labor) and are defined as individuals or families either employed or residing in the region.

³⁶ The outside world refers to individuals and activities other than government outside of the region.

³⁷ Intermediate or inter-industry demand refers to transactions among private industries within the region.

³⁸ Government can be Federal, state, or local public authorities within or outside the region.

³⁹ Final demands are sales of output considered to be in its final form, ready for the final stage of use rather than additional processing. In other words, they are goods and services leaving the region's stream of processing activity by way of exports, household or public sector consumption, or through incorporation into capital stock.

⁴⁰ Value added is the portion of total value of output exclusively contributed by the intermediate industry.

Input-output analysis works in the reverse, stressing the effects of change from final demand backward to intermediate and primary supply sectors.⁴¹ Therefore the method is market rather than input oriented and pays no attention to resource constraints or forward or complementary linkage effects.⁴² As such, input-output is said to be a demand-driven model of a regional economy that implicitly assumes that input supplies needed to meet demand are immediately forthcoming with no additive cost. For example, if export demand for a region's manufacturing products increased so that the sector's demand for labor exceeded the local labor force then it is inferred that workers from outside the region would move inside, thus filling the additional need. Conversely, a supply-driven model is dependent on the availability of input resources and assumes unlimited demand of regional products. Accordingly, supply-driven models work forward from primary supply to final demand, and changes in the draw upon primary supplies, rather than final demand, give rise to income and employment growth.

The two models of economic growth are complementary, and if taken together, would provide greater insight into the real processes of change. However, the impacts of changes to input supplies are not as easily detected as that which is due to changes in input demand. For instance, besides some special occasions where technological difference is prevalent within a sector, goods normally pass through successive stages of processing that can be defined in a general production function. Therefore, the necessary increase in inputs due to change in output demand can reasonably be determined. Increases to supply, on the other hand, are not readily traceable. It cannot legitimately be stated that the increased availability of a particular supply will be used for the process and handling of any one product, unless, once again, the form of that input is highly specialized. Given that difficulty, there is presently no model that adequately incorporates the two approaches. As such, input-output remains one-sided and the user must be aware of the implications of that bias.⁴³

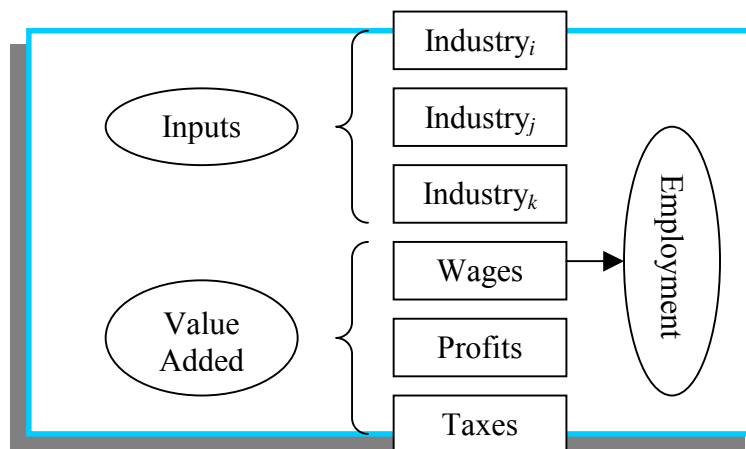
⁴¹ Inputs are known as factors of primary supply where they are inputs entering the region's processing system for the first time (e.g. labor and capital imports).

⁴² The technical limitations of input-output are based on the following assumptions: 1. The output of each sector is produced with a unique set of inputs, as such, there is no substitution of inputs. 2. The amount of input purchased is determined solely by level of output. Therefore, price effects, changes in technology, and economies of scale are not accounted for. 3. There are no external economies of scale (no agglomeration economies or new industries are included in an additive manner). 4. The in-state and out-of-state distribution of purchases and sales is fixed. 5. There are no constraints on resources, supply is infinite and perfectly elastic. 6. Local resources are efficiently employed, meaning there is no under employment of resources. All new employment stems from employees moving into the region and anyone who loses their job will leave the region.

⁴³ To guard against misleading conclusions the analysis results must be checked against the known conditions of the study region. For instance, knowledge of excess capacity or resource shortages should be considered during the

There are three descriptive measures of economic contributions associated with input-output models: output, value added, and employment. Employment represents the number of jobs or people employed in an industry and output is the total dollar value of industry production. Value added is comprised of wages, profits, and taxes that result from economic activity and it is the most readily accepted measure of economy-wide effects because it avoids the measurement error that takes place when the value of industry output is used. The error stems from multiple counting that occurs when output is summed across industries, in other words, output of an industry may be part of the value of output from another or several industries due to inter-industry linkages. Since value added is unique to each industry, it can be summed across the economy without suffering the same. Employment is a value added concept and is also exclusive to individual industries, yet it lacks as a measurement of effects by itself because it does not account for differences in productivity among industries. Figure 12 shows the relationship among these individual measures.⁴⁴

Figure 12. Total Value of Output of Industry I



As previously expressed, input-output models are driven by final demand for goods and services. In order to meet those demands industries respond by way of direct or indirect supply in the sense that each producing industry generates its own demand that other industries must

process of interpretation and wherever possible the analytical technique should be modified to reflect those conditions.

⁴⁴ Derived from conceptual model presented in Deputy and Hopkins, February 1999.

fulfill. This is an iterative process that is captured by input-output through what are known as multipliers.

Multipliers break the round by round impacts of economic stimuli into three components: direct effects, indirect effects, and induced effects. Direct effects represent the impacts of the initial change to final demand, therefore it is the change under consideration, such as an increase in product output to the manufacturing sector where demand for manufactured goods has gone up. Indirect effects are the inter-industry changes that would result from purchases made by the manufacturing sector as it responds to that new demand. This may not only result in increased activity for other sectors, but may also invoke additional changes to manufacturing as well. Induced effects represent the impacts to all local industries that result from the growth in expenditures of households.⁴⁵ Those expenditures stem from the generation of new income by way of the direct and indirect effects. For instance, that initial change in manufacturing output may yield new jobs thus producing additional income, of which a portion is spent within the regional economy, creating additional demands for goods and services in multiple industries, and so on and so forth.⁴⁶

The process described is sometimes referred to as the circular flow of income, which is presented in Figure 13.⁴⁷ Beginning with industry I, an economic stimulus (i.e. change in final demand) will result in factor payments made from industry I to land, labor, capital, and government in return for inputs and supplies, thereby creating induced effects. Those induced effects will return to industry I as well as other industries as product payments, which is income used to purchase more goods and services. The initial stimuli will also cause other industries to respond due to demands placed on them by industry I as it meets its needs. This will in turn create indirect effects that also move back through the system as factor payments in exchange for the inputs and supplies needed to meet their new demand.

This seemingly endless flow of money continues until all income generated leaks out of the region, meaning that with each iteration some of that income may go to purchase imports⁴⁸ or

⁴⁵ The input-output model treats households as a separate industry and changes in spending from within that industry reflect increases or decreases in income and/or population that result from changes in final demand. Induced effects from other factors, such as government and investment, may also be counted, but the most prevalent measure is household alone.

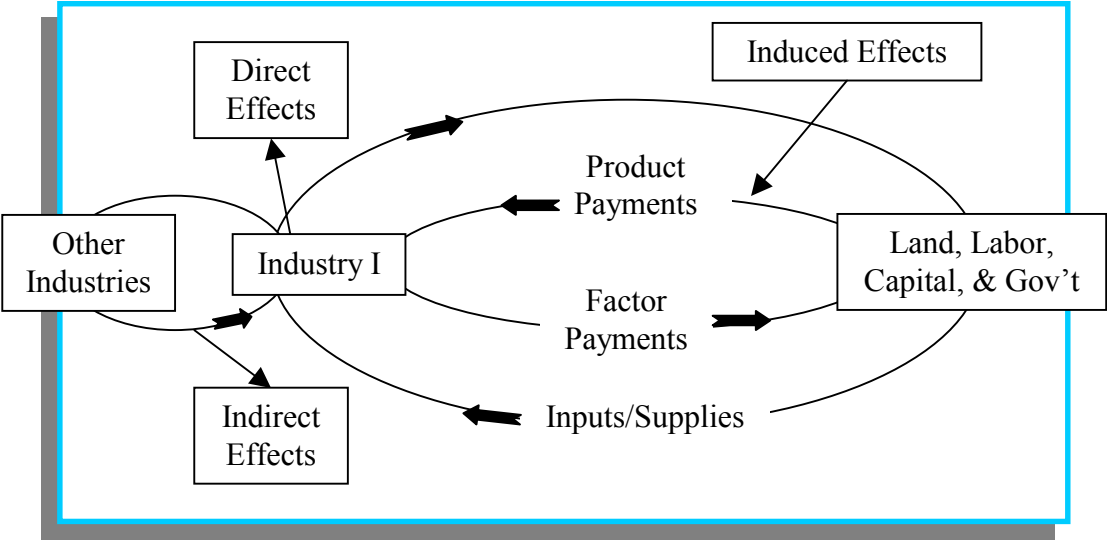
⁴⁶ Regional purchase coefficients, an econometrically derived measure of trade flows, are used to adjust for those portions of industry purchases made outside the region.

⁴⁷ Derived from conceptual model presented in Deputy and Hopkins, February 1999.

⁴⁸ Purchases made from outside the region under consideration, whether they are domestic or foreign.

into other financial realms, such as household savings. In that respect, it should be recognized that the size and location of the study area, and even the make-up of its population, might significantly alter the amount of leakage, and therefore, the magnitude of the multiplier. For instance, the greater the size of the defined region, the greater the opportunity may be to conduct economic activity within that region (e.g. a larger selection of businesses from which to make purchases). In reference to geography, locations near major economic centers external to the region may draw from the local income pool more so than would be the case for remote study areas. The last example, population, presents multiple factors related to consumption and savings patterns, such as differences based on income levels or life-cycle stages. Therefore, for multipliers to prove useful for estimating impacts to changes in the local economy or identifying the structural interdependence between sectors, they must be accompanied by additional insight with respect to the region’s situation.

Figure 13. Circular Flow of Income



IMPLAN offers three basic sets of multipliers: output, employment, and total value added. The difference between these multipliers is relative to the relationships shown in Figure 12. Output multipliers represent the sum of direct and indirect requirements from all sectors needed to deliver a one-dollar unit of output to final demand. Employment multipliers measure the total change in employment due to a one-unit change in labor force employed for a given sector. Value added multipliers represent income or any value added component derived from

the relationship between income and output. They include labor income (personal income = employee compensation + proprietor's income), other property type income, and indirect business taxes. The total value added multiplier represents the additive change in those components based on the individual dollar shift in final demand.

There are also three common types of multipliers and they vary based on the effects that are counted. Type I multipliers measure the direct and indirect effects of change in economic activity. They are limited to capturing inter-industry effects, that is, the result of local industries buying from other local industries. Type II multipliers capture direct and indirect effects that stem from income and expenditures of households in addition to the inter-industry effects. This results in a higher estimate of economic activity (i.e. larger multiplier values) than for Type I.

Finally, type SAM multipliers capture the same effects as type II, but in a more well-defined manner by using complete social accounting information to generate a model that includes non-industrial financial flows (e.g. taxes).⁴⁹ This allows for the incorporation of such things as the effects of additional institutions (e.g. government) into the model as well as the resultant effects of the disaggregation of internal and external income flows, labor by household location, and households by income.⁵⁰ Generally, type SAM multipliers will be smaller than Type II, in part because household expenditures are based on disposable rather than total income.

Although type SAM multipliers more realistically capture the process of change in a regional economy than type II, and type II more so than type I, they are also more prone to error given the level of detail. However, since government activity is thought to be directly linked to the local economy (e.g. through employment and transfers) and the role of income (i.e. poverty) is of particular concern for the region under consideration in this report, social accounts were used in the construction of the input-output model that follows.

⁴⁹ The social accounting matrix contains standard input-output information (value added factors, institutional final demand, and import/export trade) as well as: 1. Factor and institution exports- value added and institution payments received from outside the region. 2. Factor imports- distribution of payments outside the region. 3. Factor distribution- payments from value added sectors to institutions. 4. Inter-institutional transfers- payments from one institution to another.

⁵⁰ Social accounts include data on income distribution, commuting, tax payments, and savings. This allows for labor income to be distributed among households living in the region, households outside the region, and social security

Commodity Supply

Commodity supply is a measure of the resources available to a region from which to extract value added. In other words, it represents the product base on which other economic activity is dependent (i.e. by way of production and trade of those commodities). Two different forms of commodity production are considered in this analysis, industry commodity production, which represents the production of commodities by industries and institutional commodity sales or those commodities produced by non-industry sources, such as households. Each are presented as a percentage of total production for all commodities and that which is available for local and domestic consumption (Table 5).⁵¹ Industry production is further broken down into production as a percentage of market shares by individual sectors (Table 6).⁵²

Table 5. Commodity Supply; Percent of Total; Four-County Region, OH; 1998

Commodity	Industry Commodity Production*	Institutional Commodity Sales*	Total Commodity Supply*	Net Commodity Supply*
Ag, Fishing, Forestry	1.7%	1.1%	1.7%	1.7%
Mining	6.9%	0.8%	6.7%	6.4%
Construction	8.6%	0.0%	8.4%	8.9%
Manufacturing	32.8%	2.1%	31.8%	29.6%
TCPU	8.4%	0.9%	8.1%	8.2%
Trade	9.9%	5.0%	9.7%	10.1%
FIRE	6.6%	0.0%	6.4%	6.6%
Services	14.7%	80.1%	16.9%	17.8%
Government	10.1%	0.0%	9.8%	10.4%
Other	0.2%	9.9%	0.5%	0.2%
Total	320.97	20.24	341.20	326.84

Total percentages may not sum to 100 due to rounding

*Millions of Dollars

Industry based production is largely comprised of manufacturing commodities, which make up more than 32 percent of that which is produced locally (*see* Table 5). Services are the second largest industry commodity produced and also represent the most significant category of institutional commodity sales (80 percent). Virtually all of total commodity supply remains

taxes. Therefore consumption expenditures of in-region households are based on disposable income only and measures of government and investment can also be derived if so desired.

⁵¹ Local commodity demand + domestic commodity demand = net commodity supply = total commodity supply – foreign exports. Foreign exports are commodities exported beyond national borders while domestic exports are commodities exported (outside of the region) but that which remains within national boundaries.

⁵² Market shares are the percentage of the total production of a commodity that is produced by each industry.

available for local and domestic export consumption. Therefore, very little of what is produced in the region is being exported directly to foreign markets.

Industry sectors are defined by the product that they produce the most; however, total industry output may also include alternative commodity types. For instance, in the study region only 77.8 percent of service commodities are produced by the service industry. The remaining market share is for the most part produced by the government, with 15.5 percent of production (*see* Table 6).⁵³ Like most other places, government commodity production is highly diversified. In the four-county region government contributes to eight of the ten major commodities produced, potentially owing mainly to Ohio State University in Athens County as well as the numerous regional, state, and local education boards throughout the region. Yet, in general, the majority of the regional industries are of a single commodity type.

Table 6. Market Share of Commodity Produced; Percent of Total; Four-County Region, OH; 1998

Commodity / Industry	Ag, Fishing, Forestry	Mining	Const- ruction	Manu- facturing	TCPU	Trade	FIRE	Service	Govern- ment	Other
Ag, Fishing, Forestry	97.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Mining	0.0%	99.5%	0.0%	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Construction	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Manufacturing	0.0%	0.1%	0.0%	98.3%	0.0%	0.0%	0.0%	4.2%	0.0%	3.8%
TCPU	0.0%	0.0%	0.0%	0.0%	91.2%	0.0%	0.0%	1.6%	0.0%	0.2%
Trade	0.0%	0.0%	0.0%	0.0%	0.0%	97.6%	0.0%	0.0%	0.0%	0.6%
FIRE	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	98.0%	0.8%	0.0%	0.0%
Services	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	77.8%	0.0%	0.0%
Government	2.1%	0.1%	0.0%	0.0%	8.8%	2.4%	1.9%	15.6%	100.0%	0.1%
Other	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	28.0%
Capital	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	67.2%
Inventory	0.1%	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Total percentages may not sum to 100 due to rounding

Commodity Demand

Demand can also be broken into two categories, intermediate commodity demand or locally generated demand by industries for local and/or imported commodities and institutional

⁵³ Inventory consists of output that is produced but not sold within one year. The inventory production sector can be thought of as a regional warehouse in which all commodity produced that is not immediately consumed or used to produce more commodities gets placed.

commodity demand, which is local demand by non-industry sources for the same commodities. Institutional demand is comprised of household, government, and other institution final commodity demands, such as capital.⁵⁴ Each represents end users that buy goods and services for consumption (includes imports and exports). These goods and services leave the regional economy, and therefore, are not used to generate more products locally.⁵⁵ Both total intermediate and institutional demands, as well as relevant breakdowns are given in the following tables (Tables 7-14).

The leading intermediate commodity demands in the region include manufacturing, FIRE, and TCPU (*see* Table 7). FIRE and manufacturing are also among the leaders for institutional demand, holding the number one and number two spots. Intermediate commodity demand is broken into industry sectors in Table 8. This table gives an indication as to the backward linkages that exist for local industries. For instance, 52.7 percent of total demand for the construction industry is for manufacturing commodities, which are produced almost entirely by the manufacturing industry (*refer to* Table 6). However, the extent to which local manufacturing industry production is used to meet that demand will be discussed in a later section.

Table 7. Commodity Demand; Percent of Total; Four-County Region, OH; 1998

Commodity / Industry	Intermediate Commodity Demand*	Institutional Commodity Demand*	Total Gross Commodity Demand*
Ag, Fishing, Forestry	3.3%	0.5%	1.6%
Mining	5.0%	0.0%	2.0%
Construction	4.2%	10.7%	8.2%
Manufacturing	39.5%	18.6%	26.8%
TCPU	10.1%	6.3%	7.8%
Trade	7.7%	15.6%	12.5%
FIRE	19.0%	20.0%	19.6%
Services	0.8%	13.4%	8.5%
Government	0.8%	13.4%	8.5%
Other	0.9%	1.3%	1.1%
Total*	134.49	323.37	457.86

Total percentages may not sum to 100 due to rounding
 *Millions of dollars

⁵⁴ Capital is representative of private expenditures for durable goods or capital equipment, but expenditure values are not representative of those made by industrial sector, but rather, are increases to a region's overall durable goods assets.

⁵⁵ This is the same as final demands as discussed in the overview.

Table 8. Intermediate Commodity Demand; Percent of Total; Four-County Region, OH; 1998

Industry/ Commodity	Ag, Fishing, Forestry*	Mining*	Con- struction*	Manu- facturing*	TCPU*	Trade*	FIRE*	Services*	Govern- ment*
Ag, Fishing, Forestry	34.3%	0.0%	1.1%	5.2%	0.0%	1.3%	2.4%	0.3%	0.4%
Mining	0.2%	0.0%	1.2%	3.9%	10.0%	0.0%	0.0%	0.0%	4.8%
Construction	2.3%	0.0%	0.2%	1.1%	5.3%	1.6%	12.5%	2.2%	28.8%
Manufacturing	28.0%	0.0%	52.7%	54.5%	10.3%	21.1%	2.3%	18.2%	17.5%
TCPU	7.5%	0.0%	6.1%	7.9%	34.8%	11.5%	6.5%	9.0%	19.4%
Trade	11.0%	0.0%	15.3%	11.4%	4.5%	8.9%	1.2%	5.0%	2.6%
FIRE	11.2%	0.0%	3.4%	3.0%	6.4%	13.6%	50.2%	16.1%	7.7%
Services	5.2%	0.0%	19.9%	11.6%	25.1%	39.3%	22.5%	46.4%	14.2%
Government	0.1%	0.0%	0.3%	0.4%	0.6%	1.8%	2.2%	2.4%	2.2%
Other	0.0%	0.0%	0.0%	1.0%	3.1%	0.9%	0.2%	0.3%	2.3%
Total Demand*	21.14	197.98	329.33	1470.48	202.63	163.23	103.64	324.16	51.99

Total percentages may not sum to 100 due to rounding

*Millions of dollars

Total institution commodity demands include household and government demand as well as capital formation, inventory purchases, and foreign exports. In the study area households make up the largest proportion of institutional commodity demand (*see* Table 9). However, the largest percentage of commodity demand by institution is held by the government for government commodities, 66 percent by federal and 54.9 percent by state and local.

Table 9. Institutional Commodity Demand; Percent of Total; Four-County Region, OH; 1998

Institution/ Commodity	Sum of Households	Sum of Federal	Sum of State & Local*	Capital*	Inventory*
Ag, Fishing, Forestry	0.7%	0.0%	0.5%	0.0%	1.1%
Mining	0.0%	0.0%	0.0%	0.0%	0.0%
Construction	0.0%	3.5%	19.2%	53.6%	0.0%
Manufacturing	19.0%	7.4%	8.4%	36.2%	33.4%
TCPU	7.6%	2.6%	5.5%	1.2%	11.4%
Trade	19.3%	1.1%	1.7%	5.4%	14.5%
FIRE	23.0%	3.1%	3.0%	1.7%	0.0%
Services	28.2%	14.5%	6.7%	1.9%	0.0%
Government	0.7%	66.0%	54.9%	0.0%	0.0%
Other	1.6%	1.7%	0.1%	0.0%	39.6%
Total Demand*	2856.23	53.05	989.57	534.14	26.15

Total percentages may not sum to 100 due to rounding

*Millions of dollars

Table 10. Household Commodity Demand; Percent of Total; Four-County Region, OH; 1998

Household Income/ Commodity	<\$5k	\$5-10k	\$10-15k	\$15-20k	\$20-30k	\$30-40k	\$40-50k	\$50-70k	\$70k+
Ag, Fishing,									
Forestry	0.7%	0.7%	0.8%	0.8%	0.7%	0.6%	0.7%	0.6%	0.5%
Mining	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Construction	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Manufacturing	16.2%	17.8%	21.0%	20.4%	19.4%	18.1%	19.8%	19.1%	17.8%
TCPU	8.5%	8.6%	9.3%	8.3%	7.8%	7.1%	7.0%	6.7%	6.8%
Trade	16.2%	16.0%	19.4%	18.8%	20.5%	19.1%	20.7%	20.7%	19.2%
FIRE	21.3%	20.9%	23.4%	22.0%	22.2%	23.1%	24.6%	23.6%	24.9%
Services	35.5%	34.2%	24.3%	27.6%	27.2%	29.7%	24.9%	26.5%	28.1%
Government	0.6%	0.6%	0.7%	0.8%	0.8%	0.6%	0.7%	0.6%	0.8%
Other	1.0%	1.1%	1.2%	1.2%	1.5%	1.5%	1.7%	2.2%	1.9%
Total Demand*	184.24	238.81	231.58	255.31	489.68	472.87	339.17	415.21	229.37

Total percentages may not sum to 100 due to rounding

*Millions of dollars

Household commodity demand consists of payments by individuals and households to industries for goods and services used for personal consumption. Household demand makes up the largest component of final demand, as shown in Table 9. Yet, spending patterns can differ dramatically when disaggregated by income level and commodity types. For instance, spending on services in the region is greatest for the lowest two income groups, 35.5 percent for those below \$5K and 34.2 percent for \$5K-10K, compared to 24.3 percent for the next highest income group (*see* Table 10). In addition, Table 10 suggests that spending on services is greatest for all households regardless of income range and the same holds for FIRE in the second place spot. However, spending patterns begin to diverge from lower to higher income groups with the third position, which is more for manufacturing for \$5,000 to \$20,000 household incomes and Trade (combined retail and wholesale) for the \$20,000 to \$70,000 range.

Government commodity demand is broken into Federal expenditures on military purchases, non-military purchases, and investment and state and local expenditures on non-education, education, and investment. Non-military expenditures supply all other Federal government functions (e.g. natural resource management of public lands) and non-education expenditures are for all other state and local government activities, such as police protection. Federal investment expenditures are mainly for manufacturing commodities while state and local are almost entirely for construction (*see* Table 11). As would be expected, the majority of state and local education expenditures are on government commodities and the majority of all other

government institutional demands are for government commodities, but with significant amounts also in service commodities for federal non-defense and state and local non-education institutions.

Table 11. Government Commodity Demand; Percent of Total; Four-County Region, OH; 1998

Institution/ Commodity	Federal Non- defense*	Federal Defense*	Federal Investment*	State & Local Non-education*	State & Local Education*	State & Local Investment*
Ag, Fishing, Forestry	0.0%	0.0%	0.0%	0.8%	0.2%	0.0%
Mining	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%
Construction	3.6%	0.9%	19.0%	7.9%	2.3%	97.4%
Manufacturing	3.2%	1.2%	75.2%	11.5%	7.4%	2.0%
TCPU	4.2%	1.1%	0.3%	6.9%	6.0%	0.0%
Trade	1.2%	0.3%	5.5%	2.8%	1.1%	0.3%
FIRE	6.2%	0.1%	0.0%	6.4%	0.4%	0.0%
Services	25.8%	3.8%	0.0%	11.2%	4.2%	0.0%
Government	53.6%	91.2%	0.0%	52.4%	78.3%	0.0%
Other	2.2%	1.5%	0.0%	0.0%	0.1%	0.2%
Total Demand*	26.53	22.79	3.73	436.48	402.26	150.83

Total percentages may not sum to 100 due to rounding
*Millions of dollars

Table 12. Commodity Exports; Percent of Total; Four-County Region, OH; 1998

Export/Commodity	Foreign*	Domestic*	Total*
Ag, Fishing, Forestry	1.1%	5.7%	4.2%
Mining	12.0%	39.4%	30.1%
Construction	0.0%	0.0%	0.0%
Manufacturing	67.0%	48.7%	54.9%
TCPU	6.4%	6.2%	6.3%
Trade	3.6%	0.0%	1.2%
FIRE	3.4%	0.0%	1.1%
Services	2.3%	0.0%	0.8%
Government	0.0%	0.0%	0.0%
Other	4.2%	0.0%	1.4%
Total*	373.06	725.36	1098.43

Total percentages may not sum to 100 due to rounding
*Millions of dollars

The last category of commodity demands is exports. Foreign exports are shipments from local industries to destinations outside of the United States, while domestic exports are shipments outside of the local area but within the U.S. Manufacturing commodities make up the greatest percentage share of both foreign and domestic exports, but with mining following close behind in the domestic market (*see* Table 12). When the manufacturing sector is disaggregated by that

which is applicable only to the forest industry, pulp and paper commodities are the most in demand by domestic markets followed by wood products, which are the most in demand in foreign markets (*see* Table 13).⁵⁶

Table 13. Commodity Exports; Forest Sector; Percent of Total; Four-County Region, OH; 1998

Export/Commodity	Foreign*	Domestic*	Total*
All Others	98.7%	96.8%	97.1%
Non-timber	0.3%	0.7%	0.6%
Ag, Forestry, Fishing	0.0%	0.0%	0.0%
Pulp & Paper	0.0%	1.6%	1.4%
Wood Furniture	0.0%	0.0%	0.0%
Wood Products	1.0%	0.9%	0.9%
Total*	373.06	2285.54	2658.60

Total percentages may not sum to 100 due to rounding

*Millions of dollars

Consumption Patterns

In order to understand the conjunction between the supply and demand factors noted for the region and the growth potential as they relate to the local economy, consumption patterns must also be examined. Local supply and demand relationships are translated through the S/D ratio, average RPCs, and average RSCs (Tables 14 and 15). The domestic S/D ratio is the relationship of net commodity supply to total gross commodity demand. (If supply exceeds demand then the ratio is set to one). The regional purchase coefficient (average RPC) is the estimated fraction of the county's gross regional commodity demand that is satisfied by local commodities. For example, if the RPC for agriculture is equal to 0.75 then 75 percent of local demand is met by locally produced commodities and therefore, 25 percent of that demand must be met by imports (Tables 16 and 17). On the other hand, the regional sales coefficient (average RSC) is the fraction of net commodity supply used to meet county gross commodity demand. If the RSC for agriculture is 0.91 then 91 percent of that which is produced locally is consumed locally.

⁵⁶ The data necessary to subdivide non-timber forest products and agricultural, forestry, and fishing services into their respective industries/commodities were not available. Therefore, these two sub-sectors are not wholly applicable to the forest industry nor to the manufacturing sector.

Table 14. Comparison of Commodity Supply and Demand; Four-County Region, OH; 1998

Commodity	Domestic S/D Ratio	Average RPC	Average RSC
Ag, Fishing Forestry	0.8567	0.5028	0.5638
Mining	1	0.6256	0.2143
Construction	0.8721	0.8721	0
Manufacturing	0.8875	0.7076	0.6972
TCPU	0.8449	0.7665	0.8646
Trade	0.6829	0.6829	0.9778
FIRE	0.4226	0.4226	0.9685
Services	0.7294	0.7294	0.9919
Government	0.989	0.9889	0.9998
Other	0.176	0.176	0.4817

Domestic export demand for commodities produced in the region exceeds supply for all commodities except mining (*see* Table 14). The percentage of local demand met by locally produced commodities is greatest for government (99 percent) and construction (87 percent). Yet, construction has the least percentage of total commodities produced and consumed locally. In general, besides other⁵⁷ commodities, FIRE shows the greatest potential for growth domestically and potentially locally as well, since 97 percent of that which is produced is consumed locally yet only 42 percent of that demand is being filled. Trade and services also show the potential for local growth, with only 68 percent of current demand met in both markets. However, when disaggregating for the forest sector non-timber and wood products show the least growth potential for local and domestic markets (*see* Table 15). While all other forest commodity types are likely candidates for production expansion.

Table 15. Comparison of Commodity Supply and Demand; Forest Sector; Four-County Region, OH; 1998

Commodity	Domestic S/D Ratio	Average RPC	Average RSC
All Others	0.8024	0.4936	0.5781
Non-timber	1	0.6919	0.5387
Ag, Forestry, Fishing	0.262	0.132	0.5033
Pulp & Paper	0.5385	0.0029	0.0054
Wood Furniture	0.4896	0.4896	0.9997
Wood Products	1	0.8385	0.6766

⁵⁷ “Other” is a catch-all grouping of that which does not readily lend itself to categorization in any of the alternative sectors, therefore it is difficult to infer any relationships from it.

Imports in manufacturing, FIRE, and services make up the most significant portion of total imports (*see* Table 16). Among the three, FIRE commodity purchases represent the highest level of leakages for the region in terms of institutional imports. Yet manufacturing imports are greatest for intermediate use.

Table 16. Commodity Imports; Four-County Region, OH; 1998

Import/ Commodity	Intermediate*	Institutional*	Total*
Ag, Fishing, Forestry	5.2%	0.9%	2.7%
Mining	6.0%	0.0%	2.5%
Construction	1.7%	4.8%	3.5%
Manufacturing	36.9%	19.1%	26.5%
TCPU	7.6%	5.2%	6.2%
Trade	9.6%	15.0%	12.8%
FIRE	14.2%	31.7%	24.4%
Services	16.4%	19.0%	17.9%
Government	0.0%	0.5%	0.3%
Other	2.3%	3.7%	3.1%
Total*	896.44	1269.05	2165.50

Total percentages may not sum to 100 due to rounding

*Millions of dollars

Table 17. Commodity Imports; Forest Sector; Four-County Region, OH; 1998

Import/ Commodity	Intermediate*	Institutional*	Total*
All Others	94.7%	99.1%	97.4%
Non-timber	0.4%	0.1%	0.2%
Ag, Forestry, Fishing	0.4%	0.0%	0.2%
Pulp & Paper	0.6%	0.0%	0.3%
Wood Furniture	0.0%	0.1%	0.1%
Wood Products	3.9%	0.6%	1.9%
Total*	1458.11	2267.56	3725.67

Total percentages may not sum to 100 due to rounding

*Millions of dollars

Only a small percentage of forest sector commodities are imported compared to all others for the region (*see* Table 17), and when taken as a comparison of imports to exports for that sector alone, the percentage of forest sector exports exceeds those for all sectors (*see* Figure 14). This indicates that the forest sector may be a significant export base for the region, but since the region as a whole is importing far more than it is exporting, there is reason to believe that its level of self-sufficiency is low. This is supported by statewide trends that suggest that the raw materials used in the sawmill industry alone exceed 50 percent in imports.⁵⁸ In addition, looking

⁵⁸ Romig, R. 2001. *Ohio's Hardwood Industry*. Ohio State University Extension.

at the ratio of imports to exports for other dominant industries in the region, mining and manufacturing (of which the majority of the forest sector is a part), it is clear that the mining industry makes up the most significant portion of the areas export base, as was indicated in the location quotient analysis (see Figure 15).

Figure 14. Trade Balance; Percent of Total Imports & Exports; All Sectors & Forest Sector; Four-County Region, OH; 1998

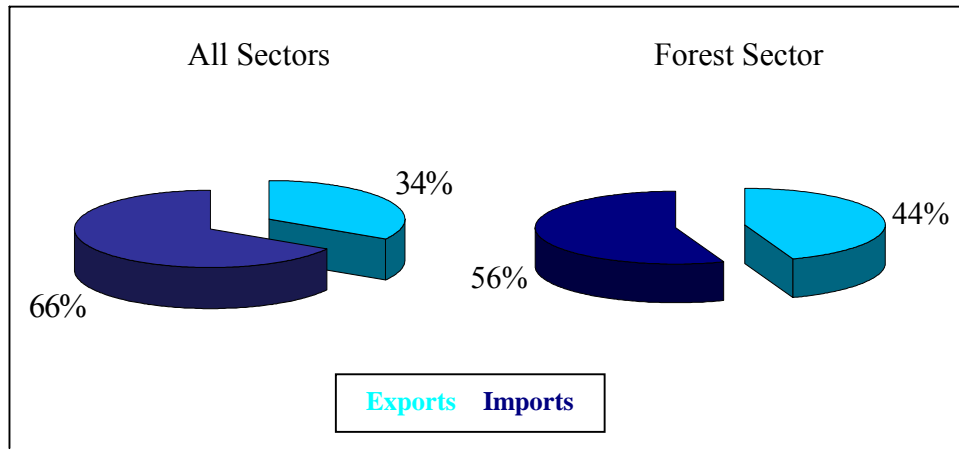
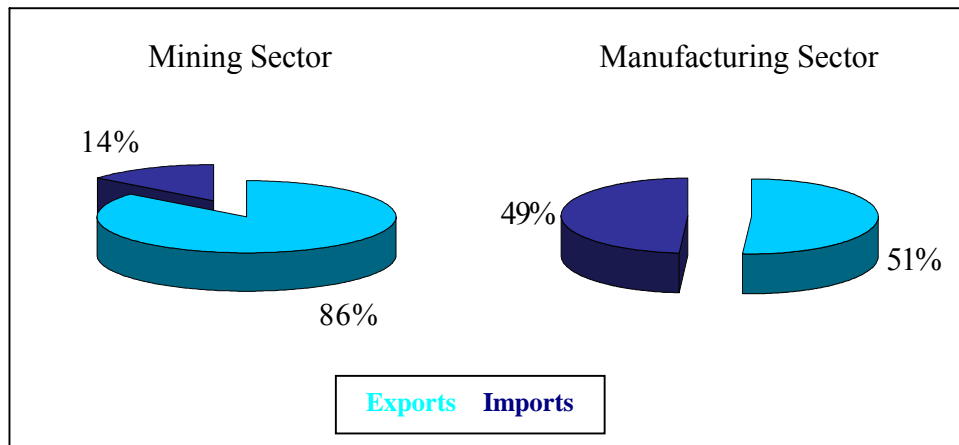


Figure 15. Trade Balance; Percent of Total Imports & Exports; Mining Sector & Manufacturing Sector; Four-County Region, OH; 1998



In reference to the last point, the economic base shows only moderate room for future growth as evidenced by comparing Tables 12 and 14. For instance, 39 percent of mining and 49 percent of manufacturing commodities were exported domestically in 1998 thereby suggesting that they accounted for a significant percentage of wealth generation in the region. In

conjunction, domestic supply of those commodities exceeded demand for mining and was at 88 percent for manufacturing, leaving little to no room for domestic export growth given market conditions. This means that the final demand for commodities on which the region is most dependent exhibits little hope for future growth in the domestic arena.

Economic Contributions

A relative measure of the economic contributions of the aforementioned activities to the region can be ascertained from examining the value of each industry's total production (output), number of jobs (employment), and related income flows (i.e. value added). Values for all aggregated industry sectors are given as well as the total in comparison to the forest sector (Tables 18 and 19).

Table 18. Output, Employment & Value Added; Percent of Total; Four-County Region, OH; 1998

Industry	Industry Output*	Employment	Employee		Other Property Income*	Indirect Business Tax*	Total Value Added*
			Compensation*	Proprietor Income*			
Ag, Fishing,							
Forestry	1.7%	4.7%	0.7%	18.4%	2.8%	1.6%	2.6%
Mining	7.4%	3.8%	5.6%	12.7%	8.8%	18.1%	7.8%
Construction	8.6%	7.4%	7.1%	16.1%	1.9%	1.5%	6.1%
Manufacturing	33.1%	11.3%	18.2%	7.5%	18.7%	7.7%	16.8%
TCPU	7.9%	3.6%	4.6%	7.5%	17.2%	14.6%	8.7%
Trade	9.8%	20.8%	13.0%	7.6%	10.5%	35.4%	13.6%
FIRE	6.6%	4.1%	2.8%	5.2%	24.3%	15.2%	9.3%
Services	13.6%	22.8%	19.2%	24.9%	7.0%	5.8%	15.6%
Government	11.1%	20.9%	28.7%	0.0%	8.3%	0.0%	19.4%
Other	0.1%	0.7%	0.2%	0.0%	0.5%	0.0%	0.3%
Total*	6052.13	75653.00	1915.66	237.22	807.98	226.70	3187.55

Total percentages may not sum to 100 due to rounding

*Millions of dollars

Total output for the regional economy was 6052.13 million dollars in 1998, of which 33.1 percent was produced by manufacturing and 13.6 percent by services (*see* Table 18). As in the trend analysis, the largest employers in 1998 continued to be services (22.8 percent), government (20.9 percent), and trade (20.8 percent). Government, which includes schools, state and local government, and federal government and military, also generated the largest percentage of

employee compensation in the county (28.7 percent) as well as the most in total value added for the year (19.4 percent). The forest sector in comparison to the rest gave the region less than 3 percent of its output, employment, and total value added (*see* Table 19). However, within the forest sector non-timber products contributed the most in terms of total value added. It did so mainly by way of proprietor income, which may be indicative of the high degree of small businesses and private non-industrial control of timberland noted previously.

Table 19. Output, Employment, & Value Added; Forest Sector; Percent of Total; Four-County Region, OH; 1998

Industry	Industry Output*	Employment	Employee		Other Property Income*	Indirect Business Tax*	Total Value Added*
			Compensation*	Proprietor Income*			
All Others	97.6%	97.7%	98.5%	94.0%	97.4%	99.2%	97.9%
Non-timber Ag, Forestry, Fishing	0.6%	1.0%	0.2%	4.5%	1.5%	0.4%	0.9%
Pulp & Paper	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Wood Furniture	1.2%	0.9%	0.8%	1.4%	0.5%	0.3%	0.7%
Wood Products	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total*	0.6%	0.2%	0.4%	0.0%	0.5%	0.2%	0.4%
	6052.13	75652.00	1915.66	237.22	807.98	226.70	3187.55

Total percentages may not sum to 100 due to rounding
*Millions of dollars

The industry to industry impact of economic activity can be determined by examining production relationships in the region. The benefit of doing so is that it allows for the estimation of changes to total economic contribution based on change in demand. One way to accomplish this is to state the patterns of expenditures made by a sector as proportions of all inputs needed to produce one dollar of output in a given sector, thus identifying linear production relationships.⁵⁹ This information is commonly presented in what is known as a direct requirements table (Tables 20 and 21).⁶⁰

The direct requirements table can only be read down, as each column essentially represents a “production recipe” for one dollar of output for the purchasing sector at the column

⁵⁹ This is done by dividing the dollar value of inputs purchases from each sector by total expenditures.

⁶⁰ This is also referred to as the matrix of technical coefficients excluding households and imports, which if included would set the total row to one for each industry.

head.⁶¹ Each number in the column is the dollar amount of inputs required from the processing sector on the left in order to produce that unit of output. For example, in the four-county region, for every dollar of sales by the manufacturing sector 28 cents worth of additional output from itself, 6 cents of output each for trade and services, and an additional 10 cents from remaining industries is required (*see* Table 20).

Given this example, an additional dollar of output by the manufacturing sector leads to the purchase of a total of 50 cents from other firms located in the region.⁶² If those production requirements are not met by industries within the region then they are either obtained from institutions (i.e. households) or are imported. Therefore, in the region’s manufacturing sector 50 cents worth of inputs are derived from institutions or imports. This gives a sense for the level of industry and inter-industry self-sufficiency of the region and its ability to generate wealth. The greater the factor payments for intermediate inputs and supplies made externally, the greater the dependency of the local economy on the outside world (i.e. sensitivity to exogenous factors of change) and the greater the opportunity for leakage. This is discussed in more detail in the remainder of this section.

Table 20. Direct Requirements Table; All Sectors; Four-County Region, OH; 1998

Purchasing / Processing Sectors	Ag, Fishing, Forestry	Mining	Const- ruction	Manu- facturing	TCPU	Trade	FIRE	Service	Government
Ag, Fishing, Forestry	0.04	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
Mining	0.00	0.08	0.00	0.02	0.03	0.00	0.00	0.00	0.00
Construction	0.00	0.11	0.00	0.01	0.02	0.00	0.03	0.01	0.02
Manufacturing	0.04	0.04	0.23	0.28	0.03	0.04	0.00	0.05	0.01
TCPU	0.01	0.03	0.03	0.04	0.11	0.02	0.01	0.03	0.01
Trade	0.02	0.01	0.07	0.06	0.01	0.02	0.00	0.01	0.00
FIRE	0.01	0.02	0.01	0.01	0.01	0.02	0.05	0.03	0.00
Services	0.01	0.02	0.09	0.06	0.08	0.08	0.04	0.13	0.01
Government	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00
Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	0.12	0.31	0.44	0.50	0.30	0.19	0.15	0.27	0.06

Assuming the direct requirements table represents the spending patterns necessary for additional production in all sectors, the effects of a change in a final demand for output in one

⁶¹ This production formula is assumed to be constant and the same for all sector establishments regardless of input prices or production levels (e.g. no economies of scale).

can be traced to that of another. For instance, in the direct requirements table for the forest sector, a one dollar unit change in demand for pulp and paper output results in an additional 22 cents worth of demand in pulp and paper products, 4 cents in wood products, and 41 cents from all other non-forest sectors (*see* Table 21). Therefore, the direct effects of that one-dollar change on the economy would be 167 cents (the initial change plus the direct effect). However, the effect of that change does not stop at that point, the indirect effects must then be estimated by carrying those changes through the impacted sectors. In other words, the 41 cents worth of new demand on all other sectors, the 4 cents on wood products, and the additional 22 cents to pulp and paper must be accounted for. This is accomplished by multiplying the value of the direct effects by the numbers in the relevant columns, which would result in an additional 37 cents, making a total region-wide impact of 204 cents.

Table 21. Direct Requirements Table; Forest Sector; Four-County Region, OH; 1998

Purchasing / Processing Sectors	All Others	Non-timber	Ag, Forest, Fish, Svc	Wood Products	Wood Furniture	Pulp and Paper
All Others	0.45	0.13	0.43	0.30	0.40	0.41
Non-timber	0.00	0.02	0.03	0.08	0.00	0.00
Ag, Forest, Fish Svc	0.00	0.04	0.01	0.00	0.00	0.00
Wood Products	0.01	0.00	0.00	0.29	0.14	0.04
Wood Furniture	0.00	0.00	0.00	0.00	0.00	0.00
Pulp and Paper	0.01	0.00	0.01	0.00	0.03	0.22
Total	0.47	0.20	0.48	0.67	0.58	0.67

The cycle of effects does not stop after just two rounds, however; the process continues until the level of indirect effects becomes insignificant (*refer to* Figure 13 *discussion*). IMPLAN calculates the sum of these effects or total requirements, which are presented in Tables 22 and 23 for all sectors and the forest sector in comparison to all others.⁶³ Each column value indicates the total dollar value of output required from the processing sector by the purchasing sector for a one-dollar increase in its final demand.⁶⁴ For example, the first element in the construction column (.01) indicates the total dollar increase in agriculture, fishing, and forestry service production that results from a one dollar increase in final demand for construction products. The second element indicates the total increase in mining output (.02) due to that same one-dollar

⁶² Sums may not be exact due to rounding.

⁶³ The total requirements table is also referred to as the Leontief inverse table.

increase in final demand for construction products. The one-dollar effect across industries continues to be captured down the row, totaling an industry-wide effect two-thirds greater than the original change to the construction industry (1.66).

Table 22. Total Requirements Table; All Sectors; Four-County Region, OH; 1998

Purchasing / Processing Sectors	Ag, Fishing, Forestry	Mining	Const-ruktion	Manu-facturing	TCPU	Trade	FIRE	Services	Government	Other
Ag, Fishing, Forestry	1.04	0.00	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.00
Mining	0.00	1.10	0.02	0.04	0.03	0.00	0.00	0.00	0.00	0.00
Construction	0.01	0.12	1.01	0.02	0.03	0.01	0.03	0.01	0.02	0.00
Manufacturing	0.06	0.11	0.35	1.42	0.07	0.07	0.02	0.10	0.02	0.00
TCPU	0.02	0.05	0.05	0.07	1.12	0.03	0.02	0.04	0.01	0.00
Trade	0.02	0.03	0.09	0.08	0.02	1.02	0.01	0.02	0.00	0.00
FIRE	0.01	0.03	0.02	0.02	0.02	0.02	1.06	0.03	0.00	0.00
Services	0.01	0.04	0.11	0.09	0.08	0.08	0.04	1.13	0.01	0.00
Government	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Total	1.17	1.47	1.66	1.76	1.38	1.24	1.19	1.34	1.08	1.00

Table 23. Total Requirements Table; Forest Sector; Four-County Region, OH; 1998

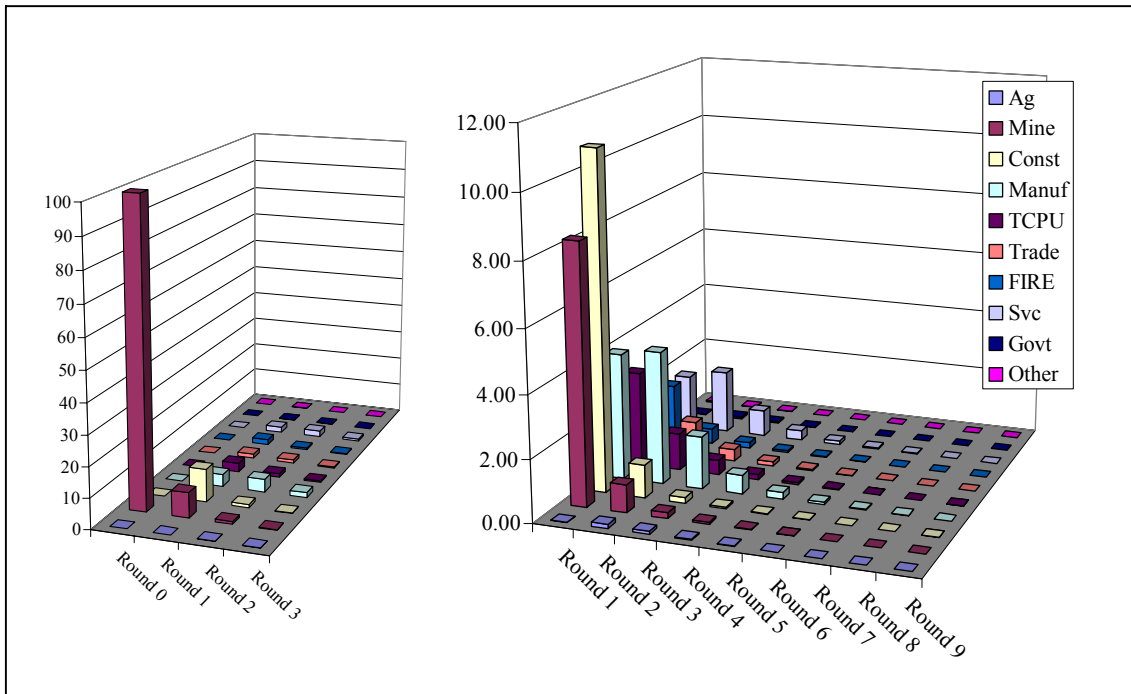
Purchasing / Processing Sectors	All Others	Non-timber	Ag, Forest, Fish, Svc	Wood Products	Wood Furniture	Pulp and Paper
All Others	1.28	0.08	0.26	0.25	0.28	0.26
Non-timber	0.00	1.01	0.02	0.07	0.01	0.00
Ag, Forest, Fish Svc	0.00	0.00	1.00	0.00	0.00	0.00
Wood Products	0.01	0.00	0.00	1.31	0.16	0.04
Wood Furniture	0.00	0.00	0.00	0.00	1.00	0.00
Pulp and Paper	0.00	0.00	0.00	0.00	0.00	1.00
Total	1.29	1.10	1.29	1.63	1.44	1.30

An additional interpretation of the total requirements table is the amount of openness within the economy based on its measure of economic linkages. As mentioned previously, highly linked economies are more self-sufficient in production and are less dependent on outside input sources. A perfectly self-sufficient economy is referred to as a closed economy, whereas open economies are those which must rely on imports and therefore suffer leakages. The degree of linkage or openness of the four-county region in Ohio can be obtained by reviewing the off-

⁶⁴ Total requirements are representative of inter-industry effects only (i.e. direct plus indirect), therefore induced effects are not included in the measure.

diagonal values in the total requirements table.⁶⁵ The larger the values the more tightly linked (closed) the economy, likewise, the smaller the values the more open the economy. The table can be difficult to interpret, however, therefore two illustrative examples for individual sectors are given (Figures 16 and 17).

Figure 16. Ripple Effect; One Hundred Mining Units; Four-County Region, OH; 1998

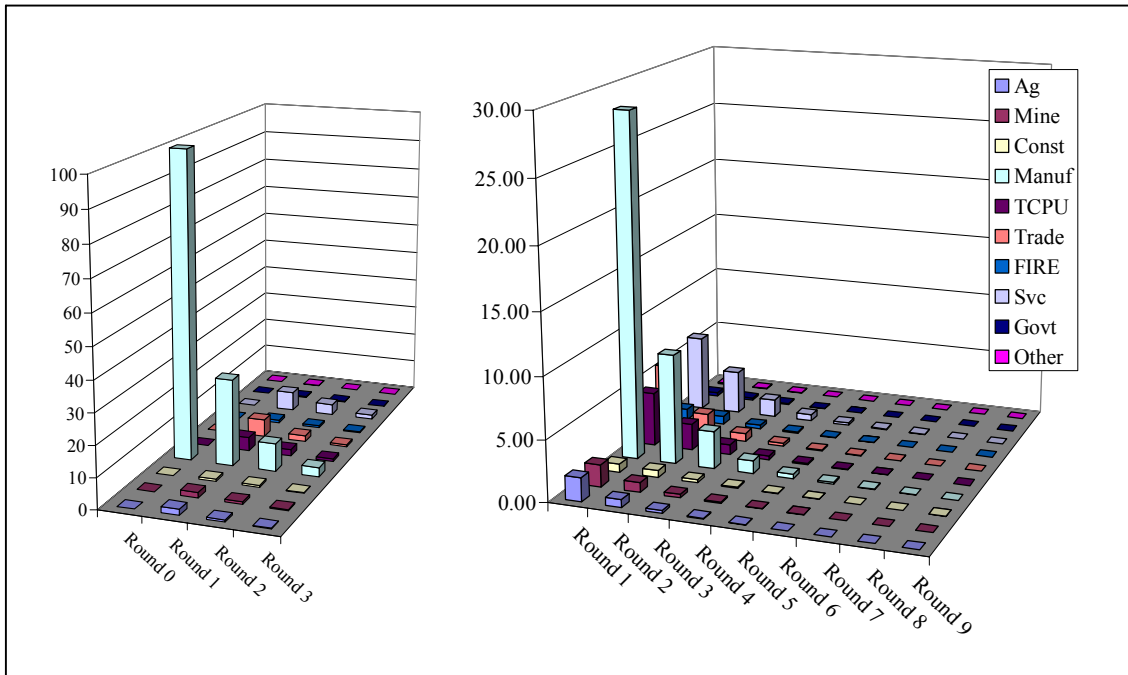


Figures 16 and 17 show the flow or ripple effect of a one hundred-dollar unit change in final demand for mining and manufacturing output, respectively. The smaller graph on the left begins with round 0, the initial change, therefore the small graphs in both figures are to scale and can be directly compared. Round 0 is dropped in the larger graph so that the changes are visually more apparent. The industry-wide direct effect of the change to manufacturing appears to be greater than that for mining, as the impact of that 100 units is less detectable in the smaller figure for mining. In addition, the scale of effects in the larger graph is 2.5 times greater for manufacturing than mining. However, as the larger graphs reveal, the backward linkages of the mining sector are more extensive (reaching more local industries) than the manufacturing sector. Both circulate through the same number of rounds of economic activity, although a greater

⁶⁵ Off-diagonal values are those that are less than one.

percentage of that 100 dollars leaks out of the economy in the first round of mining. As such, from a policy perspective, the preferred sector change would depend on the desired outcome (e.g. diversification and more self-sufficient vs. greater dollar returns but less self-sufficient).

Figure 17. Ripple Effect; 100 Manufacturing Units; Four-County Region, OH;1998



The industry to industry relationships presented numerically in the total requirements table and graphically by the ripple effect figures are equivalent to Type I output multipliers. Output is the basis of the other sets of multipliers as well, income per dollar of output for value added and output per worker ratios for employment. All three sets of final demand multipliers are given for all sectors as well as the forest sector (Tables 24 and 25). Looking at the Type SAM multipliers in Table 24, manufacturing has the greatest overall effect for total value added, employment, and output, although there is little variation among industries for output. For the forest sector, wood products has the largest multiplier for both output and value added, while pulp and paper is marginally the highest for employment, followed by wood products (*see* Table 25).

Table 24. Final Demand Multipliers; Four-County Region, OH; 1998

Effect / Industry	Direct	Indirect	Induced	Total*	Type I**	SAM***	
Value Added	Ag, Fishing,						
	Forestry	0.7960	0.0920	0.6457	1.5338	1.1156	1.9268
	Mining	0.5566	0.2196	0.5899	1.3661	1.3945	2.4544
	Construction	0.3703	0.2905	0.5296	1.1904	1.7843	3.2143
	Manufacturing	0.2664	0.3326	0.4719	1.0710	2.2487	4.0202
	TCPU	0.5784	0.2029	0.5836	1.3649	1.3508	2.3598
	Trade	0.7258	0.1242	0.6752	1.5251	1.1711	2.1013
	FIRE	0.7410	0.1083	0.5766	1.4260	1.1462	1.9243
	Services	0.6049	0.1765	0.6281	1.4095	1.2918	2.3303
	Government	0.9224	0.0375	0.7101	1.6699	1.0406	1.8104
	Other	1.0000	0.0000	0.6419	1.6419	1.0000	1.6419
Employment	Ag, Fishing,						
	Forestry	34.0888	2.6272	16.2217	52.9377	1.0771	1.5529
	Mining	6.3992	4.5299	14.8307	25.7598	1.7079	4.0255
	Construction	10.7526	7.1370	13.3128	31.2024	1.6637	2.9019
	Manufacturing	4.2600	7.8381	11.8827	23.9809	2.8399	5.6293
	TCPU	5.6017	4.0852	14.6990	24.3859	1.7293	4.3533
	Trade	26.4356	3.0903	16.9715	46.4974	1.1169	1.7589
	FIRE	7.6648	2.2486	14.4941	24.4074	1.2934	3.1844
	Services	21.0370	4.4158	15.7886	41.2414	1.2099	1.9604
	Government	23.5738	0.8311	17.8409	42.2458	1.0353	1.7921
	Other	66.4550	0.0000	16.1269	82.5819	1.0000	1.2427
Output	Ag, Fishing,						
	Forestry	1.0000	0.1722	1.1194	2.2916	1.1722	2.2916
	Mining	1.0000	0.4677	1.0064	2.4741	1.4677	2.4741
	Construction	1.0000	0.6560	0.9062	2.5621	1.6560	2.5621
	Manufacturing	1.0000	0.7643	0.8059	2.5702	1.7643	2.5702
	TCPU	1.0000	0.3846	0.9960	2.3806	1.3846	2.3806
	Trade	1.0000	0.2395	1.1446	2.3841	1.2395	2.3841
	FIRE	1.0000	0.1893	0.9931	2.1824	1.1893	2.1824
	Services	1.0000	0.3385	1.0740	2.4125	1.3385	2.4125
	Government	1.0000	0.0814	1.2298	2.3112	1.0814	2.3112
	Other	1.0000	0.0000	1.1266	2.1266	1.0000	2.1266

* total = direct + indirect + induced, ** Type I = direct + indirect, *** Type SAM = Type I + induced

Multipliers can be used to assess the potential impacts of change to a region based on a “shock” or change in economic stimuli, such as the 50 new jobs in services used to produce an example impact analysis for the region, as shown in Table 26. However, the determination as to whether or not a multiplier is accurate or the impact results reasonable requires additional research time, particularly time to answer a number of important questions. The most essential is of course: How closely does the estimate reflect economic relationships in the region under consideration? The answer may be dependent on the type of data used (e.g. primary or secondary), the level of sector aggregation, the base year from which the model was constructed,

the size of the impact in relation to the size of the affected industry, whether or not households or other institutions were included, and a number of other relevant factors. Therefore use of multipliers should be dealt with caution.

Table 25. Final Demand Multipliers; Forest Sector; Four-County Region, OH; 1998

Effects / Industry		Direct	Indirect	Induced	Total*	Type I**	SAM***
Value Added	All Others	0.5287	0.1515	0.2318	0.9119	1.2865	1.7249
	Non-timber	0.8040	0.0572	0.2771	1.1384	1.0712	1.4159
	Ag, Forestry, Fishing	0.5196	0.1570	0.2392	0.9157	1.3021	1.7624
	Wood Products	0.3332	0.2900	0.2185	0.8417	1.8702	2.5258
	Wood Furniture	0.4207	0.2061	0.2185	0.8453	1.4898	2.0092
	Pulp & Paper	0.3310	0.1531	0.1619	0.6460	1.4625	1.9517
Employment	All Others	12.5209	3.6101	5.5025	21.6334	1.2883	1.7278
	Non-timber	22.4426	1.4734	6.5791	30.4950	1.0657	1.3588
	Ag, Forestry, Fishing	69.7698	3.8151	5.6780	79.2630	1.0547	1.1361
	Wood Products	9.7049	7.6699	5.1863	22.5611	1.7903	2.3247
	Wood Furniture	10.5369	5.1955	5.1880	20.9204	1.4931	1.9854
	Pulp & Paper	4.8432	3.7137	3.8445	12.4013	1.7668	2.5606
Output	All Others	1.0000	0.2884	0.4387	1.7271	1.2884	1.7271
	Non-timber	1.0000	0.1030	0.5246	1.6276	1.1030	1.6276
	Ag, Forestry, Fishing	1.0000	0.2861	0.4527	1.7388	1.2861	1.7388
	Wood Products	1.0000	0.6287	0.4135	2.0422	1.6287	2.0422
	Wood Furniture	1.0000	0.4436	0.4136	1.8572	1.4436	1.8572
	Pulp & Paper	1.0000	0.3048	0.3065	1.6114	1.3048	1.6114

*Total = direct + indirect + induced, ** Type I = direct + indirect, *** Type SAM = Type I + induced

Table 26. Impact Estimates; 50 New Service Jobs; Type SAM Multipliers; Four-County Region, OH; 2001 (Deflated)

Total Impact / Industry	Value Added	Employment	Output
Ag, Fishing, Forestry	\$15,606	1	\$19,605
Mining	\$14,937	0	\$26,837
Construction	\$53,592	2	\$144,709
Manufacturing	\$150,224	2	\$563,917
TCPU	\$118,940	1	\$205,632
Trade	\$186,213	7	\$256,559
FIRE	\$161,316	2	\$217,696
Services	\$1,267,133	44	\$2,094,866
Government	\$255,489	7	\$276,998
Other	\$2,201	0	\$2,201
Foreign Trade	\$0	0	\$594
Domestic Trade	\$0	0	\$586,061
Total	\$2,225,651	65.3	\$4,395,675

Input-Output Analysis Summary

The input-output analysis of the four-county Ohio region has revealed a continued dependence of regional economic health on its natural resource base. The mining sector is among the area's top exporting sectors (*refer to* Table 12 and Figure 15). And, while manufacturing is the major contributor to the regional economy, it is in part due to the strength of the forest sector. For instance, as shown in Table 25, wood products alone surpasses all non-forest sectors in total value added ability by approximately 46 percent, employment by 35 percent, and output by 18 percent.⁶⁶ In other words, the economy-wide return on investment in wood products is high in comparison to all other sectors.

However, the ability of either mining or forest based manufacturing to contribute further to the wealth of the region is questionable. Potential growth in local and domestic markets appears to be limited as the markets are already saturated for mining and near saturated for manufacturing. If expansion were to be pursued in relation to either mining or forest based manufacturing, wood furniture would be among the most likely to succeed as it exhibits room for growth in both domestic and local markets and is second to wood products in total value added to the economy (*see* Tables 15 and 25). Other potential factors of growth that surfaced in the analysis are in the FIRE and trade industries. All have excess demand in comparison to both local and domestic supply and each is currently a source of leakage from the local economy, particularly FIRE.

Due to structural limitations in the model, it was not possible to estimate market potential as it pertains to foreign markets, which may serve as an opening for the current economic base. According to foreign export statistics for all Ohio products, both mining and forestry are underrepresented in terms of direct export of raw materials.⁶⁷ Yet, a number of Ohio commodity exports are in industries where those natural resources serve as local inputs, such as in the production of steel and motor vehicles, thereby contributing to total value added for the state. The market that those commodities serve is worldwide, but it is vested in the Canadian market at a rate greater than 50 percent, therefore an investigation into the potential for expanding other existing markets may be worthwhile.

⁶⁶ Based on Type SAM multipliers.

⁶⁷ Ohio Department of Development, Office of Strategic Research. July 2001. Ohio Exports 2000. *Data Line Ohio*. Vol. 9, #7.

Conclusion

The region currently has a fairly stable and diversified economic base (*see* Appendix for industry disaggregation and economic contribution), but its reliability on its natural resources raises many questions as to the ability for that structure to be maintained and for the area to further extract value added from existing industries. For instance, do the resources exist to sustain those industries and is there a potential for market growth? If past national and current local trends are any indication, then the fate of the coal mining industry is already sealed. However, the implications for the forest industry are not as clear.

Although an analysis of forest health is beyond the scope of this work, according to statistics provided by the Ohio State University Extension it appears as though Ohio's forests are thriving. For instance, they note a 2.4 to 1 growth to removal ratio for all tree species and class sizes, the largest total volume of timber ever surveyed, and an increasing number of certified tree farms and management plans for future growth.⁶⁸ In addition, unlike many other regions of the country the majority of forest lands are not in the hands of the government or "big business," therefore the ability to control resource use and capture income generated is greater for the study area than for most. Yet, the availability of wood as a raw material remains an issue facing wood product manufacturers, harvest restrictions and price increases are noted as contributing factors,⁶⁹ but whatever the case this situation is indicated in this study in the import/export data. For instance, a calculation of the percentages provided in Table 17 reveal that 80 percent of all wood products imports in 1998 were for intermediate use. In other words, the majority of that which was imported was to be used for production inputs. Therefore, much of what would be considered value added in the secondary manufacturing process was leaked out of the region through the use of externally rather than internally produced materials.

Another issue is market potential. This study does not provide the detailed information needed for a full-scale market analysis, as it is limited to current market structure. However, as previously stated it does suggest that the supply of non-timber and wood products exceeds existing demand in the domestic market and that each already makes up a large percentage of local demand for those commodities. This does not mean that each has reached its potential as

⁶⁸ Ohio State University Extension. *Forests of Ohio: Highlights*. ODNR-Division of Forestry.

⁶⁹ Romig, R. 2001. *Ohio's Hardwood Industry*. Ohio State University Extension.

additional markets can be sought, but besides resource management and regulation, consumer characteristics must be carefully considered. This is particularly true for the non-timber forest products sector, whose growth has been driven by the aging and reasonably affluent “baby-boomer” population and a favorable climate for herbal medicines and environmentally friendly products.⁷⁰ As demographics and consumer attitudes and preferences change so too may the market for non-timber forest products, either for the better or the worse. As such, further investment in this sector may be more risky than in more traditional ones and should therefore be carefully considered.

One factor that this study does point out quite clearly is the difference in the total impact of additional output in each industry sector on regional employment and income. Non-timber forest products currently contributes the highest percentage of total value added for the forest industry (*see* Table 19), however, that effect is greatest as a direct impact (*see* Table 25). In other words, the total benefit for a one-dollar unit of output is achieved mainly in the initial round of economic activity and there is little added by way of indirect effects. This makes sense since there is limited, if any intermediate processing for such products. The opposite is true for wood products, which adds value as its processes move through the regional economy, ultimately amassing a larger value added multiplier effect on the economy than non-timber forest products. The same can be said for employment, which is initially impacted more extensively for non-timber forest products, a more labor intensive sector than mechanized manufacturing, but inevitably only amounts to a multiplier that is 58 percent of that for wood products for a similar dollar increase in output.

As stated previously, multiplier values should not be taken at face value, but rather, must be considered along with other known factors pertaining to the regional economy. The results of the trend analysis suggest that there is a need for further research into labor market dynamics and local wage rates in order to provide a reasonable assessment of the validity of the estimated impacts. However, the differences presented reinforce another point made earlier, that is the need to consider the desired outcome. For instance, is the main goal to reduce unemployment or income-based poverty rates? Is the desire greater to provide increased wealth for a certain group of individuals with a particular skill level or set of social conditions? Is it to strengthen a certain

⁷⁰ Chamberlain, J., R. Bush, and A. Hammett. October 1998. Non-Timber Forest Products: The OTHER Forest Products. *Forest Products Journal*. 48(10): 10-19.

industry or the economy as a whole? Is it to protect the environment? Sustainability and growth can mean many things and depending on the answer to these and other goal-directed questions, the structural changes needed may be very different. What the economic base assessment offers is a way to consider the viability of alternatives.

References

- Alward, G., E. Siverts, D. Olson, J. Wagner, D. Senf, and S. Lindall. 1989. *Micro-IMPLAN*. Fort Collins, CO: USDA Forest Service.
- Chamberlain, J., R. Bush, and A. Hammett. October 1998. Non-Timber Forest Products: The OTHER Forest Products. *Forest Products Journal*. 48(10): 10-19.
- Deputy, D. and D. Hopkins. February 1999. *Economic Impact of the Wilmington Blue Rocks Baseball Team*. Delaware Economic Development Office, Business Research Section.
- Fuguitt, G. 1985. The Non-metropolitan Turnaround. *Annual Review of Sociology*. 11: 259-280.
- Liston, L. 1997. *Ohio: America's Crossroads*. Southeast Ohio. <<http://www.conway.com/oh/9708/southeas.htm>> Accessed 10/29/01.
- Miller, R. and P. Blair. 1985. *Input-Output Analysis: Foundations and Extensions*. Englewood Cliffs, NJ: Prentice Hall.
- Minnesota IMPLAN Group (MIG). 2000. *IMPLAN Pro Version 2 User's Guide, Analysis Guide, and Data Guide*. Stillwater MN: Minnesota IMPLAN Group, Inc.
- Ohio Department of Development, Office of Strategic Research. July 2001. Ohio Exports 2000. *Data Line Ohio*. 9(7).
- Ohio State University Extension. November 1999. *Ohio Rural-Urban Interface Series: RU-1*, Data Center, Department of Human and Community Resource Development. <http://www.ag.ohio-state.edu/~dataunit/ru-1/ru1_4.html> Accessed 10/27/01.
- Ohio State University Extension. December 1999. *A Report on the Status of Ohio*. Bulletin 881. <http://www.ag.ohio-state.edu/~dataunit/b881/b881_1.html> Accessed 10/27/01.
- Romig, R. 2001. *Ohio's Hardwood Industry*. Ohio State University Extension. <<http://www.ohiosaf.org/hardwood.htm>> Accessed 10/27/01.

U.S. Department of Agriculture. 2001. *Understanding Rural America*. Economic Research Service. <<http://www.ers.usda.gov>> Accessed June, 2001.

Data Sources

Minnesota IMPLAN Group, Inc. <<http://www.implan.com/>>

Ohio Department of Development, Office of Strategic Research.
<<http://www.odod.state.oh.us/osr/people.htm>>

Ohio Department of Job and Family Services, Office of Research, Assessment, & Accountability, Bureau of Labor Market Information. <<http://lmi.state.oh.us/>>

Ohio State University Extension, Data Center, Department of Human and Community Resource Development. <<http://www.ag.ohio-state.edu/~dataunit.html>>

Ohio State University Extension, Information, ODNR-Division of Forestry.
<<http://ohioline.osu.edu/forests/index.html>>

U.S. Census Bureau, Census of Housing and Population. <<http://www.census.gov/>>

U.S. Department of Commerce, Bureau of Economic Analysis. <<http://www.bea.doc.gov/>>

U.S. Department of Labor, Bureau of Labor Statistics, Local Area Unemployment Statistics.
<<http://stats.bls.gov/lauhome.htm>>

Appendix
Table A-1. Four-County Region Industry Sectors

Code	Industry	Industry Output*	Employment	Total Value Added*
1	Dairy Farm Products	15.232	169	13.558
2	Poultry and Eggs	0.403	6	0.194
3	Ranch Fed Cattle	6.079	205	3.723
4	Range Fed Cattle	0.64	23	0.386
5	Cattle Feedlots	3.844	36	2.252
6	Sheep, Lambs and Goats	0.298	47	0.222
7	Hogs, Pigs and Swine	2.842	69	1.384
9	Miscellaneous Livestock	0.998	75	0.775
11	Food Grains	0.586	26	0.556
12	Feed Grains	5.988	162	5.702
13	Hay and Pasture	18.036	1,505	16.105
15	Tobacco	0.104	5	0.046
16	Fruits	0.694	20	0.455
18	Vegetables	5.445	88	4.457
21	Oil Bearing Crops	2.359	79	2.301
22	Forest Products	9.527	248	7.756
23	Greenhouse and Nursery Products	18.205	379	16.578
24	Forestry Products	4.042	55	0.911
26	Agricultural, Forestry, Fishery Services	0.374	26	0.194
27	Landscape and Horticultural Services	7.957	310	4.956
37	Coal Mining	326.437	1,120	162.435
38	Natural Gas & Crude Petroleum	85.318	1,470	59.588
40	Dimension Stone	1.648	11	1.102
41	Sand and Gravel	33.087	257	25.389
48	New Residential Structures	152.152	1,196	32.292
49	New Industrial and Commercial Buildings	97.218	846	32.832
50	New Utility Structures	21.807	233	8.951
51	New Highways and Streets	18.064	179	6.937
53	New Mineral Extraction Facilities	5.182	77	2.953
54	New Government Facilities	55.421	383	20.54
55	Maintenance and Repair, Residential	42.688	571	17.112
56	Maintenance and Repair Other Facilities	114.204	1,998	70.094
57	Maintenance and Repair Oil and Gas Wells	16.296	141	1.989
58	Meat Packing Plants	0.727	2	0.053
65	Fluid Milk	55.955	157	7.6
78	Prepared Feeds, N.E.C	5.363	12	0.458
79	Bread, Cake, and Related Products	0.713	6	0.182
89	Animal and Marine Fats and Oils	7.609	31	1.166
102	Macaroni and Spaghetti	3.228	18	0.709
103	Food Preparations, N.E.C	0.652	4	0.125
124	Apparel Made From Purchased Materials	0.07	1	0.007
130	Automotive and Apparel Trimmings	24.318	197	4.191
133	Logging Camps and Logging Contractors	2.606	22	0.456
134	Sawmills and Planing Mills, General	28.357	180	6.87
135	Hardwood Dimension and Flooring Mills	0.153	2	0.076
137	Millwork	31.178	365	12.679
138	Wood Kitchen Cabinets	1.968	27	0.862

Table A-2. Four-County Region Industry Sectors

Code	Industry	Industry Output*	Employment	Total Value Added*
140	Structural Wood Members, N.E.C	0.341	3	0.096
142	Wood Pallets and Skids	6.204	87	2.527
144	Prefabricated Wood Buildings	0.278	2	0.089
147	Wood Products, N.E.C	0.365	5	0.153
148	Wood Household Furniture	1.795	19	0.787
149	Upholstered Household Furniture	0.416	4	0.161
150	Metal Household Furniture	0.131	1	0.036
151	Mattresses and Bedsprings	0.871	7	0.306
152	Wood Tv and Radio Cabinets	0.081	1	0.027
153	Household Furniture, N.E.C	0.499	6	0.317
154	Wood Office Furniture	0.118	1	0.053
155	Metal Office Furniture	49.564	241	11.764
156	Public Building Furniture	1.873	11	0.542
157	Wood Partitions and Fixtures	1.166	11	0.463
158	Metal Partitions and Fixtures	0.581	5	0.195
159	Blinds, Shades, and Drapery Hardware	0.05	1	0.007
160	Furniture and Fixtures, N.E.C	0.794	5	0.217
164	Paperboard Containers and Boxes	0.418	2	0.104
165	Paper Coated & Laminated Packaging	36.643	177	12.163
174	Newspapers	18.34	270	7.885
175	Periodicals	1.916	15	0.599
176	Book Publishing	2.772	14	0.6
179	Commercial Printing	34.971	348	12.185
184	Typesetting	0.218	3	0.059
187	Industrial Gases	8.21	54	5.089
190	Cyclic Crudes, Interm. & Indus. Organic Chem.	71.402	146	17.115
191	Plastics Materials and Resins	388.843	712	84.306
195	Drugs	0.682	3	0.252
200	Paints and Allied Products	25.224	67	8.011
208	Carbon Black	38.484	128	15.744
209	Chemical Preparations, N.E.C	2.058	7	0.541
210	Petroleum Refining	4.016	3	0.64
211	Paving Mixtures and Blocks	16.274	40	6.548
212	Asphalt Felts and Coatings	0.471	1	0.29
213	Lubricating Oils and Greases	0.424	1	0.03
218	Gaskets, Packing and Sealing Devices	0.251	3	0.044
220	Miscellaneous Plastics Products	95.649	574	30.062
224	Shoes, Except Rubber	17.232	255	10.024
230	Glass and Glass Products, Exc Containers	1.259	12	0.615
240	Porcelain Electrical Supplies	19.135	169	9.832
241	Pottery Products, N.E.C	0.043	1	0.006
242	Concrete Block and Brick	2.346	16	0.761
243	Concrete Products, N.E.C	12.832	107	4.917
244	Ready-mixed Concrete	7.737	49	2.73
245	Lime	10.769	45	3.579
250	Minerals, Ground Or Treated	0.476	4	0.207
255	Electrometallurgical Products	299.238	1,045	80.976

Table A-3. Four-County Region Industry Sectors

Code	Industry	Industry Output*	Employment	Total Value Added*
259	Iron and Steel Foundries	9.967	70	4.703
282	Fabricated Structural Metal	14.604	90	5.207
284	Fabricated Plate Work (Boiler Shops)	2.451	24	1.468
285	Sheet Metal Work	12.611	102	5.664
296	Metal Coating and Allied Services	7.718	57	2.938
303	Pipe, Valves, and Pipe Fittings	33.988	290	14.072
305	Metal Foil and Leaf	300.637	436	48.22
306	Fabricated Metal Products, N.E.C.	9.262	62	2.368
313	Oil Field Machinery	2.499	24	1.034
321	Special Dies and Tools and Accessories	6.757	97	3.576
329	Printing Trades Machinery	0.665	4	0.171
332	Pumps and Compressors	8.248	39	1.973
336	Power Transmission Equipment	48.211	345	17.305
342	Computer Peripheral Equipment,	1.092	4	0.088
349	Service Industry Machines, N.E.C.	6.968	40	2.265
354	Industrial Machines N.E.C.	3.667	47	1.411
357	Motors and Generators	11.068	80	4.608
359	Relays & Industrial Controls	4.243	25	1.667
363	Household Laundry Equipment	0.211	1	0.022
367	Electric Lamps	0.026	1	0.017
369	Lighting Fixtures and Equipment	0.3	2	0.125
372	Telephone and Telegraph Apparatus	0.125	1	0.019
380	Primary Batteries, Dry and Wet	6.209	31	3.111
381	Engine Electrical Equipment	1.861	16	0.861
384	Motor Vehicles	0.748	1	0.14
386	Motor Vehicle Parts and Accessories	0.507	2	0.176
399	Transportation Equipment, N.E.C	0.447	2	0.046
401	Laboratory Apparatus & Furniture	120.632	452	28.026
404	Instruments To Measure Electricity	0.341	2	0.102
407	Surgical and Medical Instrument	0.736	4	0.241
419	Dolls	6.831	153	4.446
420	Games, Toys, and Childrens Vehicles	0.124	1	0.058
421	Sporting and Athletic Goods, N.E.C.	3.341	29	1.33
429	Signs and Advertising Displays	12.132	149	5.254
432	Manufacturing Industries, N.E.C.	9.309	116	3.484
433	Railroads and Related Services	10.357	61	6.16
434	Local, Interurban Passenger Transit	3.693	88	2.23
435	Motor Freight Transport and Warehousing	121.764	1,296	46.435
436	Water Transportation	15.764	94	4.072
437	Air Transportation	3.399	39	2.178
438	Pipe Lines, Except Natural Gas	8.62	33	7.894
439	Arrangement Of Passenger Transportation	2.847	54	2.077
440	Transportation Services	2.606	43	1.721
441	Communications, Except Radio and TV	63.669	311	41.094
442	Radio and TV Broadcasting	3.656	27	1.624
443	Electric Services	169.464	475	138.992
444	Gas Production and Distribution	70.724	119	20.838

Table A-4. Four-County Region Industry Sectors

Code	Industry	Industry Output*	Employment	Total Value Added*
445	Water Supply and Sewerage Systems	1.798	18	1.166
446	Sanitary Services and Steam Supply	2.279	34	1.525
447	Wholesale Trade	161.985	2,098	110.18
448	Building Materials & Gardening	22.395	584	19.743
449	General Merchandise Stores	26.099	958	21.004
450	Food Stores	60.162	2,215	56.358
451	Automotive Dealers & Service Stations	61.4	1,455	53.175
452	Apparel & Accessory Stores	24.618	507	18.277
453	Furniture & Home Furnishings Stores	15.215	413	13.064
454	Eating & Drinking	142.082	4,720	71.648
455	Miscellaneous Retail	81.353	2,788	68.632
456	Banking	110.509	1,080	82.429
457	Credit Agencies	11.252	310	9.827
458	Security and Commodity Brokers	3.843	45	2.936
459	Insurance Carriers	6.257	60	3.142
460	Insurance Agents and Brokers	19.189	528	14.916
461	Owner-occupied Dwellings	132.911	0	101.753
462	Real Estate	116.22	1,044	81.537
463	Hotels and Lodging Places	19.064	404	12.535
464	Laundry, Cleaning and Shoe Repair	7.394	436	5.56
465	Portrait and Photographic Studios	2.319	63	0.964
466	Beauty and Barber Shops	8.214	424	5.039
467	Funeral Service and Crematories	5.046	131	3.466
468	Miscellaneous Personal Services	7.212	129	1.945
469	Advertising	0.817	11	0.467
470	Other Business Services	54.452	678	32.066
471	Photofinishing, Commercial Photography	6.579	106	3.109
472	Services To Buildings	11.844	371	7.498
473	Equipment Rental and Leasing	23.458	233	14.466
474	Personnel Supply Services	8.244	396	7.594
475	Computer and Data Processing Services	17.473	260	11.051
476	Detective and Protective Services	1.237	81	0.84
477	Automobile Rental and Leasing	1.426	17	0.92
478	Automobile Parking and Car Wash	5.257	114	3.941
479	Automobile Repair and Services	31.597	486	16.567
480	Electrical Repair Service	2.488	49	0.827
481	Watch, Clock, Jewelry and Furniture Repair	1.047	20	0.398
482	Miscellaneous Repair Shops	40.151	528	19.946
483	Motion Pictures	8.028	136	1.436
484	Theatrical Producers, Bands Etc.	1.27	21	0.283
485	Bowling Alleys and Pool Halls	0.487	23	0.297
486	Commercial Sports Except Racing	0.177	2	0.078
487	Racing and Track Operation	0.087	3	0.031
488	Amusement and Recreation Services, N.E.C.	4.839	236	3.212
489	Membership Sports and Recreation Clubs	3.146	122	1.628
490	Doctors and Dentists	123.965	1,507	80.597
491	Nursing and Protective Care	59.862	2,033	42.584

Table A-5. Four-County Region Industry Sectors

Code	Industry	Industry Output*	Employment	Total Value Added*
492	Hospitals	133.321	2,252	85.032
493	Other Medical and Health Services	33.526	689	18.035
494	Legal Services	23.338	359	18.32
495	Elementary and Secondary Schools	2.355	96	1.155
496	Colleges, Universities, Schools	15.491	491	10.19
497	Other Educational Services	1.767	45	0.595
498	Job Trainings & Related Services	2.813	79	0.982
499	Child Day Care Services	2.865	98	0.862
500	Social Services, N.E.C.	36.377	887	14.391
501	Residential Care	5.987	271	3.69
502	Other Nonprofit Organizations	5.196	173	2.423
503	Business Associations	5.808	123	4.095
504	Labor and Civic Organizations	18.987	1,380	15.358
506	Engineering, Architectural Services	39.389	437	18.889
507	Accounting, Auditing and Bookkeeping	8.761	306	7.897
508	Management and Consulting Services	9.597	158	4.829
509	Research, Development & Testing Services	17.647	394	10.156
512	Other State and Local Govt Enterprises	70.372	455	26.4
513	U.S. Postal Service	25.061	398	17.042
519	Federal Government - Military	14.243	438	14.243
520	Federal Government - Non-Military	20.755	343	20.755
522	State & Local Government - Education	314.493	8,867	314.493
523	State & Local Government - Non-Education	224.626	5,283	224.626
525	Domestic Services	4.042	560	4.042
528	Inventory Valuation Adjustment	4.38	0	4.38

*Millions of Dollars