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Employment Centers in the Akron, Cleveland and Youngstown Metropolitan Areas

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EMPLOYMENT CENTERS IN THE AKRON, CLEVELAND AND YOUNGSTOWN METROPOLITAN AREAS

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What is an employment center? McMillen (2003) defines an employment center as a "concentration of firms large enough to have significant effects on the overall spatial distribution of population, employment, and land prices." Bogart (1998) sees employment centers as a collection of small open economies in a metropolitan area that specialize and trade with each other. Technically speaking, an employment center is a geographic area that exceeds a threshold employment density (employees per square mile) and a threshold employment level.

The objective of this study is to identify and characterize employment centers (Centers) in Northeast Ohio using 2000 census data. The analysis characterizes Centers in three metropolitan areas—Akron, Cleveland, and Youngstown by industry sector, occupation, and size. The end result is a tool that gives economic development practitioners an easy way to identify structured areas of dense employment across Northeast Ohio and the types of industries and occupations that are concentrated in these areas.

Location quotient (LQ) analysis is used throughout this report to characterize employment centers by industry sector and occupation. Briefly, LQs are used to measure the degree to which an industry (occupation) is concentrated or specialized in a region relative to a reference economy. Strictly speaking, a LQ greater than 1.0 in an industry (occupation) indicates that the employment center specializes in that industry (occupation) and is a net exporter while a LQ less than1.0 indicates that the employment center is a net importer. In this report, an industry (occupation) with a LQ of 1.70 or greater is considered a major industry (occupation). An industry (occupation) with a LQ between 1.20 and 1.69 is considered a minor industry (occupation).

We identified 26 employment centers in the 10-county area. Twelve are in the Cleveland area, eight in metropolitan Akron, and six in the Youngstown area. The following table provides a summary by metropolitan area.

Employment Center Summary by Metropolitan Area

	Akron	Cleveland	Youngstown
Number of Counties in Metro Area	2	6	2
Number of Employment Centers in Metro Area	8	12	6
Metro Area Employment Level	330,551	1,087,207	203,073
Total Employment in Centers	120,670	323,755	61,185
Employment Share (Centers)	36.5%	29.8%	30.1%
Metro Area Size (Sq Mi)	906	2,723	1,058
Total Land Area in Centers (Sq Mi)	27.2	44.1	16.1
Land Area Share (Centers)	3.0%	1.6%	1.5%

Of the three metro areas analyzed in this report, Cleveland has the largest economy with an estimated gross metropolitan product (GMP) of $80.8 billion (in 2000). This is four times larger

than Akron's economy and six times larger than Youngstown's. Cleveland's economy is also the most diverse.

EMPLOYMENT CENTERS IN THE CLEVELAND METROPOLITAN AREA - HIGHLIGHTS

- In the Cleveland metro area we identified 12 employment centers (Centers) that specialize and trade with each other and are net exporters to the broader U.S. and international economies. Manufacturing and fire, insurance, and real estate (FIRE) are the two dominant industry sectors found in the Centers. Manufacturing is reported as a major industry in six Centers and FIRE is a major industry in five Centers.

- Downtown Cleveland and University Circle report very high concentrations of persons working in legal and science-related occupations, respectively. The concentration of persons working in these two occupation categories is more than six times greater than found on average across Northeast Ohio. These very high concentrations indicate that a significant portion of the services provided by employees is exported outside the region thereby creating wealth within Greater Cleveland. According to the Bureau of Labor Statistics (BLS), persons in the legal profession earn, on average, $85,200 per year and those in the sciences $51,100 annually.

- Five of the 12 Cleveland Centers report computer and mathematics (C&M) as a major occupation. By any definition, C&M is considered high-tech. In three of the Centers (Mayfield/I-271, Chagrin Blvd/I-271, and Rockside Rd/I-77), the C&M employment concentration level is more than three times greater than found on average across Northeast Ohio. In fact, the Mayfield/I-271 Center has the highest concentration of C&M workers in the 11-county region. The Bureau of Labor Statistics (BLS) reports the average wage paid to C&M personnel in Cleveland is $60,800 per year.

- Six of the 12 Cleveland employment centers report manufacturing as a major industry. In three of these Centers (I-480/I-71, Solon Rd/U.S. 422, and Euclid), the concentration level in manufacturing employment is more than double that found on average across Northeast Ohio. In the Solon Rd. Center, architecture and engineering (A&E) and the sciences are reported as major occupations. This suggests that Solon-based manufacturers are putting significant resources into product and process innovation that could lead to increased productivity, higher wages, and business growth. The Euclid and Elyria Centers also show A&E as a major occupation. According to the BLS, Cleveland area A&E personnel earn, on average, $58,700 per year.

EMPLOYMENT CENTERS IN THE AKRON METROPOLITAN AREA – HIGHLIGHTS

- Of the eight employment centers in the Akron metro area, the Southeast Akron/Goodyear Center stands above the others. It is unique across Northeast Ohio in two respects. First, it is the only Center to report a major concentration of all three high-tech occupation categories—architecture and engineering (A&E), computer and mathematics (C&M), and the sciences. Second, it reports the highest concentration of A&E personnel. In the Goodyear Center, there is a concentration of A&E personnel that is 5.4 times greater than found on average across Northeast Ohio. The Goodyear Center also ranks second in Northeast Ohio in the concentration of personnel working in

the sciences. Only Cleveland's University Circle reports a higher concentration of scientists.

- Complementing the Goodyear Center are the South Akron/Firestone and Twinsburg Centers. Manufacturing is a major industry sector in all three. In addition, the Firestone Center reports A&E and the sciences as major occupations while the Twinsburg Center shows A&E and computers and mathematics as major occupations. Contributing to the concentration of high-tech occupations in the Goodyear and Firestone Centers are the R&D facilities for the Goodyear Tire and Rubber Company and Bridgestone/Firestone. In addition, the Goodyear and Firestone areas are seen as a significant center for research and development in the rubber, polymer, and aerospace (Lockheed-Martin) industries.

- The Census Bureau estimates that 4,000 persons work in high-tech occupations in the Firestone, Goodyear, and Twinsburg Centers. According to the Bureau of Labor Statistics (BLS), computer and mathematics personnel earn an average of $59,110 annually, persons in architecture and engineering earn $58,250, and science-related personnel earn $54,260. Combining Census and BLS data, we estimate that wages paid to these high-tech workers totaled $230 million in 2003 dollars.

- Akron has been a major center for trucking and distribution ever since the 1950s. In fact, the transportation and warehousing (T&W) sector is more concentrated in the Akron Centers than elsewhere in Northeast Ohio. Three employment centers report T&W as a major industry—South Akron/Firestone, Chapel Hill, and Southeast Akron/Goodyear. By comparison, there is only one other Center in the Cleveland area that shows T&W as a major industry. Thirty-five trucking terminals were located in Summit and Portage counties in calendar year 2000. Sixteen of these terminals were found in the city of Akron.

EMPLOYMENT CENTERS IN THE YOUNGSTOWN METROPOLITAN AREA - HIGHLIGHTS

- In the Youngstown metropolitan area, the Golden Triangle employment center stands out among the six Centers that were identified. Although manufacturing remains the largest employer in metropolitan Youngstown (in 2000), the Golden Triangle is the only Center to report it as a major industry. Its concentration of manufacturing workers is 3.1 times greater than found on average across Northeast Ohio—the highest concentration in the 11-county region. The second highest concentration is found in Akron's Goodyear Center. Delphi Packard Electric Systems dominates the manufacturing sector in the Golden Triangle with three major facilities that employ thousands of workers.

- The Golden Triangle also shows the 2nd highest concentration of architecture and engineering (A&E) personnel of any employment center in Northeast Ohio. Only Akron's Goodyear Center reports a higher A&E concentration. In addition, the Golden Triangle has the 3rd highest number of A&E personnel of any Center in Northeast Ohio at 1,169 workers. Cleveland's Downtown Center has the most A&E workers (2,456) followed by Akron's Goodyear center (1,393 workers). According to the Bureau of Labor statistics, Youngstown area A&E workers earn, on average, $52,500 per year.

- Employment in information-related businesses is more concentrated in the Youngstown Centers than elsewhere in Northeast Ohio. Downtown Youngstown, Eastwood, and Downtown Warren each report information as a major industry. The concentration of information-related employment in the Eastwood Center is almost 5 times greater than found on average in Northeast Ohio. Of the 26 employment centers identified in the Akron, Cleveland, and Youngstown areas, Eastwood ranked 5th in information employment at 709 workers (in 2000). Call centers are playing an increasing role in Youngstown's information sector. West Corporation has a major presence in the Eastwood Center. Currently, 800 persons work at the site with projections for hiring an additional 700. This site was formerly occupied by a MCI call center. In addition, Akron-based InfoCision has a call center in Downtown Youngstown in addition to 1,000 other employees spread across Mahoning County and New Castle, Pennsylvania.

- The area in southern Trumbull County where the General Motors Lordstown facilities are located was not identified as an employment center. Although this area exceeds the employment threshold with more than 7,000 workers, it fell significantly below the density threshold with 1,550 employees per square mile.

INTRODUCTION

Employment in large U.S. metropolitan areas has become increasingly decentralized over time. Through the first half of the 20th century, most businesses were concentrated in central cities with white-collar workers primarily situated in the central business district. At the end of World War II, housing development in suburban areas, which extended into rural counties, began to intensify. Firms began following people into suburbia. However, McMillen (2003) observed that employment was not evenly distributed throughout the suburban landscape. Firms tended to congregate at highway interchanges, along rail lines, and in former satellite cities. Some of the areas where these firms located became known as employment centers.[1]

McMillen (2003) defined an employment center as a "concentration of firms large enough to have significant effects on the overall spatial distribution of population, employment, and land prices." Bogart (1998) remarked that a "useful way of viewing a metropolitan area is as a collection of small open economies (employment centers) that specialize and trade with each other." Technically speaking, an employment center is a geographic area that exceeds a threshold employment density and a threshold employment level. Traditionally, employment centers have been characterized by their industry sector specializations. In this report, we extend the characterization to include occupation specializations.

In their work, Anderson and Bogart (2001) observed that the emergence of employment centers outside the central business district represents a "systematic change in metropolitan structure rather than a random sprawling of firms." There is mounting evidence to support the hypothesis that the rank-size rule, sometimes referred to as a power law or Zipf's law, is a reasonable approximation of the size distribution of employment centers.[2] This suggests that structure not only exists in the distribution of economic activity among employment centers, but also in their size. As a result, we will also characterize the size distribution of employment centers using the rank-size rule.

[1] Researchers use various names to describe this concentration of firms. One name that has been widely adopted is employment subcenters. Giuliano and Small (1991) categorized employment concentrations in the Los Angeles metropolitan area as the main or core center, subcenters, and outer centers. In this report we have elected to use the name employment center (Center).

[2] Many man made and naturally occurring phenomena including incomes and city sizes are distributed according to a power law distribution. A power law implies that small occurrences are extremely common, whereas large instances of occurrence are extremely rare.

OBJECTIVE

The objective of this report is to identify and characterize employment centers (Centers) in Northeast Ohio using 2000 census data. The analysis includes three metropolitan areas—Akron, Cleveland, and Youngstown. Centers in each metro area are characterized by industry sector, occupation specializations, and size. The end result is a tool that gives economic development practitioners an easy way to identify structured areas of dense employment across Northeast Ohio and the types of industries and occupations that are concentrated in these areas.

The employment center analysis presented in this report is unique in two respects. First, it identifies Centers in small metropolitan statistical areas (MSAs)—Akron and Youngstown. Second, by combining three distinct MSAs, we are able to provide a comprehensive employment assessment of an entire region. In this case, one that includes 10 counties spread across 4,700 square miles.

GEOGRAPHIC AREA AND DATA DESCRIPTION: THE CENSUS TRANSPORTATION PLANNING PACKAGE 2000

The geographic area covered by this report consists of 10 counties in Northeast Ohio that are served by the region's metropolitan planning organizations (MPOs): the Akron Metropolitan Area Transportation Study (AMATS)—Portage and Summit Counties (Akron metropolitan area); the Northeast Ohio Areawide Coordinating Agency (NOACA)—Ashtabula, Cuyahoga, Geauga, Lake, Lorain, and Medina Counties (Cleveland metropolitan area); and the Eastgate Regional Council of Governments (Eastgate)—Mahoning and Trumbull Counties (Youngstown metropolitan area).

The geographic unit of analysis used to identify employment centers is the traffic analysis zone (TAZ). TAZs are an employment-based analogue to the population-based census tract. Like census tracts, TAZs are composed of census block groups. Local MPOs, such as NOACA, work with the Census Bureau in designing the Census Transportation Planning Package (CTPP) of which TAZ data are a part.[3] More specifically, an MPO draws the TAZ boundaries for its respective geographic area during the decennial census. The map is then submitted to the U.S. Department of Transportation (DOT) which works with the Census Bureau to provide estimates for 52 variables that are distributed into over 400 categories.

[3]The CTPP is a set of special tabulations from the decennial census designed for transportation planners. CTPP contains tabulations by place of residence, place of work, and for flows between home and work.

These variables include employment levels by occupation and industry for each TAZ.[4] The DOT also provides software for easy data extraction and downloading into spreadsheets. The advantages in using census data include the minimum amount of time required to obtain the data required to identify employment centers, the availability of occupation data for each TAZ, and the ability to identify employment centers at a geographic level below that of cities, zip codes, or census tracts. The disadvantage is that the census is a decennial event. Hence, changes could be occurring in employment centers that would not be known to stakeholders for many years. Further, the CTTP 2000 package was not available to the general public until August 2004.

In the 10 counties included in this analysis, the MPOs identified 2,734 TAZs. Following is a breakdown by metropolitan area: Akron – 785 TAZs; Cleveland – 1,276 TAZs; and Youngstown – 673 TAZs.

EMPLOYMENT CENTER IDENTIFICATION METHODOLOGY

Analysts have used a wide variety of methods to identify employment centers in metropolitan areas. Giuliano and Small (1991) provide an excellent overview of the methodologies. However, they conclude by saying that "given the variety of methods, it is perhaps not surprising that previous studies have obtained vastly different results, even for the same metropolitan area." The authors go on to say, "better consistency and comparability can be obtained by applying an objective definition to standard data at a fine level of geographical detail." For this analysis, we have adopted the methodology suggested by Giuliano and Small and later modified (slightly) by Bogart and Ferry (1999). Since Bogart and Ferry conducted a study on employment centers in the Greater Cleveland area that was based on 1990 census data, we felt it was important to follow their methodology so that we could make a comparison of their results to the ones presented in this report.

Identification of employment centers using the methodology suggested by Bogart and Ferry consists of the following steps:

1. Choose density (ϕ) and employment (ξ) minima, e.g., 5,000 workers per square mile and 10,000 total employees.
2. Identify all TAZs that equal or exceed the employment density ϕ.

[4] In this analysis, 14 NAICS-based (North American Industry Classification System) industry sectors and 24 SOC-based (Standard Occupational Classification System) occupation categories are analyzed. The industry sectors and occupation categories are those selected by the Census Bureau for inclusion in the Census Transportation Planning Package 2000 (CTPP 2000). See Appendix A, Table A-1 for a detailed listing of industry sectors. See Appendix A, Table A-2 for a detailed listing of occupation categories.

3. All TAZs identified in step 2 that are adjacent are combined.
4. TAZs that are adjacent to the TAZ groups identified in step 3 are combined to the groups in order of decreasing density so long as the employment density for the entire TAZ group remains greater than or equal to ϕ.
5. Gross employment for the multiple-TAZ groups formed in Step 4 and for the single-TAZ groups identified in step 2 are totaled. Groups of TAZs or single TAZs that have total employment equaling or exceeding ξ are considered employment centers.

Identifying employment centers is a very time-consuming task because it is an iterative process, that is, the series of steps outlined above were, in part, repeated three or four times for each metropolitan area. Two reasons are given for this iteration. First, the selection of the total employment and employment density threshold values is somewhat arbitrary. Values that are appropriate for the Cleveland area may not be appropriate for the Akron area because of differences in size, population and economic activity. Second, TAZ boundaries are drawn to help transportation planners in their work. They are not drawn to aid analysts in identifying employment centers. TAZ size (square miles) and, at times, its irregular shape help to make the identification process very challenging. This challenge becomes clear in later discussions on employment centers in each metropolitan area.

Throughout the identification process, we engaged representatives of the MPOs in detailed discussions. Insights they provided regarding economic activity in their respective service area proved to be extremely valuable. Our conversations often resulted in eliminating or adding TAZs to a proposed center. Although input from the MPOs may appear to violate methodology rules, the reality is that these discussions strengthened the identification. Further, identification is only the first in a two-step process. The second step is characterization, in which individual Centers are distinguished by their industry sectors, occupation specializations, and size. Characterization is the process by which each Center is set apart from all others. In a sense, characterization is the process through which a Center is truly identified.

EMPLOYMENT CENTER CHARACTERIZATION

In this report, we characterize employment centers by industry sector and occupation specialization using location quotient (LQ) analysis. Location quotients are used to measure the degree to which an industry (occupation) is concentrated or specialized in an area relative to a reference economy. A detailed discussion of LQ analysis is found in Appendix B. For those readers who are unfamiliar with LQs and their application, it is suggested they review Appendix B prior to reading the employment center analyses in the following sections.

Characterizing employment centers by size is achieved by providing statistical evidence that the rank-size rule is a reasonable approximation of the size distribution of employment centers in a metropolitan area. Appendix C provides a detailed discussion of the size distribution of the employment centers in the Akron, Cleveland, and Youngstown metropolitan areas.

EMPLOYMENT CENTERS SUMMARY

Table 1 provides a summary of the employment centers that were identified in the Akron, Cleveland, and Youngstown metropolitan areas. Two statistics of interest are employment share and land share. For example, in the Cleveland metro area, almost 30 percent of all employed persons work in one of the 12 Centers that occupy only 1.6 percent of the total area in the six-county Cleveland region. These statistics are not unusual. Using 1980 census data, Giuliano and Small (1991) report that in the Los Angeles region "nearly one-third of the employment occurs in centers occupying only 3 percent of its land area." Based on 1990 census data, Bogart and Ferry (1999) showed that 31 percent of metropolitan Cleveland's employment occurred in centers that occupied only 1.7 percent of its land area.

Table 1. Employment Center Summary by Metropolitan Area

	Akron	Cleveland	Youngstown
Number of Counties in Metro Area	2	6	2
Number of Employment Centers in Metro Area	8	12	6
Employment Threshold	6,000	10,000	5,000
Employment Density Threshold	3,000	4,000	2,300
Metro Area Employment Level	330,551	1,087,207	203,073
Total Employment in Centers	120,670	323,755	61,185
Employment Share (Centers)	36.5%	29.8%	30.1%
Metro Area Size (Sq Mi)	906	2,723	1,058
Total Land Area in Centers (Sq Mi)	27.2	44.1	16.1
Land Area Share (Centers)	3.0%	1.6%	1.5%

The following sections present the analyses of employment centers that were identified in the Cleveland, Akron, and Youngstown metropolitan areas.[5]

[5] Although agriculture and armed services are included in tables found in the text and Appendix A, employment in these industries/occupations is not included in the discussion because of the very small number of persons involved. For example, in the Cleveland metro area, only 0.5 percent of all employed persons work in agriculture and the armed services.

EMPLOYMENT CENTERS IN THE CLEVELAND METROPOLITAN AREA

This section presents a detailed discussion of the 12 employment centers that are located in the Cleveland metropolitan area. We begin by identifying the Centers using location, land area, employment level, and employment density. Next, findings in this study are compared to those in a similar study that was conducted using 1990 census data. We then examine the aggregated employment share found in the Centers for 14 major industry sectors. Finally, an analysis of the industry and occupation characterizations for each Center is discussed.

EMPLOYMENT CENTER IDENTIFICATION

We identified 12 employment centers (Centers) in the Cleveland metropolitan area.[6] These Centers report a combined employment level of 323,755 workers, which accounts for just under 30 percent of the total metro area employment. Land area occupied by the Centers equals 44 square miles. This is 1.6 percent of the total land in Greater Cleveland. For identification purposes, a threshold employment level of 10,000 and a threshold employment density of 4,000 employees per square mile were selected. Ten of the employment centers are located in Cuyahoga County, one in Lake County, and one in Lorain County. Table 2 identifies Cleveland area Centers, and Figure 1 shows their geographic location.

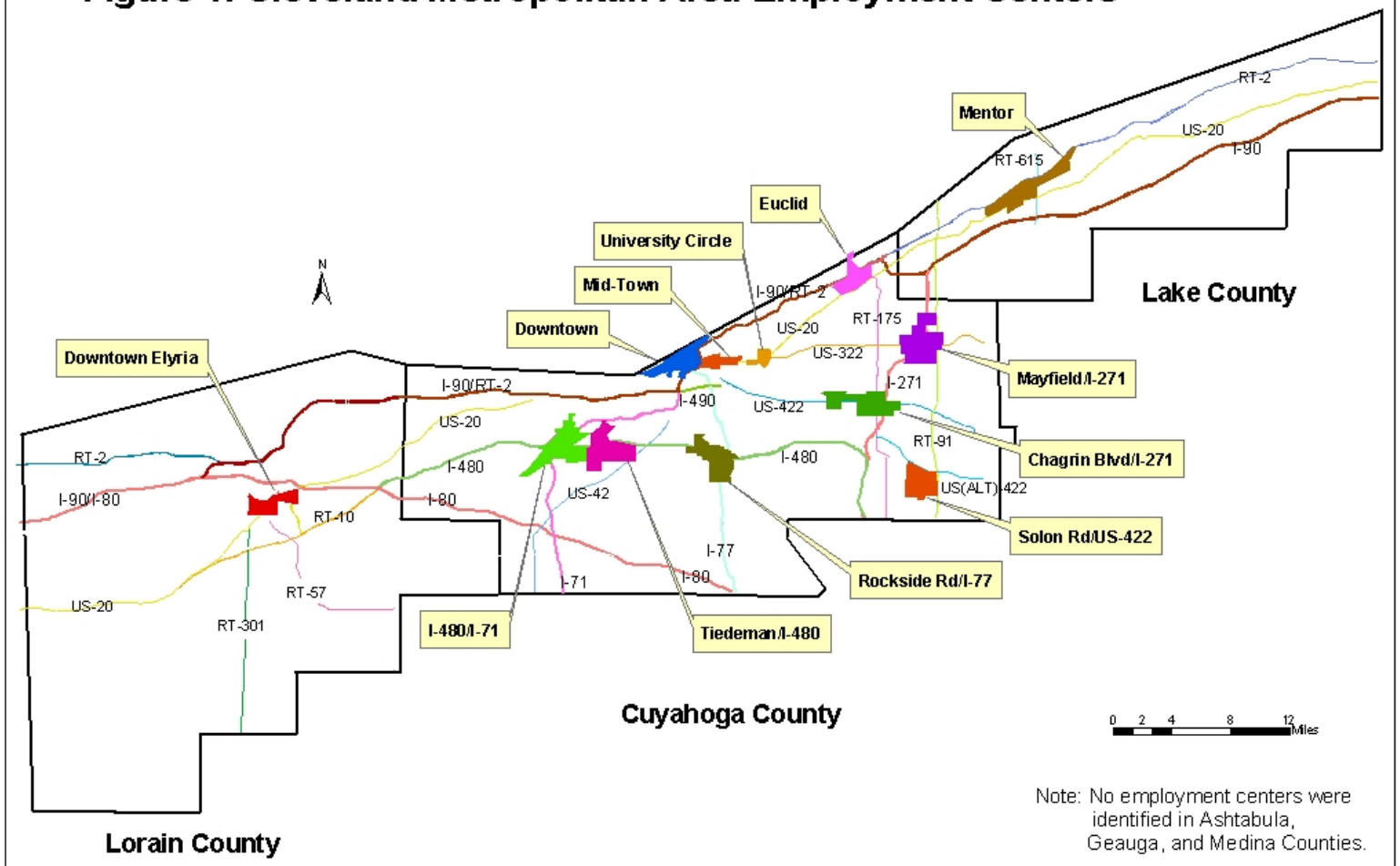
[6] In this report, the six counties served by the Northeast Ohio Areawide Coordinating Agency are included in the Cleveland metropolitan area: Ashtabula, Cuyahoga, Geauga, Lake, Lorain, and Medina.

Table 2. Cleveland Area Employment Centers Identification

Center	Area (Sq Mi)	Total Employment	Employment Density[a]	Location[b]	Distance from CBD (Miles)[c]
Downtown	3.799	109,645	28,862	Cleveland	0
University Circle	0.963	31,175	32,373	Cleveland	4
Mayfield/I-271	5.497	25,470	4,633	Highland Hts, Mayfield Hts	13
I-480/I-71	5.419	23,110	4,265	Brook Park, Cleveland	8
Tiedeman/I-480	5.037	21,450	4,258	Brooklyn, Cleveland, Parma	7
Chagrin Blvd/I-271	4.268	21,435	5,022	Beachwood, Pepper Pike	10
Mentor	4.800	19,950	4,156	Mentor	25
Rockside Rd/I-77	4.198	17,860	4,254	Brooklyn Hts, Independence,	7.5
Solon Rd/U.S. 422	3.300	15,675	4,750	Solon	14.5
Mid-Town	1.482	13,715	9,254	Cleveland	2
Downtown Elyria	2.760	13,315	4,824	Elyria	23
Euclid	2.574	10,955	4,256	Euclid	11

Note: Employment centers are ranked by total employment.
[a]Employment density: Employees per square mile
[b]Location: Municipal composition of employment centers
[c]CBD: Central business district (downtown Cleveland)

Figure 1. Cleveland Metropolitan Area Employment Centers



When looking at Figure 1 and Table 2, the reader may have observed two things. First, the area where Hopkins Airport and the NASA Glenn Research Center are located is not identified as a Center. Second, since downtown Cleveland, Mid-Town, and University Circle are adjacent to one another, why aren't these areas combined into one Center?

Regarding NASA and Hopkins—the traffic analysis zones (TAZs) that comprise the land area where the airport and NASA Glenn are located exceeds three square miles.[7] Although employment levels at these and adjacent facilities are significant (over 9,000 workers), the large land area reduces the employment density considerably below the threshold value (4,000 employees per square mile). Joining Hopkins and NASA to the adjacent I-480/I-71 Center also results in an employment density that falls below the threshold value. This situation is not uncommon in employment center identification. For example, Giuliano and Small (1991) excluded Los Angeles International Airport as an employment center because it fell below their density cutoff.

Due to extremely small TAZ areas found in central business districts (CBDs), employment densities tend to become extremely large. In downtown Cleveland, densities exceeding 150,000 employees per square mile are not uncommon. This results in large areas of an entire city becoming a single employment center if the analyst strictly adheres to the identification methodology described earlier. For example, 78 percent of the city of Cleveland would be identified as a single employment center if some boundaries to the CBD were not imposed. This same result holds for Akron and Youngstown. In fact, Giuliano and Small (1991) found that a 19 mile-long employment center could be identified in Los Angeles County. To avoid this situation, we limited CBD employment centers to their generally accepted boundaries. The solution was extended to University Circle because three of its TAZs have employment densities exceeding 75,000. This is the reason why downtown Cleveland, Mid-Town, and University Circle, although adjacent, are identified as independent Centers. The solution is supported by the fact that each of these Centers has its own distinctive occupation and industry characteristics.

COMPARISON WITH A PREVIOUS STUDY

Bogart and Ferry (1999) conducted a study on employment centers in Greater Cleveland that was based on 1990 census data. Using threshold values of 10,000 employees and 5,000 employees per square mile, the authors identified nine Centers across a five-county area with

[7] See Geographic Area and Data Description: The Census Transportation Planning Package 2000 in the Introduction section for additional information regarding TAZs.

an aggregated employment level of 304,203.[8] This is six percent lower than the employment level reported in this study using 2000 census data. Land area occupied by the nine centers equaled 34 square miles, or 1.6 percent of the total land in the five-county area. The land share figure determined by Bogart and Ferry is the same as found in this study.

Employment centers that are common to both this study and the one conducted by Bogart and Ferry include downtown Cleveland, University Circle, I-480/I-71, Tiedeman/I-480, Chagrin Blvd/I-271, Solon Rd/U.S. 422, and downtown Elyria.[9] Centers that were only identified in this study are Mayfield/I-271, Mentor, Rockside Road/I-77, Mid-Town, and Euclid.[10] Centers that were only identified by Bogart and Ferry include Metro Cleveland/Westside and Route 2/SOM Center Road.[11]

The study comparison made here supports two widely held observations. First, only a small net increase in employment was seen in Greater Cleveland during the 1990s. Second, the employment base that exists in the Cleveland area is migrating further into the suburbs. As an example, in the Bogart and Ferry study, employment in downtown Cleveland (including Mid-Town) was estimated at 147,800 workers. In this study, the employment level in downtown Cleveland and Mid-Town combined is 123,400, a decrease of 16.5 percent. In contrast, the Mayfield/I-271 Center now reports an employment figure of 25,500. Bogart and Ferry did not identify this eastern suburban area as a Center in their study.

EMPLOYMENT SHARE BY INDUSTRY SECTOR

Almost 30 percent of total employment across all industry sectors in Greater Cleveland is concentrated in the 12 identified employment centers. The finance, insurance, real estate, and rental & leasing (FIRE) sector (NAICS 52-53) reports the highest share at 50 percent. Other industry sectors with employment shares greater than 40 percent include information (NAICS 51); professional, scientific, management, and administration (NAICS 54-56); and public administration (NAICS 92). The manufacturing sector (NAICS 31-33), which reports the second highest number of workers in the Cleveland area, has a Center employment share of 29.4 percent. Table 3 provides detailed employment statistics for all industry sectors.

[8] Counties included in the Bogart and Ferry study were Cuyahoga, Geauga, Lake, Lorain, and Medina.
[9] In the Bogart and Ferry study, the I-480/I-71 Center included Hopkins Airport and NASA. Possible reasons for excluding these facilities in this study are a drop in employment at NASA and the redrawing of the TAZ boundaries resulting in a net increase in land area.
[10] In the Bogart and Ferry study, the Mid-Town area was included as part of downtown Cleveland.
[11] Although the Route 2/SOM Center Road area still reports significant employment, its density fell below the threshold value of 4,000 employees per square mile. In contrast, the Metro Cleveland/Westside area reports an employment density above the threshold value. However, its total employment fell below the threshold value.

Table 3. Cleveland Area Centers – Employment Share by Industry Sector

Sector	Cleveland Area Employment	Employment in Centers	Employment Share (Centers)
All Sectors	1,087,207	323,755	29.8%
Agriculture, Forestry, Fishing, Hunting, and Mining (NAICS 11, 21)	5,082	433	8.5%
Construction (NAICS 23)	61,735	12,488	20.2%
Manufacturing (NAICS 31-33)	215,006	63,223	29.4%
Wholesale Trade (NAICS 42)	41,574	11,034	26.5%
Retail Trade (NAICS 44-45)	120,259	25,750	21.4%
Transportation, Warehousing, and Utilities (NAICS 48-49, 22)	51,086	12,065	23.6%
Information (NAICS 51)	27,259	11,962	43.9%
Finance, Insurance, Real Estate, Rental & Leasing (NAICS 52-53)	82,431	41,343	50.2%
Professional, Scientific, Management, and Administrative (NAICS 54-56)	98,604	42,546	43.1%
Educational, Health, and Social Services (NAICS 61-62)	217,851	55,342	25.4%
Arts, Entertainment, Recreation, and Food Services (NAICS 71-72)	77,200	20,328	26.3%
Other Services Except Public Administration (NAICS 81)	46,649	9,990	21.4%
Public Administration (NAICS 92)	40,779	16,671	40.9%
Armed Services (NAICS 92)	783	439	56.1%

EMPLOYMENT CENTER CHARACTERIZATION BY INDUSTRY SECTOR

One way to characterize an employment center is through its industry specializations. A common method for identifying industries that are heavily concentrated (specialized) in a geographic area is location quotient analysis.[12] Table 4 shows industry sector specializations by location quotient for each Center in Greater Cleveland. Table A-1 in Appendix A lists location quotients by employment center for 14 industry sectors reported by the Census.

[12] Location quotient (LQ) analysis is used throughout this report to characterize employment centers by industry sector and occupation. A detailed discussion of LQs can be found in Appendix B. Briefly, LQs are used to measure the degree to which an industry (occupation) is concentrated or specialized in a region relative to a reference economy. Mathematically, the location quotient is the ratio of the industry (occupation) employment share in the Center to the industry (occupation) employment share across Northeast Ohio. Strictly speaking, an LQ greater than 1.0 in an industry (occupation) indicates that the employment center specializes in that industry (occupation) and is a net exporter while a LQ less than1.0 indicates that the employment center is a net importer. In this report, an industry (occupation) with a LQ of 1.70 or greater is considered a major industry (occupation). An industry (occupation) with a LQ between 1.20 and 1.69 is considered a minor industry (occupation).

Table 4. Cleveland Area Employment Centers – Industry Sector Specializations

EMPLOYMENT CENTER	MAJOR INDUSTRIES[a,b]	MINOR INDUSTRIES[a,b]
Downtown	Public Administration (3.18) Professional Services & Management (2.76) FIRE (2.64)[c] Information (2.40)	
University Circle	Education, Health & Social Services (4.04)	
Mayfield/I-271	FIRE (4.15)	
I-480/I-71	Transportation & Warehousing (2.63) Manufacturing (2.37)	FIRE (1.24)
Tiedeman/I-480	Manufacturing (1.86) FIRE (1.78)	Information (1.50) Retail Trade (1.47) Wholesale Trade (1.22)
Chagrin Blvd/I-271	FIRE (3.46) Professional Services & Management (2.41)	
Mentor	Manufacturing (1.92) Retail Trade (1.72)	Information (1.34) Wholesale Trade (1.30)
Rockside Rd/I-77	Information (3.12) Professional Services & Management (2.35) Wholesale Trade (2.31) FIRE (2.26)	
Solon Rd/U.S. 422	Wholesale Trade (2.33) Manufacturing (2.07)	
Mid-Town	Wholesale Trade (2.19) Other Services (1.75)	Public Administration (1.48) Construction (1.43) Information (1.41) Professional Services & Management (1.25)
Downtown Elyria	Public Administration(1.86) Manufacturing (1.75)	Information (1.58)
Euclid	Manufacturing (2.49)	

[a]The number in parentheses adjacent to the industry sector is that sector's location quotient. For example, public administration in the downtown Center has a location quotient of 3.18.

[b]The selection of a LQ value that clearly identifies an industry as major or minor is left to the discretion of the analyst. After reviewing the literature, we decided that an industry sector with a location quotient of 1.70 or greater would be considered a major industry in the respective employment center. An industry sector with a location quotient between 1.20 and 1.69 would be considered a minor industry.

[c]FIRE: Finance, insurance, real estate, and rental & leasing.

Table 4 shows significant variation in the industrial makeup of employment centers across Greater Cleveland. At one extreme, the Euclid and Mayfield/I-271 Centers each reported a single major industry—manufacturing and FIRE, respectively. A review of Harris Infosource indicates that one company dominated each of these industries in 2000.[13] Lincoln Electric accounted for 40 percent of Euclid's manufacturing employment, and Progressive Insurance accounted for nearly all of FIRE-related employment in the Mayfield/I-271 area. A location quotient (LQ) of 2.49 tells us that in the Euclid Center, the employment concentration level in manufacturing is 2.5 times greater than the Northeast Ohio average. Likewise, a LQ of 4.15 indicates that in the Mayfield/I-271 area, the employment concentration in the FIRE sector is four times greater than found on average across Northeast Ohio. The Chagrin/I-271 Center also reported a high FIRE LQ—3.46.

In contrast to Euclid and Mayfield/I-271, the Downtown and Rockside/I-77 Centers both show four major industry sectors, none of which is dominated by a single employer. The Downtown Center has an industry distribution that is typically found in a central business district—public administration, professional services and management, FIRE, and information. According to 2000 Census estimates, downtown Cleveland reported 12,500 persons employed in pubic administration, a concentration level that is 3.2 times greater than found on average across Northeast Ohio. The highest employment concentration (LQ = 3.12) found in the Rockside/I-77 Center was in the information sector. Information is a very diverse sector and includes telecommunications, radio and television broadcasting, newspapers, software, and database publishing.

Although the manufacturing employment share across all Cleveland area Centers is about 30 percent (see Table 3), six of the 12 Centers report manufacturing as a major industry (LQ > 1.7). In three of these Centers (I-480/I-71, Solon Rd/U.S. 422, and Euclid), the concentration level in manufacturing employment is more than double that found on average across Northeast Ohio. According to Harris Infosource, well-known manufacturing companies in Solon include Swagelok, Nestle USA (Stouffer Foods), and Royal Appliance (Dirt Devil vacuum cleaners). The Ford engine and casting plants are among the dominant manufacturers in the I-480/I-71 area.

[13] Giuliano and Small (1991) had similar findings in their analysis of employment centers in the metropolitan Los Angeles region. For example, two Centers—Hawthorne and Lawndale—each had more than half their 1980 employment in a single defense plant. As a result, Giuliano and Small conducted additional analysis and derived five employment center clusters: specialized manufacturing, mixed industrial, mixed service, specialized entertainment, and specialized service. The Hawthorne and Lawndale Centers were put under the specialized manufacturing cluster.

Of special significance is the presence of the education, health, and social service sector found in the University Circle (UC) Center. The employment concentration level in this industry sector is four times greater than found on average across Northeast Ohio. CWRU, the Cleveland Clinic, and University Hospitals are primarily responsible for the industry concentration in University Circle.

EMPLOYMENT CENTER CHARACTERIZATION BY OCCUPATION

A second way of characterizing employment centers is through their occupation specializations. Similar to industry sector characterization, the location quotient (see Appendix B for a detailed discussion on location quotients) is commonly used to identify occupations that are heavily concentrated (specialized) in a geographic area. Table 5 shows occupation specializations by location quotient for each employment center in greater Cleveland. Table A-2 in Appendix A lists location quotients by employment center for 24 occupation categories reported by the Census.

Table 5. Cleveland Area Employment Centers – Occupation Specializations

EMPLOYMENT CENTER	MAJOR OCCUPATIONS[a,b]	MINOR OCCUPATIONS[a,b]
Downtown	Law (6.27) Business & Financial Operations (2.73) Computer & Mathematics (2.20) Protective Services (1.94) Arts, Design & Entertainment (1.81)	Management (1.48) Office & Administrative Support (1.30) Community & Social Services (1.26)
University Circle	Sciences (6.61)[c] Healthcare Practitioners (6.13) Healthcare Support (2.17) Education (1.89)	Community & Social Services (1.33) Computer & Mathematics (1.30) Arts, Design & Entertainment (1.30)
Mayfield/I-271	Computer & Mathematics (4.77) Business & Financial Operations (2.37) Architecture & Engineering (1.75)	Management (1.31) Healthcare Practitioners (1.30) Office & Administrative Support (1.28)
I-480/I-71	Installation, Maintenance & Repair (2.30) Production (2.24) Transportation & Material Handling (1.85)	Sciences (1.69)
Tiedeman/I-480	Computer & Mathematics (2.06) Production (1.73)	Arts, Design & Entertainment (1.65) Installation, Maintenance & Repair (1.60) Business & Financial Operations (1.47)
Chagrin Blvd/I-271	Computer & Mathematics (3.13) Business & Financial Operations (2.56) Management (1.78)	Sciences (1.62) Arts, Design & Entertainment (1.42) Office & Administrative Support (1.42) Law (1.40)
Mentor	Production (1.96)	Sales (1.69) Architecture & Engineering (1.62)
Rockside Rd/I-77	Computer & Mathematics (3.30) Business & Financial Operations (2.34)	Farming (1.57) Management (1.56) Law (1.51) Office & Administrative Support (1.32) Arts, Design & Entertainment (1.29) Sales (1.25)
Solon Rd/U.S. 422	Architecture & Engineering (2.14) Sciences (1.73)	Production (1.58) Management (1.44)
Mid-Town	Community & Social Services (6.46)	Arts, Design & Entertainment (1.79) Healthcare Support (1.47) Construction (1.31) Architecture & Engineering (1.26)
Downtown Elyria	Architecture & Engineering (2.42) Healthcare Practitioners (2.01) Production (1.83)	Building & Grounds Maintenance (1.22)
Euclid	Architecture & Engineering (3.41) Production (2.04)	Protective Services (1.47) Installation, Maintenance & Repair (1.26)

[a]The number in parentheses adjacent to the occupation is that occupation's location quotient. For example, law-related occupations in downtown Cleveland have a location quotient of 6.26.

[b]The selection of a LQ value that clearly identifies an occupational category as major or minor is left to the discretion of the analyst. After reviewing the literature, we decided that an occupation with a location quotient of 1.70 or greater would be considered a major occupation in the respective employment center. An occupation with a location quotient between 1.20 and 1.69 would be considered a minor occupation.

[c]Sciences include the life, physical, and social-related.

Looking at Table 5, we see that the major occupations listed for each Center are complementary to the major industries shown in Table 4. For example, the Mayfield/I-271 Center reported FIRE as its only major industry sector (Table 4) and Progressive Insurance as the dominant employer. Computer and mathematics along with business and financial operations (Table 5) reflect the types of occupations that are commonly found in an insurance carrier's corporate offices.

Especially noteworthy are the disproportionately high location quotients for legal occupations (6.27) in downtown Cleveland and science occupations (6.61)—life, physical, and social—in University Circle. This tells us that the concentration of employees in these two occupational fields is more than six times greater than found on average across Northeast Ohio. In addition, the high LQs indicate that a large portion of the services provided by these employees is exported outside the region, thereby creating wealth within the Cleveland metro area. Law and science-related occupations are also high paying. According to the Bureau of Labor Statistics (BLS), persons in the legal profession earn, on average, $85,200 per year and those in the sciences $51,100 annually.[14] In the Cleveland area, legal personnel rank number two in wages, and science-related occupations rank 6th. Table A-7 in Appendix A lists average annual wages for all major occupation categories for the three metro areas in Northeast Ohio.

As seen in Table 4, the Solon/U.S. 422 Center reports manufacturing as a major industry. However, Table 5 shows that the major occupations in the Solon Center are architecture and engineering (LQ=2.14) and the sciences (LQ=1.73) while production and management are minor occupations. This suggests that Solon-based manufacturers are putting significant resources into product and process innovation that could lead to increased productivity, higher wages, and business growth. Two other Centers, Euclid and Elyria, also report manufacturing as a major industry complemented by architecture and engineering (A&E) and production as major occupations. According to the BLS, A&E is the 4th highest paid occupation in the Cleveland metro area with an average wage of $58,700.

Five of the 12 Cleveland area employment centers report computer and mathematics (C&M) as a major occupation. C&M is generally considered a high-tech occupation. In three of these Centers (Mayfield/I-271, Chagrin Blvd/I-271, and Rockside Rd/I-77), the C&M employment concentration level is more than three times greater than found on average across Northeast Ohio. In fact, the Mayfield/I-271 Center leads the entire region with a C&M location

[14] Wage data source: Bureau of Labor Statistics, November 2003 Metropolitan Area Occupational Employment and Wage Estimates; http://www.bls.gov.

quotient of 4.77. The average wage for Cleveland area personnel working in C&M is $60,800 per year, ranking it 3rd among occupational categories.

Finally, the highest-paying occupation in Greater Cleveland is management, with an estimated average wage of $87,100 per year. Persons included in this category range from managers of fast food outlets to the chief executive officer of a Fortune 500 company. Only one Center reported management as a major occupation—Chagrin/I-271. Four other Cleveland Centers show management as a minor occupation. However, 95,600 persons, or 8.8 percent of employed persons in the Cleveland area, work in management occupations. This ranks management number four out of 24 occupation categories across Greater Cleveland.[15] Simply stated, although there are a significant number of managers in the Cleveland metro area, they are not concentrated in employment centers.

[15] Office and administrative support is the highest-ranking occupation category in the Cleveland metro area with an employment share of 16.3 percent. This is followed by sales (11.1 percent) and production (11.0 percent).

EMPLOYMENT CENTERS IN THE AKRON METROPOLITAN AREA

In this section, we present a detailed discussion of the eight employment centers (Centers) that are found in the Akron metropolitan area. First, the Centers are identified by location, land area, employment level, and employment density. Next, we examine the aggregated employment share found in the employment centers for 14 major industry sectors. Finally, an analysis of the industry and occupation characterizations for each Center is discussed.

EMPLOYMENT CENTER IDENTIFICATION

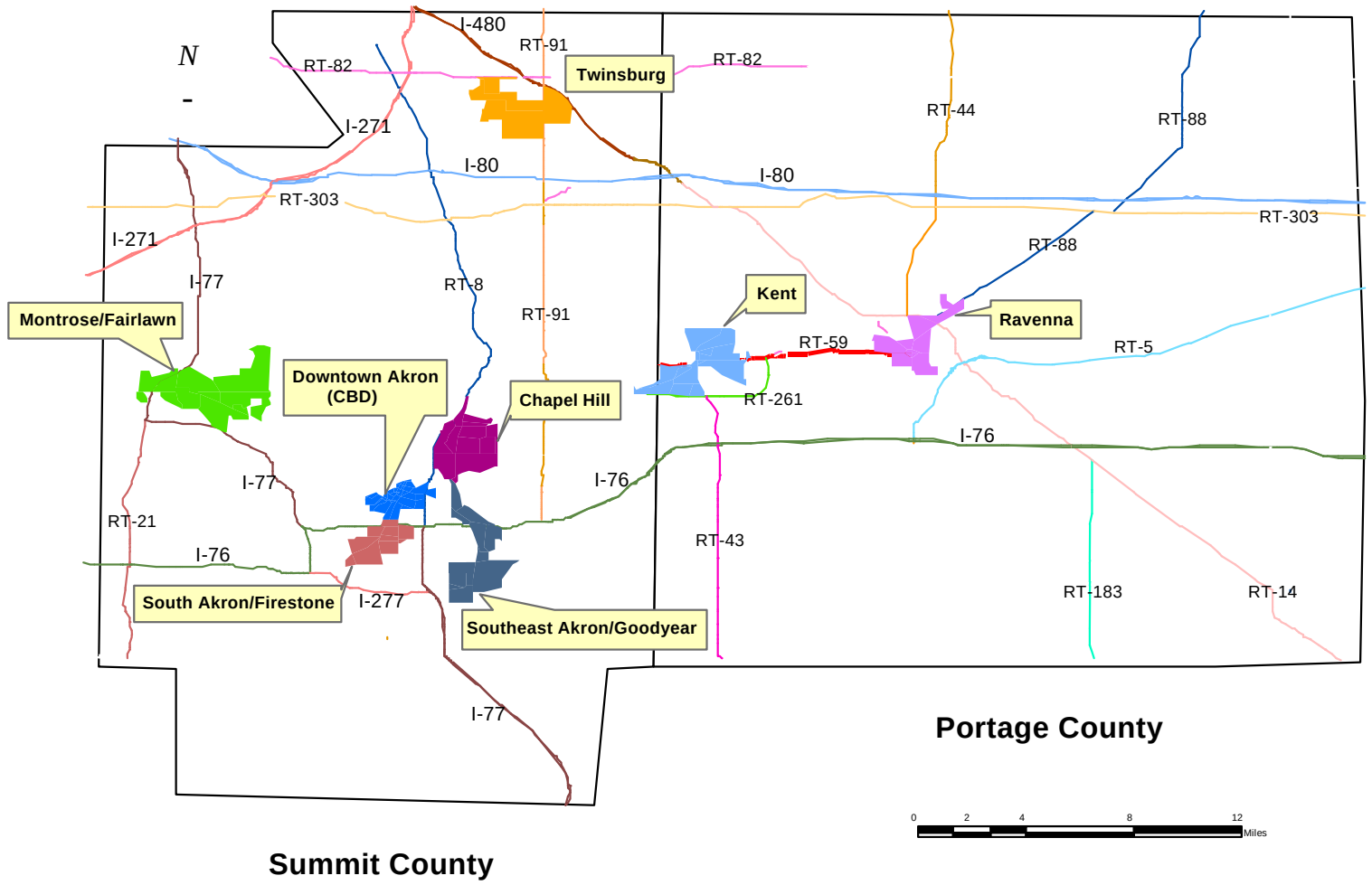
The Akron metropolitan area has eight employment centers located in Portage and Summit Counties. Combined, these Centers report an employment level of 120,670 workers, which accounts for 36.5 percent of the total metro area employment. This employment share is almost seven percentage points higher than in the Cleveland Centers. Land area accounted for by the Centers equals 27.2 square miles or three percent of the total land in metropolitan Akron. This is almost double the land share reported by the Cleveland Centers. For identification purposes, a threshold employment level of 6,000 and a threshold employment density of 2,300 employees per square mile were selected. Table 6 identifies the Akron area Centers, and Figure 2 shows their geographic location.

Table 6. Akron Area Employment Centers Identification

Center	Area (Sq Mi)	Total Employment	Employment Density[a]	Location[b]	Distance from CBD (Miles)[c]
Central Business District	1.625	37,305	22,957	Akron	0
Montrose/Fairlawn	5.822	17,480	3,002	Akron, Copley Twp, Fairlawn, Bath Twp	6.5
Chapel Hill	3.646	13,230	3,629	Akron, Cuyahoga Falls	3
Kent	3.813	12,805	3,358	Kent	9.5
Twinsburg	3.899	12,770	3,275	Twinsburg, Twinsburg Twp	15
Southeast Akron/ Goodyear	3.720	12,465	3,351	Akron	3
Ravenna	2.670	7,820	2,929	Ravenna	15
South Akron/Firestone	2.044	6,795	3,324	Akron	2

Note: Employment centers are ranked by total employment.
[a]Employment density: Employees per square mile
[b]Location: Municipal composition of employment centers
[c]CBD: Central business district (downtown Akron)

Figure 2. Akron Metropolitan Area Employment Centers



From Figure 2 and Table 6, we see that four of Akron's eight employment centers are located within the city of Akron and are within very close proximity to one another. However, each Center is distinguished by its industry and occupational characteristics. This location distribution suggests that the outward migration of employment seen in the Cleveland metro area is not occurring as rapidly in Akron.[16] In fact, the Montrose/Fairlawn Center represents the only typical suburban retail/office market—similar to Cleveland's Chagrin/I-271—in metropolitan Akron. The only other areas in Summit and Portage Counties where Centers similar to Montrose/Fairlawn may emerge in the future are in Green (along I-77) or Stow (along State Route 8).

Boundaries for the Central Business District Center were determined with the assistance of the Akron Metropolitan Area Transportation Study (AMATS), Akron's metropolitan planning organization (MPO). Imposing these boundaries was necessary, otherwise, a significant portion of the city of Akron would have been identified as a single employment center.[17]

EMPLOYMENT SHARE BY INDUSTRY SECTOR

Over 36 percent of Akron's metro area employment across all industry sectors is found in the employment centers. Public administration (NAICS 92) records the highest share at 57 percent. Other industry sectors with employment shares approaching or greater than 40 percent include information (NAICS 51); education, health, and social services (NAICS 61-62); professional, scientific, management, and administration (NAICS 54-56); and transportation, warehousing, and utilities (NAICS 22, 48-49). The manufacturing sector, which reports the highest number of employees in the Akron metro area (66,800) has a Centers employment share of almost 38 percent. Table 7 provides detailed employment statistics for all industry sectors.

[16] When considering the migration of employment centers to suburban communities in the Cleveland and Akron metro areas, it is interesting to compare corresponding changes in population. According to the Census Bureau, the city of Cleveland reported a population loss of 16.6 percent between 1980 and 2000. During that same time period, the city of Akron experienced a population loss of 8.5 percent.

[17] For further discussion, refer to the section Employment Centers in the Cleveland Metropolitan Area: Employment Center Identification.

Table 7. Akron Area Centers – Employment Share by Industry Sector

Sector	Akron Area Employment	Employment in Centers	Employment Share (Centers)
All Sectors	330,551	120,670	36.5%
Agriculture, Forestry, Fishing, Hunting, and Mining (NAICS 11, 21)	1,214	99	8.2%
Construction (NAICS 23)	19,331	4,447	23.0%
Manufacturing (NAICS 31-33)	66,837	25,181	37.7%
Wholesale Trade (NAICS 42)	13,894	4,455	32.1%
Retail Trade (NAICS 44-45)	39,816	12,647	31.8%
Transportation, Warehousing, and Utilities (NAICS 48-49, 22)	17,553	6,916	39.4%
Information (NAICS 51)	7,746	3,704	47.8%
Finance, Insurance, Real Estate, Rental & Leasing (NAICS 52-53)	18,314	6,850	37.4%
Professional, Scientific, Management, and Administrative (NAICS 54-56)	26,696	10,605	39.7%
Educational, Health, and Social Services (NAICS 61-62)	64,803	28,653	44.2%
Arts, Entertainment, Recreation, and Food Services (NAICS 71-72)	26,789	7,276	27.2%
Other Services Except Public Administration (NAICS 81)	16,023	3,631	22.7%
Public Administration (NAICS 92)	10,680	6,078	56.9%
Armed Services (NAICS 92)	182	85	46.7%

EMPLOYMENT CENTER CHARACTERIZATION BY INDUSTRY SECTOR

Location quotient (LQ) analysis is used here to characterize Akron's employment centers by industry specialization.[18] Table 8 shows the major and minor industry sectors for each Center in the Akron metropolitan area. Table A-3 in Appendix A lists location quotients by Center for 14 industry sectors.

[18] See Appendix B for a detailed discussion of location quotient analysis .

Table 8. Akron Area Employment Centers – Industry Sector Specializations

EMPLOYMENT CENTER	MAJOR INDUSTRIES[a,b]	MINOR INDUSTRIES[a,b]
Central Business District	Public Administration (3.00) Education, Health & Social Service (2.18) Information (2.03)	Professional, Scientific & Management (1.41)
Montrose/Fairlawn	Retail Trade (2.38) FIRE (1.80)[c]	Arts, Entertainment & Food Services (1.61) Professional, Scientific & Management (1.46)
Chapel Hill	Transportation & Warehousing (2.75) Retail Trade (2.11)	Arts, Entertainment & Food Services (1.55) Construction (1.39)
Kent	Education, Health & Social Service (2.13)	Arts, Entertainment & Food Services (1.30)
Twinsburg	Wholesale Trade (2.93) Manufacturing (2.36) Information (2.13)	
Southeast Akron/ Goodyear	Manufacturing (2.90) Transportation & Warehousing (1.82)	Wholesale Trade (1.38)
Ravenna	Public Administration (2.93)	Education, Health & Social Service (1.70)
South Akron/ Firestone	Transportation & Warehousing (3.43) Wholesale Trade (2.20) Manufacturing (1.88)	Construction (1.26) Public Administration (1.22)

[a]The number in parentheses adjacent to the industry sector is that sector's location quotient. For example, public administration in Akron's central business district has a location quotient of 3.00.

[b]The selection of a LQ value that clearly identifies an industry as major or minor is left to the discretion of the analyst. After reviewing the literature, we decided that an industry sector with a location quotient of 1.70 or greater would be considered a major industry in the respective employment center. An industry sector with a location quotient between 1.20 and 1.69 would be considered a minor industry.

[c]FIRE: Finance, insurance, real estate, and rental & leasing.

Akron has been a major center for trucking and distribution ever since the 1950s when the heyday of the tire and rubber industry coincided with the creation of the interstate highway system. In fact, the transportation and warehousing (T&W) sector is more concentrated (specialized) in the Akron Centers than elsewhere in Northeast Ohio.[19] Three employment centers report T&W as a major industry—South Akron/Firestone (LQ = 3.43), Chapel Hill (LQ = 2.75), and Southeast Akron/Goodyear (LQ = 1.82). By comparison, there is only one Center in the Cleveland area that shows T&W as a major industry. Neither the Cleveland nor Youngstown metro areas report T&W as a minor industry. In the Firestone area, a LQ of 3.43 means that T&W has an employment concentration level that is 3.4 times greater than found on average across Northeast Ohio. Two factors contributing to this high LQ are the presence of Roadway Express' headquarters and a main distribution center for Federal Express. A main distribution center for UPS can be found in the Chapel Hill area. According to estimates

[19]Transportation and warehousing is a broad-based sector and includes all modes of air, rail, and truck transportation, delivery and courier services, and all types of warehousing and storage.

provided by AMATS, 35 trucking terminals were located in Summit and Portage Counties. Sixteen of these terminals were found in the city of Akron.

Manufacturing is reported as a major industry sector in three Akron Centers—Southeast Akron/Goodyear (LQ = 2.90), Twinsburg (LQ = 2.36), and South Akron/Firestone (LQ = 1.88). Three nationally known companies have a major presence in the Goodyear Center—Goodyear Tire & Rubber Company (including its world headquarters), Lockheed Martin Tactical Defense Systems, and Aircraft Braking Systems. The Firestone area is home to Bridgestone/Firestone and Cargill Inc. (known for its production of road salt). In the Twinsburg area, Daimler-Chrysler is the largest manufacturing employer, accounting for almost one-third of sector-related employment according to Harris Infosource.

Akron's central business district (CBD) has a fairly typical industry mix for a downtown area. Major industries include pubic administration; education, health, and social services; and information. Professional, scientific, and management services is reported as a minor industry. The location quotient for public administration (3.0) is about the same as that found in Downtown Cleveland (3.2) and Downtown Youngstown (2.9). These relatively high LQs can be accounted for by the fact that most city government offices are typically located in downtown areas, as are the county seats of government. The University of Akron accounts for most of the employment in education.

The Montrose/Fairlawn Center was described earlier as the only typical suburban retail/office market in metropolitan Akron. This is supported by the industry characterization shown in Table 8. The big box retail trade (LQ = 2.38) along Route 18 is surrounded by several small office parks housing many FIRE (LQ=1.80) and professional, scientific, and management-(LQ = 1.46) related businesses. Headquarter offices for First Energy and Sterling Jewelers are also found in Montrose/Fairlawn.

EMPLOYMENT CENTER CHARACTERIZATION BY OCCUPATION

In this section, we characterize Akron's employment centers by occupation using location quotient analysis.[20] This analysis identifies major and minor occupations for each Center. Table 9 shows occupation specializations by location quotient for each employment center in metropolitan Akron. Table A-4 in Appendix A lists location quotients by employment center for 24 occupation categories.

[20] See Appendix B for a detailed discussion of location quotient analysis.

Table 9. Akron Area Employment Centers – Occupation Specializations

EMPLOYMENT CENTER	MAJOR OCCUPATIONS[a,b]	MINOR OCCUPATIONS[a,b]
Central Business District	Law (3.45) Healthcare Practitioners & Technicians (2.76) Protective Services (2.36) Community & Social Services (1.89)	Education & Libraries (1.66) Computer & Mathematics (1.55) Healthcare Support (1.30) Arts, Entertainment & Sports (1.29) Office & Administrative Support (1.29)
Montrose/Fairlawn	Sales (2.12) Business & Financial Operations (1.72)	Computer & Mathematics (1.64) Food Preparation (1.56) Office & Administrative Support (1.29) Healthcare Support (1.21)
Chapel Hill	Food Preparation (1.81) Sales (1.77)	Life, Physical & Social Sciences (1.43) Construction & Excavation (1.34) Transportation & Material Moving (1.28)
Kent	Education & Libraries (2.98) Arts, Entertainment & Sports (2.25)	Life, Physical & Social Sciences (1.69) Protective Services (1.52) Building & Grounds Maintenance (1.40) Food Preparation (1.35)
Twinsburg	Architecture & Engineering (2.33) Production (2.15) Computer & Mathematics (1.93)	Installation, Maintenance & Repair (1.54) Transportation & Material Moving (1.38)
Southeast Akron/ Goodyear	Architecture & Engineering (5.37) Life, Physical & Social Sciences (3.38) Computer & Mathematics (2.29)	Production (1.50) Installation, Maintenance & Repair (1.47) Transportation & Material Moving (1.23) Management (1.22)
Ravenna	Healthcare Practitioners & Technicians (2.17) Community & Social Services (1.75) Law (1.70)	Healthcare Support (1.56) Building & Grounds Maintenance (1.39) Architecture & Engineering (1.28)
South Akron/ Firestone	Life, Physical & Social Sciences (2.46) Architecture & Engineering (2.01)	Production (1.68) Protective Services (1.61) Construction & Excavation (1.45)

[a]The number in parentheses adjacent to the occupation is that occupation's location quotient. For example, law-related occupations in Akron's central business district have a location quotient of 3.45.

[b]The selection of a LQ value that clearly identifies an occupational category as major or minor is left to the discretion of the analyst. After reviewing the literature, we decided that an occupation with a location quotient of 1.70 or greater would be considered a major occupation in the respective employment center. An occupation with a location quotient between 1.20 and 1.69 would be considered a minor occupation.

Comparing tables 8 and 9, we see three Centers—Twinsburg, Goodyear, and Firestone—that report manufacturing as a major industry also show architecture and engineering (A&E) as a major occupational category. Only one of the Centers—Twinsburg—reports production as a major occupation. Goodyear and Firestone show production as a minor occupation. In addition, two of the Centers—Twinsburg and Goodyear—show computer and mathematics as a major occupation and two of the Centers—Goodyear and Firestone—also show the sciences as a major occupation.

Of special significance is the Goodyear Center. It is unique in that it is the only Center in Northeast Ohio to report all the high-tech occupations (architecture and engineering, computer and mathematics, and the sciences) as major occupational categories. In addition, the

Goodyear Center has the highest concentration of A&E personnel in Northeast Ohio (LQ = 5.37) and the second highest concentration of personnel working in the sciences (LQ = 3.38). Only Cleveland's University Circle reports a higher concentration of scientists. These disproportionately high LQs indicate that a significant portion of the services provided by these workers is exported (at least indirectly through product sales) outside the region, thereby creating wealth within the Akron metro area.

Contributing to the concentration of high-tech occupations in the Goodyear and Firestone Centers are the presence of Goodyear's and Bridgestone/Firestone's research and development (R&D) facilities. In addition, these Centers are seen as a focal point for research and development in the rubber, polymer, and aerospace (Lockheed-Martin) industries. In addition, the occupation distribution found in the Twinsburg, Goodyear, and Firestone Centers suggests that manufacturing-related companies are placing significant resources into product and process innovation that could, over the long term, result in company growth and wealth creation for the Akron metro area.

According to Census estimates, 4,000 persons work in the computer and mathematics, architecture and engineering, and science-related occupations across the Firestone, Goodyear, and Twinsburg Centers. The Bureau of Labor Statistics (BLS) ranks these occupations 3rd, 4th, and 6th, respectively, in average annual wages paid in metropolitan Akron.[21] Wage estimates provided by the BLS are as follows: computer and mathematics ($59,110); architecture and engineering ($58,250); and life, physical, and social sciences ($54,260). Combining Census and BLS data, we find that the wages paid (2003 dollars) to these high-tech workers totaled $230 million.

In the previous section, it was reported that the transportation and warehousing (T&W) sector has a greater employment concentration in Greater Akron than elsewhere across Northeast Ohio. T&W's complementary occupation is transportation and material moving (TMM). Two of the three Akron Centers (Chapel Hill and Goodyear) that reported transportation and warehousing as a major industry list TMM as a minor occupation (see Table 9). TMM is ranked 17th out of 21 occupation categories in wages at $27,100 per year (see Appendix A, Table A-7). Some workers in the construction and manufacturing sectors hold jobs that fall under the TMM occupation category. The Firestone Center, which reports the highest T&W employment concentration across Northeast Ohio, also shows manufacturing as a major industry and construction as a minor industry.

[21] See footnote 13 for information regarding wage data.

In looking at Table 8, we observe that education, health, and social services is listed as a major industry in the Central Business District (CBD) and Kent Centers. Both Centers report almost identical industry location quotients (2.1). The CBD is home to The University of Akron (UA), and Kent is the home of Kent State University (KSU). However, Table 9 shows that education is a minor occupation (LQ = 1.66) in the CBD whereas, in Kent, it is a major occupation (LQ = 2.98). The primary reason for this discrepancy lies in the calculation of the location quotient.[22] Looking exclusively at employment levels and excluding employees at the Akron Public Library (also in the CBD), we find that UA and KSU have about the same number of persons who would be counted under the education occupation category. In metropolitan Akron, persons in education-related occupations earn, on average, $43,200 per year, ranking this category 8th in wages paid.

Finally, looking at Table 9, we observe that management is not included as a major occupation in any of the Akron employment centers, and it is listed as a minor occupation in only one Center—Southeast/Goodyear. However, the Census Bureau estimates that 27,500 persons work in management occupations in Portage and Summit Counties. This is an 8.3 percent share of total metro area employment. In the Centers, the share of persons working in management occupations equals 8.7 percent. In the Akron area, managers are ranked first in average wages at $86,000 per year.

[22] Mathematically, the location quotient is the ratio of the occupation (or industry) employment share in the Center to the occupation (or industry) employment share across Northeast Ohio (reference economy). Since the employment level in the CBD is almost three times greater than in Kent, the education occupation share in the CBD (LQ numerator) is diluted, which results in a much lower location quotient. In fact, the education share in the CBD equals 8.3 percent. This compares to 14.8 percent for the Kent Center.

EMPLOYMENT CENTERS IN THE YOUNGSTOWN METROPOLITAN AREA

This section presents a detailed discussion of the six employment centers (Centers) that are found in the Youngstown metropolitan area. First, the Centers are identified by location, land area, employment level, and employment density. Next, we examine the aggregated employment share found in the Centers for 14 major industry sectors. Finally, an analysis of the industry and occupation characterizations for each employment center is discussed.

EMPLOYMENT CENTER IDENTIFICATION

Six employment centers (Centers) were identified in the Youngstown metropolitan area.[23] Combined, these Centers report an employment level of 61,185 workers, which accounts for 30.1 percent of total employment in Mahoning and Trumbull Counties. Land area occupied by the Centers equals 16.1 square miles or 1.5 percent of the total land in the metro area. The employment and land shares reported for the Youngstown Centers are almost identical to those found for the Cleveland Centers. For identification purposes, a threshold employment level of 5,000 and a threshold employment density of 2,300 employees per square mile were selected. Table 10 identifies the Youngstown Centers, and Figure 3 shows their geographic locations.

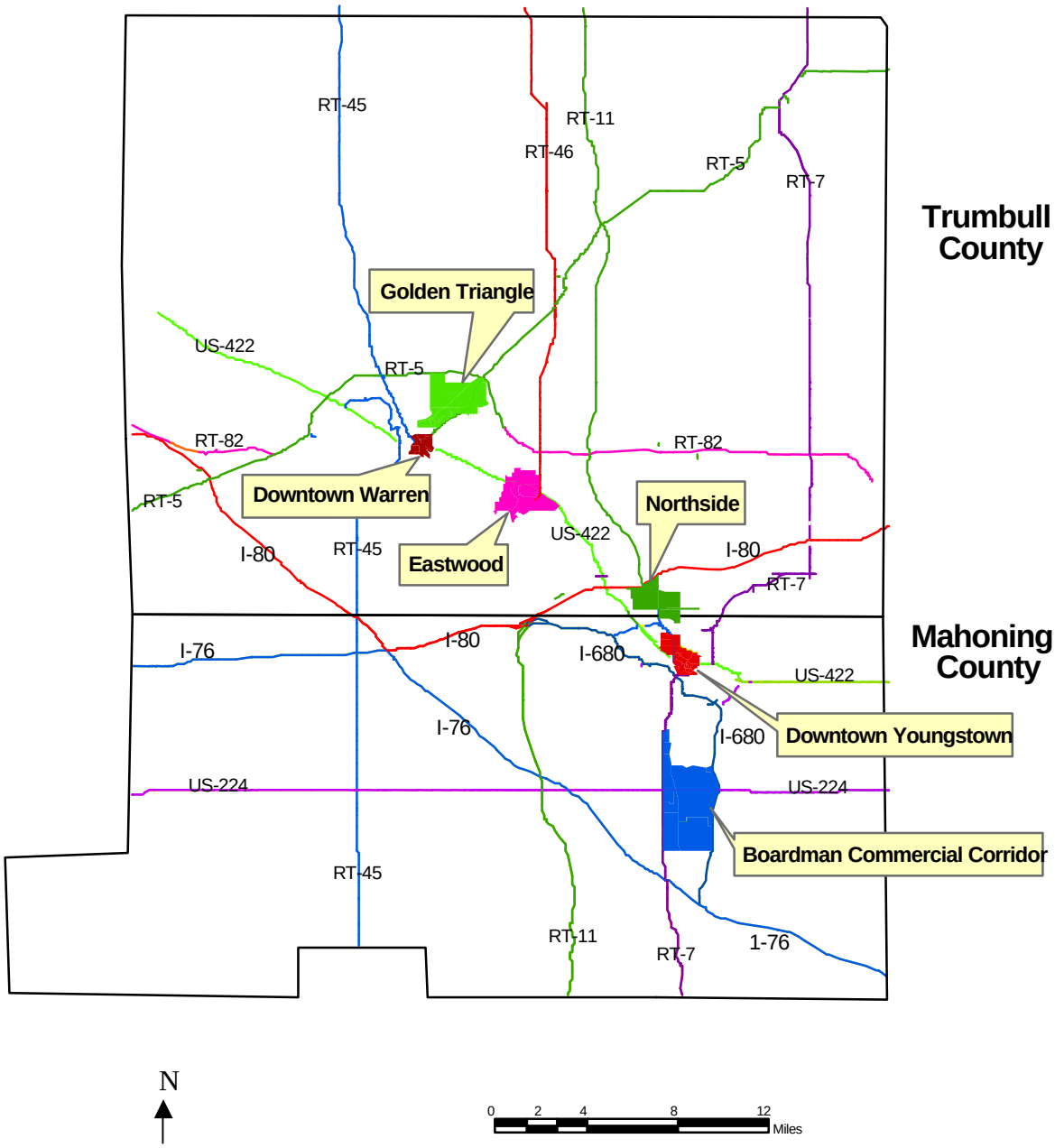
Table 10. Youngstown Area Employment Centers Identification

Center	Area (Sq Mi)	Total Employment	Employment Density[a]	Location[b]	Distance from CBD (Miles)[c]
Downtown Youngstown	1.326	14,895	11,233	Youngstown	0
Boardman Commercial District	6.386	14,760	2,311	Boardman Twp	5.5
Golden Triangle	3.136	14,365	4,581	Warren / Howland Twp	12
Eastwood	2.522	6,180	2,450	Niles	7.5
Downtown Warren	0.636	5,705	8,970	Warren	10
Northside	2.107	5,280	2,506	Youngstown / Liberty Twp	2.5

Note: Employment Centers area ranked by total employment.
[a]Employment density: Employees per square mile
[b]Location: Municipal composition of employment centers
[c]CBD: Central business district (downtown Youngstown)

[23] The Youngstown metropolitan area includes Mahoning and Trumbull Counties.

Figure 3. Youngstown Metropolitan Area Employment Centers



Looking at Figure 3, we see that three of the employment centers (Downtown Warren, Golden Triangle, and Eastwood) are located in Trumbull County, two Centers (Boardman Commercial Corridor and Downtown Youngstown) are in Mahoning County, and the Northside Center straddles the Mahoning/Trumbull County line. Employment in Trumbull County has been relatively stable over the past 10 years. Representatives of the Eastgate Regional Council of Governments (Eastgate) believe the same Trumbull County Centers would be identified using 1990 Census data.[24] In contrast, Mahoning County has seen a steady migration of people and jobs from the city of Youngstown into suburban areas. In fact, the city of Youngstown lost 29 percent of its population between 1980 and 2000. According to Eastgate representatives, many people who worked in steel-related companies now commute to the Pittsburgh and Cleveland areas to work at jobs that pay equivalent wages.

The potential exists for a future Mahoning County employment center in a corridor that runs between Downtown Youngstown and Struthers along the Mahoning River. This is the area where many of Youngstown's steel mills once operated. The area has a good transportation infrastructure and is suitable for warehousing and distribution. In addition, it may be a suitable area for heavy equipment repair, maintenance, and storage.

Boundaries for the Downtown Center were determined with the assistance of Eastgate personnel. Imposing these boundaries was a necessary step to avoid identifying a significant portion of the city of Youngstown as a single employment center.[25] From Figure 3, we also see that Downtown Warren and the Golden Triangle are within very close proximity as are Downtown Youngstown and Northside. However, each of these Centers is distinguished by its industry and occupational characteristics.

The area in southern Trumbull County where the General Motors Lordstown facilities are located was not identified as an employment center. Although this area exceeds the employment threshold with more than 7,000 workers, it fell significantly below the density threshold with 1,550 employees per square mile. The density constraint is due to the size of the traffic analysis zones (TAZs), which are typically much larger in outlying areas of a county. However, the importance of manufacturing activity in the Lordstown area to the Youngstown economy must be acknowledged. Combining Census Bureau and Bureau of Labor Statistic (BLS) estimates, we find that workers associated with the production and distribution of materials and products at the Lordstown facilities were paid wages approaching $190 million (in 2003 dollars).

[24] The Eastgate Regional Council of Governments is Youngstown's metropolitan planning organization.
[25] For further discussion, refer to the section Employment Centers in the Cleveland Metropolitan Area: Employment Center Identification.

As seen in Table 10, the Boardman Commercial District has the largest land area (6.4 square miles) of any employment center in metropolitan Youngstown. In fact, its land area is more than double that of the next largest Center—Golden Triangle. Boardman is Mahoning County's largest retail district, centered at the intersection of U.S. Route 224 and Ohio Route 7 (Market Street). Commercial buildings line both sides of Route 224 with little market activity behind them. Due to the rules governing TAZ boundaries, unused land—or land used for residential development—behind the commercial buildings must be included in the TAZ, resulting in an unusually large Center. Only TAZs on the east side of Market Street were used to identify the Boardman Center. If TAZs on both sides of Market Street (or Route 224) had been used, than the proposed Center would have fallen below the threshold employment density. Further, because of the constraints imposed by TAZ areas, some office development along Route 224 was also excluded.[26] Boardman and Lordstown demonstrate the downside in using TAZs to identify employment centers. However, they are the best geographic unit available to analysts on a national basis.

EMPLOYMENT SHARE BY INDUSTRY SECTOR

Slightly more than 30 percent of total employment across all industry sectors in metropolitan Youngstown is found in the six identified Centers. Information (NAICS 51) reported the largest share at 51 percent. The manufacturing sector (NAICS 31-33), which accounted for the highest number of workers (44,900) in Greater Youngstown, has a Center employment share of 26.8 percent. This share value would have increased significantly if we were able to include the 7,200 manufacturing employees in the Lordstown area. Other industry sectors with employment shares greater than 35 percent were FIRE (NAICS 52-53), public administration (NAICS 92), retail trade (NAICS 44-45), and arts, entertainment, recreation, and food services (NAICS 71-72).[27] Table 11 provides detailed employment statistics for all industry sectors.

[26] Significant development is now taking place along U.S. Route 224 from State Route 11 to I-680. Included are small office parks housing professional service firms. Many of these firms are migrating out of the city of Youngstown. Technically, this corridor might already be an employment center, were it not for the large TAZ areas. Major or minor occupations would include law, healthcare practitioners, food preparation, and sales. This corridor is similar to Akron's Montrose/Fairlawn Center.

[27] FIRE: Finance, insurance, real estate, rental and leasing

Table 11. Youngstown Area Centers – Employment Share by Industry Sector

Sector	Youngstown Area Employment	Employment in Centers	Employment Share (Centers)
All Sectors	203,073	61,185	30.1%
Agriculture, Forestry, Fishing, Hunting, and Mining (NAICS 11, 21)	1,388	23	1.7%
Construction (NAICS 23)	10,765	1,816	16.9%
Manufacturing (NAICS 31-33)	44,888	12,029	26.8%
Wholesale Trade (NAICS 42)	6,994	1,402	20.0%
Retail Trade (NAICS 44-45)	27,841	10,140	36.4%
Transportation, Warehousing, and Utilities (NAICS 48-49, 22)	9,538	1,892	19.8%
Information (NAICS 51)	4,332	2,203	50.9%
Finance, Insurance, Real Estate, Rental & Leasing (NAICS 52-53)	9,547	3,810	39.9%
Professional, Scientific, Management, and Administrative (NAICS 54-56)	12,399	4,050	32.7%
Educational, Health, and Social Services (NAICS 61-62)	41,137	13,044	31.7%
Arts, Entertainment, Recreation, and Food Services (NAICS 71-72)	15,848	5,618	35.4%
Other Services Except Public Administration (NAICS 81)	10,122	2,197	21.7%
Public Administration (NAICS 92)	7,270	2,853	39.2%
Armed Services (NAICS 92)	241	40	16.6%

EMPLOYMENT CENTER CHARACTERIZATION BY INDUSTRY SECTOR

In this section, we characterize Youngstown's employment centers by industry specialization using location quotient analysis.[28] Table 12 shows the major and minor industry sectors for each Center in metropolitan Youngstown. Table A-5 in Appendix A lists location quotients by Center for 14 industry sectors.

[28] See Appendix B for a detailed discussion of location quotient analysis.

Table 12. Youngstown Area Employment Centers – Industry Sector Specializations

SUB-CENTER	MAJOR INDUSTRIES[a,b]	MINOR INDUSTRIES[a,b]
Downtown Youngstown	Public Administration (2.89) Education, Health & Social Service (2.22) Information (1.75)	
Boardman Commercial Corridor	Retail Trade (2.56) Arts, Entertainment & Food Service(1.97)	
Golden Triangle	Manufacturing (3.11)	
Eastwood	Information (4.83) Retail Trade (3.82) Arts, Entertainment & Food Service (2.49)	
Downtown Warren	Public Administration (4.88) Information (3.02)	Finance, Insurance & Real Estate (1.63) Professional Services & Management (1.47)
Northside	Education, Health & Social Service (2.38)	

[a]The number in parentheses adjacent to the industry sector is that sector's location quotient. For example, public administration in Downtown Youngstown has a location quotient of 2.89.

[b]The selection of a LQ value that clearly identifies an industry as major or minor is left to the discretion of the analyst. After reviewing the literature, we decided that an industry sector with a location quotient of 1.70 or greater would be considered a major industry in the respective employment center. An industry sector with a location quotient between 1.20 and 1.69 would be considered a minor industry.

Employment in information-related businesses is more concentrated in the Youngstown Centers than elsewhere in Northeast Ohio. Three Centers report information as a major industry—Downtown Youngstown, Eastwood, and Downtown Warren.[29] In fact, the Eastwood Center has an information sector employment concentration level that is almost five times greater than found on average across Northeast Ohio. Of the 26 employment centers identified in the Akron, Cleveland, and Youngstown areas, Eastwood ranks 5th in information employment at 709 workers. Information is a very diverse sector and includes telecommunications, radio and television broadcasting, newspapers, software, and database publishing. Call centers are playing an increasing role in Youngstown's information industry. West Corporation has a major presence in the Eastwood Center. Currently, 800 persons work at the site with projections for hiring an additional 700.[30] This site was formerly occupied by a MCI call center. The site was originally developed for K-Mart. In addition, Akron-based InfoCision has a call center in Downtown Youngstown in addition to 1,000 other employees spread across Mahoning County and New Castle, Pennsylvania.

[29] Cleveland has two Centers reporting information as a major industry—Downtown and Rockside; Akron also has two centers reporting information as a major industry—Central Business District and Twinsburg.

[30] 1,500 employees needed. (2005, February 23). *The Vindicator*, p. A1.

Although the manufacturing sector remains the largest employer in metropolitan Youngstown (in 2000), only one Center reports it as a major industry—the Golden Triangle.[31] However, with a location quotient (LQ) of 3.11, the concentration of manufacturing employment in the Golden Triangle is the highest of any Center in Northeast Ohio. The second highest concentration is found in Akron's Goodyear Center (LQ = 2.90). This high LQ indicates that most of the products manufactured in the Golden Triangle are shipped outside the region, resulting in wealth being created in the Youngstown area. Delphi Packard Electric Systems dominates the manufacturing sector with three major facilities that employ thousands of workers. Products include power and electrical distribution components, automotive electronic systems, and wiring assemblies. In addition, GE Lighting has a major lamp plant in the Golden Triangle.

The employment concentration in retail trade is higher in metropolitan Youngstown than found on average across Northeast Ohio. Eastwood and Boardman not only report retail trade as a major industry sector, but their associated LQs (3.82 and 2.56, respectively) are higher than any other employment center in either Akron or Cleveland. According to Census figures, Boardman has more than 4,400 persons employed in retail trade compared to 2,800 in Eastwood.

EMPLOYMENT CENTER CHARACTERIZATION BY OCCUPATION

In this section we characterize Youngstown's employment centers by occupation using location quotient analysis.[32] This allows us to identify major and minor occupations for each Center. Table 13 shows occupation specializations by location quotient for each employment center in metropolitan Youngstown. Table A-6 in Appendix A lists location quotients by employment center for 24 occupation categories.

[31] If the area in which General Motor's Lordstown facilities are located were included as an employment center, it undoubtedly would have reported manufacturing as a major industry.

[32] See Appendix B for a detailed discussion of location quotient analysis.

Table 13. Youngstown Area Employment Centers – Occupation Specializations

SUB-CENTER	MAJOR OCCUPATIONS[a,b]	MINOR OCCUPATIONS[a,c]
Downtown Youngstown	Protective Services (2.74) Law (2.32) Healthcare Practitioners & Technicians (2.28) Healthcare Support (2.02) Arts, Design & Entertainment (1.86 Education (1.85)	Office & Administrative Support (1.46) Community & Social Services (1.20)
Boardman Commercial Corridor	Sales (2.23) Food Preparation & Serving (1.96)	
Golden Triangle	Architecture & Engineering (3.92) Production (2.80) Installation, Maintenance & Repair (1.86)	Transportation & Material Moving (1.35)
Eastwood	Sales (3.55) Food Preparation and Serving (3.11)	
Downtown Warren	Law (4.34) Protective Services (4.00) Community & Social Service (2.84)	Business & Financial Operations (1.47) Office & Administrative Support (1.43) Arts, Design & Entertainment (1.32) Installation, Maintenance & Repair (1.32)
Northside	Healthcare Practitioners & Technicians (4.93) Healthcare Support (2.11)	

[a]The number in parentheses adjacent to the occupation is that occupation's location quotient. For example, protective service-related occupations in downtown Youngstown have a location quotient of 2.74.

[b]The selection of a LQ value that clearly identifies an occupational category as major or minor is left to the discretion of the analyst. After reviewing the literature, we decided that an occupation with a location quotient of 1.70 or greater would be considered a major occupation in the respective employment center. An occupation with a location quotient between 1.20 and 1.69 would be considered a minor occupation.

In the previous section, we saw that the manufacturing sector had the highest concentration of workers in the Golden Triangle than in any other Northeast Ohio Center. Table 13 shows that manufacturing's complement occupation, production, has an employment concentration level in the Golden Triangle that is almost three times greater than found on average across Northeast Ohio. In fact, the Golden Triangle reports the highest production LQ of any Center in metropolitan Akron, Cleveland, or Youngstown. According to the Bureau of Labor Statistics (BLS), production workers in the Youngstown area are paid an average wage of $34,610 per year.[33] Table A-7 in Appendix A lists average annual wages for major occupational categories in Northeast Ohio's three metropolitan areas.

Of equal importance to the Youngstown economy is the fact that the Golden Triangle has the 2nd highest concentration of architecture and engineering (A&E) personnel of any employment center in Northeast Ohio (LQ = 3.92). Only Akron's Goodyear Center reports a higher A&E concentration (LQ = 5.37). In addition, the Golden Triangle reported the 3rd highest number of A&E personnel of any Center in Northeast Ohio at 1,169 workers. Cleveland's Downtown Center has the most A&E workers (2,456) followed by Akron's Goodyear center (1,393 workers). The disproportionately high location quotient for A&E personnel suggests that

[33] See footnote 14 for additional information regarding BLS wage statistics.

manufacturing companies in the Golden Triangle are putting resources into product and process innovation that could, over the long term, result in company growth and wealth creation for the metro area. According to the BLS, architecture and engineering workers average $52,500 in annual wages in metropolitan Youngstown, ranking it 4th among 21 occupational categories.

In the previous section, it was reported that the Youngstown Centers had the highest concentration of retail trade when compared to all employment centers in Northeast Ohio. The Boardman and Eastwood Centers also have the highest concentration of persons working in occupations that are complementary to retail trade—sales and food preparation and serving. Table 13 shows the location quotients for these occupations. According to the BLS, sales personnel in the Youngstown area rank 16th in annual wages at $27,000 while food-related occupations rank last in wages at $15,330.

Although a high concentration of food preparation and sales personnel exists in the Boardman and Eastwood Centers, the overall employment share for these occupations across Mahoning and Trumbull Counties is not much higher than in either metropolitan Akron or Cleveland. The share of persons working in sales ranges from 11.1 percent in Cleveland to 11.9 percent in Youngstown. The share of persons working in food preparation ranges from 4.7 percent in Cleveland to 5.9 percent in Youngstown.

Finally, the Downtown Youngstown and Downtown Warren Centers report fairly typical occupation distributions for central business districts. Table 13 shows both Centers have law and protective services as major occupations. Although the location quotient (4.34) for legal-related occupations in the Downtown Warren Center is disproportionately high, its value may be attributable to the relatively small number of persons working in the Center.[34] Of more significance is the presence of the legal profession in downtown Youngstown. Here, the employment concentration among legal professionals in the Downtown Center is 2.3 times greater than found on average across Northeast Ohio. In fact, Downtown Youngstown reports the third highest number of legal-related professionals in Northeast Ohio at 358. Downtown Cleveland is 1st (7,125) and Downtown Akron is 2nd (1,333). Downtown Warren reports 257 legal professionals, ranking it 7th among the Northeast Ohio Centers. According to the BLS, legal professionals in metropolitan Youngstown are paid an average wage of $57,130, ranking it 2nd among occupational categories (see Table A-7, Appendix A).

[34] Mathematically, the location quotient is the ratio of the occupation employment share in the Center to the occupation employment share across Northeast Ohio (reference economy). Since the employment level in Downtown Youngstown is 2.6 times greater than in Downtown Warren, the legal occupation share in Downtown Youngstown (LQ numerator) is diluted, which results in a lower location quotient. In fact, the legal occupation share in Downtown Youngstown equals 2.4 percent. This compares to 4.5 percent in Downtown Warren.

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APPENDIX A – DATA TABLES

Table A-1. Industry Sector Location Quotients for Cleveland Area Employment Centers

Industry Sector	Tiedeman / I-480	Chagrin Blvd / I-271	Downtown	Euclid	Mayfield Rd / I-271	I-480 / I-71	Downtown Elyria	Mentor	Mid-Town	Rockside Rd / I-77	Solon Rd / U.S. 422	University Circle
I-01	0.00	0.13	0.53	0.00	0.03	0.13	0.00	0.00	0.00	0.87	0.25	0.00
I-02	0.35	0.46	0.78	0.66	0.41	0.51	0.65	0.74	1.43	1.13	0.83	0.30
I-03	1.86	0.37	0.35	2.49	0.95	2.37	1.75	1.92	0.81	0.53	2.07	0.07
I-04	1.22	0.92	0.43	0.86	0.60	1.10	0.45	1.30	2.19	2.31	2.33	0.05
I-05	1.47	1.16	0.32	1.01	0.92	0.61	0.63	1.72	0.60	0.64	0.82	0.15
I-06	0.74	0.69	0.93	0.63	0.24	2.63	0.42	0.49	0.73	0.72	0.46	0.11
I-07	1.50	0.83	2.40	0.67	0.81	0.52	1.58	1.34	1.41	3.12	0.93	0.42
I-08	1.78	3.46	2.64	0.44	4.15	1.24	0.44	0.61	0.35	2.26	0.67	0.20
I-09	0.55	2.41	2.76	0.47	1.14	0.28	0.63	0.75	1.25	2.35	0.84	0.33
I-10	0.35	0.64	0.49	0.40	0.80	0.17	1.13	0.19	1.19	0.30	0.38	4.04
I-11	0.46	1.01	1.01	0.46	0.77	0.74	0.60	1.08	0.43	1.09	0.81	0.74
I-12	0.54	0.73	0.67	0.67	0.41	0.77	0.80	0.70	1.75	0.64	0.83	0.29
I-13	0.38	0.21	3.18	1.19	0.32	0.12	1.86	0.12	1.48	0.89	0.28	0.45
I-14	2.62	0.00	4.15	0.00	0.83	0.61	0.00	2.11	0.00	0.00	0.00	0.90

I-01: Agriculture, forestry, fishing, hunting, and mining (NAICS 11, 21)

I-02: Construction (NAICS 23)

I-03: Manufacturing (NAICS 31-33)

I-04: Wholesale Trade (NAICS 42)

I-05: Retail Trade (NAICS 44-45)

I-06: Transportation, warehousing, and utilities (NAICS 48-49, 22)

I-07: Information (NAICS 51)

I-08: Finance, insurance, real estate, rental, and leasing (NAICS 52-53)

I-09: Professional, scientific, management, and administrative (NAICS 54-56)

I-10: Educational, health, and social services (NAICS 61-62)

I-11: Arts, entertainment, recreation, accommodation, and food services (NAICS 71-72)

I-12: Other services except public administration (NAICS 81)

I-13: Public administration (NAICS 92)

-14: Armed services (NAICS 92)

Table A-2. Occupation Location Quotients for Cleveland Area Employment Centers

Occupation	Tiedeman / I-480	Chagrin Blvd / I-271	Downtown	Euclid	Mayfield Rd / I-271	I-480 / I-71	Downtown Elyria	Mentor	Mid-Town	Rockside Rd / I-77	Solon Rd / U.S. 422	University Circle
O-01	0.99	1.78	1.48	0.96	1.31	0.93	0.94	1.08	1.19	1.56	1.44	0.87
O-02	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00
O-03	1.47	2.56	2.73	0.89	2.37	0.77	0.66	0.80	1.18	2.34	1.04	0.52
O-04	2.06	3.13	2.20	0.71	4.77	1.00	1.05	0.61	0.81	3.30	1.11	1.30
O-05	1.05	0.81	1.08	3.41	1.75	1.00	2.42	1.62	1.26	1.09	2.14	0.44
O-06	0.63	1.62	1.09	0.73	0.77	1.69	0.52	0.61	0.64	0.80	1.73	6.61
O-07	0.29	0.75	1.26	0.22	0.46	0.18	0.79	0.27	6.46	0.39	0.28	1.33
O-08	0.47	1.40	6.27	0.39	1.09	0.09	0.41	0.30	1.01	1.51	0.43	0.16
O-09	0.34	0.33	0.61	0.69	0.53	0.12	0.43	0.20	0.65	0.21	0.56	1.89
O-10	1.65	1.42	1.81	0.64	0.79	0.44	0.53	0.88	1.79	1.29	1.11	1.30
O-11	0.56	0.91	0.34	0.18	1.30	0.17	2.01	0.30	0.55	0.41	0.31	6.13
O-12	0.34	0.93	0.29	0.21	0.80	0.34	0.96	0.27	1.47	0.28	0.33	2.17
O-13	0.39	0.51	1.94	1.47	0.52	0.29	0.55	0.35	0.90	0.36	0.41	1.09
O-14	0.49	0.77	0.67	0.51	0.78	0.61	0.85	1.12	0.36	0.81	0.87	0.47
O-15	0.65	0.92	0.93	0.67	0.65	0.66	1.22	0.73	1.01	0.67	0.63	1.00
O-16	0.35	0.91	0.46	0.61	0.67	0.41	0.51	0.60	0.54	0.29	0.44	0.53
O-17	0.97	1.18	0.65	0.84	1.15	0.60	0.62	1.69	0.73	1.25	0.98	0.20
O-18	1.14	1.42	1.30	1.01	1.28	1.04	0.92	0.84	1.03	1.32	1.05	0.95
O-19	0.00	0.08	0.09	0.00	0.00	0.37	0.15	0.32	0.31	1.57	0.55	0.06
O-20	0.55	0.22	0.78	0.93	0.39	0.76	0.72	0.74	1.31	0.94	0.57	0.42
0-21	1.60	0.27	0.54	1.26	0.50	2.30	0.99	1.05	1.03	1.05	1.10	0.27
0-22	1.73	0.22	0.36	2.04	0.38	2.24	1.83	1.96	0.90	0.43	1.58	0.13
O-23	0.98	0.37	0.59	0.85	0.27	1.85	0.70	0.74	0.77	0.60	1.08	0.19
O-24	6.48	0.00	3.34	0.00	0.00	0.80	0.00	0.00	0.00	0.00	0.00	1.49

O-01: Management
O-02: Farmers & Farm Managers
O-03: Business & Financial Operations
O-04: Computer & Mathematics
O-05: Architecture & Engineering
O-06: Life, Physical & Social Sciences
O-07: Community & Social Services
O-08: Law
O-09: Education, Training & Libraries
O-10: Arts, Entertainment & Media
O-11: Healthcare Practitioners & Technicians
0-12: Healthcare Support
O-13: Protective Services
O-14: Food Preparation & Serving
O-15: Building & Ground Maintenance
O-16: Personal Care & Service
0-17: Sales
O-18: Office & Administrative Support
O-19: Fishing & Forestry
O-20: Construction & Excavation
O-21: Installation, Maintenance & Repair
O-22: Production
O-23: Transportation & Material Moving
O-24: Armed Forces

Table A-3. Industry Sector Location Quotients for Akron Area Employment Centers

Industry Sector	CBD	Montrose / Fairlawn	Chapel Hill	Kent	Twinsburg	SE Akron /Goodyear	Ravenna	South Akron / Firestone
I-01	0.08	0.33	0.20	0.00	0.30	0.31	0.00	0.00
I-02	0.31	0.31	1.39	0.64	0.88	0.62	0.87	1.26
I-03	0.21	0.36	0.96	0.67	2.36	2.90	1.09	1.88
I-04	0.37	0.63	0.98	0.32	2.93	1.38	0.44	2.20
I-05	0.25	2.38	2.11	0.68	0.78	0.28	0.46	0.46
I-06	0.97	0.69	2.75	0.30	0.66	1.82	0.48	3.43
I-07	2.03	0.45	0.94	1.05	2.13	0.72	1.13	0.22
I-08	1.18	1.80	0.57	0.49	0.41	0.22	0.43	0.32
I-09	1.41	1.46	0.64	1.08	0.73	0.59	0.71	0.74
I-10	2.18	0.72	0.19	2.13	0.22	0.15	1.70	0.26
I-11	0.42	1.61	1.55	1.30	0.25	0.66	0.47	0.35
I-12	0.64	1.01	0.65	0.61	0.31	0.51	0.89	0.64
I-13	3.00	0.22	0.28	0.58	0.47	0.48	2.93	1.22
I-14	1.32	0.00	4.25	0.00	0.00	0.00	1.80	0.00

I-01: Agriculture, forestry, fishing, hunting, and mining (NAICS 11, 21)

I-02: Construction (NAICS 23)

I-03: Manufacturing (NAICS 31-33)

I-04: Wholesale Trade (NAICS 42)

I-05: Retail Trade (NAICS 44-45)

I-06: Transportation, warehousing, and utilities (NAICS 48-49, 22)

I-07: Information (NAICS 51)

I-08: Finance, insurance, real estate, rental, and leasing (NAICS 52-53)

I-09: Professional, scientific, management, and administrative (NAICS 54-56)

I-10: Educational, health, and social services (NAICS 61-62)

I-11: Arts, entertainment, recreation, accommodation, and food services (NAICS 71-72)

I-12: Other services except public administration (NAICS 81)

I-13: Public administration (NAICS 92)

I-14: Armed services (NAICS 92)

Table A-4. Occupation Location Quotients for Akron Area Employment Centers

Occupation	CBD	Montrose / Fairlawn	Chapel Hill	Kent	Twinsburg	SE Akron / Goodyear	Ravenna	South Akron / Firestone
O-01	0.98	1.12	0.96	1.03	1.16	1.22	0.83	1.18
O-02	0.00	0.00	0.68	0.00	0.00	1.04	0.00	0.38
O-03	1.16	1.72	0.89	0.68	1.12	1.16	0.84	0.87
O-04	1.55	1.64	1.11	1.14	1.93	2.29	0.67	1.04
O-05	0.96	0.70	0.67	0.73	2.33	5.37	1.28	2.01
O-06	1.19	1.08	1.43	1.69	1.17	3.38	0.76	2.46
O-07	1.89	0.42	0.31	1.11	0.14	0.48	1.75	0.69
O-08	3.45	0.90	0.28	0.24	0.30	0.50	1.70	0.35
O-09	1.66	0.40	0.15	2.98	0.10	0.23	1.15	0.33
O-10	1.29	0.64	0.52	2.25	0.76	1.06	1.31	0.36
O-11	2.76	0.87	0.28	0.33	0.36	0.11	2.17	0.14
O-12	1.30	1.21	0.09	0.43	0.14	0.15	1.56	0.10
O-13	2.36	0.43	0.40	1.52	0.35	0.61	1.15	1.61
O-14	0.51	1.56	1.81	1.35	0.31	0.59	0.47	0.38
O-15	0.87	0.82	0.61	1.40	0.55	0.59	1.39	0.67
O-16	0.39	0.97	0.55	1.16	0.05	0.26	0.51	0.17
O-17	0.49	2.12	1.77	0.77	0.67	0.41	0.48	0.77
O-18	1.29	1.29	0.98	1.05	0.98	1.00	1.05	1.18
O-19	0.17	0.49	0.00	0.34	0.00	0.00	0.00	0.00
O-20	0.47	0.30	1.34	0.73	1.07	0.86	0.77	1.45
O-21	0.61	0.30	1.05	0.79	1.54	1.47	0.86	1.15
O-22	0.29	0.32	1.05	0.73	2.15	1.50	1.15	1.68
O-23	0.40	0.33	1.28	0.58	1.38	1.23	0.86	1.16
O-24	3.11	0.00	5.25	0.00	0.00	0.00	0.00	0.00

O-01: Management
O-02: Farmers & Farm Managers
O-03: Business & Financial Operations
O-04: Computer & Mathematics
O-05: Architecture & Engineering
O-06: Life, Physical & Social Sciences
O-07: Community & Social Services
O-08: Law
O-09: Education, Training & Libraries
O-10: Arts, Entertainment & Media
O-11: Healthcare Practitioners & Technicians
0-12: Healthcare Support
O-13: Protective Services
O-14: Food Preparation & Serving
O-15: Building & Ground Maintenance
O-16: Personal Care & Service
0-17: Sales
O-18: Office & Administrative Support
O-19: Fishing & Forestry
O-20: Construction & Excavation
O-21: Installation, Maintenance & Repair
O-22: Production
O-23: Transportation & Material Moving
O-24: Armed Forces

Table A-5. Industry Sector Location Quotients for Youngstown Area Employment Centers

Industry Sector	Downtown Youngstown	Boardman Commercial Corridor	Golden Triangle	Eastwood	Downtown Warren	Northside
I-01	0.05	0.00	0.20	0.00	0.00	0.15
I-02	0.48	0.77	0.37	0.27	0.52	0.63
I-03	0.11	0.53	3.11	0.18	0.34	0.31
I-04	0.53	0.89	0.55	0.14	0.70	0.46
I-05	0.31	2.56	0.84	3.82	0.53	0.98
I-06	0.96	0.78	0.32	0.12	0.70	0.96
I-07	1.75	0.71	0.63	4.83	3.02	0.00
I-08	1.09	1.18	0.31	0.58	1.63	1.15
I-09	0.93	0.84	0.53	0.42	1.47	0.74
I-10	2.22	0.55	0.23	0.44	0.94	2.38
I-11	0.70	1.97	0.82	2.49	0.85	0.82
I-12	1.14	0.89	0.36	0.40	1.01	0.87
I-13	2.89	0.35	0.11	0.25	4.88	0.15
I-14	1.89	0.00	0.00	0.00	4.93	0.00

I-01: Agriculture, forestry, fishing, hunting, and mining (NAICS 11, 21)

I-02: Construction (NAICS 23)

I-03: Manufacturing (NAICS 31-33)

I-04: Wholesale Trade (NAICS 42)

I-05: Retail Trade (NAICS 44-45)

I-06: Transportation, warehousing, and utilities (NAICS 48-49, 22)

I-07: Information (NAICS 51)

I-08: Finance, insurance, real estate, rental, and leasing (NAICS 52-53)

I-09: Professional, scientific, management, and administrative (NAICS 54-56)

I-10: Educational, health, and social services (NAICS 61-62)

I-11: Arts, entertainment, recreation, accommodation, and food services (NAICS 71-72)

I-12: Other services except public administration (NAICS 81)

I-13: Public administration (NAICS 92)

I-14: Armed services (NAICS 92)

Table A-6. Occupation Location Quotients for Youngstown Area Employment Centers

Occupation	Downtown Youngstown	Boardman Commercial Corridor	Golden Triangle	Eastwood	Downtown Warren	Northside
O-01	0.87	0.82	0.50	0.54	1.08	0.68
O-02	0.00	0.00	0.00	0.00	0.00	0.49
O-03	0.81	0.77	0.84	0.53	1.47	0.80
O-04	0.54	0.49	0.92	0.20	0.70	0.04
O-05	0.58	0.45	3.92	0.23	0.58	0.35
O-06	0.61	0.68	0.23	0.09	0.10	0.36
O-07	1.20	0.51	0.19	0.31	2.84	1.18
O-08	2.32	0.41	0.16	0.23	4.34	0.35
O-09	1.85	0.18	0.10	0.37	1.15	0.40
O-10	1.86	0.94	0.32	0.81	1.32	0.82
O-11	2.28	0.94	0.54	0.51	0.53	4.93
O-12	2.02	0.74	0.32	0.94	0.50	2.11
O-13	2.74	0.72	0.62	0.54	4.00	0.09
O-14	0.71	1.96	0.97	3.11	0.95	1.09
O-15	1.18	0.97	0.73	0.44	0.71	0.81
O-16	0.77	0.96	0.32	0.80	0.20	0.98
O-17	0.36	2.23	0.56	3.55	0.77	0.78
O-18	1.46	0.91	0.63	0.82	1.43	0.92
O-19	0.23	0.41	0.12	0.28	0.00	0.00
O-20	0.56	0.72	0.70	0.37	0.39	0.51
O-21	0.60	0.95	1.86	0.62	1.32	0.64
O-22	0.30	0.70	2.80	0.27	0.46	0.49
O-23	0.65	0.93	1.35	0.47	0.52	1.47
O-24	4.67	0.00	0.00	0.00	3.25	0.00

O-01: Management
O-02: Farmers & Farm Managers
O-03: Business & Financial Operations
O-04: Computer & Mathematics
O-05: Architecture & Engineering
O-06: Life, Physical & Social Sciences
O-07: Community & Social Services
O-08: Law
O-09: Education, Training & Libraries
O-10: Arts, Entertainment & Media
O-11: Healthcare Practitioners & Technicians
0-12: Healthcare Support
O-13: Protective Services
O-14: Food Preparation & Serving
O-15: Building & Ground Maintenance
O-16: Personal Care & Service
0-17: Sales
O-18: Office & Administrative Support
O-19: Fishing & Forestry
O-20: Construction & Excavation
O-21: Installation, Maintenance & Repair
O-22: Production
O-23: Transportation & Material Moving
O-24: Armed Forces

Table A-7. Northeast Ohio Metropolitan Area Wage Schedule

Occupation	Akron	Cleveland	Youngstown
Management	$86,050	$87,080	$75,980
Business & financial operations	$51,610	$51,920	$44,530
Computer & mathematics	$59,110	$60,840	$53,530
Architecture & engineering	$58,250	$58,710	$52,500
Life, physical, & social sciences	$54,260	$51,090	$49,210
Community & social services	$38,880	$37,920	$34,770
Law	$83,400	$85,170	$57,130
Education, training & libraries	$43,180	$42,310	$39,970
Arts, design, entertainment, sports & media	$35,000	$38,680	$30,400
Healthcare practitioners & technicians	$57,250	$56,810	$51,710
Healthcare support	$22,100	$23,140	$21,120
Protective services	$35,640	$32,910	$30,030
Food preparation & serving	$16,520	$17,240	$15,330
Building & grounds maintenance	$21,160	$22,110	$19,940
Personal care & service	$19,390	$22,870	$17,280
Sales	$29,810	$31,720	$27,000
Office & administrative support	$27,450	$28,270	$24,930
Construction & excavation	$37,710	$43,310	$40,210
Installation, maintenance & repair	$35,310	$37,080	$36,660
Production	$30,110	$31,870	$34,610
Transportation & material moving	$27,130	$28,400	$27,570

Data source: Bureau of Labor statistics (BLS), November 2003 Metropolitan Area Occupational Employment and wage Estimates; http://www.bls.gov.
Three of the occupation categories reported by the Census—farmers and farm managers, fishing and forestry, and armed forces—are not included in BLS wage estimates.

APPENDIX B: LOCATION QUOTIENT ANALYSIS

Location quotients (LQ) are used to measure the degree to which an industry (occupation) is concentrated or specialized in a region relative to a reference economy. In this report, LQs are used to measure the concentration or specialization of either an industry sector or occupational category in an employment center (Center) relative to the 11-county Northeast Ohio region.[35] Mathematically, the location quotient is the ratio of the industry (or occupation) employment share in the Center to the industry (or occupation) employment share across Northeast Ohio.

Typically, the reference economy is either a state—in this case, Ohio—or the U.S. However, in their analysis of employment centers in the Cleveland metropolitan area, Bogart and Ferry (1999) contend that the Cleveland-Akron consolidated metropolitan statistical area (CMSA) is a diverse economy that does not differ substantially from that of the U.S. in terms of sectoral employment composition. Consequently, their choice for a reference economy, that is, the seven-county Cleveland-Akron CMSA, is sufficiently robust. We agree with Bogart and Ferry, but extend their recommendation to include the 11-county Northeast Ohio region as the reference economy for this report's analysis.

LQs are useful in determining whether or not a region employs a large share of the workforce in a given industry (occupation) when compared to a reference economy. Technically, if an LQ is greater than 1.0, then the employment center has a higher concentration of an industry sector's (occupation category) employment when compared to the Northeast Ohio region as a whole. A very high LQ indicates a disproportionately large share of the workforce. For example, in Table 4 we see that the Mentor Center reports a manufacturing LQ of 1.92. This means that manufacturing employment in the Mentor Center is 92 percent higher than would be the case if the Center reflected the 11-county Northeast Ohio industry employment mix. Said another way, the Mentor Center has a manufacturing employment concentration level that is 1.9 times greater than found on average across Northeast Ohio.

Anderson and Bogart (2001) provide another interpretation of location quotients related to trading patterns. The authors state "if consumption of goods and services in each employment center is proportional to the metropolitan area's sectoral employment composition,

[35] In this report, 14 NAICS-based (North American Industry Classification System) industry sectors and 24 SOC-based (Standard Occupational Classification System) occupation categories are analyzed. The industry sectors and occupation categories are those selected by the Census Bureau for inclusion in the Census Transportation Planning Package 2000 (CTPP 2000). See Appendix A, Table A-1 for a detailed listing of industry sectors. See Appendix A, Table A-2 for a detailed listing of occupation categories.

then employment centers with relatively high employment in a sector presumably export that sector's output to the rest of the metropolitan area and to the wider economy. Strictly speaking, a location quotient greater than 1 in a sector indicates that the employment center specializes in that sector and is a net exporter, while a location quotient less than 1 indicates that the employment center is a net importer."

The selection of a LQ value that clearly identifies Centers that are net importers and exporters or which Centers have a significantly high concentration of an industry sector's (occupation) employment is left to the discretion of the analyst. After reviewing the literature, we decided that an industry sector or occupation category with a location quotient of 1.70 or greater would be considered a major industry or occupation in the respective employment center. An industry sector or occupation category with a location quotient between 1.20 and 1.69 would be considered a minor industry or occupation in the respective employment center.

APPENDIX C: EMPLOYMENT CENTER SIZE DISTRIBUTION

Work done by Giuliano and Small (1991), Bogart and Ferry (1999), and Anderson and Bogart (2001) shows that the rank-size rule is a reasonable approximation of the size distribution of employment centers (Centers) in a metropolitan area. The rank-size rule asserts that rank times size is constant throughout the distribution. Their work suggests that structure exists not only in the distribution of economic activity among the employment centers (industry and occupation specializations), but also in their size. Giuliano and Small characterized the size distribution of Centers using a Pareto distribution, that is, estimating a regression relating the log of the Center's rank (by size) and the log of the Center's employment:

$$\ln(\text{rank}) = b_0 + b_1 * \ln(\text{employment})$$

If the estimated coefficient on ln (employment) is not statistically different from -1 at a 95 percent significance level, then the rank-size rule is a reasonable approximation of the size distribution of employment centers in a given metropolitan area. Table C.1 summarizes the results of the rank-size rule regression for the Akron, Cleveland, and Youngstown metropolitan areas.

Table C.1 Rank Size Rule Regression Summary

Metropolitan Area	Intercept[a]	ln(Emp)[a]	R^2	Rank-Size Rule[b]
Akron	13.54	-1.28	0.89	Yes
	(1.67)	(0.17)		
Cleveland	13.70	-1.20	0.89	Yes
	(1.32)	(0.13)		
Youngstown	10.99	-1.08	0.72	Yes
	(3.05)	(0.33)		

[a] Standard errors are in parentheses.
[b] The variable Rank-Size Rule is "yes" if we accept the hypothesis that the coefficient on ln(employment) equals –1 at the 95 percent significance level.

According to Anderson and Bogart, the rank-size rule states that a regression of the logarithm of the employment center rank on the logarithm of the Center's employment level will have a slope of –1. This rule has been found to be a reasonable description of the size distribution of cities in a wide variety of places and over a wide range of time periods. A coefficient on ln(employment) that is less than one in absolute value implies that employment is more concentrated in larger employment centers than predicted by the rank-size rule. Conversely, a coefficient greater than one in absolute value implies that employment is less concentrated in larger employment centers than predicted by the rank-size rule.