5-2001

Manufacturing communities of Appalachian Tennessee 1958-1992

Fred A. Pierce

To the Graduate Council:

I am submitting herewith a thesis written by Fred A. Pierce entitled "Manufacturing communities of Appalachian Tennessee 1958-1992." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Geography.

Charles S. Aiken, Major Professor

We have read this thesis and recommend its acceptance:

Thomas L. Bell, Leonard W. Brinkman Jr.

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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Accepted for the Council:

Associate Vice Chancellor
And Dean of the Graduate School

Manufacturing Communities of Appalachian Tennessee 1958-1992

A Thesis

Presented for the

Master of Science

Degree

The University of Tennessee, Knoxville

Fred A. Pierce III

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ABSTRACT

Nonmetropolitan communities often orient development efforts around the attraction and retention of manufacturing employment. Manufacturing location has typically been explored using traditional methodologies, which focus on regional location factors. However, it is extremely difficult for nonmetropolitan communities to alter regional factors, and consequently, they focus their attention on the development of their local community infrastructure. For accurate interpretation and description of manufacturing location it is imperative that both manufacturing and community description be included.

This study examines the communities of Appalachian Tennessee with a comprehensive methodology that measures manufacturing not as an absolute, but as a component of the overall community, over a 34 year continuum. A principal component analysis is performed on seven data sets that contain fifty six community description variables. Five summary community components are produced. These descriptors are used as predictors for five measures of manufacturing location in stepwise multiple regression models for eight observation years. The resultant model fit and component trends mirror both national and Appalachian manufacturing developments. The regression residuals are

clustered into three groups and examined. Changes in the manufacturing sector are identified on a county by county basis. The analysis specifically targets changes in nonmetropolitan manufacturing. Shifts in local developments are illustrated and the symbiotic nature of metropolitan centers and their adjacent communities is demonstrated.

Two case studies, Greene and McMinn Counties, are identified as Appalachian Tennessee's premiere nonmetropolitan communities. Both communities have maintained their manufacturing sectors through the creation of economic development agencies, the hiring of experienced industrial recruiters, and the construction of new industrial parks and facilities. Despite shifts in the national economy toward information technologies and globalization these communities illustrate that many nonmetropolitan communities remain committed to the development of their manufacturing bases as the primary means of sustaining their economies.

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CHAPTER I

INTRODUCTION

American society has long concerned itself with the location of manufacturing activity. Industrialists, governors, civic leaders, even ministers, have extolled the virtues of industrial development (Cobb 1982). "Next to God, what this town needs is a cotton mill," proclaimed a Salisbury, North Carolina evangelist in the 1880s (quoted in Goldfield 1982). Manufacturing is regarded as the panacea for all economic ailments. It provides a basic form of employment and may have significant community building characteristics. These qualities, plus a high degree of locational mobility, make it particularly attractive in community development strategies (Lonsdale and Seyler 1979). The focal point of numerous nonmetropolitan communities' economic development programs often becomes manufacturing recruitment and retention (Lapping, Daniels, and Keller 1989). While some scholars predict decline in United States' manufacturing and subsequently decline in nonmetropolitan areas, others predict a greater integration of nonmetropolitan America in the evolving global economy through high-growth small and medium size manufactures

(Harris 1995; Malecki 1988; Ettlinger 1994; Wojan and Pulver 1995).

Successful industrial development depends on a complex set of factors. Traditionally, nonmetropolitan communities developed promotional activities around regional and local advantages. Steven Kale and Richard Lonsdale identified eleven of the most significant factors (Kale and Lonsdale 1979)

: Regional Factors:

availability of low cost labor
labor skills
labor productivity and "lack of" unionization
transportation
markets
environmental considerations
energy

: Local and Community Factors:

housing
developed sites and industrial parks
available buildings
community livability
community leadership

Numerous studies have identified the regional set as more important (Hart and Chestang 1978; Cromley and Leinbach 1981; Hart 1988; Johnson 1989; Johnson 1991; Barkley 1992; Blair 1995). With advances in communications, technology, and transportation, regional factors, while still significant, are becoming less important (Hart 1988). James Cobb noted that if "as locational theorists insisted labor costs, markets, raw materials and a host of other economic,

technical, or physical factors were still the basic site-selection determinants, many communities in several states could satisfy most of these criteria almost equally as well (1982)."

With so many suitable sites, industrial location is greatly influenced by community related factors (Hart 1988; Lapping, Daniels, and Keller 1989; Barkley 1992). Robert Cromley and Thomas Leinbach found community infrastructure, as measured by town size and availability of industrial sites, were more important determinants of manufacturing employment levels in nonmetropolitan Kentucky than labor supply (1981). They also discovered that access to highways had a declining influence. Steven Holloway and Timothy Bawden found little evidence to support labor factors as the primary determinant for nonmetropolitan industrialization in either Georgia or Wisconsin (1992). Factors like education levels and infrastructure expenditures were more significant.

Regional factors are difficult to alter, but community factors are an arena where a county or municipality can concentrate efforts and set itself apart. Karl Raitz surveyed Chamber of Commerce executives throughout the Southeast and discovered that even though many regarded community characteristics as the most insignificant location factors, their promotional brochures were filled with

references to livability: climate, amenities, and recreation (1988). Most went so far as to document the pleasantness of their community with graphs and tables. They were attempting to create a competitive advantage by aggressively marketing community factors.

Purpose

The purpose of this study is to examine Appalachian Tennessee's nonmetropolitan manufacturing communities with a comprehensive methodology. To incorporate a wide array of data that reflect changes in regional and community characteristics, and, consequently, identify which communities are perpetuating their economies through continued successful attraction and retention of industry. The hypothesis is that manufacturing communities can be identified by manufacturing's relevance in the community's socio-economic structure, rather than by size of the manufacturing base. Simplistic absolute measures such as the number of firms, value added by manufacture, and number of production workers correlate strongly with population. For example, Knox County is Appalachian Tennessee's most populous county. Regionally, it ranks second in the number of manufacturing firms (502), third in number of production

workers (14,400) and value added by manufacture (1.3 billion dollars), yet more personal income is derived from service (29.3%) and government (17.7%) employment than from manufacturing (14.1%)(County and City Data Book 1994). Because Knox County is more a service and government oriented community than a manufacturing one, it is important to examine the entire community in order to understand manufacturing. Rather than just a few select manufacturing indices, regional and local factors must be examined.

Communities do not exist in a vacuum. They are parts of regional linkages or networks that affect their economic, social, and demographic structures. Ron Shaffer concluded that the economic impact of nonmetropolitan industrialization is largely associated with workers' geographic spending patterns and business purchases (1979). In other words, multiplier effects associated with the location of a new factory are not necessarily restricted to the host community, especially with changes in communication, transportation, and technologies. Subsequently, a group of communities, metropolitan and nonmetropolitan, must be included in analysis to reflect these linkages. The economy is forever changing and communities are continually evolving. They grow, decline, or achieve a state of stability. It is important to examine

communities through a temporal continuum to assess consistency in development (Hart 1982).

Study Area

While many scholars have attempted to explore the distribution of manufacturing on the national, regional, and state scales, few geographers have attempted studies on a sub-state level. Adrian Esparza argued that while large-scale studies are enlightening they are not beneficial in addressing the localized nature of manufacturing (1990). Within a region some communities garner a greater concentration of manufacturing than others. Esparza felt that successful economic development policy could only be created at the community level (1990). Appalachian Tennessee was selected as the region for this study. The Appalachian Regional Commission's definition of Appalachian Tennessee is used (Figure 1-1).[1] The study area includes 50 of Tennessee's 95 counties.

Manufacturing first surpassed agriculture as the South's leading employer in 1958 (Hammond 1972).[2] Because 1958 and 1992 were years in which the Census of Manufactures

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[1] *Public Law 90-103 amended the Appalachian Development Act of 1965 (Public Law 89-4), resulting in 50 Appalachian Tennessee counties; Cannon County was added.*

[2] *Hammond's South is the 16 State region generally referred to as the Census South.*

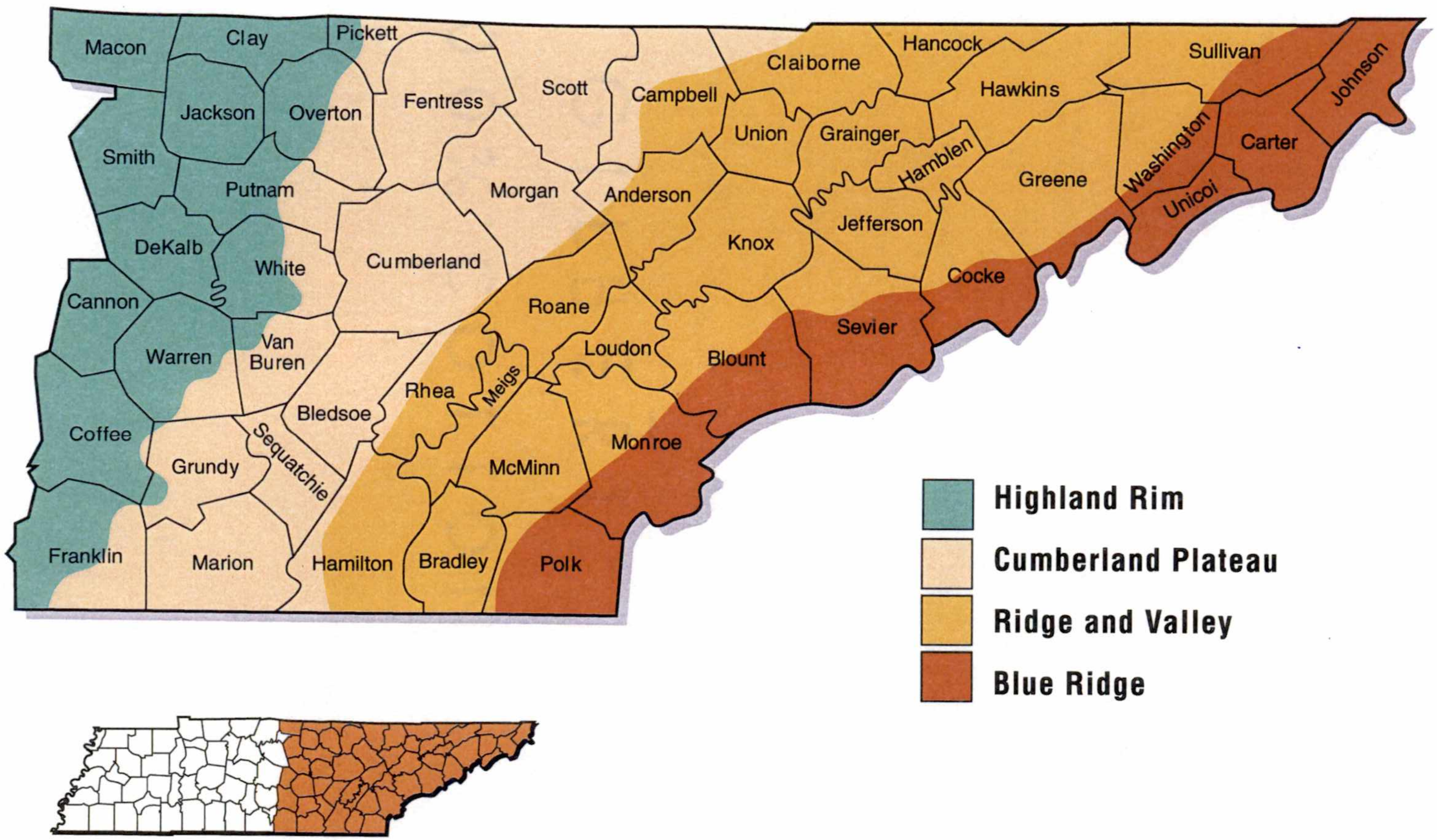


Figure 1-1. Appalachian Tennessee, Counties and Landform Regions.

was taken, the time period 1958 to 1992 is employed in this study. Nonmetropolitan communities whose commitment to the attraction and retention of industry are deemed significant are examined further to identify their approach to manufacturing development.

Charles Quittmeyer and Lorin Thompson explored the development of manufacturing in Appalachia between 1929 and 1958 in Thomas R. Ford's The Southern Appalachia Region.[3] Despite popular conceptions of Appalachian residents as unsuitable industrial employees, Quittmeyer and Thompson found manufacturing thriving in the region. In the 1950s Appalachian Tennessee was industrializing at a faster rate than most of Tennessee, Appalachia, and the nation.

Appalachian Tennessee is a group of counties with a variety of geographic, economic, and social characteristics. There are three Metropolitan Areas: Chattanooga, Knoxville, and Johnson City-Kingsport-Bristol (Tri-cities)(Figure 1-2). The region includes nonmetropolitan counties adjacent to Metropolitan Areas, nonmetropolitan counties along interstate highways, and remote or isolated nonmetropolitan counties without significant population concentrations. In 1990 Appalachian Tennessee had only six incorporated places

[3] *Quittmeyer and Thompson's region consisted of 37 Tennessee counties, Cannon, Clay, Coffee, De Kalb, Franklin, Jackson, Macon, Overton, Pickett, Putnam, Smith, Warren, and White were not included.*

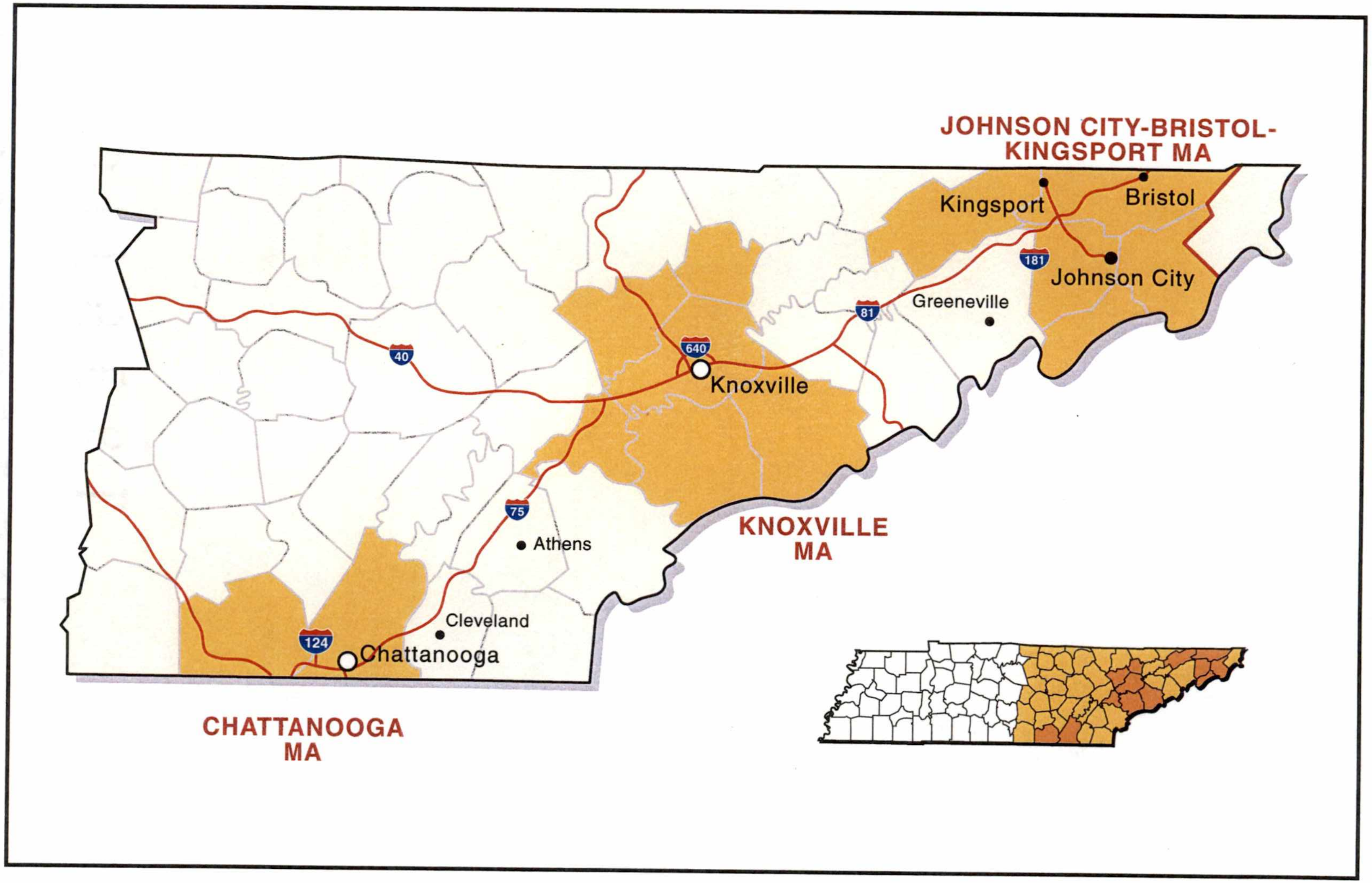


Figure 1-2. Appalachian Tennessee, Metropolitan Areas.

with populations greater than 25,000. Of the six, only Cleveland (Bradley County) was not in a Metropolitan Area (1990 Census of Population and Housing).

In 1992, 33.3% of Appalachian Tennessee's labor force was employed in manufacturing, well above the state average of 23.3% and the national average of 17.7%. Forty-four of Appalachian Tennessee's 50 counties had greater percents of their labor forces employed in manufacturing than the state. Eleven of the 50 counties had more than 40% their labor forces employed in manufacturing (County and City Data Book 1994). These statistics contrast sharply with data from the 1956 County and City Data Book, when the region (20.1%) was below both the state (21.8%) and the nation (25.9%) in percent of labor force employed in manufacturing. Since the 1950s, Appalachian Tennessee's economy has become heavily vested in manufacturing as a primary source of employment.

Historically, Tennessee was one of the most industrialized Southern states (Hartshorn, 1997). Commitment to industrial development in Appalachian Tennessee has been fervent. In 1968, citizens of Bradley County appealed to community leaders to organize a committee of 100 strictly for the purpose of economic and community development (Cobb 1982). In Morristown (Hamblen County), the efforts of Jack Fishman and the Industrial Board to fill their industrial park in the 1970s were nothing short of a

crusade and applauded by organizations such as the Appalachian Regional Development Commission (Newman 1981).

Data

The analysis utilizes a methodology that incorporates economic, social, and demographic data to ascertain the relative importance of manufacturing within communities. In this study a county is defined as a community. Measures of manufacturing are derived from data obtained from eight Census of Manufactures, 1958-1992.[4] The censuses are referred to as observation years. Measures of community are more complex. The Census Bureau produces comprehensive summaries of social, demographic, and economic data in the County and City Data Book. Social and demographic data are from the latest decennial Census of Population and economic data are from the most recent Censuses of Agriculture, Manufactures, Mineral Industries, Retail Trade, Services, and Wholesale Trade. All are reported at the county level. Both place of residence, household data, from the Census of Population and place of employment, payroll data, from the Censuses of Agriculture, Manufactures, Mineral Industries, Retail Trade, Services, and Wholesale Trade are

[4] *The Census of Manufactures was published: 1958, 1963, 1967, 1972, 1977, 1982, 1987 and 1992. The 1997 edition was not available when data was examined.*

incorporated. Using a combination of household and payroll data should offset the bias toward metropolitan counties inherent in workplace data (Hart 1988). Observation years and data sets are matched to represent the closest associations. In other words, a data set's components are those most representative of the observation year. Because the multiplier effects associated with changes in the industrial economy are not instantaneous, the temporal difference should be of little consequence. Table 1-1 summarizes the relationships between data sets from County and City Data Books and the data from the Censuses of Agriculture, Manufactures, Mineral Industries, Population Retail Trade, Services, and Wholesale Trade, as well as observation years.

Table 1-1. Data Sets and Observation Years.

Population Census	Censuses of Manufactures, Retail Trade Services, Wholesale Trade	Census of Agriculture	County and City Data Books (Data Sets)	Observation Years
1960	1958	1959	1962	1958
	1963	1964	1967	1963
1970	1967	1969	1972	1967
	1972	1974	1977	1972
1980	1977	1978	1983	1977
	1982	1982	1988	1982
1990	1987	1987	1994	1987
				1992

CHAPTER II

MANUFACTURING LOCATION AND COMMUNITY CHARACTERISTICS

Southern Nonmetropolitan Industrialization

Traditionally, the South lacked substantial industrial activity despite a large cache of natural resources. Agricultural production dominated economic life and the region's first manufacturing ventures. The pioneer industry was cotton textile manufacturing. As early as the 1830s locally financed mills were developed along southern rivers (Goldfield 1982). However, with short supplies of white labor and transportation routes, development was extremely localized. Following the Civil War, there were concerted efforts to promote Southern industrialization. Editors of prominent Southern newspapers, like Henry Grady of Atlanta or William Mahone of Richmond, preached the vision of a prosperous "New South" replete with industrial development (Eller 1982). Boosterism became rampant among local community leaders as they pursued industrial development with crusade-like vigor. The "Cotton Mill Campaign" of the 1880s and 1890s lured cotton textile producers in New England to Southern locations (Goldfield 1982). The typical relocating textile mill sought access to water, electricity,

and white farmers (Johnson 1997). The "Great Hustle" was on and by 1925 the South surpassed New England in the number of spindles (Simpson 1966).

By the 1930s, two of the country's "sickest industries" were agriculture and textiles, the backbone of the Southern economy (Eller 1982). Consequently, communities began to pursue alternate forms of employment (Goldfield 1982). Mississippi was the first Southern state to fully embrace the new crusade for anything industrial with their 1936 subsidization program, Balance Agriculture With Industry (Cobb 1982). Since the Second World War many Southern communities have engaged in, what some have called shameless, self promotion by industrial "buffalo hunters" to attract industry from more established locales (Johnson 1997).

Community promotion and manufacturing recruitment worked. By 1958, manufacturing surpassed agriculture as the South's leading employer (Hammond 1972). The rise in Southern industrialization was specifically related to declines in agricultural employment and maturation of industries in the American Manufacturing Belt (Wheeler and Muller 1986; Hartshorn 1997; Johnson 1997). In 1950 manufacturing was primarily an urban activity associated with first and second order cities. These cities such as Boston or Chicago were centers of finance and distribution

(Hartshorn 1997). The South had none of these centers. It was largely a region of small cities and towns oriented around agricultural processing and wholesale and retail trade (Lonsdale and Browning 1971; Goldfield 1982; Glasmeier and Leichenko 1996).

When industry began moving to the South, the locational pattern changed. Manufacturing was no longer relegated to first and second order cities. Manufacturing in the United States became more nonmetropolitan as it began to decentralize. Between 1962 and 1978 nonmetropolitan areas added 1.8 million manufacturing jobs, 56% of the total increase in manufacturing employment (Harren and Holling 1979). Most of the growth was associated with product maturation and the development of branch plants (Leinbach and Cromely 1982; Glasmeier and Leichenko 1996). Early innovative stages of the product life cycle are dominated by low capital intensity, short production runs, and changing technologies. Engineering and skilled labor are the primary inputs for production. Product development typically occurs in large urban areas, centers of innovation where labor costs are substantially higher. Once a production method is standardized, new machinery increases capital intensity. Unskilled and semi-skilled labor becomes the dominant input in mass-produced, consumer-oriented products such as appliances. In the mature standardized phase of the product

life cycle, production is often relocated to branch plants in areas with lower labor costs, often nonmetropolitan areas (Erickson and Leinbach 1979; Cromley and Leinbach 1981; Leinbach and Cromely 1982; Glasmeier and Leichenko 1996).

Product maturation and subsequent branch plant development made the 1960s and early 1970s the most significant period of nonmetropolitan industrial growth. More than half of the 1.8 million nonmetropolitan manufacturing employment increase between 1962 and 1978 occurred prior to 1967; the increase was essentially complete by the economic recession of 1974 (Harren and Holling 1979).

In the late 1970s, growth in nonmetropolitan manufacturing employment weakened, and during the recession of 1979-1982 virtually every nonmetropolitan county in the nation experienced relative and absolute manufacturing employment losses (Barkley 1992). The recovery of the middle 1980s, resulted in renewed nonmetropolitan manufacturing employment growth, but the decline was not completely reversed (Bluestone and Long 1989). Since the 1980s manufacturing employment in nonmetropolitan areas has grown, but most analysts believe that the era of rapid nonmetropolitan industrialization ended (Barkley 1992).

Many researchers believe the future of manufacturing growth is in urban agglomerations. Scott argued that new

production scenarios such as global economic restructuring, short production runs, niche marketing, and innovative production technologies require agglomeration (1988). These production systems produce uncertainty and instability, which undermine internal economies of scale. Subsequently, firms seek external economies of scale by locating facilities in close to services, thereby reducing production costs (Scott 1988). Furthermore, just-in-time production creates manufacturing scenarios that result in dispersed agglomerations. To reduce inventory and storage costs, production cycle times, as well as improving quality control, manufacturers locate within reasonable distance of assembly facilities (Inman 1991). This proximity results in a spaced or dispersed clustering around central facilities rather than in an urban clustering (Inman 1991; Linge 1991). Moreover, national trade agreements, including the North American Free Trade Agreement (NAFTA) and the Caribbean Basin Initiative, created areas of competition featuring low-wage labor with reasonable proximity to markets in the United States (Johnson 1997). Low-wage labor and market proximity, once the strengths of nonmetropolitan southern communities, are now strengths of northern Mexico and the Caribbean Basin (South 1990; Bates 1994). In short, some researchers predict the South's dispersed pattern of

manufacturing will vanish in the age of global restructuring.

Examining manufacturing in the Southeast, Truman Hartshorn concluded that data from 1992 Census of Manufactures indicate that most of the South's industrial activity is associated with the realm's largest metropolitan centers (1997). Hartshorn's analysis was based on the examination of one measure, value added by manufacture. Does this single absolute variable truly represent all of the complexities associated with manufacturing location in the Southeast? Should local developers abandon attempts to attract manufacturing if their community is not one of the bastions of urbanity? Merrill Johnson argued that metropolitan and select nonmetropolitan counties were the major beneficiaries of recent Southern industrial growth. However, two components in Johnson's analysis, manufacturing employment as a percentage of total employment and change in manufacturing employment share, clearly indicate a strong correlation between manufacturing and nonmetropolitan counties (1997). The question arises, how can select nonmetropolitan manufacturing communities be systematically identified?

John Fraser Hart documented movement of manufacturing into small towns in the Midwest (1988). He argued the future of small towns is dependent on conversion from

agricultural to manufacturing centers. Manufacturing can stimulate economic activity and ward off community deterioration. Hart argued that conversion occurs only through concerted efforts by people who believed in their communities. However, he offered no systematic method for identifying communities with aggressive leadership.

Traditional Manufacturing Indices

Geographers have long been concerned with areal extent of phenomena. An early focus for economic and industrial geographers was the location and distribution of manufacturing. Early studies employed five basic approaches: industry, region, location factors, individual factory, and area potential (Table 2-1). Despite the array of approaches, most early studies were of an industry or region and focused on the development or delimitation of manufacturing regions using a variety of industrial criteria.

Traditionally, studies of manufacturing location used Census of Manufactures indices (e.g., number of firms, value added by manufacture, and number of production employees) in absolute or ratio form to determine concentration and areal extent. The predicament of which index or indices were most

Table 2-1. Traditional Approaches to Manufacturing Studies.

Approach	Areal Extent	Purpose
Industry	Multi-region	Explore the relationships and characteristics of a single industry (e.g., textiles, steel, automotive).
Region	Single Region	Explore the spatial pattern of several industries within a designated region (e.g., city, county, state, metropolitan area).
Location Factors	Multi-region	Explore particular relationships related to the location of an industry or factory (e.g., raw materials, markets, low-cost or skilled labor).
Individual Factory	Multi-region	Explore relationships between the factory and the regions it affects, and the factory and the regions, usually local, that affect it (e.g., linkages, supply regions, market regions, multiplier affects).
Area Potential	Single Region	A predictive effort to discover a region suitable for the location of new or additional manufacturing (e.g., labor availability, market potential, energy costs).

Source: Miller 1962.

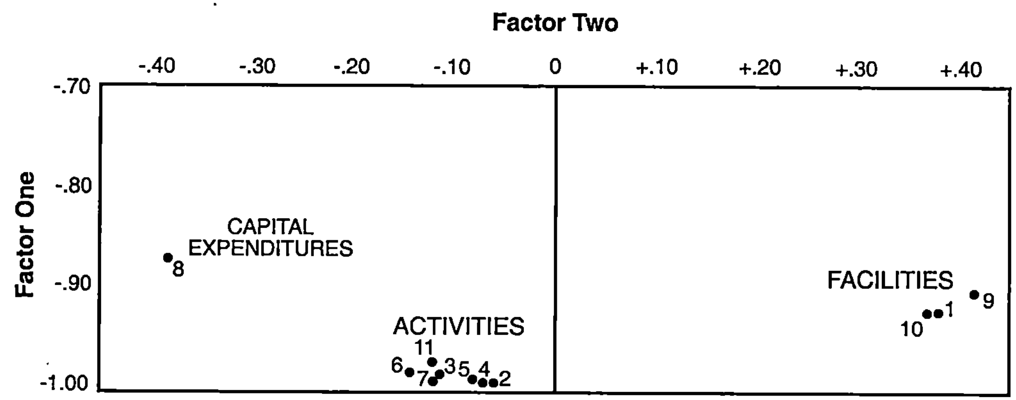
elucidating created ample opportunity for scholarly debate. John Alexander and James Lindberg concluded that due to the high correlation among the thirteen indices it really did not matter which was used (Table 2-2)(1961). With the possible exception of capital expenditures (8), the mapping of any one index would produce virtually the same location pattern as the mapping of any other index. For instance, if value added by manufacture and number of production workers were each mapped and patterns compared they would essentially be identical.

Morrison, Scripter, and Smith argued that Alexander and Lindberg had oversimplified the relationship (1968). They used the eleven indices reported in the 1958 Census of Manufactures in principal components analysis. The analysis resulted in two components, the first of which accounted for 92% of the total variation in 2,474 United States counties. However, when the indices were plotted as vectors oriented to their component loadings, Morrison, Scripter, and Smith concluded that there were three distinct measures of manufacturing (Figure 2-1). "Activities" included indices associated with manufacturing: number of employees, payroll for all employees, number of production workers, man-hours for production workers, wages for production workers, and value added by manufacturing. "Facilities" consisted of the number of establishments, number of establishments with 1-19

Table 2-2. Alexander and Lindberg. Measures of Manufacturing, United States 1954. Coefficients of Correlation for 2416 Areal Units (Metropolitan Areas and Counties).

Criteria		2 E	3 VEP	4 PW	5 PMH	6 VW	7 VA	8 CE	9 47E	10 47VA	11 T-1	12 T-20	13 T-100
1.	T (number of establishments)	.94	.92	.94	.93	.91	.92	.40	.92	.93	.99	.99	.93
2.	E (number of employees)		.99	.99	.99	.99	.99	.62	.99	.99	.99	.93	.99
3.	VEP (value of employee payroll)			.99	.99	.99	.99	.66	.98	.98	.91	.92	.98
4.	PW (production workers)				.99	.99	.99	.62	.99	.99	.93	.93	.99
5.	PMH (number of production man-hours)					.99	.99	.63	.99	.99	.92	.93	.99
6.	VW (value of wages paid production workers)						.99	.68	.98	.98	.90	.91	.98
7.	VA (value added)							.65	.99	.99	.91	.92	.98
8.	CE (1954 capital expenditures)								.61	.60	.38	.59	.46
9.	47E (number of employees 1947)									.99	.92	.92	.98
10.	47VA (value added 1947)										.92	.93	.98
11.	T-1 (number of establishments 1954 with 1-19 employees)											.99	.92
12.	T-20 (number of establishments 1954 with 20-99 employees)												.93
13.	T-100 (number of establishments with 100 or more employees)												

Source: Alexander and Lindberg 1961, p.73.



1- Number of Establishments
2- Number of Employees
3- Payroll for All Employees
4- Production Workers
5- Man-hours for Production Workers
6- Wages for Production Workers
7- Adjusted Value Added by Manufacturing
8- New Capital Expenditures
9- Number of Establishments 1-19 Employees
10- Number of Establishments 20-99 Employees
11- Number of Establishments 100+ Employees

Figure 2-1. Morrison, Scripter, and Smith. Component Loading for 1958 Indices of Manufacturing. Source: Morrison, Scripter, and Smith, 1968.

employees, and number of establishments with 20-99 employees. The "new capital expenditures" index represented a measure unto itself. Morrison, Scripter, and Smith concluded that each of the three had different areal distributions; and, therefore, all should be used to capture the true nature of manufacturing distribution. With the exception of Alexander and Lindberg, most scholars incorporated multiple criteria, and their results delimited manufacturing regions centered on the urbanized areas of the United States (Strong 1937; Wright 1938; Jones 1938; Hartshorne 1929; Thompson 1955; Alexander and Lindberg 1961; Morrison, Scripter, and Smith 1968).

Zelinsky's Manufacturing Indices

Studies using Census of Manufactures and other industrial data report place of work data and are inherently biased toward metropolitan areas (Hart 1988). Manufacturing establishments are located in communities for an array of reasons that are not included in traditional manufacturing location studies. Other components should be considered in analyzing manufacturing communities.

Wilbur Zelinsky argued that measures of manufacturing activity should incorporate social and economic factors

(1958). He concluded the five best variables for revealing the distribution of manufacturing were:

Value added by manufacture

Number of production workers

Value added per production worker

Per-capita value added by manufacture

Number of production workers per-capita.

Zelinsky argued value added by manufacture and number of production workers, while similar (absolute numbers), were different enough to warrant separate consideration. Value added per production worker provided a measure of intensity and was a proxy for the level of sophistication in manufacturing processes. Per-capita value added by manufacture and number of production workers per-capita were measures which allowed comparison of locales, something that absolute numbers failed to grant (Zelinsky 1958). Zelinsky's indices provide multiple criteria, and one aspect of community data, population, which is incorporated via per-capita measures. I use Zelinsky's measures and summary socio-economic community data to analyze manufacturing location.

Measures of Community

The summary socio-economic community data for Appalachian Tennessee counties in the County and City Data Books are inconsistent. For example, the 1962 County and City Data Book includes 160 measures of community data, whereas the 1994 book presents 240.[1] The decision was made to examine 56 variables that are consistent among all data sets 1962 through 1994 (Table 2-3).[2,3] The refined data sets included an array of economic, demographic, and quality of life information.

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[1] *The number of variables ranged from a low of 140 in 1967 to a high of 296 in 1977.*

[2] *The original data sets for the study contained 58 variables. Wholesale trade sales and number of wholesale trade employees were variables for which census disclosure rules resulted in a large number of omissions. Any county with missing data was removed from analysis. These two variables loaded significantly on only one component and it was well defined by other variables. Because of limited scope, Wholesale trades sales and number of wholesale trade employees were removed.*

[3] *The 56 variables and the year of measurement are described in the Appendix.*

Table 2-3. Community Variables 1962-1994.

Item	Variable
1	County name
2	FIPS code (Census designated numeric identifier)
3	Land area
4	Total population
5	Rank in population
6	Population per square mile
7	Percent of population change
8	Percent of population nonwhite
9	Percent of population under 5 years of age
10	Percent of population 18 years and older
11	Percent of population 65 years or older
12	Total vote cast for president
13	Leading party for president
14	Percent of vote cast for the leading party for president
15	Live births
16	Deaths
17	Number of families
18	Median family income
19	Percentage of persons 25 years and older who have completed high school and more
20	Number of students enrolled in kindergarten - high school, public and private
21	Total civilian labor force
22	Percent of civilian labor force unemployed
23	Percent of civilian labor force employed in manufacturing
24	Percent of civilian labor force employed in wholesale and retail trade
25	Percent of employed persons (civilian labor force) working outside county
26	Percent of employed persons (civilian labor force) using public transportation to work
27	Number of housing units
28	Percent of single family housing units
29	Percent of housing units built during previous census period
30	Total occupied housing units
31	Percent of occupied housing units with 1.01 or more persons per room
32	Total number of owner occupied housing units
33	Median value of owner occupied housing units
34	Total number of renter occupied housing units
35	Median gross rent per month of renter occupied housing units
36	Total bank deposits
37	Capital of savings and loan associations
38	Total general revenue of local government
39	Total general expenditures by local government
40	Total number of manufacturing establishments
41	Percent of manufacturing establishments with 100 or more employees
42	Number of manufacturing employees
43	Payroll of employees in manufacturing
44	Number of manufacturing production workers
45	Number of manufacturing production work hours
46	Manufacturing production worker wages
47	Value added by manufacture
48	Number of retail trade establishments
49	Number of retail trade establishments with payroll
50	Sales of all retail trade establishments
51	Number of wholesale trade establishments
52	Number of service establishments with payroll
53	Land in farms
54	Number of farms
55	Average size of farms
56	Percent of farms under 10 acres (1959-1974) and under 50 (1978-1987) - small
57	Percent of farms above 1000 acres (1959-1974) and above 500 (1978-1987) - large
58	Total value of farm products sold

Principal Component Analysis and Component Interpretation

Fifty-six variables are a lot to consider in any analysis.[4] Principal components analysis was employed to decrease the number of community variables to a more manageable set. Principal components analysis reduces a data set by partitioning variance among variables. The resulting subsets (components) are linear combinations of parts of variance formed from the original variables. The common variance, that variance which correlates with other variables in the matrix, is assigned to a principal component, which is standardized with a mean of zero and a variance of one (Weiss 1970; Kim and Mueller 1978). Each variable shares common variance with resultant components and has a factor loading that correlates with each component (Norušis 1994). Loading values range from -1.0 to 1.0. For the purposes of this analysis, any variable with a component loading above 0.4 (absolute value) indicates a significant correlation between variable and component.

Since components tend to correlate with many variables, the data can be rotated to redistribute the variance over the data set. A varimax rotation (orthogonal) was used because it minimizes the number of variables with high

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[4] *Item 1 (county name) and Item 2 (FIPS code, the census designated numeric identifier) are used for identification purposes only and not variables used in analysis.*

component loadings, reducing colinearity and making the components easier to interpret (Norušis 1994). Only the most significant components, eigenvalues greater than 1.0, were used in further analysis.

Principal components analysis was performed on all data sets 1962 through 1994. The analysis reduced 56 variables into as few as six significant components for 1962 and as many as eight for 1972, 1983, 1988, and 1994. Component loadings were examined to determine what each represented in terms of community description. When a component was consistent, the variables correlating with a component were similar from year to year, it was grouped across data sets and given a name representative of the interpretation.

The first component, derived from each data set, community size, correlates with well over 60% (37 of 56) of all variables (Table 2-4). Correlations are extremely high on variables measuring absolute numbers, e.g., people, houses, firms, workers, value. Variables that loaded weaker represent median values, e.g., median income and median gross rents. Only two variables, rank in population (5) and percent of single family dwellings (28), have negative correlations. Rank in population is a small number for counties with large populations; therefore, the variable is inversely related to size. More densely populated counties have a larger number of multi-family dwellings

Table 2-4. Loadings for Community Size Component, Data Sets 1962-1994.

Item	Year and Component Created Variable	1962 (1)	1967 (1)	1972 (1)	1977 (1)	1983 (1)	1988 (1)	1994 (1)
4	Population	.97613	.97849	.97647	.97669	.96776	.97515	.97078
5	Rank Population	-.55116	-.57882	-.63168	-.53065	-.52261	-.54001	-.51738
6	Pop. / Square Mile	.90205	.90725	.91342	.90395	.89138	.89577	.89469
8	% Nonwhite	.69904	.70815	.72096	.75394	.79772	.77799	.80817
12	Total Vote Pres	.96355	.97820	.97882	.97196	.96866	.97634	.96895
15	Births	.97585	.97121	.97965	.98250	.97944	.98040	.98106
16	Deaths	.97946	.98490	.97666	.98035	.97568	.96270	.97347
17	Families	.97140	.97818	.97659	.98182	.96486	.97222	.96615
18	Median Income	.53210	.56405	.53116	.56727	.51092	.47756	.46933
19	% > 25 High School	.58976	.62946	.60009	.61651	.64411	.62812	.61329
20	School Population	.97312	.97947	.98166	.98206	.97392	.97937	.97612
21	Labor Force	.97108	.97772	.97759	.97934	.96823	.96919	.96975
24	% Employ Whl & Rtl	.45675	.48287	.46038	.46382		.60135	.40617
26	Public Transport	.95729	.94672	.60397	.60512	.87725	.86415	.67041
27	Housing Units	.97317	.97985	.97782	.97878	.96741	.97452	.97098
28	% Single Family	-.80742	-.83023	-.71058	-.74009	-.47794	-.55028	-.43901
30	Occupied Units	.97335	.97991	.97823	.97911	.96776	.97476	.97096
32	Owner Occup Units	.96235	.97021	.97236	.97078	.95855	.96614	.95985
33	Median Value Units	.58260	.60722	.44082	.45705	.44907	.48875	.53296
34	Renter Occup Units	.98222	.98640	.98110	.98656	.97386	.97991	.98070
35	Median Gross Rent	.41366	.44519	.46628	.49473	.45249	.48330	.50648
36	Bank Deposits	.98423	.98483	.97556	.97756	.96493	.97618	.96686
37	S & L Deposits	.86607	.86521	.86227	.92774	.92154	.92666	.93418
38	General Revenue	.98755	.98797	.98946	.99055	.97884	.98444	.96730
39	General Expend	.98295	.97336	.98076	.98855	.98388	.97218	.96592
40	Manufact Establish	.96836	.96288	.94747	.96458	.95210	.96596	.96939
42	Manufact Employees	.91368	.89964	.94320	.93398	.41281	.88233	.88442
43	Payroll	.87266	.83891	.91673	.91891	.86101	.83805	.83733
44	Production Workers	.91723	.92030	.94670	.93419	.89608	.88845	.88008
45	PW Hours	.91259	.91402	.94133	.93394	.89577	.88354	.86991
46	PW Wages	.88537	.88664	.92433	.92762	.88018	.84503	.82350
47	Value Added	.86271	.86935	.89863	.88973	.82801	.79849	.81006
48	Retail Trade Est	.97457	.97542	.97277	.97066	.96223	.96942	.96751
49	R T with Payroll	.97331	.97801	.97261	.97323	.96234	.96672	.96742
50	R T Sales	.98387	.98251	.98270	.98590	.97219	.97256	.97614
51	Whole Trade Est	.98008	.98213	.97432	.97938	.98344	.98573	.98746
52	Service Establish	.97648	.97909		.97221	.96830	.97132	.97683

(apartments and condominiums), so the percent of single family dwellings is larger in less densely populated counties, which explains the negative correlation. All other significant variables are positively correlated, indicating the larger the number the more significant the relationship. Clearly, this component measures community size.

The second most consistent component I identify as community vibrancy (Table 2-5). It is second in all data sets. Median income (18), percent of persons 25 and older who completed high school (19), median value of owner occupied housing units (33), median gross rent per month of renter-occupied housing (35), are positively correlated in all data sets. These variables measure family wealth, housing quality, and education. In addition, the component is sensitive to other housing issues. The percent of single-family housing units (28) in data sets 1962-1977 and percent of occupied housing units with more than one person per room (31) 1972-1994 are negatively correlated. Therefore, communities with large percentages of single family dwellings or overcrowded housing negatively impact this component. Measures of population change are also significant. Percent population change (7) has a strong positive correlation in data sets 1962 through 1977.

Table 2-5. Component Loadings for Community Vibrancy, Data Sets 1962-1994.

Item	Year and Component Created Variable	1962 (2)	1967 (2)	1972 (2)	1977 (2)	1983 (2)	1988 (2)	1994 (2)
5	Rank Population	-.67784	-.60016	-.63168	-.53065			-.45655
7	% Population Change	.91250	.91040	.80386	.81026			
9	% Population < 5	.56834	.52471			-.55263	-.64333	
10	% Population > 18					.65553	.72054	
11	% Population > 65	-.73577	-.74131	-.45486	-.58942			
18	Median Income	.77393	.74936	.67105	.69853	.68873	.66151	.77823
19	% > 25 High School	.67314	.62439	.64135	.65820	.59218	.60880	.65987
22	Unemployed						-.70487	-.61055
23	% Employ Manufact	.60548	.61211					
24	% Employ Whl & Rtl	.57272	.45100	.58781	.47590			
25	Work Outside County			-.43025				
28	% Single Family	-.46221	-.42104	-.62724	-.55469			
29	% Built Prev Decade	.86638	.87110	.78270	.75352			
31	% Occ Units > 1.01			-.55742	-.49182	.74199	-.81876	-.66235
33	Median Value Units	.67145	.59603	.67417	.63023	.78615	.73540	.66081
35	Median Gross Rent	.83956	.80568	.76716	.71493	.68195	.60505	.62589
41	% Manufact 100 Emp	.74015	.72659	.47392				
52	Service Establish			.53053				

Percent population 18 and older (10) is positively correlated, whereas percent population five and under (9) is negatively correlated in 1983 and 1988.[5] During these two observation years, increases in working age population are more significant than just increases in population. In all data sets, except 1994, this component is sensitive to population adjustments. In the 1962 through 1977 data sets, the employment structure of the county, the types of work in which people are employed, is significant. Percent of civilian labor force employed in manufacturing (23) 1962-

[5] *Item 10, percent of population 18 years and older was percent of population 21 years and older in the 1962 and 1967 data sets. Since either distinction measures working-age people they were treated as the same variable.*

1967, percent of the civilian labor force employed in wholesale and retail trade (24) 1962-1977, and percent of manufacturing firms with more than 100 employees (41) 1962-1977, are positively correlated. Issues of income, education, housing, population change, and employment sectors combined indicate this component explains economic health, or community vibrancy.

The small-scale agriculture component is oriented toward small or part-time agricultural enterprises (Table 2-6). It has a strong positive correlation with percent of small farms (56), farms under 10 acres in data sets 1962 through 1977 and under 50 acres in data sets 1983 through 1994, for all data sets. Additionally, it has and a significant positive correlation with number of farms (54) for 1967 through 1977 and 1988. Moreover, it has strong negative correlations with percent of large farms (57), farms above 1,000 acres in data sets 1962 through 1977 and above 500 acres in data sets 1983 through 1994, and average farm size (55). Conversely, the large-scale agriculture component has strong positive correlations with land in farms (53), number of farms (54), total value of farm products sold (58), and total land area (3) (Table 2-7).[6] All four variables are related to farm size in the

[6] *Item 58, total value of farm products sold includes all farms in the 1962 and 1967 data sets, but only farms with more than $2,500 in sales for all other sets.*

Table 2-6. Loadings for Small-scale Agriculture Component, Data Sets 1962-1994.

Item	Year and Component Created Variable	1962 (5)	1967 (3)	1972 (3)	1977 (3)	1983 (3)	1988 (3)	1994 (3)
9	% Population < 5					-.54512	-.40181	
10	% Population > 18				.42548	.41205		
13	Leading Party				.64158			
14	% Cast Lead Party			.70490			.73435	
23	% Employed Manufact	-.43679						
25	Work Outside County	.47870						
26	Public Transport			.43605	.46382			
29	% Built Prev Decade					-.46331		-.45531
54	Number of Farms		.43802	.46020	.44463		.43796	
55	Average Farm Size	-.88580	-.93130	-.91385	-.94905	-.92971	-.92101	-.93171
56	% Small Farms	.86712	.90303	.90352	.85958	.90786	.86607	.86874
57	% Large Farms	-.62714	-.81314	-.70490	-.76502	-.88649	-.84791	-.88030

Table 2-7. Loadings for Large-scale Agriculture Component, Data Sets 1962-1994.

Item	Year and Component Created Variable	1962 (4)	1967 (5)	1972 (4)	1977 (4)	1983 (4)	1988 (4)	1994 (5)
3	Land Area	.60283	.66830	.40355	.49090	.52236	.60560	.40448
53	Land in Farms	.89989	.87514	.93397	.93778	.91144	.92114	.96238
54	Number of Farms	.86046	.82218	.80978	.83693	.78072	.80547	.88315
58	Value Farm Products	.89989	.80783	.77879	.79731	.84556	.84732	.76043

agricultural economy. No other variables correlate significantly with large-scale agriculture.

Population structure is the only other component created in every data set (Table 2-8). The percent of population over 18 (10) and percent of population over 65 (11) have significant correlations for all data sets. These two variables are positively correlated in the 1962-1977 data sets, and the percent of population under five (9) and percent of occupied housing with 1.01 or more persons per

Table 2-8. Loadings for Population Structure Component, Data Sets 1962-1994.

Item	Year and Component Created Variable	1962 (3)	1967 (4)	1972 (5)	1977 (5)	1983 (5)	1988 (7)	1994 (6)
3	Land Area	-.57324	-.45317					
5	Rank Population					-.41610		
7	% Population Change					.53921		
9	% Population < 5	-.66367	-.60296	-.84504	-.81133			-.81605
10	% Population > 18	.82058	.76078	.76292	.79271	-.46867	-.43107	.82568
11	% Population > 65	.44207	.45606	.72811	.68534	-.86994	-.81309	.61748
13	Leading Party					.61464		
14	% Cast Lead Party				.57059			
18	Median Income						.40371	
22	Unemployed	-.71751	-.73233					
31	% Occ Units > 1.01	-.77232	-.73562	-.53935	-.57237			-.53483
53	Land in Farms		.42035					
57	% Large Farms	-.53662						

room (31) is negatively correlated. People over 18 with few young children are significant in explaining the variance in these data sets. The strongest correlation is with percent of population older than 18. Therefore, the component is most influenced by working-age people. This correlation is replicated in the 1994 data set. In the intervening data sets, 1983 and 1988, percent of population over 18 and 65 are negatively correlated. The correlations for percent of population older than 65 is nearly double that for the percent of population older than 18. Large concentrations of elderly people have a negative impact in 1983 and 1988. This component, while emphasizing different population cohorts in 1983 and 1988, nonetheless, addresses population structure in each data set.

Five other components are created by the data sets, varying among them. Variable correlation is neither numerous nor consistent. A political component is created in the 1962, 1967, 1972, and 1994 data sets (Table 2-9). Vote cast for the leading party for president (14) has a significant correlation in four sets, and percent of the vote cast for the leading party for president (13) has a significant correlation in 1962, 1967, and 1994. The 1967, 1977, 1983, 1988, and 1994 data sets produce a commuting component (Table 2-10). Percent of persons working outside their counties of residence (25) has a strong negative correlation in each set. A manufacturing employment component is created in data sets 1972 through 1988 (Table 2-11). Percent of the civilian labor force employed in manufacturing (23) has a strong positive correlation in 1972 and 1977 and a strong negative correlation in 1977 and 1973. Moreover, percent of firms with 100 or more employees (41) has a significant correlation in data sets 1972 through 1983 and is positively correlated in 1972 and negatively correlated in 1977 and 1983.

The final identifiable component is related to growth and is created only in the 1983 and 1988 data sets (Table 2-12). In 1983: percent of population change (7), percent of the vote cast for the leading party for president (14), percent of the civilian labor force unemployed (22), and

Table 2-9. Loadings for Political Component, Data Sets 1962-1994.

Item	Variable (Year and Component Created)	1962 (6)	1967 (6)	1972 (8)	1977 (-)	1983 (-)	1988 (-)	1994 (7)
8	% Nonwhite			.40871				
11	% Population > 65							-.65501
13	Leading Party	.81200	.87368	.85228				.53577
14	% Cast Lead Party	.62676	-.66743					-.62169
28	% Single Family							-.62948

Table 2-10. Loadings for Commuting Component, Data Sets 1962-1994.

Item	Variable (Year and Component Created)	1962 (-)	1967 (7)	1972 (-)	1977 (7)	1983 (7)	1988 (6)	1994 (8)
3	Land Area							.51797
22	Unemployed				.52030			
23	% Employ Manufact						.87187	
24	% Employ Whl & Rtl		.40433					
25	Work Outside County		-.81041		-.71320	-.75004	-.74694	-.65501
28	% Single Family					-.42508		
42	Manfact Employees					.54412		

Table 2-11. Loadings for Manufacturing Employment Component, Data Sets 1962-1994.

Item	Variable (Year and Component Created)	1962 (-)	1967 (-)	1972 (6)	1977 (6)	1983 (6)	1988 (6)	1994 (0)
3	Land Area				.50989			
7	% Population Change					.42193		
23	% Employ Manufact			.80779	-.79079	-.78244	.87187	
24	% Employ Whl & Rtl				.44439	.57767		
25	Work Outside County						-.74694	
41	% Manufact 100 Emp			.55980	-.52896	-.66196		

Table 2-12. Loadings for Growth Component, Data Sets 1962-1994.

Item	Variable (Year and Component Created)	1962 (-)	1967 (-)	1972 (7)	1977 (0)	1983 (8)	1988 (5)	1994 (-)
7	% Population Change					-.42504	.88447	
14	% Cast Lead Party					-.51778		
22	Unemployed					-.67883		
29	% Built Prev Decade					-.51778	.86301	

Table 2-13. Loadings for Unidentified Components, Data Sets 1962-1994.

Item	Variable (Year and Component Created)	1962 (-)	1967 (-)	1972 (7)	1977 (-)	1983 (-)	1988 (8)	1994 (-)
3	Land Area			.57915				
13	Leading Party						.58217	
22	Unemployed			.75915				
25	Work Outside County			-.46229				
41	% Manufact 100 Emp						-.76668	

the 1988 component, percent of population change and percent of housing units built in the previous decade. Correlations are positive. The remaining components are unidentifiable (Table 2-13). The components created for each data set and the order in which they were created are summarized in Table 2-14. In all sets the total explained variation exceeded 88%.

Because the political, commuting, manufacturing employment, growth, and unidentified components are not created in every data set, and their interpretations are tenuous given the paucity of correlating variables, they are not used in further analysis (Tables 2-9 through 2-13)

tenuous given the paucity of correlating variables, they are not used in further analysis (Tables 2-9 through 2-13). Elimination of these five components does not significantly diminish total explained variance. After removing the tenuous components the total explained variance is above 79% for all data sets (Table 2-14 and 2-15).

Components Used in the Study

The five selected components: community size, community vibrancy, small-scale agriculture, large-scale agriculture, and population structure, are excellent characteristics for further analyses of communities and manufacturing. Community size and community vibrancy are the two most consistent components (Table 2-15). They are first and second in all data sets. Community size accounts for more than 56% of the explained variance in all data sets, and community vibrancy more than 9% in all sets except 1994. Small-scale agriculture is third in each data set, except for 1962 when it is fifth and accounts for only 3.9% of explained variance. The amount of variance explained by small-scale agriculture declines from a high of 8.1% in 1967 to 5.8% in 1988 and rebounds to 6.5% in 1994. Large-scale agriculture is fourth and fluctuates between 5.5% and 4.0% of explained variance, except in 1967 when it accounts for

Table 2-14. Principal Components, Data Sets 1962-1994.

Data Set Component Order	1962	1967	1972	1977	1983	1988	1994
1 variance	Community Size (60.1)	Community Size (60.0)	Community Size (56.3)	Community Size (57.9)	Community Size (57.7)	Community Size (58.8)	Community Size (57.6)
2 variance	Community Vibrancy (9.4)	Community Vibrancy (9.9)	Community Vibrancy (9.5)	Community Vibrancy (9.3)	Community Vibrancy (9.7)	Community Vibrancy (9.2)	Community Vibrancy (8.1)
3 variance	Population Structure (8.4)	Small-scale Agriculture (8.1)	Small-scale Agriculture (7.2)	Small-scale Agriculture (7.0)	Small-scale Agriculture (5.4)	Small-scale Agriculture (5.8)	Small-scale Agriculture (6.5)
4 variance	Large-scale Agriculture (5.5)	Population Structure (4.4)	Large-scale Agriculture (5.0)	Large-scale Agriculture (5.4)	Large-scale Agriculture (5.2)	Large-scale Agriculture (5.3)	Manufacturing Employment (5.3)
5 variance	Small-scale Agriculture (3.9)	Large-scale Agriculture (3.8)	Population Structure (4.4)	Population Structure (4.2)	Population Structure (3.8)	Growth (3.8)	Large-scale Agriculture (4.0)
6 variance	Political (2.3)	Political (2.7)	Manufacturing Employment (2.8)	Manufacturing Employment (2.6)	Manufacturing Employment (3.2)	Commuting (3.3)	Population Structure (3.0)
7 variance		Commuting (1.8)	Unidentified (2.8)	Commuting (2.3)	Commuting (2.3)	Population Structure (2.4)	Political (2.1)
8 variance			Political (1.9)		Growth (1.9)	Unidentified 2.3	Commuting (2.0)
Total Variance Explained	89.5%	90.7%	89.8%	88.7%	95.7%	89.2%	88.6%

Components

- Community Size
- Community Vibrancy
- Small-scale Agriculture
- Large-scale Agriculture
- Population Structure
- Political
- Commuting
- Manufacturing
- Unidentified
- Growth

Table 2-15. Principal Components Used in the Study, Data Sets 1962-1994.

Data Set / Component Order	1962	1967	1972	1977	1983	1988	1994
1 variance	Community Size (60.1)	Community Size (60.0)	Community Size (56.3)	Community Size (57.9)	Community Size (57.7)	Community Size (58.8)	Community Size (57.6)
2 variance	Community Vibrancy (9.4)	Community Vibrancy (9.9)	Community Vibrancy (9.5)	Community Vibrancy (9.3)	Community Vibrancy (9.7)	Community Vibrancy (9.2)	Community Vibrancy (8.1)
3 variance	Population Structure (8.4)	Small-scale Agriculture (8.1)	Small-scale Agriculture (7.2)	Small-scale Agriculture (7.0)	Small-scale Agriculture (5.4)	Small-scale Agriculture (5.8)	Small-scale Agriculture (6.5)
4 variance	Large-scale Agriculture (5.5)	Population Structure (4.4)	Large-scale Agriculture (5.0)	Large-scale Agriculture (5.4)	Large-scale Agriculture (5.2)	Large-scale Agriculture (5.3)	Large-scale Agriculture (4.0)
5 variance	Small-scale Agriculture (3.9)	Large-scale Agriculture (3.8)	Population Structure (4.4)	Population Structure (4.2)	Population Structure (3.8)	Population Structure (2.4)	Population Structure (3.0)
Total Variance Explained	87.3%	86.2%	82.4%	83.8%	81.8%	81.5%	79.2%

Components

Community Size
Community Vibrancy
Population Structure
Large-scale Agriculture
Small-scale Agriculture

3.8%. Population structure varies more than any other component among the five used in further analysis. It is third in 1962 and accounts for 8.4% of explained variance, fourth in 1967 and explains only 4.4% of the variance, and fifth in 1972 (4.4%) where it remains through 1994. With the exception of 1983, total variance explained declines in each progressive data set over the continuum, however the decline in explanatory power is not significant.

CHAPTER III

REGRESSION ANALYSIS AND INTERPRETATION

Regression Analysis

Principal components analysis creates a component score for each of the 50 Appalachian Tennessee counties used in each data set. The component scores are composite variables and summarize each county's demographic, social, and economic situation. They are appropriate for use in multiple regression analysis (Johnston 1978). To further analyze how the components relate to the location of manufacturing, multiple regressions are run using the five component data sets as independent variables. The dependent variables are Zelinsky's measures of manufacturing: value added by manufacture, number of production workers, value added per production worker, per-capita value added by manufacture, number of production workers per-capita.[1,2] For each observation year five separate regressions are run, one

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[1] *Manufacturing indices are from the Census of Manufactures: 1958, 1963, 1967, 1972, 1977, 1982, 1987, and 1992. Per-capita measures are from the closest corresponding decennial Census of Population (Table 1.1).*

[2] *Any county that has manufacturing data withheld by the U.S. Bureau of the Census for disclosure reasons is excluded from the analysis.*

for each measure of manufacturing, against the composite component scores from the appropriate data set. Five models of manufacturing location are thus created for each observation year.

To ensure that only components with significant explanatory power are included, a stepwise multiple regression is employed. Stepwise multiple regression loads independent variables in order of importance, which is determined by to what extent the independent variable reduces the variance in the dependent variable as indicated by the partial correlation coefficient (Johnston 1978). At each step all variables are examined to determine if any of the previously included variables should be excluded. This method of analysis builds a model one step at a time. Inclusion or exclusion is determined by the Probability of F-to-enter (PIN) and the Probability of F-to-remove (POUT) (Norušis 1990). A variable enters the equation if the probability associated with the F test is less than or equivalent to the PIN. Stepwise selection then examines the entered variable to determine if it should be removed, that is whether the probability associated with the F test is less than or equivalent to the POUT. Variables not in the equation are then examined for entry. Following each step, variables in the equation are examined for removal. These steps continue until no more variables meet either the entry

or removal criteria (Norušis 1990). For the purposes of this analysis a PIN of .10 and a POUT of .15 are used.

Analysis for 1958

In 1958, manufacturing data were reported for 37 Appalachian Tennessee counties. These data are regressed against the composite community components created from the 1962 data set. Table 3-1 summarizes the results of the five models. All models predict well. The coefficient of determination (R^2) ranges from a high of .95 for the number of production workers model to a low of .61 for the value added per production worker model. All principal components enter at least one model, indicating all are necessary to explain the variance in the manufacturing indices.

The most important components are community size and community vibrancy. They are significant in all five models. Community size accounts for the largest increase in the coefficient of determination (R^2) for the value added by manufacture, number of production workers, and value added per production worker models. Value added by manufacture and number of production workers are absolute numbers; therefore, it is logical that community size enters the models first and explains the majority of the variance. In the models community size's beta coefficients are significantly larger than those of other components.

Table 3-1. Stepwise Multiple Regression Results, 1958.

Manufacturing Model	Principal Component	Increase in R^2	Beta Coefficient
Value Added by Manufacture	Community Size	.7443	.8627
	Community Vibrancy	.1018	.3191
	Population Structure	.0166	.1290
	Total R^2	.86272	
	Standard Error	23,628,270.87	
Number of Production Workers	Community Size	.8413	.9172
	Community Vibrancy	.0839	.2897
	Population Structure	.0157	.1253
	Small-scale Agriculture	.0072	-.0850
	Total R^2	.94815	
	Standard Error	1,288.60	
Value Added per Production Worker	Community Size	.4549	.6745
	Community Vibrancy	.0971	.3117
	Large-scale Agriculture	.0627	.2504
	Total R^2	.61474	
	Standard Error	2,270.86	
Per-capita Value Added by Manufacture	Community Vibrancy	.4802	.6930
	Community Size	.0824	.2870
	Population Structure	.0533	.2309
	Total R^2	.61590	
	Standard Error	341.21	
Number of Production Workers Per-capita	Community Vibrancy	.4284	.6546
	Population Structure	.1248	.3533
	Small-scale Agriculture	.1031	-.3211
	Community Size	.0498	.2231
	Total R^2	.70610	
	Standard Error	.02	

Components

- Community Size
- Community Vibrancy
- Small-scale Agriculture
- Large-scale Agriculture
- Population Structure

Although community size is positively correlated in all five models, its contribution to the increase in R^2 is less substantial in the per-capita value added by manufacture and number of production workers per-capita models. In the per-capita value added by manufacture and the number of production workers per-capita models community vibrancy is more significant. It accounts for the majority of increase in R^2. Also, beta coefficients indicate strong positive relationships. In each model community vibrancy's beta coefficient is almost twice that of any other component.

Population structure, emphasis on working-age people with few children, is the next most significant component. It enters four of five models, absent only from value added per production worker. In each model the beta coefficient indicates a positive correlation. Population structure's most significant contribution to the increase in R^2 is in the number of production workers per-capita model.

Small-scale agriculture contributes only to the number of production workers and number of production workers per-capita models. It explains the greatest amount of variance in the latter accounting for a .10 increase in R^2, or 18%. However, both beta coefficients indicate negative correlations. A community with a significant amount of small-scale agriculture has fewer production workers and number of production workers per-capita. Large-scale

agriculture only enters the value added per production worker model, but it is positively correlated and is responsible for a 10% increase in the coefficient of determination.

Analysis for 1963

Table 3-2 summarizes the results of the five stepwise multiple regression models for 35 Appalachian Tennessee counties in 1963. The measures of manufacturing are regressed against composite community components created from the 1967 data set. The coefficients of determination (R^2) are similar to those for 1958 (Table 3-1). Only the number of production workers per-capita model's R^2 decreased significantly, .71 to .49. The order components enter each model remains fairly consistent. However, there are fewer components in all models, except value added per production worker. In essence, it takes fewer components to explain variance in the 1963 manufacturing indices with virtually the same level of predictability.

Again the two most important components are community size and community vibrancy. Community size enters four of the models and is instrumental in explaining variance in the value added by manufacture and number of production workers models. Its contributions to increases in R^2 and beta coefficients are similar to 1958 (Table 3-1). However,

Table 3-2. Stepwise Multiple Regression Results, 1963.

Manufacturing Model	Principal Component	Increase in R^2	Beta Coefficient
Value Added by Manufacture	Community Size	.7558	.8693
	Community Vibrancy	.1101	.3319
	Total R^2	.86594	
	Standard Error	28,697,678.60	
Number of Production Workers	Community Size	.8470	.9203
	Community Vibrancy	.0902	.3003
	Population Structure	.0108	.1043
	Total R^2	.94804	
	Standard Error	1,326.07	
Value Added per Production Worker	Community Vibrancy	.3168	.5629
	Large-scale Agriculture	.1502	.3875
	Community Size	.0752	.2741
	Small-scale Agriculture	.0430	.2076
	Total R^2	.58525	
	Standard Error	3,091.89	
Per-capita Value Added by Manufacture	Community Vibrancy	.5684	.7539
	Community Size	.0605	.2460
	Total R^2	.62892	
	Standard Error	380.70	
Number of Production Workers Per-capita	Community Vibrancy	.3787	.6154
	Population Structure	.1078	.3282
	Total R^2	.48647	
	Standard Error	.03	

Components

- Community Size
- Community Vibrancy
- Small-scale Agriculture
- Large-scale Agriculture
- Population Structure

community size is less significant in the value added per production worker model. It enters the 1958 model first and accounts for 74% of the increase in R^2, but in 1963 it enters third and accounts for only a 12% increase (.07 of a total .58). Thus community size's ability to explain variance in the value added per production worker decreases significantly. Community vibrancy replaces community size as the most significant component for all other models. Community vibrancy enters these models in the same order as in 1958; however, its percent of increase in the coefficient of determination (R^2) is more significant. Hence, a community's economic health is significant in explaining the variance in the manufacturing indices.

Population structure, emphasis working-age people with few children, is significant in only number of production workers and per-capita value added by manufacture. It enters both models in the same location as before, and its contribution to increases in R^2 is roughly the same as in 1958 (Table 3-1). Because population structure is present in four of the five models in 1958, its ability to explain the variance in the 1963 manufacturing models decreases. Agricultural activity, whether large or small, is fairly insignificant, with the exception of the value added per production worker model, in the explanation of variance in manufacturing activity in 1963. Small-scale agriculture is

positively correlated with value added per production worker.

Analysis for 1967

Forty counties are included in the stepwise multiple regression analysis for 1967. Table 3-3 summarizes the results of the manufacturing indices regressed against the composite community components created from the 1972 data set. Value added by manufacture, number of production workers, and value added by production workers models' explanatory power decrease marginally from 1963 (Table 3-2). Decreases in the total R^2 of the per-capita value added by manufacture (.63 to .43) and number of production workers per-capita (.49 to .31) are more substantial. More important, the structure of explanation changes as population structure fails to enter any model, indicating it is no longer significant in explaining variance in manufacturing indices.

Community size and community vibrancy are still the most significant components. They appear in the same models as in 1963, but community size explains a greater share of the variance (Table 3-2). In the value added by manufacture and number of production workers models, community size accounts for 97% and 96% of explained variance. In 1963 community size explains 87% and 89%. Beta coefficients

Table 3-3. Stepwise Multiple Regression Results, 1967.

Manufacturing Model	Principal Component	Increase in R^2	Beta Coefficient
Value Added by Manufacture	Community Size	.8075	.8686
	Community Vibrancy	.0241	.1550
	Total R^2	.83157	
	Standard Error	45,585,860.55	
Number of Production Workers	Community Size	.8962	.9467
	Community Vibrancy	.0407	.2016
	Total R^2	.93690	
	Standard Error	1,644.70	
Value Added per Production Worker	Large-scale Agriculture	.1947	.4413
	Community Vibrancy	.1462	.3825
	Community Size	.1412	.3758
	Small-scale Agriculture	.0409	.2034
	Total R^2	.52296	
	Standard Error	3,848.36	
Per-capita Value Added by Manufacture	Community Vibrancy	.2164	.4652
	Community Size	.1266	.3557
	Large-scale Agriculture	.0856	.2926
	Total R^2	.42861	
	Standard Error	654.52	
Number of Production Workers Per-capita	Community Vibrancy	.3131	.5596
	Total R^2	.31311	
	Standard Error	.04	

Components

- Community Size
- Community Vibrancy
- Small-scale Agriculture
- Large-scale Agriculture
- Population Structure

indicate that community vibrancy is less significant in 1967 than in 1963. For every model the coefficient is significantly smaller. Also, it enters the value added per production worker model second, instead of first, and accounts for 27% of the increase in R^2 verses 54% in 1963.

The large-scale agriculture component enters two models. It enters the value added per production worker model first and accounts for 37% of the increase in the coefficient of determination. Explanation of the variance is more evenly distributed among community vibrancy and community size. Large-scale agriculture enters the per-capita value added by manufacture model third, accounting for 20% of the increase in R^2. In both models large-scale agriculture is positively correlated. Conversely, small-scale agriculture enters only the value added per production worker model and is positively correlated.

Analysis for 1972

The results of the stepwise multiple regression models for 42 counties in 1972 are summarized in Table 3-4. The measures of manufacturing are regressed against composite community components created from the 1977 data set. The overall explanatory power (total R^2) of most models remains fairly consistent from 1967 (Table 3-3). In four of the five total R^2 decreases, the exception being value added by

Table 3-4. Stepwise Multiple Regression Results, 1972.

Manufacturing Model	Principal Component	Increase in R^2	Beta Coefficient
Value Added by Manufacture	Community Size	.7916	.8897
	Community Vibrancy	.0374	.1953
	Large-scale Agriculture	.0150	.1222
	Total R^2	.84398	
	Standard Error	60,138,862.86	
Number of Production Workers	Community Size	.8727	.9342
	Community Vibrancy	.0551	.2346
	Total R^2	.92776	
	Standard Error	1,757.43	
Value Added per Production Worker	Large-scale Agriculture	.1872	.4327
	Community Vibrancy	.1358	.3685
	Community Size	.1181	.3436
	Population Structure	.0430	-.2073
	Total R^2	.48405	
	Standard Error	5,023.21	
Per-capita Value Added by Manufacture	Community Vibrancy	.2480	.4980
	Large-scale Agriculture	.1058	.3254
	Community Size	.0724	.2690
	Total R^2	.42619	
	Standard Error	954.90	
Number of Production Workers Per-capita	Community Vibrancy	.2239	.4732
	Total R^2	.22393	
	Standard Error	.05	

Components

- Community Size
- Community Vibrancy
- Small-scale Agriculture
- Large-scale Agriculture
- Population Structure

manufacture. Only the number of production workers per-capita model R^2 is reduced significantly, .31 to .22.

Community size continues to be the most significant component in the value added by manufacture and number of production workers models. Again, it enters the value added per production worker model third and accounts for roughly the same increase in the coefficient of determination as in 1967 (Table 3-3). Community size enters the per-capita value added by manufacture model third, instead of second, and accounts for 16% of the increase in R^2, down from 29%. Community vibrancy, which appears to be declining in significance in 1967, stabilizes. It enters all five equations on the same step. Moreover, beta coefficients are relatively stable and the component accounts for roughly the same percent increase in R^2 for each model as in 1967.

The large-scale agriculture component is more significant than in previous observations. Again, it enters the value added per production worker model first, contributing about the same percent increase in R^2. It maintains its contribution to explained variance in per-capita value added by manufacture and enters value added by manufacture for the first time. All are positive correlations. Specifically, the presence of large-scale agriculture is significant in explaining variance among the

manufacturing indices. For the first time, the small-scale agriculture component is absent from all models.

Population structure, which is absent from all models in 1967, re-emerges as a significant component in value added per production worker, where it enters fourth. However, its beta coefficient indicates a negative correlation, which implies that communities with a large number of childless working-age people have a lower value added by manufacture per production worker.

Analysis for 1977

Measures of manufacturing for 1977 are regressed against composite community components created from the 1983 data set. Table 3-5 summarizes the results of the stepwise multiple regression models for 40 counties. The overall explanatory power of all models decreases significantly from 1972 (Table 3-4). The declines are most significant in value added per production worker (.48 to .36) and per-capita value added by manufacture models (.43 to .21). Number of production workers per-capita fails to predict. The established significance level, probability of F-entering (PIN) = .10, is not reached. Therefore no components enter the model. Despite the declines, community size remains the most significant component in value added by manufacture and number of production workers. Community

Table 3-5. Stepwise Multiple Regression Results, 1977.

Manufacturing Models	Principal Component	Increase in R^2	Beta Coefficient
Value Added by Manufacture	Community Size	.6856	.8280
	Community Vibrancy	.0371	.1925
	Population Structure	.0346	.1861
	Total R^2	.75734	
	Standard Error	114,621,225.2	
Number of Production Workers	Community Size	.7511	.8667
	Community Vibrancy	.0560	.2367
	Total R^2	.80713	
	Standard Error	2,803.65	
Value Added per Production Worker	Population Structure	.1014	.3184
	Small-scale Agriculture	.0941	.3067
	Community Vibrancy	.0858	.2930
	Community Size	.0750	.2739
	Total R^2	.35632	
	Standard Error	9,692.36	
Per-capita Value Added by Manufacture	Community Vibrancy	.1405	.3749
	Population Structure	.0747	.2732
	Total R^2	.21517	
	Standard Error	1,591.44	
Number of Production Workers Per-capita	no components entered		

Components

- Community Size
- Community Vibrancy
- Small-scale Agriculture
- Large-scale Agriculture
- Population Structure

size continues to account for more than 90% of the total increase in R^2. Beta coefficients continue to be much larger than other component's and are positively correlated. Community size's relative position does decrease in the other two models. It enters value added per production worker fourth, instead of third, and accounts for roughly the same percent increase in the coefficient of determination (24% in 1972 and 21% in 1977). However, community size fails to enter the per-capita value added by manufacture model for the first time.

The other constant, positively correlated component, community vibrancy, appears in all four models. It enters value added by manufacture, number of production workers, and per-capita value added by manufacture in the same places as in previous observations. It dominates the per-capita value added by manufacture model, accounting for 65% of the increase in the diminished R^2. Its relative position falls in the value added per production worker model, entering third rather than second.

The most significant change in 1977 is the re-emergence of population structure. In earlier data sets population structure had strong positive correlations with working-age and older people, but in the 1983 data set it has a strong negative correlation with people over 65 (Table 2-7). Population structure is the most significant component in

value added per production worker. It entered first and accounts for a .10 (28%) increase in R^2. The beta coefficients for population structure indicate positive correlations for all models. The other development is the absence of agricultural components. Large-scale agriculture, present in three models in 1972, is absent. Small-scale agriculture enters the value added per production worker model on step two, is positively correlated, and accounts for a .09 (26%) increase in R^2.

Analysis for 1982

Table 3-6 summarizes the results from the stepwise multiple regression models for 1982. Composite community components created from the 1988 data set are regressed against the measures of manufacturing for 43 counties. Again, number of production workers per-capita fails to predict. Of the four predicted models, only the coefficient of determination for value added per production worker fails to produce better results than in 1977 (Table 3-5). The increase is most pronounced in the number of production workers (.80 to .87) and per-capita value added by manufacture (.21 to .30) models. The increase in R^2 for value added by manufacture is negligible, and value added per production worker decreases from .36 to .24.

Table 3-6. Stepwise Multiple Regression Results, 1982.

Manufacturing Models	Principal Component	Increase in R^2	Beta Coefficient
Value Added by Manufacture	Community Size	.6376	.7985
	Population Structure	.0744	.2728
	Community Vibrancy	.0478	.2185
	Total R^2	.75976	
	Standard Error	154,489,109.9	
Number of Production Workers	Community Size	.7893	.8884
	Population Structure	.0420	.2049
	Community Vibrancy	.0401	.2001
	Total R^2	.87135	
	Standard Error	1,904.40	
Value Added per Production Worker	Community Vibrancy	.1546	.3932
	Population Structure	.0952	.3085
	Total R^2	.24984	
	Standard Error	18,512.65	
Per-capita Value Added by Manufacture	Community Vibrancy	.1568	.3960
	Population Structure	.0846	.2908
	Large-scale Agriculture	.0568	.2384
	Total R^2	.29820	
	Standard Error	2,150.20	
Number of Production Workers Per-capita	no components entered		

Components

- Community Size
- Community Vibrancy
- Small-scale Agriculture
- Large-scale Agriculture
- Population Structure

Community size remains the consistent component in the value added by manufacture and number of production worker models. It continues to account for the greatest amount of increase in R^2 and remains positively correlated. However, community size decreased in significance in value added per production worker in 1977, and in 1982 it fails to explain any variance (Table 3-5).

Again, community vibrancy is significant and positively correlated in four predicted models. The most significant change occurs in the value added per production worker model where it enters first, up from third in 1977, and accounts for a .16 (61%) increase in R^2. It also enters the per-capita value added by manufacture model first and accounts for a 52% increase in the coefficient of determination. However, community vibrancy lost relative position in the absolute measure models, value added by manufacture and number of production workers. It was superseded in each case by the population structure component. However, beta coefficients indicate no significant change in importance.

Population structure, strong negative correlation with people over 65, continues to be significant. In 1977 it enters three models: value added by manufacture (last), value added per production worker (first), and per-capita value added by manufacture (last) (Table 3-5). In 1982, population structure enters four models on the second step

and contributes significantly to increases in R^2. All beta coefficients indicate positive correlations. Therefore, communities with large elderly populations correlate with these manufacturing indices. The large-scale agriculture component, absent from all models in 1977, reappears in per-capita value added by manufacture, where it enters third. Its beta coefficient indicates a positive correlation, and it accounts for .06 (19%) increase in the coefficient of determination.

Analysis for 1987

The results of the stepwise multiple regression models for 1987 are in Table 3-7. Measures of manufacturing for 47 counties are regressed against composite community components created from the 1994 data set. Results indicate increases in the coefficients of determination for all predicted models (Table 3-6). Number of production workers per-capita again fails to predict. While most of the increases are nominal, the R^2 for value added per production worker jumps from .25 to .42.

Community size and community vibrancy remain the two most important components. As usual, community size dominates the value added by manufacture and production workers models. Community size also enters value added per

Table 3-7. Stepwise Multiple Regression Results, 1987.

Manufacturing Models	Principal Component	Increase in R^2	Beta Coefficient
Value Added by Manufacture	Community Size	.6562	.8101
	Community Vibrancy	.1282	.3580
	Small-scale Agriculture	.0192	.1385
	Total R^2	.80358	
	Standard Error	177,726,390.0	
Number of Production Workers	Community Size	.7745	.8801
	Community Vibrancy	.0732	.2705
	Large-scale Agriculture	.0204	.1428
	Small-scale Agriculture	.1038	.1174
	Total R^2	.88186	
	Standard Error	1,642.46	
Value Added per Production Worker	Community Vibrancy	.2802	.5293
	Community Size	.0915	.3026
	Small-scale Agriculture	.0545	.2333
	Total R^2	.42616	
	Standard Error	22,121.79	
Per-capita Value Added By Manufacture	Community Vibrancy	.2590	.5090
	Large-scale Agriculture	.0708	.2660
	Total R^2	.32978	
	Standard Error	2,883.76	
Number of Production Workers Per-capita	no components entered		

Components

- Community Size (red)
- Community Vibrancy (blue)
- Small-scale Agriculture (yellow)
- Large-scale Agriculture (grey)
- Population Structure (green)

production worker, which is absent in 1982, on the second step and accounts for a .09 (21%) increase in total R^2. Community vibrancy, as in other observations, enters the predicted models. It is the most significant component in value added by manufacture and per-capita value added by manufacture, where it accounts for 66% and 78% increase in R^2. Community vibrancy, which was superseded by population structure in 1982 in the value added by manufacture and the number of production workers models, again enters these models second (Table 3-6). Correlations for all models are positive.

The most significant change in model composition is the re-emergence of the agriculture. At least one agricultural component enters every model. Small-scale agriculture enters value added by manufacture, third, number of production workers, fourth, and value added by manufacture per production worker, third. Large-scale agriculture enters number of production workers third and the per-capita value added by manufacture second. Correlations are positive for all models. These components enter all models on the last step, and their contributions to increases in the coefficients of determination, or relative impact as measured by beta coefficients, are not as significant as other components.

Population structure, which was so prominent in the 1982 observation, fails to enter any equation (Table 3-6). In 1987, this component had a negative correlation with working-age people and a much stronger negative correlation with persons over 65 (1983 and 1988 data sets); however, in the 1994 data set it has strong positive correlations with people working-age and those over 65, and a strong negative correlation with people under five.

Analysis for 1992

The results of the stepwise multiple regressions for the 1992 measures of manufacturing models are summarized in Table 3-8. Data for 45 counties are regressed against community components created from the 1994 data set.[3] Once again, number of production workers per-capita fails to predict. The coefficients of determination for all predicted models decrease from 1987 levels (Table 3-7). For the first time the R^2 for both value added by manufacture and number production workers is below .80. Fewer components are significant in this set of models than in previous ones.

[3] Forty-seven counties reported manufacturing data in 1992, but due to omissions in composite variables there are only 45 observations.

Table 3-8. Stepwise Multiple Regression Results, 1992.

Manufacturing Models	Principal Component	Increase in R^2	Beta Coefficient
Value Added by Manufacture	Community Size	.5804	.7618
	Community Vibrancy	.1715	.4142
	Total R^2	.75190	
	Standard Error	248,927,168.4	
Number of Production Workers	Community Size	.6663	.8163
	Community Vibrancy	.0980	.3129
	Large-scale Agriculture	.0286	.1693
	Total R^2	.79290	
	Standard Error	2,071.68	
Value Added per Production Worker	Community Vibrancy	.3162	.5623
	Community Size	.0581	.2411
	Total R^2	.37428	
	Standard Error	29,965.45	
Per-capita Value Added by Manufacture	Community Vibrancy	.2536	.5036
	Total R^2	.25364	
	Standard Error	4,191.68	
Number of Production Workers Per-capita	no components entered		

Components

- Community Size (red)
- Community Vibrancy (blue)
- Small-scale Agriculture (yellow)
- Large-scale Agriculture (grey)
- Population Structure (green)

Community size and community vibrancy are the most important components. Community vibrancy enters all four predicted models, and community size enters all but the per-capita value added by manufacture model. Community size, as usual, is the dominant component in the value added by manufacture and number of production workers models. Community vibrancy enters value added by manufacture and number of production workers on the second step, and the value added per production worker and per-capita value added by manufacture models first, just as it did in 1987 (Table 3-7). Community vibrancy is the only significant component in the per-capita value added by manufacture model. The only other significant component is large-scale agriculture, which enters the number of production workers model last and accounts for a mere 4% increase in the coefficient of determination. Correlations for all components are positive. In 1992, only the size and economic health of communities explain the variance in manufacturing location.

Interpretation of the Regression Analysis

Each model set indicates how effective composite components are in explaining manufacturing location at a specific moment in time. To fully comprehend the regression analysis the entire spectrum must be considered. The fit

and component structure of the five models for the eight observation years are summarized in Table 3-9.

Model Fit Trends

Model fit, total R^2, decreases significantly between 1958 and 1992. However, careful examination indicates specific trends. Manufacturing location is predicted most consistently in 1958 and 1963. The coefficient of determination (R^2) for all models decline in 1967 and 1972 and reach their lowest value 1977. Number of production workers per-capita fails to predict in 1977 and in every following observation year.

Of the 750,000 nonmetropolitan manufacturing jobs created nationally between 1971 and 1974, virtually all were lost during the 1974-1975 recession (Harren and Holling 1979). Job loss was most severe in the building materials, textile, and apparel industries, which were dominant in the Appalachian Tennessee manufacturing economy (Raitz and Ulack 1984). This situation was further complicated by the return to Appalachia of laid-off workers from Midwestern metropolitan centers (Harren and Holling 1979; White 1983). The recession of 1974-1977 contributes to the decline in explanatory power in 1977. During the recession of 1979-1982, manufacturing employment losses continued (Barkley

Table 3-9. Model Fits and Component Trends 1958-1992.

Model / Observation Year and Number	1958 37	1963 35	1967 40	1972 42	1977 40	1982 43	1987 47	1992 45
	Components Entering Model							
Value Added By Manufacture — Total R^2	.86	.87	.83	.84	.76	.76	.80	.75
	C-S .7443	C-S .7558	C-S .8075	C-S .7916	C-S .6856	C-S .6376	C-S .6562	C-S .5804
	C-V .1018	C-V .1101	C-V .0241	C-V .0374	C-V .0371	P-S .0744	C-V .1282	C-V .1715
	P-S .0166			L-A .0150	P-S .0346	C-V .0478	S-A .0192	
Number of Production Workers — Total R^2	.95	.95	.94	.93	.81	.87	.88	.79
	C-S .8413	C-S .8470	C-S .8962	C-S .8727	C-S .7511	C-S .7893	C-S .7745	C-S .6663
	C-V .0839	C-V .0902	C-V .0407	C-V .0551	C-V .0560	P-S .0420	C-V .0732	C-V .0980
	P-S .0157	P-S .0108				C-V .0401	L-A .0204	L-A .0286
	S-A* .0072						S-A .0138	
Value Added per Production Worker — Total R^2	.61	.58	.53	.48	.36	.25	.43	.37
	C-S .4549	C-V .3168	L-A .1947	L-A .1872	P-S .1014	C-V .1546	C-V .2802	C-V .3162
	C-V .0971	L-A .1502	C-V .1462	C-V .1358	S-A .0941	P-S .0952	C-S .0915	C-S .0581
	L-A .0627	C-S .0752	C-S .1412	C-S .1181	C-V .0858		S-A .0545	
		S-A .0430	S-A .0409	P-S* .0430	C-S .0750			
Per-capita Value Added by Manufacture — Total R^2	.62	.63	.43	.43	.21	.30	.33	.25
	C-V .4802	C-V .5684	C-V .2164	C-V .2480	C-V .1405	C-V .1568	C-V .2590	C-V .2536
	C-S .0824	C-S .0605	C-S .1266	L-A .1058	P-S .0747	P-S .0846	L-A .0708	
	P-S .0533		L-A .0856	C-S .0724		L-A .0568		
Number of Production Workers Per-capita — Total R^2	.71	.49	.31	.22	no components entered	no components entered	no components entered	no components entered
	C-V .4284	C-V .3787	C-V .3131	C-V .2239				
	P-S .1248	P-S .1078						
	S-A* .1031							
	C-S .0498							
	Period 1 Traditional		Period 2 Transitional		Period 3 Shake Out		Period 4 New Paradigm	

Components

- C-S Community Size
- C-S Community Vibrancy
- P-S Population Structure
- L-A Large-scale Agriculture
- S-A Small-scale Agriculture

* Indicates a Negative Correlation

1992). Appalachian Tennessee lost 11,200 production workers between 1977 and 1982 (1977 Census of Manufactures; 1982 Census of Manufactures).[4] Even with this prodigious decline in production workers, the model fits for 1982 are similar to 1977. The number of production workers and per-capita value added by manufacture models improved slightly. However, value added per production worker continues to decline.

All models' explanatory power increases between 1982 and 1987. During this period, the region added 14,900 production workers (1982 Census of Manufactures; 1987 Census of Manufactures).[5] Explanatory power decreases in 1992 despite an addition of 6,700 production workers (1987 Census of Manufactures; 1992 Census of Manufactures).[6] The observation years 1977, 1982, and 1992 are the last years of recessions. Consequently, these years produce the worst model fits in the analysis.

Value added by manufacture and number of production workers are the best model fits (R^2) for all observation years. These indexes measure absolute numbers and, not surprisingly, they are the best predicted models. Absolute

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[4] *Forty counties reported data in 1977 verses 43 in 1982.*

[5] *Forty-seven counties reported data in 1987.*

[6] *Forty-seven counties reported data in 1992.*

numbers correlate with components measuring size. However, measures of absolute numbers are inherently biased toward communities with larger populations, metropolitan counties.

Value added per production worker is the next most consistent model fit and varied little until 1977. Model fit (R^2) fell precipitously from 1972 to 1977 and reached a low in 1982, a major transition period in southern nonmetropolitan manufacturing. Many low-technology plants closed during the recessions of 1974-1977 and 1979-1982 (Barkley 1992). New plants were high-technology branch plants or plants with higher value-added products (Glasmeier and Leichenko 1996).

During periods of economic restructuring the composite socio-economic components are less effective at explaining variance in value added per production worker models. Appalachian Tennessee's technological sophistication was at its lowest in 1958 (Lonsdale and Browning 1971) when this model fit is best. As manufacturers restructured plants, fewer workers were needed to produce greater value goods and value added per production worker proved more difficult to predict. In the inter-recessionary year of 1987 the index recovers, only to slip again in 1992.

Per-capita value added by manufacture model fit (R^2) also declines prodigiously between 1972 and 1977, from .43 to .21. However, it recovers more quickly than value added

per production worker and remains relatively stable. With increased technologies, value added rose and the number of production workers fell. However, population grew substantially. Between 1970 and 1980 Appalachian Tennessee's population increased 22.6% compared to 16.9% for the state and 11.4% for the nation (1970 Census of Population; 1980 Census of Population). Increases in population correlate with increases in value added by manufacture. Therefore, the ratio between population and value added by manufacture is less affected.

The number of production workers per-capita model, third best fit in 1958, declines rapidly until 1972. During the most fervent period of nonmetropolitan industrial job growth (1962-1978), 1.8 million jobs were added nationally, service and other non-industrial employment increased by 6.7 million (Lonsdale and Browning 1979). Between the 1950s and the 1990s the national economy reoriented from manufacturing to services (Warf and Grimes 1997). As manufacturing became more capital intensive, fewer production workers were employed. Total population, however, continued to rise, resulting in the failure of these socio-economic composite components: population size, community vibrancy, small-scale agriculture, large-scale agriculture, and population structure, to predict the ratio of production workers and

population. From 1977 to 1992 no components are significant, and the model fails to predict.

Component Trends

In addition to examining model fits, the structure of explanation is also explored. Five composite socio-economic components are used in 40 multiple stepwise regressions to predict measures of manufacturing. Table 3-9 describes component order and appearance for models and observation years.

The five components are community size, community vibrancy, small-scale agriculture, large-scale agriculture, and population structure. Community size is clearly the most significant component. It is present in 28 of 40 models and accounts for a lion's share of the explanatory power (R^2) in 18 of the 28 models. Community size is first in value added by manufacture and number of production workers models and provides the greatest increase in the coefficient of determination. Both of these measures represent absolute numbers, which correlate with size. Moreover, community size is significant in all models in 1958 and four models in 1963, 1967, and 1972. While clearly the most important component, community size's influence wanes after 1972. It is insignificant in predicting number of production workers per-capita between 1963 and 1992, per-

capita value added by manufacture between 1977 and 1992, and value added per production worker in 1982. In 1987 and 1992 community size is significant again in the value added per production worker models. It enters on the second step in 1987 and 1992.

Community vibrancy is the second most significant component. It appears in 36 of 40 models. Although, community vibrancy enters more models than community size, its contribution in R^2 is less substantial. In the value added by manufacture and production workers models it enters second for all years except 1982 where it enters third. Community vibrancy is the most significant component in value added per production worker, per-capita value added by manufacture, and number of production workers per-capita. It enters all per-capita value added by manufacture first, and its contribution to the increase in R^2 is more than double that of any other component in virtually every observation year. Community vibrancy enters value added per production worker models first or second, except in 1977 when it enters third. It is most significant in 1963 when it accounts for 54% of the increase in R^2 (.58), 1987 when it accounts for 65% (.28 of .43), and 1992 when it accounts for 85% of the increase.

Population structure enters 14 of 40 models. However, it is most significant to four years. In 1958 it enters

four of five models, all except value added per production worker. It enters on the third step in all but number of production workers per-capita, where it enters second and accounts for a 17% increase in R^2. In 1963, population structure enters both the number of production workers and number of production workers per-capita models. The components for 1962 and 1967 are positively correlated with working-age people and persons over 65 and negatively correlated with children under five. Conversely, the population structure component that enters three of four predicted equations in 1977 and all in 1982, has a strong negative correlation with persons over the age of 65 (Table 2-7).

Population structure is most significant in 1982 when it enters all predicted equations second. Population shifts and the return migration account for the changed nature of population structure. The late 1970s and early 1980s was a period of counterurbanization (Fuguitt and Beale 1976; Licther and Fuguitt 1982). Americans were moving out of metropolitan areas for the perceived safety and comfort of nonmetropolitan locales. Moreover, industrial cutbacks and factory closures in the Midwest resulted in the return of numerous former Appalachians to their ancestral homeland (Lonsdale and Browning 1971; White 1983). The trends ceased in the middle 1980s, and the population structure component

reverted in 1994 to re-emphasis on working-age persons and de-emphasis on children. Population structure is not significant in 1987 or 1992.

The last two components represent the agricultural economy and are of periodic importance. Large-scale agriculture is significant in nine of forty equations and small-scale agriculture in eight of forty. Large-scale agriculture's presence is most significant in 1967 and 1972, when it enters two and three of five models. It enters value added per production worker first and accounts for the largest percent increase in R^2. Large-scale agriculture's contribution to explained variance in per-capita value added by manufacture is marginal but consistent. Between 1963 and 1972 the number of production workers in Appalachian Tennessee increased by 34,575 (1963 Census of Manufactures; 1972 Census of Manufactures).[7] The presence of large-scale agriculture was indicative of mechanized production and displaced agricultural workers. Rapid industrialization required available labor; therefore, the correlation between manufacturing location and large-scale agriculture between 1962 and 1972 is logical. In 1987 and 1992 it enters the number of production workers models third, but its impact is marginal.

[7] *Forty-seven counties were reported in 1963 and 43 were reported in 1972.*

Small-scale agriculture is of periodic significance. It is most prevalent in the value added per production worker model, entering four models in eight observation years. In 1958, it enters the number of production workers and number of production workers per-capita models and is negatively correlated. The greater the amount of small-scale agriculture the smaller the measure of manufacturing. Small-scale agriculture is indicative of less mechanization of an agricultural community, and therefore, fewer displaced agricultural workers. After 1958 small-scale agriculture is positively correlated in all models. Its most significant contribution occurs in 1977 when it enters the value added per production worker model second and accounts for a 26% (.09 of .36) increase in the coefficient of determination.

In 1987, small-scale agriculture enters three of the four predicted equations on the third step. While its contribution to total R^2 is marginal, its presence in three models is significant. The Census of Agriculture indicates that land in farms and the number of farms in Appalachian Tennessee decreased steadily between 1959 and 1977. In 1982 both measures increased. Land in farms increased by 36,880 acres, and the number of farms increased by 3,442 (1977 Census of Agriculture; 1982 Census of Agriculture). However, between 1982 and 1987 both measures declined significantly, land in farms by 278,913 acres and the number

of farms by 5,207 (1982 Census of Agriculture; 1987 Census of Agriculture). A consequence of the economic recessions of 1974-1977 and 1979-1982, was the loss of 14,900 production workers in Appalachia Tennessee (1972 Census of Manufactures; 1982 Census of Manufactures).[8] Increases in land in farms and number of farms in 1982 suggest that laid-off factory workers turned to small-scale agriculture to offset manufacturing unemployment. Tobacco production rose from 37,578 acres to 50,449 acres, an increase of 12,811 acres (1978 Census of Agriculture; 1982 Census of Agriculture). With an increase of 14,900 production workers between 1982 and 1987, tobacco production fell by 16,722 acres (1982 Census of Manufactures; 1987 Census of Manufactures; 1978 Census of Agriculture; 1982 Census of Agriculture).[9] Small-scale agriculture is positively correlated with three models in 1987. Its presence, even though marginal in explanatory power, is indicative of a labor pool that was being lured back to the factories. By 1992 the transition was complete as 6,700 new production workers contribute to the disappearance of small-scale

[8] *Forty-three counties reported data in 1972 and 45 counties reported data in 1982.*

[9] *Forty-seven counties reported data in 1987.*

agriculture as a significant component (1987 Census of Manufactures; 1992 Census of Manufactures).[10]

Periods of Industrialization of Appalachian Tennessee

Examination of model fits and component trends reveal four distinct periods in Appalachian Tennessee's industrialization (Table 3-9 and Table 3-10). The first period (1958-1962) represents a Traditional Period of industrialization. Ten manufacturing models: value added by manufacture, number of production workers, value added per production worker, per-capita value added by manufacture, and number of production workers per-capita, for 1958 and 1963 are predicted reasonably well. These ten models incorporate all composite socio-economic components to explain the variance in the selected measures of manufacturing. Although community size and community vibrancy are far and away the most significant components, other aspects of community are also important. In the 1958 models, communities with large working-age populations and large-scale agricultural economies, correlate with the selected measures of manufacturing location. These measures

[10] *Forty-seven counties reported data in 1992.*

Table 3-10. Periods of Industrialization in Appalachian Tennessee 1958-1992.

Traditional 1958–1963	Transitional 1967–1972	Shake Out 1977–1982	New Paradigm 1987–1992
Prediction and Components			
Excellent Community Size Community Vibrancy Population Structure Large-scale Agriculture Small-scale Agriculture	Decreasing Community Size Community Vibrancy Large-scale Agriculture	Lowest Community Size Community Vibrancy Population Structure	Recovering Community Size Community Vibrancy Small-scale Ag. (1987) Large-scale Ag. (1987)
Community Characteristics			
Manufacturing first surpasses agriculture as the region's primary source of employment.	Agricultural workers displaced by mechanization turn to manufacturing employment.	The recessions of 1974-1977 and 1979-1982 result in a decrease of 14,900 production workers.	Agriculture is abandoned as workers return to manufacturing employment.
Communities are transitioning from agriculture to other forms of employment.	Large increase in the number of production workers (34,575) and firms (395).	Substantial return migration, counterurbanization, and population growth.	Large increase of production workers (21,600) and firms (623).
	Large increase in the number of service related jobs.	Displaced workers resort to small-scale agriculture, specifically, tobacco farming.	
Manufacturing Development			
Labor intensive manufacturers oriented toward resources and low-cost labor.	Rapid development of branch plants represent increased capital investment and technical sophistication.	Communities suffer losses in manufacturing employment as manufacturers transition to standardized production methods.	Development of high-technology plants focus on niche production, flexibilism, and just-in-time delivery systems.
Technological sophistication is at its lowest.	Value added by manufacture doubles.	Value added by manufacture declines.	Value added by manufacture increases by 40%.
	Development is concentrated in nonmetropolitan areas to take advantage of low-cost unskilled labor.	Communities, especially nonmetropolitan communities, initiate industrial development programs.	Low-tech labor intensive industries move off shore in the era of global restructuring.

continue in the 1963 models. However, fewer components are required to explain location. The late 1950s and early 1960s were dominated by the infusion of low-technology and low-value added manufacturers that located in metropolitan and select nonmetropolitan counties. Industrial development was the continuation of existing trends.

The second period in the industrialization of Appalachian Tennessee, the Transitional Period was from the late 1960s through the middle 1970s. Observations for 1967 and 1972 indicate a shift in the composite socio-economic component's ability to explain manufacturing variation. The coefficients of determination for all models decrease. Community size and vibrancy, while still highly correlated with the absolute measures of value added by manufacture and number of production workers, falter in their ability to explain variance in the value added by manufacture, per-capita value added by manufacture, and number of production workers per-capita. Transportation and communication developments made the location of manufacturing more complex as firms chose smaller nonmetropolitan locales. Communities with large agricultural economies and subsequently displaced farm workers were able to attract new branch plants. These new plants produced products in the mature phases of the product life cycle. Therefore, low-skilled or semi-skilled laborers could produce high-value added products. The

Transitional Period represents the most rampant period of nonmetropolitan industrialization, nationally and in Appalachian Tennessee. The region added 395 new firms and 34,575 production workers. Value added by manufacture nearly doubled, 6.3 billion to 11.3 billion dollars (1963 Census of Manufactures; 1972 Census of Manufactures).[11]

The recessions of 1974-1977 and 1979-1982 ended the flood of nonmetropolitan manufacturing jobs. During this Shake Out Period (1977-1982), only the strongest nonmetropolitan plants survived. Appalachian Tennessee lost 14,900 production workers and value added by manufacture increased marginally, from 11.3 to 11.6 billion dollars (1972 Census of Manufactures; 1982 Census of Manufactures).[12] Models for this period are the least well predicted. Number of production workers per-capita failed to predict. The declining importance of manufacturing in the national economy, plus increases in service employment, made this measure untenable. Community size and vibrancy, while still highly correlated with the absolute measures of value added by manufacture and the number of production workers, were no longer highly correlated with other

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[11] *Value added by manufacture is measured in 1992 dollars, as determined by the Consumer Price Index inflation calculator.*

[12] *Forty-three counties reported data in 1972 and 45 in 1982.*

manufacturing measures. Nonmetropolitan communities were overrun with return migrants and the five measures of manufacturing correlated with aging populations. With declining manufacturing bases and bulging populations many nonmetropolitan communities initiated industrial recruitment programs (Anderson and Barkley 1982; Newman 1981). In Appalachian Tennessee many displaced workers resorted to part-time tobacco farming.

The New Paradigm Period (1987-1992) reflects major advances in technology and communication. High-technology and niche production resulted in supply factories locating in reasonable proximity to assembly plants, creating dispersed agglomerations (Inman 1991; Linge 1991). Community size and vibrancy dominate predicted models. Explanatory power peaked in 1987 and then declined in 1992. The region added 14,900 production workers between 1982 and 1987 and another 6,700 by 1992 (1982 Census of Manufactures; 1987 Census of Manufactures; 1992 Census of Manufactures).[13] Residents abandoned part-time tobacco farming for manufacturing employment. In the New Paradigm Period community size and community vibrancy are the only factors explaining variance in manufacturing location.

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[13] *Forty-five counties reported data in 1982, 47 in 1987, and 47 in 1992.*

CHAPTER IV

CLUSTER ANALYSIS AND CASE STUDY SELECTION

The goal of this research is to identify which Appalachian Tennessee nonmetropolitan counties are successful at perpetuating their economies through industrial development. A methodology was employed to incorporate multiple indices of manufacturing location and community characteristics. Regression analysis illuminated trends in development between 1958 and 1992. To fully comprehend results generated by 36 regression models, a method of classification is necessary. Each regression produced a residual for each observation (county) that reveals how closely the model was predicted by composite socio-economic components. Residuals were standardized to allow comparison among models. Standardized residuals have a mean of zero and a standard deviation of one. Their values indicate standard deviation units above and below the mean or predicted value (Norušis 1990). By grouping the residuals from each observation (county) for all models of an observation year, levels of industrialization can be identified and compared.

A hierarchical agglomerative clustering method groups similar entities or observations (communities) within a data set (Aldenderfer and Blashfield 1984). Ward's method of cluster analysis was chosen to group the standardized residuals produced by the five manufacturing models from each observation year because it optimizes the minimum variance within clusters (Ward 1963). In other words, it forms tight clusters. Clusters are formed from residual values that are most alike as determined by the squared Euclidean distance between observations.

The number of clusters generated was established at three to represent underpredicted, predicted, and overpredicted levels of industrialization. Creation of more than three clusters complicated interpretation. The cluster analysis results are indicators of which counties to examine more closely. Sample communities are ones consistently identified as manufacturing communities.

Traditional Period (1958-1963)

Cluster Analysis for 1958

Thirty-seven Appalachian Tennessee communities (i.e., counties) reported manufacturing data in 1958.

Manufacturing indices were regressed against composite community components from the 1962 data set. The results are summarized in Table 4-1 and Figure 4-1. Twenty-seven counties are in the predicted category. More specifically, the analysis predicted the level of manufacturing for 72% of the observations. Given the high levels of the coefficients of determination for the 1958 models, it is not surprising the majority of counties are predicted (Table 3-9). A hypothesis of the study is that manufacturing counties can be identified by manufacturing's relevance to the community's socio-economic structure, rather than by the size of the manufacturing base, therein removing the bias toward metropolitan areas.

Three communities, Washington, Knox, and Coffee are overpredicted, meaning they had less manufacturing than the analysis expected, given their socio-economic structure. All three overpredicted communities are home to large government service and research institutions: Washington County has East Tennessee State University; Knox County is the home of The University of Tennessee; Coffee County has Arnold Engineering and Development Center and The University of Tennessee Space Institute. If one measure of manufacturing, e.g., number of production workers or value added per production worker, was mapped, Knox County would

Table 4-1. Traditional Period, 1958 Manufacturing Model Residuals and Cluster Results.

County	Manufacturing Models: Value Added by Manufacture	Production Workers	Value Added per Production Worker	Per-capita Value Added by Manufacture	Production Workers Per-capita	Cluster
ANDERSON						
BLEDSOE	.08938	-1.00214	-.44566	.01627	-1.20274	5
BLOUNT						
BRADLEY	-.62406	-.08932	-1.01933	-.46497	.38025	5
CAMPBELL	-.08197	.59614	-.48979	.19455	1.53850	5
CANNON						
CARTER						
CLAIBORNE	.36239	.50683	-.20152	.39050	.03631	5
CLAY						
COCKE	-.10023	.21486	-.23871	-.32441	.10681	5
COFFEE	-.97081	-1.07641	-1.87848	-1.94989	-2.07331	6
CUMBERLAND	.19744	.03221	-.44715	-.12820	-.71282	5
DE KALB						
FENTRESS	.25310	.16862	-1.20749	.16503	1.24570	5
FRANKLIN	-.27498	-.47150	-.29287	-.74399	-1.37526	5
GRAINGER	.21170	.16967	-.67810	-.24020	-1.12257	5
GREENE	.70039	.41295	2.47317	1.08449	.03059	4
GRUNDY	.70055	1.22732	.73213	.51174	.77255	4
HAMBLEN	-.60792	.11459	-.43235	-.44055	.74672	5
HAMILTON	2.15728	2.35128	.30552	.31575	-.12279	4
HANCOCK						
HAWKINS	-.24735	-.34885	.28566	-.68796	-1.34563	5
JACKSON	.35721	.01419	.79082	.54746	-.26696	5
JEFFERSON	-.49140	-.45139	-.13303	-.68409	-.57222	5
JOHNSON	.26556	.45095	1.11765	.17587	-.42998	5
KNOX	-3.37919	-3.56186	-.75485	-.90213	-.27637	6
LOUDON	-.52240	-.44341	.20787	-.11952	.39999	5
MCMINN	.37247	.08869	1.40504	1.65356	.93103	4
MACON	.03079	-.04276	.98431	.52033	.73462	4
MARION	-.02584	-.24526	.34139	-.35428	-.77106	5
MEIGS						
MONROE	.11551	.18139	-.59814	.15974	.32055	5
MORGAN	.19637	-.29471	.08328	.03809	-1.01720	5
OVERTON	.28492	.50074	-.39704	.47176	1.75931	5
PICKETT						
POLK						
PUTNAM	-.44271	-.01744	-.74511	-.59359	.08214	5
RHEA	-.27439	-.63697	.48771	-.07367	-.19746	5
ROANE	1.83545	.69489	2.96323	3.98658	1.72867	4
SCOTT	.34298	.39139	-.16464	.43292	.74156	5
SEQUATCHIE						
SEVIER	-.24461	-.15276	-.45996	-.76419	-.93401	5
SMITH	-.04846	-.16201	.20426	-.10798	-.38994	5
SULLIVAN	2.43332	2.21011	.71946	.80382	.34192	4
UNICOI	-.43321	.03012	.01781	-.94151	-.25440	5
UNION						
VAN BUREN						
WARREN	-.37406	-.31928	-1.02614	-.52588	-.14105	5
WASHINGTON	-1.65449	-1.29436	-.87168	-1.40575	-.53280	6
WHITE	-.10874	.25348	-.63727	-.01570	1.84135	5

4 Underpredicted; 5 Predicted; 6 Overpredicted; (blank) Data Withheld by Census Bureau

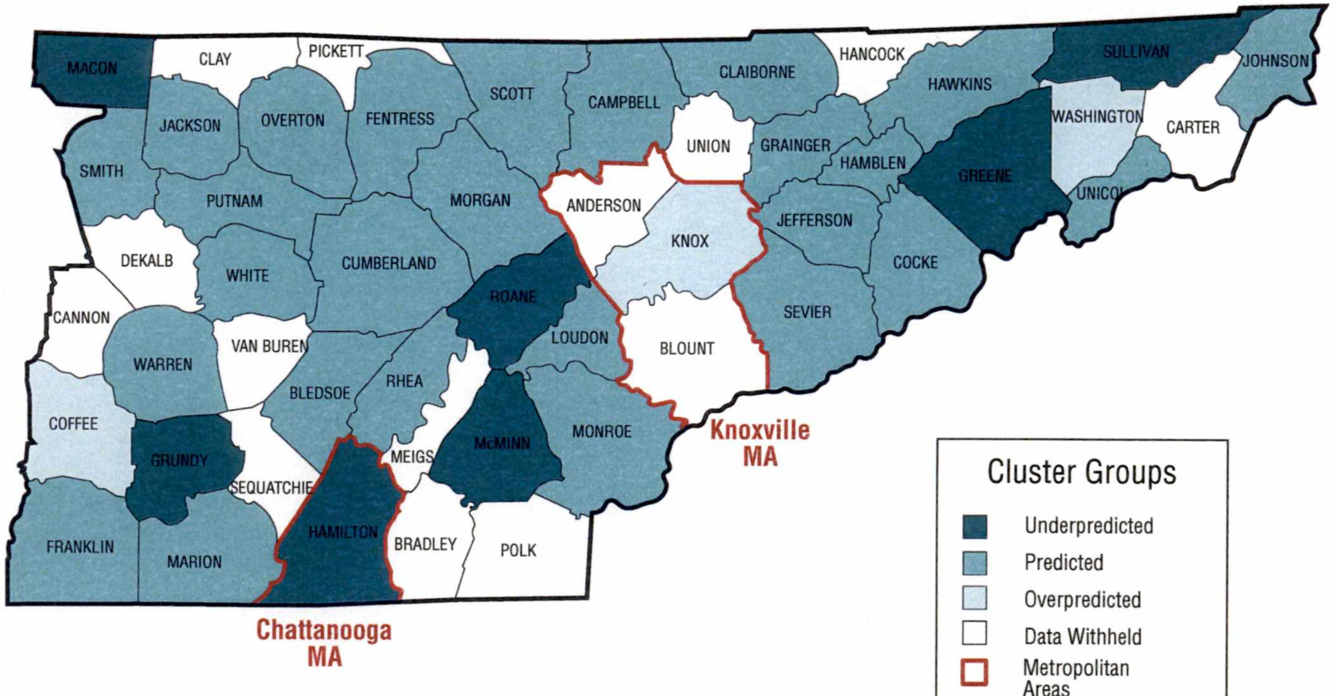

Figure 4-1. Appalachian Tennessee, Traditional Period, 1958 Manufacturing Models Residual Clusters.

be identified as a manufacturing community. However, by including community data Knox County is identified as having less manufacturing than expected given its socio-economic structure.

Seven communities are underpredicted. They have more manufacturing than the models predicted. Sullivan, Greene, Roane, McMinn, Grundy, Hamilton, and Macon counties are communities with significant manufacturing concentrations. Six of the seven underpredicted counties are nonmetropolitan. Hamilton is the only metropolitan county and by all measures it has more manufacturing than any other community.

Component trends indicate that community size and vibrancy are most dominant in interpreting variance in the manufacturing models in 1958 (Table 3-9). Other relevant components include population structure (working-age) and a large-scale agricultural economy. Of the six underpredicted nonmetropolitan communities, four are in the Ridge and Valley (Sullivan, Greene, Roane, and McMinn), one is on the Cumberland Plateau (Grundy), and the other on the Highland Rim (Macon) (Figure 1-1). The majority of the counties had average farm sizes below or near the regional average of 90 acres (1959 Census of Agriculture).

Cluster Analysis for 1963

Residuals and clusters from the 1963 regressions are in Table 4-2 and Figure 4-2. The composite community components from the 1967 data set were regressed against 1963 measures of manufacturing for 35 counties. Even though most regression models predicted reasonably well, fewer communities are predicted (12 of 35 or 34%) than in the 1958 analysis (Table 4-1 and Figure 4-1).

Sixteen counties (45%) are overpredicted, indicating less manufacturing activity than composite community components suggest. Three of the 16 are the same large service or research counties identified for 1958 (Washington, Knox, and Coffee). Seven of the remaining 13 are adjacent to one of the three, and the remainders are adjacent to underpredicted communities. Any county with large service and research facilities or that is an established industrial center can attract commuters from adjacent counties. Therefore, the analysis results are logical.

There are seven underpredicted communities: Sullivan, Greene, Campbell, Roane, McMinn, Hamilton, and Macon. Six of the seven were underpredicted in 1958 (Table 4.1). Grundy County moved from underpredicted to predicted and Campbell from predicted to underpredicted. In Grundy County

Table 4-2. Traditional Period, 1963 Manufacturing Model Residuals and Cluster Results.

County	Manufacturing Models: Value Added by Manufacture	Production Workers	Value Added per Production Worker	Per-capita Value Added by Manufacture	Production Workers Per-capita	Cluster
ANDERSON						
BLEDSOE	.20330	-.08939	.18907	-.49921	-.51537	6
BLOUNT						
BRADLEY	-.29111	.79235	-.47476	.07739	.97770	5
CAMPBELL	-.08281	.28967	1.54329	.50381	.52187	4
CANNON						
CARTER						
CLAIBORNE	.38494	.26922	-.32213	.22429	-.61398	6
COCKE	.00639	.56267	.01384	-.02987	.24081	5
COFFEE	-1.34779	-1.54373	-1.68795	-2.04951	-1.30216	6
CUMBERLAND	-.32665	.03611	-.10152	-.48738	-.00760	6
DE KALB						
FENTRESS						
FRANKLIN	-.65394	-1.01131	-.56495	-.84918	-.95137	6
GRAINGER						
GREENE	1.72631	.77938	2.77045	2.68083	-.14080	4
GRUNDY	-.00361	.91153	-.33547	-.08408	1.44414	5
HAMBLEN	.00422	.81387	-.45190	.94059	1.35856	5
HAMILTON	1.69580	1.86962	.53037	.40562	.78984	4
HANCOCK						
HAWKINS	-.42587	-.99841	-.00058	-1.12938	-1.81925	6
JACKSON						
JEFFERSON	-.25422	-.06535	-1.03665	-.38792	.30331	5
JOHNSON	.71039	.36365	.36591	.55586	-.47238	6
KNOX	-2.79771	-2.53869	-.68738	-.74385	.28877	6
LOUDON	-.05197	-.12957	.58000	.25036	-.06216	6
McMINN	.27360	.35078	.64743	1.08554	.44723	4
MACON	.93871	.53843	1.12347	1.62109	.54958	4
MARION	-.89090	-.93372	.95763	-1.13991	-.87937	6
MEIGS						
MONROE	-.19636	.23904	-.87140	-.35615	.18672	5
MORGAN	-.35260	-.51347	-.25090	-.90778	-1.05236	6
OVERTON	.30690	.56693	.01403	.58630	1.41776	5
PICKETT						
POLK						
PUTNAM	.00886	.73541	-.44807	.65432	1.28568	5
RHEA	-.13842	.37945	.26015	.23678	1.52946	5
ROANE	.20494	-.61669	2.03971	1.13021	-.42813	4
SCOTT	.01561	.83852	.05782	-.36628	.58396	5
SEQUATCHIE						
SEVIER	-.74919	-1.10129	-1.52573	-1.47165	-1.52581	6
SMITH	.53471	-.30642	-.43997	.46078	-.36769	6
SULLIVAN	3.11621	1.96421	.51226	1.20674	-.01287	4
UNICOI	-.18459	-.36436	.36733	-.57176	-.70699	6
UNION	-.08805	-.80028	-.19185	-.83980	-1.95142	6
VAN BUREN						
WARREN	.14303	.29973	-.16701	.88368	.95177	5
WASHINGTON	-1.49653	-1.86841	-1.33395	-1.28425	-1.16503	6
WHITE	.05838	.28052	-1.08058	-.30624	1.09759	5

4 Underpredicted; 5 Predicted; 6 Overpredicted; (blank) Data Withheld by Census Bureau

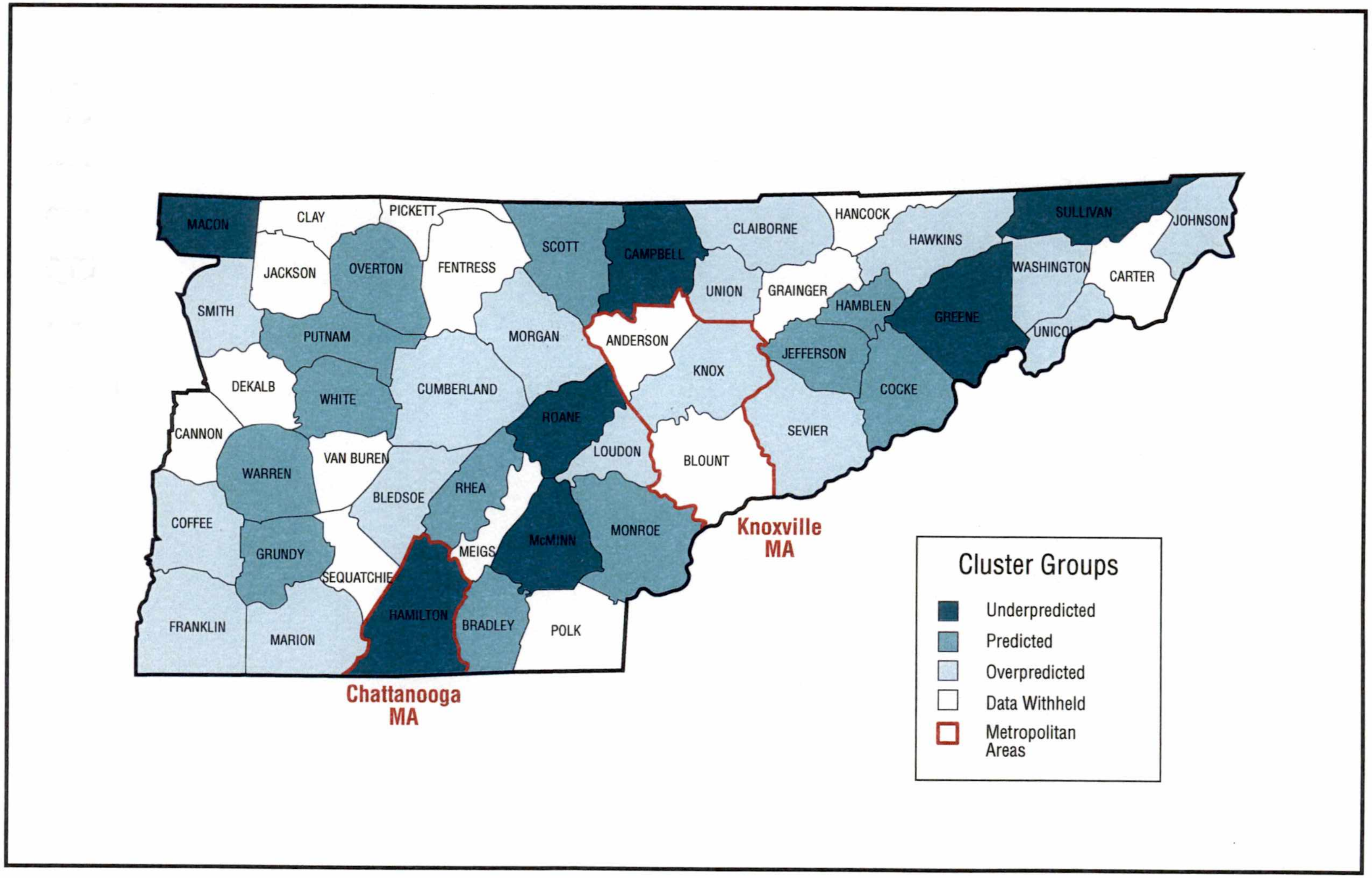

Figure 4-2. Appalachian Tennessee, Traditional Period, 1963 Manufacturing Models Residual Clusters.

the number of manufacturing workers increased from 100 to 800, and value added by manufacture from 1.8 to 12.3 million dollars (1958 Census of Manufactures; 1963 Census of Manufactures).[1] Conversely, Campbell County lost 100 production workers, a decrease from 1,300 to 1,200, but increased value added by manufacture from 18.9 to 54.9 million dollars. Also, Campbell County added four new plants (1958 Census of Manufactures; 1963 Census of Manufactures). Evidence suggests that Grundy County's industrial development was traditional. Manufacturing development was by labor-intensive industries, increases in value added by manufacture occurred by increases in the number of production workers. However, Campbell County received new plants with advanced technologies that produced higher-value goods per worker.

Traditional Period Summary

The 1958 and 1963 observations constitute the Traditional Period and the analyses produce similar results. Manufacturing first surpassed agriculture as the South's leading employer in 1958 (Hammond 1972). The emergence of Appalachian Tennessee as a manufacturing region coincided

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[1] *Value added by manufacture is measured in 1992 dollars as determined by the Consumer Price Index inflation calculator.*

with the changing employment structure of the South. During the Traditional Period most manufacturing growth occurred in small-scale, low-technology, labor-intensive fields such as textiles, apparel, timber, and food processing (Hartshorn 1997; Johnson 1985). These pioneering industries required substantial amounts of low-cost labor. The analysis indicates that while the variance in measures of manufacturing correlates with community size and vibrancy, population structure (emphasis working-age) and an agricultural economy were also significant. Communities with pools of cheap available labor were in rural counties and small towns (Lonsdale and Browning 1971). The analysis captures changes in manufacturing and suggests that counties adjacent to established centers of employment are less likely to be predicted.

Transitional Period (1967-1972)

The Transitional Period in Appalachian Tennessee's industrial development is marked by a decrease in the ability of the composite community components to predict all regression models (Table 3-9). Both the coefficients of determination and the number of components used decrease. The effects of population structure and small-scale agriculture are marginal. However, large-scale agriculture

becomes increasingly significant in the value added per production worker and per-capita value added by manufacture models.

Cluster Analysis for 1967

Table 4-3 and Figure 4-3 summarize the standardized residuals and cluster groupings for 40 counties in 1967. Twenty-two counties (55%) are predicted, 15 (37%) are overpredicted and only three are underpredicted. Most of the overpredicted counties are the same ones overpredicted for 1963. With the exception of Putnam, all overpredicted counties are adjacent to the three service and research centers (Washington, Knox, and Coffee counties) or to communities that were underpredicted earlier.

The most significant change is the decline in the number of underpredicted communities from 1963. Only, Roane, Greene, and Sullivan remain underpredicted, i.e., they have more manufacturing than components predicted. Hamilton, despite the addition of 41 firms, 6,800 production workers, and an increase in value added by manufacture from 1,657.4 to 2,276.1 million dollars, is overpredicted (1963 Census of Manufactures; 1967 Census of Manufactures). Macon, McMinn, and Campbell, underpredicted in 1963, are predicted. These communities' socio-economic structures

Table 4-3. Transitional Period, 1967 Manufacturing Model Residuals and Cluster Results.

County	Manufacturing Models: Value Added by Manufacture	Production Workers	Value Added per Production Worker	Per-capita Value Added by Manufacture	Production Workers Per-capita	Cluster
ANDERSON						
BLEDSOE	-.13835	-.13001	-.21423	-.19837	.28025	5
BLOUNT						
BRADLEY	-.00873	.18146	.03376	.09656	-.05353	5
CAMPBELL	-.39920	-.37504	.59718	.30592	-.16051	5
CANNON						
CARTER	-.45035	-.25279	.11422	.22295	-.16155	5
CLAIBORNE	-.12161	-.17836	-.20227	-.51109	-.68020	6
CLAY						
COCKE	-.10865	-.04176	.23409	.37622	.36731	5
COFFEE	-.20101	-.25199	-.20583	-.72618	-.88230	6
CUMBERLAND	-.11302	-.48678	1.43758	.11814	-.66918	6
DE KALB	.05123	.23877	-.53473	-.07950	.79976	5
FENTRESS	-.20843	-.03534	-.49767	-.12551	.60158	5
FRANKLIN	-.11735	-.09743	-.67074	-1.01439	-.86713	6
GRAINGER	-.20293	-.48708	-.40192	-.90592	-1.41661	6
GREENE	2.30788	1.06051	2.38116	2.20187	.80296	4
GRUNDY	.00272	.10909	-.33862	-.10063	-.20835	5
HAMBLEN	.28341	1.39551	-.48729	1.15290	1.72049	5
HAMILTON	1.33972	2.32999	.18646	.29020	1.68863	5
HANCOCK						
HAWKINS	-.21611	-.63130	.50170	-.85436	-.94691	6
JACKSON	-.10457	-.10411	-.24188	-.13800	.06556	5
JEFFERSON	.05470	.68952	-.99007	-.10855	.87032	5
JOHNSON	-.06266	.03254	-.84658	-.20979	-.04169	5
KNOX	-3.50043	-3.98749	-1.35206	-1.88577	-.47933	6
LOUDON	.11401	.27660	.96505	.97723	.75462	5
McMINN	.30384	.71873	.60965	1.24897	1.53424	5
MACON	.12579	.36907	.06284	.29456	.80259	5
MARION	-.29650	-.57930	.82910	-.29819	-1.12833	6
MEIGS	-.21752	-.49134	-.36470	-.36868	-1.16230	6
MONROE	-.30472	.11371	-1.20139	-.55296	.71437	5
MORGAN	-.24869	-.38509	-.26388	-.37666	-.79778	6
OVERTON	-.40022	-.10051	-1.04753	-.51532	1.13222	5
PICKETT						
POLK						
PUTNAM	-.48727	-.51209	-1.03519	-1.27164	-1.27825	6
RHEA	-.20701	-.18330	.91626	.74626	.84542	5
ROANE	.90610	.60237	2.88662	2.85378	1.32057	4
SCOTT	-.39975	-.60281	.15756	-.32711	-.55924	6
SEQUATCHIE						
SEVIER	-.44461	-1.01584	-.57829	-1.40542	-2.03665	6
SMITH	.12573	.20896	-1.25958	-.91342	-.89889	6
SULLIVAN	3.98846	2.64870	1.55364	2.23550	1.19309	4
UNICOI	.08603	.17039	.67565	.58972	-.12778	5
UNION						
VAN BUREN						
WARREN	.13439	.55818	-.38764	-.01298	.70490	5
WASHINGTON	-.92863	-1.12749	-1.17096	-1.21997	-1.14712	6
WHITE	.22034	.67195	.15052	.72845	1.54200	5

4 Underpredicted · 5 Predicted · 6 Overpredicted · (blank) Data Withheld by Census Bureau

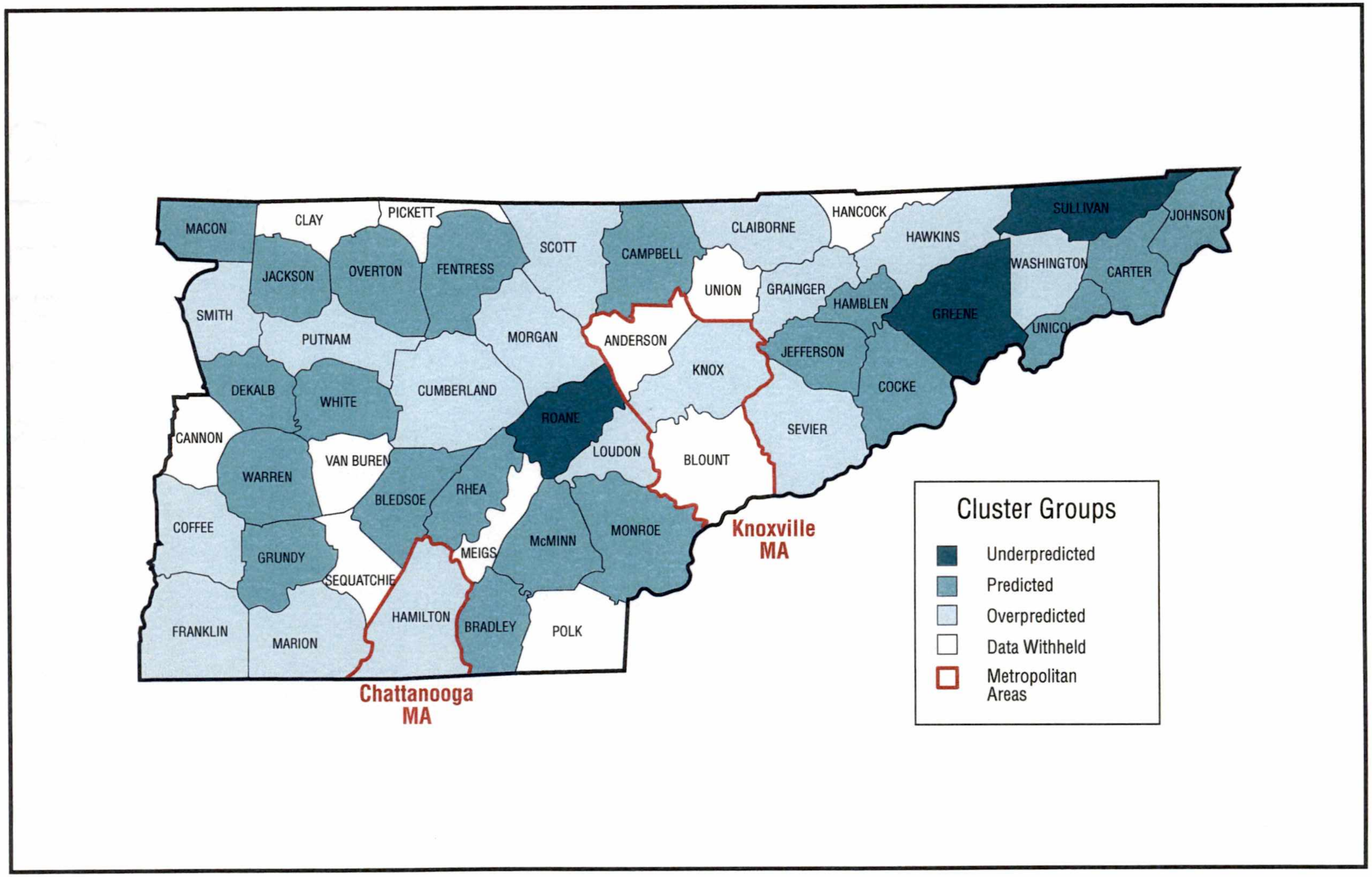

Figure 4-3. Appalachian Tennessee, Transitional Period, 1967 Manufacturing Models Residual Clusters.

adjusted to their growing manufacturing sectors. McMinn County added only one firm, but 1,200 production workers. Value added by manufacture increased from 208.4 to 296.1 million dollars (1963 Census of Manufactures; 1967 Census of Manufactures). Macon County added six firms, but only 100 production workers. Value added by manufacture rose from 37.1 to 42.4 million dollars (1963 Census of Manufactures; 1967 Census of Manufactures). However, Campbell County, lost five firms and value added by manufacture decreased from 54.9 to 48.3 million dollars. The addition of 300 production workers indicates the county's dependence on labor-intensive industries. (1963 Census of Manufactures,; 1967 Census of Manufactures).

The three underpredicted communities posted significant increases in the number of production workers between 1963 and 1967, Roane 1,000; Greene 2,400; and Sullivan 4,000 (1963 Census of Manufactures; 1967 Census of Manufactures). These communities manufacturing sectors grew faster than their socio-economic structure adjusted.

Cluster Analysis for 1972

Table 4-4 and Figure 4-4 summarized the standardized residuals and cluster groupings for 43 counties in 1972. Twenty-five counties (53%) are predicted. There is a concentration on the Cumberland Plateau and Highland Rim.

Table 4-4. Transitional Period, 1972 Manufacturing Model Residuals and Cluster Results.

County	Manufacturing Models					Cluster
	Value Added by Manufacture	Production Workers	Value Added per Production Worker	Per-capita Value Added by Manufacture	Production Workers Per-capita	
ANDERSON						
BLEDSOE	-.38921	-.82026	-.75273	-.68855	-1.01003	6
BLOUNT						
BRADLEY	.16762	.64626	-.79783	.40802	.60272	5
CAMPBELL	.25220	.48962	.24879	.48366	.25354	5
CANNON						
CARTER	-.13440	-.16617	.16981	-.19688	-.56914	5
CLAIBORNE	-.06276	.46643	-.57195	-.38396	-.16569	5
CLAY						
COCKE	.08648	.51366	.14996	.53322	.47171	5
COFFEE	-.89327	-.86416	-1.17232	-1.37656	-.79823	6
CUMBERLAND	-.03011	-.32757	1.05582	.12826	-.54844	5
DE KALB	-.21092	-.13640	-.56152	-.30096	.91361	5
FENTRESS	-.02107	.32908	-1.11339	.02949	.75507	5
FRANKLIN	-.98513	-1.23942	.10011	-1.68364	-1.68879	6
GRAINGER	-.30260	-.41231	-.51730	-.90326	-1.13617	6
GREENE	1.77785	1.87402	2.25989	2.24675	.92131	4
GRUNDY	.04939	-.34336	-.78378	-.43718	-.69987	6
HAMBLEN	1.19715	2.28692	-.16310	2.32637	2.64892	4
HAMILTON	1.79658	2.13607	-.19280	.36785	1.02276	4
HANCOCK						
HAWKINS	-.33395	.31481	-.34722	-.25072	.04238	5
JACKSON	.13461	.24870	.03387	-.11627	-.26366	5
JEFFERSON	-.30776	.59108	-1.23962	-.36202	.99857	5
JOHNSON	.11459	.22433	-.33485	.06470	.57897	5
KNOX	-3.63187	-3.52971	-.80149	-1.51895	-.63800	6
LOUDON	.10526	-.14151	1.35850	.93014	.33327	5
McMINN	.22830	.81809	.58120	1.57387	1.55529	4
MACON	-.18357	.13516	.16371	.08439	.44029	5
MARION	-.54222	-1.17237	-.38999	-.83810	-1.22875	6
MEIGS	-.35062	-.93996	-.47570	-.38789	-.63728	6
MONROE	-.47867	-.26974	-.91998	-.83665	-.69723	6
MORGAN						
OVERTON	-.17371	.09816	-.24907	-.17093	.27224	5
PICKETT	.52819	.24451	.32871	.80823	1.31725	4
POLK						
PUTNAM	-.00655	-.65207	1.39053	-.28625	-1.04653	5
RHEA	.09615	.19362	.12838	1.32675	1.70336	4
ROANE	.72618	-.11684	2.66560	1.72944	.13183	5
SCOTT	.16538	-.10996	.59605	.31005	-.40565	5
SEQUATCHIE	-.16277	-1.01164	-1.21794	-.90212	-1.13333	6
SEVIER	-.54682	-.93213	-.56077	-1.54040	-1.73854	6
SMITH	-.36017	-.08291	-.45090	-.66710	-.07853	5
SULLIVAN	3.39772	1.32514	2.05883	1.30396	-.06962	4
UNICOI	.61815	.07388	1.47737	.66413	-.26802	5
UNION	-.12429	-.64934	.60266	-.71201	-1.63472	5
VAN BUREN						
WARREN	-.31791	.53101	-.55747	.26344	1.06803	5
WASHINGTON	-.61556	.18818	-.65789	-.90521	-.44837	6
WHITE	-.27587	.18909	-.54015	-.11708	.87348	5

4 Underpredicted; 5 Predicted; 6 Overpredicted; (blank) Data Withheld by Census Bureau

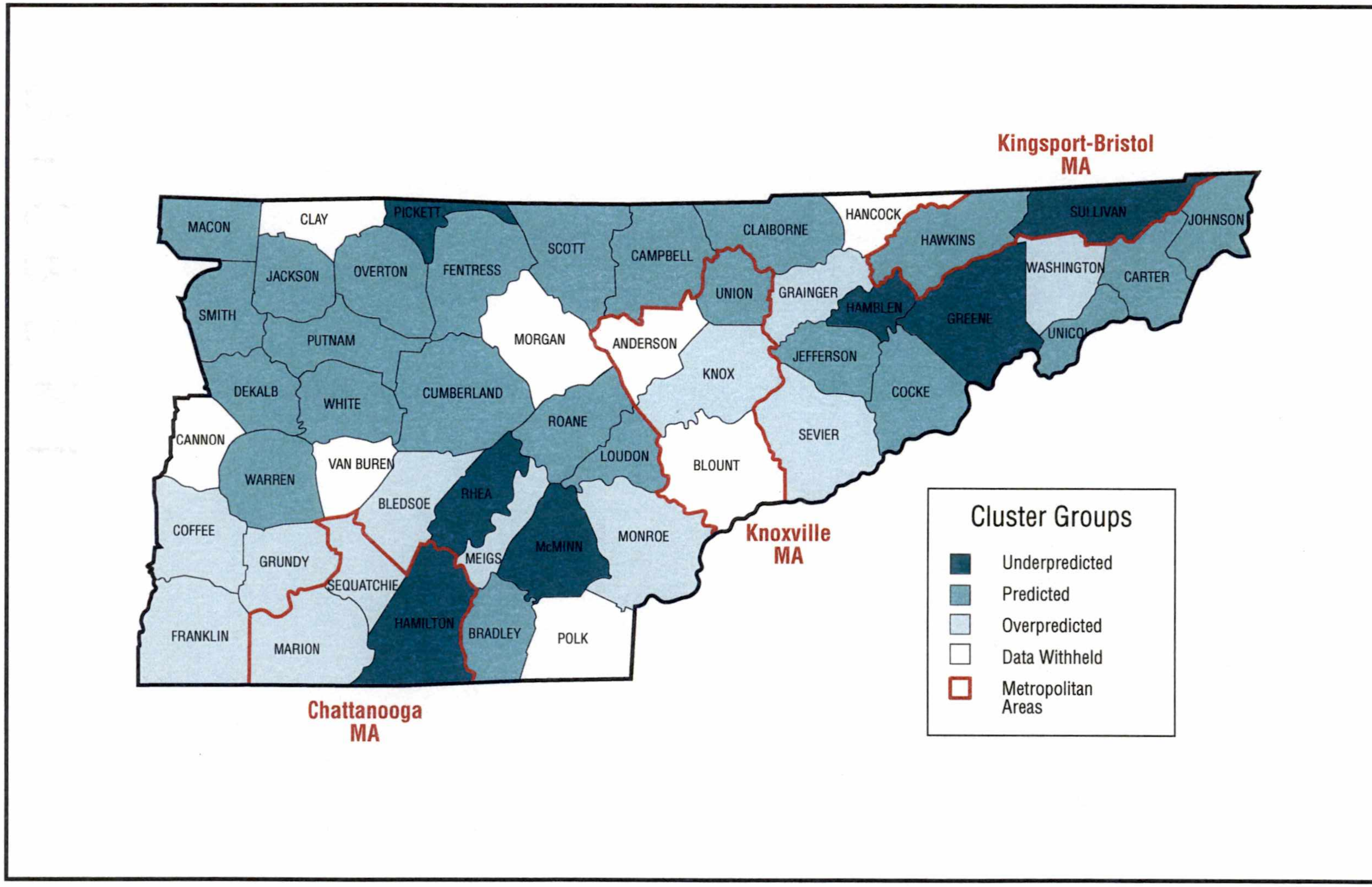

Figure 4-4. Appalachian Tennessee, Transitional Period, 1972 Manufacturing Models Residual Clusters.

Predicted communities are concentrated in the north and overpredicted communities in the south. The pattern indicates northern counties were developing industrial bases and economies more than the southern ones. Comparison of this Figure 4-4 with Figure 1-2 suggests proximity to Interstate 40 aided industrial development. Ten communities (24%) have less manufacturing than predicted. Washington, Knox, and Coffee are among the ten. The remaining seven are adjacent to one of the three or to an underpredicted community, a county with more manufacturing than predicted.

Further examination of the cluster groupings for 1972 indicates an increase in the number of underpredicted counties. Sullivan, Greene, Hamblen, Pickett, Rhea, McMinn, and Hamilton are counties with more manufacturing than predicted by the composite socio-economic components. Five of these communities are nonmetropolitan. Sullivan and Greene are consistently underpredicted. However, value added by manufacture and the number of production workers both increased in Greene, but decreased substantially in Sullivan (<u>1967 Census of Manufactures</u>; <u>1972 Census of Manufactures</u>). Sullivan County was in transition to new technologies whereas Greene County's development was traditional. Hamblen County added 20 firms and 3,000 production workers. Value added by manufacture increased from only 10.1 million to 10.7 million dollars which

indicates that the manufacturing development was labor intensive (1967 Census of Manufactures; 1972 Census of Manufactures). Conversely, Rhea, McMinn, and Hamilton counties either attracted more technologically advanced industries or upgraded existing industry technology. Rhea County added one firm and 1,000 production workers. Value added by manufacture increased from 90.7 to 148.3 million dollars (1967 Census of Manufactures; 1972 Census of Manufactures). McMinn County added four firms and 1,100 production workers. Value added by manufacture increased from 296.1 to 415.4 million dollars (1967 Census of Manufactures; 1972 Census of Manufactures). The number of firms in Hamilton County increased by 26. Only 300 production workers were added, and value added by manufacture increased from 2,276.1 to 2,577.4 million dollars (1967 Census of Manufactures; 1972 Census of Manufactures).[2]

Transitional Period Summary

Between 1963 and 1972, Appalachian Tennessee added 395 firms and 34,575 production workers (1963 Census of

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[2] *Pickett County did not report any data other than the number of firms in 1967. The community lost one manufacturing firm between the 1967 and 1972 (1967 Census of Manufactures; 1972 Census of Manufactures).*

Manufactures; 1972 Census of Manufactures).[3] This was by far the most rapid period of nonmetropolitan industrial development, both regionally and nationally (Harren and Holling 1979). Production methods were simplified and standardized, which meant industries could open branch plants in areas with supplies of inexpensive unskilled labor and access to transportation routes (Glasmeier and Leichenko 1996; Leinbach and Cromley 1982; Cromley and Leinbach 1981). The majority of the counties that are identified as having greater concentrations of manufacturing than expected were nonmetropolitan, despite the number of census designated metropolitan counties increasing from four to nine. All of Appalachian Tennessee benefited from increased manufacturing employment. The analysis captured the development of high-technology plants in Sullivan, Hamilton, Rhea, and McMinn counties and substantial increases in traditional manufacturing activity in Hamblen and Greene counties.

Shake Out Period (1977-1982)

The Shake Out Period in Appalachian industrialization includes the effects of two recessions, 1974-1977 and 1979-

[3] *Forty-seven counties reported data in 1963 and 43 in 1972.*

1982. Virtually every county in the region lost production workers. The number of production workers fell from a high of 175,500 to 160,600, a decrease of 14,900 (1972 Census of Manufactures; 1982 Census of Manufactures).[4] The coefficients of determination for all regression models were lower than in any other period. With increases in service employment, counterurbanization, and return migration, the number of production workers per-capita model failed to predict. Population structure (emphasis elderly people) re-emerged as a significant component in all predicted regression models. The agricultural economy was no longer significant in predicting the variance of manufacturing indices.

Cluster Analysis for 1977

Table 4-5 and Figure 4-5 summarize the standardized residuals and cluster groupings for 40 counties in 1977. Thirty-three communities (82%) are overpredicted, indicating less manufacturing than the composite socio-economic components suggest. Given that 1977 was the end of a recession period, the results are not surprising. In the previous period manufacturing growth was rampant, and community economic infrastructure developed simultaneously.

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[4] *Forty-three counties reported data in 1973 and 45 in 1982.*

Table 4-5. Shake Out Period, 1977 Manufacturing Model Residuals and Cluster Results.

County	Manufacturing Models				Cluster
	Value Added by Manufacture	Production Workers	Value Added per Production Worker	Per-capita Value Added by Manufacture	
ANDERSON					
BLEDSOE					
BLOUNT					
BRADLEY	-.06525	.94159	-.16391	.19252	6
CAMPBELL	-.01175	.19037	-.54696	-.36774	6
CANNON					
CARTER	-.23928	-.25045	-.79304	-.51343	6
CLAIBORNE	-.06946	.22101	-.84103	-.39817	6
CLAY	.70290	-.35709	.92989	.32365	6
COCKE	.03994	.11137	.60757	.89029	6
COFFEE	-.21790	-.37738	.27359	-.41795	6
CUMBERLAND	-.36851	-.35902	.16383	-.57908	6
DE KALB	.19458	-.43777	-.39091	.00146	6
FENTRESS	.43493	.35956	.57126	.40586	6
FRANKLIN	-.20599	-.47227	-.27542	-.74076	6
GRAINGER	-.27437	-.36103	-.15211	-.63525	6
GREENE	.76477	.76664	1.00196	1.03969	5
GRUNDY	-.41694	-.21833	-1.21356	-.60358	6
HAMBLEN	.51388	1.80487	-.77839	1.32741	5
HAMILTON	1.15684	1.29458	.17589	1.05769	5
HANCOCK					
HAWKINS	-.37034	-.28455	.53155	-.34279	6
JACKSON					
JEFFERSON					
JOHNSON					
KNOX	-2.64234	-2.54682	-.79416	-.24591	6
LOUDON	.17449	-.39299	1.07234	.62134	6
McMINN	.65330	.85583	1.00021	1.57146	5
MACON	-.40861	-.72446	-.66661	-.44064	6
MARION	-.26767	-.53693	1.06609	-.28475	6
MEIGS	-1.40151	-1.27378	-1.05477	-1.95817	6
MONROE	-.30056	-.06060	-.15969	-.24352	6
MORGAN	-.31866	-.29649	-.04858	-.55223	6
OVERTON	.05030	-.54065	-.23513	-.34348	6
PICKETT					
POLK					
PUTNAM	.05635	-.12795	-.45099	-.72017	6
RHEA	-.49662	-.08119	.08739	.45060	6
ROANE	1.65589	.12632	3.65542	2.94712	4
SCOTT	-.20439	.25046	.42227	-.17992	6
SEQUATCHIE	-.58785	-.35448	-1.32337	-1.23600	6
SEVIER	-1.10031	-1.06285	-.86068	-1.52974	6
SMITH	-.13483	2.84964	-1.58511	-.42572	5
SULLIVAN	4.03901	2.63737	1.13580	1.84288	4
UNICOI	.24211	-.45237	.41989	.02375	6
UNION	-.52588	-.52711	-.64467	-1.27533	6
VAN BUREN	-.95291	-1.25489	-.78102	-.57957	6
WARREN	.56102	.65906	.99648	1.59076	5
WASHINGTON	.03424	.33220	-.46526	-.33521	6
WHITE	.30739	-.04941	.11391	.66265	6

4 Underpredicted 5 Predicted 6 Overpredicted Data Withheld by Census Bureau

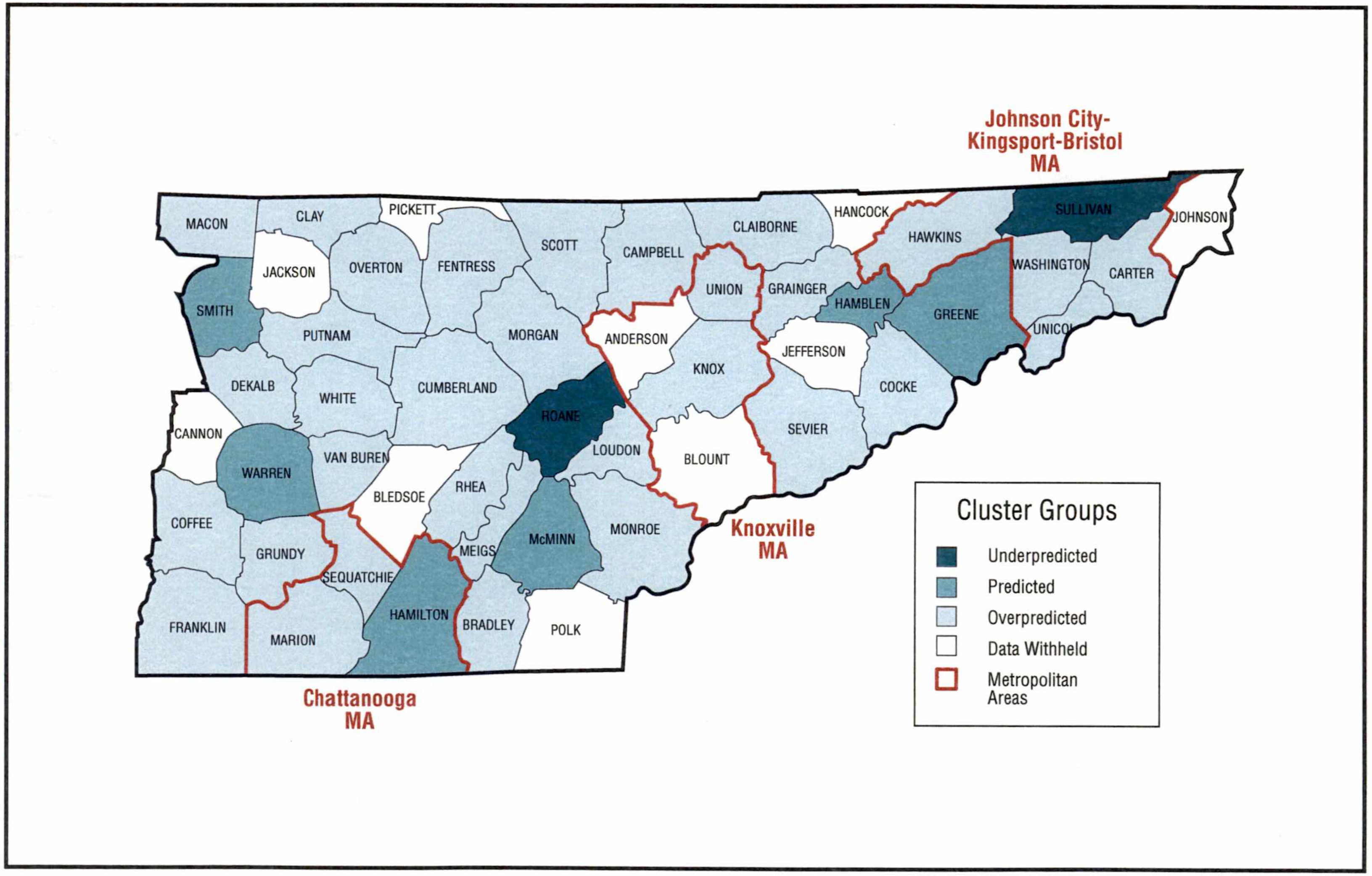

Figure 4-5. Appalachian Tennessee, Shake Out Period, 1977 Manufacturing Models Residual Clusters.

During the 1974-1977 recession population growth was substantial as laid-off Midwestern workers returned home and urbanites moved into nonmetropolitan communities. Regional population growth was 22.6% compared with the state average of 16.9% and national average of 11.4% (Census of Population, 1970 and 1980). Because the increases in population and the new economic infrastructure that developed during the meteoric rise in manufacturing activity between 1962-1972, models predicted more manufacturing than was present.

Sullivan and Roane are the only two communities with more manufacturing activity than expected. Sullivan is metropolitan and drew from a large commuting field. The Census Bureau incorporated three communities (Washington, Carter, and Unicoi) into the Johnson City-Kingsport-Bristol (Tri-cities) Metropolitan Area after the 1970 census (1977 Census of Manufactures). Sullivan County added 14 firms and 2,400 production workers, and value added by manufacture increased from 1,620.6 to 1,960.8 million dollars (1972 Census of Manufactures; 1977 Census of Manufactures). Roane County added 7 firms, 1,400 production workers, and more than doubled value added by manufacture from 406.4 to 884.3 million dollars (1972 Census of Manufactures; 1977 Census of Manufactures). Sullivan and Roane counties developed a significant amount of high-value-added manufacturing while

the majority of the region was experiencing losses in manufacturing work.

Only six counties are predicted. Four - Greene, Hamblen, McMinn, and Hamilton - were underpredicted in 1972. Greene and Hamblen counties both managed to increase the number of firms (13 and 25) and value added by manufacture (122.4 and 238.9 million dollars), but each lost production workers (800 and 700) (1972 Census of Manufactures; 1977 Census of Manufactures). McMinn County lost seven firms but managed to add 200 production workers and increase value added by manufacture from 415.5 to 465.5 million dollars (1972 Census of Manufactures; 1977 Census of Manufactures). Hamilton County added 21 firms and 500 production workers, but value added by manufacture fell from 2,577.4 to 2,420.3 million dollars (1972 Census of Manufactures; 1977 Census of Manufactures). Industrial development in Greene, Hamblen, McMinn, and Hamilton counties was in the form of new technologies and higher-value added production. Significant increases in value added by manufacture and developed community infrastructure development caused models to accurately predict these communities.

Cluster Analysis for 1982

For 1982, which also was the end of a recession, results similar to 1977 might be expected (Table 4-5 and

Figure 4-5). The standardized residuals and cluster groupings for 1982 are summarized for 43 counties in Table 4-6 and Figure 4-6. Most counties, 22 (51%), are overpredicted or have less manufacturing than expected given community characteristics. Three are counties with the large service and research institutions (Coffee, Knox, and Washington). Four are located in metropolitan areas, and 11 are adjacent to metropolitan areas. Sixteen counties (37%) are predicted, up from only six in 1977. None of the 16 experienced large increases in number of firms, number of production workers, or value added by manufacture. In fact most lost production workers (1977 Census of Manufactures; 1982 Census of Manufactures). Community characteristics simply had time to adjust to the rapid changes begun in the first recession of the Shake Out Period, which resulted in more accurate prediction.

Five counties were underpredicted: Greene, McMinn, Warren, Smith, and Anderson (first reporting). Greene County added only three firms and 100 production workers, but value added by manufacture increased from 460.4 to 731.6 million dollars (1977 Census of Manufactures; 1982 Census of Manufactures). McMinn County lost three firms and 400 production workers, but value added by manufacture increased from 465.5 to 500.2 million dollars (1977 Census of Manufactures; 1982 Census of Manufactures). Smith County

Table 4-6. Shake Out Period, 1982 Manufacturing Model Residuals and Cluster Results.

County	Manufacturing Models: Value Added by Manufacture	Production Workers	Value Added per Production Worker	Per-capita Value Added by Manufacture	Cluster
ANDERSON	1.59826	-.42863	2.72736	2.03125	4
BLEDSOE	-.64579	-.89614	-.48369	-1.20257	6
BLOUNT					
BRADLEY	-.03240	1.14306	-.55210	.54670	5
CAMPBELL	-.02596	-.00687	.08343	.01045	5
CANNON					
CARTER	-.63730	-.43819	-.69319	-.87507	6
CLAIBORNE	-.49293	-.37471	-.85392	-1.06264	6
CLAY	.13351	.04091	-.55642	.04374	5
COCKE	.04086	.05461	.71584	.18685	5
COFFEE	-.46444	-.22147	-.39256	-.38132	6
CUMBERLAND	-.19097	-.37567	.11374	-.74006	6
DE KALB	.31961	.25099	.18969	.51046	5
FENTRESS	.55659	.83474	-.38159	-.05188	5
FRANKLIN	-.88971	-1.00619	-1.09701	-1.81329	6
GRAINGER	-.47956	-.53582	-.51093	-.86100	6
GREENE	2.44270	1.59427	2.97252	2.00538	4
GRUNDY	-.89663	-1.13882	-1.07936	-.74731	6
HAMBLEN	.14145	1.87720	-.66572	1.30370	5
HAMILTON	.57120	1.19264	.77314	.83309	5
HANCOCK					
HAWKINS	-.54050	-.77790	.60720	-.46840	6
JACKSON	.58914	.37061	.99678	1.13409	5
JEFFERSON	-.46061	-.02667	-.97146	-.90939	6
JOHNSON	.63747	1.10471	-.18433	.62571	5
KNOX	-1.93627	-2.35168	.89466	-.03774	6
LOUDON	-.13121	-.30656	.56675	.20034	5
McMINN	.77915	1.09613	.66892	1.70096	4
MACON	-.12804	-.05503	-.53187	-.31315	6
MARION	-1.05085	-1.32282	-.26114	-.95767	6
MEIGS					
MONROE	-.67044	-.39968	-.82767	-1.01695	6
MORGAN	-.68856	-1.02197	.51157	-.41916	6
OVERTON	.30506	.25582	-.70787	-.67071	6
PICKETT	.70646	.70533	-.50112	.66393	5
POLK					
PUTNAM	.06390	.42401	-.28704	-.21091	6
RHEA	-.44331	-.07715	-.44839	.63647	5
ROANE					
SCOTT	-.11263	-.39896	1.13455	.16432	5
SEQUATCHIE	-.96873	-1.22208	-1.61718	-1.12765	6
SEVIER	-.73782	-.80833	-.58947	-1.17108	6
SMITH	-.47573	-.51164	-1.01045	-.89755	6
SULLIVAN	3.75681	2.58925	1.25385	1.66871	4
UNICOI	.37963	.22261	1.34082	.65438	5
UNION					
VAN BUREN	-.88703	-1.23731	-.89562	-.17190	6
WARREN	.87726	1.01557	1.09160	1.56583	4
WASHINGTON	-.47901	.21362	-.50021	-.81071	6
WHITE	.56735	.95419	-.04211	.43177	5

4 Underpredicted | 5 Predicted | 6 Overpredicted | Data Withheld by Census Bureau

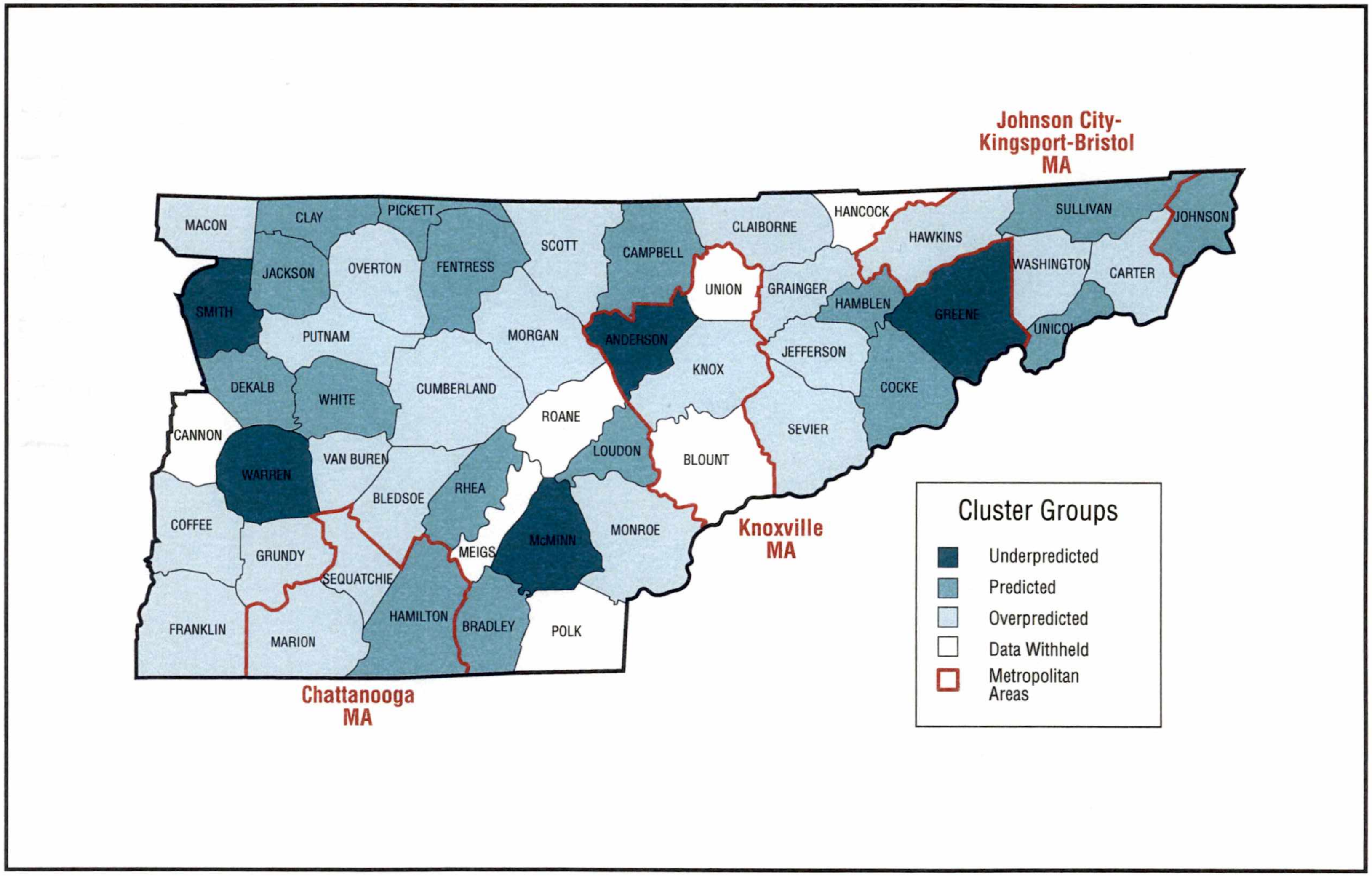

Figure 4-6. Appalachian Tennessee, Shake Out Period, 1982 Manufacturing Models Residual Clusters.

lost three firms but increased production workers by 200 and value added from 34.9 to 44.2 million dollars (<u>1977 Census of Manufactures</u>; <u>1982 Census of Manufactures</u>). Warren County added one firm but lost 1,100 production workers. Value added by manufacture decreased from 351.4 to 342.1 million dollars (<u>1977 Census of Manufactures</u>; <u>1982 Census of Manufactures</u>). These communities were in transition to standardized manufacturing methods which increased value added but resulted in job losses.

Shake Out Period Summary

Inflation, recession, and manufacturing employment losses dominated the Shake Out Period. Only the strongest companies survived. By 1980, virtually every nonmetropolitan county in Appalachian Tennessee had lost significant manufacturing employment in relative or absolute terms (Barkley 1982; Anderson and Barkley 1982). Explanatory power declined in all models and failed to predict number of production workers per-capita. Counterurbanization and return migration reorganized population distribution, and increasing numbers of people entered service occupations. Many low-technology and under-funded manufacturing facilities shut down. Most new factories that opened were high-technology branch plants, which required fewer employees. It became increasingly

difficult to attract and retain industry, which forced many communities to aggressively market themselves (Newman 1981; Hart 1988; Raitz 1988).

New Paradigm (1987-1992)

The last period in Appalachian Tennessee industrial development is associated with a return to dominance of community size and vibrancy in explaining variance in manufacturing location (Table 3-9). Population structure (emphasis elderly persons) was no longer significant. The small-scale agriculture component re-emerged in three models in 1987, which indicated a labor market that could be lured away from tobacco production and into standardized high-value-added manufacturing jobs. The majority of low-technology labor intensive production began to move into foreign countries resplendent with low-wage labor. Industrialization focused on the development of supply plants within reasonable proximity of central assembly plants. By 1992 in Appalachian Tennessee the number of production workers had increased from 160,600 to 182,200, and the number of firms from 2,865 to 3,488 (1982 Census of Manufactures; 1992 Census of Manufactures).

Cluster Analysis for 1987

Table 4-7 and Figure 4-7 summarize the standardized residuals and cluster groupings for 47 counties, which is the largest number reporting for any observation year. The majority, 30 or 64%, are overpredicted, and thus have less manufacturing than expected. Eleven of 15 metropolitan counties are overpredicted. These communities represent commuting fields; and, therefore, overprediction is logical. The majority of the counties in the Cumberland Plateau and Highland Rim regions are also overpredicted, which indicates that the community infrastructure developed in the 1970s, still is indicative of communities with more manufacturing than exists.

There are nine (19%) predicted counties, only one of which is metropolitan. The remaining six are adjacent to metropolitan or underpredicted communities. Monroe, Scott, Cumberland, Bledsoe, and Hawkins counties were all overpredicted in 1982 (Table 4-6 and Figure 4-6). Monroe County lost five firms, but managed to increase production workers by 1,000 and value added from 64.7 to 190.9 million dollars (1982 Census of Manufactures; 1987 Census of Manufactures). Bledsoe County also lost seven firms but added 100 production workers, and value added by manufacture increased from 14.4 to 24.7 million dollars (1982 Census of

Table 4-7. New Paradigm Period, 1987 Manufacturing Model Residuals and Cluster Results.

County	Manufacturing Models: Value Added by Manufacture	Production Workers	Value Added per Production Worker	Per-capita Value Added by Manufacture	Cluster
ANDERSON	.98668	-.64647	6.76746	5.69666	5
BLEDSOE	.59845	-.45465	5.08585	-.55955	5
BLOUNT	-.76446	-.74577	-.56060	-.89685	6
BRADLEY	5.96908	5.84677	.76775	5.44581	4
CAMPBELL	-.00457	.46456	-.06646	.69479	6
CANNON					
CARTER	-5.54760	-.68447	-5.66647	-.68574	6
CLAIBORNE	-.64441	-.64695	-.94558	-.96896	6
CLAY	-.65786	-.55486	-.66677	.69508	6
COCKE	.86944	.68546	6.65568	5.65967	5
COFFEE	-.76457	-.56966	-.40709	-.70587	6
CUMBERLAND	.48455	.68660	5.04679	-.60040	5
DE KALB	-.65645	-.48479	-.76667	-.45959	6
FENTRESS	.44767	.48599	-.44867	-.45471	6
FRANKLIN	-5.65461	-5.75908	-.97066	-6.54951	6
GRAINGER	-.08596	-.54975	-.45446	-.85665	6
GREENE	5.89856	5.40580	5.09966	.89647	4
GRUNDY	.05576	-.60406	-.70741	-.64965	6
HAMBLEN	.86096	6.95670	-.75467	6.66866	4
HAMILTON	.75665	5.50469	-.50497	.85980	4
HANCOCK					
HAWKINS	.76655	-.56567	5.64766	.75849	5
JACKSON	-.55607	-.48495	.58495	.05057	6
JEFFERSON	-.47556	-.56004	-.65468	-.78955	6
JOHNSON	.56849	.58456	.45665	.86409	5
KNOX	-6.44845	-6.04761	-.77547	.00066	6
LOUDON	-.55587	-.79559	5.50555	-.08675	5
McMINN	5.40568	5.74446	.80950	6.04460	4
MACON	-.50509	-.55057	-.90467	-.58446	6
MARION	-.49047	-.48765	.57468	-.68578	6
MEIGS	.65070	.58590	-.45456	-.94775	6
MONROE	.59665	.69655	.64896	.47407	5
MORGAN	-.66448	-.46867	.54068	-.59050	6
OVERTON	.00578	-.56586	-.65095	-.64895	6
PICKETT	-.49445	-.65554	-5.44555	-.55056	6
POLK					
PUTNAM	-.55907	.96605	-.48467	.56957	6
RHEA	.45558	5.67566	-.00655	5.46546	4
ROANE	-5.67865	-.98769	-5.56675	-5.44096	6
SCOTT	.75777	.68506	5.45086	.84967	5
SEQUATCHIE	-.44747	-.60849	-5.65766	-5.45470	6
SEVIER	-.76406	-.55655	-.54005	-5.09880	6
SMITH	-5.09550	-5.54556	-.06481	-.68651	6
SULLIVAN	4.47590	5.64880	.74791	5.65847	4
UNICOI	-.65676	.09584	-.58966	.69881	6
UNION	-.54479	-.56406	-.86456	-5.06605	6
VAN BUREN	-.44675	-.45457	-.95406	-.06710	6
WARREN	.66677	-.45597	.75855	.64966	5
WASHINGTON	-.54549	-.56767	.56407	-.44886	6
WHITE	-.55996	.65675	-.47667	.57766	6

4 Underpredicted; 5 Predicted; 6 Overpredicted; (blank) Data Withheld by Census Bureau

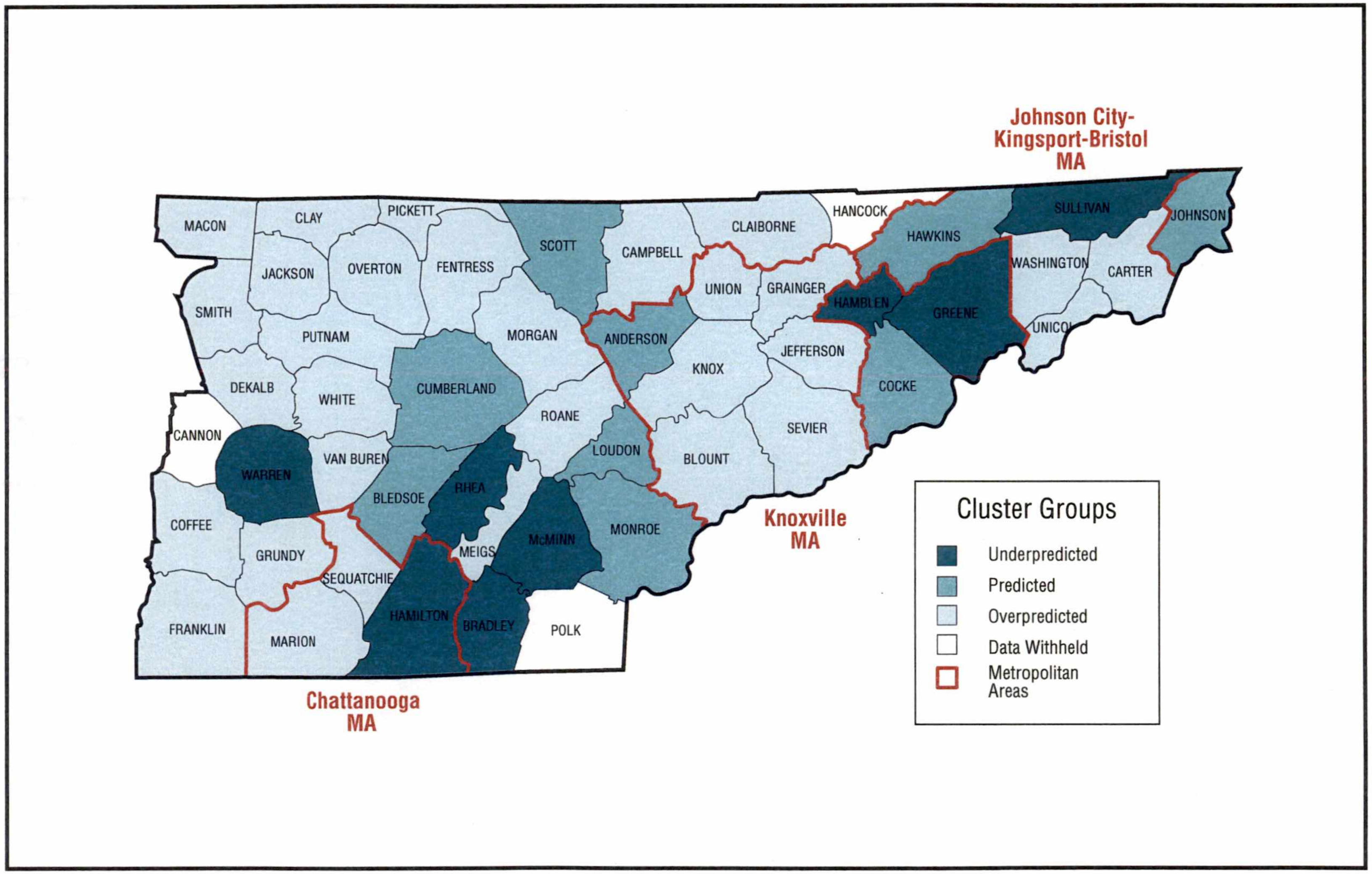

Figure 4-7. Appalachian Tennessee, New Paradigm Period, 1987 Manufacturing Models Residual Clusters.

Manufactures; 1987 Census of Manufactures). Scott County added 10 firms, 600 production workers, and value added by manufacture increased from 28.5 to 72.9 million dollars (1982 Census of Manufactures; 1987 Census of Manufactures). Cumberland County added nine firms, 900 production workers, and value added increased from 68.2 to 166.8 million dollars (1982 Census of Manufactures; 1987 Census of Manufactures). Hawkins County added 14 firms, 900 production workers, and value added increased from 288.0 to 473.5 million dollars (1982 Census of Manufactures; 1987 Census of Manufactures). All predicted counties experienced significant increases in value added by manufacture and the number of production workers whether they lost firms or not. Because of the increases the composite socio-economic components were able to predict levels of manufacturing. Communities were rebounding from the declines in manufacturing employment in the Shake Out Period.

There are seven underpredicted communities in 1987: Sullivan, Greene, Hamblen, McMinn, Rhea, McMinn, Bradley, Warren, and Hamilton. Five of the seven are nonmetropolitan. Most are in the Ridge and Valley region, adjacent to or near metropolitan areas. McMinn, Greene, and Warren are underpredicted in 1982. Sullivan and Hamblen, each had a significant increase in the number of firms, 143 to 153 and 110 to 117, and value added by manufacture,

1,777.9 to 1,892.5 million dollars and 489.7 to 796.7 million dollars. However, Hamblen added 1,200 production workers and Sullivan lost 2,200 (1982 Census of Manufactures; 1987 Census of Manufactures). Rhea County lost three firms but added 1,200 production workers and increased value added by manufacture from 28.5 to 72.9 million dollars (1982 Census of Manufactures; 1987 Census of Manufactures). Bradley County added only one firm and 100 production workers but increased value added by manufacture from 638.0 to 1,068.1 million dollars (1982 Census of Manufactures; 1987 Census of Manufactures). Because these underpredicted nonmetropolitan counties were able to maintain strong manufacturing employment bases, their economies grew and their labor forces remained.

Cluster Analysis for 1992

Standardized residuals and cluster groupings for 45 counties are summarized in Table 4-8 and Figure 4-8.[5] Twenty-one counties (51%) are predicted. Each has as much manufacturing as expected by the composite socio-economic components. The majority of communities experienced production worker growth in either 1987 or 1992, which means

[5] *Forty-seven counties reported manufacturing data in 1992, but due to omissions in the composite variables there are only 45 observations.*

Table 4-8. New Paradigm Period, 1992 Manufacturing Model Residuals and Cluster Results.

County	Manufacturing Models: Value Added by Manufacture	Production Workers	Value Added per Production Worker	Per-capita Value Added by Manufacture	Cluster
ANDERSON	1.48160	-.54019	3.54962	1.28858	4
BLEDSOE					
BLOUNT	-.01587	-.52413	.74852	-.61713	5
BRADLEY	2.12699	1.18580	.77095	1.53510	4
CAMPBELL	.39340	.49261	.15585	-.47482	5
CANNON					
CARTER	-.78296	-.08038	-1.01882	-1.30192	6
CLAIBORNE	.18494	.16558	-.27908	.01770	5
CLAY	-.52488	-.51740	-.09196	1.09854	5
COCKE	1.26375	.58448	2.69158	1.43858	4
COFFEE	-.95568	-.69821	-.69585	-.44503	6
CUMBERLAND	-.21340	-.19858	.36757	-.69624	5
DE KALB	.03808	-.44973	1.82820	2.90256	4
FENTRESS	.04517	.02127	-.42954	-.17461	5
FRANKLIN	-1.36532	-1.73802	-.95474	-1.63843	6
GRAINGER	.19670	-.05086	-.33546	-.44077	5
GREENE	1.40752	.64132	.72953	1.01654	4
GRUNDY	.24675	-.03407	-.62971	-.69279	5
HAMBLEN	.82037	3.54187	-1.19278	1.28900	4
HAMILTON	.27641	1.21205	-.44836	.03159	5
HANCOCK					
HAWKINS	1.04194	.48939	.89755	1.16910	4
JACKSON	-.32572	-.79393	1.16500	.13588	5
JEFFERSON	-.39885	-.17240	-.79502	-.86975	6
JOHNSON	.46304	.44478	.57572	.59397	5
KNOX	-1.92529	-2.23182	-.05270	-.30833	6
LOUDON	-.79436	-.73835	.08407	-.66950	6
McMINN	.57704	1.09016	-.18465	1.17581	5
MACON	-.25837	-.20584	-.63291	.00517	5
MARION	-.91706	-.69068	-1.14053	-1.23249	6
MEIGS					
MONROE	.41480	.54351	.02048	.19192	5
MORGAN	-.47014	-.43997	-.38598	-.90097	6
OVERTON	.08375	-.13253	-.25472	-.19854	5
PICKETT	-.23288	-.12782	-.34803	-.16489	5
POLK					
PUTNAM	.64043	.80465	.24099	.88230	5
RHEA	-.37081	.78283	-.99203	-.03606	5
ROANE	-1.79662	-1.41486	-1.27724	-2.01953	6
SCOTT	.62627	.69781	.28921	.12179	5
SEQUATCHIE	-.78987	-.54924	-.37524	-.71617	6
SEVIER	-.76765	-.64423	-.55047	-1.37867	6
SMITH	-1.22749	-1.25770	-.95982	-.50978	6
SULLIVAN	3.34962	2.13040	.54062	.71612	4
UNICOI	-.16392	.33460	.54310	-.18385	5
UNION	-.11867	-.13639	.71421	-.16768	5
VAN BUREN	-.50550	-.58658	-.47854	-.06760	5
WARREN	.39408	.07743	.25558	1.47744	5
WASHINGTON	-.82983	-.14192	-.94151	-1.00961	6
WHITE	-.32149	-.14467	-.72267	-.17255	5

4 Underpredicted | 5 Predicted | 6 Overpredicted | Data Withheld by Census Bureau

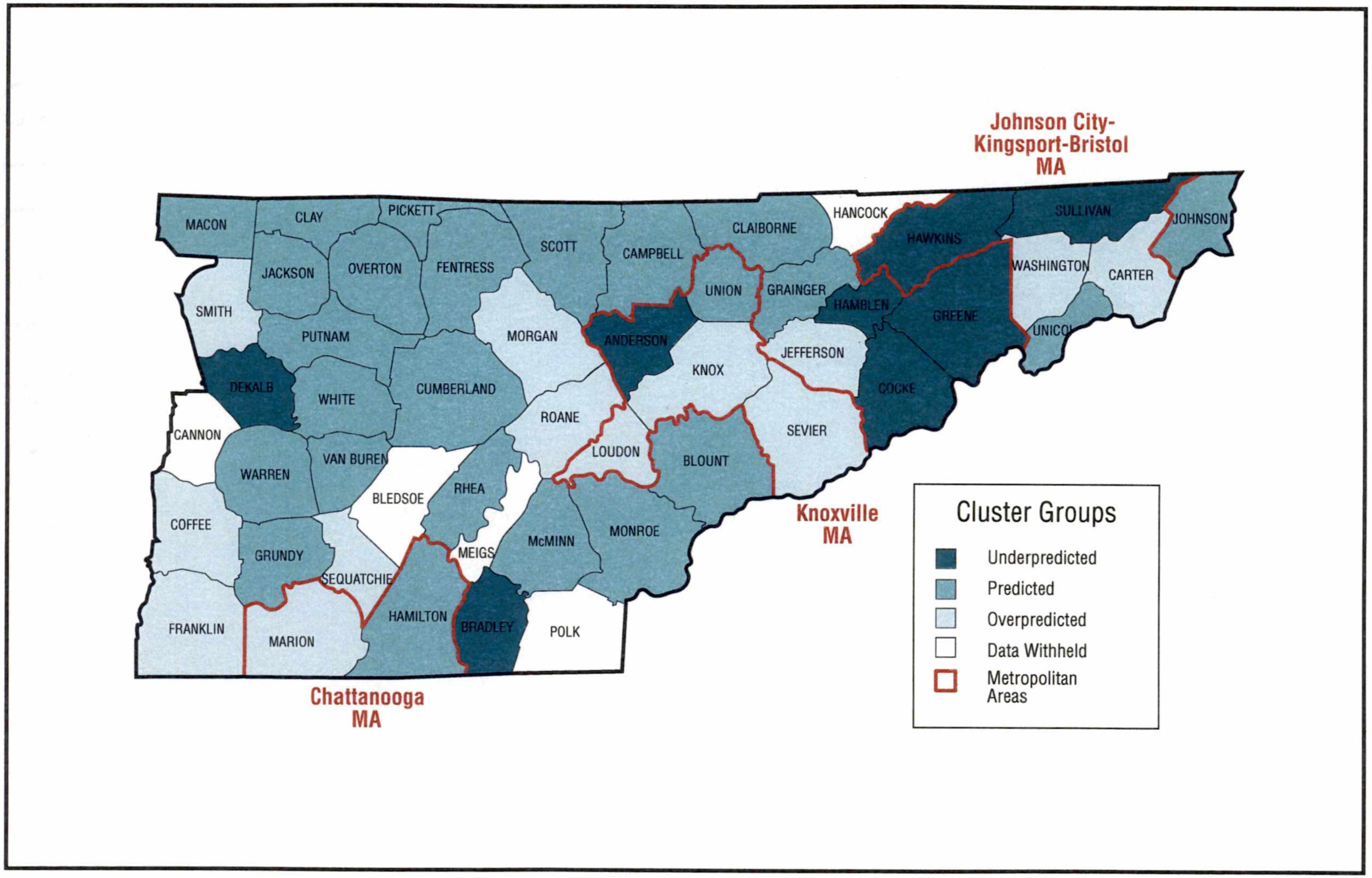

Figure 4-8. Appalachian Tennessee, New Paradigm Period, 1992 Manufacturing Models Residual Clusters.

infrastructure growth and accurate prediction. Only 13 (29%) are overpredicted. All of the overpredicted counties but one, Smith, are metropolitan, adjacent to a metropolitan area, or adjacent to one of the region's service and research counties (Coffee, Knox, Washington). Counties in one of these geographic situations were continually overpredicted, which indicates reliance on adjacent communities for employment and ultimately the source behind their development of community infrastructure.

The majority of underpredicted counties, ones with more industrialization than expected, are in the Ridge and Valley and are in or adjacent to metropolitan areas. De Kalb County is the only exception. Five of the eight are nonmetropolitan. Sullivan, Greene, Hamblen, and Bradley were underpredicted in 1987 (Table 4-7 and Figure4-7). Continued underprediction means faster manufacturing growth than community infrastructure growth. Cocke, Hawkins, and Anderson counties were predicted in the previous period and De Kalb was underpredicted. Hawkins County experienced the most impressive growth, adding eight firms, 1,400 production workers, and increasing value added by manufacture from 473.5 to 566.2 million dollars (1987 Census of Manufactures; 1992 Census of Manufactures). Cocke County added 10 firms, 200 production workers and increased value added by manufacture from 46.4 to 77.4 million dollars (1987 Census

of Manufactures; 1992 Census of Manufactures). Anderson County added three firms but lost 100 production workers. Value added by manufacture increased from 1,022.6 to 1,228.0 million dollars (1987 Census of Manufactures; 1992 Census of Manufactures). These communities have high-value-added manufacturing in their industrial bases. De Kalb County added eight firms and 500 production workers, but experienced a decrease in value added by manufacture from 166.8 to 156.0 million dollars (1987 Census of Manufactures; 1992 Census of Manufactures).

New Paradigm Period Summary

The 1987-1992 period featured the dominance of community size and community vibrancy in predicting manufacturing location. New production scenarios including global restructuring, flexibilism, and just-in-time production require supply plant locations near central assembly facilities. The majority of underpredicted communities are either in or adjacent to metropolitan areas. The counties in and around the Johnson City-Kingsport-Bristol Metropolitan Area were the recipients of significant industrial growth. This result supports many location theorists' belief that new production scenarios produce dispersed agglomerations (Scott 1988; Inman 1991; and Linge 1991). However, the majority of the underpredicted counties

were nonmetropolitan, which implies that rural communities can participate in the new manufacturing economy.

Case Study Selection

Community characteristics and multiple manufacturing indices identify which Appalachian Tennessee communities rely on industrialization to maintain their economies. Table 4-9 summarizes the cluster groupings for all observation years. Case study selection is based on how consistently underpredicted standardized residuals are grouped. Underpredicted counties have more manufacturing than the composite socio-economic components predict.

A heuristic method is employed to interpret predictability between 1958 and 1992. To be considered consistently underpredicted a community must be identified as such in more than half of the eight observation periods. Only three counties meet this criterion: Greene (7), Sullivan (7), and McMinn (6). The purpose of the study is to determine which nonmetropolitan communities have maintained a significant manufacturing base. Sullivan County, while designated nonmetropolitan through 1972, was added to the Johnson City-Kingsport-Bristol Metropolitan Area in 1977. Therefore, Sullivan County is eliminated. Greene and McMinn counties are in the Ridge and Valley

Table 4-9. Cluster Results, Observation Years 1958-1992.

County \ Year	1958	1963	1967	1972	1977	1982	1987	1992
ANDERSON						4	5	4
BLEDSOE	5	6	5	6		6	5	
BLOUNT							6	5
BRADLEY	5	5	5	5	6	5	4	4
CAMPBELL	5	4	5	5	6	5	6	5
CANNON								
CARTER			5	5	6	6	6	6
CLAIBORNE	5	6	6	5	6	6	6	5
CLAY					6	5	6	5
COCKE	5	5	5	5	6	5	5	4
COFFEE	6	6	6	6	6	6	6	6
CUMBERLAND	5	6	6	5	6	6	5	5
DE KALB			5	5	6	5	6	4
FENTRESS	5		5	5	6	5	6	5
FRANKLIN	5	6	6	6	6	6	6	6
GRAINGER	5		6	6	6	6	6	5
GREENE	4	4	4	4	5	4	4	4
GRUNDY	4	5	5	6	6	6	6	5
HAMBLEN	5	5	5	4	5	5	4	4
HAMILTON	4	4	5	4	5	5	4	5
HANCOCK								
HAWKINS	5	6	6	5	6	6	5	4
JACKSON	5		5	5		5	6	5
JEFFERSON	5	5	5	5		6	6	6
JOHNSON	5	6	5	5		5	5	5
KNOX	6	6	6	6	6	6	6	6
LOUDON	5	6	5	5	6	5	5	6
McMINN	4	4	5	4	5	4	4	5
MACON	4	4	5	5	6	6	6	5
MARION	5	6	6	6	6	6	6	6
MEIGS			6	6	6		6	
MONROE	5	5	5	6	6	6	5	5
MORGAN	5	6	6		6	6	6	6
OVERTON	5	5	5	5	6	6	6	5
PICKETT				4		5	6	5
POLK								
PUTNAM	5	5	6	5	6	6	6	5
RHEA	5	5	5	4	6	5	4	5
ROANE	4	4	4	5	4		6	6
SCOTT	5	5	6	5	6	6	5	5
SEQUATCHIE				6	6	6	6	6
SEVIER	5	6	6	6	6	6	6	6
SMITH	5	6	6	5	5	4	6	6
SULLIVAN	4	4	4	4	4	5	4	4
UNICOI	5	6	5	5	6	5	6	5
UNION		6		5	6		6	5
VAN BUREN					6	6	6	5
WARREN	5	5	5	5	5	4	5	5
WASHINGTON	6	6	6	6	6	6	6	6
WHITE	5	5	5	5	6	5	6	5

4 Underpredicted; 5 Predicted; 6 Overpredicted; (blank) Data Withheld by Census Bureau

province, Interstate highways cross them and they are close to metropolitan areas. Greene and McMinn counties are Appalachian Tennessee's premiere nonmetropolitan manufacturing communities (Figure 4-9).

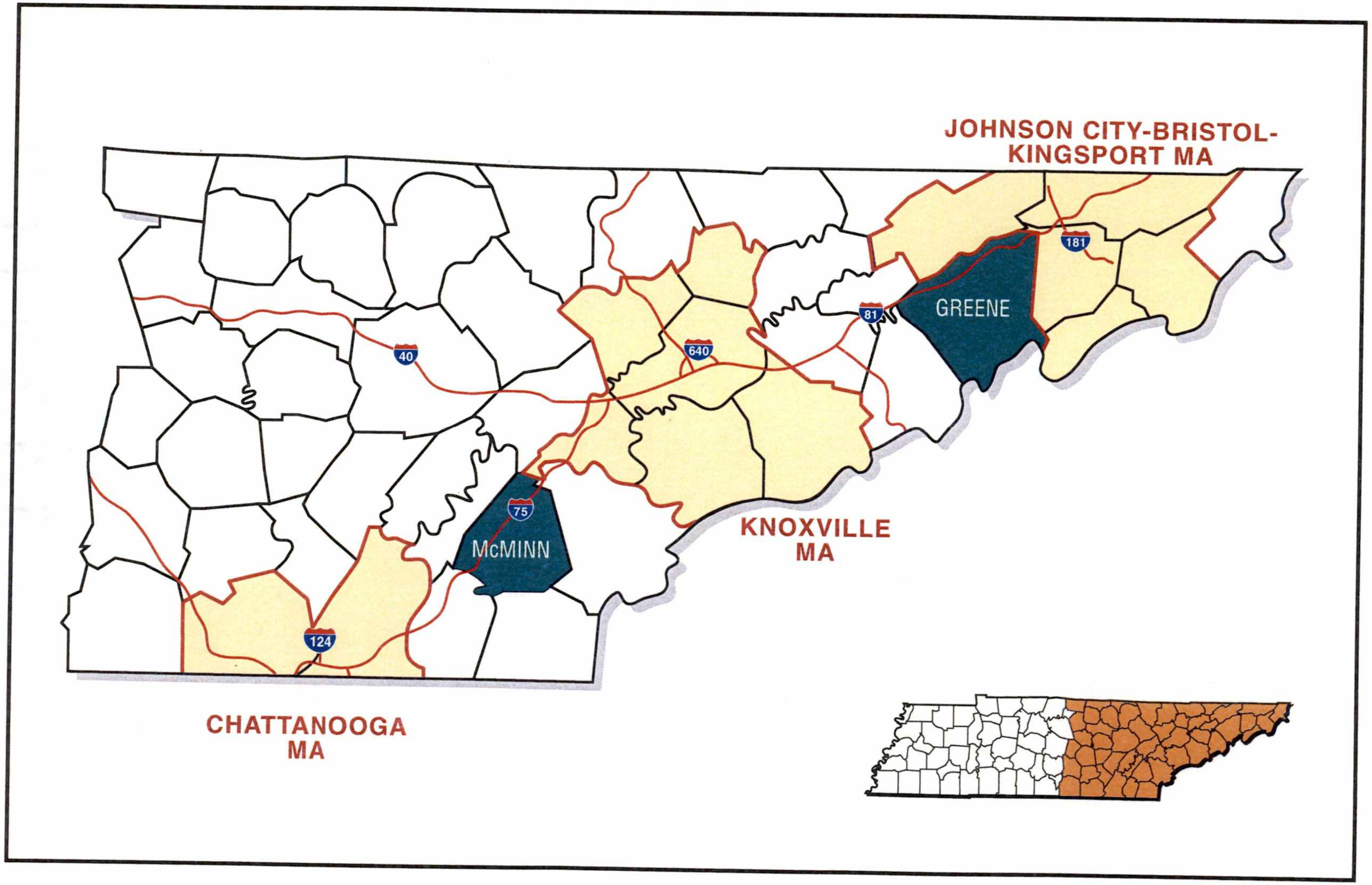

Figure 4-9. Appalachian Tennessee,Selected Case Studies.

CHAPTER V

ANALYSIS OF MANUFACTURING IN GREENE AND McMINN COUNTIES

Manufacturing Indices

Greene and McMinn counties are Appalachian Tennessee's premiere nonmetropolitan manufacturing communities. Their levels of manufacturing were consistently underpredicted by an analysis that incorporated both community characteristics and multiple manufacturing indices. Manufacturing employment is central to the future of these communities, despite shifts in the national economy toward service and information-technology employment.

Table 5-1 summarizes indices used to determine the significance of manufacturing in both counties. Number of firms, an additional measure of manufacturing, is included. In Greene County value added by manufacture, number of production workers, value added per production worker, and per-capita value added by manufacture peaked in 1972, the height of industrialization in Appalachian Tennessee. These measures decreased in 1977, increased in 1982, but declined in 1987 and 1992. Number of production workers per-capita peaked in 1977, decreased until 1987, and rose in 1992. However, the number of firms increased in every year except 1972. In 1992 the county had 95 firms.

Table 5-1. Summary of Manufacturing Indices: Greene and McMinn Counties (1958-1992).

Indice / Year	1958	1963	1967	1972	1977	1982	1987	1992
Value Added by Manufacture (millions)								
Greene	$175.5	$340.4	$664.2	$786.6	$460.5	$731.7	$608.2	$487.2
McMinn	$217.1	S208.5	$296.2	$415.5	$465.5	$500.2	$643.3	$569.0
Number of Production Workers								
Greene	2,400	3,100	5,500	6,400	5,600	5,700	7,700	6,800
McMinn	3,900	4,000	5,200	6,300	6,500	6,100	7,200	7,300
Value Added per Production Worker								
Greene	$73,114	$109,815	$120,760	$122,914	$82,224	$128,360	$78,992	$71,647
McMinn	$55,669	$52,119	$56,956	$65,948	$71,623	$81,996	$89,349	$77,945
Per-capita Value Added by Manufacture								
Greene	$4,161.81	$8,074.07	$13,944.53	$16,515.78	$8,106.58	$12,881.21	$10,889.97	$8,722.90
McMinn	$6,449.73	$6,193.20	$8,351.77	$11,716.00	$11,116.73	$11,943.65	$15,178.53	$13,425.19
Number of Production Workers Per-capita								
Greene	17.57	13.60	8.66	7.44	10.14	9.96	7.25	8.21
McMinn	8.63	8.42	6.82	5.63	6.44	6.87	5.89	5.81
Number of Firms								
Greene	51	59	62	61	74	77	85	95
McMinn	79	89	90	95	87	84	75	75

All indices associated with value added by manufacture are measured in 1992 constant dollars as determined by the Consumer Price Index inflation calculator.

In McMinn County the number of firms reached its peak in 1972 (95). In 1992 the county had fewer firms than in 1958, but it had almost twice the number of production workers. The number of production workers continually increased, with the exception of 1982. Value added by manufacture, value added per production worker, and per-capita value added by manufacture peaked in 1987 and declined in 1992. Number of production workers per-capita peaked in 1982.

Greene and McMinn are both expanding their industrial bases but it appears by different methods. Greene County's industrial development is focused on the attraction of new small firms to replace declines in the number of production workers in existing industries. McMinn County's development is focused on expanding existing industry and the attraction of large higher-value-added industries to offset the closure of older plants. Number of production workers per-capita indicates that Greene County is becoming more heavily vested in manufacturing employment, whereas McMinn County is diversifying its economic base.

John Fraser Hart argues that the only way nonmetropolitan communities can save themselves is through concerted efforts by individuals who believe in their communities and actively promote them as industrial locations (Hart 1988). Greene and McMinn are examined to

determine what efforts are employed to ensure their futures as viable manufacturing centers.

Greene County

Greene County's terrain is predominately that of the Ridge and Valley, but the Blue Ridge Mountains flank the eastern border (Figure 1-1). In 1995, the county had a population of 58,095 (Tennessee Statistical Abstract 1996/97). There are four incorporated places: the county seat, Greeneville with 14,509 persons, Tusculum with 2,067, Moshiem with 1,591, and Baileyton with 319 (Figure 5-1) (Tennessee Statistical Abstract 1996/97). The county is connected to the surrounding region by Interstate 81 and U.S. highways 11 East and 321. It is also served by the Norfolk/Southern railroad. Greene County has a small municipal airport but no navigable waterways (Tennessee Community Data: Greeneville 1999). The Johnson City-Kingsport-Bristol Metropolitan Area borders Greene County to the northeast, but in 1990 only 12.7% of the workforce journeyed outside the county to work (1990 Census of Population).

Greene County's economy, as much of the South's and Appalachian Tennessee's, traditionally centered on agriculture. Although the economy is heavily vested in

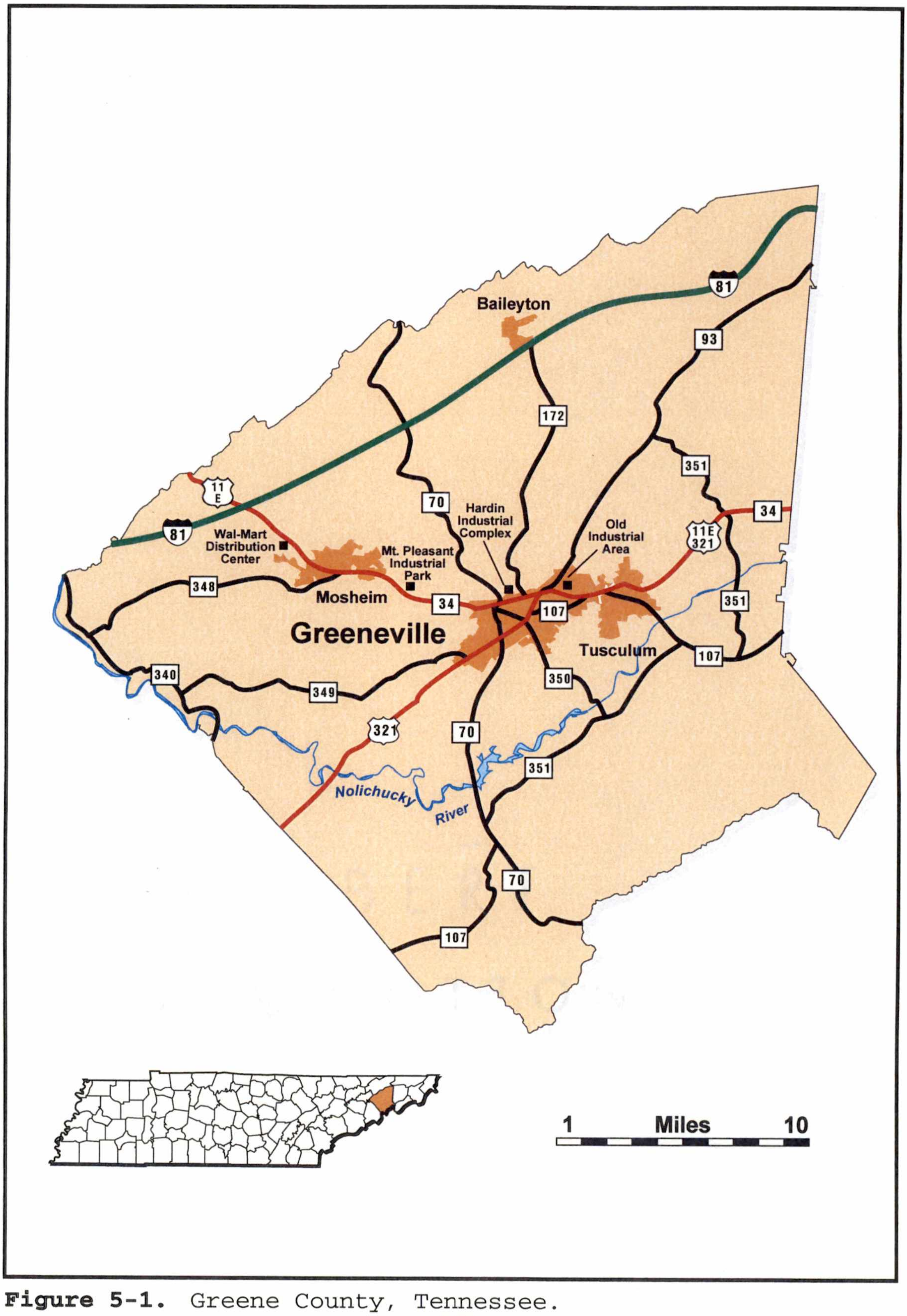

Figure 5-1. Greene County, Tennessee.

Manufacturing, agriculture continues. Greene is Tennessee's leading agricultural county (Greeneville/Greene County Tennessee). In 1992 it ranked first in number of farms (3,380), number of tobacco farms (2,357), acres in tobacco (6,711), pounds of tobacco produced (12,576,318), number of milk cows (10,760), and number of dairy farms (257) (1992 Census of Agriculture). Agriculture for Greene County residents is not only an economic endeavor, but also part of their culture and heritage. They believe that the way to maintain their family farms and the community's bucolic nature is through the expansion and retention of manufacturing (Ferguson 1999).

Initial analysis of manufacturing data indicates that Greene County is stimulating manufacturing growth by attracting new, small firms to supplant manufacturing job losses in existing industries. In 1992, Philips Consumer Electronics Company, manufacturer of color and projection televisions, employed 3,000 of the 6,800 production workers (Directory of Tennessee Manufacturers 1992). However, in 1991 the company employed 4,400 (Tennessee Directory of Manufactures 1991). Job cut backs in 1991 and 1992 resulted in the county unemployment level rising to 12.3%, well above the state level of 6.4% (Bureau of Labor Statistics 1999). The community reacted by reassessing development efforts. A long history of dealing with the fluctuations of one

industry, and more specifically, one company, that provided the bulk of manufacturing employment had exhausted community leaders' patience.

The Greeneville Cabinet Company was founded in 1947, as a subsidiary of The Magnavox Company of Fort Wayne, Indiana, and employed 350 people (Tennessee Directory of Manufactures 1947). The company was established to take advantage of local hardwood stands for the manufacture of radio, phonograph, and television set cabinets. Employment at this facility steadily increased and, by 1975, the Magnavox Company of Tennessee employed 8,500 workers (Tennessee Directory of Manufactures 1975). By the end of the recession in 1977, a large European company, Philips Corporation, purchased the American owned company. Employment plunged to 2,040 as production methods were standardized and many activities were relocated to other locations, i.e., television cabinets were more often made of plastic rather than wood (Tennessee Directory of Manufactures 1978). By 1982, some manufacturing jobs were replaced. North American Philips Corporation employed 3,300 workers in the Greene County facility, a level that was maintained throughout much of the decade (Tennessee Directory of Manufactures 1982; Tennessee Directory of Manufactures 1989). The community longed for the glory days of the Magnavox Company of Tennessee and job increases in

1990 and 1991 seemed to be an indication that those days were returning (Ferguson 1999). However, the loss of 1,400 jobs from 1991 to 1992 crushed any notion of such a recovery. Since 1992, employment has continued to decline as much of the electronics industry has moved to low cost international locations (Ferguson 1999). As of 1999, Five Rivers Electronic Innovations (Philips current incarnation) employed 1,700 (Tennessee Economic Development Center 1999).

By 1994, job growth (13.4%) in Greene County ranked third in the state and Greene County was the only nonmetropolitan community featured in a Site Selection article on Tennessee's economic growth (Park 1995; Cooper-Capps 1995). Throughout the economic upheaval the county managed to maintain its Governor's Three-Star rating (Tennessee Department of Economic and Community Development 1999).[1] Furthermore, Greeneville was selected as one of the best 100 small towns in America (Crampton 1995). Job growth was associated primarily with increases in manufacturing employment. Manufacturing accounted for 43% of non-

[1] *The Governor's Three-Star Program for Community Economic Preparedness evaluates communities with regard to four major areas: organization development, community development, education/workforce development, and economic development. Communities are reviewed annually. As of 1998, 43 counties and 14 municipalities were certified. Greene County has been certified since 1985.*

agricultural employment in 1994. The number of factories increased from 95 in 1992 to 109 in 1996 (Tennessee Statistical Abstract 1996/1997; 1992 Census of Manufactures; County Business Patterns 1996).

Many Faces One Vision: The Greene County Partnership

In 1992, Tom Ferguson was hired as Greene County's industrial recruiter. He was lured from Miami, Florida where he was president of Beacon Council, an organization responsible for the recruitment and retention of industry in Dade County (Park 1995; Ferguson 1999). Greene County was suffering from job cuts at Philips Consumer Electronics, and the monthly unemployment rate was fluctuating around 14% (Ferguson 1999; Local Area Unemployment Statistics 1999). Because the county was without a recruiter for more than six months no new projects were in the works (Park 1995). Greene County's community development was coordinated through four separate boards: Chamber of Commerce, Economic Development Board, Tourism Council, and Keep Greene Clean (Greene County Partnership 1998). All boards were staffed with community leaders who volunteered their time. Ferguson spent the first few months developing strategy and community vision. The four existing boards were merged into a single organization, which was called the Greene County Partnership (Figure 5-2) (Park 1995; Ferguson 1999).

Figure 5-2. Greene County Partnership.

The majority of Ferguson's efforts (95%) are directed at the recruitment and retention of industry. He developed a product-life-cycle classification of Greene County's factories. By understanding where companies are in product development, the Partnership can anticipate job expansion and the possibility of job loss to cheaper labor markets. Results of the 1995 survey indicated three industries that will in all probability, be short lived (Ferguson 1999). While retention and expansion of existing industry is important, new firm development is crucial to stability in Greene County's economy. Ferguson believes one of the best methods for the county to stay competitive is by keeping the cycle in perpetual motion, having facilities and developed land in place (Ferguson 1999).

Industrial Park Development

Greene County's industry is located along a corridor running from east Greeneville at the confluence of U.S. highways 11E and 321 and state highway 93 through the center of the city to Interstate 81 to the west (Figure 5-1). The old industrial area is where many of Greene County's original industries, including Five Rivers Electronic Innovations, are located. Industries are clustered around the Norfolk/Southern railroad and bordered by the highways.

In 1991, Greene County established its first industrial park, Mt. Pleasant (Figure 5-3), a 180-acre development on U.S. 11 East between Moshiem and Greeneville. It is not served by rail. With the exception of one community financed 54,000 square foot building, the park is full (Ferguson 1999). Mt. Pleasant is a modern park. It has buried utilities and good highway access. The Greene County Partnership's goal is to concentrate industry in tightly-controlled spaces where covenants and rules can be enforced. However, when Wal-Mart sought to locate a distribution facility in Greene County in 1994 the company was strictly looking for an undeveloped green-field site. After careful review of the implications, the economic development board approved extending water and utilities to a site just west of Moshiem on U.S. highway 11 East (Figure 5-4). The decision was reached after consulting with landowners and determining their amenability to sell, in the event of future industrial development. While the Wal-Mart site is not an industrial park, it could serve as the anchor for an industrial region that could eventually become a park. In 1996 the Partnership located DTR Industries, a company that makes rubber parts for the automotive industry, a short distance up the highway from Wal-Mart (Figure 5-5)(Ferguson 1999). DTR was an 18 million dollar community investment.

Figure 5-3. Mt. Pleasant Industrial Park.

Figure 5-4. Wal-Mart Distribution Center.

Figure 5-5. DTR Industries.

Initial employment was 67 with a projection of 300 by 2001 (Press Release: DTR 1996).

Greene County's other industrial park, Hardin Industrial Complex, is located close to downtown Greeneville, one mile north of U.S. highway 11 East on state highway 172 (Figure 5-1 and 5-6). It is a new 200-acre development without rail access that was the developed to accommodate Angus-Palm, a company that manufactures protective cabs, headquartered in Watertown, South Dakota. The company specifically requested location close to downtown. The Partnership determined that a new park was justified (Ferguson 1999). The complex opened in June of 2000. Ferguson believes that the new park's build-out period is five years, and that 10 to 12 companies will occupy the new facility (Ferguson 1999).

With infrastructure expansion and industrial park development Greene County has positioned itself to serve the needs of new industrial ventures. They have an empty speculative building to attract prospects. Ferguson indicated another building would be constructed after the empty one is occupied. Utilities were extended practically to Interstate 81, which gives the county a ten-mile corridor to develop green-field sites. Land and facilities are controlled, positioned, and ready for development.

Figure 5-6. Angus-Palm and Hardin Industrial Complex.

Economic Development Strategy

Tom Ferguson believes that Greene County's leadership has enabled him to develop an organization adept at courting new industry. The Greene County Partnership emphasizes a team approach. Initial meetings with prospects last from 30 minutes to an hour. In that window of opportunity Ferguson has to sell the community to a group of persons on a tour of 26 or 28 towns (Anderson 1999). Rather than attend conferences, trade shows, or run advertisements in industry trade publications Ferguson relies on the Northeast Tennessee Office of the Department of Economic and Community Development to distribute information and coordinate community visits.[2] In 1993 Ferguson revamped the Greene County marketing package (Ferguson 1999). It is a concise professionally produced color brochure with removable insets highlighting specific information: industrial sites, taxes, labor, quality of life, transportation, market, utilities, and education (Greeneville/Greene County Tennessee). It won first place in the 1994 state awards for best industrial marketing brochure for cities with population under 75,000

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[2] *The primary purpose of the regional offices of the Tennessee Department of Community and Economic Development is to compile and distribute statistics, data, and information on buildings, properties, and communities (Anderson 1999; Thompson 1999)*

(Park 1995).[3] Ferguson believes the community's money is best spent on efforts to improve community infrastructure rather than on hunting factories.

To date the Partnership approach has been successful. Greeneville ranks fifth among America's top 50 small towns for corporate facilities, and 57th among the top 100 U.S. cities for foreign investment (Venable 1999; Arend 1999). However, Greene County is not looking for any generic industry. The county profiles the types of industry desired. Specifically, county leaders are looking for companies that are family-owned or owned by a few people, in the early stages of product development, will eventually employ 200-300 people, pay approximately $8.50 an hour, and be philanthropically involved in the community. Alpine Industries, which will employee 2,800 by 2001, located its corporate headquarters in Greene County. Consequently, community leaders decided that they did not want to be heavily vested in one corporation again (Venable 1999; Ferguson 1999).[4] County leaders are specifically interested in automotive manufacturing and metal fabrication facilities.

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[3] *While the Greene County Partnership maintains a page on the World Wide Web, the marketing brochure is not included.*

[4] *Alpine Industries manufactures home and business environmental systems.*

Manufacturing industries provide the community with employment supportive of the traditional agricultural economy and provide abundant opportunities for residents to find local jobs through various internship and technical training programs (Ferguson 1999; Greene County Partnership 1999).[5] In short, Greene County has chosen manufacturing as the foundation of the community's economic future and has taken proactive steps to ensure that future.

McMinn County

McMinn County is located in southeast Tennessee between the Knoxville and Chattanooga metropolitan areas (Figure 4-9). Virtually the entire county is in the Ridge and Valley region (Figure 1-1). Starr Mountain, physiographically part of the Blue Ridge, extends along the southeast border. In 1995 the county had a population of 45,001 (Tennessee Statistical Abstract 1996/97). McMinn County has five incorporated places (Figure 5-7). Athens, the county seat has a population of 13,815, Etowah 4,327, Engelwood 1,712,

[5] *The Greene County Partnership operates Partners in Education, a program designed to place high school students in industrial internships. Tennessee Technology Center in Elizabethton (Carter County), a branch of Walters State Community College in Greeneville, and Northeast State Community College in Blountville (Sullivan County) provide industrial training programs.*

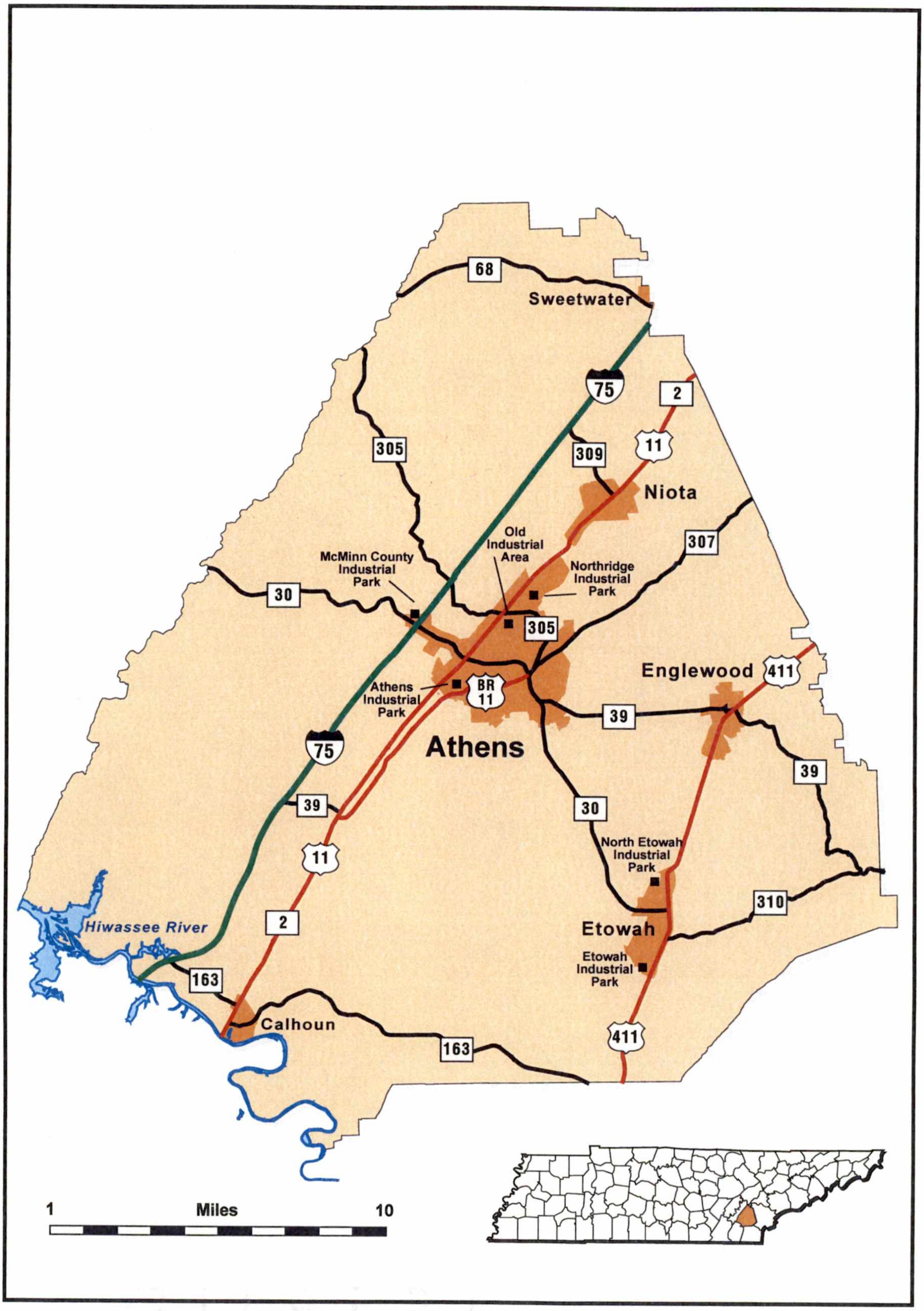

Figure 5-7. McMinn County, Tennessee.

Niota 893, and Calhoun 649 (Tennessee Statistical Abstract, 1996/97). The county is connected to the adjacent region via Interstate 75 and U.S. highways 11 and 411.[6] All major arteries run northeast to southwest. McMinn County is served by the Norfolk/Southern and CSX railroads, a small airport, and a small port at Calhoun on the Hiwassee River (Tennessee Community Data: Athens 1999). McMinn is adjacent to the Knoxville Metropolitan Area to the north. In 1990, 20.8% of the labor force worked outside the county (1990 Census of Population).[7]

Initial analysis suggested McMinn County's industrial recruiting efforts were waning because the number of firms and number of production workers per-capita were declining (Table 5-1). However, the number of production workers was at its highest level in 1992, which suggests expansion of existing industry. The unemployment rate in 1991 was 10.2%, the highest of the decade, and 9.3% in 1992 (Bureau of Labor Statistics 1999).[8] In 1994, manufacturing accounted for 49% of McMinn County's non-agricultural employment (Tennessee Statistical Abstract 1996/97). Moreover, the number of

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[6] *US Highway 411 is currently being widened from Maryville, Tennessee to the Georgia State line.*

[7] *Loudon County was incorporated into the Knoxville Statistical Area in the 1990 Census of Population.*

[8] *Tennessee's unemployment rate in 1991 was 6.7% and 6.4% in 1992.*

firms increased from 75 in 1992 to 84 in 1996 (1992 Census of Manufactures; County Business Patterns 1996). While development occurred in a number of industries, specific increases in rubber, plastics, and industrial machinery (County Business Patterns 1996; County Business Patterns 1993).[9] The increases offset loses of more traditional Appalachian industries: apparel, textiles, and furniture. Specifically, the closing of Eureka Sportswear, Morgan Manufacturing, and G.F.M. Manufacturing Corporation resulted in the loss of 585 textile jobs (Tennessee Directory of Manufactures 1997; County Business Patterns 1996; County Business Patterns 1993).[10] Clearly, McMinn County continued to focus on the expansion of existing industries, as well as seeking new factories.

Unlike the majority of the nonmetropolitan South and Appalachian Tennessee, manufacturing has been the dominant form of employment in McMinn County since 1950. The 1950 Census of Population reported that 29.3% of the labor force was employed in manufacturing and 25.2% in agriculture. Textiles, lumber, and furniture were typical of Appalachian

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[9] *McMinn County added three rubber and miscellaneous plastic products firms, and three industrial machinery and equipment firms between 1992 and 1996.*

[10] *McMinn County lost three apparel and textile products firms and three furniture and fixtures between 1992 and 1996.*

Tennessee (1954 Census of Manufactures; Raitz and Ulack 1984; Quittmeyer and Ford 1962).[11] In 1954, a newsprint factory, Bowater Incorporated, opened and sealed McMinn County's future as an industrial community (Stout, 1999, Etowah Quality Council 1998; Tennessee Directory of Manufactures 1997). While agriculture remained important in the local economy, McMinn County leaders focused on economic development and envisioned a community with a substantial industrial base (McMinn County Tennessee 1993; Stout 1999; Rogers 1999).[12]

Partners for Progress: McMinn County Economic Development Authority

Interest in economic development has a long history in McMinn County. The Athens Area Chamber of Commerce created the first organization, known as the Industrial Committee of 100, in the 1960s (Stout 1999; Arterburn 1999; Tennessee State Planning Office 1980). This organization was volunteer and staffed by community leaders. During the tumultuous 1970s, the Industrial Committee of 100 assisted the Tennessee State Planning Commission office in Chattanooga with the development of three planning

[11] *Of McMinn County's 51 firms in 1957, five were textile, twenty-three lumber, and seven furniture.*

[12] *Mayfield Dairy Farms, currently owned by Dean Foods, was founded in 1923 and the corporate headquarters is in McMinn County (Directory of Tennessee Manufacturers 1997).*

instruments. The Population and Economic Study laid the groundwork for determining McMinn's economic focus (Tennessee State Planning Office 1970). The Land Use and Transportation Plan (1977) and the Industrial Site Survey (1980) further documented the need for planned economic development combined with community livability (Tennessee State Planning Office 1977; Tennessee State Planning Office 1980).

By the middle 1980s, it was evident a part-time staff was incapable of devoting the necessary attention to the McMinn's economic development. The number of manufacturing firms peaked in 1972 and the number of production workers in 1977 (Table 5-1). Community leaders concluded that a central agency was required to coordinate community development efforts. Seven water utility companies, four sanitary sewer systems, and four planning commissions operated in county in 1980 (Stout 1999; Tennessee State Planning Office 1980).[13] Industry was located in all of the county's five incorporated communities and they completed new factories (Tennessee State Planning Office 1980). In 1985 the Industrial Committee of 100 became a professional,

[13] *Athens, Englewood, Etowah, Niota, and three utility districts operated water utilities. Athens, Englewood, Etowah, and Niota had sanitary sewers. Planning agencies included a county commission and municipal commissions in Athens, Etowah, and Englewood. Zoning is confined to the municipalities.*

centralized agency, the McMinn County Economic Development Authority (Stout 1999; McMinn County Tennessee 1993). This public, non-profit organization was chartered to coordinate industry recruitment and assist existing industries with expansion (McMinn County Tennessee 1993; Stout 1999).[14] To emphasis its role as a county agency the Economic Development Authority moved from the Athens Area Chamber of Commerce to the McMinn County courthouse (Figure 5-8) (Stout 1999).

An Executive Vice President and a 25-person Board of Directors oversee the agency. The board is staffed by community leaders. Stephen Stout currently serves as the Executive Vice President. He was hired in 1990 after five years with the National Marketing Division of the Tennessee Department of Economic and Community Development in Nashville. Economic development can encompass various economic ventures. However, since both Athens and Etowah have chambers of commerce to handle retail and commercial development, virtually all (90 to 95 percent) of the Economic Development Authority's efforts are targeted at manufacturing development (Stout 1999).

Stout concentrates on recruiting new industry and assisting existing industries with expansion. Services to

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[14] *Funding is from taxes and membership dues.*

Figure 5-8. McMinn County Courthouse: Location of the McMinn County Economic Development Authority.

existing industries include quarterly seminars for plant managers, which are aimed at addressing specific concerns and assisting with expansion (Stout 1999). Prospect visits are arranged through the Middle Tennessee Office of the Tennessee Department of Economic and Community Development in Knoxville (Stout 1999; Thompson 1999). The initial visits are handled in the same fashion as in Greene County, including a tour of sites. Stout serves as primary contact and arranges meetings with local officials. In addition to the contacts generated by the regional office, Stout also regularly attends industry trade shows and advertises McMinn County in trade publications (Stout 1999). The primary marketing instrument is a 24-page black and white, ring bound brochure (McMinn County Tennessee 1993). The brochure is also available on the World Wide Web.[15]

The Etowah Area Chamber of Commerce

Athens and Etowah are McMinn County's largest municipalities. Etowah, population 4,327, is located southeast of Athens (Figure 5-7). Etowah was established by the L&N Railroad as a company town in 1906 and has traditionally considered itself different from Athens (Etowah Quality Council 1998; Clayton 1999; Rogers March

[15] *McMinn County Tennessee is available at www.mcminncoeda.org.*

1999). An example of this distinction is that Etowah has been a Governor's Three-Star Community since 1989, but Athens and McMinn County have failed to qualify.[16] Etowah instigated a visioning process in conjunction with TVA after it lost the Etowah Manufacturing Company in 1998 and Morgan Manufacturing Company in 1996.[17] The conclusions of the evaluation and planning process were that Etowah needs to attract more business and industry by improving industrial parks and community livability (Etowah Quality Council 1998). The Etowah Area Chamber of Commerce coordinates economic development and is located in the restored L&N Depot on U.S. 411 in the center town (Figure 5-9)(Etowah Quality Council 1998).[18] Sherry Rogers, the Executive Director, heads the chamber's economic development efforts, which encompass any form of industrial, commercial, or retail development.

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[16] *The Governor's Three-Star Program for Community Economic Preparedness evaluates communities with regard to four major areas: organization development, community development, education/workforce development, and economic development. Communities are reviewed annually. As of 1998, 43 counties and 14 municipalities were certified.*

[17] *The plant closings cost the city 400 manufacturing jobs (Clayton 1999; Etowah Quality Council 1998).*

[18] *The L&N Depot was restored in 1979 and is on the National Register of Historic Places (Etowah Quality Council 1998; Etowah, Tennessee).*

Figure 5-9. Former L&N Depot. Home of the Etowah Area Chamber of Commerce.

While the McMinn County Economic Development Authority works primarily with the Tennessee Department of Economic and Community Development in Knoxville, the Etowah Area Chamber of Commerce works closely with the office in Chattanooga. Like Stout, Rogers markets the community by attending industry trade shows and advertising in trade publications (Rogers 1999).[19] The Etowah Area Chamber of Commerce also produces a small color brochure, available both in paper and on the World Wide Webb.[20]

Economic Development Strategy Through Industrial Parks

Although McMinn County's two organizations responsible for industrial development differ in their orientation, their community vision is identical. Both see the recruitment and retention of industry as the "straw that stirs the drink" (Stout 1999; Rogers 1999). While neither Stout nor Rogers prefer specific types of manufacturing both expressed interest in automotive, plastics, high-quality food processing, and medical products manufacturers. The county is blessed with rail, road, highway, and water access. The primary focus is on firms shipping finished

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[19] *The Etowah Chamber has advertised in The Tennessee Economic Development Guide, Plants Sites and Parks, and Area Development.*

[20] *Etowah Tennessee is available at www.etowahcoc.org.*

products by highway. Rather than target specific industries, county leaders focus on wages and benefits. County leaders are interested in companies that will pay employees seven to eight dollars an hour with additional benefits that equate to 25 to 30% of the wage. A preference is for smaller firms, approximately 100 jobs, as opposed to larger ones. Both the McMinn County Economic Development Authority and the Etowah Area Chamber of Commerce have developed industrial parks and constructed speculative buildings to encourage and assure prospective firms continue to visit the community (Stout 1999; Rogers March 1999).

Athens Industrial Park, which was funded by local government in 1962, was one of the first industrial parks constructed between Knoxville and Chattanooga (Figure 5-7) (Good 1973). Although the three original inhabitants - Thomas & Betts Corporation (1964), Plastic Industries (1966), and State Area Vocational Training School (1967) - are still located on the site, there is no longer a formal park structure (Good 1973; Tennessee Directory of Manufactures 1997; Stout 1999).[21] The park was full by 1967, and the county did not venture into controlled

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[21] *Thomas & Betts Corporation (formerly Mid-Land Ross Corporation) manufactures electronic components and fittings. Plastics Industries manufactures plastic injection moldings (Tennessee Directory of Manufactures 1997).*

industrial development again until 1980 with the construction of Northridge Industrial Park (Stout 1999; Tennessee State Planning Office 1980). This park was essentially an extension of the industrial area that developed in the 1970s along U.S. 11 and the Southern Railway (Figure 5-7) (Tennessee Directory of Manufactures 1997; Tennessee State Planning Office 1980). Stout indicated that the park is full; however, field observation and the Tennessee Department of Economic and Community Development's Available Industrial Sites Listings (1999) indicate one 35-acre tract is vacant.

The McMinn County Economic Development Authority's first venture into park development occurred in 1991 with the creation of the 158-acre McMinn County Industrial Park, also known as Interstate Park Figure 5-10 and 5-11 (McMinn County Tennessee 1993; Stout 1999).[22] The site was not within Athens' city limits. Because zoning is municipality based, not countywide, Athens had to annex the property so covenants could be enforced (Stout 1999; McMinn County Tennessee 1993; Tennessee State Planning Office 1980). Development of this park indicates the reorientation of industrial sites away from rail to interstate access. The

[22] *McMinn County's unemployment level was 10.3% in 1991, the highest rate during the 1990s (Bureau of Labor Statistics 1999).*

Figure 5-10. Entrance to McMinn County Industrial Park.

Figure 5-11. McMinn County Industrial Park.

park's principal occupant is Denso Manufacturing Tennessee Incorporated established 1997.[23] There are 100 available acres (Tennessee Community Data: Athens 1999; Stout 1999). Stout stated that the McMinn County Economic Development Authority constructed four speculative buildings and that all are sold or leased. He feels having available buildings is crucial to future development. It is estimated that 87% of companies begin their searches by evaluating existing buildings, but only 13 percent find the appropriate building (Ticknor 1999; Reese 1994). Speculative buildings ensure prospective traffic.

In addition to the two Athens parks are two in Etowah. The first, Etowah Industrial Park, was developed in 1992 (Etowah Quality Council 1998; Rogers March 1999; Clayton 1999).[24] The Etowah Area Chamber of Commerce's first venture into park development has been less than successful to date. The park is located three blocks off of U.S. 411 south of downtown (Figure 5-7). All the utilities are in place for the 45-acre park. It, however, it remains completely vacant (Rogers March 1999; Stout 1999; Tennessee Community Data Sheet: Etowah 1999). The deteriorating sign

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[23] *Denso produces automotive components and systems.*

[24] *With the development of the North Etowah Industrial Park in 1996, the first park is often referred to as South Etowah Industrial Park.*

on U.S. 411 points down a gravel road, which goes through a residential area and dead ends at a pad-locked gate. Beyond the gate, a rough-cut dirt road is the only indication of planned development (Figure 5-12 and 5-13).

The North Etowah Industrial Park has proven much more successful (Figure 5-7). The initial development in 1996 was a 105-acre site along U.S. 411 and the CSX railroad (McMinn County Tennessee 1993; Tennessee Community Data Sheet: Etowah 1999; Rogers March 1999). The community constructed its first speculative building on a 12-acre site adjacent to the widened highway. The building was sold to Oasis Plastics in 1998 (Figure 5-14) (Etowah Quality Council 1998; Rogers March 1999).[25] In July of 1999 Waupaca Foundry Incorporated purchased the remaining 93 acres (Figure 5-15).[26] A 249,000 square foot facility will produce gray iron castings for the automotive industry and employ 250 people. The facility is a 95 million dollar investment. If successful, a second phase, estimated at 105 million dollar investment and 250 jobs may be developed (Press Release: Waupaca 1999; Clayton 1999). Because of the success the

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[25] *Oasis Plastics manufactures plastic compounds and color concentrates for the plastic molding industry.*

[26] *Waupaca Foundry incorporated was founded in 1955 in Waupaca, Wisconsin and this facility represents its sixth plant. The parent company is The Budd Company of Troy, Michigan, which is part of ThyssenKrupp Automotive (Clayton, 1999; Press Release, 1999).*

Figure 5-12. Entrance to Etowah Industrial Park.

Figure 5-13. Etowah Industrial Park.

Figure 5-14. North Etowah Industrial Park, Oasis Plastics.

Figure 5-15. North Etowah Industrial Park, Waupaca Foundry Site.

community decided to expand the park and purchased an additional 417 acres (Rogers November 1999). Utilities and roads can be extended rather than run to a new site.

Conclusion

Initial analysis of Census of Manufacturers indices indicated Greene and McMinn Counties were pursing different economic development strategies. Greene County appeared to be becoming more heavily vested in manufacturing by attracting new, small firms. Conversely, McMinn County appeared to be diversifying its economic base. Manufacturing employment appeared to be increasing because existing firms seemed to be expanding. However, careful examination indicates both are dedicated to the same mission, ensuring their economies' vitality through attracting new manufacturing firms.

Not only are the two counties similar in mission and vision but also in geography and history. Both are in the Ridge and Valley region of Appalachian Tennessee and benefited from early transportation routes. Each was blessed with the location of rather large, long-lived manufacturers, Magnavox or Philips (1947) in Greene County and Bowater Incorporated (1954) in McMinn County (Tennessee

Directory of Manufactures 1997). Early manufacturing ventures transformed agricultural workers into industrial workers and forged the communities' futures.

Expectations in manufacturing communities differ from those of agricultural communities. Of foremost concern is continued access to manufacturing jobs. While planned economic development and community activism has a longer history in McMinn County, both communities responded in the late 1980s and early 1990s to slowing industrial growth, manufacturing job loss, and increasing unemployment rates by taking aggressive, proactive steps to ensure further development. New industrial parks and speculative buildings were constructed. Centralized countywide economic development organizations were created, and experienced, professional industrial recruiters were hired. Expansion and retention of manufacturing industries was the primary goal.

Both the Greene County Partnership and the McMinn County Development Authority are successful. They target industries, either from a company, wage and benefit, or product profile. While marketing approaches differ slightly, both counties work closely with the regional offices of the Tennessee Department of Community and Economic Development and continue to develop infrastructure In short, both Greene and McMinn counties developed

community visions and positioned themselves to compete for new manufacturing ventures.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

The United States is integrating with a new world economy. As one of the most technologically advanced nations, the primary focus of employment growth is in service, technology, and information industries. Manufacturing is a secondary activity associated with developing nations (de Souza and Stutz 1994). Improvements in technology, transportation, and communication increase the production range of most manufactured goods. Consequently, United States manufacturers produce products in the mature stage of the product life cycle at significant distances from markets. Trade arrangements like the North American Free Trade Agreement and the Caribbean Basin Initiative allow manufactures to move facilities to transnational locations (Johnson 1997). Projections indicate that the share of the nation's labor force employed in manufacturing will decline from 27% in 1970 to 12% in 2005 (Harris 1995). Opportunity in the traditional manufacturing sector is, in essence, going the way of agricultural employment. Given this shift, it is imperative that communities dependent on manufacturing understand changes in the national economy. Communities, specifically

nonmetropolitan communities, are confronted with the loss of parts of the economic infrastructure, which culminate in increased competition for a shrinking number of factories (Ferguson 1999). Community development becomes increasingly complex, something that is particularly harrowing for unprepared nonmetropolitan communities.

Scholars utilized various techniques in studies of nonmetropolitan manufacturing location. Studies focus on factories, industries, regions, location factors, plant characteristics, and production scenarios. A variety of techniques and measures are used to examine location. Most rely on a single data source. Payroll, or place of work, data are inherently biased toward large communities (Hart 1988). Studies that used any form of community analysis limit their scope to select factors (Leinbach 1972; Leinbach and Cromley 1982; Holloway and Bawden 1992). Incorporation of community characteristics, at best, is limited. One of the major deterrents to the inclusion of community factors is the difficulty of satisfactory measurement (Stafford 1979).

This study demonstrates that comprehensive community factors can be measured and integrated into the study of manufacturing location. The use of place of work (payroll) and place of residence (household) data for metropolitan and nonmetropolitan communities creates a methodology where

changes in manufacturing development and community linkages are identified. By using 50 Appalachian Tennessee counties, differences in regional factors like labor costs, labor availability, unionization, taxes, and access to markets are minimized. Interpretation of the analysis is specific to community change.

Fifty-six socio-economic variables, consistent over a 32 year period were compiled from seven data sets and subjected to principal components analysis. Seven data subsets consisting of five common composite components were created (Table 2-15). Community size, community vibrancy, population structure, large-scale agriculture, and small-scale agriculture proved excellent comprehensive community components. Explained variance or total R^2 declined across observation periods, which indicates increasing complexity of community factors.

Five measures - value added by manufacture, number of production workers, value added per production worker, per-capita value added by manufacture, and number of production workers per-capita - were used as dependent variables in a series of stepwise multiple regressions. The summary socio-economic components serve as predictor data sets or independent variables for eight observation years. The resultant models elucidate national and regional trends in industrial development. They also identify four distinct

periods of industrialization: Traditional, Transitional, Shake Out, and New Paradigm (Table 3-9).

Summary regression results indicate that as time increases explained variance in manufacturing location decreases and the number of relevant comprehensive socio-economic community components decrease. In other words, it becomes more difficult to predict manufacturing location with composite community components. Community size and community vibrancy are the only consistently significant components. The presence or absence of these two components indicates changes in community infrastructure and trends in development.

During the Traditional Period (1958-1963) all five community components are significant and manufacturing location is accurately predicted. The analysis captures the development of pioneering industries, particularly in communities without significant concentrations of small-scale agriculture and with pools of working-age persons, in essence, nonmetropolitan counties with towns and small cities. The influence of community size and population structure waned during the Transitional Period (1967-1972) because manufacturing location was less discriminating. New factories were established in nonmetropolitan counties with substantial agricultural enterprises. New manufacturing plants correlate with displaced agricultural workers. This

period was one of significant product maturation, and, consequently, branch plants were located across Appalachian Tennessee. Community infrastructure failed to keep pace with industrial development. Eager communities launched aggressive development schemes and constructed industrial parks with the hopes they would be converted from agricultural hamlets to industrial meccas.

The Shake Out Period (1977-1982) reflects the fallout from the 1974-1977 and 1979-1982 recessions. Numerous industries closed, and virtually every county lost industrial jobs. Population growth increased more rapidly in nonmetropolitan than in metropolitan areas. Sons and daughters returned to Appalachian Tennessee from industrial centers of the Midwest. The population structure component, emphasis elderly, reflects the changing composition of these counties. The nature of the U.S. economy also began to change. Composite community components failed to predict the number of production workers per-capita model and it failed to predict from 1977 forward. The loss of manufacturing jobs and increases in service and related employment mark the transition of the economy to tertiary and quaternary activities and make prediction untenable. The New Paradigm Period (1987-1992), indicates that, with the exception of small-scale agriculture in 1987, only

community vibrancy and community size are significant in explaining variance in manufacturing location.

Ward's cluster analysis was used to summarize each set of manufacturing models for the eight observation years. Counties were clustered to determine whether they are underpredicted, predicted, or overpredicted by the regression analysis. The use of multiple manufacturing indices insures that one measure does not bias the analysis. Shaffer argued that the multiplier effects associated with manufacturing are dependent on the interaction between manufacturing enterprises and host communities. Workers' geographical spending patterns and commuting patterns effect a community (Shaffer, 1979). It was difficult for traditional studies to capture these multiplier effects. By using metropolitan and nonmetropolitan counties, multiple manufacturing indices, and community descriptors, my analysis captures these effects. The composite community components indicate socio-economic infrastructures indicative of communities more replete with manufacturing in metropolitan counties. Significant manufacturing in nonmetropolitan counties is consistently identified by the analysis.

A hypothesis of this study is that with advances in technology, communication, and transportation regional factors are becoming less significant and community

characteristics more significant in the location of manufacturing. Kale and Lonsdale included housing, developed sites and industrial parks, available buildings, community livability, and community leadership in their description of local and community factors (1979). These factors suggest the presence of local planning agencies and industrial development corporations. Only four Appalachian Tennessee communities - Hawkins, Pickett, Polk, and Van Buren - have no planning agency, and only Overton County has no industrial development corporation. Only four counties - Grundy, Polk, Smith, and Van Buren - have no industrial parks. Of the 50 Appalachian Tennessee counties, 43 have the necessary organizations and facilities for industrial development.

As ubiquitous as developed community characteristics may be, presence fails to measure quality. Specifically, one community characteristic varies greatly and is difficult to measure, leadership. Virtually all manufacturing studies comment on community leadership, but rarely is it emphasized. Usually, the reference to leadership is a warning to be suspect of overzealous community boosters.

Examination of the results of the cluster analysis identified two counties for detailed study, Greene and McMinn (Table 4-9). Both communities are centered between metropolitan areas, which dictated the need for certain

amounts of self-preservation. Both benefited from industrial inertia, large long-lived industries, Philips-Magnavox and Bowater.[1] Given their long industrial histories both counties are committed to manufacturing. Both concentrate development efforts on the construction of new industrial parks and speculative buildings. Both communities have experienced professional economic developers, manufacturing oriented development agencies, consensual community vision, and aggressive marketing programs. Current thought dictates that a community can be successful at manufacturing development if it has leaders that are willing to commit fiscal and social resources (Anderson 1999; Thompson 1999; Ferguson 1999; Stout 1999; Park 1994). Given the future of manufacturing and the lack of types of employment community leaders believe that the development process is too vital to leave to "boosters." Tom Ferguson indicates the level of professionalism and training for recruiters has increased drastically in the last ten years (1999). He believes the future for manufacturing in the United States is in nonmetropolitan areas. Only dedicated communities will benefit from the new industrial geography, which is why Ferguson left

[1] *Philips-Magnavox is currently Five Rivers Electronic Innovations.*

metropolitan Dade County for nonmetropolitan Greene County Tennessee.

Much of the research on manufacturing location supports Ferguson's optimism about nonmetropolitan areas. New production scenarios like just-in-time delivery and niche marketing result in the creation of dispersed agglomerations of factories arranged around central assembly facilities. Counties in Appalachian Tennessee with effective leaders can compete in this new era of industrial development. In addition to the new industrial parks in Greene and McMinn counties are new ones in Bradley and Hamblen counties (Figure 6-1).[2] Hiwassee River Industrial Park is a 547-acre site in Bradley County (Ocoee Region of Tennessee, 1999). It is near Interstate 75 and has railroad access - utilities and a road are in place. Hamblen County is constructing a new 900-acre park, the East Tennessee Progress Center.[3] This park is close to Interstate 81 and extends into Jefferson County (Davis 1999). Together these four nonmetropolitan counties have more than 2,300 acres

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[2] *Bradley and Hamblen County have long industrial histories. While neither of these communities met the selection criteria, both were underpredicted in 1987 and 1992 indicating substantial industrial communities (Table 4.9).*

[3] *There are 100 available acres at Morristown's Airport Park. The 670-acre park was developed in the 1970s and was the communities' second venture into industrial development (Davis 1999).*

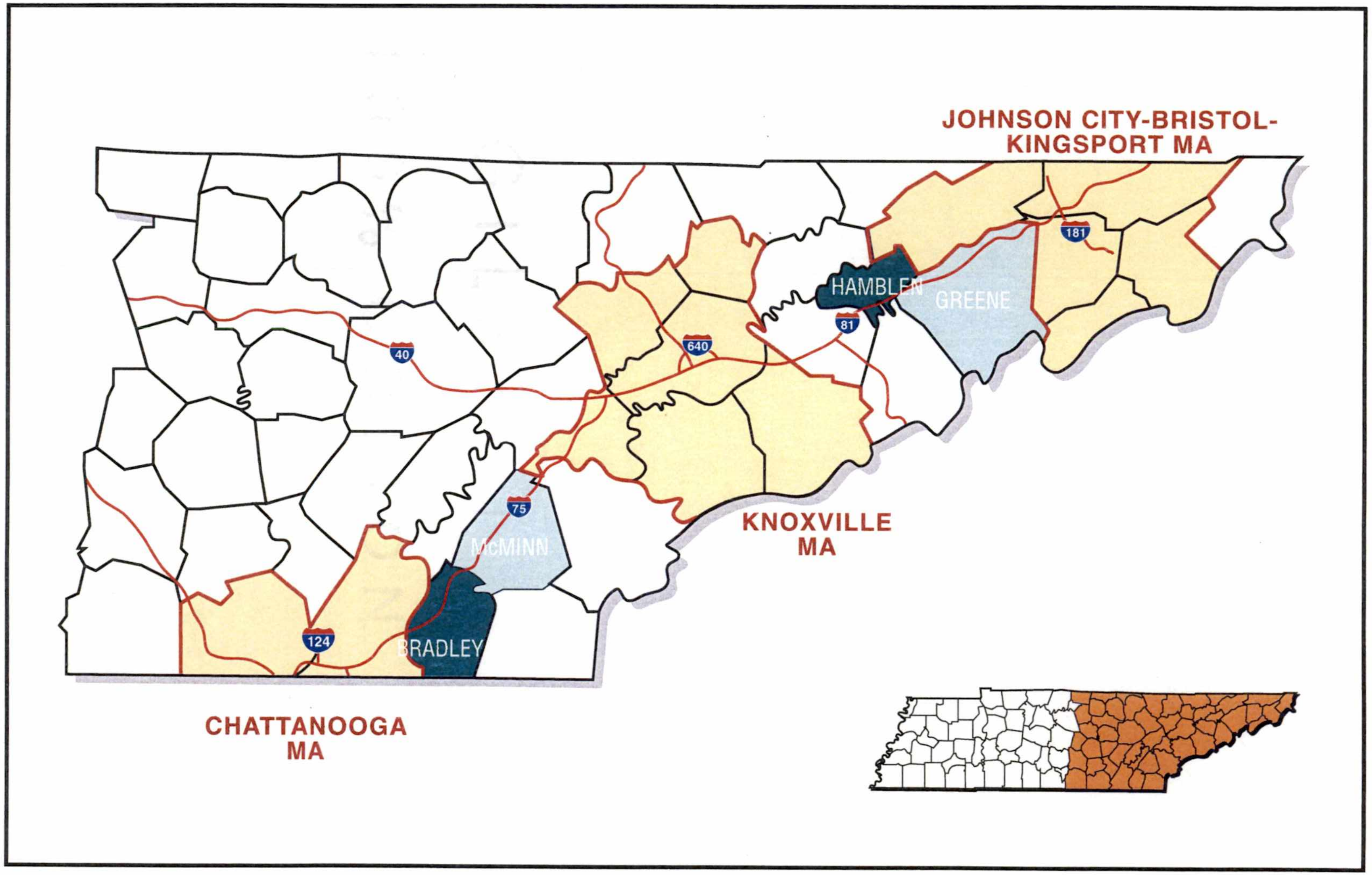

Figure 6-1. Appalachian Tennessee's Nonmetropolitan Industrial Core.

available in industrial parks. Clearly these communities are constructing a palette on which Appalachian Tennessee's new industrial landscape will be developed. They represent a potential industrial core or a potential dispersed agglomeration. The leaders of these nonmetropolitan communities feel confident that by establishing mega-parks and developing community vision they have the leadership that will guarantee a future with substantial manufacturing development and employment.

The future of manufacturing location in Appalachian Tennessee is primarily dispersed agglomerations in nonmetropolitan areas. However, as the industrial landscape develops geographers will need to understand the distinctions among communities and how linkages are created and function. As new industrial arrangements are investigated, scholars need to incorporate multiple manufacturing and community indices. Only communities committed to saving themselves will remain viable in the new age.

My analysis identified communities that would not have been interpreted as exceptional employing traditional research methods. The evolution of our economies and communities necessitate development of more comprehensive methods of analysis. Our inquiries, dialogues, and methodologies must be more comprehensive and flexible to

address the complexities inherent in the evolution of our world.

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Appendix
Community Variables

Item	Variable
1	Area name
2	FIPS code
3	Land area (census year)
4	Total population (census year)
5	Rank in population (census year)
6	Population per square mile (census year)
7	Percent of population increase or decrease previous census year to latest census year
8	Percent of population nonwhite (latest census)
9	Percent of population under 5 years of age
10	Percent of population 21 years and older (1962 & 1967), 18 and older (1972, 1977, 1983, 1988, 1994)
11	Percent of population 65 years or older
12	Total vote cast for president, last election
13	Percent of vote cast for leading party for president (party) 1 Democratic 2 Republican 3 American Independent (1972)
14	Percent of vote cast for the leading party for president
15	Vital statistics: live births 1960 1964 1970 1975 1980 1984 1988

Item	Variable
16	Vital statistics: deaths 1959 1964 1970 1975 1980 1984 1988
17	Number of families or household families (latest census)
18	Median family or household money income (latest census)
19	Percentage of persons 25 years and older who have completed high school or more (latest census)
20	Number of persons enrolled in kindergarten, elementary and high school, public and private (latest census)
21	Total civilian labor force 1960 1970 1982 1986 1991
22	Percent of civilian labor force unemployed 1960 1970 1982 1986 1991
23	Percent of civilian labor force employed in manufacturing
24	Percent of civilian labor force employed in wholesale and retail trade
25	Percent of employed persons in civilian labor force working outside county of residence (latest census)

Item	Variable
26	Percent of employed persons in civilian labor force using public transportation to work (latest census)
27	Number of housing units (latest census)
28	Percent of housing units in one unit structure (latest census)
29	Percent of housing units built during previous census period
30	Total occupied housing units (latest census)
31	Percent of occupied housing units with 1.01 or more persons per room, latest census period
32	Total number of owner occupied housing units (latest census)
33	Median value of owner occupied housing units (latest census)
34	Total number of renter occupied housing units (latest census)
35	Median gross rent per month of renter occupied housing units (latest census period)
36	Total bank deposits (latest census) 1960 1964 1970 1976 1981 1986 1992

Item	Variable
37	Savings capital of savings and loan associations (latest census) 1960 1964 1970 1976 1981 1986 1992
38	Total general revenue in local government 1957 1962 1971 1977 1982 1986
39	Total general expenditures in local governments 1957 1962 1971 1977 1982 1986
40	Total number of manufacturing establishments (latest manufacturing census)
41	Percent of manufacturing establishments with 100 or more employees (latest manufacturing census)
42	Number of manufacturing employees (latest manufacturing census)
43	Payroll of employees in manufacturing (latest manufacturing census)
44	Number of manufacturing production workers (latest manufacturing census)
45	Number of manufacturing production work hours (latest manufacturing census)
46	Number of manufacturing production worker wages (latest manufacturing census)

Item	Variable
47	Value added by manufacture (latest manufacturing census)
48	Total number of retail trade establishments (latest retail trade census)
49	Number of retail trade establishments with payroll (latest retail trade census)
50	Retail trade: sales of all establishments (latest retail trade census)
51	Number of wholesale trade establishments (latest wholesaling census)
52	Total number of service establishments with payroll (latest service census)
53	Land in farms (latest agricultural census)
54	Number of farms (latest agricultural census)
55	Average size of farms (latest agricultural census)
56	Percent of farms under 10 acres 1959 1964 1969 1974 Percent of farms under 50 acres 1978 1982 1987
57	Percent of farms above 1000 acres 1959 1964 1969 1974 Percent of farms above 500 acres 1978 1982 1987

Item	Variable
58	Total value of farm products sold, latest agricultural census (millions of dollars) (farms with more than $2,500 in sales beginning 1969)

VITA

Fred A. Pierce III was born 15 July 1964 in Bristol, Virginia, the first of three children born to Ralph O. and E. Faye Pierce. His formative years were spent between his grandfather's farm in Blountville, Tennessee and the City of Bristol, Virginia. After graduating from Virginia High School in 1982 he promptly fled his Appalachian home for a brief college experience at Delta State University in Cleveland, Mississippi. Eight weeks later he returned home and worked several part-time jobs until leaving for a surveying position in Charlotte, North Carolina in 1984.

After two and a half years he enrolled at the University of North Carolina at Charlotte. He graduated magna cum laude with a Bachelor of Arts, major in Economics and minor in American Studies, in 1992. His undergraduate career was greatly enriched by courses with geographic content. Dr. Tyrel G. Moore provoked an interest in mentoring and a passion for a region and history he spent the majority of his life fleeing. After graduation he returned to Abingdon, Virginia to work at People Incorporated, a community action agency dedicated to the people of Southwest Virginia. There he worked with at-risk high school students with the specific intent of encouraging them to pursue post-secondary education.

In August of 1994 he was offered graduate teaching assistantship in the Department of Geography at the University of Tennessee. He pursued course work specific to the American South, Appalachia, and economic geography. In May 1997 he was offered the opportunity to apply the skills acquired mentoring high school students to college students with a graduate assistantship in the College of Arts and Sciences Advising Services. He received his Master's of Science with a major in Geography in May 2001.

Fred is currently the Assistant Director of the College of Arts and Sciences Advising Services.